Biomass-to-energy facilities are rapidly becoming part of the quest for economical, sustainable energy. Designed to burn materials such as waste wood, nut hulls, fruit pits or corn and wheat stalks, biomass facilities can reduce landfill needs and lower consumption of coal and natural gas.

Burns & McDonnell is helping clients identify applications where biomass is a viable alternative — and providing detailed studies, funding assistance, design and engineer-procure-construct (EPC) services to bring biomass-to-energy facilities online.
Carbon-Neutral Energy
While biomass-to-energy facilities do release carbon dioxide (CO2) emissions, they use fuel that’s already part of the active carbon cycle. Biomass comes from plants, which take up carbon as they grow. The carbon is returned when the plants decompose — or are burned as a power source.

For this reason, biomass systems are sometimes referred to as “carbon neutral.” The carbon energy stored deep underground in fossil fuels, such as coal and gas, is not part of the active cycle. When we burn these fuels, the released carbon is added to the active cycle. Biomass facilities are eligible for renewable energy tax credits, as outlined in the American Recovery and Reinvestment Act (ARRA).

Compared to other renewable energy technologies, biomass-to-energy facilities have certain advantages. They have a smaller footprint than solar fields. And unlike the wind, biomass provides a constant energy source. In many cases, existing facilities can be converted to burn biomass, saving capital costs on ancillary systems.

Food Processors a Natural Fit
The U.S. Department of Energy (DOE) has identified the food processing industry as a promising area for development of biomass technology. Burns & McDonnell is providing EPC services for an innovative biomass boiler demonstration project funded in part by the DOE.

The project involves a 60,000 pounds-per-hour steam boiler designed to significantly reduce the amount of natural gas consumed for steam production at a Frito-Lay processing facility in Topeka, Kan. The biomass boiler will use pre-chipped waste wood as fuel, including green wood and pallets.

According to the DOE, industrial boilers in the U.S. food manufacturing sector consume 237 trillion British thermal units (Btu) of natural gas each year. The DOE estimates that up to 20 percent of these boilers can be replaced by biomass technology.

Funding Assistance
“We helped secure DOE funding to support Frito-Lay’s application of biomass technology,” says Rod Schwass, a Burns & McDonnell project manager who assists clients in applying for federal and state incentive funding. “Burns & McDonnell is helping Frito-Lay administer the grant, including meeting reporting requirements for the pilot study.”

The pilot study will analyze 18 months of the Topeka facility’s biomass boiler operation in terms of effectiveness in meeting process needs, efficiency and emissions. Research is also being performed to assess alternative biomass boiler technology and the use of additional renewable fuel sources, including on-site food processing waste streams. Design of the project explored issues related to boiler sizing and integration of process and controls systems — with an eye toward wider application in the food processing industry.

Since 2001, Burns & McDonnell has brought more than $160 million in federal grants, cost-share funding and tax credits to clients’ energy projects, including combined heat and power (CHP) and renewable energy projects. In 2009 alone, Burns & McDonnell secured more than $30 million in ARRA funding for multiple innovative energy-efficiency projects.

Burns & McDonnell is providing EPC services for a 60,000 pounds-per-hour biomass steam boiler at a Frito-Lay processing facility in Topeka, Kan.
Environmentally Responsible, Economically Sound

The Topeka biomass project is part of a larger sustainability initiative flowing from management at Frito-Lay parent company PepsiCo. While much of the food industry’s interest in biomass energy is driven by government programs, customer demand and competitive pressure, the combination of reduced landfill costs and natural gas savings could make biomass facilities an economical choice for many food processors.

“The return on investment for biomass depends on the variability of the oil and gas markets,” says Burns & McDonnell project manager Dave Knapp, who is EPC manager for the biomass project at Frito-Lay’s Topeka facility. “I don’t think anyone expects natural gas prices to stay down.”

With the ability to meet electrical, thermal and process-steam needs, integrated CHP systems are particularly suited to use of large-scale biomass boilers. Burns & McDonnell is performing a feasibility study for a regional utility to examine the suitability of a 250,000 pounds-per-hour biomass boiler as part of a CHP system providing steam and electricity to several large industrial clients.

Seeing the Light: Solar Power Gains Momentum

Solar power, once considered experimental — or at least impractical for large-scale deployment — is becoming mainstream, helped by falling prices for components of photovoltaic systems, tax credits and development of new solar technologies. According to The Wall Street Journal, solar energy production in the United States nearly doubled between 2008 and 2009.

As owner’s engineer for Sempra Energy, Burns & McDonnell provided technical and construction-phase services for a 10-megawatt (MW) photovoltaic installation next to an existing power plant near Boulder City, Nev. The project was accelerated to enable eligibility for tax credits that were scheduled to expire.

“Utilities have embraced photovoltaics,” says Burns & McDonnell project manager Matt Brinkman. “What we’ve seen in the utility market is a lot of regulatory uncertainty related to coal-fired plants. Permitting uncertainty coupled with the Yucca Mountain debacle have impacted plans for nuclear. Those factors, along with renewable power standards, have fueled an interest in solar and other renewables.”

