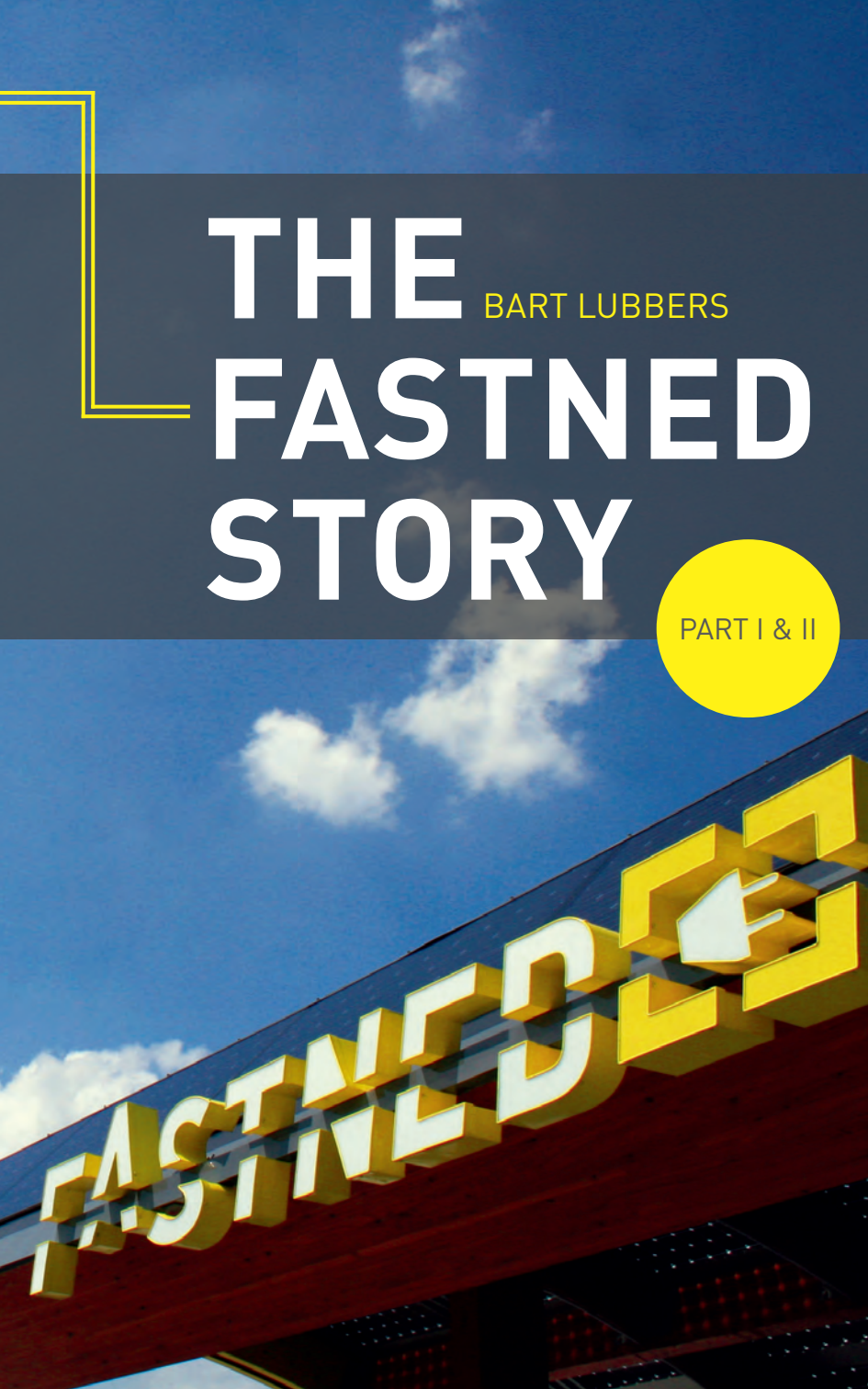
THE FASTNED STORY

BART LUBBERS

PART I & II



THE FASTNED STORY

PART I & II

The Fastned Story part I, first published in 2014
The Fastned Story part I&II, first published in 2015

Self-published in cooperation with
Uitgeverij Boekenbent
Fastned's corporate style Angelique Verheij
Design Hannah Weis-Roos
Cover photo and page 204 Roos Korthals Altes
Editing Hannah Aukes and Glass Translations
ISBN 978-94-6203-796-0

THE FASTNED STORY

BART LUBBERS

PART I & II

CONTENTS PART I

CONTENTS PART II

"YOU WON'T SEE IT UNTIL YOU GET IT"

JOHAN CRUIJFF

PROLOGUE PART I

It was only when I'd seen pictures on a digital camera, that I understood why Kodak was doomed. It was only when I had my own cell phone, that I realized why it was practical. It was only when I'd used an iPhone, that I got the point of a smartphone. Seeing is believing. Or in the words of the famous Dutch footballer, Johan Cruijff: "You won't see it until you get it."

Four years ago I had a similar experience with electric cars (electric vehicles, or 'EVs' in the jargon). Until that time I'd associated driving EVs mostly with 'environmentally friendly' and 'a fantastic driving experience'. And then it hit me: driving is freedom. All car advertising is about freedom, all road movies tell a story about the freedom to go wherever you want, and all car stories embody the ultimate feeling of freedom. It's precisely this sensation – or even just the promise of it – that makes driving so attractive.

The penny had dropped. I realized that EVs would never amount to much without this exhilarating sense of freedom. Or to put it in another, more positive way: if you can give EVs the aura of freedom, you're sitting on a pot of gold.

What do you need to experience freedom with a car? Firstly, it has to be an easy way to cover plenty of ground. And for that you need to be confident you can drive and refuel anywhere, at any time. Without confidence there's no freedom. For EVs that implies fast-charging – everywhere en route.


FUMATUL OPRIT

Next, I addressed the question of where the fast-charge stations would have to be built. That was an easy one: the past century has shown that the most popular stations by far are those along the highway. Oil companies are willing to pay large sums of money to gain control of these sites. The easily accessible highway stations are able to charge higher fuel prices – saving time is freedom for the driver, and people will pay for that. In addition, these sites are scarce. Only 245 of the 4,500 filling stations in the Netherlands are located along the highway. The law forbids other sites from being developed there. Fifteen-year concessions for highway sites are auctioned each year, for an average of 6 million euros per site! That amounts to a total of 1.5 billion euros for the entire network.

Getting hold of these sites is no easy matter for oil companies. But now, the emergence of the EV has thrown the playing field wide open. The best sites are gold mines. It's all about location, location, location. And as luck would have it, this happens to be Fastned's cornerstone.

Bart Lubbers
Amsterdam, February 2014

APRIL 27, 2012

A good draw

I'm watching the state notary, Robbert Gallas, in suspense. He shakes the biscuit tin and draws a lot, followed by a second one. "Bergh-Zuid service area: number 1 ANWB; number 2 Fastned." His assistant carefully notes the result, as do we. The notary briskly produces another lot. "Knorrestein service area: number 1 Fastned; number 2 MisterGreen." I glance at my Fastned partner Michiel Langezaal. He can't help grinning. We've got that one too!

It goes on like that all afternoon. We've been summoned by the State of the Netherlands to the office of Pels Rijcken & Droogleever Fortuijn , the public attorney, that Friday, April 27th 2012. A few months earlier, on December 20th 2011, the Ministry of Infrastructure and the Environment published an article in the *Government Gazette* inviting parties to bid for the construction and operation of charging stations for EVs at the 245 highway service areas. There are several candidates for a number of the sites, so a draw has been organized.

HISTORIC MOMENT

I film 48 seconds of this historic moment with my phone. It's hard to believe that the plan we showed the ministry, is now becoming reality. Sites that oil companies fought over for decades are being dished out on a single Friday afternoon. I point my smartphone camera at the attendees. Their concentrated faces pass the screen one by one, as they carefully record the names and numbers being announced by the notary. Michiel waves unobtrusively at the camera.

Michiel and I look pretty relaxed in the picture. We applied for permits for all 245 sites back in December 2011. The other five parties – the ANWB, The New Motion, MisterGreen, GreenFlux and Liandon – took a more modest approach, focusing on a few dozen sites. When the auction window closes on January 16th 2012, there are offers for every site – some even receive several bids. A comprehensive nationwide EV infrastructure is going to be built. It's a resounding success, far exceeding the ministry's expectations.

At the end of the afternoon the notary allocates the final service area. Time to take stock. According to our calculations, we were hoping to get two hundred sites. We got 201 – not bad.

We didn't just bid on all 245 sites for nothing. Our plan was – and is – a comprehensive nationwide network of highway charging stations. It all started a few years back.

MARCH 2, 2009

A bright orange electric Lotus Elise

The first time I drive an EV is on March 2nd 2009. A bright orange Lotus Elise that belongs to Willem van der Kooi. This enthusiastic entrepreneur is trying to convince the world that driving EVs is above all fun. I'm sold on the idea and take a 10 percent stake in his company, ECE. On top of this, my seventy-year-old father starts driving an electric Volkswagen Golf, which has been converted by ECE. My father is one of the first Dutch EV pioneers. He clocks up substantial mileage.

Willem tells me he's not the only one making EVs. The Californian company Tesla also makes a sports car based on the Lotus Elise chassis. "A real beauty", Willem says, before hastily adding, "unaffordable of course; they'll probably only sell a couple of dozen."

Between the Tesla Roadster's introduction in 2008 and the end of production in 2012, Tesla sells 2500 of them.

MAY 20, 2010

Dutch start-up Epyon opens the first fast-charge station

My first experiences with EVs taught me a few things. They are fun to drive, accelerating like a bullet. However, their range is limited and charging is slow. My father is forever calculating how many kilometers he can manage. This often means he has to turn off the air conditioning or heating to reduce power consumption. My mother heaves a sigh when my father tells how he got back with only a couple of percent left in the battery. Or the times he doesn't make it home, and calls from the local pub to say that the bartender has been kind enough to let him use a socket. But even that usually ends well. My father drinks a cup of coffee with the bartender, and afterwards both of them have a good story.

RANGE ANXIETY

It soon becomes clear to me that a solution has to be found for the range problem, or 'range anxiety' as it is also known. Almost every EV driver says that range anxiety is the single biggest obstacle to a serious breakthrough for EVs. Driving is freedom – but a car with a small battery, plugged in so often for hours on end, isn't fun for long.

Incidentally, range anxiety is not new. In the early days of the internal combustion engine, people initially only drove short distances. You wouldn't want to run out of fuel on your way somewhere. This changed on August 5th 1886, in Germany. Bertha Benz, the wife of Karl Benz, took his car on a 106

kilometer trip. She refueled by buying the local pharmacy's complete stock of fuel. People still regularly take the Bertha Benz Memorial Route from Mannheim to Pforzheim. And the pharmacy in Wiesloch has become a tourist attraction, entering history as the world's first filling station.

DUTCH SOLUTION

The Dutch solution to range anxiety comes on May 20th 2010. A company called Epyon opens the country's first fast-charge station, for electric taxis in the northern Dutch town of Leeuwarden. I read about it in the newspaper and call the company. Two weeks later, my father and I have a meeting with Epyon's managing director, Hans Streng and its founder, Crijn Bouman.

Epyon is based in a nondescript concrete building on a canal near Delft. It is a typical Delft start-up, staffed by young engineers who will often know each other from the nearby Delft University of Technology. They work extremely hard on the development of chargers for EVs. For them it is beyond any doubt: EVs are on their way.

When they are not working there's time for fun. Like the Friday afternoon that Michiel Langezaal, who still works for Epyon at the time, takes a Nissan Leaf on a 24 hour road trip around the Netherlands with Wouter Robers and Lars Bech. In essence they make a large triangle between the fast chargers from Taxi Prestige in Utrecht, Amsterdam, and Epyon's base, in Delft. They drive a total of 1,254 kilometers. The film, called '24-hour EV Road Trip', goes viral among EV fans.

Hans, Crijn, my dad, and I soon come to an agreement. We take an 8 per cent stake in Epyon via our investment company, and I become a member of the supervisory board.

MICHIEL

Michiel, who will later set up Fastned with me, is still working for Epyon in 2010. He first got involved with EVs during a consulting project in 2009, when Pon, a major car dealership, asked him to take a look at Tesla Motors. At the time Tesla Motors is working on the Roadster, which can travel 250 kilometers with ease and speeds up incredibly quickly. "The acceleration is unbelievable!", Michiel enthuses. Pon is also impressed – not just by the car, but also by Tesla's entrepreneurial spirit. This is virtually unheard of in the slow and unwieldy automotive industry.

It's not long before Michiel decides that EVs are the future – he wants to be a part of the change this is going to bring about in the automotive industry. By talking to people and doing research on the internet, he identifies the two most important problems facing EVs, as mentioned before: the driving range and the charging speed. That's why, when the first fast charger is introduced in June 2010, Michiel immediately arranges to meet Crijn Bouman from Epyon. He thinks they are "a cool bunch", and joins Epyon in late August as its new business developer.

FOCUS

Things move fast at Epyon. Hans Streng, a former top manager at Philips, builds a strong team, and the company rapidly pro-

fessionalizes. And, as importantly, they market their product. Hans works effectively and decisively, halting everything unrelated to the core objectives, like forklift and scooter charging. The new focus is crystal clear: Epyon makes fast chargers for major car companies' mass-produced EVs. Full stop.

Michiel and Crijn put Epyon's strategy and the fast-charging method (DC charging, see the box on page 20) on paper, and test them at the many trade fairs they visit. The front runners are the Japanese, who are going down the same route, having already implemented DC fast-charging with their CHAdeMO plug (box page 20). Epyon responds quickly, adapting this standard for its chargers. The German car industry, however, still doesn't seem to get it. It's stuck in the slow charging mindset, with relatively small batteries, expensive chargers in the vehicle, and inner city charging posts. We will later witness a change of perspective in German industry, and then things will move quickly. They'll invest billions of euros in the development of German EVs and their own fast-charging standard.

THREE CONCLUSIONS

In their search for answers, Michiel and Crijn prepare a number of presentations that will make history. They arrive at three important conclusions:

1. When dealing with the problem of range anxiety, fast charging is as big a concern as the driving range.
2. Fast-charging is only possible if the charger is not in the car. That's because the faster you charge, the bigger and more ex-

pensive the charger becomes, whereas the purpose of mass-production is to produce cars as cheaply as possible for consumers. 3. If you take the charger out of the car, you can share it with many other people. This is an important economic benefit.

In 2010 and 2011 these three conclusions become painfully obvious to the German and American automotive industry, swiftly admitting that the Japanese were right: DC charging – with a fast charger that's not in the car – is the only way EVs can be mass-produced.

The Epyon sales team sells dozens of chargers, mostly to subsidized pilot projects at first. More importantly, they also sell them to the car manufacturers, also known as original equipment manufacturers (OEMs). Michiel spends his time whizzing across Europe, giving numerous presentations to electricity utilities. At the time everyone is convinced that these companies will realize the infrastructure for EVs; virtually all of them have a team working on it. They dream of endless possibilities, introducing the term 'smart grid'. An important part of this idea is that every consumer will "soon" be able to store power in their EV, and sell it back to the grid at a favorable moment. Epyon sells chargers for this kind of pilot project to practically every European utility.

STANDARDS WAR

Now the German and American automotive industry realize that DC charging is the future, and that they are lagging behind, Epyon receives many orders for test chargers, which the car manufacturers use to try out the charging of their

prototype EVs. This is serious business – everything is investigated and examined from every angle. Batteries, chargers and cars are really put to the test – they're shipped around the world, and tested in all conditions, from the Arctic Circle to the desert.

The Japanese CHAdeMO charging system is secretly analyzed. Audi, BMW, Chrysler, Daimler, Ford, General Motors, Porsche and Volkswagen set up the Combined Charging System Coalition. Together, they come up with an improved – or more accurately, their own – design: called the DC Combo, or the Combined Charging System (CCS). This is the start of the standards war, or in more positive terms, the race to develop a more advanced and faster charging standard. In the future the Germans and Americans will be better and faster at charging than the Japanese.

DC CHARGING VERSUS AC CHARGING

The beauty of the Japanese technology CHAdeMO is that charging is done with direct current (DC). This is in contrast to the alternate current (AC) charging the French manufacturers have opted for. The big difference is the charger itself.

AC charging requires a charger under the bonnet. This means an additional investment per EV. Moreover, a rapid charger is larger, heavier and more expensive. The big advantage of AC charging is that you can simply insert the plug into a (primed) electrical socket at home or at work. On the downside, the socket determines the charging rate, and every car needs its own charger – which is expensive.

All the electronics in DC charging are built into in the charger, which is located in the charging station. In effect the electricity is 'blown' directly into the car battery. The big advantage of this is that the investment in the charger is shared by dozens of cars, and the car itself doesn't need expensive equipment. (See the illustration on page 72).

Although initially enthusiastic about EVs and smart grids, the utilities take a wait-and-see approach to the standards war. Most decide not to make any more significant investments as long as there is no standard, effectively sidelining themselves.

The importance of uniformity is debated all the way up to the European Commission. It is a rather pointless debate in our view, as the industry will ultimately determine which plugs are used. In addition, innovation will inevitably result in improved – and therefore various – plugs. Conversely, a variety of plugs will encourage continuous improvement, as well as leading to innovation. Moreover, conventional fuel pumps are equipped with multiple hoses with various dispensers; it won't take long for charger manufacturers to come up with multi-standard chargers allowing you to charge all types of cars, regardless of the plug. There will just be three cables next to each other. Nothing changes really.

As long as the battle hasn't been decided, the German and American product suppliers need to buy chargers to test their cars. Hans Streng's decision to focus entirely on mass-produced cars has become a reality. Epyon is focused entirely on making chargers for the automotive industry.

FEBRUARY 25, 2011

Location, location, location

During board meetings I'm always struck by Epyon's bold management style. Decisions are made quickly, and the CFO, Stefan Franco, has his figures always right up-to-date. The company is very international; the board includes Taiwan's Lite-On, and Chrysalix of Canada. What is new for me is the phenomenon of almost always having two laptops running Skype at meetings. In this way shareholders in Taiwan and Canada are directly involved, and lines of communication are kept short.

Everyone talks incessantly about the technology, which makes sense given the phase the industry is in: most of the chargers are bought by car manufacturers to test their cars with. Conversation turns all too often to transformers, electrical overload, and other relevant technical issues. Yet there's something missing in the discussions.

There are also the early adopters who buy the first EVs and need chargers. It seems obvious to me that the chargers Epyon sells to municipalities, car dealerships and taxi stations can only have value, from an economic perspective, if they are optimally exploited. These are expensive devices – so if you only charge one car with them it'll never make financial sense. For a cost-effective model multiple users will have to share a charger; or even better, dozens of users will share a station with several chargers. Like the idea of a charger with multiple cables, the idea of a station with several chargers resembles the layout of a filling station – quite logical really. Such cost-effective stations will of course only work in

good locations with many users. Isn't it about time someone started thinking about what the consumer infrastructure will look like?

METRO'S SUCCESS

I experienced the necessity of nationwide coverage a few years earlier, in a totally different industry. Together with two partners, Tiago Jurgens en Falk Madeja, I launched the free newspaper *Metro* onto the Dutch market in 2001. First we had to negotiate a contract with the Dutch Railways for exclusive distribution at all railway stations. Only then were we able to launch the newspaper. It was an instant success – in one fell swoop *Metro* became the Netherlands' second-biggest newspaper, both in terms of circulation and readership.

Commuters were key to *Metro*; cars are key to fast chargers. Railway stations were the best locations for *Metro*; highway service areas are the best locations for fast chargers. As with retail, it's all about location. In fact, fast-charging *is* retail – so, EVs are all about location, location, location!

I start thinking up a plan for a nationwide charging network. When I discuss it with Epyon's board or others, the response is lukewarm. There are hardly any EVs, so there doesn't seem to be a business case for hundreds of charging stations. I turn the argument around: because there are hardly any EVs, no one is doing anything. This is precisely the right moment to gain control of the best sites.

BACK INJURY

I suffer a back injury during a winter holiday in February 2011. I can't ski, and decide to stay in the chalet instead, drawing up a plan for a nationwide fast-charging network. All I have is a temperamental internet connection and my new MacBook. It'll have to do; being cut off from the web might stimulate deeper reflection.

I initially work with the assumption that you need 500 sites to create a sense of nationwide coverage. This is similar to the 405 Dutch railway stations used to distribute *Metro*.

By way of comparison, I first delve into the dynamics of refueling at filling stations. Refueling and recharging requirements will tend to roughly coincide with each other. I discover that there are 4,200 filling stations in the Netherlands. If EVs take off, the market will be huge; and, just as importantly, the market is ripe for the picking.

THE RIGHT LOCATION

The most successful filling stations are along the highway, which are interspersed every 30 to 40 kilometers across the country. This is ideal for a nationwide network of charging stations – especially as I don't believe in the logic of a detour to a station off the highway. I'm also wary of combining different services, like charging and eating hamburgers. In my view you're there to charge your car; the rest is irrelevant. It's all about focus.

Choosing for highway sites is only half the story, though. Most highway filling stations are controlled by big oil companies, and I dread the prospect of negotiating with them. Not

only are they backed by powerful oil conglomerates, they are also bureaucratic juggernauts. Negotiations could take years, and there isn't that kind of time. This is the moment – it has to happen *now*.

ONE OWNER

The internet falters. On the chalet's balcony I just manage to get a strong enough wifi signal from the neighbors to be able to surf the web. Huddled on the balcony, I discover who owns the Dutch highway service areas. This is one of the most crucial elements in this story. It turns out that the filling stations only rent a small part of the land adjacent to Dutch highways. The good news is that all of this land has only one owner: the Ministry of Infrastructure and the Environment. The bad news is that there are only 245 sites along the highway, less than half of my original calculation.

Nevertheless, Friday, February 25th 2011 is a good day: it's possible to build a nationwide network with 245 sites. While my friends and family are skiing in the mountains, I'm smiling at my MacBook. In my opinion this is a breakthrough, solving the chicken and egg problem facing EVs and charging. Despite – or perhaps because of – my back pain, this turned out to be a very good skiing trip.

On the same wavelength

Meanwhile at Epyon, Michiel is growing increasingly frustrated by the utilities' lack of progress. A good example is a meeting he has in Austria with Verbund, one of Europe's biggest utilities, where he gives a presentation of several hours and answers questions. The audience laps it up, but it takes the company months to order their first charger. To this day they hasn't come up with a serious plan. Talk about inertia.

Epyon's sales team says Michiel shouldn't set so much store by building charging networks in European countries. They argue for a less ambitious approach: the company should concentrate on selling just a few chargers for now; charging networks will follow later, and sales will increase in due time. Michiel isn't convinced; he thinks that the charger industry, the media, and the automotive industry are all waiting in vain for the utilities to build a charging infrastructure. The reality is that the utilities might not see it this way. Nor does Michiel believe the utilities really understand the concept of charging as a product. They are used to seeing a customer as a number in a database, which seems at odds with the idea of operating a charging network, with stations and customers. After all, it is about retail – meaning customers, customer service, and enticing consumers. This is something utilities still don't grasp.

Utilities have much more luck pleasing consumers with all sorts of charge cards. You can tell someone has an EV if they have one of these RFID (Radio Frequency Identification) cards. EV drivers proudly show them off at dinner parties,

and can use them to activate charging points. The idea is that utilities will be able to use them to build up their own customer base. These cards dominated the discussion about EVs in the Netherlands for years. Unlike other industries, where existing payment methods are used, the utilities are trying – with varying degrees of success – to construct their own payment system.

One of the ideas behind the utilities' cards is that the electricity you use when charging en route is not all that different to power from your domestic socket. Ideally your entire electricity consumption would be billed on one collective invoice. This conveniently overlooks the fact that the price that is paid for charging is determined by the owners of the charging infrastructure, who will incorporate their investment and the location in their price. Moreover, the market will ultimately determine what consumers are willing to pay for a charging service at any particular location. Finally, charging station operators will want to build a strong relationship of their own with their customers. As I said before, charging will become retail.

THE RIGHT COVERAGE

In the autumn of 2010, Michiel and Crijn develop a revenue and investment model to see if there's a business case for building a charging network. The results are interesting: even you can only charge half the price of petrol per kilometer, you can build a profitable network. Michiel also sees an interesting parallel between the EV fast-charging industry and the telecoms industry. Drivers, like cell phone users, are willing

to pay for good network coverage. In short, it could be very profitable to be in this industry.

But there's one question that keeps bothering Michiel after all his many discussions with the utilities. There aren't really any EVs yet, so why now? Why invest now; is it the right time? This question will keep coming back to him, but he doesn't come up with a concrete answer.

Not knowing that Michiel is already pondering the issue, I ask Crijn Bouman whom I should talk about my idea of a national network with. He doesn't miss a beat; on April 6th 2011 – one year after my first visit to Epyon – Crijn takes me to meet Michiel.

ANSWER

It soon becomes apparent that Michiel and I have been working in parallel on many of the same issues, and that our ideas are closely related. What's more, we complement each other very well. Michiel is much more knowledgeable about the charging industry, the technology, and the EV consumer, and I, drawing on my experience launching *Metro*, can give a good answer to the question why this is the moment to invest. The time is now, because this is the moment to acquire the best sites – now that they're still readily available. Michiel immediately understands what I mean, having spent some time puzzling over the issue.

We both realize by now it's going to be a massive job getting the sites, sorting out the permits, and building the stations. The number of EVs will grow steadily during this time, so it's not too early to start. With a bit of luck, supply

from charging stations and demand from EVs will grow at the same pace.

JUNE 1, 2011

The visit to the Ministry of Infrastructure and the Environment

We have a meeting with Frank ten Wolde on June 1st 2011. He's the EV program manager at the Ministry of Infrastructure and the Environment. Throughout this adventure, he turns out to be the right person in the right place. We show him our entire plan, and make a clear request. "We want to lease all 245 sites on the Dutch highways in order to build charging stations for EVs." Frank is enthusiastic and very motivated, but soon points out a number of difficulties. Are charging stations subject to the so-called Petrol Law? Which plugs are we going to use?

As far as the plugs are concerned, we soon set Frank right. The Netherlands doesn't have an automotive industry; so we have no say in the matter. We'll have to wait and see what the Germans, Japanese and French come up with.

PETROL LAW

The Petrol Law is a controversial issue. Until 2000, the oil companies had perpetual rights to the filling stations along the highway. Tough negotiations with the Dutch State resulted in the oil companies relinquishing their perpetual rights, in return for an auction program ending in 2024. This agreement was formalized in the Petrol Law. There are auctions for fifteen-year concessions for every filling station along the highway, the proceeds going to the incumbent party. In exchange for giving up their monopoly, the oil companies

have received assurances that no new points of sale for fuel will be permitted until 2024. This issue will be revisited later in the filling station owners' court case.

