Small-scale power

World-class manufacturers are examining alternatives to the traditional energy market.

By Harry Hutchinson, Managing Editor

Perhaps a third of the world lives without electricity, in most cases because there is no way to deliver it. That comes to about two billion people with a clear need.

Meanwhile, back in the industrialized world, markets are changing. There are customers willing to pay to gain more control over their power supply. At the same time, others, concerned about future fuel supplies, cost control, and emissions into the atmosphere, are looking for alternative sources of power, including renewables and small, economical generating plants.

One of the products in prototype at ABB is a wind turbine that the company predicts will generate power as cheaply as conventional plants can.

was due to expire in 1999, but in fact has been extended to December 2001.

The author, Heidi Anderson, predicts that the big bump in investment is likely to level off over the next couple of years, but will pick up again by 2004.

According to the “Global Wind Energy Market Report” of the American Wind Energy Association, more than 3,600 megawatts of wind power capacity were added worldwide in 1999, representing a 36 percent increase from 1998. AWEA estimated the world’s total capacity, when this year began, at 13,400 MW.

Meanwhile, companies as different as ABB in Zurich and Capstone Turbine Corp. in Chatsworth, Calif., are taking orders for installations of distributed generation plants running on natural gas.

Capstone, which made its initial public offering this past summer, specializes in marketing microturbines for generating electricity. In August, it received an order worth $1.5 million from Cinergy Corp. to install more than 50 microturbines, averaging about 30 kW each, in midwestern states. Cinergy said that the small plants would serve customers who needed additional capacity or higher-than-grid-quality power reliability. When sufficient numbers are installed, microturbines will help ease the strain of peak loading periods, Cinergy added.

ABB is a diversified engineering company with old roots. It has built turbines and transmission lines, and operated power plants all over the world.

One of its recent generation contracts is to install, over the next year and a half, 10 combined heat and power units in the United Kingdom for Scottish and Southern Energy plc, an energy provider based in Perth, Scotland. The $100 million deal calls for ABB to operate the plants for the next 17 years. The installations, which are to use natural gas-fueled reciprocating engines, will have capacities up to 750 kW each.

Some of the units will be placed in greenhouses, so as an added touch, those turbines will recycle exhaust CO₂ to stimulate plant growth.

A greenhouse in Stratford-upon-Avon, in England, already has a similar heat, power, and CO₂-capture installation using a Capstone microturbine.

PUTTING EGGS IN A NEW BASKET

Given the numbers, no one suggests that revenues from distributed generation and alternative energy are close to the value of the mainstream business of central power plants feeding regional or national grids. Even so, that emerging power business is the basket where ABB has put its eggs.

Goran Lindahl, ABB’s CEO, said of the company’s new approach to the business: “This will not replace large-scale power generation; it’s a complement. It will offer a more economically viable and environmentally prefer-
able solution demanded in many parts of the world.”

According to ABB, demand for alternative energy sources and distributed power generation—including wind farms, fuel cells, and small combined heat and power plants—is a rapidly growing market. That market has been sparked in large part by deregulation, which has forced power suppliers to put a higher priority on profitability.

ABB has argued that small-scale power, because it requires less up-front capital investment, often meets this need better than conventional large plants.

It probably comes as little surprise that Terry Peterson, manager for solar and green power at the Electric Power Research Institute in Palo Alto, Calif., is an advocate of small-scale power and alternative energy technology. Peterson pointed out that small plants are especially attractive to developing countries, where “distributed generation is the way to go.” According to Peterson, “The lack of a grid in developing countries makes a central station plant less economical.”

Other world-class manufacturers are examining alternatives to the traditional energy business, too. General Electric, for instance, has investments in microturbines and home fuel cells for distributed generation; BP Amoco has a unit devoted to photovoltaic systems. At the same time, they have by no means relaxed their efforts to pursue their traditional core businesses. GE remains one of the world’s largest builders of generating plants, and BP Amoco continues as a leader in petroleum products.

**A Change in Direction**

Perhaps the biggest change for ABB has come in its power generation segment. Since May of this year, the company no longer builds or runs large power plants.

So far, ABB is the only one of the global energy giants to leave the business of gigawatt powerhouses to go after a market involving such technologies as renewables, efficient distributed generation from fossil fuels, and related transmission systems.

