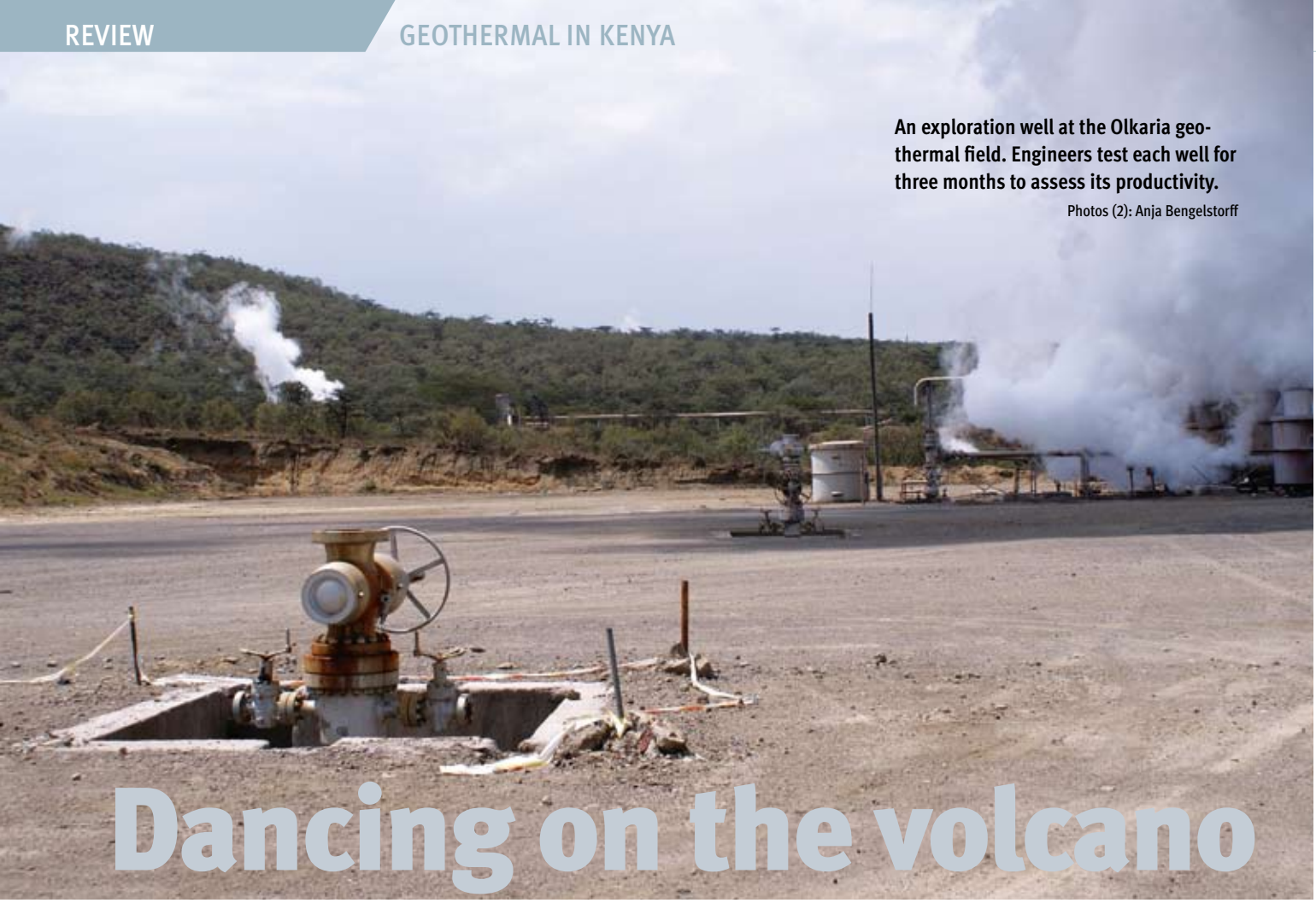


An exploration well at the Olkaria geothermal field. Engineers test each well for three months to assess its productivity.