The question right now is whether charging is subject to the Petrol Law. We felt it was quite clear: electricity is not a fuel. Furthermore, every electrical socket would then be subject to this law. But what would the Ministry of Finance make of it? Our position was confirmed a few months later when the ministry states that EVs aren't subject to the Petrol Law.

THE LETTER

We hold several weeks of talks with the Ministry of Infrastructure and the Environment and the Ministry of Economic Affairs. They are friendly, but we don't really get any further. The initiative is losing momentum, while civil servants find it unnecessarily complicated. "Wouldn't it be much easier if you installed the chargers at filling stations? Can't you talk to Shell, Esso and BP, for instance?" We've heard this before, and as far as we're concerned, it would be flogging a dead horse. So, in a final attempt, we send a letter to Frank ten Wolde on July 11th 2011, applying for permits to build and operate charging stations at all 245 service areas.

The letter proves decisive – we're being taken seriously at last – and on August 8th 2011, the government finally makes a decision. Michiel phones Frank ten Wolde, who tells us that the law will be changed before the end of the year, authorizing fast-charge stations to be built along the highway. An amendment will be published in the *Government Gazette* invit-

ing bids. In addition to paying fees, operators are required to get the charging stations up and running within one and a half years. There won't be any time to sit around: anyone who tries to be clever, by claiming sites and not developing them, will irrevocably lose their permit after eighteen months.

This is how the ministry wants to prevent opportunism of the kind that happened when internet domain names were first auctioned. There was a run on the best names, and cybersquatters were then able to extract a high price for them. The deadline gives the ministry an effective means of ensuring the sites are developed quickly. Civil servants have several ways of measuring the progress being made: have the drawings been submitted? Has a soil analysis been done? Has the application for an electrical connection been made? We're champing at the bit to get on with it – our dream is to develop a network of stations enabling EVs to drive trouble-free. In this sense we share the same interests as the ministry.

JULY 1, 2011

Multinational ABB acquires Epyon

Meanwhile, the orders keep pouring in at Epyon. One of the bigger catches is Estonia. This progressive little country at the edge of the European Union is a technical pioneer , with nationwide wifi and companies like Kazaa and Skype. All of which has earned it the nickname e-Stonia.

First it was the internet revolution, and now EVs. Estonia starts building a nationwide network of fast chargers. To do this it pulls off a stunt. At the peak of the market, the country sells 10 million euros worth of carbon emission rights to the Japanese technology company Mitsubishi. In addition, Estonia is granted generous European subsidies. The proceeds are spent on the purchase of 507 electric Mitsubishi iMiEVs for civil servants and 200 fast chargers. Led by the gifted civil servant, Jarmo Tuisk, Estonia becomes the first country with a nationwide fast-charging network. It's dubbed ELMO, an abbreviation of 'electric mobility'.

Epyon bids for the Estonian tender for fast chargers, with Michiel as tender manager. He spends several months in the country in the autumn of 2011, literally witnessing the birth of the first nationwide network of fast chargers. This will prove to be a valuable experience when setting up Fastned.

AND THE WINNER IS...

Meanwhile, Epyon's board has to deal with a considerable dilemma. On the one hand, it would like to land the Estonia order. On the other hand, this would require a large investment in Epyon's production capacity. Plus it looks difficult for a relatively small company to actually bag this mega order without a major industrial name behind it. On top of this, it doesn't have local office in Estonia to support and execute operations. As a result the shareholders decide to sell Epyon to one of the big boys. There is a short takeover battle between Siemens and ABB, in which ABB comes out on top. On July 1st 2011 Epyon is renamed in ABB Product Group EV Charging Infrastructure. It wins the Estonian tender on December 7th 2011.

The Estonian experience also clearly shows that the bottleneck for installing chargers is obtaining sites and permits. This is always a priority in retail, but still doesn't seem to have dawned at all on the charger industry. Many of Epyon's customers are still preoccupied with charging passes and plugs, while often failing to acquire the necessary sites. This becomes painfully obvious when the Estonians are forced to admit there are teething troubles, such as the reluctance of local authorities to cooperate in identifying suitable locations. The entire ELMO project is ultimately delayed by the lack of priority given to site selection.

DECEMBER 20, 2011

9:01 am: we go for the lot!

While he's in Estonia, Michiel maintains close contact with Frank ten Wolde. In late November he finally informs him that the *Government Gazette* publication announcing the bidding process will go online at 9:00 a.m. on Tuesday, December 20th 2011. Parties can register until January 16th 2012. We spend the weeks before this frantically preparing the permit applications – we want to be first, and don't want to risk missing the boat! I ask everyone in the office to keep this Tuesday morning free. It turns out not to be necessary: Michiel has prepared everything in such a way that, with a few clicks, he is able to do all the applications at once. By 9:01 am on December 20th 2011, we've submitted our applications for all 245 sites.

There are five other bidders. Their applications vary from two sites to several dozen, mainly focusing on the more densely populated west of the country, or based on range-circles of EVs. There is a considerable overlap between the other five parties' sites, and of course with ours. This results in the draw on April 27th 2012, and the favorable allocation for Fastned.

By this time Michiel has told Epyon's founder Crijn Bouman he's 'fallen in love' with a new project. When the bidding window closes on January 16th 2012, it's immediately clear that Fastned is viable: many of the sites have no other bidder. Michiel resigns from Epyon in order to set up Fastned. Crijn couldn't have wished for a better compliment to his school of entrepreneurship. Moreover, it's obvious that Fastned will

be a potential customer of Epyon. If the plan succeeds, the Netherlands will be a model for the rest of the world. This will be particularly appealing to ABB, as Epyon's new owner.

FEBRUARY 1, 2012

Fastned is incorporated

We incorporate Fastned as a limited company within a few weeks. We both own half of the shares in the company. Michiel is a keen yachtsman and calls his personal holding company Carraig Aonair Holding BV – a reference to the Ireland's southernmost point, an islet with a lighthouse, also known as 'Fastnet Rock'. It's the central point of one of the most famous yachting races in the world, the Fastnet Race. My own holding company has a less exotic name: Wilhelmina-Dok, named after my restaurant in Amsterdam. We stick to the name Fastned for now.

JANUARY 16, 2012

Focus, focus, focus

As soon as the bidding window closes on January 16th 2012, Michiel and I put our heads together. There's a lot to do; and perhaps more importantly, there is a lot not to do. Our experience at Epyon helps us tremendously when it comes to focusing on the right things. We decide not to participate in RFID cards, hydrogen cars, slow charging, charging point search systems, subsidies, EV teams, EV conferences, and interoperability consultations. We'll concentrate on building 201 charging stations at 'our' highway service areas. We can always join up later, where necessary.

YOUNG, EAGER AND HANDS-ON

The first thing we need is someone to design a blueprint for the sites. What should a charging station look like? How do you situate it within the service area? In the very first week we get a visit from Margot Eelkman Rooda, an engineer and industrial designer. She has already been dropping heavy hints about how she would like to get involved. Margot is also a yacht-enthusiast like Michiel, and they get on from the start. Margot sets our hiring norm: young, eager and hands-on.

The first purchase is a computer with Google Earth Pro. Michiel spends days entering complex coordinates and the names of the service areas. It's a hellish job, but proves to be very valuable. During the dozens of meetings with the Ministry of Infrastructure and the Environment's road districts, the ability to zoom in on sites is not only highly effective, but comes across as very professional. Abstract discussions

with civil servants often resolve themselves when – courtesy of Google – we take them on a virtual stroll around the sites, and show that it's all really not as difficult as it seems.

We make plans of each site, aerial photographs and AutoCAD drawings of all the service areas, sketch the stations, and confer with road district officials. Then we visit all the sites and incorporate their suggestions and comments. The aim is to agree on the best and safest location for each charging station. The meetings take thousands of hours, and we drive tens of thousands of kilometers.

GREEN ELECTRICITY

We've decided only to use green power – but there are different shades of green. Some of it does come directly from windmills or solar panels, but much of it comes from heavily polluting coal-fired plants, which have bought Green Certificates – nowadays called 'Guarantees of Origin'. These certificates often come from Norway, where 97 percent of the country's electricity is from hydroelectric plants and are entitled to Green Certificates. So what do the Norwegians do with them? Sell them to the Dutch. The result is the curious situation in which electricity in Norway is almost entirely green in reality, but only for a small part on paper; whereas Dutch electricity is only 5 percent green, compared to more than 30 percent on paper. To add to the confusion, you have to navigate your way through jargon like 'co-incineration with CO_2 neutral biomass'. Translation: a small proportion of wood is burnt along with the coal in coal-fired power stations.

We also need someone to supply electricity – in mega-

watts at first, but in terawatts in the long run. In order not to get bogged down in discussions about the definition of green, we decide to restrict ourselves exclusively to electricity from windmills and solar panels. We won't use any kind of fuel – from biomass, or any other source. We agree with our supplier on which wind farms and solar panels will supply our electricity.

JANUARY 23, 2012

The creation of the Fastned station

A few days after first meeting her, on January 23rd 2012, we decide to make Margot responsible for designing the stations. We soon agree that all the stations will be identical – a site with a canopy – to ensure maximum visibility and brand recognition. The customer doesn't go looking for a charging station, but simply comes across one – as opposed to charging posts, which are complicated to find, often requiring navigation and smartphone apps.

Building identical stations will be an immense task, as contractors and builders in the Netherlands have little experience with industrial processes. Most buildings are designed and built only once, but we think standardization will be more efficient: the economies of scale from building the same station 201 times will deliver substantial savings. Building materials can be bought in bulk; the design only needs to be made once; the building team will gain experience, progressively cutting the construction time; any improvement to one station is an improvement for all stations. And last but not least: since each station is the same, the risk of setbacks and extra work – resulting in higher costs – is limited, reducing risks to site-specific problems.

The station is a platform for the chargers. You start off by building a station in a prime location, and then install extra chargers when queues start to form. In this respect they resemble a small supermarket with tills: if there's a queue, open a new till.

We speak about the idea of a canopy with solar panels on it. Michiel is unimpressed at first: while only producing enough power to charge four cars, the solar panels are a large investment, a hassle, and a distraction from Fastned's focus. The breakthrough comes when Margot presents several station designs. As it turns out, there are solar panels that can be used as building material, enabling Margot to design a canopy made of solar panels, piquing Michiel's interest. The design is much more attractive, and this concept only requires a single investment, as you avoid first building the canopy and then putting solar panels on top. Everything is done in one go.

YELLOW FOR SPEED

Margot goes all out on the Fastned brand identity. We spend many sessions discussing the look, the customer, and the experience. Margot makes mood boards with slogans and pictures from magazines. This is very effective: in the beginning we got stuck on ideas about green, healthy and happy; and now we soon agree on what it should be about. EVs are driven by relatively young professionals who like beautiful, fast cars (two characteristics most EVs lacked until recently). They also want to be able to drive unimpeded wherever they want. Lastly, they love speed – with their fabulous acceleration, this is definitely something EVs can offer driving enthusiasts.

The definitive design is based on the teardrop shape that forms when you put a car in a wind tunnel. The air current forms a beautiful curve around the profile of the car. This gives the station a distinctive appearance, differentiating it from regular filling stations.

We have a short discussion about the color. Naturally enough, many green initiatives choose the color green. Blue is often chosen for downtown electric charging spaces. The electric Nissan Leaf is also blue. What we want Fastned to convey most of all is 'speed': our customers must be able to recharge quickly along the highway. Margot convinces us that yellow is the only color that conveys speed. This is a completely new insight for me, and I question whether this is so, comparing yellow with other colors. I look around me for similar examples of things that convey speed. Finally I'm convinced that Margot is right – yellow is the color of speed. The station will be different, striking and have a modern look.

A model is made of the station design, including entrance and exit lanes. It's on the same scale as the toy cars we get every time we visit car dealers. In the beginning only little Nissan Leafs drive around our model, but Tesla, BMW i3s, and fast-charging hybrid cars like the Mitsubishi Outlander soon follow them. On June 18th 2012 we take the model with us for the first time, on a visit to a Rotterdam alderman.

At each visit the model proves out to be an eye-opener for EV skeptics. People are suddenly able to see the future in front of them – a station where you recharge your car. All their doubts and uncertainties disappear in an instant. When Michiel and I invited to speak on a famous Dutch radio car program, *Tros Autoshow*, hosted by Bas van Werven and Carlo Brantsen. The first thing the petrolheads say when they see our model is: "Oh, it's just a filling station?! That's alright then." When Michiel puts an analog and a digital camera side by side on the table the message is clear: the internal combus-

tion engine is fantastic twentieth century technology, but we're going for twenty-first century technology. From fuel to electricity; from analog to digital.

PIT STOP

The team briefly returns to the discussion about the name 'Fastned'. Michiel came up with the name as a working title, related – whether by chance or not – to his beloved rock in the Irish Sea. Now that things are getting serious, we start thinking about a better name. We consider several alternatives: Pitstop, Power2, Ster, ZOEV, Contact, Energized, Stekker, Spoel, and Bliksem. We decide to stick with Fastned until something better comes up – which of course it doesn't, and Fastned soon sounds so familiar that we can't imagine a better name.

IKEA STYLE

The German company FATH helps us look for the optimal way of building a solar panel roof in the charging station's droplet shape. This is one of the dividends of Germany's lead in solar energy: only German industry has the scale and knowledge to build roofs from solar panels at a reasonable price. We soon come to the conclusion that, by doing it in this way, a solar panel roof is hardly more expensive than a conventional roof. The real difference is that the roof also provides sufficient power to charge four cars a day, which fits in perfectly with everything else – solar energy flows straight from the roof into your car. That's as green as it gets.

We decide to use timber to build the stations, as it is both

sustainable and cheap. We get hold of De Groot Vroomshoop, one of the biggest timber builders in the Netherlands, and tour their factory. We see how ready-to-use roof kits are made for residential homes, and when we learn that these roofs work like laundry racks that are unfolded on location, our minds are made up: they are going to help us build 'IKEA style'. By building the same way every time, we can make substantial costs savings, and complete the stations quickly.

NERVE

As often happens in the journey from vision to reality, we risk getting bogged down when putting things into practice. The stations keep getting heavier and more expensive; they even have two supporting pillars in the middle just to be on the safe side. No one wants to risk putting too much strain on the structure, or the solar panels being damaged in a squall. This is understandable, as using a round and open roof for our stations is new for everyone. There is also a problem with drainage, due to the W-shaped steel frames that are normally used to fasten the solar panels. They turn out to be unsuitable for the curvature of the roof we have in mind.

This leads to intense discussions in the team. Can we stick to our brand identity, with the teardrop shape and translucent roof, or will we resign ourselves to a less spectacular, but easier and cheaper design? In the end the team bites the bullet, and we choose the tough option. "Of course we'll solve the technical problems!"

It's a process of continuous improvement. In the summer of 2013 we get another engineering bureau, De Fietsenmak-

ers (The Bicycle Repairmen in English), to go through all the calculations again. The boffins re-examine technical issues, like the drainage, from all angles. The process shows – once again – the strength of a young team with fresh minds: everyone listens to each other, and works together towards the best solutions. The result is that the station design is greatly improved within weeks. It is lighter, has good drainage, is tens of thousands of euros cheaper, and enables us to get rid of the supporting pillars – all without compromising the design's identity!

MARCH 22, 2012

A working business model

Despite our determination not to go to EV conventions, Michiel and I attend the Electric Mobility Congress on March 22nd 2012. Michiel thinks it's a waste of time, but I think we should go – we might learn something. Almost the entire conference is about solving the chicken and egg problem: as long as there are too few chargers, there will be too few EVs.

There are many important speakers; all of them recognize the problem. Fortunately their organization, city, or province is heading in the right direction. We'll get there – with the help of green EV subsidies, of course.

Halfway through the event, the little-known civil servant, Frank ten Wolde, takes the stage. He calmly explains the solution to the chicken and egg problem: his ministry has arranged for entrepreneurs to build 245 charging stations along the highway within the next 18 months. Without any subsidy! Everyone just gazes vacantly at the stage. Underwhelmed, we look around the auditorium. We'd expected enthusiasm – the breakthrough has been made!

Instead, nothing happens, nothing at all – they don't understand, or don't want to understand. Frank makes way for a more important speaker, who goes straight back to the chicken and egg problem, and the attendant subsidies. A new buzzword for this problem is incorporated into almost every speech: the 'financial gap'.

Michiel was right: the congress hasn't been very worthwhile. Delegates are mainly there to meet each other. We learn that focusing on convincing all and sundry is a waste of

energy. Our job is to create a working business model – and a profitable business.

UNECONOMICAL PROPOSITION

The 'financial gap' brought up at the conference refers to the slow charging points a number of municipalities have installed. The initial investment is so big that it will be impossible to ever recoup it. These projects require government intervention. Slow charging points don't just have a 'financial gap' however, they're completely uneconomical. They are expensive to buy and maintain – but the electricity is given away for free, requiring even more subsidy. Even if a charging fee is introduced at some point, it will be so low that the venture will still be uneconomical.

The introduction of the term 'financial gap' results in endless discussions between the government and lobbyists. In particular the manufacturers, and contractors who install the charging points, want the government to pay for them. An added attraction for local politicians is that these charging points are nice, visible projects – creating welcome publicity and fanfare for aldermen. The result is that the necessary subsidies are forthcoming; the Dutch government subsidizes the installation of thousands of charging points, forking out tens of millions of euros. It has to be said that this certainly helped enable the introduction of the first thousand EVs in the Netherlands. Besides, without a fast-charging network, EV drivers have to rely on public charging points.

Lacking subsidies, Fastned has to rely on a normal business model. That means investing first, and then making

money. In this regard, charging stations aren't all that different from filling stations: you build them in a good location, and then consumers are happy to pay in order to charge at a prime location.

TAKE NOTHING FOR GRANTED

Michiel and I estimate that a complete station – with a canopy and four chargers – will require an investment of about two hundred thousand euros. This is comparable to a small, unmanned filling station. The advantage is that you don't need to install underground fuel tanks, or an impervious floor. On the other hand, you need a heavy-duty power connection, and we want solar panels on the roof. Just like a regular filling station, it needs to be paved, drainage and lighting need to be installed, cables laid, and so on.

We've been able to keep the investment at an acceptable level by writing very comprehensive and detailed tender documents, and negotiating good deals with suppliers and contractors. Having a young team with spirit and vision contributed tremendously in this process. Since we're completely new to most things, we often wonder why something costs as much as it does. We query things that others take for granted. Sometimes the contractor has a good explanation, but there's often a better, cheaper solution. All in all, it looks like Fastned's actual investment requirements for the next two years will be very similar to the estimate Michiel and I made when we founded the company.

A crucial element in the success of our plan is the time it takes to build the stations. As soon as a building permit has

been granted for a site, it can be developed. The order and timing of permit approvals – and hence site development – is entirely dependent on when the civil servants finish the paperwork for a particular site. The station will then be built in two weeks – a week for the foundations, and a week for the canopy and the installation of the equipment.

Each station will initially have one or more chargers, with additional chargers installed as demand rises. The more customers we get, the more chargers we'll install.

GUT FEELING

The next step is to recoup the investment by operating the stations. Our gut feeling is that there's money to be made charging EVs along the highway. But what are the hard numbers? At the moment there are hardly any EVs. Is the behavior of pioneers a good indication of how things will go in the future? This is important, as we are investing for the next fifteen years.

To get an idea of the size of the market, we look at the fuel market first: as our direct competitor, it provides an interesting comparison. 24 billion euros worth of vehicle fuel is consumed annually in the Netherlands, which is about 3,000 euros per driver. The Netherlands' 8 million drivers use about 14 billion liters of petrol, diesel and gas a year, equivalent to ten large stadiums filled to the brim. We want to take a small share of this huge market. Suppose we manage to get a market share of half a percent – that's a cool one hundred million euro turnover. Is that a realistic figure?

Looking at it in another way, suppose that there are

200,000 EVs in the Netherlands in 2020, as the government estimates. And suppose that these 200,000 cars charge on average once a week at one of our stations, for say ten euros a time. Then the annual turnover would again be one hundred million euros.

WHAT'S REASONABLE?

This calculation sounds realistic to us, but will people really be willing to pay ten euros to charge their EV? We ask around; the answers vary widely. One respondent finds it too expensive – charging has been free up until now. Someone else thinks it's ridiculously cheap – a full tank of petrol costs around one hundred euros. That leads to the question what we should be comparing the price to.

Extracting oil from the ground only costs a few euros per barrel, yet a barrel of oil costs just under one hundred euros, and by the time the petrol reaches the pump, it costs over 1.90 euros per liter. Or to take another comparison: how much does it actually cost to make a phone callphone call? Or why do you pay 5 euros an hour to park in downtown Amsterdam, while parking is free a few hundred meters outside the center? Apparently people are willing to pay a premium for location. Will this also be the case for charging?

Price sensitivity will develop in time, as the various parties start asking for money to charge at one of the hundreds of slow charging points and the several dozen fast chargers in the Netherlands. The price for slow charging is 1 euro per hour. The price for fast-charging will be between 8 and 12 euros.

SEVERAL POSSIBILITIES

As well as fast-charging on the go, the great advantage of EVs is that you can charge them slowly at home. It feels almost free; moreover, as long as there is no proper infrastructure, you will always want to leave home with a full battery in the morning. However, in most cases you still have to buy and install a wall box for domestic charging – and, of course, you'll preferably have one at the office too. All in all, scrupulously taking all the costs of the devices and installation into account, the cost of two wall boxes soon runs into thousands of euros. And we're still talking about slow charging. This is why domestic charging is actually more expensive than fast-charging on the go – unless you clock up a huge number of kilometers.

The next question is, of course, what happens when the batteries get bigger. For a start, the charging speed will rise, as this will enable more kilowatts to be delivered to the battery in a shorter time. Tesla has set the standard, producing the biggest batteries and the fastest chargers. We see this as a positive development, as we assume it will boost the popularity of EVs and the demand for fast-charging. In this way consumers will be more willing to pay for the infrastructure over time. Greater numbers of EVs also means the stations will be better utilized. Ultimately, all of this means that fast-charging will become more popular and accepted.

From our experience in Estonia, we conclude that a mix of payment options will be used: pay-per-use, a monthly flat-fee, or even a fixed fee for the car's lifespan. The latter is Tesla's strategy: charging a Tesla at one of its own stations is 'free'.

Not really, of course – we estimate that a customer pays a few thousand dollars extra for free charging over the car's lifespan. This model has its advantages, too.

APRIL 11, 2012

The bureaucratic pipeline

Margot, Michiel and I are on the train to Goes, in the south-east of the country. It's April 11th 2012, time for the first of dozens of visits to the road districts. At the same time, we're launching the company, designing the stations and doing everything else that needs to be done. Today will give us a taste of what lies ahead, as we have to go over all 201 site plans with civil servants from the 17 road districts. Topics range from layout, road safety, traffic circulation, picnic benches, trees, ditches, birds, see-saws, gas mains, so-called 'hop-overs' for birds, overhead power lines, soil types, pollution to everything else relating to service areas.

Every district is different. Some traffic experts are well prepared, armed with photos and maps; we need to start from scratch with others. Some civil servants are enthusiastic and co-operative; others oppose everything. When the team returns from a visit to a district, I can see on their faces how it went. "Well, another bunch from the Department of Red Tape and Mismanagement", is one of our standing jokes. Luckily we generally deal with the "Department of Solutions".

Each WBR permit requires road district approval; WBR is the Dutch abbreviation for the Public Works Management Law. We have to conduct 201 separate discussions, needing all our powers of persuasion, and lots of drawings. Then yet more drawings, and deliberations, until everyone agrees and the site is approved on paper. The final, so-called AutoCAD site drawing shows the station with traffic lanes and paving – the whole hog – and once it is ready the WBR permit ap-

plication can be submitted. A temporary permit – which is contestable – is submitted for approval; if all goes well, the definitive WBR permit is usually issued six weeks later.

At a certain point, we have four AutoCAD draftsmen working full-time at the sites, while Michiel zips from one service area to another in his old Saab. His boot is stuffed with traffic cones, tape measures and red and white cordon tapes. Each site's station plan is staked out with traffic cones and cordon tape, and then photographed to give civil servants an impression of its dimensions.

THOUSANDS OF DRAWINGS

We buy a large printer that churns out the thousands of drawings we need for talks with the ministry, site visits, and the grid operators. For a while Fastned looks like an incredibly productive graphic design office.

Two members of the AutoCAD team become permanent employees: Bas van Leeuwen and Maria Garcia. I met Bas at the cinema *De Uitkijk* he worked at while studying architecture in Delft and was struck by his positive attitude. He turns out also to be an excellent AutoCAD user, and to with a keen understanding of traffic flow design. It doesn't take him long to become *the* Fastned site designer. It would be fair to say that, by now, Bas knows the service areas better than anyone at the ministry.

Maria, one of the many Spaniards who moved to the Netherlands during the economic crisis, is an architect. She's not only a skilled AutoCAD draftsman; she also makes fabulous impressions of the stations. Maria's drawings show not only

the technology, but also the visitors – you see people charging their cars, and an infatuated couple holding hands while gazing at the Fastned station. This really helps convince civil servants at the ministry, and later the municipal review committees. Once again, seeing is believing.

Margot and Maria design the whole station in-house, right down to the smallest screw. Doing so, we're able to stay in control of the process, influence synergies and costs, and keep things moving fast.

QUIZ

During our Christmas dinner at my restaurant Wilhelmina-Dok, it becomes clear how deeply the stations have affected our lives. We think and breathe stations, and some of us probably dream of them. We know every detail, down to the difference between sandwiches from Shell and Texaco.

Margot has chronicled Fastned's adventures in the last year on a gigantic piece of paper. She's drawing particular events, and a line showing the highs and lows.

The whole team gets an orange football shirt for Christmas, with the service area name that most suits their personality printed on the back. We also do a quiz entitled 'Guess the station', or what engineers would call "interim knowledge measurement". A couple of us are able to identify every single station from an aerial photograph – not bad, considering there are more than two hundred stations and they all look alike, especially from space.

The glacial pace of process is illustrated by the fact that the first definitive WBR permits only come in on June 7th

2013, when the Veluwe road district issues thirteen in one go. Thanks to the Fastned team's diligent work, there are nearly two hundred applications in the pipeline – which include photographs and drawings of every site, and the minutes of all the meetings. Over the next few months the permits gush out of the bureaucratic pipeline.

