ENVIRONMENTAL TECHNOLOGISTS SET UP A BUSINESS

Plant power

The Wageningen company Plant-e generates electricity from living plants. Environmental technologists David Strik and Marjolein Helder set up the company in 2009. Now Helder heads the growing business; Strik is an assistant professor and works on optimizing waste flows.

TEXT ALEXANDRA BRANDERHORST **PHOTOGRAPHY** HARMEN DE JONG

In the laboratory of the Environmental Technology chair group there is cordgrass growing in a dish full of mud. There are also some transparent pipes sticking out of the mud. They contain the electrodes, says David Strik. The roots of the plants excrete organic substances which bacteria in the soil convert into carbon dioxide, hydrogen ions and electrons. 'The electrodes capture these electrons, generating electricity. No oxygen must get into the system, which is why we work with cordgrass and reed manna grass. They grow in moist, anaerobic soils,' says Strik. Elsewhere in the lab, cordgrass plants grow between flat boards full of electrodes, their green blades sticking out cheerfully.

Since 2006, Strik has been doing research on what is called the plant microbial fuel cell, an idea developed by Bert Hamelers of the Environmental Technology chair group for producing electricity with the aid of bacteria living off plant waste. 'We were looking for a marsh plant to use and it was winter, so it wasn't easy to find something suitable. Then we picked some reed manna grass in the water meadows by the Rhine. We built an installation and it worked.' Bigger projects and sponsorship followed. From 2008, PhD candidate Marjolein Helder and postdoc Strik did research together on increasing the amount of electricity generated. Helder and Strik also set up a spin-off company, Plant-e, to start marketing the technology. During that period, Strik was working four days a week as a researcher at the university, and one day a week for Plant-e.

CONNECTING PLANT TRAYS

Plant-e was launched in 2009 with a rooftop party. 'In August David and I did our first experiment with plants on the roof of the Agrotechnion. We worked on the rooftop installation for a few days. The evening we finished, we carted pizzas and beer up there,' reminisces Helder. 'Everything we did brought us new insights. Even an experiment which didn't work was publishable.' And their cooperation ran smoothly. Helder: 'David is more of a researcher, and I am more of an entrepreneur. We are a fantastic team. We are both extremely headstrong and stubborn but we soon came to appreciate each other's qualities.'

Now, eight years down the line, Helder heads a team of seven as well as a small group of students who are on call to work when needed. 'Things moved very fast. In the first years Plant-e was mainly funded by subsidies, but nowadays it runs largely on its own sales. We broke even for the first time last year,' says Helder. In 2014, Plant-e launched its first product on the market: connecting plant trays which can cover between one and a hundred square metres. 'We mainly sell this modular system in the Netherlands, to municipalities, ministries and companies,' explains Helder. Their other product is a do-it-yourself package for consumers and schools or company departments. 'That is sold all over the world, including in Japan, China, South Africa, Brazil, the US and Australia.' The smallest package for five plants costs 135 euros. Children of 10 and above can put it together: you just have to weave a few wires through a cloth and connect plugs. The plants are not included; you have to go to a garden centre for those.