Photos (2): Anja Bengelstorff

Dancing on the volcano

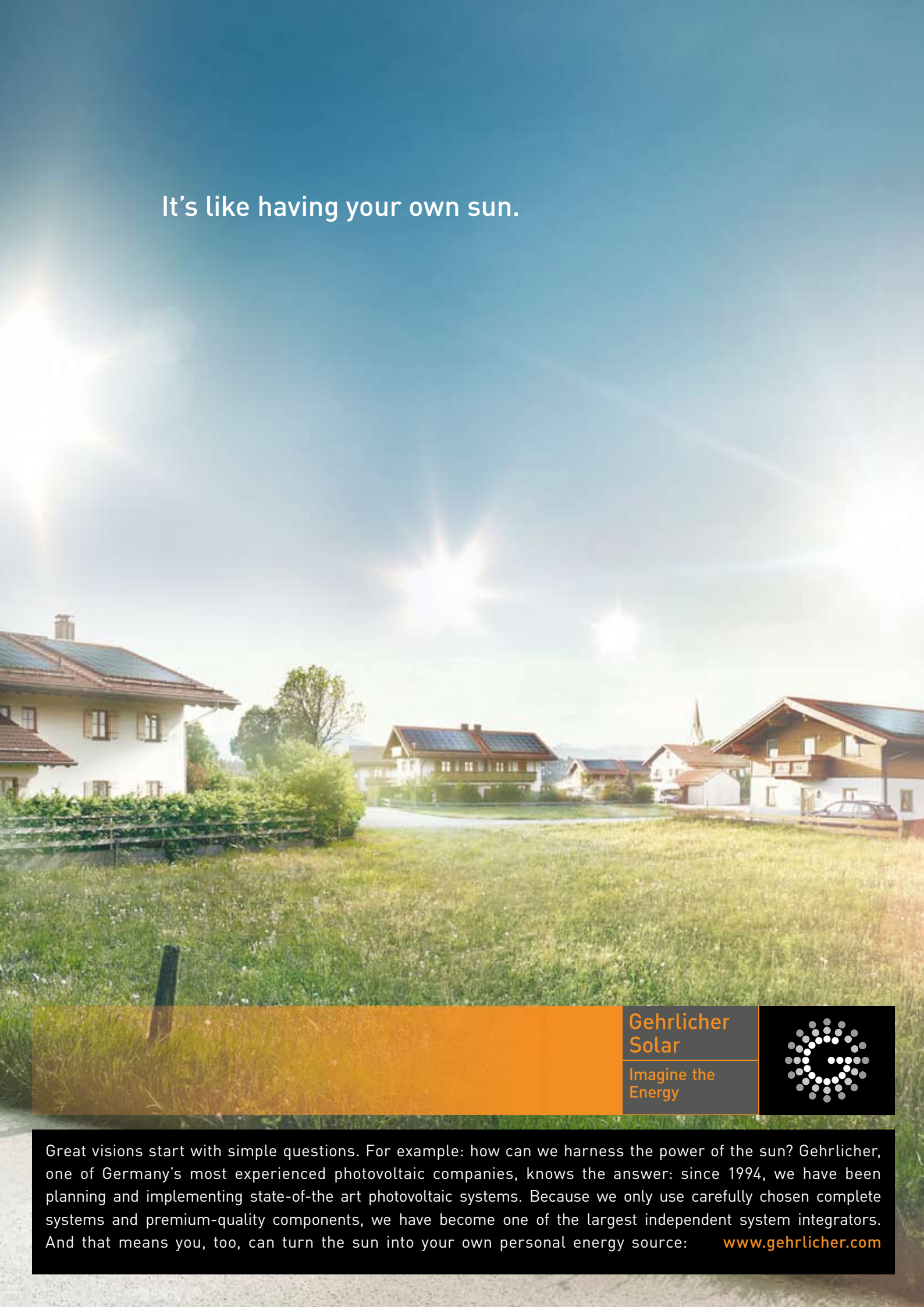
Situated along the Great Rift Valley of East Africa, Kenya has the biggest geothermal potential on the continent. The country is rated 7th in the world in geothermal production. This renewable energy form is quickly proving to become the solution to high energy costs and increasing power demands.