AUGUST 22, 2012

201 building permits

Michiel and I soon become masters at knotting our ties in the reflection of ministry windows. After winning our concessions, the permit process has started. Apart from obtaining 201 WBR permits from the ministry, we also have to get 201 municipal permits.

A municipal building permit has a total of fifty-two appendices, which include drawings, forms and surveys – easily enough filling a thick binder for each site. We think it's ludicrous, and raise it with several top civil servants.

We learn a great deal from our many visits to the various ministries. We might believe in EVs, we might be convinced of the necessity of charging stations for thousands of cars, we might believe we have a concession for 201 highway sites. But for the government it's all still pie in the sky. "Yes, EVs are wonderful and these start-ups are terrific – but things won't just change overnight", is the sentiment. Despite dozens of meetings, we're starting to feel like Don Quixote. No matter, we're not here to convince the whole world. We're here to build the stations.

"THAT'S JUST THE WAY THINGS GO IN THE NETHERLANDS"

Nevertheless, we manage to make progress. One of our encounters with a senior Cabinet Office official, Carla Moonen, is particularly memorable. We meet up in The Hague, but she seems a bit hurried. It turns out that she has to go to Amsterdam for one of Shell's famous 'scenario sessions', to

discuss various future scenarios with policy makers. We offer her a lift – a good opportunity to freely exchange views in an informal setting. As we zoom over the A4 towards Amsterdam, we tell Carla about Fastned's permit issue. "That's just the way things go in the Netherlands", she answers, but promises to put our charging stations on the list of Crisis and Recovery Law projects. She wrote this law at the beginning of the economic crisis with a view to accelerating certain, mainly infrastructural, projects by significantly reducing the administrative review process. Carla keeps her word and gets the stations listed within a few months.

I call the Green Party to get EVs on the political agenda. It's election time, and I speak to Joris Wijnhoven, a campaigner who is looking for a quote for the party leader, Jolande Sap. A week later, I hear her repeat my quote on the radio: "An entrepreneur wants to build two hundred fast-charging stations with solar panels. You don't need permission to install a charger or a solar panel, but if you combine the two, you do. For his two hundred fast-charge stations, the entrepreneur now has to arrange two hundred building permits, from two hundred different municipalities."

STREETS AHEAD

Once we've done our ties, we go into the Ministry of Infrastructure and the Environment for our meeting with Jan Hendrik Dronkers, the Director-General of Public Works. It's taken some time, but we're finally meeting the big boss. We think it would be useful for him to know that we're going to build 201 stations on his land.

Building a charging station is still a novelty for many of the people we talk to. "Isn't charging normally done at a charging point in a parking place? Why would you want to build an entire station?" Time and again we tell our story, explaining that dozens of cars driving in and out of parking places to charge won't work along the highway. Traffic safety experts won't even go there: the only safe way to do things, according to them, is to model the stations on filling stations that you can drive through.

Margot and Michiel make a film to illustrate what happens when you want to plug a car into a charging point, to recharge in a service area. Just as Michiel is about to reverse his car into a parking space, a car whizzes by – between him and the curb – at more than 70 kilometers an hour. Extremely dangerous and good visible evidence backing our decision to build stations.

The Director-General wants to hear more about Fastned's plans. He welcomes this kind of entrepreneurship wholeheartedly, but tells us that he also has to manage expectations, and then mentions sensitivities related to the Petrol Law and the current service area operators.

We realize that our ideas are already streets ahead of the others – the registration and site draw has, in our opinion, rendered the Petrol Law obsolete. Instead of endlessly debating these things, we decide to go for what's feasible: getting a civil servant from the ministry assigned to help the roll-out of fast chargers. Dronkers can't do much to cut the red tape, as "that's just the way things go in the Netherlands." Instead – in a brilliant move – he assigns Frank ten Wolde to this

project. We're now going to get support from the man who arranged the registration process for the construction and operation of the service areas.

Frank's presence at our many visits to the road districts is a tremendous help. Not only does he witness first-hand the huge differences in quality between the districts, he also comes up with solutions when talks don't go well. What is the best position for the station in the service area? Closer to – or even further from – the filling station? It's often about road safety and public safety, but also about practical matters such as whether a ditch should be filled or a tree moved. But what really makes the difference in most cases is having the courage to intervene in insoluble disagreements.

CHARMING

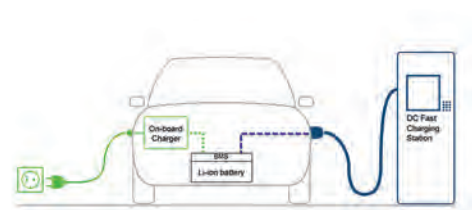
"That's just the way things go in the Netherlands", is an excuse we will often hear, usually followed by "Ridiculous, I know, but..." After some time, we conclude that there isn't really an alternative: we're just going to have to slash our way through hundreds of permits. The man for the job is Christiaan Florentinus.

Christiaan has little experience, but all the more charm – a vital asset. He develops personal relationships with the civil servants responsible for permits, making practical problems more easily negotiable. There are many issues, from trees birds use as 'hop-overs' to a site of archaeological interest. In the latter case, he discovers that the archaeologist did research with his grandfather, and shows her a picture of them together as proof.

Technology in itself isn't enough; a healthy dose of tact eases the passage of our first building permit, which is issued on May 27th 2013. We celebrate with champagne at the office, even though the site's WBR permit is still open to public comment. How ironic that Barneveld – the Netherlands' poultry metropolis – would be the place where the chicken and egg problem is solved. After this, a steady stream of building permits flow in.

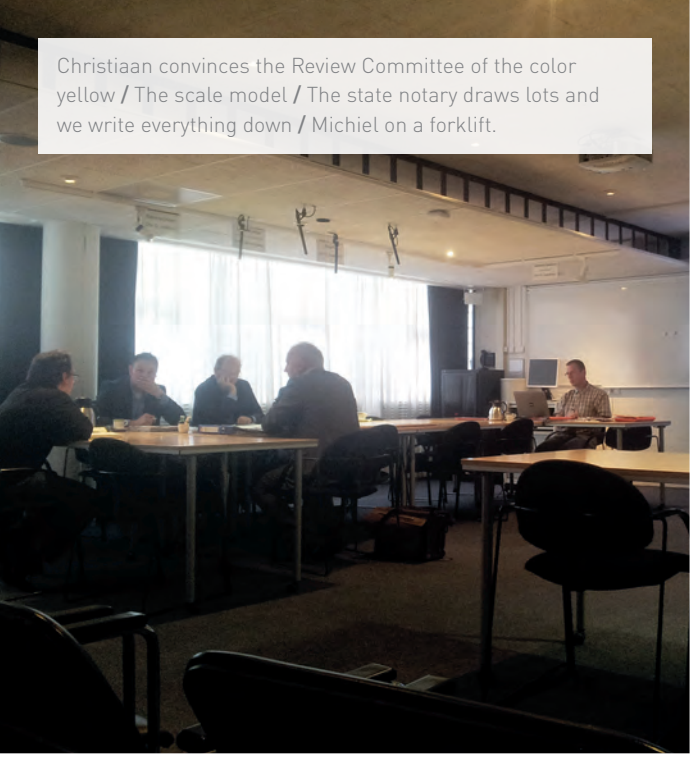
My first ride in an EV, with my brother Paul (L) and my father / Michiel in uncle Ton's car / The Fastned team in December 2012 (from left to right): Bart, Maria, Bas, Margot and Michiel.


ECCENTRICITIES
REVANCHE
(untitled)

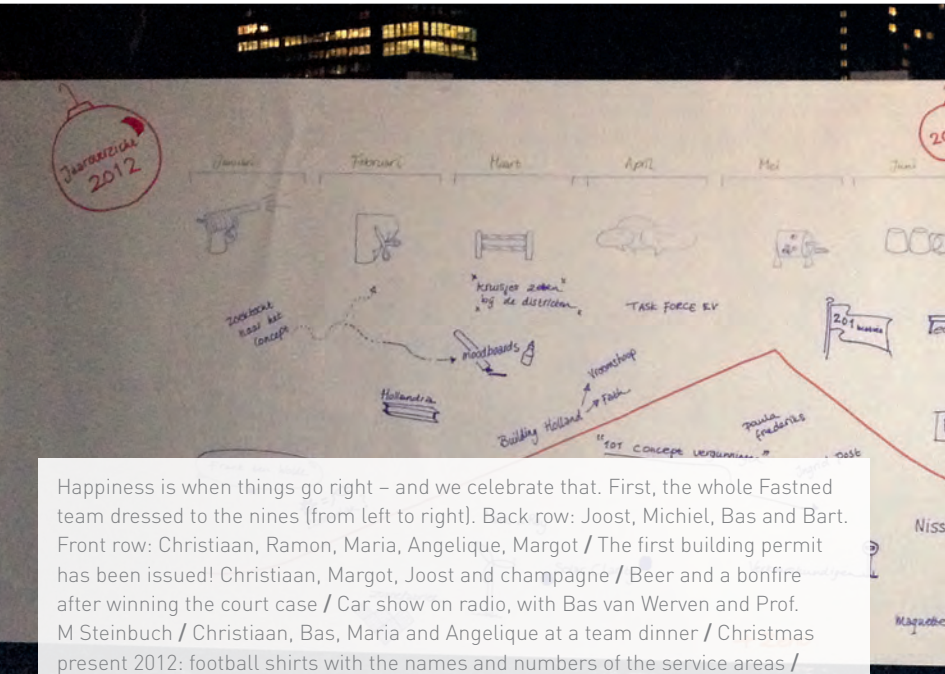


Bas keeps a tab on things: hundreds of permits, 201 sites, 1 list / 'The Slide that changed the world' / The design team: Maria and Margot / Our first office; we moved in with a film distributor / The first trial station.

Christiaan convinces the Review Committee of the color yellow / The scale model / The state notary draws lots and we write everything down / Michiel on a forklift.



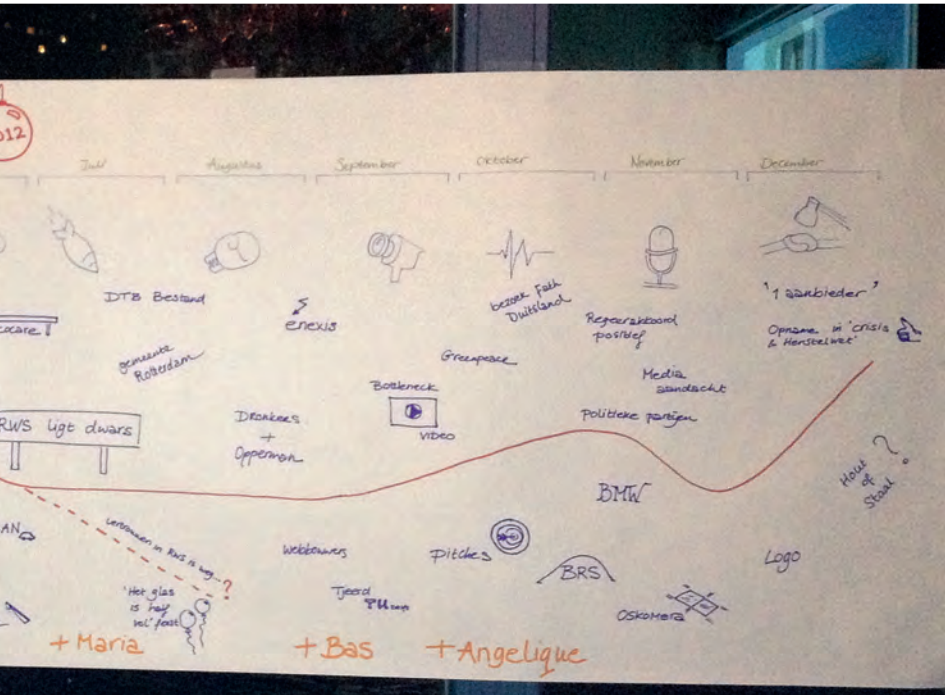

DGV 004
HYSTER
HYSTER 2.00



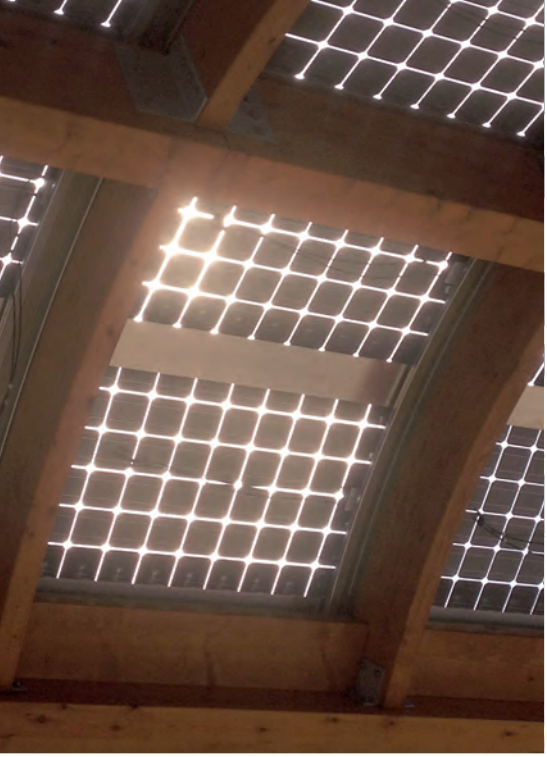
Happiness is when things go right – and we celebrate that. First, the whole Fastned team dressed to the nines (from left to right). Back row: Joost, Michiel, Bas and Bart. Front row: Christiaan, Ramon, Maria, Angelique, Margot / The first building permit has been issued! Christiaan, Margot, Joost and champagne / Beer and a bonfire after winning the court case / Car show on radio, with Bas van Werven and Prof. M Steinbuch / Christiaan, Bas, Maria and Angelique at a team dinner / Christmas present 2012: football shirts with the names and numbers of the service areas / Bottom: Margot's review of the year, with all of its high and low points.


FRIDAY
26
Heineken


A-FILM
187
119
190
240
255
197


Juli
Augustus
September
Oktober
November
December
DTB Bestand
enexis
bezoek Feik Duitsland
Regeerakkoord positief
'1 aanbieder'
Opname in 'crisis & Herstelwet'
gemeente Rotterdam
Greenpeace
Media aandacht
Bottleneck
video
Politieke partijen
RWS ligt dwars
Drankees + Opperman
BMW
Hout of Staal
Logo
BRS
Oskomera
Pitches
Tjeerd
+ Maria
+ Bas
+ Angelique

The first Fastned station in its test set-up with Joost (L) and Michiel (R) / Margot / Joost and Michiel / Me with my wife Marieke and children Rosa, Wietse and Ole. Our eldest son Boyke was in Amsterdam.



Finally! The solar panels are on the roof. Margot and Maria are happy.


IT'S NOT A JOB...
IT'S A LIFE ...STYLE
SELWYN SENATOR

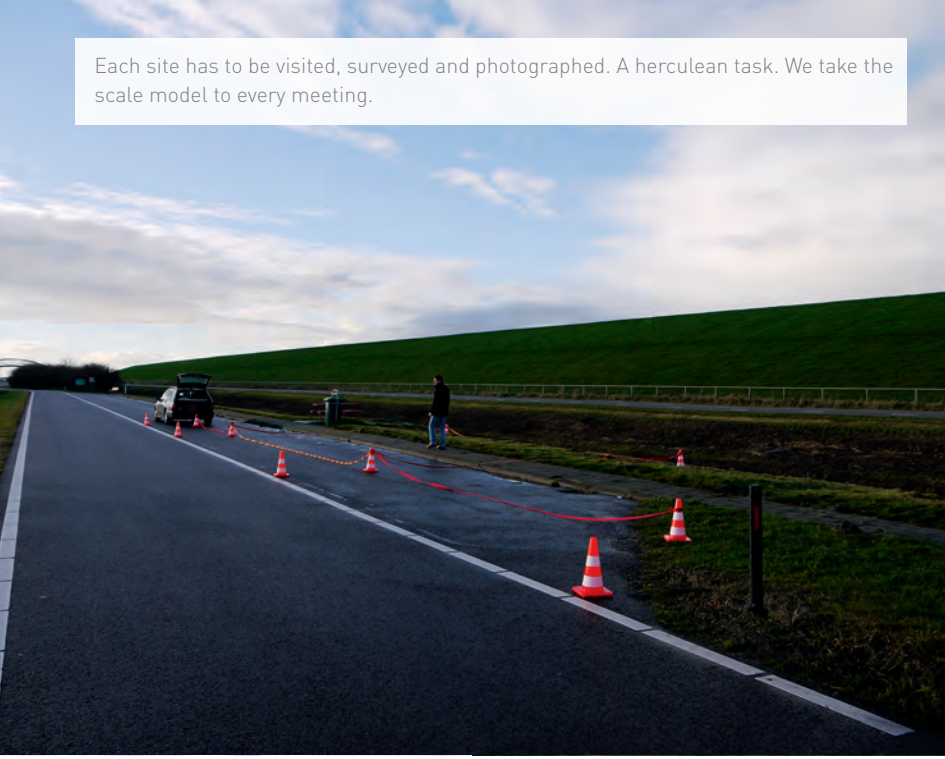

SANDEMA


FUMATUL OPRIT

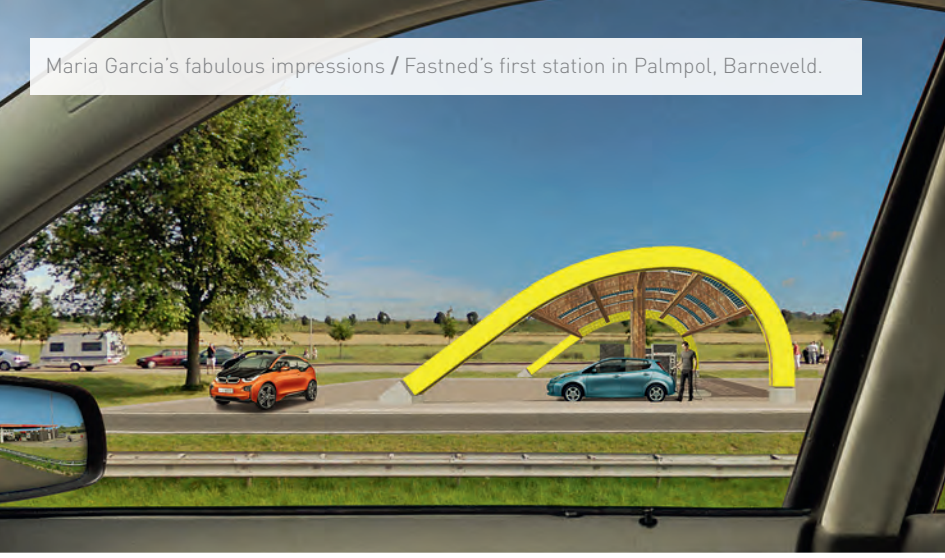
The Fastned team on the road: Bart and Michiel in frigid Estonia with Vahur Viigimäe (L) / Christiaan getting the permits in / Arriving at a Christmassy Munich Airport / Neon advertizing in Porto / Bart writing *The Fastned Story* / Margot in action / Visiting BMW's HQ.


Keizershof

Each site has to be visited, surveyed and photographed. A herculean task. We take the scale model to every meeting.



Maria Garcia's fabulous impressions / Fastned's first station in Palmpol, Barneveld.



SEPTEMBER 25, 2012

Tesla Supercharger Station

"Good evening ladies and gentlemen. My name is Franz von Holzhausen, Tesla Motors' Chief Designer. Let me introduce to you to Elon Musk." The speaker shakes hands with the Silicon Valley legend and the event begins. Elon Musk (1971), the CEO of Tesla, made his fortune with PayPal, a global online payment system. He then went looking for new adventures by founding SpaceX, a private company that develops rockets for space travel. On May 25th 2012 SpaceX docked with the International Space Station (ISS), making history as the first commercial venture to do so. He's also the founder of SolarCity, which installs large numbers of solar panels in the United States.

These solar panels come in handy for Musk's latest creation: the Tesla Supercharger Station, a charging station with solar panels on the roof. Now why is that idea so familiar? Given our admiration for the man, we're very pleased with this endorsement – it looks like we're on the right track.

Elon Musk started developing a fully electric car for Tesla in 2003. He's come a long way since – in addition to his own capital, his annual investment rounds raise about 40 million dollars. Tesla is able to start its own car factory after receiving a 465 million dollar government loan in June 2009. Daimler and Toyota invested an additional 50 million dollars each in the company. Impressive – especially considering that only 2500 Tesla Roadsters were sold in nine years.

HOME RUN?

Tesla is floated on the NASDAQ in June 2010. The IPO raises 226 million dollars – enough to repay several venture capitalists. It's not yet a home run though; there's still plenty to do. The breakthrough is the development of the Tesla Model S, a superior car that can compete with the likes of a BMW 5 Series. It dispels the notion that EVs are only suitable as small run-around cars for in the city: the Model S is a serious – and expensive – car, whose 85 kilowatt hour (kWh) battery has a range of almost 500 kilometers.

The Model S, introduced in June 2012, is an instant hit. The entire annual production of 20,000 units sells out immediately. Car journalists praise it to the skies and the *National Geographic Channel* airs a spectacular documentary about Tesla's ultramodern car factory. When Musk announces Tesla's first profit, in April 2013, its share price goes through the roof. The company is worth more than the Fiat group, and repays its government loan ahead of time.

DILEMMA

The Model S presents Tesla with a new challenge. A large battery increases the range, but what do you do when you're 500 kilometers from home? Recharge, of course. From a domestic socket? Not unless you want to hang around for two days. The solution is fast-charging – or in Tesla's terminology, supercharging.

This sets the standard for what Michiel dubs the "megapixel race". In the digital camera industry, the number of megapixels went up from less than one to more than ten in

the space of a decade. Considered impossible only a short time ago, ten megapixels or more is now standard for cell phone cameras. We soon get used to progress.

Although delivering power to batteries is technically dissimilar to megapixels, we're witnessing a similar development, in which the technology progresses by leaps and bounds. The Nissan Leaf has a battery capacity of 24 kWh; in contrast, Tesla's Model S has an 85 kWh battery. The fastest charging standard that the Japanese and Germans use is still only 50 kilowatt (kW); Tesla uses 120 kW. The race is on. Talk all you want about shape and color, but the real battles in the near future will be about range and charging speed.

It's quite straightforward: for a greater range you need a larger battery – which, in turn, requires a higher charging speed. Bigger batteries make slow charging more and more redundant; on the long term, charging on the go will become increasingly attractive – why would you spend hours plugged into a socket if you can recharge in half an hour with a fast charger?

Elon Musk makes two important promises when he opens the first Tesla Charger Station. The first is that Tesla stations will be built all over the country within the foreseeable future. The second is that Tesla's sparse station network in California will be expanded into a network that covers 80 percent of the United States within two years.

TESLA IN THE NETHERLANDS

In May 2013, Michiel and Johan Peeters of ABB talk to Tesla's Greg Callman. Greg lived in the Netherlands for a couple

of years, and speaks fluent Dutch. A busy man who makes serious air miles, he's looking for charging station sites in Europe. Michiel tells him that Fastned has acquired the best sites in the Netherlands, and that we're going to install chargers for mass-produced cars. Fastned's philosophy is that all mass-produced EVs should be able to charge at our stations, so we'd certainly be open to the idea of Tesla putting its own chargers in our stations.

The man from Tesla is excited about Fastned's plan. He's impressed that we're building a nationwide network in only two years, and thinks it makes good sense to build complete stations with multiple chargers. There are already queues at their own stations in California.

Greg also gives Michiel a tip. "Go straight for a heavy-duty power connection: the number of EVs is increasing, as is the charging capacity." All Tesla stations now get a three times 1,000 amp connection from the start.

Finally, Michiel discusses station financing with him. Greg reckons that charging network finance is dependent on investors' faith in EVs: only people who are convinced of their potential will be willing to invest money in this industry.

NOVEMBER 14, 2012

At BMW's HQ on the Knorrstraße

At 7:05 a.m. on the dot, Lufthansa flight LH 2313 takes off from Schiphol Airport, heading for Munich. Michiel and I are on our way to visit Dr. Georg Schmitt of BMW. He's responsible for promoting the roll-out of charging infrastructure. This needs to be up and running in time for the launch of BMW's first fully electric car, the i3, which it hopes will take the world by storm.

Looking around at the other passengers in the plane, I see only businessmen; which is hardly surprising for this time on a weekday. My suspicions are confirmed by the logos on people's bags, their jackets, and the presentations they're carefully reading: we're on our way to the automotive industry's Mecca. Southern Germany is home to Porsche, BMW, Volkswagen, and Mercedes. It seems like everyone on the flight is a petrolhead – except for us.

'THUNDERBIRDS ARE GO!'

Only the two of us? Not quite. I happen to sit next to an old acquaintance, Gijs van Breda Vriesman, who works for Shell. We get talking – there's no such thing as coincidence – and he tells me that he's also going to see the car manufacturers in Munich. He isn't there for petrol fuelled cars either – Gijs is responsible for introducing hydrogen as an alternative fuel for cars. He may work for Shell, but isn't a petrolhead.

Notwithstanding hydrogen's promise, the OEMs are more interested in focusing on mass-produced EVs. There's still talk about hydrogen cars – and huge amounts of subsidies are

spent on the technology. However, not a single OEM has set up a production line for them. In spite of all the fine words, we only believe what we see.

Regardless our very different views on the future – or perhaps because of them – we have an animated conversation. I knew Gijs as a quick-thinking and active student; he hasn't changed at all in that respect.

We part company at Munich Airport. Michiel tells me that he's dead-set against hydrogen cars. "The sole purpose of hydrogen cars is to hold back EVs." I'm a bit taken aback, and ask him to explain. "Well," Michiel replies, "for years we've been told not to bother with EVs because hydrogen cars were just around corner. So where are they?"

If there's any time this afternoon, we'll look around the basement of the BMW Driving Experience Center. That's where BMW keeps its prototype hydrogen car – which has never been brought into production. It looks more like a vehicle from Thunderbirds than a serious consumer product.

Michiel and I walk through the arrivals hall, already brimming with Christmas decorations. Between the fir trees and shiny baubles there's a massive billboard advertizing the BMWi3.

TOP SECRET

When we arrive at BMW's HQ, Dr. Georg Schmitt promptly whisks us off to a windowless room. We're presented with a non-disclosure agreement, after which he shows us a top secret presentation.

