Engineers are still ‘real men.’ They are easy to recognize as students, thanks to their penchant for wearing plaid shirts with their jeans and the way with which expressions like “flange,” “torque” and “that only runs under Linux” flow from their lips. They design avant-garde skyscrapers for Dubai, work on fuel-efficient engines, and provide clean drinking water in the crisis-ridden regions of the world.

Engineers are seen as down-to-earth, reliable and, on a private level, “technical saviors.” Before putting the drill to the wall, they automatically know that the small anchor is much too weak for the shelf. And if it goes without saying that it is beneath their dignity to call roadside assistance when the car acts up. Women who have one of this species at their side are sure to be the envy of their friends.

However, the “engineer = man” equation is no longer a universally applicable one. Female chemists and physicists have been around for some time, and the walls of what is probably the last of the male academic bastions – the engineering sciences – have long been crumbling. While, in 1981, fewer than 10 percent of engineers or “Dipl.-Ing.s” who graduated from a German university or university of applied sciences were women, 25 years later, almost every fourth degree is conferred on a female engineer.

All of this is completely normal for Ulrike Krewer. The title “Frau Dr.-Ing.,” which is used to address female engineers in German, is not as rare today as it was two decades ago. Today, it is even possible to find women engineers whose careers take a more unusual path than those of their male colleagues – like the career of Ulrike Krewer, for example. The 32-year-old process engineer researches fuel cells at the Max Planck Institute for Dynamics of Complex Technical Systems in Magdeburg. She is researching direct methanol fuel cells at the first – and to date only – institute of the Max Planck Society devoted to the engineering sciences.

It is a cliché, but it is nonetheless okay to ask: “What does a little girl who wants to become an engineer play with?” Ulrike Krewer considers the question briefly, smiles, and says: “A highway with a parking lot! The cars were able to access the road directly from the parking decks. I made that for myself when I was seven years old.” Were there dolls too? “Of course. My little sister and I competed to see who could collect the most Barbies. But the Lego box was equally popular.”

Family Bias Fostered Career Aspirations

Ulrike Krewer grew up in a small village near Trier in southwest Germany (“... more cows than inhabitants”). There, she developed a software program that could be used to optimize industrial chemical processes. The aim of the project was to enable industry to use fewer but more suitable and, above all, more environmentally friendly solvents in synthesis processes. The chemical industry operates completely differently in an emerging country like India than in Germany, explains Krewer: “There are many small industrial companies in which production involves pouring substance A from a bucket into a barrel of substance B, with something or other being produced as a result.” Gloves and masks? Not a chance! “So it helps if a suitable solvent can be used from the outset. One that evaporates on the spot.”

Ulrike Krewer

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That complex phenomena outside life. “They are far more balanced and ans’ philosophy and attitude toward She was very impressed by the Indi-

ABOUT THE GODS

DANCING OUT STORIES

says the Max Planck researcher. "Not very compact for the power requirements, can be connect-
ed to power plants of three shoeboxes – at 60 watts. "Not very compact for the power produced," as Ulrike Krewer notes.

The fact that DMFCs are not yet available on the mass market and are still not used for powering computer notebooks and cell phones is due to such problems as voltage fluctuations. These arise when a surge in the power requirement is applied to the cell. This happens, for example, when a CD is inserted into the laptop: the fan switches on immediately and the device needs more power for a time. Ulrike Krewer studied such processes and found that the voltage does not drop after this, but that a power change causes overshooting of the cell voltage curve. A curve form is produced that is reminiscent of an ECG showing cardiac malfunction. Krewer’s analyses found that the three reactions that take place on the anode during methanol oxidation occur in parallel or in sequence, but at different speeds, and their interaction is the cause of the overshooting. She received a dissertation award from Otto von Guericke University in Magdeburg in 2006 for this groundbreaking work.