Hell's Gate National Park lives up to its visitor's expectations: while driving through the hilly area with protruding acacia trees scattered around and the occasional giraffe grazing in the distance, white steam clouds slowly rise from between the shrubs. The discomforting smell of hydrogen sulphide wavers through the air, but Isaac Kirimi just shrugs and smiles. "Only when you don't smell anything is the time to get worried", the Drilling Superintendent of the Olkaria geothermal fields inside the national park says.

He has taken his visitors to the Olkaria view point. Kilometres of steam and water pipes cover the area like a spider's web, connecting the geothermal wells with the Olkaria II power plant. Down in the valley the eight cooling towers, the turbines connected to the generators and finally the power transformers. Olkaria II near the town of Naivasha is Africa's biggest geothermal power plant, currently producing 105 MW electrical power generated from 22 wells, according to Kirimi. But it is not the first of its kind in Kenya.

In 1956, British settlers performed the first surface drillings in the Great Rift Valley of East Africa. From 1967, the United Nations Development Programme (UNDP) together with the Kenyan government conducted the first geological and geophysical research between Olkaria and Lake Bogoria. The initial geothermal drilling, "X 1", took place 40 years ago in 1971. The UNDP studies promised the highest potential for the Olkaria area. Therefore, in 1981, Olkaria I started the geothermal production with a 15 MW plant. With two additional units, Olkaria I produces 45 MW from 28 wells until today. Added the output of the privately owned Olkaria III power plant, Kenya's geothermal production today stands at 207 MW or about 13 % of the overall power generation of the country.

60 % of Kenya's power needs are today covered by hydro stations. But this energy form, though renewable, is becoming increasingly erratic due to changing weather patterns and frequent droughts. Power shortcuts have become the norm to millions of Kenyans, of whom only 20 % are connected to the national grid in the first place, mainly in urban areas. The current power rationing is hitting East Africa's largest economy hard. Kenya currently has an installed energy capacity of about 1,300 MW against an estimated deficit of about 1,100 MW. Last year, the Kenyan government created the Geothermal Development Company (GDC) as a special vehicle to fast-track development of geothermal resources. By effectively increasing the amount of geothermal power produced in the country, Kenya is expected to consolidate its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efforts of reducing over-reliance on hydro power as well as the need to use diesel for power generation. Kenya has over-relied on fossil fuels for its energy demands resulting in high energy costs.