The BMW man starts by telling us about the beauty of the

i3, and explains at some length why EVs are city cars. Then he goes on to present the famous circles that illustrate the car's range. Our hearts sink into our boots – it's the same old story, based on expensive batteries with little range. This only means one thing to us: BMW isn't serious about EVs. Is this what we signed that paper for? What's so secret about it?

I don't know why – perhaps Georg notices our disappointment, or maybe he's been testing us – but halfway through his story there's an unexpected twist. He tells us that BMW has come to the conclusion that fast-charging is essential to the success of EVs. Germany's love affair with driving is only possible if you can get around the whole country in your car – making fast-charging indispensable. BMW has opted for DC charging, and assumes that domestic charging will eventually be done with an external DC charger. This brings down the cost and weight of the car, and saves space in the bargain.

"The penny has finally dropped", we think. The OEMs get it at last: cars stand for freedom. The Germans should know this already – every ad, for every car brand, exudes freedom. Why bother with a city car, when you can drive non-stop? From Munich to Berlin, from Berlin to Hamburg, or even to Paris!

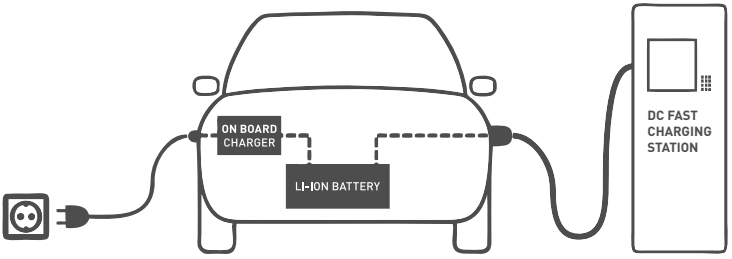
Years after Nissan and Mitsubishi saw the logic of DC charging, BMW – along with almost the entire German and American automotive industry – has now embraced it (see box on page 20). Two years earlier, Michiel – together with Wouter Robers from Epyon – schematically illustrated the difference between AC and DC charging on a nifty slide (see

illustration). DC charging makes it possible to share the charger with many other cars, rather like a filling station. This lowers the cost of the car, and investment in charging infrastructure can be shared among many users – a real breakthrough for the EV industry. We sometimes jokingly call it "The slide that changed the world".

IMITATION IS THE SINCEREST FORM OF FLATTERY

Georg triumphantly explains why BMW has embraced DC charging, listing all its benefits, and shows us a surprisingly familiar slide. Michiel looks amused – imitation is the sincerest form of flattery. "Enlightening, isn't it", Georg comments with a beam on his face. "Most enlightening", Michiel replies, "I drew it myself, two years ago."

It's clear to us that the industry has made its choice: with the exception of Renault, all car manufacturers have thrown their lot in with DC charging. The Japanese got the ball rolling with CHAdeMO, the Germans and Americans followed with CCS and Tesla's Superchargers also use DC.



In the spring of 2012, the CCS Coalition – consisting of Audi, BMW, Chrysler, Daimler, Ford, General Motors, Porsche and Volkswagen – organizes a European road show. On April 23rd 2012, they host a private event at the Mercure Hotel in Amsterdam, in which they reveal that they've agreed on a common plug. It's a big, ungainly thing – the result of compromises, after certain parties insisted on combining AC and DC charging in one plug. At least it works. A year later, on June 11th 2013, joint CCS testing is completed – just in time for the first BMW i3s to roll off the production line.

Incidentally, throughout the negotiations we have never tried to present ourselves as anything other than site owners. The basis of our business plan is having stations in good locations. Different kinds of cars come to our stations to charge; the type of chargers we install depends on consumer demand – as long as they're fast.

'INTRAVENOUS DRIP'

201 charging stations along the highway are going to provide the Netherlands with reasonable coverage. Wherever you go, a fast-charge station is never more than 40 kilometers away. Naturally there will still be slow chargers – charging points – at home and at offices. In short, running out of power is quickly becoming a thing of the past.

For now, slow chargers are still indispensable: without a nationwide network of fast chargers and with relatively small batteries, you'll soon run into trouble if you can't top up with a slow charger. As for the long-term usefulness of slow chargers, it seems that we see things somewhat differ-

ently to everyone else. Even though the OEMs have embraced fast-charging, car dealers have yet to grasp this concept. They reveal an outmoded way of thinking in conversation, and in their TV ads: you charge your EV at home. Home is the center point – that's why they often throw a free wall box in with a new EV. It's not really free, of course, simply incorporated in the car price – often to the tune of more than 1000 euros. On top of this, you have to pay for the power yourself.

The predominant vision is currently along the lines of: "You charge at home while sleeping; fast chargers are an emergency solution, for when you're on the go." If you follow this logic, then the scenario for petrol-fuelled cars would be for drivers to keep an oil drum at home and only go to a filling station in emergencies. This would be a bit weird, wouldn't it?

We see it the other way around: you charge at a charging station during the day – and, when needs be, you can put your car on an 'intravenous drip' at home, plugging it into a slow-charging domestic socket.

This technological battle between domestic charging and charging on the go, explains the term 'city car', or 'Mega City Vehicle' in BMW's terminology. As if all you want to do is drive circles around your house. Mega City Vehicle is a fancy term, used to sell a car with little range. We don't buy it for a second: a car means the freedom to drive from where you are, to where you want to go – without restrictions. This means being able to charge at anytime, anywhere. If anything has defined the success of cars in the last hundred years, then it has to be freedom.

MARCH 1, 2013

Crates of Belgian beer

The back door of the old Soviet factory opens, and we help Vahur Viigimäe lug in crates of beer – it's one of the goods he sells in his import business. Vahur acquired a taste for Belgian beer during the time he spent installing parking payment systems in the country. As he drives us through Tallinn, on March 1st 2013, we stop regularly at alternative bars to deliver crates of beer from his boot. Most of these bars are housed in former Soviet factories, built when Estonia was a Soviet republic.

Vahur Viigimäe is around my age. He did military service in Siberia in the eighties, and then went on to study computer science. When Estonia regained its independence in 1991, Vahur was one of the few people able to set up a proper computer system for the brand new Customs Department – it was his first job.

Today, he works for NOW!, a typical Estonian start-up. It's an international frontrunner, providing parking systems for dozens of cities across the United States and Europe. NOW! administers our back office, just as it does for ELMO, Estonia's nationwide fast-charging network.

While the Fastned team is up to its ears in building plans and permits, Michiel and I visit Estonia to discuss back office administration with NOW! Üllar Jaaksoo is the driving force behind NOW! – which is underscored by the fact that he looks and behaves like the movie star Vin Diesel, from the racing movie *Fast and the Furious*. But Üllar doesn't need to tear around in cars to assert his leadership. With a large felt-

tip pen, he illustrates on a white board how to successfully establish a car charging infrastructure. During his presentation he recites his mantra:

Step 1: coverage
Step 2: capacity
Step 3: fine-tuning

FINE-TUNING

We were already familiar with this philosophy, but it's nice to see it confirmed. Nationwide coverage is the core idea behind Fastned; you need it for driving around, just as you need mobile network coverage for making a phone call. Ensuring nationwide coverage is undoubtedly the first step. The second is to provide sufficient capacity for fast-charging; as soon as queues start to form at the stations, chargers need to be added. The final step is the fine-tuning – offering a variety of subscriptions, alternative forms of payment, discounts, additional services, et cetera.

We do the sums again – how often have we done this, in the past year? Two hundred stations provide good coverage – check. The next question is capacity: how many cars can we expect, and how many chargers should we install?

Fixating on the fact that there are only a few hundred electric cars in the Netherlands makes little sense. In the same vein, blindly adopting the Dutch government's ambition to have more than 200,000 EVs on the road by 2020 seems a little easy to us. We decide to go back to the basics. Which factories are being built for EVs? How many EVs will they produce?

First let's go back to the EV breakthrough for a minute. Initially, EVs are anathema to OEMs – it's not without reason that car enthusiasts like to call themselves petrolheads. Their first reactions to EVs are openly hostile: "They're more polluting than petrol-fuelled cars, because they ultimately run on coal power. They're dangerous because you can't hear them. You get stuck with an empty battery, because the range is too limited. And, last but not least, they're ugly." In the early nineties General Motors solves the 'EV problem' by buying all 1,100 EVs and scrapping them.

BREAKTHROUGH

The real breakthrough comes in 2009, when Mitsubishi introduces the all-electric iMiEV in Japan, along with CHAdeMO fast chargers in Tokyo. For years Mitsubishi and Nissan have worked on batteries that can be recharged quickly without getting damaged or rapidly deteriorating. Together with Tepco, a utility, they develop a charging plug and charging standard. Tepco installs over a thousand fast chargers in Japan. The system is called CHAdeMO, Japanese for a cup of tea, as charging takes 20 minutes – the time you need to drink a cup of tea.

The OEMs now start to take EVs seriously. Mitsubishi's iMiEV is soon followed by the launch of Nissan's Leaf. While they're certainly not the first EVs, they are the first mass-produced ones.

CAR FACTORIES

OEMs rely on mass production in huge factories in order to produce affordable cars. When fast-charging became technically feasible, the OEMs got into gear to mass-produce EVs. Nissan and Mitsubishi both open factories in 2011. Nissan's plant in Oppama churns out around 50,000 EVs a year; Mitsubishi's Miszushima plant manages about 20,000. A year later Nissan's French partner, Renault, builds its own factory in Flins. In 2013, Nissan expands its EV production capacity with the addition of a European plant in Sunderland and an American plant in Smyrna.

The Germans are the next to get moving. BMW builds a factory in Leipzig for the i3 and the i8; Volkswagen develops production lines for its electric e-Up and E-Golf in Bratislava and Wolfsburg. These plants each have a capacity of 50,000 to 100,000 cars a year! Seeing pictures of the plants and the production lines, we are convinced that these numbers are realistic.

Since the numbers relate to annual production, the number of EVs on the road will increase cumulatively; we are starting to come round to the government estimate for 2020. When the OEMs begin calling us in mid-2013 – instead of the other way around – we know we're on to something.

Adding up the numbers, we reach a total annual production of half a million EVs in Europe. Although the Netherlands is a small country – corresponding to a relatively modest share

of the market – the target of 200,000 EVs on the road by 2020 doesn't seem unrealistic.

How many fast chargers are needed? For our highway stations we make the cautious assumption that EVs will fast-charge along the highway once a week on average. If there are 200,000 EVs, each station will receive a weekly average of a thousand visitors! That's 150 visitors a day per station. Several chargers per station will be needed to avoid long queues.

Are 150 visitors a day unlikely? Not really. We know that highway filling stations get between 500 and 2000 customers a day – and they have to compete with 4000 other filling stations on secondary roads, and in towns and villages. Moreover, highway filling stations often have more than 20 pumps.

RESULT

We do these calculations several times – bottom-up, top-down – and always reach the same conclusion. If we want to be able to handle the expected flow of customers, we'll have to install several chargers at each station. We decide to start with 4 slots per station.

For the payment system we follow Estonia's example, where all EV drivers simply pay with a smartphone. We've seen this work with the Dutch parking systems Yellowbrick and Parkmobile – so we opt for phone payment too. NOW! provides the system – they have the necessary experience and, even more importantly, they're two years ahead of the competition. NOW!'s help enables us to leapfrog debit cards and various charge cards – and all the consultations and problems they bring along.

MARCH 14, 2013

"So you're having McKinsey lay your cables?"

"So you're having McKinsey lay your cables?", our roll-out manager exclaims, unable to contain himself any longer – the price differences between the network operators providing our electrical connections are so enormous that a bit of sarcasm is warranted.

In early 2013, we start preparing for the construction of the stations. With 201 stations to build, we soon decide on setting up a roll-out team and hire a roll-out manager. Joost Hoffman arrives at the perfect moment; he's just got back from Singapore and is eager to join a start-up. He read about Fastned in an online Dutch newspaper while he was still in Singapore, and sends us an e-mail. When we invite him for lunch at our office, it turns out that Joost and Michiel used to play hockey together in Delft. Joost soon starts working for us as Fastned's new roll-out manager.

LISTS AND MAPS

Michiel, Joost and Bas, our site architect, draw up detailed tender documents for the groundwork, paving, wiring and construction of the stations. Various contractors are invited to make a quote. Fortunately, there are quite a few Dutch contractors with experience in building filling stations – which are quite similar to our charging stations.

Before long, the office walls are covered in long lists, comparing every detail of the various offers. You can easily see

where contractors' quotes are too high, or sometimes even improbably low. There might be an economic crisis, but realism is a virtue. We occasionally have to protect a contractor from himself – quoting below cost might seem alright, but during implementation it always goes wrong; a risk we can't afford to take with our ambitious roll-out tempo. Joost and Bas soon become skilled negotiators.

We also put up a large map of soil types in the Netherlands – as our two hundred sites are spread evenly across the country, we have to deal with different soil types and foundation requirements. The sandy eastern soils are much more solid than the soggy polders predominant in the west. Foundations in polder soil don't only have to ensure that the station doesn't sink; they also have to be strong enough to deal with heavier winds – especially on the coast. Our beautifully curved glass roofs not only have the shape of a wind tunnel, some say they also look like oversized kites. We want our business to take off, not the stations.

PRICE DIFFERENCES

We pay special attention to the Dutch grid operators. These former state-owned companies have a monopoly on electricity connections in their region. The Authority for Consumers & Markets (ACM) maintains strict supervision to prevent them from abusing their monopolies.

Although law forbids large price differences, prices do of course vary – to the tune of what to us are substantial amounts. Fastned is a unique project as all the applications are made simultaneously for identical connections across the

country. This clearly highlights the price differences between network operators. In fact, the differences are so big that at a certain point Joost asks one of the operators, Liander, to explain them.

Prices are determined by the cost of the connection and the distance between the electrical substation and the site. If there's already a substation at a service area, the distance is a few hundred meters at most; in other cases the closest substation is several kilometers away, which means a lot of digging. A third possibility is that there's a substation at the service area, but the network operator has sold it to the local filling station.

Network operator Liander is roughly twice as expensive as, say, Enexis, partly because its big investment backlog means it simply has fewer substations at service areas in its region. This puts Liander in a dilemma: it can either drastically reduce its prices or increase investment in highway substations. Looks like an easy one to us.

In an attempt to draw attention to these price differences, we pay a visit to Rens Knegt, the head of the Association of Dutch Energy Network Operators, on March 14th 2013. Rens and I go back a long way, to when we were both part of a team advising a Dutch snack producer Beckers.

Rens receives us in his modest office in the center of The Hague, where he hears us out, and promises to raise the price differences with the network operators. He keeps his word, and two months later Michiel and I are invited to Enexis's offices in Arnhem to thrash it out with the managers responsible for setting the rates at Enexis and Liander. Michiel wonders

how they're going to explain why Liander is twice as expensive as Enexis. I warn him that they'll probably be able to explain away the price differences, but that's beside the point. The crucial point is that the ACM doesn't allow big price differences, regardless of what the network operators say.

Two hours later the meeting is over. After hearing their explanations, we're no longer under the illusion that the price differences can be resolved in an afternoon. We present our findings to the ACM and the Ministry of Economic Affairs, and decide to focus on things we have more control over.

TAKING THE DEVIL OUT OF THE DETAILS

Since we know exactly what we want to build and are very familiar with the sites, we can prepare the roll-out in detail. This is not something that the contractors are used to. They're used to last-minute modifications during construction, and almost always work on one-off projects. All Fastned stations are identical, however, and the sites are already known beforehand – as are any complications, such as trees, ditches, sewers, gas mains, and archaeological sites. We've drawn the site plans ourselves, and visited them several times, making ground measurements and taking soil samples at all of them. After two years of drawing and planning, Fastned knows the sites better than the Ministry of Infrastructure and the Environment. This makes it all but impossible for contractors to get up to any funny business, charging for extra work during construction.

This allows contractors to distinguish themselves in other ways – one of the most important being speed. Admittedly,

the construction rate is largely determined by the rate at which building permits are issued, but building 201 stations in two years still presents an enormous challenge.

At a certain point, we will be opening two stations a week. Each station takes two weeks to build – a week for the foundations, and a week for the canopy and the installation of the equipment. At the peak of construction, there will be four building teams working in parallel.

ABB's chargers

It goes without saying that Michiel, with his experience at Epyon, knows all the ins and outs of fast charger technology. He uses this knowledge to write a comprehensive tender document stating our aim of finding the best chargers for all types of mass-produced cars.

Michiel and I fly to Porto in Portugal in early 2013, to discuss a bid from one of the charger manufacturers, Efacec. Its commercial manager, Manuel Fernandes, shows us around the production facility. We notice how much they still do by hand – it looks more like a garage than a production line. The chargers are fine, but stuffed with transformers and wiring – probably explaining their popularity among utilities, who also think in terms of transformers. We see things rather differently, more in terms of computers and advanced software. It's clearly still a very young industry.

Manuel is the perfect host and good companion in the evening, and he braves the pouring rain with us to look around the picturesque city. Looking across the old town, we see the famous port brands advertized in white neon letters: Sandeman, Kopke, Calem. When Margot asks me later which neon letters I think best suit the Fastned station, I show her the snaps I took in Porto.

A few weeks later, in February 2013, we're in the high-speed train to Lille, to meet Alexandre Borgoltz of the French charger manufacturer DBT. They've done nicely from Renault's alliance with Nissan, producing lots of chargers for the Japanese giant. Nissan wants to boost EV

sales by giving away free chargers. Not a bad idea, except the charging sites, once again, prove to be the bottleneck – making the whole exercise unprofitable. Nissan's mega order is also causing problems for DBT, which has devoted so much of its energy to converting Nissan chargers for the European market that it has neglected its own development.

After careful consideration, we end up opting for Epyon's successor, ABB. They lead the field in developing chargers that communicate with the cars and the back office. It also helps that we know each other well.

UNACCEPTABLE TERMS AND CONDITIONS

On April 8th 2013 we have an amusing meeting with ABB about the terms and conditions. As a start-up, we don't have any purchasing terms and conditions yet, and decide for expediency's sake to copy ABB's – simply replacing their name with Fastned.

ABB is more than happy to do business with us, but object to our terms and conditions. We'd been expecting something like this, and arrange a meeting to go through the conditions, article by article. The atmosphere is rather frosty, until Michiel and I crack up laughing. Luckily the ABB team also appreciates the irony of the situation, and we eventually agree on a reasonable contract.

We order multi-standard chargers, supporting the Japanese CHAdeMO, the German-American CCS, and the French AC protocol. It's not really all that different to a Tokheim or a Schlumberger fuel dispenser, which have three or four different fuel hoses.

We might not know exactly how chargers are going to develop, but one thing is clear – batteries will get bigger, and charging will get faster. We won't have a choice but to keep up with developments. Replacing chargers with faster ones is a no-brainer: if there's enough demand, replace them. This has three advantages: you sell more power in less time, you please your customers, and – just as importantly – you stay one step ahead of the competition.

APRIL 18, 2013

Amsterdam's charging points

There aren't many fast-charging facilities available for the first thousand EVs in the Netherlands. They have to be charged at home, at work, or at a public charging point. The majority of them are company cars, driven by people who live downtown; less than a third of EV drivers are able to charge their car in a garage or on a driveway – the rest of them have to rely on an extension cable or a charging point.

The grid operators achieved much with their collective foundation e-laad – by the end of 2012, there were 1,200 slow charging points with parking places in the Netherlands. It has enabled the first generation of EVs to both charge and park for free. Later on, when drivers do have to pay for parking, charging points remain popular. The problems start with the arrival of large numbers of EVs. While feasible when there were only several hundred EVs, it's not viable installing charging points for tens of thousands of EVs – it's too costly and there just aren't enough parking places. In addition, 'designated' parking places are a sensitive issue in such a densely populated country.

On April 18th 2013, we have a meeting with the municipality of Amsterdam. They want to get rid of their charging points, which are unprofitable and expensive to maintain. Since our focus is solely on highway fast-charging, we recommend talking to other parties – like The New Motion – which sell slow charging sockets.

The municipality is taken aback by our warning that buyers will only be interested if the charging points are of-

fered with a long-term concession. They'll also have to throw money or free parking places into the bargain. All of this goes to show that slow charging in public places is turning into a relic from the early days of EV technology. It was certainly beneficial that the government and other parties, like the network operators, encouraged the development and uptake of EVs. However, the industry is now rapidly maturing and the introduction of hundreds of thousands of mass-produced EVs means it's time for fast-charging at stations that can serve dozens of vehicles a day.

JULY 11, 2013

The court case

"Perhaps some extra chairs could be arranged, so everyone can sit down?" The judge looks at the clerk, and then surveys the courtroom, which is bursting at the seams. The Association of Highway Fuel Station Licensees (VPR), which objects to the allocation of highway sites for charging stations, has taken the Dutch State to court. The VPR's case is based on the Petrol Law, which is the formalization of a deal on highway filling stations. Oil companies used to have perpetual rights to the filling stations on Dutch highways, but this became unacceptable to the government. A compromise was reached in 1999, introducing a system of filling station auctions and prohibiting new filling stations along the highway until 2024.

The auctioning system is ludicrous. While it's supposed to promote competition, it has actually led to a situation in which hardly any stations change hands. The incumbent party receives the proceeds if it is outbid. If it wins then it only has to pay the difference between its bid and the next bid – but no more than 30 percent of his bid – to the state. The station licensees clearly have much to lose.

The VPR lawyer argues that the Petrol Law also covers electricity, arguing that no one could foresee at the time that cars would ever run on electricity.

Several months earlier, we'd consulted Paul Glazener, a lawyer at Allen & Overy. I met him in 1999, when I was setting up the free newspaper *Metro*. We had an exclusive distribution contract with the Dutch Railways for all railway

stations in the Netherlands, including newspaper stands in the stations. Any competitors would have to stay outside.

THE BEST COMPETITION LAWYER

Our competitor – the country's leading daily, *De Telegraaf* – argued that this was unfair competition. The Dutch Railways got cold feet, and in alarm we decided to protect our business by finding the best competition lawyer in the Netherlands. Paul Glazener came highly recommended, and argued convincingly that protection for a new product, like a free newspaper, was entirely lawful for the first few years. The Dutch Railways and *De Telegraaf* concurred.

De Telegraaf had missed the boat, but wasn't about to give up. In record time, it started its own free newspaper, *Sp!ts*. When Metro was launched at all railway stations in the country on June 21st 1999, hundreds of people were deployed outside stations to hand *Sp!ts* to commuters. It costs *De Telegraaf* a fortune, but it persevered with *Sp!ts* and eventually bought the Dutch franchise for *Metro* thirteen years later.

It's no wonder that we made a beeline for Paul Glazener when we set up Fastned. Michiel and I arrange two extensive sessions with Paul and his colleague Leon Mensink to discuss the legal significance of the registration, the draw and the Petrol Law. They're surprised how transparent and straightforward the procedure is, considering the importance of the concessions. Paul and Leon think it's an interesting case, but question the usefulness of the meetings, as nobody is actually taking legal action. "It's obvious", we reply. "When the lawsuit comes, you'll be well prepared – and there's definitely going to be one."

IN COURT

And today, here we all are in the courtroom, Paul and Leon flanked to the right by VPR's lawyers, and to the left by the public attorneys. Plus the entire public attorney legal team is sitting next to us – this is serious business.

Public attorney Liesbeth Schippers gives an impassioned plea, setting forth all the legal arguments in favor of the allocation of highway sites for charging stations. Then there's a speech by a European law specialist from Pels Rijcken & Droogleever Fortuijn , the public attorney. As we've been allowed to join the case as an interested party, Leon Mensink puts our case to the court next. And when Paul Glazener takes the floor, even the judge pricks up his ears. One of his main points is that it could never have been the intention of the law for an incumbent party to obstruct the development and application of new technology.

The VPR lawyer is in a pickle. When the judge asks him if he believes that filling stations have a monopoly on the sale of everything cars can run on, he replies in the affirmative. "And, if cars are able to run on water some day, do you believe that your client has the exclusive right to all water taps along the highway?" The lawyer has no choice but to answer "yes" again, as he watches his case collapse.

BONFIRE

Our hopes are confirmed two weeks later, while I'm camping with my family in Romania. When I see a missed phone call from our lawyer, on the morning of July 25th 2013, I know why he was calling. I ring Michiel at once, who confirms

that it's a complete victory – the judge has thrown out all of VPR's claims. Although not unexpected, it's still great news.

While I'm making coffee on a gas burner, the calls and text messages start flooding in. We even receive congratulatory messages from as far afield as China, where Hans Streng and Crijn Bouman are on business for ABB. I get a message from Margot in the evening, with a picture of a jubilant Fastned team around a bonfire. "Hi Bart, is your bonfire this big? Greetings from all of us!" Looking at the picture carefully, I notice the party is in Michiel's tiny secluded garden in the heart of old Amsterdam.

EPILOGUE

First the Netherlands, then the world

As I write this, the first Fastned stations have been built. We opened our first station on November 29th 2013 – it was the start of the roll-out of the complete network.

Fastned owes its success to its young and highly focused team. For now we're devoting all our energy to our sites on the Dutch highways. After that we're going to follow a two-pronged strategy. The first is geographic expansion – first the Netherlands, then the world. We'll need good sites, and focused and dedicated local partners. Will we find them? Of course. The world is full of young, ambitious people who want to fulfill their dreams, and – just as importantly – who want to do something to contribute to a cleaner planet.

The other prong is vertical integration. Fastned's solar panel roofs are the first investment in our own energy production. In the future, profits will be invested in windmills and solar energy, providing us with our own clean power. In the same way that Shell has been selling its own oil at its stations for a century, Fastned will sell its own wind and solar energy at its charging stations – the difference being that our energy is renewable and non-polluting.

Fastned's 201 stations are part of the transition to clean energy – EVs reduce CO_2 emissions, and higher demand for clean electricity boosts the solar and wind energy industries.

Investment in EVs still only amounts to a fraction of investment in conventional fuel-powered cars. We're talking

about a share of a few percent of the market. In the near future, a quarter of a percent of Dutch cars will be electric, and Fastned's network will break even. Once that rises to several percent, Fastned will become highly profitable.

Going back to what Dutch footballer Johan Cruyff said: "You won't see it until you get it." That's why everything only falls into place when you see EVs driving around. It isn't too late yet. The world is getting cleaner.

-- To be continued --

“HAPPINESS IS WHEN THINGS SUCCEED”

PROLOGUE PART II

When the first Fastned stations open, we witness something we had long predicted: the car is increasingly turning into a computer on wheels. Something we are familiar with when it comes to computers, has reached the automotive industry: updates, updates, updates. Version 1.0, version 2.0, version 3.0. Your car improves while you are driving it. Read: your EV.

