

POWER PLAYS

From wind farms and solar panels to nuclear energy, here is a look at some of the largest energy projects in the U.S.

BY JENNIFER GILL » ILLUSTRATIONS BY KENT LEECH

American households will need 40 percent more electricity by 2030, projects the U.S. Department of Energy (DOE), as population growth and disposable income lead to an increased need for products and services that require power.

Meeting these demands calls for a comprehensive energy strategy from Washington, D.C., says Marvin Odum, president of Shell Oil Co., an affiliate of **ROYAL DUTCH SHELL PLC** (RDS). “We live on the razor’s edge of supply just equaling our everyday demand,” he says. “The hurricanes in 2005 showed how perilous the supply chain is.” Odum says he would like to see the federal government expand access to domestic oil and gas resources, particularly in the Gulf of Mexico. Meanwhile, he says, Shell is pursuing projects with renewable energy sources, such as wind and biofuels. The company’s timing could not be better, as 24 states and the District of Columbia now have standards in place that require electricity providers to tap renewable energy resources for a minimum percentage of their power by a certain date, the DOE reports.

Developing technologies to improve traditional methods of generating energy is imperative, notes David Crane, president and CEO, **NRG ENERGY INC.** (NRG). The company says it plans to capture and sequester about 1 million tons of greenhouse gas emissions annually in one of the world’s largest post-combustion projects. Located at an existing coal-fueled power plant near Sugar Land, Texas, the demonstra-

tion facility is scheduled to be operational in 2012, reports NRG, which adds that it expects the captured carbon dioxide to be used in enhanced oil field recovery operations in the Houston area. Coal-fired power plants should

NEW TECHNOLOGIES AND IMPROVEMENTS TO EXISTING APPROACHES ARE CHANGING ENERGY SOLUTIONS.

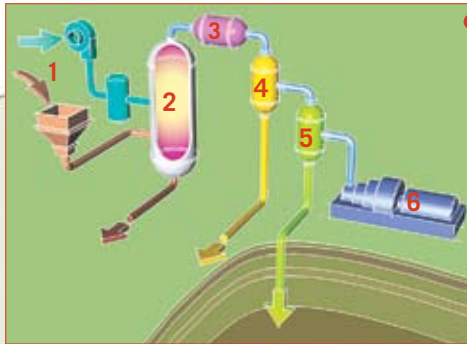
continue to supply most of the U.S. electricity through 2030, according to the DOE.

Nevada Power, a **SIERRA PACIFIC RESOURCES** (SRP) subsidiary, says it will build a 1,500-megawatt coal-fired power plant that will reduce emissions of nitrogen oxide, sulfur oxides, mercury and particulates more effectively than older plants. It will also employ a hybrid cooling system using only half the water typically required by other technologies, a key benefit for

arid regions like Nevada, notes Michael Yackira, the company’s president and CEO.

Meanwhile, “our grid, literally a 100-year-old machine, has lost some of its ability to perform,” cautions Dave Pacyna, president and CEO, Siemens Power Transmission & Distribution, a **SIEMENS AG** (SI) subsidiary. To strengthen the backbone of America’s infrastructure, Siemens says, it developed new high-voltage direct-current technology that transmits electricity over long distances with superior efficiency. Such technology reduces the need for new power plants near urban centers, NRG’s Crane adds. Because of the point-to-point nature of the technology, he explains, a wind farm in remote West Texas could ship power in bulk to Dallas. “We want energy supplies to be reliable and at a cost that enables our economy to be strong and our country to compete globally,” Pacyna says.

THE ALTERNATIVE ENERGY REVOLUTION



FUTUREGEN

- 1 PULVERIZED COAL AND A LIMITED AMOUNT OF OXYGEN ARE PUMPED INTO A FURNACE.
- 2 THE FURNACE "COOKS" THE COAL, RELEASING A BURNED ASH THAT IS USED IN THE CONCRETE INDUSTRY.
- 3 THE GAS FLOWS INTO A WATER STEAM SHIFTER, FREEING UP MORE HYDROGEN.
- 4 THE GAS THEN PASSES THROUGH A SERIES OF CLEANERS TO REMOVE SULFUR AND OTHER WASTES THAT CAN BE USED BY THE CHEMICAL INDUSTRY.
- 5 CARBON DIOXIDE IS REMOVED AND INJECTED INTO DEEP UNDERGROUND SALINE ROCK FORMATIONS AND STORED THERE PERMANENTLY.
- 6 CLEAN GAS PASSES THROUGH TURBINES TO BE USED FOR INDUSTRIAL PURPOSES, FUEL CELLS AND POWER GENERATION.