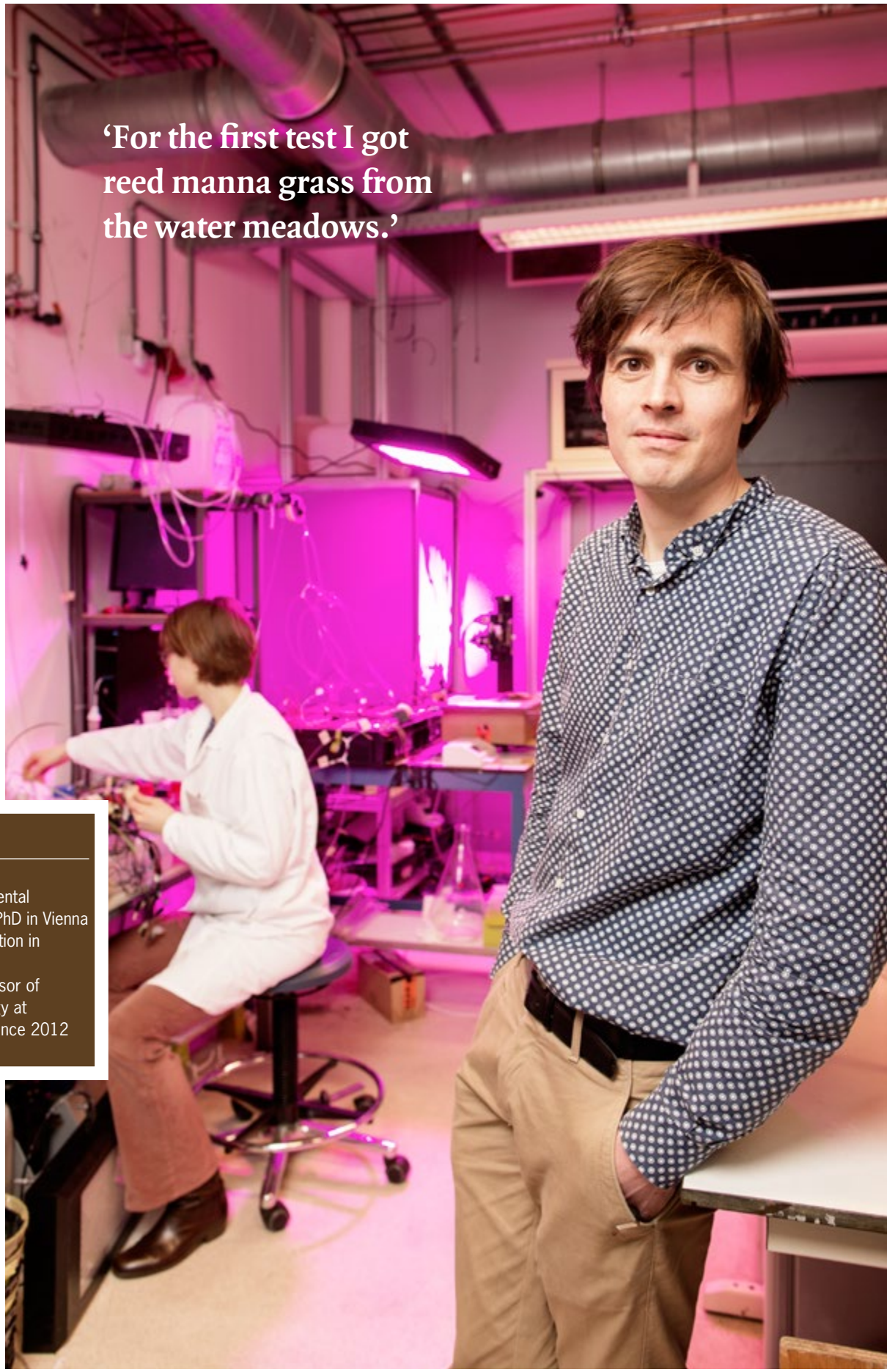
CHARGING SMARTPHONES

The success of the plant power is not its production capacity at this stage. One square metre of plants produces enough electricity for a LED light. If you want to charge a smartphone, you need 100 square metres of plants. 'That doesn't sound like all that much energy, but it is a steady 24-hour supply. That is the crux,' explains Helder. And research is still being done on how to in- >

‘We soon came to appreciate each other’s qualities’

MARJOLEIN HELDER

Age: 33
Studied: BSc and MSc Environmental Sciences, 2001-2008. PhD in Wageningen for a study of electricity production from plants, in 2012
Works: Founder and director of Plant-e since 2009



DAVID STRIK

Age: 41
Studied: MSc Environmental Protection 1997-1999. PhD in Vienna for a study of contamination in biogas, in 2004.
Works: Assistant professor of Environmental Technology at Wageningen University since 2012

WHERE DO ENVIRONMENTAL TECHNOLOGISTS END UP?

Between 1986 and 2016, 2438 people graduated from the Master's in Environmental Protection, later Environmental Sciences. Information is available on where 1055 of the graduates work. One quarter are working for national or local government, and the same number work for technical and consultancy firms. 18 percent are employed by universities and research institutes, and 10 percent in trade and industry. The rest are in other branches. *Source: KLV Wageningen Alumni Network*

crease the yield, witness Strik's tests with flexible pipes. These can be laid down in rice fields, for example. Strik is also working on the development of electrodes made with a fraction of the material they currently require. In 2011, Strik stopped working for Plant-e when he became a father and an assistant professor. In that capacity he continues to do research at the university on plant electricity technology.