Photovoltaic systems can use monocrystalline, polycrystalline or thin-film technologies on fixed or tracking-mounted systems. Burns & McDonnell engineers help clients model the energy production and corresponding cost and benefits of each. They’ve also helped clients explore concentrating solar-trough technology, which uses the sun’s heat to create steam for power production, rather than converting light itself to electrical energy.

“Because of the steam-cycle equipment and supporting infrastructure needed, solar thermal systems are cost-effective at 50 MW,” Brinkman says. “Utility-scale photovoltaic systems are typically installed in 1 MW increments. Their modular nature is an advantage in sizing the photovoltaic system to meet project financing constraints.”

Solar Installations for End Users

Installation of photovoltaic systems under 1 MW for industrial and even residential end-users is also snowballing.

Burns & McDonnell project engineer John Bothof helps industrial clients deploy roof-mounted or building-integrated photovoltaic systems. “We calculate the power output and costs, help them choose technology and perform design,” Bothof says. “We recently put together a large study for Ameren Energy to help it educate itself as a corporation and educate the public about the potential of photovoltaic arrays.”

As part of the study, Burns & McDonnell is helping Ameren place five types of photovoltaic arrays at Ameren headquarters in St. Louis. The utility has since installed photovoltaics at area schools. It also offers net metering, which allows system owners to sell excess power transferred to the grid. “In Missouri, systems under 25 kilowatts (kW) can reach payback in less than 10 years,” Bothof says. “And there are new rebates in Missouri for systems 25 kW and lower.”
Popular Support
Biomass boilers and biomass power generation facilities are subject to the same permitting requirements as traditionally fueled facilities — but the going can be a little easier.

Burns & McDonnell is assisting Oglethorpe Power Cooperative in Atlanta with environmental document preparation and permitting of a 100-megawatt (MW) electrical generating facility to be fueled by a woody biomass mixture. The plant will be a steam-electric generating station using conventional steam turbine technology, firing fuel to include processed roundwood, primary manufacturing residue and forest residue. The plants will be designed to allow for the co-firing of other types of biomass, such as pecan hulls and peanut shells.

“We held a public-involvement meeting at a possible site for the project,” says Burns & McDonnell permitting specialist Greg Knauer. “There was a lot of public support.”

Location, Location
It’s hoped that biomass-to-energy facilities will become widespread — but understanding the technology’s limitations is important. Biomass facilities must be located near a suitable source of fuel in sufficient quantities. Hauling biomass materials in gas- or diesel-powered trucks can quickly negate their economic and environmental advantage.

“We see biomass as a high-potential application for regional uses,” says Chris Bowman, a development engineer in the Burns & McDonnell Energy Group. “You typically need a sustainable, renewable fuel supply within a 50- to 75-mile radius for a biomass plant to be economical.”

Co-Firing Possibilities
When a power-generation facility doesn’t have sufficient biomass to meet its fuel needs within a 75-mile radius, it can still offset a portion of its fossil-fuel consumption with the use of biomass by co-firing biomass along with a traditional fuel such as coal.

Burns & McDonnell provided development assistance, conceptual engineering and permitting services to Old Dominion Electric Cooperative for a biomass co-firing system at the cooperative’s Cypress Creek project in Virginia. At Cypress Creek, two 750-MW coal boilers will burn woody biomass as 2 percent of their fuel requirements, using all the woody biomass determined to be available.

Legislative Uncertainty
Like wind and solar power, co-fired biomass and biomass facilities can help utilities meet state renewable portfolio standards. Enacted in all but a few states, these standards — also known as alternative energy standards — typically require a certain percentage of power to be generated using renewable energy technologies, often by the year 2020.

Despite available tax credits, uncertainty created by lack of a federal renewable energy standard and delay of a widely anticipated energy bill regulating CO2 emissions is holding some utilities back from committing to biomass conversions. But others are leading the way, in anticipation of a future that will likely require adding renewable energy to the mix of power generation sources by any means possible.

For more information, contact Robert Healy, 816-823-7102.

Riding on the Wind:
Incentives Driving Development
Rural areas in America’s Midwest, Northwest and other regions are sprouting a bumper crop of wind turbines. The American Wind Energy Association (AWEA) reports that U.S. wind power has increased by 39 percent each year for the past five years.

Burns & McDonnell is providing project development, engineering design and construction-phase services for Puget Sound Energy’s Lower Snake River Wind Energy Project in southeast Washington State. Now under construction, phase one of the project will generate enough electricity for more than 100,000 homes.

“There are 3 gigawatts of wind power under construction right now,” says Robert Healy, senior manager of renewables at Burns & McDonnell. “People are trying to complete projects by 2012 to take advantage of the current incentives.”

Wind power producers can choose between a 10-year production tax credit of 2.1 cents per kilowatt-hour or a 30 percent investment tax credit for facilities coming online by the end of 2010. If construction begins in 2010, as defined in the ARRA, the credit is available for facilities coming online through the end of 2012.

“The public is largely supportive of wind farms,” Healy says. “The question is how to get the power from the windy areas to the major load centers. Transmission system capacity and system constraints are now the major issues for wind development.”

Lacking coordinated investment in the transmission grid, wind power could be at risk of becoming too much of a good thing.