According to Lindahl, “With deregulation of the power market, global efforts to cut pollution, and government initiatives to boost electricity production from alternative energy—especially in Europe—we think this market is poised for tremendous growth.”

The company forecasts that its revenues in the distributed generation power business, including renewables and related technologies, will reach about $1 billion in 2005 and climb to $2.5 billion in 2010. The money is significantly less than in the power generation business that ABB has sold off.

In response to competitive pressures, ABB merged its power generation business with that of Alstom in June 1999. Alstom, based in Paris, and ABB each held half of the joint venture.

The new entity, ABB Alstom Power, reported revenues roughly equivalent to $5.5 billion for its first six months of operation, through December, and orders received in the period were worth about $6 billion. It was the largest power company in the world.

In the financial report, management said it had set a long-term goal of achieving an operating margin of 7 or 8 percent.

Less than a year after it helped launch the venture, ABB walked away. Alstom bought out its partner’s 50 percent of the business in May for a price of 1.25 billion euros—about $1.15 billion at the exchange rate of the time.

A spokesman for ABB in Zurich said that, although the traditional, large-plant business promised a lot of growth, it carried slim margins. So ABB sold off its “heavy assets” in the power business.

ABB has not stated what it expects margins to be in distributed generation, but according to the spokesman, Thomas Schmidt, the company expects them to be higher than they are in the big-plant field.

It was also in May of this year that ABB completed the sale of its nuclear power assets to a British company, BNFL, for $485 million. According to ABB, those businesses, headquartered in the United States with operations in Europe and Asia, reported revenues in 1999 of about $600 million.

In June, ABB called a press conference in London, where it spelled out its new approach to the energy business.
Executives said the company would apply its considerable assets to advancing technology for distributed generation, transmission, and distribution, as well as to the software to control everything. ABB also will arrange financing and service.

“We have developed technologies that make wind power and other renewable and alternative energies economically attractive for the first time,” Lindahl said.

Perhaps the tense of the verb is a bit premature, but ABB has come up with a new design for a wind turbine that has the potential, the company said, to generate electricity at a cost of less than 4 cents per kilowatt-hour, putting it in a class with conventional gas, coal, and oil-fired power plants.

Called the Windformer, the system reduces maintenance and equipment costs by eliminating both the gearbox and the transformer.

The final model isn’t ready for market. ABB is testing a 500-kW prototype. Vattenfall, an energy company based in Stockholm, has agreed to install a 3-MW demonstration Windformer, probably in the summer of 2001.

The turbine will be erected on the island of Gotland in the Baltic Sea, where Vattenfall has tested wind turbines for almost 20 years. The new machine will stand on the southern part of the island, some 120 meters from the sea. Vattenfall said it expects that the placement will offer conditions very similar to those offshore.

Additional windmills will be installed away from land, Vattenfall said, not only to take advantage of the wind over open water, but also to remove the noise of the rotating blades.

According to ABB, it can get around the problem of the changing frequencies of current created by variable winds by converting the power to high-voltage direct current for transmission. That brings in another of the company’s products, which it calls HVDC Light.

HVDC Light uses semiconductor technology and control systems to eliminate the problem of incompatible frequencies by doing away with frequency altogether.

High-voltage direct current can cut transmission losses by 50 percent, but generally has been practical only on a large scale, ABB said. For instance, ABB has a contract to build a large-scale dc power transmission link between a substation in northern Argentina and another in southern Brazil.

Because the 1,000-MW link is direct current, it becomes irrelevant that two electric systems have different frequencies.

At the end of August, ABB received a $120 million order to lay a direct current transmission line under Long Island Sound to link the power grids of Connecticut and New York. The connection will use HVDC Light technology to carry 330 MW over a distance of 40 km.

The project, known as the Cross-Sound Link, is being managed by TransEnergie U.S. Ltd. of Westborough, Mass. One of its intended effects is to promote competition in the New York and New England electricity markets by enabling electricity to be traded among power generators and customers in both regions.

ABB claims that its HVDC Light system can economically transmit the power output of a small generator, perhaps a wind farm, as far as 40 km.

**Small Gas Turbines**

The company is also recommending the use of small gas turbines to provide electricity for homes, commercial buildings, hospitals, and small factories. Their compact size and high reliability make them suitable for small combined heat and power installations.

