Highlights

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Siemens is building the world's largest offshore wind farm on the North Sea off the Danish coast. The rotors are so stable they can withstand hurricanes.

19 African Sunlight for Europe
The goal of the Desertec initiative is to help Europe meet its future energy requirements by supplying solar power from North Africa. The necessary technology exists already today.

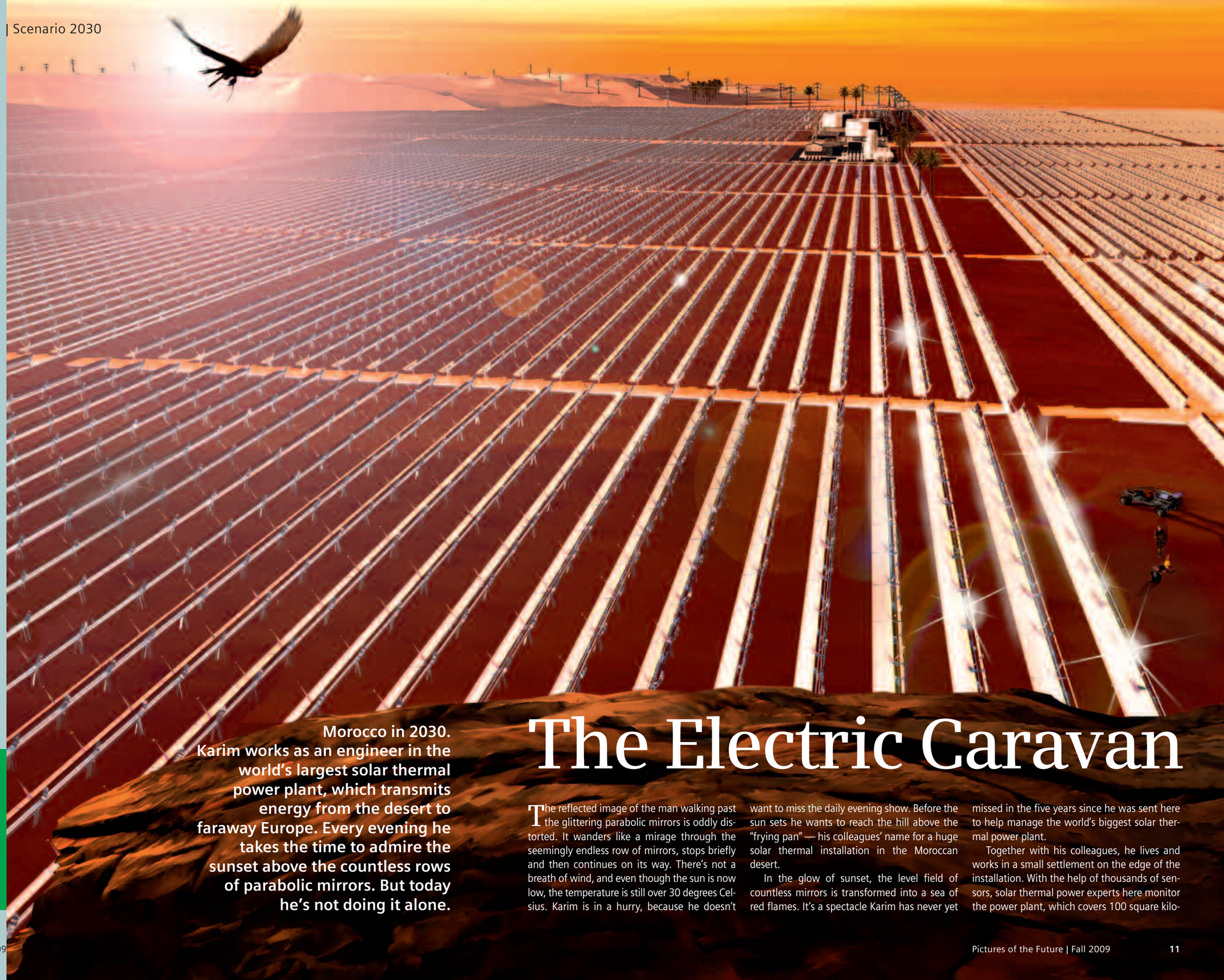
24 China's River of Power
Starting in 2010, hydroelectric plants are to supply energy to megacities in southeast China — with power generated 1,400 kilometers away. An HVDC transmission line from Siemens will transport this environmentally-friendly electricity in the most powerful system of its kind anywhere.

31 Trapping the Wind
In the future, fluctuations in wind power will have to be balanced by storage systems in order to prevent power grids from being overloaded. One option could be gigantic underground hydrogen storage centers.

44 From Wind to Wheels
Electric cars could play a stabilizing role in tomorrow's power grids, as mobile electricity storage units. Siemens is investigating how vehicles, the grid, and renewable energy sources interact.

2030

Harvesting electricity in 2030. A solar thermal power plant in the Moroccan desert covers 100 square kilometers, which makes it the world's largest installation of its kind. Using HVDCT lines, the electricity is transmitted as direct current at 1000 kilovolts to the coast, where it transforms salt water into pure drinking water. From there, it is transmitted across the sea to Europe, where it provides clean power to many countries.