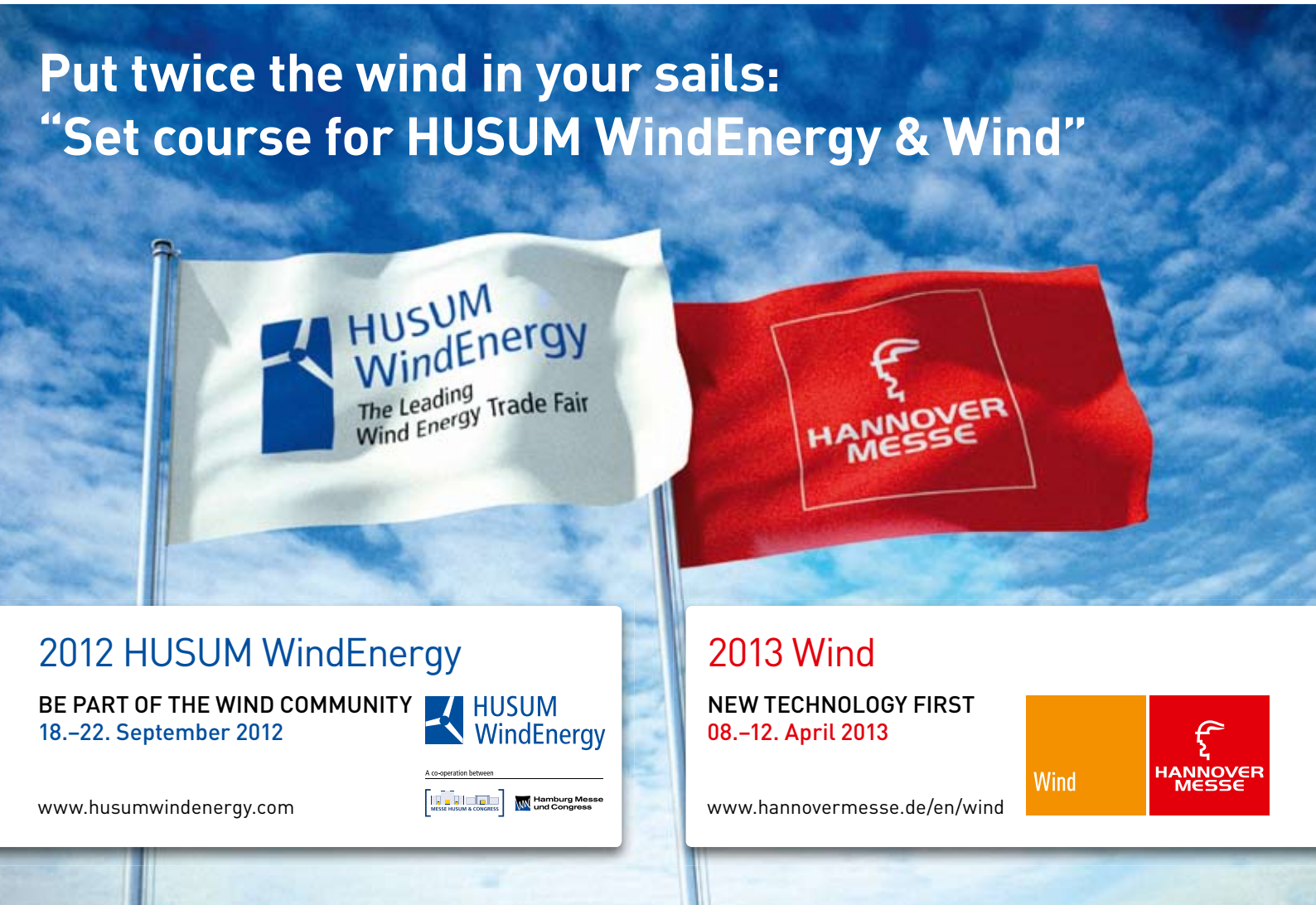
The German government through the KfW Bank has jumped on the steam train and loans the state-owned power generator Kenya Electricity Generating Company (KenGen) € 60 million for the extension of Olkaria I and the construction of a new power plant, Olkaria IV, for engineering services and steam pipes. Upon completion, both Olkaria I and IV will produce 140 MW each, expected by the end of 2013, according to KfW. Kenya's growing economy relies on increased power supply; the energy demand rises by 8 % annually. The huge potential of 15,000 MW in 14 high temperature geothermal sites along the Great Rift Valley offers a sustainable and reliable solution to the country's energy needs. KenGen predicts to cover 49 % of those needs through geothermal by 2018 and therefore be instrumental in fullfilling Kenya's ambitious aspiration of becoming a middle-income country by 2030. By then, the power demand countrywide is estimated at 15,000 MW of which a third is to be covered by geothermal sources.

But the initial costs of geothermal production are immense. One kWh of geothermal energy is currently produced by KenGen at US$-ct 6.4 and therefore the cheapest energy form in the country, but only because the exploration costs are not factored in as they are covered by the goverment. Drilling a well currently costs around € 3.8 million – and not every well is exploitable. "We drill exploration wells first and test them for about three months", reports Kirimi. "The wells at Olkaria are between 700 and 2,200 m deep and can be used for 15 years and longer. We have an ideal high temperature field of between 300 and 350 °C."

Geothermal energy is available in East Africa due to former volcanic activity in the Great Rift Valley: the heat inside the earth is intense enough to melt rocks. Those molten rocks are known as magma. Because magma is less dense than the rocks surrounding it, it rises to the surface. Sometimes magma escapes through cracks in the earth's crust, erupting out of volcanoes as part of lava. But most of the time magma stays beneath the surface, heating surrounding rocks and the water that has become trapped within those rocks. Those temperatures can be used: geologists drill wells through which hot water and steam can reach the surface where they are separated like in Olkaria. While the water is pumped back into the earth, the steam is transformed into electrical energy and fed into the national grid.