COAL-FUELED POWER The public-private partnership FutureGen Alliance says it is building a first-of-its-kind coal-fueled, near-zero-emissions power plant in Illinois. Working with the DOE, the 13 alliance members — including **AMERICAN ELECTRIC POWER CO. INC. (AEP)**, **CONSOL ENERGY INC. (CNX)**, **FOUNDATION COAL HOLDINGS INC. (FCL)**, **PEABODY ENERGY CORP. (BTU)**, **PPL CORP. (PPL)**, **RIO TINTO PLC (RTP)** subsidiary Rio Tinto Energy America and **SOUTHERN COMPANY (SO)** — say it will cost about \$1.5 billion to design and build the plant. The plant, reports the organization, will feature innovative technologies, such as carbon sequestration, which captures and permanently stores carbon dioxide deep below the earth's surface. The plant will also produce hydrogen and other by-products for use by other industries. Construction is expected to begin next year, with full-scale operations starting in 2012, the alliance reports.

SOLAR PHOTOVOLTAIC SYSTEM, NELLIS AIR FORCE BASE North America's largest solar photovoltaic system is now operating at Nellis Air Force Base, reports MMA Renewable Ventures, a subsidiary of Municipal Mortgage & Equity LLC, which financed the project. The 72,000 solar panels use tracking technology to follow the sun throughout the day, delivering up to 30 percent more energy than traditional fixed-tilt ground systems, according to the company. In all, MMA Renewable says the panels will supply 25 percent of the electricity used by the 12,000 people who live and work at the military base. Nevada Power, a subsidiary of **SIERRA PACIFIC RESOURCES (SRP)**, says it will support the project by purchasing renewable energy credits generated by the solar plant.

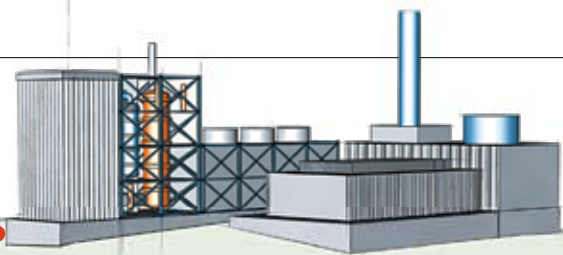
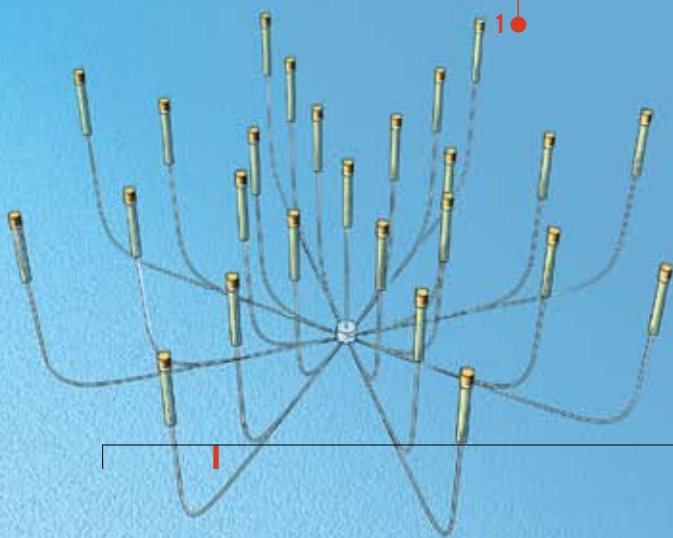
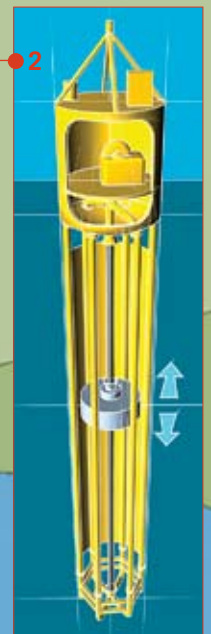
SOLAR PANELS AT NELLIS AIR FORCE BASE WILL REDUCE CARBON DIOXIDE EMISSIONS BY AN ESTIMATED 24,000 TONS A YEAR.

