Haiti, this distributed network infrastructure came as a blessing.

NetHope, a "collaboration of 28 of the world's leading international humanitarian organizations," was one of the NGOs taking advantage of satellite service. The organization was working with San Francisco–based Inveneo to bridge the proverbial last mile by establishing Internet connectivity in the Haitian capital of Port-au-Prince and surrounding areas via VSAT links combined with long-range Wi-Fi. The Inveneo network supports Internet access in and out of the country, carries voice communications, and allows for the collaboration and sharing of resources among up to 20 NGOs.

Inveneo cofounder Mark Summer and engineer Andris Bjornson arrived in Haiti one week after the quake hit with the logistical assistance of the housing aid group CHF International. Summer and Bjornson brought with them more than 330 kilograms of equipment, including climbing gear, power drills, power strips, electrical cords, coaxial cable, wireless routers, more than a dozen 5-gigahertz RocketDish parabolic antennas, and 10 Linux miniservers.

Three days after their arrival in Port-au-Prince, Summer and Bjornson reported back to Inveneo via the Internet connection they had helped establish. They had connected a server to a VSAT satellite Internet downlink from ITC Global and installed a local access point for the CHF International headquarters. Then they created two long Wi-Fi links from the headquarters to two different offices of Save the Children Federation in Port-au-Prince. Later that afternoon they established a third link to the offices of Catholic Relief Services.

As Inveneo's partners and other NGOs shift from rescue to recovery to rebuilding, Internet access will continue to play an important role.

"In the long term, getting people access to cheap, diverse, reliable telecommunications will be one important element in Haiti's rebuilding as a nation," says James Cowie, chief technology officer at Renesys, an Internet-monitoring firm.

Because Haiti's mobile-phone penetration rate was pretty high before the quake, Cowie thinks that most of the population will be accessing the Internet through mobile devices in the future. "I'd like to think that cheap mobile Internet access could turn out to be one of the small factors that improve education and create economic opportunities for Haitians in the long run," he says. "But in the face of so much suffering, they obviously have much more serious and immediate concerns to deal with this year."

—Harry Goldstein

"Cheap mobile Internet access could turn out to be one of the small factors that improve education and create economic opportunities for Haitians in the long run."
–James Cowie, chief technology officer, Renesys

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Europe Plans a North Sea Grid

Undersea cables will transport wind, hydro, and solar power

The European Union hopes to generate a fifth of its electricity from renewable energies by 2020. But that can't be done unless its member states can easily move that electricity from one country to another. To that end, late last year nine European countries agreed to build a power grid of high-voltage cables under the North Sea. It would be the first multinational grid designed to address the fluctuating nature of green power generation.

The grid will transport energy generated by a mix of wind, solar, and tidal power between Belgium, Denmark, France, Germany, Ireland, Luxembourg, the Netherlands, Norway (the only non-EU participant), and the United Kingdom to better balance supply and demand. Energy produced at night in UK wind farms, for instance, could be stored in Norway's hydropower facilities and released the following day. Around 100 gigawatts

CAPRICE OF THE WIND: Robust marine transmission lines could allow Europe to exploit the sporadic production of most alternative sources of energy.
PHOTO: SIEMENS

of offshore wind power are currently planned by European power companies. The UK, in particular, has launched a £100 billion (US $160 billion) program to expand its offshore wind farms, already the world's biggest at around 1 GW, to as much as 40 GW by 2020.

The cable project, estimated to cost the nine countries more than €30 billion ($40 billion) over 10 years, will be financed through a mix of taxpayers' money and private investment, largely from energy companies. Government officials were to begin coordinating the project in February.

The sooner such projects get off the ground, the better, says Sven Teske, an electrical engineer by training and a renewable energy expert with Greenpeace International. "The wind industry is a huge driver behind the push for supergrids and cross-border infrastructure," he says. "The new players need the grids or they won't survive."

Before Europe's grid can handle the planned renewable energy, 34 existing high-voltage alternating current (HVAC) interconnections between neighboring countries will need to be upgraded, at a cost of approximately €3 billion, according to Greenpeace. Another 17 high-voltage direct current (HVDC) interconnections will need to be either built or upgraded at a cost of about €16 billion. And up to 11 new long-distance HVDC supergrid connections will be necessary, at a cost of approximately €100 billion—much more than EU ministers agreed to in December.

Onshore, the EU ministers envision a combination of interconnected smart grids for distribution and connecting decentralized renewable generation, and supergrids that distribute electricity across its member states and beyond. The smart grids would use advanced communication systems as well as new monitoring and control technologies to balance supply, demand, and storage over a region more effectively than is done today.

The supergrids, by comparison, would transport large energy loads to balance electricity surpluses or deficits between regions and also transport bulk electricity from large wind and solar farms. Under plans being shaped by EU policymakers and industry leaders, the supergrids will likely be based on HVDC technology. But HVAC, the mainstay in Europe, will continue to play a role in the region.

The big advantage of HVDC over HVAC is lower electricity loss over long distances. Two types of systems are competing. One, called line commutated converter technology, offers comparatively low energy losses—between 2 to 3 percent for a 500-megawatt transmission over 100 kilometers, including losses in converters and transmission, according to the Greenpeace energy grid study "Renewables 24/7: Infrastructure Needed to Save the Climate." But this system typically requires a strong HVAC network on both sides of the HVDC connection. The other, called voltage source converter (VSC), is a comparatively new technology. VSC-based HVDC offers more control of the power flow, but its total efficiency is still slightly less than that of the commutated design and also requires more cable and more converter stations.

Someday, these planned new supergrids could connect with the European industry-led Desertec project, which plans to transport solar energy from northern Africa under the Mediterranean to Europe. But trying to "bundle too many activities in the early phase" of building new infrastructure could be a mistake, warns Antonella Battaglini, senior scientist at the Potsdam Institute for Climate Impact Research, in Germany. Connecting northern Europe to smart grids and supergrids is, in her opinion, enough of a challenge.

—John Blau