A fuel-powered car never changes after being bought. And, developing a new model easily takes between seven and ten years. The advent of the EV is accompanied by a new breed of electrical and software engineers, bringing other insights to the automotive industry. Moore's Law comes into play – battery prices drop 20 percent year on year. This will eventually bring the purchase price of EVs down to the same level as fuel-powered vehicles, or even lower.

EVs are connected to the internet. Just like smartphones, cars are starting to run on applications. Touchscreens are being introduced, opening a world of possibilities. Developers all around the world can now contribute to new applications for cars. Software regulates engines and driving behavior. Updates and upgrades are simply done online. Furthermore, an improved model is released on the market within a year or two. The era of Car 2.0 is finally coming into being – the car as a computer on wheels. And: computers run on electricity.

It is the insight that all vehicles will be electric on which we have built Fastned's foundations and our preparations for growth – massive growth. Because in our view all vehicles will be electric in the future. It may take ten years, it may take twenty years; but it is inevitable and actually very near.

The focus in phase 1 was on getting the 201 concessions, drafting site plans, obtaining the first permits. Designing the station, selecting suppliers, and building the team. We were a start-up.

When the first station opens in Barneveld, on November 27th 2013, we enter the next phase. In phase 2, Fastned is focusing on four major themes: the construction of stations, foreign markets, the IPO and business operations. As stations are completed, we start operating them. We are a company that is growing at a rapid pace, driven by the EV revolution.

We consider how we want to expand our charging network and take the first steps to achieve this. Apart from finding locations for more stations in the Netherlands, we are particularly looking beyond our national borders. There too are highways, service areas and EVs. There too are similar aspirations for even greater numbers. Up until now there has only been one serious example of highway charging: Fastned. We have a head start thanks to our experience and the fact that we have already built a comprehensive station network in the Netherlands.

In phase 2 we are going public. It's only the Dutch SME Exchange, NPEX, but still! As a newcomer to the market we manage to get our prospectus approved by the Netherlands Authority for the Financial Markets (AFM) in just a few months. A considerable achievement. We change the company's ownership structure to enable the original employees to become co-owners.

All of this is possible because of our professional business operations. In part II of *The Fastned Story* you can read how Fastned grows up, without losing its start-up mentality. You will see once more how our clear mission streamlines operational decision-making. *Fastned builds and operates charging stations along the highway. Full stop.* Our objectives are both ambitious and realistic. This is how we will ensure that we are successful, which is crucial for the team spirit. After all, happiness is when things succeed; as, inversely, happiness is the engine of success.

The fossil industry establishment is strong, very strong. The term 'CO_2 war', or carbon war, is an apt description of the battle between these forces and the new green industry. Fastned is pulling out all the stops to outdo the established order and accomplish its mission: building stations so everyone can drive EVs. Fuelled by the sun and wind instead of oil. Everywhere along the highway.

For Fastned to succeed we must excel in all areas. What started as an idea is now a responsibility. The design, con-

struction, charger uptime, payment system, financing, legal affairs, marketing, reporting, foreign markets: everything has to be tiptop! If not, we will lose the battle. Or in the words of *Apollo 13* Flight Dynamics Officer, Jerry Bostick: "We just calmly lay out all the options, and failure is not one of them. We never panic, and we never give up on finding a solution." For we believe in the urgency of what we are doing and how we are doing it. Read and share the experience in part II of *The Fastned Story*. Since, as we said at the end of part I: it's not yet too late. The world is getting cleaner.

Bart Lubbers,
Amsterdam, March 2015

NOVEMBER 4, 2013

The first station, in Barneveld

The site of our first station is 'Service area Palmpol', in Barneveld. It is the Netherlands' poultry capital, home to 3.5 million chickens, where the foundation stone is laid for the solution to the chicken and egg problem facing EVs.

Joost and his building team spent a great deal of time looking for the right contractor prior to construction in Barneveld. Together with the selected candidate, they can now for the first time implement everything that has been meticulously prepared in advance. The contract documents are detailed, and there is a tight schedule. All of this is new for the contractor too. He has never worked for such young clients. But he is particularly out of his comfort zone when it comes to our way of working: we give him our complete trust, but schedule and cost overruns are a no-go.

Within weeks the wheels start falling off. It begins with the abrupt replacement of our contact at the contractor. Then they miss deadlines and submit declarations for extra work. They keep telling us about everything that's not possible, but don't offer any solutions. Our communication with them founders. In the meantime, they bombard us with requests for additional expenditure – and present it to us as if it is quite normal.

At this time we've already committed to open four stations on November 29th 2013. But now, two months before the deadline, things go wrong – with the very first station. What should we do? It doesn't take long to make a decision. Fastned is our company and we'll decide what happens.

Michiel, Bas and I arrange to meet the contractor at a café in Amsterdam on Monday September 23rd 2013. Joost, the head of our building team, is absent – he just became the proud father of a baby girl the Thursday before. During the conversation the contractor asks me what I think about the situation. My answer is that I have three criteria: planning, results and confidence. I can only conclude that he scores below par in all three areas.

We end our partnership and reach a settlement. We get the first contractor to down tools at once and call Dennis van der Werff of Ecocare. Would they be interested in taking over the job? Dennis responds sportsmanlike: of course he was disappointed that he wasn't our first pick, but he would still like to do the job. We later hear that he happened to be on a boat with his entire team at the time. The men listen in on the entire conversation and can immediately celebrate landing this great job together!

SOLUTIONS

We know Dennis well. Ecocare has already built hundreds of unmanned service stations for Tango, and it was one of the best parties in our tender procedure. On top of this, Ecocare is the Dutch importer of the Portuguese charger manufacturer Efacec. We got to know Dennis and his business partner Stephan Romers during our visit to Porto, where they introduced us to Efacec. Even though we eventually opted for ABB's chargers, we stayed in touch. They are nice, reliable guys.

Getting Ecocare to build the stations turns out to be the perfect choice. The company understands what we want: to

erect hundreds of identical stations with a single method. 'Cost overruns' make way for a 'learning curve'. We learn from each station, as does the contractor. Things can always be more efficient. We're on the right track now. Instead of suspicion, there's trust between us. Obviously we still run into problems, but they are sorted out – and certain problems simply don't occur anymore.

For instance, the first contractor didn't build the foundations properly: the ground underneath the station has not been sufficiently reinforced. The inspector doesn't trust the geotechnical engineer's advice, so he decides to do some ground measurements. We watch him stick the long rod of a cone penetration test meter into the ground, allowing him to measure whether the soil is solid enough. He frowns as it reveals that the geotechnical engineer's measurements are wrong. As a result all the formwork has to be removed, and we have to dig up the ground under the footings and replace it with fresh, load-bearing sand. There are many technical people in Fastned's team. When everyone pores over the calculations the reason soon becomes clear: the geotechnical engineer has used numbers from another site in his calculations. Fortunately, this sort of problem is a thing of the past when Ecocare takes over.

An interesting discussion takes place during Palmpol's construction. While an electrician is connecting the first solar panels on the roof of the station he says solar panels hardly produce any electricity, especially in the Netherlands. Michiel dares him to grab hold of the power cables coming from the roof – if the panels aren't doing anything, it surely

must be safe for him to touch the copper? The man grins and of course wisely refrains from doing so. Even though it is an overcast day, the cables have a DC charge of about 400 volts. Our 80 panels produce enough power for four households – or more accurately, for four charges a day!

THE TIME HAS COME

On Monday November 4th 2013, Michiel and Joost are standing in the just completed Palmpol station, waiting for the ABB truck. All of the problems have been overcome. Now they just have to wait for the first chargers. They eagerly greet the driver of the ABB truck. With a bit of luck, within an hour they will be able to charge at our own station for the first time. But when the driver opens the tailgate, Michiel and Joost gaze with surprise into an empty cargo space. They forgot to load the chargers in! It's a bit of a shock, but *c'est la vie*. The driver makes the same trip again, returning with two chargers this time. It's ten o'clock in the evening before the first car can be charged.

Michiel sends me a text message. For the first time in history an EV has charged at a fast-charging station along the highway. It's a bit like when Bertha Benz stopped at the first 'filling station' in Wiesloch in 1886. It has been a long time coming, but many more EVs and fast-charging stations will follow on from today.

A few weeks later, on November 27th 2013, the first four Fastned stations have been brought into operation. We invite a few journalists to Palmpol "for a glimpse of the future", as some would say. The most enthusiastic member of the group

is trend watcher and video blogger Vincent Evers. He drives his bright red Tesla full speed into Palmpol, jumps out the car and yells: “Fantastic!”

After the on-site interviews, Vincent asks whether I’m also going to Amsterdam. To my delight, he suggests swapping cars. I drive his Tesla and he takes Fastned’s Nissan Leaf. We agree to meet at our office in Amsterdam North. It’s my first long drive behind the wheel of a Tesla, and I do what everyone probably does when driving this great car for the first time: put the pedal to the metal. Going from 80 km/h to 120 km/h in seconds, the adrenaline surges through my body.

Back at the office Vincent has a good laugh. “Nice huh, accelerating like that. I was following you on my iPhone.” A bit abashed, I smile back, but Vincent has already moved onto something else. He spontaneously decides to interview everyone there, recording the conversations with the camera on his phone. The result is a legendary start-up interview, which can be found on YouTube as ‘Fastned the Company’. The video really shows how positive the Fastned team’s mentality is. Maria tells all about the station. With a straight face and a great sense of understatement, Christiaan relates his experiences with municipal licensing procedures. Joost talks about the grid connections. “Laying a cable takes just one day, but it is mandatory to first go through three and a half months of bureaucracy.” This will later prove to be overly optimistic.

I get to talk about the parameters of our plan: we are building two hundred stations in two years, for 200,000 euros each. That will cost 40 million euros. We’re issuing four million

certificates, for ten euros each. And charging costs about ten euros a time. Two years after starting up our plan hasn't changed. Not bad.

When the first four stations open, we wait in anticipation for the first customers. When will we get the first call? Do the chargers work? We feel like we are now going "out into the world". It's a good feeling, with a healthy dose of excitement.

NOVEMBER 27, 2013

Our first customers

Once the first stations open, we get our first customers. This is a big change for Fastned; after laying the foundations for the first few years, we are now in business. As a result we need more people on the team. We hire them according to Michiel's philosophy which says there has to be at least two months of work waiting for a new employee. This ensures that they can immediately start working on something specific. We grow from five to twenty people within a year.

The first of the new recruits is Sandra Lameijer. On November 3rd 2013 she starts working for us as a controller – a job she has previously done at both an architectural firm and a payment service provider. Her experience will be put to good use. The building team is now spending serious money, and our customers will shortly be paying online.

Jessica Bouws is hired as a web designer. Her online retail experience at a large Dutch IT retailer makes her a good complement to Angelique Verheij, who has been doing all our graphic design for the past year. Having this expertise in-house allows us to move quickly. From that moment on the website is continuously optimized, while maintaining the same recognizable Fastned style.

The next addition to the team arrives soon afterwards, with the appointment of Maartje Sonnenberg. Maartje is going to set up the retail operation. She has a Master's degree in marketing, and spent the past few years working for the detergent giant Henkel. As a pilot project she started a laundry in Amsterdam called Wash & Coffee. This, of course, we like the most.

In cooperation with our Estonian friends from NOW! Innovations, we set up both the front and back office within a few months. NOW! is making the Fastned app, with which customers will soon be able to charge and pay. We sign an agreement with payment service provider Adyen for the online payments. Sandra has experience in this area.

FEEDBACK

With customers charging at our stations we start to get the first phone calls. Charging newer EV models in particular, like the BMW i3 and the Renault ZOE, does not always go smoothly. We set up a customer support number – we have to make sure customers can easily get hold of us, also in the evenings and weekends.

All of the questions are new. We learn a great deal, as does ABB. The latest software for their chargers is tested at our stations, and our first customers give a lot of feedback. They are true pioneers and come up with new ideas, which is fantastic. Some EV drivers actually take the trouble to visit new stations and test the chargers. Despite the teething problems, the drivers are positive – everyone wants this to succeed. They are very excited that someone is taking things seriously by building attractive stations with high quality fast chargers along Dutch highways.

While we are launching the initial series of nine stations and looking after the first customers, Maria is already working on station 2.0: the next and improved version of the earlier design. The design process aims to reduce the costs by 20 percent each optimization round. This means fewer materials,

smarter construction and reduced construction times – without affecting the look and feel of the station. Maria succeeds in bringing version 2.0 more in line with the original design Margot sketched two years ago: a roof supported by an arch on opposite ends. We are now actually going to build what at the time intuitively felt to be technically possible.

The hallmark of the first nine stations is the double column in the middle of the station. From the tenth station onwards these columns will no longer exist. This also means two fewer concrete blocks between the arches and more space for the chargers.

The construction process is ongoing. The customer team has been launched. It is high time for funding, because we are going to invest – in a big way.

OCTOBER 28, 2013

Put your money where your mouth is

I discuss Fastned's funding with Michiel. We need investors: to get the job done – to build two hundred stations costing 200,000 euros each – requires 40 million euros. We are confident that all cars will be EVs in the future. For that reason alone, we feel that investing in Fastned is a no-brainer. But will investors see it that way too? We test the waters in a number of talks with potential candidates.

A similar pattern keeps cropping up. On a personal level people are very enthusiastic; so much so that they often ask whether they can invest after half an hour of conversation. Yet when they have to convince their boss they hesitate. Are EVs really going to take off? Will people just keep charging at home? Why invest in a start-up? "We never do that as a rule", is the tentative refrain.

Later we will discover that this is a persistent pattern. Talks with a number of investors reach an advanced stage. They show plenty of interest at first – especially when their due diligence team has studied the figures. Only then do they realize the size of the future market. More than 20 billion euros worth of fuel is sold by Dutch filling stations, which indicates how big the market for charging cars will be. Fastned has a unique position thanks to its highway sites.

Yet unfortunately, reality proves to be more complicated than this initial enthusiasm. The investment decision is not made by the people who are so positive about it. The

proposition first has to pass various investment committees and then finally ends up at the executive board. This is where it runs aground on the crucial question: "Will EVs really take off?" When the people from the investment committee and the analyst team call to break the bad news, they express genuine disappointment. They had really hoped the board would be bold enough to go for it, especially after such thorough analysis and positive advice.

This is exactly how things go, for example, when a large insurer approaches us– the company wants to invest in sustainable infrastructure and Fastned's charging network seems to tie in well with this goal. Several months later the executive board eventually rejects the plan. But the investment team's sincerity will be demonstrated later, when we float on the NPEX. They are the first people to invest significant amounts on an individual basis. Bravo – what a fine example of putting your money where your mouth is. At the IPO we will see many of the people who were enthusiastic early on invest in an individual capacity in our fast-charging stations. We greatly appreciate this endorsement.

This pattern prompts us to employ a two-track strategy to attract investors. We negotiate with large potential investors, while at the same time making it possible for individuals, mostly small investors, to get involved. That is our answer to the question many people ask: "Can I buy shares?" Moreover, this second track helps build a community of EV fans who not only charge at Fastned, but also serve as its ambassador.

NIELS

While looking for comparable initiatives offering extensive opportunities for individual involvement, I come across the Windcentrale. It's an organization that enables individuals to become co-owners of a wind turbine. As owners, their electricity will be directly sourced from the windmill they have invested in.

It turns out that Joost is well acquainted with Anne Janssens from the Windcentrale. She pays us a visit, along with her business partner Harm Reitsma. The Windcentrale has used crowdfunding to raise a whopping total of 7 million euros. Surprisingly, finding people willing to part with their money is not the bottleneck, but rather the availability of enough suitable windmills.

Anne and Harm have a compelling story. The idea of having a large number of private investors appeals to us; it might be a model for Fastned too. Why wouldn't EV drivers want to invest in their own charging network?

I arrange to have coffee with Niels Korthals Altes at an Amsterdam co-working club on May 2nd 2013. Niels devised and co-founded of the Windcentrale, but is no longer actively involved. He is entrepreneurial, and a fast thinker. He started his career at Unilever, and before setting up the Windcentrale he started GreenSeat, an organization offering CO_2 compensation for air travel emissions. Niels is a committed environmentalist, and listens attentively to my story about Fastned. We talk about crowdfunding; could this work for Fastned? He thinks it could. A few weeks later I send him the manuscript of *The Fastned Story* part I. Niels calls me the next morning,

and tells me he was kept up the whole night by all sorts of ideas for Fastned. He would like to join us.

Niels joins the Fastned team shortly before the opening of first station, and buys into the company like the other employees.

TRIODOS BANK

I have a meeting with Matthijs Bierman, the director of Triodos Bank, in the autumn of 2013. The purpose of the conversation is to understand how Triodos's shareholding structure works. Matthijs gives an impassioned account. The core of Triodos is its sustainable mission: making money work for positive social, environmental and cultural changes. Investors can buy certificates from the Triodos Foundation. By doing so they endorse its statutory mission. The foundation's board oversees the implementation of this mission. Simple and clear. This looks to me like a good structure for Fastned. Our mission is also clear: to develop and operate a network of fast-charging stations for EVs. This mission has to stay clear to ensure its successful execution.

The next morning I discuss it with Michiel, who soon concurs that this is the best construction for Fastned. He has seen way too many start-ups whose missions have been watered down because shareholders demanded a different course. The Triodos setup will prevent this. If Fastned's mission is in black and white then it is crystal clear to investors what is being done with their money. The Triodos structure also enables large numbers of small investors to get involved – a prerequisite if we want the crowdfunding initiative to

take off. This is Niels's first job: creating a future ownership structure for Fastned, which enables everyone to become a co-owner.

All of the employees invest in Fastned

And that's how we do it. Like Triodos Bank, we get all Fastned shares certified. We set up a foundation with the appropriate name FAST: the Dutch acronym of Fastned Administration Foundation. FAST is the sole owner of Fastned B.V. and issues one certificate for every share. The shareholders become certificate holders. The foundation's board will have control, and will oversee the implementation of Fastned's mission: rolling out a network of fast-charging stations for EVs.

Lawyer Eveline Mutsaers, notary Nick van Buitenen and candidate notary Gerlies Vink show us the ropes in setting up a shareholder structure inspired by the Triodos Bank model. We hold Eveline in high regard; she was responsible for incorporating Fastned B.V., and also did good work for Epyon. First we get her to investigate how to make it possible for Fastned employees to be certificate holders of the company. Each certificate is equivalent to a share.

We ask notary Nick van Buitenen to join the foundation's board. The other two members of the board are Geert Kloppenburg and Hieke Rees-Spoelstra, who will be the chairman. Hieke knows Michiel from his time at consulting firm A.T. Kearney, where she was known for her ability to bring people together. She currently works at PostNL. Geert spent many years as the chairman of DOET – Dutch Organization for Electric Transportation – the trade association for electric transport. In this way we create a balanced mix of backgrounds and abilities on our board.

The opening of the first four stations is now just around the corner. At the office everyone is working hard to get the stations up and running. The preparations for the launch party are also in full swing. We call the whole team together on Friday 25th November 2013. Michiel takes the floor and presents the various ways in which the employees can participate in Fastned. And we announce that Michiel and I have decided to mark the opening of the first station – which is a great milestone! – by giving every employee a bonus. What could be better, from our perspective, than to pay the bonus in Fastned certificates.

What a special day. Almost all of the employees indicate that they want to invest in Fastned. Even though the amounts vary, it is a large commitment for each individual employee. Michiel and I are impressed. The team is so fully committed to Fastned that they are putting their personal savings into the company even before the first station has opened. From then on all of the shares are certified and the foundation has full control of the company. Shortly afterwards we all sign the necessary documents at the long lunch table. It's a poignant moment. This is a team that wants to change the world.

NOVEMBER 16, 2013

Fastned The Movie

Building the first stations shows a growing number of people what Fastned is about: building electric charging stations along the highway. This of course calls for an official opening ceremony – or even better: a big party with all our business contacts, friends and family. We think it would be a good idea to have a marquee overlooking the highway at Palmpol station. It shouldn't be too difficult to arrange a permit for a tent from the Ministry of Infrastructure and the Environment, as we have enough experience with permit procedures by now. We choose November 29th 2013 for the bash. So far so good.

However, the devil is in the details. Won't a site along the highway be a bit bleak in late November? Isn't serving alcohol along the highway asking for trouble? Are we going to put diesel generators next to the tent? Why are we actually doing this? With this in mind, we reconsider the whole thing. There are a number of reasons. First of all, the deadline is reasonable and it will be an excellent collective target to open the first stations before November 29th. The idea is to really be able to show a few stations by then. We also think it would be good to organize a get-together with investors and people from both the automotive and charging industries. Finally, we would also like to show Fastned fans and our friends and family what we have been busy with all that time.

We quickly drop the idea of a party next to the highway. Instead we end up choosing the old abandoned Stork factory

as a venue. It is around the corner from our office in Amsterdam North, easy for everyone to get to and big enough for what we want. It also has the right look.

We get Maxine de Jong to do the PR and to organize the party. She is still rather involved in student life, but that actually suits us quite well. The last thing we want at Fastned is a formal do. Max, as we will come to know her, visits the office on the July 9th 2013. She has just graduated in Media, Information & Communication, but has been working in a clothes shop. During the interview we find out that she did the web editing for a well-known Dutch television program. Great, but what does she actually know about cars? "Not much", Max replies poker-faced. "But of course I can hear the difference between a 4 and 6 cylinder engine."

HOLLYWOOD

The building team is working hard to finish four stations on time. Four stations at once, because Fastned is building a network. Max and Margot take responsibility for the party decoration. The invitations are sent, and Michiel and Lot Lewin join forces to form the film team for *Fastned The Movie*. Some time ago Lot made a film about a sailing trip Michiel and some friends made in Croatia. I've seen the film, and its upbeat enthusiasm stuck with me – that's the feeling we want to convey at the opening. So I'm immediately in favor of a film by Lot. First there was *The Fastned Story*, now there is also *Fastned The Movie*.

The film team can get to work. With *Fastned The Movie* we want to take people on the exciting Fastned adventure.

Time is limited, as is the budget – this will be a challenge for Lot. She plans the filming in great detail. Interviews with the founders will be alternated with spectacular images of EVs and the stations. Lot soon befriends the Ecocare building team. They like the idea of being filmed on the construction site. Several GoPro cameras are installed at the Geulenkamp service area for a two-week period. Lot builds a bird house-like construction around them so they are not stolen. Every other day she drives more than one hundred kilometers from Amsterdam to Didam, on the Dutch-German border, to change the cameras' memory cards and batteries.

The film team plans to shoot on several different days, in order to get footage of different types of cars at the same time at one charging station – just like you would see in a filling station. This proves to be quite a task. Michiel calls Tesla, BMW, Volkswagen, Nissan, Renault and Mitsubishi. Volkswagen is really enthusiastic, and is willing to loan us an e-UP! The car is transported on a trailer from Wolfsburg in Germany to Palmpol station in Barneveld, where the filming will be done.

Getting hold of a BMW i3 is more complicated, as there aren't enough i3s registered in the Netherlands. Niels Burgman of BMW finally comes up with a creative solution. The i3 in the showroom at BMW's Dutch headquarters isn't used in the weekend. As the car isn't yet registered, it can't be driven on the open road, and will also be brought on a trailer. Palmpol looks like a film set in Hollywood, with cars in the limelight.

FILMING

At the start of the film weekend, on Friday 15th and Saturday 16th November 2013, friends and family are ready to drive in convoy to Palmpol. There's an upbeat mood. Lot is the director today, and has brought a professional cameraman in toe.

When all the cars arrive in the station, everyone suddenly realizes that never before have so many different brands of cars charged together at a charging station. Yes, of course Tesla has roofless superchargers, exclusively for Teslas. But a complete covered station where any car can fast-charge? This really is the first time! A world first! And we are part of it – and even better: we are making it possible! The team is ecstatic.

On Saturday afternoon, after all the highway footage has been shot, Lot decides to film an EV with the nearby Veluwe national park as a backdrop. The Mitsubishi Outlander is of course the natural choice for this. We find an open gate, giving us access to the hiking area, and put the Outlander in 4x4 mode. Lot is in her element and makes great shots. Then things go wrong. Michiel and Christiaan haven't being paying enough attention to where they can and can't drive. A hump turns out to be too big – the borrowed Outlander gets stuck in the heathland sand, with its wheels spinning. What can we do? With the camera crew howling with laughter in the distance, the passengers try to push the car off the hump. After a few unsuccessful attempts, Harmen Lewin, one of Michiel's friends and a film extra, takes charge. Eight men are needed to push the Outlander out of the powdery sand.

The vehicle has been saved. And the film director is satis-

fied. After an adventurous Saturday – which included beautiful nature shots – the caravan heads homewards.

NOVEMBER 29, 2013

The opening party

The drinks have been chilled, the confetti has been tested and the Fastned team is present. Let the party begin! The guests – which include the entire European EV industry – start to arrive. First in are the men from Epyon, now ABB: Crijn Bouman, Hans Streng, Daan Nap. They are soon followed by the German car makers: Niels Burgman and Erick Oberink from BMW and Matthias Kübel from Volkswagen. Bart Thienen from Nissan. The NOW! delegation from Estonia: Vahur Viigimäe, Jarmo Tuisk and Olga Gutenko. And from the CHAdeMO organization, Tomoko Blech.

Once in, the guests look around, somewhat taken aback. There's a nice long table; it'll definitely be a festive evening – but where are the officials? Where are the ministers who will talk about European ambitions, and where are the energy giants who will discuss smart grids? No, it is not going to be that kind of evening. For the first time, the conversation will not be about politics, government ambitions and utilities' interests. It's going to be about the number of cars, the necessary chargers and good sites. A breath of fresh air.

BUILD YOUR DREAM

The evening kicks off with a dinner for eighty people. The entire EV industry is sitting in between investors, Fastned staff and their partners. My parents are also present. Michiel has invited Hans Streng to capture the audience's imagination by giving an introductory speech during the starter – what is the urgency of our get-together?

Hans has just returned from a trip to China. By now Epyon is well integrated into ABB and is growing fast in this vast country, where they are also setting up a production line for fast chargers. The Epyon top man begins his story with a Beijing headline: for the first time an eight-year-old has been diagnosed with lung cancer. The room is silent. The Chinese government is investing heavily to improve air quality, Hans continues. In 2010 Shenzhen started a pilot project with few dozen electric Build Your Dream e6 taxis; now, there are thousands of these clean vehicles operating in the city. They can be recharged in skyscraper basements. Hans calls these charging hubs 'Estonia in the Basement': around two hundred fast chargers are installed in each basement, which is exactly the number of chargers along all of Estonia's roads.