HUMBOLDT COUNTY OFFSHORE WAVE ENERGY POWER PLANT

California utility Pacific Gas and Electric Co., a subsidiary of **PG&E CORP. (PCG)**, says its agreement to buy wave-generated electricity from Canada's Finavera Renewables Inc. is the first commercial wave energy contract in the U.S. Finavera indicates that it will build and operate the wave energy project more than two miles off the coast of Eureka, Calif., and will start delivering electricity by 2012 after securing necessary permits. The project consists of a cluster of high-tech buoys moored in the water that convert wave energy into electricity, which will be sent to shore through a secure undersea transmission line, Finavera reports. PG&E says it currently supplies 13 percent of its energy from qualifying renewable energy sources and already has contractual commitments for more than 20 percent of its future power deliveries from renewables, including wind, biomass and geothermal.

1 A WAVE FARM, AN ARRAY OF WAVE BUOYS, IS DESIGNED TO GENERATE ELECTRICITY KINETICALLY THROUGH WAVE ENERGY.

2 A WAVE BUOY IS A LONG CYLINDER WITH AN UNDERWATER CENTER WEIGHT HELD IN POSITION BY TWO LONG FLEXIBLE HOSES. AS THE BUOY BOBS, IT ALTERNATELY COMPRESSES EACH HOSE, PUSHING WATER, VIA A CHECK VALVE, TO THE WATER TURBINE GENERATOR HOUSED IN THE TOP OF THE BUOY.





NUCLEAR PLANT NEW INTERNAL REACTOR PUMPS IMPROVE SAFETY AND PERFORMANCE BY ELIMINATING EXTERNAL RECIRCULATION SYSTEMS.