Morocco in 2030. Karim works as an engineer in the world's largest solar thermal power plant, which transmits energy from the desert to faraway Europe. Every evening he takes the time to admire the sunset above the countless rows of parabolic mirrors. But today he's not doing it alone.

The Electric Caravan

The reflected image of the man walking past the glittering parabolic mirrors is oddly distorted. It wanders like a mirage through the seemingly endless row of mirrors, stops briefly and then continues on its way. There's not a breath of wind, and even though the sun is now low, the temperature is still over 30 degrees Celsius. Karim is in a hurry, because he doesn't want to miss the daily evening show. Before the sun sets he wants to reach the hill above the "frying pan" — his colleagues' name for a huge solar thermal installation in the Moroccan desert.

In the glow of sunset, the level field of countless mirrors is transformed into a sea of red flames. It's a spectacle Karim has never yet missed in the five years since he was sent here to help manage the world's biggest solar thermal power plant.

Together with his colleagues, he lives and works in a small settlement on the edge of the installation. With the help of thousands of sensors, solar thermal power experts here monitor the power plant, which covers 100 square kilo-

meters. As soon as these tiny digital assistants register a defect, Karim and the rest of his maintenance crew go to work.

Karim, a true son of the desert, moves through the heat very slowly and carefully — and in contrast with his European colleagues, who rush around sweating, his shirts always remain dry. But now he too is in a hurry, and he's relieved when he has reached the garage with the off-roaders.

Trained as an engineer, Karim is a calm and deliberate man. He seldom uses bad language — only in the rare cases when there isn't enough sugar in his tea or when one of his colleagues has forgotten to "tank up" the off-roader, as has just happened.

The electric vehicle wasn't plugged into an electrical socket — sockets that are supplied with power from the solar thermal installation. Nevertheless, Karim gets into the driver's seat and presses the starter button. The vehicle's 150 kilowatt electric motor starts up with a soft purr. A pictogram on the control panel indicates that the battery only has 10 percent of its full capacity. When fully charged, the vehicle has a range of 350 kilometers — and ten percent is not enough to get him up the hill.

But the off-roader is equipped with a small, highly efficient gasoline engine for emergencies, which works like a generator and gives the vehicle an additional range of 300 kilometers. And the gas tank is still full. Karim is satisfied, steps on the gas pedal, and the off-roader jolts off almost silently along the sandy trail toward the hill.

The final meters are the most difficult ones. The electric off-roader pushes through the sand with great effort, but eventually it reaches its goal. Karim climbs out of the vehicle and hurries to the top of the hill. The sun has already reached the horizon, and the temperature has dropped noticeably. A gentle breeze is coming from the sea. But Karim doesn't notice it, because he now smells something burning.

Nearby he finds a small campfire. In front of it sits a nomad holding a teapot above the crackling flames. The old man greets him with the traditional "Salam" and motions for him to come closer. Karim hasn't seen any nomads in this area for a long time now — but he knows that they're always on the go. He gives the old man a friendly nod and sits down beside him at the campfire.

"My name is Hussein," says the nomad as he hands Karim a glass of tea. "What brings you here?" Karim shovels several spoonfuls of sugar into his tea. He points down the hillside. "Do you see those countless mirrors that are just now reflecting the last rays of the sun? They are generating electricity from the sun's heat. This power plant produces enough electricity to supply all of Morocco. My job is to make sure everything runs smoothly."

Hussein looks down at the installation, which is starting to glow red in the sunset. "A power plant? I'd say it looks like a work of art created by some crazy European."

Karim grins. "You're not too far off the mark. This technology was in fact developed in Europe. Installations like this one are being built all over North Africa. They've been going up for years. The mirrors automatically swivel so that they're always facing the sun. They capture the sun's beams and focus them on a pipe that is filled with a special salt. The salt is heated to as much as 600 degrees Celsius and generates steam, which in turn drives a turbine that produces electricity."

Hussein points to the west, where the sun is dipping beneath the horizon. "And what happens after it gets dark?" he asks. "The power plant is equipped with storage systems that contain the same kind of salt that's in the pipes," explains Karim. "This salt stores so much heat that the plant can also produce electricity at night."

The nomad looks thoughtful. "But what do we need all that electricity for?" he asks. "There's only dust and gravel here wherever you look, and Casablanca is far away." Karim points to a gigantic high-voltage overhead line leading northward from the installation through the desert until it is lost from sight. "We use some of the power to change seawater into drinking water," he says. Hussein nods. This makes sense to him.

Karim likes explaining things to people and is now hitting his stride. "But we also sell a lot of it at good prices to European countries that want to become less dependent on oil, natural gas, and coal. The energy is transported to them via electricity highways like this one. It works like a caravan — the electricity travels across distances as great as 3,000 kilometers to European cities that use enormous amounts of power. However, by transmitting it at 1000 kilovolts hardly any electricity is lost in transit."

Karim sips his tea with satisfaction. "The desert holds our past and also our future," he muses. "In the old days we pumped petroleum out of the ground and today we're harvesting solar energy."

The old man lays a hand gently on Karim's shoulder. "The sun gives us everything we need to stay alive — our forefathers already knew that," he says with a smile as he hands a warm blanket to his guest. "But the night is coming on quickly. Here, take this. In spite of your gigantic power plant down there you're shivering like a sick camel." ■ *Florian Martini*