Strik's interest in the environment goes back a long time: at primary school in Oisterwijk he set up a nature club which picked up litter in the woods. A career choice test suggested the field of technology and the environment, and Strik did a degree in Environmental Technology at HAS Den Bosch, an applied sciences university. 'During an internship on wastewater purification at the university in Vienna, I did lab experiments and made up my mind to go on to further studies.' Still living at home at that point, Strik moved to Wageningen in 1997. Student life was calling and Strik became an active member of Unitas and took up climbing with Ibex mountaineering club, where he was also on the board. He looks back with pleasure on the many weekends away and the summers in the mountains. 'You get away from it all, and you completely recharge your batteries.'

DISAPPOINTING FIRST YEAR

In that period Marjolein Helder was still at secondary school in Krommenie. After an open day in Wageningen, she knew for sure: that's the university for me. 'The informal teacher-student relations here appealed to me. I went for environmental sciences because I was interested in doing something technical and I was always concerned about things like reducing waste, saving energy and a vegetarian diet.'

But the first year of her degree programme was disappointing. 'It was very general. I wondered what I was doing here. From the second year there was more substance to the programme and I started enjoying myself more.' During her university years Helder was chair of student society SSR-W. 'It's like heading a company with 250 volunteer staff. That forces you to run a tight ship and at the same time you can never please everybody so you learn to cope with criticism.'

Helder went on to take a minor in business studies and entrepreneurship; contents-wise, she focused on energy. During her internship in the Brazilian town of Piracicaba, she studied the production of bio-ethanol from sugar cane. When she returned, she was offered a place to do a PhD and to start a spin-off company as part of it. That was what clinched it for her.

INTO ICT

Strik was less lucky after graduating in 1999. There were no PhD places available so he went into ICT. After one and a half years he could go back to the University of Vienna, where they were looking for a PhD student to develop software. The research was about the purification of biogas. 'There are substances in waste which end up in the biogas. Sulphur and ammonia, for instance. They are bad for the engines. I looked into the effect of waste selection and the conditions in the reactor, such as temperature and acidity, on these substances,' says Strik. On the side, he went climbing every weekend. A PhD trajectory is shorter in Austria than in the Netherlands: Strik finished in two and a half years. He and a friend then travelled around Europe for a year in a minibus, from one climbing location to the next.

When he got back in 2006, he got a job as a postdoc in Wageningen, working on the plant microbial fuel cell. In 2012 he got onto the tenure track, a career path for talented academics. 'My ambition is not necessarily to become a full professor, but to develop myself and realize my research ideas.' Strik is currently studying ways of extracting useful chemicals from biomass waste flows such as green household waste. He has just won an Open Mind grant from Technology Foundation STW, to enable him to do further research. 'Acetic acid, and more valuable food ingredients, can be extracted from the carbon dioxide, hydrogen and electrons which bacteria produce.'

Strik wants to apply new technologies to help close cycles and maximize recycling. 'Plastic mainly gets burned because we don't have good ways of reusing it. But biodegradable plastics, made of sugar beet or maize for instance, can be recycled with bacteria too. If you do that you don't have to grow any more plants to produce new biodegradable plastics,' says Strik.

POWER FROM RICE PADDIES

While working towards her PhD, Helder also took courses on running a business and developed a masterclass on bio-energy and innovation, together with the Wageningen Business School. 'There weren't as many facilities for starters as there are now, but there was a lot of coaching.' In January the European Commission made Helder a member of the High Level Group of Innovators. 'Fifteen people were selected from 450 submissions. We will look at how we can make the European research programme more accessible for start-up technology companies.' Helder will spend a lot of time abroad next year to promote Plant-e. 'With the growing world population, we must use land multifunctionally and effectively. Our systems can be used on a large scale in rice fields, wet nature areas and peaty areas: everywhere where plants grow on wet ground.' Once the system is in place, it can be highly productive, Helder stresses. 'Above all because it can be combined with something else, such as food production. This can become an integral part of a sustainable energy supply.' ■