The upshot of his story is clear. The Netherlands is lagging behind, and if we don't get in now we will soon become a backward country stuck in the fossil fuel era.

After dinner, the doors are opened and the room fills with other interested people and acquaintances. After everyone has taken their place on the grandstand, Michiel and I get on stage. We briefly recount the start of our adventure and promise the public a brilliant presentation film. It's no exaggeration; Lot's film blows them away. The message gets through: the EV revolution is under way – and Fastned is playing an important role in it.

After the film, there is time for questions from the audience. The first question is whether people can invest in an individual capacity in Fastned. We promise to make this possible and that people will be able to invest for ten euros per

certificate. A commitment we put into practice half a year later. Another question is whether people will still come and charge if their EV's battery – and therefore range – increases. It's a question we are often asked. We know from the Japanese experience that when range is increased, people have the confidence to drive further afield. This in turn increases the need to charge on the go.

After the audience questions it is time for the official opening. The whole Fastned team – twelve people at the time – comes onto the stage. Pressing a big red button sets off two confetti cannons: the opening is official. The video screen simultaneously displays images from the four stations that are open. We did it: we're live!

JANUARY 6, 2014

Office on the Amstel River

We have gradually outgrown our office in Amsterdam North. At first there were five Fastned employees, sharing two desks at Amstelfilm's offices. Now there are fourteen of us sitting on two rows of tables, in the same couple of dozen square meters. Time for the next step.

Joost, who has a real estate background, goes looking for something else. We would prefer an office in the *Rivierenbuurt*, in the south of the city. Most of the team members live around the area; besides, it's handy for the building team as it's near the highway and has plenty of parking.

It seems an impossible combination, but we eventually find an ideal office on the Amstel, in Amsterdam's largest (and half empty) office building: Rivierstaete. Pronam, an IKEA investment vehicle, bought the building, and will renovate it in two years. That's a sea of time for a young company. We get an entire floor for a low rent. Lisa, who joined the team a few months earlier, designs the office interior for us. She creates separate areas for the three teams: 'construction', 'customers' and 'financing'. The meeting rooms and telephone booths will all be made of plywood, and there will also be a big lunch table. The plan is to move in after the Christmas holidays.

Joost gets several tenders for the conversion. The prices he receives vary wildly, and he's perplexed as to why the installation of a few walls and a fitted carpet should cost 70,000 euros. Joost happens to be refurbishing his home at that moment, with the help of Harun, an eager Turkish contractor. He is more than happy to help Fastned and comes up with a real-

istic and attractively priced tender. Moreover, Harun and his Turkish buddies don't mind working in the Christmas break.

During the holidays, Michiel and Joost take turns at the office to oversee Harun. It is almost ready when the whole team returns to work on January 6th 2014. We operate from the storage room next to the office for a few days, and then we move in properly. It's fantastic! A light and spacious office, overlooking the Amstel. What a great start to the New Year.

EXPANSION

In the first weeks of January we are confronted by reality. Fastned has grown too big for an off-the-cuff mentality, typical of start-ups. When there were five team members, we could arrange cleaning the office and computer administration amongst ourselves – Michiel did the server administration himself. Moving to a new office, it soon dawns on us that we need to start outsourcing things. Then we can devote all our energy entirely to building stations, taking care of customers and financing. We call a cleaning company and ask our old neighbors New Media 2Day to look after our computers. They have already helped us out in the past when we were at our wit's end. Thijs Parée, the owner, is someone you can rely on.

In the meantime, the number of EV's shared by the Fastned team keeps expanding. It's time for charging points at the office. We install the first two in the Rivierstaete parking lot. It's quite a job arranging everything. When they're installed we wrap them in gift paper, get a bottle of champagne and call Joop van Zanten and Martin de Klark, the men from the recep-

tion desk. Surprise! Joop and Martin are given the honor of unwrapping the chargers, which have the nameplates 'Joop' and 'Martin' on them. The men are pleasantly surprised.

There is also expansion on the domestic front. This is one of the special things about working with a relatively young team. The first Fastned baby is born in September 2013. That's to say, the first child born since setting up Fastned BV: Joost and his girlfriend Karin's daughter, Vicky. The Fastned team surprises the fledgling pioneer's parents with a huge pink toy EV. They eventually decide to park the gift in the storage room – at 1.5 meters long, it was a bit big for the living room. From then on, daughter Vicky never misses an opportunity when the storage room door is open. The one-year-old crawls into the room, and clambers behind the wheel.

There are also other new arrivals. In the spring of 2014 Angelique has twin boys, Noah and Siem. A few months later Lisa gives birth to a son, Jules. It's stimulating for us. The new generation – that's who we are doing it for.

A lot of family comes to our New Year's reception. When we see the young children running around the office, we realize they will probably never drive a fuel-powered car. This awareness grows even stronger later in the year, when we open Zuidpunt station, on October 30th 2014. We think it would be a great idea to do the opening with investors. Investor Hans Hermans brings his daughter with him. Together with Christiaan's younger brother, she cuts the ribbon at the opening.

JANUARY 16, 2014

Serious CO_2 reduction

The most important yardstick for the Dutch government's air pollution reduction ambitions is the lowering of CO_2 emissions. To achieve this, it has deployed a clever instrument for company cars: the additional tax liability. The higher the emissions, the higher the additional tax liability. You have to pay an additional tax liability of 25 percent for the most polluting fuel-powered cars; the rate for the cleanest fuel-powered cars is 14 percent.

Plug-in cars were initially subject to a 0 percent rate. Due to the success of plug-in hybrids, a new scheme was introduced on January 1st 2014, with two categories: 7 percent for plug-in hybrids and 4 percent for fully electric cars. In order to encourage fully electric vehicles the government will further increase this differential in 2016. The taxman will charge 4 percent for fully electric cars, and increase the rate for plug-in hybrids to 15 percent. There will only be two rates for hybrids and fuel-powered cars: 21 and 25 per cent.

This is a very successful policy. While the most polluting cars had a market share of over 70 percent eight years ago, a large number of them have been replaced by cleaner cars thanks to the additional tax liability. The average CO_2 emissions of new cars were 167g/km in 2006, but these emissions had dropped to only 118 g/km in 2012.

On Saturday March 29th 2014, *De Volkskrant*, a major Dutch newspaper, runs with the headline that EVs are costing the government half a billion euros in tax benefits. The Mitsubishi Outlander PHEV in particular – which inciden-

tally isn't a proper EV, but a plug-in hybrid – comes in for a lot of flak. The paper neglects to mention that the fall in tax revenues is largely due to the lower additional tax liability being paid by efficient fuel-powered cars. A couple of thousand EVs – a tiny fraction of the ten million cars in the Netherlands – have a negligible influence on the supposedly dwindling Dutch tax revenues. Moreover, the tax authorities are not stupid, and the government keeps raising the standards. So even though cars get cleaner every year thanks to stricter standards, the exchequer is still raking it in – the well-known thumbscrew technique.

A few days later, I speak to the managing director of Mitsubishi Netherlands, Marco de Lange. Didn't he find the article very one-sided? "Yes – fantastic", Mark replies. "We've never had as many orders for the Outlander as last weekend."

AMSTERDAM CLIMATE & ENERGY FUND

To promote CO_2 reduction the Dutch government has set up climate funds. Modeled on private equity funds, they aim not only to make a financial return on their investments, but also a CO_2 reduction.

On January 16th 2014, I talk to Jeroen Meinders of the Amsterdam Climate & Energy Fund (AKEF). I've known for some time that Jeroen is a real EV enthusiast. He's been driving a converted electric Beetle for years. Jeroen tells me that AKEF's norm is a CO_2 reduction of 30 kilograms for each euro invested. This is a good opportunity for us to see if we can meet that standard. It turns out to be shockingly simple. Basically, each new EV replaces a fuel-powered car. And since even a

'clean' fuel-powered car still emits an average of 100 grams of CO_2 per kilometer, this is the reduction per kilometer with an EV. An EV goes 5 kilometers on 1 kWh. So every kilowatt hour Fastned sells (electricity from solar and wind energy), is equivalent to a 500 gram reduction in CO_2 emissions.

Fastned expects to sell about ten billion kWhs in its fifteen-year concession period, resulting in some 50 million kilometers being driven in EVs and a reduction of 5 billion kilograms of CO_2. And all of this for an investment of 40 million euros – the equivalent of 125 kilograms of CO_2 for every euro invested. Piece of cake.

The conditions attached to AKEF's loan agreement turn out to be rather more complex. These CO_2 reductions are all well and good, but everything needs to be on market-based terms. To ensure this, the municipality of Amsterdam has established an investment committee composed of bankers. As well as a high interest rate, the committee naturally also demands a very high degree of certainty. This is a tall order for a new business in a new market, and leads to months of negotiations. In these same months Fastned manages to raise capital on the stock market and organize a loan from Flowfund. This strengthens our conviction that it must be possible to get a loan with reasonable conditions from AKEF too. The lack of certainty remains the biggest stumbling block. AKEF is not prepared to pre-finance construction; it is only willing to refinance existing stations, with the completed operational stations serving as collateral – and of course only in the Amsterdam region. On top of this, we will have to put ownership of the Amsterdam stations in an SPV (Special Purpose

Vehicle). We think it is all unnecessarily complicated. Talks were still ongoing when this book went to press.

AKEF's CO_2 reduction norm makes us appreciate once more just how much clean electricity we are going to use. In ten years time Fastned expects to consume more power than the Dutch Railways (NS): 1.5 billion kilowatt hours per year. That's one percent of the entire annual electricity consumption of the Netherlands. The NS currently clocks up 16.8 billion passenger kilometers per year, for which it uses 1.4 billion kilowatt hours. In other words: you can go 12 passenger kilometers with 1 kWh by train. That is more efficient than an EV, which can only go 5 kilometers on 1 kWh. But with three passengers in your car, power consumption per passenger drops below that of the train. Fortunately, the NS is going to switch to green power, like Fastned. This process will start in 2018 – time to build more solar panels and windmills.

OCTOBER 30, 2014

Putting our mark on the map

Fastned has only just settled into its new office when Michiel gets a call from Johan Peeters from ABB. They are exploring the possibility of applying for TEN-T (Trans-European Transport Networks) funding from the European Commission, and would like to submit the application with a number of other parties. TEN-T is a program focused on the construction of new ports, railways, and roads. Would Fastned like to participate in the application?

Michiel is game. Subsidies are usually directed towards research and pilot projects. Since Fastned is in the business of developing actual infrastructure, we have never yet been eligible for this sort of funding. In this instance the subsidies are aimed at developing innovative infrastructure. Moreover, the fund has hundreds of millions of euros to spend. We decide to go for it.

The plan gets fleshed out over the next few weeks. The evaluation commission turns out to be crazy about the word 'corridor'; in other words, a route in Europe along which you can charge your EV every few kilometers. This is a bit odd in Fastned's opinion: we prefer to think in terms of density of coverage. But if it helps us to get part of the infrastructure subsidized, that would of course be great.

Shortly afterwards we get together with ABB, the Danish company Clever and Sweden's Öresundskraft to discuss the plan. Clever is the initiative of a number of Danish utilities for a fast-charging network. The company has installed dozens of fast chargers in Denmark, mostly in business parks and

shopping centers. Site owners arrange a spot for the charger and Clever operates it. Öresundskraft, based in southern Sweden, is also a utility. It hasn't yet done much in the field of fast-charging.

Johan Peeters draws a line across the map of Europe with a felt tipped pen. It runs from Stockholm to Copenhagen, Amsterdam, The Hague and finally via the Ruhr to Munich and Salzburg. A partner still has to be found for Germany. Everyone understands that a corridor without Germany, the heart of Europe's automotive industry, won't impress the evaluation commission. The Germans are rapidly developing EVs which will compete with Teslas. There's a copy of this week's *Auto Bild* on the table. The leading German car magazine's cover announces that "Audi is building the German Tesla". The description below the pictures of the electric Audi Q8 reads: "Tesla fighter!"

Johan calls the BMW and Volkswagen people. Would they like to help? Could we install chargers at their dealerships on the route? "Couldn't Fastned and Clever do the German expansion together?", suggests Michiel. Clever is cautious; whereas Fastned is keen.

In the end, the project plan stipulates that Fastned will develop 30 sites in the Netherlands and 67 in Germany for the corridor. Clever will also lend a helping hand, building a dozen or so sites in northern Germany. The plan is designed so that the subsidy provider will pay a maximum of 50 percent for the installation of one fast charger per site; we will have to stump up the other half of the investment ourselves. We are applying for a total grant of about 2 million euros for

Fastned's part of the plan – for the installation of a total of 96 chargers in the Netherlands and Germany. This works out at about 20,000 euros per charger.

KNOWING THE INS AND OUTS

ABB has decided to enlist the help of consultant and lobbyist Concilius AG to spearhead the program and write the project proposal. This firm is specialized in writing grant proposals for the European commission. They know the ins and outs of Brussels. Predictably, this results in a discussion about who will foot the bill if the project is not accepted. Concilius is familiar with this dilemma, and so works on a no-cure-no-pay basis. They write the proposal and are responsible for communication with and reporting to the EU.

As is always the case with subsidy applications, umpteen questions have to be answered and signatures collected. Will Fastned be able to get the necessary permits? Will this infrastructural development have a negative impact on Natura 2000 protected natural areas? As hundreds of sites are involved, it would be impossible for us to hand over permits for each site beforehand. The Concilius people understand our predicament, but insist: we have to prove we can obtain the necessary permits in each country. We've already managed to do so in the Netherlands. Our best reference is the concessions we have been granted – we have WBR and building permits that can be shown as examples. But Germany is more complicated. How will we deal with it?

Sandra has only just started working at Fastned, but she's quickly finding her feet. Not only does she help Michiel im-

plement several necessary professionalization measures, but she is also rapidly finalizing Fastned's annual accounts. When Michiel asks her to help compile the necessary documentation for the TEN-T subsidy, she looks a little dismayed at first. Not that too! But a moment later she puts her best foot forward, and manages – along with all her other work – to get the necessary documents to Concilius on time. She compiles documents from the Chamber of Commerce, annual reports from previous years, and completes all the prerequisite official forms. A few weeks later, and she has amassed a thick pile of paper, which is sent by express delivery to Brussels.

HOLIDAY ROMANCE

Lisa has been plotting all the sites on the German *Autobahn*, using the trusted Google Earth. It's a hell of a job. She has also been reading up on German legislation, because Concilius has advised us to get a German municipality to issue a positive statement about a building permit. This will increase the grant application's evaluation commission confidence in the project. Lisa is initially skeptical about the plan. She grew up in Germany, and explains that there is no way municipalities in her native country will sign any such document prior to extensive research. Michiel understands the problem, and calls Frederic Maas at Concilius. Frederic explains the rationale once more: "It's not about whether the plan is feasible or not, but about making sure the evaluation commission can never be accused of having made a mistake. If the project were to fail, they couldn't be blamed if they were to have an official letter from a German municipality in the dossier." It

sounds very similar to building permits in the Netherlands – it's not just the content that matters.

Time is running out: the subsidy application has to be submitted in seven days. Out of the blue, Christiaan tells us about his German holiday romance. "I think she works for a municipality. Maybe I can get her to arrange something?" That same afternoon he jumps into the car and heads for central Germany, in the hope that this girl can help us. A week later the application is ready to be submitted. Will we get the subsidy? In any case, the application includes a signed statement from the mayor of a German village declaring he is in favor of electric charging stations in his municipality. That particular box has certainly been ticked. The joke doing the rounds in the office is: "Christiaan arranges subsidies via Tinder!"

FEBRUARY 1, 2014

Oil pollution and bird hop-overs

Besides all the necessary paperwork, a soil survey has to be conducted before each Fastned station is built. In the first place this is used to determine how thick the layer of rubble and sand directly beneath the station's paving should be. The second reason is more complicated: to determine the level of soil contamination – a prerequisite for lease agreements with the Dutch state. When a new concession is granted in fifteen years time, these measurements will be used to determine the change in soil contamination. Incidentally, we see this requirement as a relic from the filling station era, but we do whatever is considered necessary to conclude the lease.

We get the results of several of the soil surveys in February 2014, including those for the Zuidpunt and Knuvelkes service areas. It's not long before Bas has frustrating news for Michiel. "The research bureau has environmental concerns about building the charging station. Now what?"

Michiel and Bas delve deeper into the reports. Zuidpunt has elevated levels of PAHs, polycyclic aromatic hydrocarbons. Ah, a collective term for a group of compounds which includes petrol and diesel. Bas and Michiel grin at each other. Ha! Ha! Of course, the charging station is less than a hundred meters from one of the biggest polluters in the area, the filling station. What is more, the service area is the perfect place to top up your car's engine oil. More often than not, some of it is spilled.

It turns out later that Zuidpunt is not the only site with a comparable report. Dutch filling stations have really polluted the surrounding land.

PICNIC AREA

Do we have to do a cleanup? And if so, why hasn't this already been done? Hasn't this information been around for a long time? The research bureau reassuringly advises us: "No, a cleanup really isn't the next step, but additional research will have to be done. Only then will we know more precisely what the soil contains and in what quantities." Michiel sees where this is going: the research bureau will be able to charge us for extra research. Let's talk to our contractor; Ecocare must have encountered similar problems before.

It turns out that they are indeed able to give us more useful advice. According to the Ecocare people, it is not always necessary to decontaminate the soil when there is this kind of small-scale contamination. However, it is crucial to inform the other parties involved with the site, so they can take this into consideration – for example, in the form of protective measures for the building team. It's also important for Fastned to find out at an early stage in the building process whether the soil at the station will have to be replaced. If so, we will have to bring it to a special soil depot. It is unclear who would bear the cost. The nearby filling station? The oil industry? The landowner, that is the Dutch state? Or Fastned? Bas and Michiel can see that this is likely to lead to endless wrangling, and it would be better to leave all the soil at the site if possible.

The issue is revisited a few months later, when the lease agreement is being drafted by the Central Government Real Estate Agency. "Dear Fastned, we have been informed that there are environmental concerns regarding construction.

What are we going to do about it?" Michiel points out that until recently families picnicked at this site and dogs were walked there. If it really is so unacceptable, then it's not up to Fastned to find a solution, but up to the state. And why didn't they do something about it years ago? The Central Government Real Estate Agency decides to drop the issue.

Fastned will hardly change the current situation, in which the service area's soil is already contaminated. We are only building charging stations on sites that were already used for parking and picnicking.

As well as contaminated oil, there is something else in the ground near Zuidpunt station. While drafting the station in AutoCAD, we notice that the Amsterdam - Brussels high-speed rail line passes through a tunnel 17 meters below the ground – practically under the station! We discuss the issue with the Ministry of Infrastructure and the Environment, the municipality, ProRail and the relevant water board. Conclusion: we shift the station a little, so it is at a safe distance from the tunnel.

BIRD HOP-OVERS

As well as oil pollution and underground tunnels, the sites have other issues too. Michiel and Bas meet with Theo Onwijn from the road district Twente Achterhoek in the spring of 2014. Theo is the contact person for WBR permits in this region. Site by site, Michiel and Bas discuss the building plans for the Fastned stations with Theo and his team. The team has, as is conventional, a traffic expert and a person responsible for service areas. The meeting goes smoothly, and in close

consultation they make choices about the design of each service area. Bas is in his element. “If it carries on like this, then the permit process for these sites will be done in a jiffy.”

Then they get to the second last site, called Struik. It is a very large service area, with a filling station, a restaurant and a hotel. Theo explains that the trees at the site Fastned has in mind, are a so-called ‘bird hop-over’: a specific crossing place for birds and bats. Bas and Michiel take a deep breath and try to see things from a planner’s perspective. Birds fly, don’t they? You’re pulling my leg, right? They decide to leave it for now, reckoning it’s better to end the meeting on a positive note, and with a good number of plans approved. Theo promises to find out how to deal with the issue.

A few weeks later Theo forwards us an e-mail from one of his colleagues, who is a subject specialist. Michiel, Bas and Theo soon conclude that they simply don’t have the expertise to evaluate the bird hop-over. Yet nature conservation is obviously a good thing – and in the end, that’s what we are doing it for. The station’s position will be moved. The birds are happy, the bats are happy, and so too is Fastned.

Dear Theo,

Things could be difficult if the hop-over is actually being used. The purpose of a hop-over is to guide birds and bats, so that it is less effort for them to transverse a barrier in the landscape. Simply felling one or more of the trees could have a considerable effect on its functioning. It of course depends on the situation in its entirety. Bats are often 'dependent' on a hop-over to get from their roost to their foraging grounds. That is because bats are very susceptible to wind and therefore have difficulty crossing open spaces or, for example, roads where the traffic has a strong influence on the airflow. Since bats are strictly protected in the Flora and Fauna Act, the situation could be quite difficult.
The species (of birds, bats) using the hop-over, as well as its broader significance in the landscape, will have to be identified prior to the construction of an e-charging point. This will have to be done by an ecological consultancy.
If the hop-over has a function for a particular species, it cannot just be removed. An application would have to be made for an exemption (from the Flora and Fauna Act), and mitigative/compensatory measures would have to be taken (to create an 'alternative' route; possibly even before the current trees are felled, as trees take time to grow large). This kind of application takes time (from a few months to half a year) and it may even be the case that an exemption cannot be granted, and that alternatives will have to be found for the e-charging point. I suggest that an ecological consultancy is employed to advise on this, to conduct field research if necessary, and to apply for

an exemption. Preferably by the 'requesting' party. I would like to see the report (in my capacity at the Ministry of Infrastructure and the Environment), as the ministry may be asked questions about this by the local community.
Furthermore, I wish to draw your attention to the Forest Act: the ministry has to give official notification to the Regulation Department before trees can be felled.
Another option is of course to move the e-charging point.

Yours Sincerely,
Environmental advisor / technical management of flora and fauna consultant

APRIL 7, 2014

Foreign markets: off we go!

I sit down with Michiel to discuss the period after the two hundred stations have been built. At the time we haven't even opened our first station, but we have to look ahead. How do we want to keep growing? Especially as we now know it takes two years to get all the permits. So if you still want to be moving in two years time, you will have to arrange the concessions now. If not, construction will come to a standstill in two years.

But where are we going to expand? Michiel points out that building a few extra stations is useful, but that the process is only efficient if you erect least one hundred stations simultaneously. Only then do you get economies of scale in site acquisition, concessions, permits and the construction work itself. Moreover, it's only on this scale that you can really create a network and a brand. With the experience of the past two years in mind, I cannot help but agree with him.

Broadly speaking, we see three kinds of sites for the expansion of Fastned's network: the provincial roads, the four major cities and highways in other countries. We do not want to negotiate with too many parties. Preferably we would like to deal with one party which owns several sites, as is the case with highway sites. As there are twelve provinces in the Netherlands, we rule out the provincial roads. That leaves the four major cities and highways in other countries.

Joost makes arrangements to develop stations in the four major cities – Amsterdam, Rotterdam, Utrecht and The Hague. The main reason for these urban sites is the shortage

of highway service areas around these cities. The rest of the country is already pretty well covered by the sites we were awarded by the Ministry of Infrastructure and the Environment. We would like to have between five and ten stations on each city's main access roads. First, Bas selects good sites with the help of Google Earth. Then he and Christiaan use their trusted traffic cones and tape measures to inspect the sites and evaluate whether they are suitable. Even though it is often a tight fit, there is enough space near quite a few of the access roads.

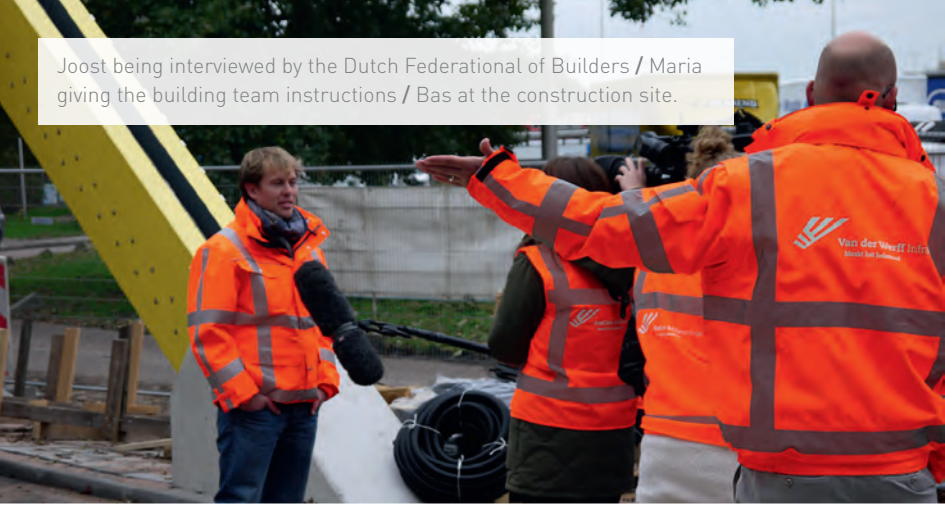
In his discussions with the municipalities, Joost explains what it is we want to do. Is the municipality prepared, like the central government, to lease land to Fastned for the construction and operation of charging stations? The municipalities do not have to invest anything; we will take care of that ourselves. In fact, in addition to the rental income, they can also save on investment in charging points – each station is the equivalent of hundreds of charging points.

That leaves foreign markets. Michiel is optimistic. All the major oil companies have filling stations in various countries too, don't they? An additional advantage is economies of scale – building urban charging stations will be a lot of effort for relatively few sites. In foreign markets we can organize expansion on an altogether grander scale.

LAND GRAB

We get out a map of Europe and establish priorities. As so often, we have to make choices. What are we going to do and what are we not going to do? Naturally, it makes sense for

Joost being interviewed by the Dutch Federational of Builders / Maria giving the building team instructions / Bas at the construction site.



Fastned stations are built in two weeks.

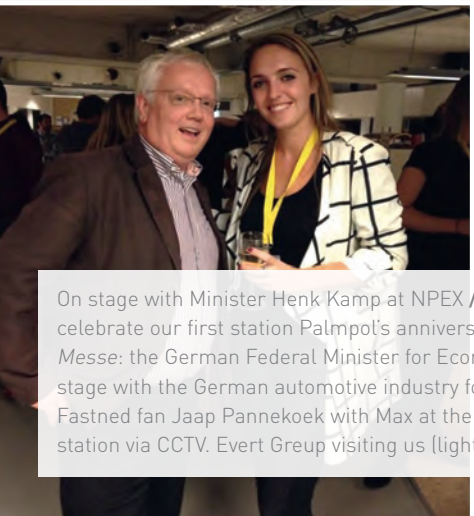
The Fastned team in June 2014 / Zuidpunt station being opened by two young Fastned investors / Bas testing a charger / The BMW i3 is seen more and more at our stations / Niels being congratulated for the AFM license / Elsgeest station being opened by Jan Waaijer, the Mayor of Oegstgeest.