Africa's flagship project

And GDC is not sleeping on the job, thanks to its visionary Managing Director, Dr. Silas Simiyu. In May, the company struck a substantial amount of geothermal steam from the new well in Menengai, another dormant volcano, near the town of Nakuru. The discovery well has a potential of 10 MW. "This is a mile-



stone for our country", Simiyu is quoted in the company's house magazine "Steam". The successful completion of the well at the geothermally rich Menengai area could see Kenya start generating an additional 8 MW of power as early as March next year. The development could rid Kenya of its energy challenges in less than five years, Simiyu says.

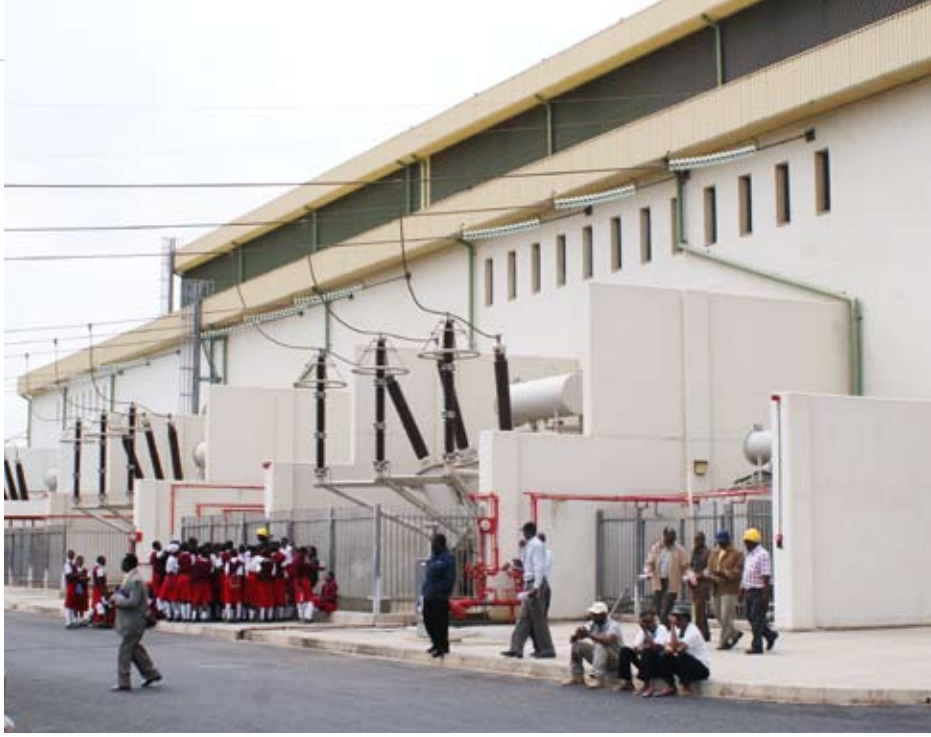
"This well has been drilled at half the costs of the other wells that are normally drilled here in Kenya." GDC employed its own two rigs as well as engineers, drastically bringing down the costs of drilling. The reduction in the cost of drilling and the concept of early wellhead generation unit, Simiyu explained, would bring down the cost of power generated by half.

Simiyu said the model of harnessing geothermal energy employed by GDC in striking the first of a projected 120 geothermal wells in the area, to last more than 40 years, is fast and cheap compared to other models. For the first time, GDC is encouraging the installation of small portable wellhead generators that will start producing electricity within one year after well completion as they await the construction of the conventional plant by 2014, a move whose economic benefits are expected to ripple across the country. The Menengai Geothermal Field itself has a potential of 1,600 MW. Several Independent Power Producers (IPPs) have already been invited to put up conventional power plants.