ABB’s Model MT100 microturbine, developed in 1998 with Volvo Aero Corp., is a single-shaft unit that generates 100 kW of electricity and 167 kW of thermal energy. According to ABB, it is designed for remote-controlled, unsupervised operation. Emissions of unburned hydrocarbons are less than 10 parts per million; NO\textsubscript{x} and CO are less than 15 ppm. The cost of the energy it generates is between 6 and 8 cents per kilowatt-hour.

The microturbine represents a very young business. ABB expects that by the end of this year it will have sold a total of 30 of them.

Information technology to control disparate and widely dispersed sources of power is critical to the structure.

ABB is talking about using its information technology to capture power from wind farms or residential microturbines. The power can be transmitted to the main grid, or can circulate in small-area microgrids. The idea has become practical, ABB said, because the Internet makes it possible to monitor and maintain microgrids remotely.

The 10 small heat and power plants to be installed in the United Kingdom, for instance, will be monitored...
According to this illustration by ABB, the company predicts that three Windformers will do the work of two dozen conventional windmills.

and remotely controlled by computer systems.

In August, ABB put out word that it was expanding its info technology resources with a deal to buy Energy Interactive Inc. of Oakland, Calif., a seller of software designed for utilities, power marketers, energy service providers, and major energy consumers.

**Risks and Rewards**

The reordering of priorities at ABB, as with any investment, carries no guarantee of success.

Although it’s too early to predict how rich a road ABB has chosen, Standard & Poor’s early last month affirmed the company’s long-term corporate credit rating of AA-minus and changed the outlook from “stable” to “positive.”

S&P cited ABB’s move toward “higher value-added, more knowledge-based activities and away from very asset-intensive businesses.”

Anderson of Frost & Sullivan pointed out during a conversation that there is other potential value to be gained. That is the hard-to-account-for asset known as good will.

ABB has been working to build a reputation for concern over a number of sensitive issues, particularly protection of the environment and conservation of resources.

In July 1998, *The World Energy Council Journal* carried a paper bylined by one of ABB’s key researchers, Baldur Eliasson, manager of the company’s energy and global change R&D center in Baden, Switzerland. Called “The Road to Renewables,” the text has been posted on ABB’s Web site.

Eliasson discussed the need for new energy technology that will assure sustainable, long-term development around the globe. In the paper, the author estimated that one-third of the world’s six billion people live without electricity.

In April 1999, Lindahl delivered a speech that carried the title “From Greenhouse to Cleanhouse.” Even considering that the content was tailored to its audience—Oikos, the International Student Organization for Sustainable Economics and Management—it sounds unusually candid indeed when a power conglomerate’s CEO admits that his company is responsible for 1.7 million tons of CO₂ emissions every year, and its customers turn out 600 times more. His point was that ABB and its customers have to “adopt a lifecycle perspective when designing products and systems” if industrialized nations are going to meet the goals of current emissions limitations.

While it courts a greener image, ABB is also escaping controversies such as the one it ran into a few years ago in the county of Devon in England.

ABB planned to build a power plant near the rural village of Broadclyst, which was also home to a number of articulate opponents who had a talent for organizing themselves.

Mike Squires, who was vice chairman of the Broadclyst and District Generation Action Group, or BADGAG, admitted that much of the group’s motivation could be attributed to NIMBYism, the “not in my backyard” syndrome. But of particular concern was that the plant was to be air-cooled, using large ventilation fans that might be heard miles away.

Squires, a mechanical engineer by training, was the group’s noise and air pollution specialist. He was one of a number of other specialists on board, including a professor from the nearby University of Exeter. The group Web site even invoked the authority of a 19th-century Poet Laureate, Robert Southey, who once called the area “one of the richest landscapes in the kingdom.”

The plant was not built. “They went away,” Squires said. “Maybe they’ll come back.”

That’s not likely now, he was told.

In the speech delivered to Oikos, Lindahl made a statement that appears to sum up ABB’s new approach to the energy business.

“We have our roots in the power field—generating, transmitting, distributing, and utilizing electrical energy,” he said. “But we are also in oil, gas, and petrochemicals, and growing fast in the high-tech field of automation with a focus on knowledge-based activities. So our activities cover both the supply side and the demand side, and that brings a double responsibility. On the supply side we have to produce more with less—whilst on the demand side we have to use less to produce more.”