Twee jonge mede-eigenaren openen het station op De Zuidpunt.

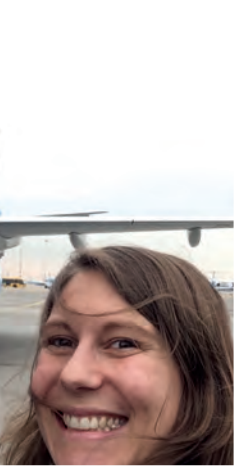
First ‘Shell of the future’ opened in South Holland

Fastned is building a nationwide fast-charging network. The first station in the province of South Holland was opened on Thursday at Zuidpunt on the A16 in Dordrecht. It was opened by two young Fastned investors from the region. They recently became co-owners of the filling stations of the future by buying share certificates.

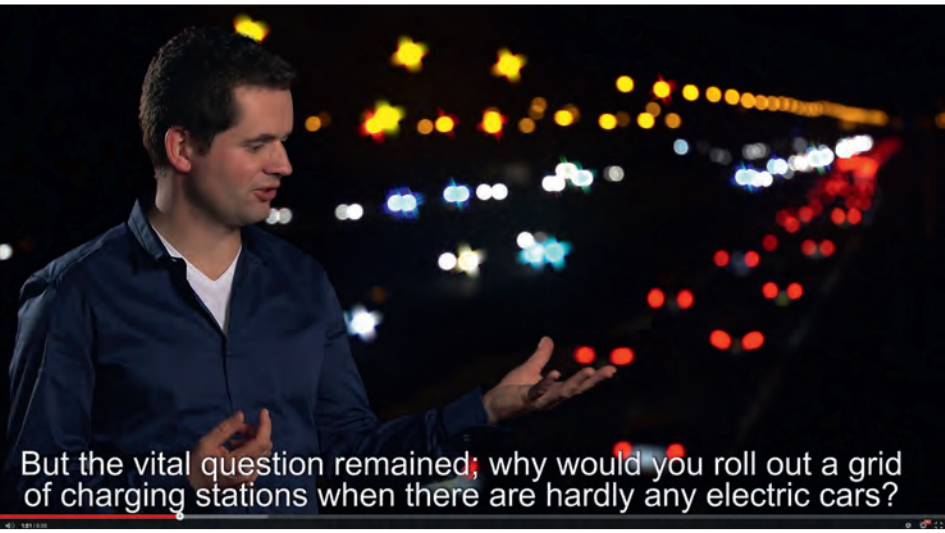
The first Fastned road signs / Pieter and Pieter-Jan charge the e-Golf / The first charging traffic jam occurs at Knorrestein station's opening / Zuidpunt station / Murphy's law: accidents happen anyway / Maria charges with her smartphone.



On stage with Minister Henk Kamp at NPEX / Michiel and Lisa visiting Basel / We celebrate our first station Palmpol's anniversary on November 4th 2014 / *Hannover Messe*: the German Federal Minister for Economic Affairs Brigitte Zypries standing on stage with the German automotive industry for SLAM / Vicky in her pink Fastned car / Fastned fan Jaap Pannekoek with Max at the Open Day / Following the opening of a station via CCTV. Evert Greup visiting us (light blue shirt).

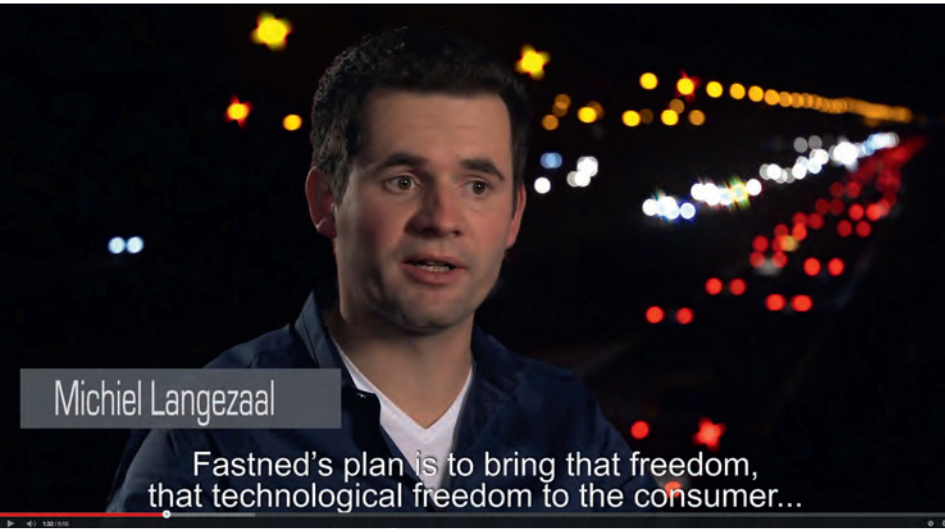



EVERYWHERE ALONG THE HIGHWAY

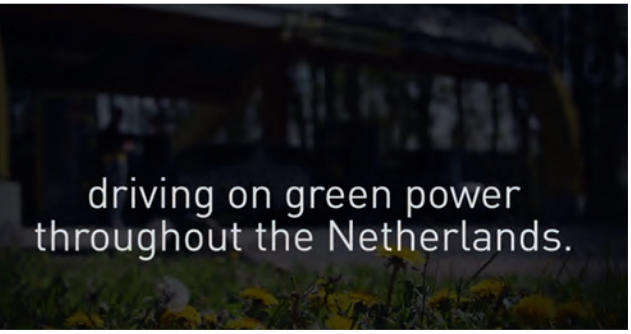


Screenshots from *Fastned The Movie*.

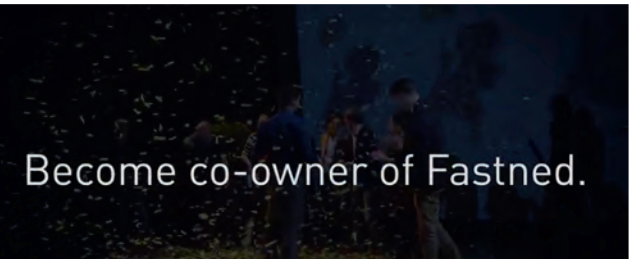

This enables the electric car to provide real freedom.

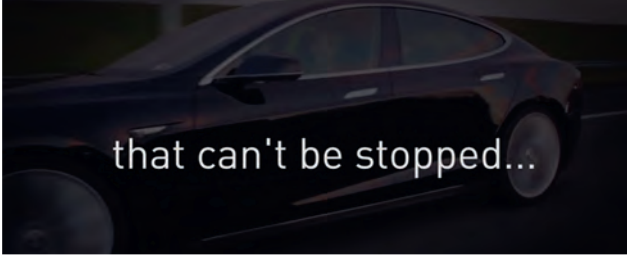

Michiel Langezaal
Fastned's plan is to bring that freedom,
that technological freedom to the consumer...

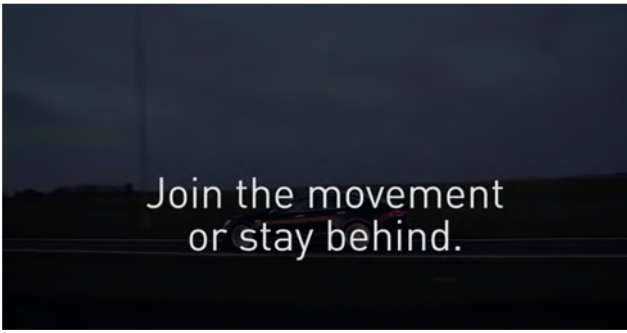
Opening event on November 29th 2013 in the former Stork factory in Amsterdam North / We hang the disco ball in each newly completed station.



The 74 second video clip for the Fastned IPO.

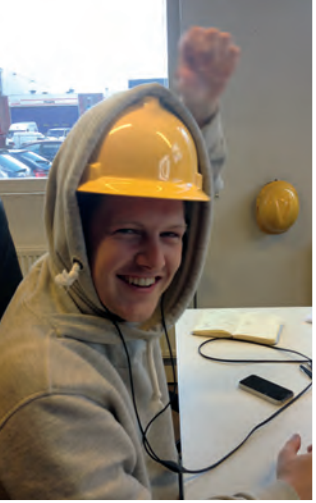


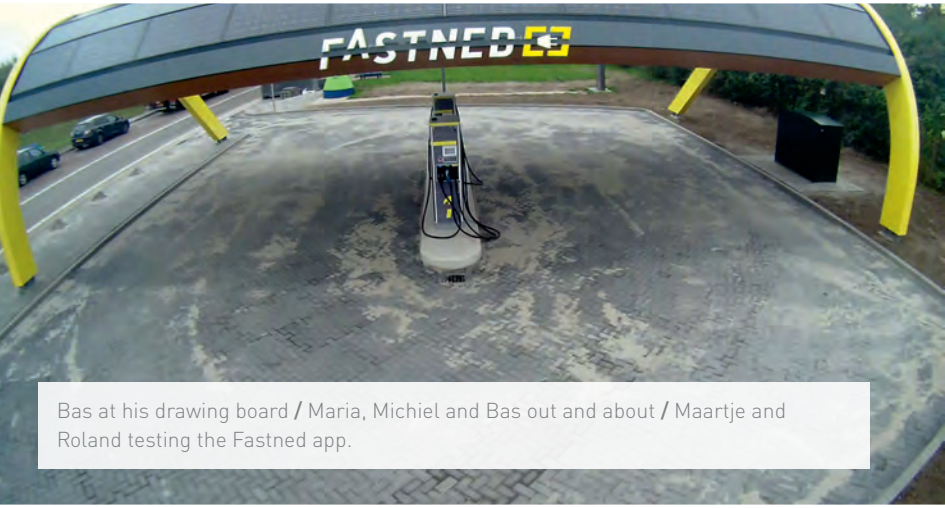

that can't be stopped...


Join the movement
or stay behind.

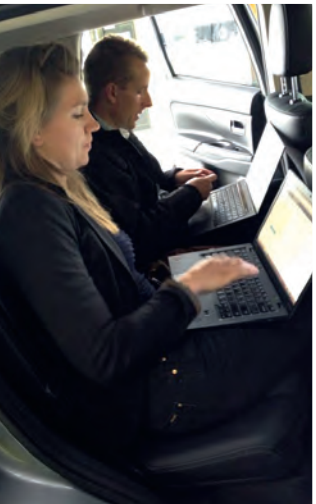

Invest in the future.


FASTNED
BMW Amsterdam
B-SRH-96





Bas at his drawing board / Maria, Michiel and Bas out and about / Maartje and Roland testing the Fastned app.



Fastned to build stations in Germany. It has a huge automotive industry, which is working hard to produce EVs. However, it still lacks a charging infrastructure. And, oh yes – Dutch people have to drive through Germany to get to the Alps for winter sports. So that would be pleasant for many motorists, and come in handy if the Fastned team wants to go skiing.

Belgium is nearby, the majority of Belgians speak Dutch, and the country has quite a few EVs. Even so Michiel wonders, bearing in mind the difficulties of co-operation in this divided country, whether it is a wise choice. Also, Belgians are not exactly perfectionists when it comes to road construction. There are far fewer high quality service areas in Belgium. Nevertheless, it doesn't seem logical to us for our network to stop at the border, when two countries are as deeply integrated as the Netherlands and Belgium.

I mention Switzerland. Jörg Beckmann, the CEO of Swiss eMobility, dropped in to see me last November. An incredibly pleasant man. He also understands our thinking about sites. Swiss eMobility is leading a collaboration of various parties, including ABB, to create the 'EVite-fast-charging network' in Switzerland. Fastned would fit perfectly in this consortium, according to Jörg. In addition, Switzerland is attractive because the Swiss love beautiful cars and have plenty of renewable power from their hydroelectric plants.

We soon take Denmark off the list, as the local utilities have already set up Clever, which has built dozens of fast-charging sites. One by one, we cross countries off. It's painful, but essential if we want to make informed decisions – we can't do everything.

I ask Michiel what he thinks of France. The complement to winter sports is the summer holidays. In my childhood we drove down the *Autoroute du Soleil* every summer. Doing this route with an EV is a wonderful prospect. Michiel gets the logic, but for now France is the odd man out when it comes to EVs. Renault is still working on AC fast-charging, for which it hasn't managed to find any allies. So, *malheureusement*, France will be crossed off for now.

That leaves: Germany, Switzerland and Belgium. For the time being, we are going to focus on these countries – as well as the Dutch roll-out, of course.

Michiel asked Bas at the beginning of November 2013 if he had anyone in mind for working on the German expansion. He comes up with Lisa Haenitsch, one of his former classmates in Delft, who was born and raised in Germany, but has been living in the Netherlands for years. She is fluent in German, English and Dutch. Also being an architect, she will really be able to help with the site plans. Michiel is immediately enthusiastic, and meets Lisa a few days later at the Starbucks next to Amsterdam Central Station. Lisa joins the team shortly afterwards. At first she learns to be a Fastned site architect, under Bas's supervision. She also starts plotting the 450 highway sites in Germany.

Lisa proves to be fantastically well organized, as well as a really sunny personality. Like Maria, Lisa deals well with the building team's macho culture, and they often have a laugh. Try and find work boots in size five, or a fluorescent orange work jacket in XXS. Our contractor's men apparently often have a chuckle when Maria unfolds the building plans. With

these huge men towering around her, she discusses problems and how to improve things. Armed with a Spanish architecture degree from the Universitat Politécnica de València, her technical expertise commands respect. After these meetings everybody gets back to work with renewed motivation, and goes the extra mile.

GRAND SLAM

On April 7th 2014, Michiel, Lisa and I drive to the *Hannover Messe*, the world's biggest industrial fair. Lisa comes from Lübeck, in Germany, so it's familiar terrain for her. We have plenty of time during the four-hour drive to Hanover to see the service areas Lisa has so accurately mapped out in recent months. The sites are not only bigger, but also further apart than their Dutch counterparts. The norm in the Netherlands is 30 to 40 kilometers between service areas; 60 kilometers is not unusual in Germany. There is quite a difference: the Netherlands has 250 service areas; whereas Germany, which is nearly ten times as large, has just 450 service areas along the highway. From perspective this is an advantage: there are a good number of highway service areas, but not too many, keeping things manageable for us. These service areas are called *Raststätte* in German. There are also *Rasthof*, which are usually larger and located further away from the highway; you have to take a highway exit to get to them.

The *Hannover Messe* is gigantic. There are halls solely dedicated to driving EVs. We see a presentation by SLAM – the German acronym for 'fast-charging network for corridors and metropolitan areas'. The German Federal Minister for

Economic Affairs, Brigitte Zypries, is standing on the stage with the German automotive industry men. They are all holding a thick electric cable with a plug to dramatize their story: this is what the future of the automotive industry looks like. E. L. E. C. T. R. I. C. When the men see us in the audience, they have to laugh at their own presentation. We had seen each other just a few months back, at our presentation during our opening ceremony in Amsterdam. During the dinner we had talked informally with them about developing a Fastned network in Germany.

After the minister leaves, the German car men come and find us. We pull up a few chairs, and discuss how a complete EV charging network could be built in Germany within a few years. SLAM appears to think in terms of 'corridors and metropolitan areas'; in other words, chargers along the main arteries and in big cities. That is not enough, in our view. Our motto is: one station every 60 kilometers throughout the whole of Germany. "If you take care of the concessions, we'll build the stations – a one hundred million euro investment", I challenge them. "Yes, *bitte*", is their somewhat surprising answer.

It's a first step. Germany is a few years behind the Netherlands, but when Germany gets going, it will fly. We need to get hold of concessions, and for that reason, we start looking for the right civil servant – the German Frank ten Wolde, so to speak. He was the civil servant from *The Fastned Story* part I, who was responsible for the breakthrough in the Netherlands in 2011: a tender procedure and a draw for fast-charging stations along the Dutch highways. It turns out that Bonn is the place to be.

On top of this, we are convinced that we need a German Fastned employee on location, so we decide to hire Heiner Sprunk. Heiner, who grew up in the former East Germany (GDR), is my age and has already proven to be a go-getter. He used to sell parts of ships built in shipyards in the former GDR. Many of these vessels are still in service in countries like Azerbaijan and Ukraine. He, too, has examined the sites on the German Autobahn. Heiner and Michiel pay a visit to the Federal Ministry of Transport and Digital Infrastructure on October 16th 2014.

The meeting is a rerun of the meeting with the Dutch Ministry of Infrastructure and the Environment, three years earlier. There are similar obstacles, the same discussion about charging points versus stations, and they also have doubts about the arrangements with filling station licensees. Do they have an equivalent of the Petrol Law here too? When Michiel says Fastned would like to build stations at all 450 highway sites, the German civil servants' jaws drop. They were thinking more along the lines of several dozen chargers, just enough to drive from Bonn to Berlin.

Then they discuss Germany's ambition to have one million EVs on the road in Germany in 2020. "Yes, that is our ambition, and it will be achieved", nod the officials. After which they emphasize that Germans are cautious before announcing something – and, therefore, when targets are set they are also feasible. And how much charging infrastructure does this require in your estimation? Heiner and Michiel calculate with the civil servants what it entails. It slowly dawns on them that the German automotive industry is about to

go through a revolution. If there are going to be a million EVs in Germany, this will require at the very least hundreds of charging stations with multiple fast chargers per station. Playtime is over; off we go.

SWITZERLAND

In addition to her work on the Dutch and German plans, Lisa is making progress with the plan for Switzerland. She learns on the hoof how the concessions were obtained in the Netherlands and makes agreements with Swiss eMobility in Switzerland. She also gets in contact with Krispin Romang, the project manager at EVite, the as yet unbuilt fast-charging network in Switzerland.

Michiel, Lisa and Joost visit Swiss eMobility's office in Bern on March 5th 2014. They explain in great detail the significance of the fifteen-year concessions for the Dutch market. Concessions provide the security necessary for investment. They see good opportunities for a similar start in Switzerland. It also helps that, alongside Jörg Beckmann and Krispin Romang, Remo Lütolf – the CEO of ABB Switzerland – is present at the meeting. Remo happened to be the person at ABB who made the decision to take over Epyon. Thanks to this he knows a lot about fast-charging and puts in a good word for Fastned: "They might be cowboys, but they know very well what they are doing and achieve results. This really is a newcomers' market." He also remembers Epyon's explosive growth and how the company managed to achieve a lot with a small, strong team – something giants like ABB can only dream of.

This is followed by a long discussion about which sites are appropriate for building stations – a story we are familiar with. Krispin comes well prepared; he shows us aerial photos of highway sites where there clearly seems to be insufficient space. Remo and Michiel intervene. "This is all very interesting, but it's a problem for later. The political decision first has to be taken to allow concessions to be issued. Then we can deal with the permits and build the stations. Start with the first step: the concessions." That's clear enough.

Krispin and Jörg are first going to concentrate on lobbying for concessions to be issued. Krispin, Michiel and Lisa work closely together in the weeks after the Bern meeting, to produce a memo to convince Swiss politicians. Fastned and Swiss eMobility present the plan to issue concessions for charging stations at the Swiss eMobility congress in Luzern in late June 2014. Politicians and captains of industry are also present. Michiel gives a speech and I give the MPs who are present a copy of *The Fastned Story* part I. A few days later the *Automobil Revue*'s headline is "Charging EVs thanks to Dutch help?" Swiss decision makers' eyes are opened too.

MAY 2, 2014

Tesla moment in the Atlas Mountains

EVs are gradually becoming a common sight in the streets. Tesla in particular is a status symbol. If you drive a Tesla, you are both environmentally conscious and successful in life. My daughter Rosa cycles every morning from our house in Amsterdam North to her school in Amsterdam's well-heeled Old South district. She witnesses the start of the hype: within a few months there is at least one Tesla on every street in Old South. Charging cables hang like cobwebs on the sidewalk.

At a barbecue, a friend tells me about the "Tesla moment". He has noticed that whenever you happen to be talking with a group, the subject invariably turns to Tesla. Football, women and cars have of course always been the mainstay of these conversations, but when Tesla is mentioned the discussion takes an interesting turn. Supporters are utterly convinced and try to persuade petrolheads, who until recently were by definition fuel car drivers. These attempts are not very successful, unless there's someone there who actually owns a Tesla. Then it isn't long before everyone walks down to the parking lot. First they admire the car – there's a boot under the bonnet instead of an engine, and the dashboard has been replaced by an iPad-like touchscreen. Next it's time for a test drive. The car silently zooms off. Once on the road, the owner dares the driver to put his foot down. The car effortlessly accelerates to 100 km/h in 5.6 seconds. The driver

can feel the adrenaline pumping through his body and *voilà*, he gets a Tesla grin on his face. When they get back to the parking lot it's his turn to convince everyone. He's driven the car of the future. That's a foregone conclusion.

NORM AND JANET

In the spring of 2014 we go on holiday with the children to Morocco. We spend a few days in Marrakech and a few days hiking in the Atlas Mountains. The mountains are magnificent; we pass through villages which have only had electricity for a few years – and now have wifi. We sleep in guesthouses.

One evening we meet an American couple in their seventies, Norm and Janet Pease from San Francisco. Norm has just climbed Toubkal Mountain. After a while we get onto the subject of renewable energy. "No, it can't be", I think, but yes, it's true. Norm drives a Tesla Roadster and Janet a Tesla Model S. Fantastic cars, Norm says, and he should know: he has been driving EVs since 1970. It all started because his farm was not connected to the grid and so he needed a windmill and batteries. He has bought every single EV model that has come onto the market in the last few decades. They are all still in his barn: an electric Honda, Toyota, Nissan Leaf, Tesla Roadster, and the latest Tesla Model S, with the number plate TESLA 007. Though he was forced to return his EV1 when GM decided to stop producing EVs and repossessed all the EV1s on the road in order to send them to the car crushers. Norm Pease is still upset about it. But Norm and Janet have no doubt that in the future everyone will drive EVs. When I

get back to the Netherlands, I send Norm the English version of *The Fastned Story* part I.

Less than six months later, and I'm in for a big surprise at Schiphol Airport. In October 2014 a whole fleet of Tesla taxis – 167 in all – start serving the national airport. What better calling card could the Netherlands want, as a frontrunner in driving EVs.

MAY 12, 2014

Connected! Using the Fastned app

After five months of development and testing, we launch the Fastned app on May 12th 2014. The app enables customers to use Fastned's chargers. New customers can create an account on the spot. You download the app, register, fill in your bank or credit card details, and two minutes later you can start charging. So there's no waiting for an RFID card to arrive in the post.

Charging and payment at Fastned are done with the app, and not with a EV charging card. Everyone, including foreigners, can charge at Fastned stations – and without delay. An added benefit for our customers is that charging at Fastned is free for the first three months, while we test everything.

Like every other time we have to deal with an issue, it is important to keep it simple. Our core business is charging cars. Payment must be simple – for the customer and for us. That's why we have opted for the best technology with the least hassle available at the time: paying with your phone using the Fastned app. We are not going to issue our own RFID cards; which you have to physically produce, and send to customers and easy to lose. Above all else, the app offers the possibility of adding other options, like viewing your charging history, finding stations and posing questions or sending feedback to Fastned. It is also handy for the user to be able to see directly on the app where new stations have opened: giving them even more opportunities to charge! In short, this app is a direct link with our customers. We're connected.

Most customers respond positively. Our decision to launch an app instead of an RFID card causes, as expected, mild resistance. New methods often encounter resistance. Once customers have charged for the first time, however, we don't hear any more about it. In order to be able to serve company car drivers – most EVs are driven for business purposes and use payment cards – we decide to collaborate with the biggest fuel card suppliers. This proves to be relatively simple: instead of using their bank details, people can simply fill in their fuel card number. The bills go to the boss, just as the fuel bill used to. Not everything changes.

FIRST SALE!

When we launch the app we also publish the price for charging at Fastned. Determining a fair price is quite complicated. Domestic charging is relatively cheap at 23 cents per kWh, but requires an investment of 1,200 euros for a wall box – and it's slow. Using public charging points is also slow, but according to our calculations the actual cost is well above one euro per kWh.

We start with two types of subscriptions. You either pay 69 cents per kWh excluding VAT, or you take out a subscription for unlimited charging for one hundred euros a month excluding VAT. Nice and simple. We can always introduce various monthly plans and the like at a later date. In the beginning there is discussion in some quarters about our price being higher than domestic charging. When you do the sums, however, it is not bad at all. If you want to be able to charge on the go, then this requires serious, costly infrastructure –

as is the case with mobile telephony – so you pay for your freedom.

When customers have to start paying to charge, on August 12th 2014, we barely see any change in charging behavior. Everyone who wants to charge has already downloaded the app, and authorized Fastned to charge their bank account or credit card. It's simply a matter of ticking the check box in the payment module. The first payment comes in just before lunch – a BMW i3 charges 13.8 kWh at quarter to twelve. Our very first sale: 11.60 euros. It feels like a tap that's slowly being opened. First it drips, and then it starts to flow.

Soon people are twittering less and less about price and more about the stations. Most of the tweets are about when and where we are opening new stations. Something special is tweeted about each new opening: "The first station in our province", "The first station on the A44", "Great to have a station on my daily route", "Thank you Fastned!", "Thanks to you my car's value has gone up!" This is often accompanied by selfies at the various stations. It's clear that EV drivers yearn for freedom!

Every time a mayor opens a Fastned station, his municipality is connected to the EV network. It's comparable to the connection of one municipality after the other to the Dutch railway network, more than one and a half centuries ago.

We gradually see the development of behavioral patterns. Many customers charge at the end of the afternoon, before they go home. People seem to want a full battery when they are at home, so they can leave at any time. The first monthly subscriptions for one hundred euros are also sold. We had

expected this unlimited charging subscription only take off when we had a comprehensive network. But in practice, commuters who charge at the same station every day also prove to like this option.

JULY 1, 2014

Fred Matser offers a helping hand

In the spring of 2013 I meet up with Duncan and Thijs Dirkzwager for a coffee in Amsterdam. Duncan and I lived in the same fraternity house in Utrecht, as did his younger brother Thijs a few years later. They are both exited when I tell them about Fastned. When Thijs drops by at Fastned a few months later, it becomes clear just how enthusiastic they are. He wants to invest in the company and thinks he can also get his father-in-law, Fred Matser, interested. I'm surprised. I know Fred Matser – a successful real estate developer, with a particular passion for sustainable developments.