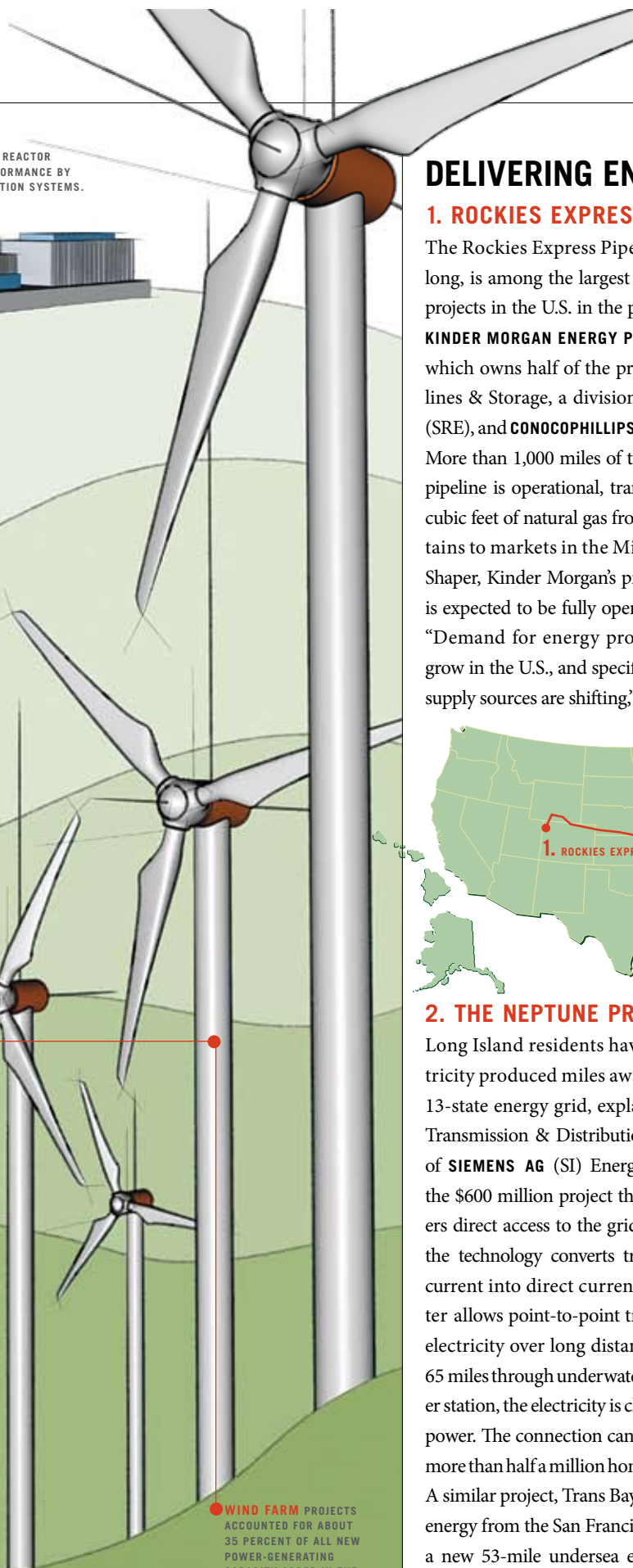
SOUTH TEXAS PROJECT NUCLEAR

GENERATING STATION **NRG ENERGY INC.**

(NRG) says it plans to build and operate two new nuclear reactors and that it has filed the first application to be submitted to the Nuclear Regulatory Commission (NRC) in nearly 30 years. The new units, which will stand alongside two reactors currently in operation, will use advanced boiling-water reactor technology that has already been employed in Japan, reports NRG. The reactors' safety innovations include internal water pumps that replace external circulation systems and eliminate some entry points to the vessel. NRG says that the new units will produce at least 2,700 megawatts of electricity — enough to power more than 2 million homes in south-central Texas. Pending approval from the NRC, the company says it expects operation of the \$8 billion project to begin in 2015.

WIND FARM Shell WindEnergy Inc., a division of **ROYAL DUTCH SHELL PLC** (RDS), and Luminant Worldwide Corp., a subsidiary of Energy Future Holdings Corp., report that they have plans to start building a 3,000-megawatt wind power plant in the Texas panhandle. That is more than four times the size of the world's largest wind farm, also in Texas, according to the DOE. The two companies say they'll explore using compressed-air energy storage at the wind farm, in which power pumps store air underground for later use in generating electricity. The cost of the project has yet to be determined, report the companies, but the wind farm is expected to have more than 1,000 turbines when complete.

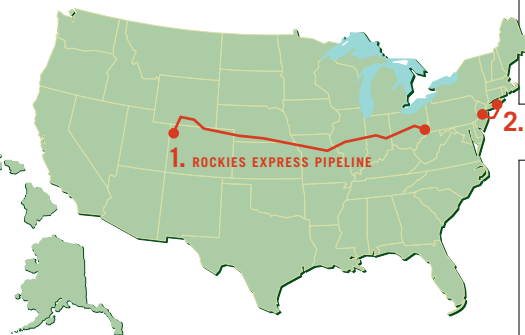
WIND FARM PROJECTS ACCOUNTED FOR ABOUT 35 PERCENT OF ALL NEW POWER-GENERATING CAPACITY ADDED IN THE U.S. IN 2007, ACCORDING TO THE AMERICAN WIND ENERGY ASSOCIATION.



DELIVERING ENERGY

1. ROCKIES EXPRESS PIPELINE

The Rockies Express Pipeline, at 1,679 miles long, is among the largest natural gas pipeline projects in the U.S. in the past 25 years, reports **KINDER MORGAN ENERGY PARTNERS LP** (KMP), which owns half of the project. Sempra Pipelines & Storage, a division of **SEMPRA ENERGY** (SRE), and **CONOCOPHILLIPS** (COP) own the rest. More than 1,000 miles of the 42-inch-diameter pipeline is operational, transporting 1.5 billion cubic feet of natural gas from the Rocky Mountains to markets in the Midwest, says C. Park Shaper, Kinder Morgan's president. The project is expected to be fully operational in late 2009. "Demand for energy products continues to grow in the U.S., and specific to natural gas, the supply sources are shifting," he adds.



2. THE NEPTUNE PROJECT

Since 2007, Long Island residents have tapped into electricity produced miles away by a neighboring 13-state energy grid, explains Siemens Power Transmission & Distribution, the U.S. division of **SIEMENS AG** (SI) Energy Sector, which led the \$600 million project that provided customers direct access to the grid. The company says the technology converts traditional alternating current into direct current power, which better allows point-to-point transmissions of bulk electricity over long distances. After traveling 65 miles through underwater cables to a converter station, the electricity is changed back into AC power. The connection can deliver electricity to more than half a million homes, Siemens reports. A similar project, Trans Bay Cable, will transmit energy from the San Francisco East Bay area via a new 53-mile undersea energy highway to a Pacific Gas and Electric Co. substation by 2010.