The effective efficiency of methanol fuel cells is approximately 60 percent; a normal power plant obtains a maximum of 40 percent from coal. Other advantages include the fact that, because they do not contain any mobile parts, fuel cells work almost completely silently and, depending on the power requirements, can be connect-
ed in series like traditional batteries. The crucial difference between fuel cells and batteries, however, is that the former do not store energy, do not discharge and thus need no recharg-
ing; they generate electricity continuously when required until the at-
tached fuel tank is empty. Such cells are already used in the caravanning sector. They make it possible to watch television by lamp-
light in the middle of nowhere where there are no wall sockets. Previously, the alternative was a loud, petrol-
operated “rat-a-tat-tat” generator. The technology is also already being used in yachts: fuel cells guide them safety and quietly into the harbor when engine use is prohibited by water protection legislation. These electricity generators, including their methanol cartridges, are still the size of three shoeboxes – at 60 watts. "Not very compact for the power produced," as Ulrike Krewer notes.

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Ulrike Krewer needs to fit screws so often that she always carries a screwdriver with her. Even the characters, which are utterly indistinguishable to the uninitiated, were easy to learn. “For every syllable, there is a symbol composed of the individual letters arranged in a clockwise direction.” She immediately grabs a pen and sketches the structure of the letters and syllables. It’s obvious how the almost mathematical logic behind it would have had an immediate appeal for her.

She also learned Taekwondo — although not for self-defense purposes, as she had already earned enough respect. She laughs, “For Heaven’s sake! The woman is tall, speaks out, and when things get serious, she will not respect my personal space,” is what her colleagues thought of her. When she was leaving, the director of the research center said to her, with a smile, that she had always been very aggressive in her approach. A clear compliment: she had earned his respect, too.

Ulrike’s Fusion in Her Own Kitchen

Ulrike Krewer was awarded the Otto Hahn Medal of the Max Planck Society in 2007. She had briefly considered continuing to work in industry in Korea — but ultimately decided against it. “You cannot really get to the bottom of problems there, but just hope that one of the paths taken will lead to your objective before the project changes direction,” she says. So she was happy to accept the offer that went with the medal, to establish a junior research group at the Max Planck Institute. “Fuel cells — now for real!” is the plan she has been putting into action since her return to Magdeburg. In addition to the Asian group dynamic — she deliberately shares an office with her colleagues — she brought back a preference for light cuisine from Korea. This mainly takes the form of “Ulrike’s fusion” in her own kitchen at home, as there is not a single Korean restaurant in all of Magdeburg. What a pity, as she would have had to point and say “Num- ber 32, please,” and would have been able to order in Korean. “Even with or without meat” — an important detail, as she is a vegetarian.

Ulrike relaxes after work by doing karate or reading. At the moment, the main focus of her reading is the German Republic, as she has a soft spot for history. There is only one thing she misses in Magdeburg: “My boyfriend!” He works in a different city. They have had a long-distance relationship for six years, a situation unlikely to change for the next five years, and a fate that Ulrike Krewer shares with scientists all over the world whose career is equally important to them as family, if not more so.

For the time being, she is taking it easy in this regard. Children? “Probably not.” Not for now, at least. Research is her top priority. She would like to teach students herself at some point, a wish that may be fulfilled in a few years; being head of a junior research group is an ideal springboard to a professorship. At this academic altitude in Germany, the air for female engineers is nearly as thin as it is on Nanga Parbat: only 6 percent of the professorships at German universities are held by women.

A Screwdriver as a Personal Accessory

Until then, Ulrike Krewer will continue her systematic study of portable fuel cells. The scope of application for this power pack is enormous. They would be useful anywhere where electricity is needed and there is no grid, or where batteries discharge too quickly. Submarines can already remain quietly at diving stations for weeks with the help of such fuel cells. The University of Magdeburg backs up the emergency power supply for its hospital with a 250-kilowatt fuel cell power plant. The cells also are also stoically resistant to extreme environmental conditions, whether hot desert winds or sub-zero temperatures. The methanol fuel cells at the Neumayer II Arctic research station, for example, provide electricity for scientific experiments when not a single ray of sunshine touches the solar cells and the wind generator has long been shock frozen. All they need is a bit of methanol once a month.

Ulrike Krewer is playing her part in ensuring that this technology will soon work perfectly in smaller formats, too, and that fuel cells become the “power plant for the handbag,” the title she gave to a recent lecture, and an image at which her mentor Kai Sundmacher may well shake his head with an amused smile. Even though her personal accessories now also include an oil-smeared screwdriver, when it comes to her handbag, a brilliant female engineer like Ulrike Krewer still thinks just like any other woman.