Thijs, his wife Nina and his father-in-law Fred, pay us a visit on December 19th 2013. We do a presentation, and are able to show pictures of a few completed stations by then. Firing one tough question after the other, Fred's reaction reveals he is an idealist with a critical spirit. This teaches us to be clear about Fastned's value. We discuss valuing Fastned at 160 million euros. "Is that pre-money or post-money?", Fred asks. We're taken aback for a moment, and go through our reasoning with Fred once more. We want to sell a quarter of the shares for 40 million euros; that puts Fastned's total value at 160 million euros. But only after the investment – so it's a post-money valuation.

Fred is keen, but really only wants to participate if his American partners Generation IM (GIM) do likewise. GIM is a major American investment fund, in which former Vice

President Al Gore is involved. It invests mainly in sustainable companies that are publicly traded. GIM informs us on March 22nd 2014 that Fastned is a bit too small for them.

FLOWFUND

In the meantime Fred has roped in his financial man, Evert Greup. The former banker and member of War Child's board has a good idea. War Child founder Willemijn Verloop, and former McKinseyite Machteld Groothuis have just set up Social Enterprise NL. Evert proposes getting Machteld, together with with Jelle van der Steeg and Steven Boekhoudt, to do a due diligence investigation and thoroughly vet Fastned's business.

In order to do the job, the team spends a couple of days at the Fastned office over a number of weeks. Having been in the EV industry for several years now, and with a solid plan, we're very confident about the outcome. We spent months working on the financial model and know exactly what the investment costs are. At this point we already have nine stations. Industry benchmarks have been done for all operating costs. We have estimates of the number of charging sessions per month, the size of the battery, the consumption per charging session, the electricity price, etcetera, etcetera. They grill us several times about the assumptions in the plan. In our opinion, the team will only encounter one really important uncertain factor, which has been taken into account in our model: are EVs going to take off, and in what numbers?

While we can answer all of the due diligence team's questions, we sense some misgivings. Whenever members of the

team are with us, they seem convinced and enthusiastic, but when they talk to other people in the EV (often slow) charging industry, their hesitations return. This makes sense, as no one has experience in this completely new market. Huge numbers of mass-produced EVs have yet to materialize.

Nonetheless Fred decides to make a contribution towards the development of the stations and we hammer out a compromise. He extends us a 2.5 million euro convertible loan from his Flowfund Foundation. Great! The call for new stations is getting louder. We can build twelve stations with the Flowfund money, and if it is a success Flowfund can convert the loan into certificates. The building team carries on working, and the planned roll-out continues.

To celebrate our collaboration, Fred, Evert and the Fastned team have a drink at the office on July 1st 2014. The building team has already finalized its orders for the next ten stations by now. The engine will rev up again in September 2014: the aim is one station a week.

JULY 9, 2014

We go public

Niels comes in all excited. “Have you EVER seen a response from the AFM in which they make such detailed commentary on the underlying business case? They’re acting like they’re EV experts, which they certainly aren’t.” It’s May 2014, and he is working on the approval of the prospectus by the Netherlands Authority for the Financial Markets (AFM). Emotions run high when he receives another long list of questions.

We need a trading platform to make Fastned certificates tradable. There is only really one suitable platform: NPEX, the Dutch stock exchange for small and medium enterprises (SMEs).

Since Niels set up the whole shareholder structure, he is also responsible for writing the prospectus. An AFM approved prospectus is mandatory if we want to enable large groups of people to invest in Fastned. We emulate the Triodos Bank model once more. We download their prospectus, and use Word’s ‘Find and Replace’ function to get a first impression of what Fastned’s prospectus could look like. It is a thick document which, in addition to providing general information, primarily aims to explain to investors the risks of investing in Fastned.

The AFM would like to see all risks mentioned. For instance, the risk that EVs don’t take off or the risk of an economic crisis. We briefly discuss the point of mentioning all these obvious points in the prospectus, but soon realize there’s no way back. If we want a stock market listing, then we will have to produce a prospectus, which will have to be thorough. Niels valiantly

gets down to work and produces dozens of pages describing all the risks: the risk that EVs don't take off, technological risks, behavioral risks, infrastructural risks, roll-out risks, systemic risks, fiscal risks, legal risks. These are of course divided into sub-risks, etc. It is clearly a case of 'more is less'.

Niels finishes the first draft of the prospectus on March 20th 2014. After a final legal check by Esther Vis and Roman Roos, from the relatively small law firm CLCS, specialized in AFM license applications, the prospectus is sent to the AFM. The financial regulator gives several rounds of commentary – a stressful process for everyone involved, not only for us. No businesses have gone public in the Netherlands in recent years because of the economic crisis. And everything about Fastned is different for the AFM. EVs are new; the market has yet to develop. Furthermore, the regulator is used to working with established banks and large law firms. On top of that, the Netherlands is not Silicon Valley. American exchanges may covet new companies like Google, Netscape and Tesla which create new markets, but the Netherlands is another kettle of fish. Most of the shares on the Dutch stock exchange are of established companies in proven markets.

This is further complicated by the fact that the AFM will not allow us to publish our revenue model in the prospectus. This is, after all, based on future projections of the number of EVs and might entice consumers to enter this unknown market. It's unfortunate because the question investors most often ask is: "How does your revenue model work?" Our solution to this problem is to put a revenue calculator on our website a few months later. By filling in the number of cars,

charging sessions, kWh per charging session and the charging price per kWh, people can make their own estimate of the revenue potential. We don't use it to make any inferences in the prospectus, but it enables the investor to get a sense of the impact the different variables have on Fastned's potential turnover. The tool proves to be popular with investors.

The Minister of Economic Affairs, Henk Kamp, gives a presentation during a NPEX event on May 8th 2014. It is the day Fastned's IPO is announced. We are photographed with the minister. This first announcement results in a flurry of publicity. After years of crisis, the Netherlands is apparently in the mood for good news. It also results in a lot of reservations for certificates. There are even people who deposit money on their NPEX investment account, ready and waiting for Fastned to go public.

ABOUT EMOTION

We start the IPO campaign beforehand. Having limited resources, we have to use creative ideas. Lot Lewin, who also made the film for the opening, is going to do make the film for the flotation. There are several possible scenarios. Which approach are we going to choose? Is it about new technology? Pioneers? The next generation? Opting for clean energy? There's one thing we all soon agree on: it must appeal to the viewer's emotions. To hope, and the desire to join in. We watch some good examples of this: *The Crazy Ones*, a 1997 Apple commercial, and the trailer of *The Social Network*, a film about Facebook.

In the end Lot makes a great 74 second clip, with images

of EVs, our stations, tweets from users, but above all of the Fastned team. The message is clear:

Things have been set in motion... that can't be stopped... Driving on green power throughout the Netherlands... It's up to you now... Join the movement or stay behind... Invest in the future... Will you join us? ... Become a co-owner of Fastned... Subscribe now.

Kyra Hartlief is taken on to help us with publicity. She has worked for magazines like *FHM* and a big Dutch music magazine. One of the things she did at *FHM* was to organize the girl next door election. Kyra is going to get articles and interviews published in newspapers. This all nicely comes together on May 8th 2014. From that day, people can take an option on certificates via the website. At seven o'clock in the morning I am interviewed on national business radio by the Dutch hockey legend Tom van 't Hek. That same day articles are published in the country's biggest newspaper, *De Telegraaf*, and the main business paper, the *Financieele Dagblad*.

When I get into the car with Michiel to go to The Hague, at nine o'clock, the first 34,294 certificates have been reserved. At NPEX, Minister Henk Kamp doesn't hide his enthusiasm:

"Fastned builds and runs fast-charging stations for EVs; it's very promising for you can see the time coming that we will all drive EVs in the Netherlands, and they have to be able to charge quickly, so that company is engaged in a very sensible and useful activity."

Two weeks later 400,000 certificates have been reserved. Since this is non-binding, it of course says more about the enthusiasm for Fastned than about firm commitments. Even so, everyone at the office is in a jubilant mood.

BIG SMILE

The last few weeks of the AFM approval process are exciting. Acceding to the AFM's preference for working with big names, we ask Joost Elsenburg from Allen & Overy to help us in the final phase. This boosts the AFM's confidence in us, and on Monday July 7th 2014, we get the green light. It takes some getting used to, but it really is true. Fastned is going public! The financial regulator has approved the prospectus, in fifteen weeks. A considerable achievement. We thank the AFM people. The result is a solid prospectus, which is also acceptable to them. There's nothing else in our way: the next stop is the NPEX stock exchange!

Two days later, on July 9th 2014, the stock is listed. Niels beams from ear to ear the whole day long. It has been a hard slog, but he's done it – an IPO without having to leave it up to banks or expensive consultants. Just doing it ourselves and working very, very hard.

Ten euros per certificate

The decision to go public means we have to put a number on Fastned's value. For you can't sell something without a price. Yet how do you determine that price? There aren't any comparable companies, and the market has yet to develop.

To get some kind of sense of a value, I make a financial model at the beginning of 2011. This model starts with the expected number of EVs. While it is speculative, there is a lot of consensus about this. The government, the automotive industry, and almost everyone assumes there will be around 200,000 EVs in the Netherlands in 2020 and one million in 2025. Based on the current total of eight million passenger cars, that is a market share of 2.5 percent in 2020, rising to 12.5 percent in 2025. Not very impressive.

Then I assume that these EVs charge (slowly) at home and the office, as well as for an average of ten euros along the highway once a week. This means a turnover of one hundred million euros in 2020 for charging along the highway.

When I show Michiel my model in 2011, it turns out that he and Epyon founder, Crijn Bouman, have made their own financial model too. Not only the design, but also the conclusions are the same: if you are able to secure stations along the highway for a long period, you can earn good money if EVs take off. That same year we bid for all of the Ministry of Infrastructure and the Environment's highway sites. When we are allocated 90 percent of the sites for a period of fifteen years, we realize we have a license to print money.

MORE CALCULATIONS

The original financial model forms the basis of the value model we make two years later. It is a discounted cash flow model, based on the number of EVs, charging sessions and the resulting revenue. Then the electricity costs and operating expenses are deducted. This results in cash flow which we discount to current values. We limit the model we are using for calculations to the 201 Dutch sites for now. We provisionally treat the foreign operations as a bonus for those who get involved now.

It soon becomes clear that the valuation is astronomical. Fastned is tapping a huge market. Which is hardly surprising, if you consider the fact that twenty billion euros is currently spent on fuel for cars in the Netherlands alone. There's a good reason why highway filling stations are auctioned for an average of six million euros. We have 201 of these sites, admittedly for EVs, but still.

We have already said ten euros a share is a nice sum. So that's 160 million euros for the whole thing. Since we think it reasonable to stick to this, we look more closely at the value model. Which parameters can we change to lower the valuation? We have been very careful about estimating the costs, also using benchmarks. They are realistic, so can't be changed much.

The model is driven by the number of EVs. Currently, 7 percent of new cars sold have a plug. But how realistic is our assessment of the future? What will happen to Fastned's valuation if the growth of EV numbers is better or worse? We decide to develop an optimistic and a pessimistic scenario,

and then to look at the valuation. Well, still very high. What do you do?

CLAIRE

Claire Tange visits our new office on the Amstel in January 2014. Michiel knows her from Delft, where she studied chemical engineering. She has just returned from London, having spent four years in RBS's corporate finance team making financial forecast models, business valuations and capital structure analyses. Michiel has asked her to go through all the calculations in the model. Claire is impressed by the model; it's very robust. Several of the formulae could be constructed more logically, but the results remain the same.

We discuss the effect of the discount factor with Claire. The discount factor indicates the risk. We apply a high discount factor of around 30 percent in our valuation model. Tesla, by comparison, used a discount factor of between 10 and 15 percent for its IPO. The high discount factor has a twofold effect: you discount the value for risk and you make the longer-term forecasts less relevant for the value. So a high discount factor means a much lower entry price now. But it also means that if the uncertainty decreases in the coming years – and therefore the discount factor – the value of Fastned will increase explosively. Thanks to the high discount factor, the valuation model gives a range of ten to fifteen euros a share.

We decide to introduce the shares at the lowest price for the IPO. This values Fastned at 160 million euros – or 800,000 euros per station. Which is not unreasonable. If someone wanted to build a comparable station, he or she would first

have to obtain a concession (which won't happen for the next fifteen years), then go through a two-year permit process (which has not been done before) and then design and build the station themselves. Not to mention the back office and maintenance. And then you still only have one solitary station, which is not part of a network with a recognizable brand. No – 800,000 euros per station is not unreasonable, even when calculated from the costs.

Our assessment is vindicated a few months later when we go public. More than 700 investors buy shares at ten euros each. They can't yet be traded, but apparently they have made the same evaluation as we have. We are investing in the future. The IPO confirms what we already knew: Fastned's head start and unique position along the Dutch highways give it a valuation of 160 million euros on the day of the IPO.

Claire joins our team in May, before the IPO. That day in January inspired her with enough confidence to take the plunge. The former banker is now the financial director of a young and fast growing public company. For Fastned it is an excellent opportunity to recruit another person with expertise which is needed at that time.

JUNE 20, 2014

Teething problems

We knew we would have them, but they are still disappointing: teething problems. EVs are new, the chargers are new, and our app is new. Everything is new. And everything has to communicate with everything else. This regularly goes wrong, and then people start calling. Maartje, Max, Christiaan and later Roland, our Network Operations Center (NOC) manager, take turns manning the telephone. This sometimes goes quite far. There's the time Max is called while she is in a fitting room. She assists an EV driver with her clothes around her ankles. When she leaves the fitting room ten minutes later, with a big smile on her face, the shop assistant stares questioningly at her.

There are calls from one of our stations several times a day. Fortunately they are all pioneers and are very understanding. The solution is often simple, but problems are sometimes hard to resolve.

We see a pattern after a while. Nissans which use CHAdeMO to charge have the least problems. Hardly surprising, considering that Nissan's experience dates back to 2010. BMW is the next best. They are also well tested.

In the beginning manufacturers sometimes forget to install the latest software on their cars – this is both crucial and new for manufacturers. A fuel car simply has to be refueled, whereas an EV 'talks' to the car charger. If one of them doesn't understand the other, or considers it to be unsafe, charging is halted. That's why it is necessary for each new EV to first be approved before it hits the road. Checking the seatbelts and air bags used to be enough; nowadays a test also has to show

whether the car's software is compatible with the charging infrastructure. This is often a problem with Teslas. They are great cars, for sure, but while some of them have the right software, others are still using an outdated, inferior or different version.

BETTER AND BETTER

We encounter the most problems with the Renault ZOE in the beginning. The French are still sticking to fast AC charging. This means they have their own 43 kW charger under the bonnet.

ZOE drivers are thrilled when we enable them to charge at this level of power in June 2014. An AC/43 kW connection is installed in our fast chargers. But unfortunately, it often goes wrong. 60 percent of the complaints received by the Fastned help desk are from ZOE drivers. The most common complaint is that charging constantly malfunctions. When we look into it, the cause of the problem soon becomes clear: the charger under the bonnet heats up quickly, so the ZOE's software has a built-in 'charging break' to ensure adequate cooling. Our charger detects the break and concludes, as prescribed by the charging protocol, that the charging session has ended and stops. Then the motorist has to restart their charging session. Most inconvenient.

Once you find the problem, the solution is often close at hand. In this case, we adjust our chargers' software to be able to handle the breaks. The charging session carries on as usual, while the ZOE occasionally takes a break. It has no effect on kilowatt consumption, but is a great improvement for the

driver's peace of mind. The problem with software updates and charging protocols comes up during a dinner with men from ABB. Hans Streng advocates the introduction of some kind of certification. Until now ABB has had to 'hunt' for new versions of EV models, in order to test them on their chargers. It would be more logical for a car to be given certification before it hits the road.

Fastned gets a real NOC manager, to get to a maximum charging uptime and to stay there. Roland van der Put gets the job done. He identifies the problems and spends a lot of time consulting NOW!, ABB and the car manufacturers. A large screen is installed in the office, where we can keep tabs on all of the chargers and their status. We immediately take action when a charger malfunctions. After a few months Roland can take credit for an uptime of 99.8 percent. "There's still room for improvement", he wryly notes.

MORE THAN CHARGING

As well as charging, we obviously have to deal with payments made with the app. This, too, is new. We set the bar high for ourselves: our starting point is that it should be as easy and clear as possible for the consumer. We are not going to use credit balances or other complications – you pay when you charge. Business drivers are given the option of monthly invoicing – we expect this will be the future norm. So why not arrange it now, and get it right in one go? It takes several sessions with the people from NOW! and Adyen, the company that will process all our payments, but we eventually get it done.

Then something else crops up. Our stations are high enough for passenger cars and vans. After much discussion in the team, we decide not to take electric trucks into account – there are hardly any of them yet. By the time they are being mass produced we will already be building new stations. Something we hadn't expected – but should have according to Murphy's law – happens in the first few months. Inattentive truck drivers looking for a parking spot drive into the roof and lighting. Luckily everything is recorded on CCTV and the damage is compensated. To prevent recurrence, we install a gateway at the entrance to each station which indicates the maximum height of 2.50 meters. The gateway is erected; another obstacle has been overcome.

EPILOGUE

A new station every week

Building resumes in earnest after the industry's summer break. From September we complete one station every week. We buy a disco ball which we hang in each newly completed station every Friday afternoon. A bit of fun for the building team and for ourselves. Our meticulous preparations pay off now: there are building teams simultaneously at work on two to three sites all the time. We aim for a construction period of two weeks per station, which we come very close to meeting. Everyone knows what to do. Almost every operation is routine. Each station is completed on time. And the predicted learning curve kicks in. After a few stations, the building team even finishes a day earlier, and the cost per station drops. Our aim to spend 200,000 euros per station becomes a reality.

Joost starts expanding his team. As well as the construction, we now also need to pay attention to maintenance. Christiaan has an idea. There's a young building inspector at one of the municipalities who is enthusiastic about Fastned. Peter Verwoert changes jobs in May 2014, becoming the person responsible for maintenance. After almost five years as a building inspector, he is now on the other side of the table.

Once stations are completed we can open them. Each station is in a different municipality. Local officials and aldermen have approved each building permit. What could be better than getting the local alderman or mayor to do the official opening?

We arrange the champagne and ribbon. There are usu-

ally two Fastned employees at the station, along with local politicians and press. The rest of the Fastned team follows the ceremony via CCTV images on large screens at our office. Since this is usually done on Friday afternoon, we often have a drink too.

After the local alderman has cut the ribbon, come the good wishes. For Fastned, this is done in our Fastned Whatsapp group. Christiaan texts back. "Thanks! Now it's time to return the scissors I borrowed from the Shell station."

In the midst of the flurry of weekly openings, we receive a thick envelope from Brussels in late October 2014. It should be the result of the TEN-T funding. Beaming, Michiel opens the package. And? Yes! The signed TEN-T grant. Everyone congratulates Michiel, and of course Sandra, who did huge amounts of work. I scroll through the document and ask Michiel if there's anything he notices. "No, why?", Michiel asks a little suspiciously. "The whole document is in Dutch! Someone in Brussels has translated the document. And if that has been done for us, then it has also been done in Swedish, Danish and German. Incredible." It's bizarre, but doesn't dampen the celebratory mood. Our building program just keeps on rolling.

OUR FUEL

We celebrate having nineteen operational stations at our annual Christmas dinner on December 17th 2014. The stations are now spread more or less nation-wide. You can now drive around the whole country. What Üllar Jaaksoo of NOW! made clear more than one and a half years earlier during our

visit to Estonia is now a reality: national coverage is Fastned's key strength.

What is also evident is that the Fastned train is unstoppable. The 2015 roll-out has already been planned. From January we have once again completed one station a week. This means that we will be able to open the fifty-seventh Fastned station in the Netherlands in the last quarter of 2015. This is a milestone, as we will then have the most stations along the highway. Tipping the current number one, Shell, which has 56 stations – admittedly filling stations – but still. It's useful to have milestones. The goal is to succeed. Because, happiness is when things succeed; and as explained earlier, that is Fastned's fuel.

-- To be continued --

GLOSSARY

AC charging: shorthand for alternate current (AC) charging. It requires an on-board charger, meaning you always have your own charger with you. The electricity network uses AC, so you can easily charge your car at home or at the office with a (primed) socket. The downside is that the charging speed is determined by the socket, and every car needs its own – heavy and expensive – charger.

Additional tax liability: when a leased company car is also used for private ends, the tax man regards this as income in kind. The additional tax liability is a certain percentage of the company car's list price which the lessee has to add to his income. The government also uses this as an instrument to make the Dutch vehicle fleet cleaner. The higher the company car's CO_2 emissions are, the greater the additional tax liability on your income and the more income tax you pay.

CCS (DC Combo): combined charging system, the plug and associated charging protocol developed by the Combined Charging System Coalition.

CHAdeMO: the plug and associated charging protocol, developed by the Japanese to enable DC fast-charging. CHAdeMO is Japanese for a cup of tea – charging takes twenty minutes; which is about the time you need to drink a cup of tea.

Charger uptime: the percentage of time that a charger is functioning properly.

Chicken and egg problem: the 'what came first' dilemma, the EV or the charging station? The EV was first, but Fastned has concluded that EVs will only succeed in a meaningful way if there are enough charging stations – that is, Fastned stations. Many of the great and good have been mesmerised by this problem for years, whereas Fastned is more of a believer in putting your money where your mouth is: either focus on the chicken, or the egg, but do something.

Combined Charging System Coalition: the alliance between Audi, BMW, Chrysler, Daimler, Ford, General Motors, Porsche and Volkswagen – to develop fast-charging for their cars. The protocol enables both AC slow charging and DC fast-charging with a single plug.

Cone penetration test meter: a device used to measure (pressure) strength of soils.

Crisis and Recovery Law: written at the beginning of the economic crisis, in order to accelerate a number of infrastructural projects by significantly reducing the administrative review process.

DC charging: shorthand for direct current (DC) charging. It doesn't require an on-board charger, as almost all the electronics are in the charging station equipment. Power is delivered directly to the car's battery, which has the advantages of enabling the investment in the charger to be shared between dozens of cars.

Discounted cash flow model: a valuation method for businesses, in which future cash flows are discounted to give their present values.

e-Stonia: a nickname for Estonia, referring to its technophilia – it has nationwide wifi, and is home to internet companies like Kazaa and Skype.

ELMO: Estonia's fast-charging network, an abbreviation of electromobility in Estonia.

EV: electric vehicle.

FAST: abbreviation of the Dutch name for the Fastned Administration Foundation, the foundation that owns all of Fastned's shares.

Fastned app: Fastned's application for charging and online payment. Charging and payment at Fastned are done using the app, and not with a debit card.

Fastned share certificates: certificates of shares of Fastned. This is how investors can become co-owners of Fastned. Go to www.fastned.nl/invest for more information. An investment always has to be based on the prospectus.

Petrol Law: passed in 2000, it regulates the sale of fuel on Dutch highways. Before 2000, incumbent filling station licensees had perpetual rights to sell fuel along Dutch highways.

Negotiations between the Dutch State and the oil companies resulted in a deal in which oil companies gave up their perpetual rights, in return for a system of auctions for filling stations that ends in 2024. Bids are made for fifteen-year concessions for each filling station. The proceeds of the first auction went to the incumbent licensees; the proceeds of subsequent auctions go to the state. In addition, no new filling stations can be built until after 2024.

Green certificates: (Guarantees of origin), documents that guarantee that electricity is from windmills, hydroelectric plants, solar panels or biomass plants.

Moore's Law: the observation that the number of transistors in an integrated circuit doubles approximately every two years. This law is often used in a broader context for exponential technological progress. In the case of solar panels and batteries, the current rate is annual growth of twenty percent per year.

Natura 2000: a European network of protected natural areas. Particular species and their habitats are protected in Natura 2000 areas to preserve biodiversity.

NPEX: the Dutch stock exchange for small and medium enterprises (SMEs) with a license from the Authority for the Financial Markets (AFM), and under AFM and Dutch Central Bank supervision.

OEMs: original equipment manufacturers, the car manufacturers.

Plug-in hybrid: a hybrid vehicle which uses a rechargeable battery which can be charged with electricity from the grid.

Post-money: the value of a company after an investment has been made.

Pre-money: the value of a company before a capital injection.

Range: the distance a vehicle can travel on a full battery or fuel tank.

Range anxiety: the fear that a vehicle lacks sufficient range to reach its destination and will be stranded on the way.

Rasthof: a private service area in Germany, at a greater distance from the highway. These sites often include hotels and restaurants.

Raststätte: a service area directly along the highway in Germany.

RFID cards: radio frequency identification cards, a system of charge cards used by electricity utilities to bind customers to it.

Service areas: official jargon for highway filling station sites in the Netherlands. The Dutch State owns all of them.

Smart grid: a smart electricity grid. For example, a system which enables consumers to save power in their EV or elsewhere, and sell it back to the grid at a favorable moment.

Special Purpose Vehicle (SPV): a legal entity created and used specifically for a single transaction. It can also be called an SPC (Special Purpose Company) or SPE (Special Purpose Entity).

Standards war: the battle between producers and producer alliances over different technical standards, with a view to creating a dominant standard. It's comparable to the video standards war, between VHS, Betamax and Video2000, or the smartphone and app war between Android, iOS, Blackberry and Windows Mobile.

Wall box: an EV charger, installed at home or at the office. They are also referred to as (primed) sockets in the text.

WBR permit: the abbreviation of the Public Works Administration Act permit. It's the authorization needed to build and operate a fuel or charging station on land managed by the Ministry of Infrastructure and the Environment.

INDEX

Page numbers written in italics refer to an explanation in the glossary.


FASTNED

"I'm watching the state notary in suspense. He shakes the biscuit tin and briskly produces a lot. 'Knorrestein Service Area: number 1 Fastned.' I glance at my Fastned partner Michiel Langezaal. He can't help grinning. We've got that one too!"

This is one of the exhilarating episodes in *The Fastned Story*, which relates the account of the Dutch start-up, and brainchild of Bart Lubbers and Michiel Langezaal. Fastned is the first company in the world to build a nationwide charging station network for electric cars. This is the solution to the chicken and egg problem that has hampered their take-off.

The Fastned Story reads like an adventure book. You join the pioneers as they deal with setbacks, solve puzzles, and savor their victories. *The Fastned Story* shows the realities of a start-up, and is an eyewitness account of the rise of electric cars.

BART LUBBERS is an entrepreneur, and founded Fastned with Michiel Langezaal. He read history at the University of Utrecht and did an MBA at the Rotterdam School of Management. Bart is also one of the founders of the Dutch edition of the newspaper *Metro*.

www.fastned.nl

ISBN 978-94-6203-796-0

FASTNED