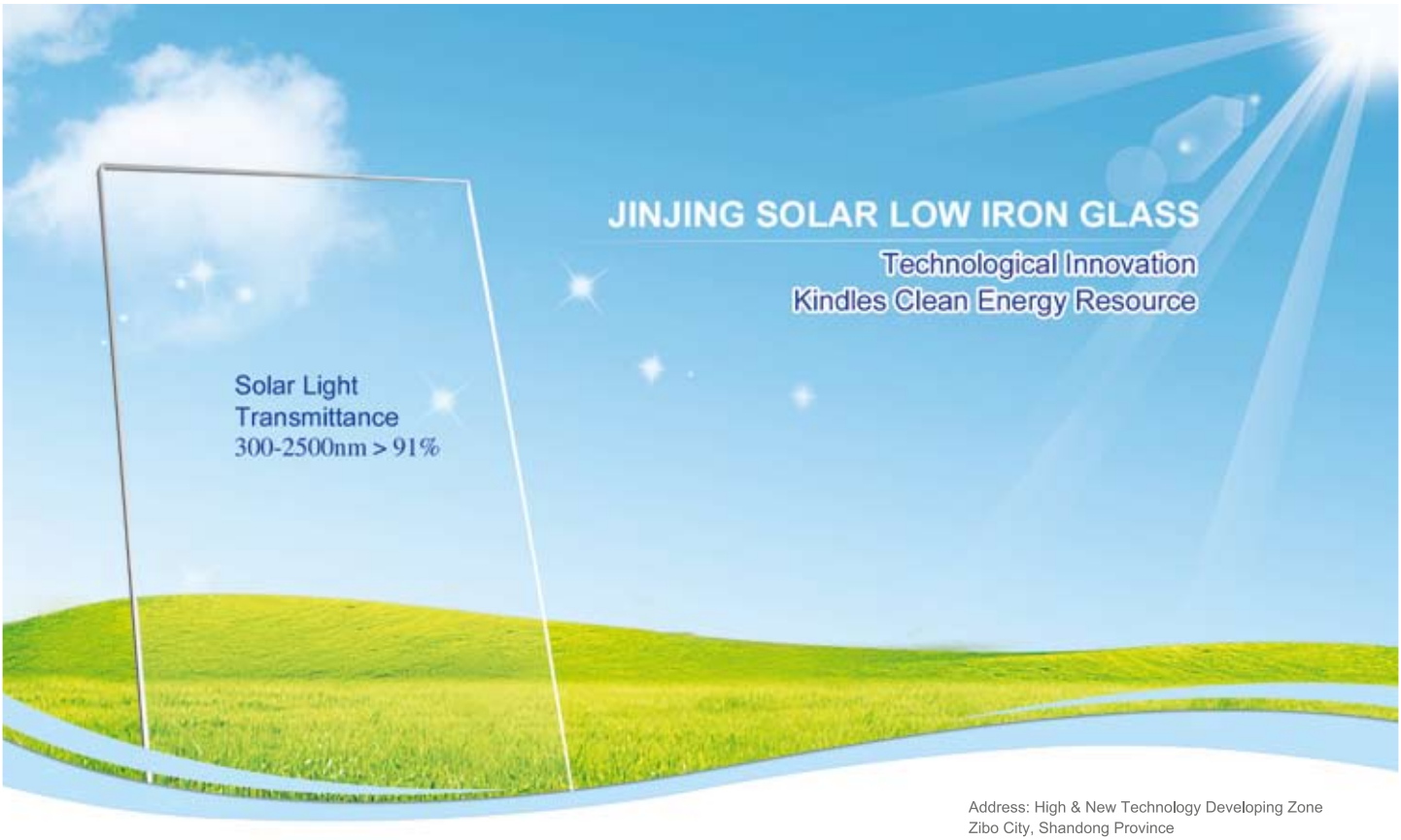
"We believe that with the journey we have started, in the next two or three years GDC will be the leading developer of geothermal resources in the world," Simiyu concludes. Kenya – a force to reckon with.

KenGen has been exporting geothermal consultancy services to neighbouring countries. Rwanda is set to become a geothermal producing country by December 2011 and to develop 300 MW by 2017. Uganda, Tanzania and Rwanda have potential to generate geothermal power as they sit on the western arm of the volcanic ranges. *Anja Bengelstorff*

Further information:
www.kengen.co.ke



Even school children – here in front of the turbine hall – are taken to visit the Olkaria II geothermal plant.



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