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**GEMI Quick Guide CASE STUDIES:
Renewable and Alternative Energy**

ABOUT THE CASE STUDIES FOR THE GEMI QUICK GUIDE ON RENEWABLE AND ALTERNATIVE ENERGY

GEMI members provided the enclosed mini-case studies to share with readers' unique attributes that made their renewable and alternative energy technology project and strategy successful as well as those that presented challenges.

*The **GEMI Quick Guide on Renewable and Alternative Energy** is designed to provide insight into how corporations assess and implement renewable and alternative energy technologies. The guide is designed to help companies at any level of implementation and, in addition, may be helpful to companies evaluating their renewable and alternative energy options. The information and case studies provided in this guide are designed to help define a strategy that makes sense for a company. In addition, this guide may be helpful to the broader sustainability community.*

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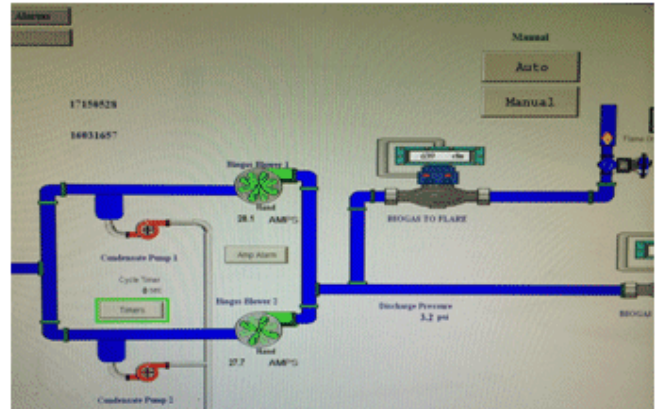
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Case Study: Smithfield Foods, Inc. – Biogas Recovery

Smithfield Foods, Inc. implemented biogas recovery and used biogas as a fuel source in two 700 HP boilers at its Tar Heel Facility in North Carolina. The system typically reduces the facility's natural gas use by 10 percent. The project has added benefits:

- Combusting the biogas, as opposed to venting it to the atmosphere, reduces the facility's carbon emissions.
- Covering anaerobic digesters and capturing biogas for energy recovery reduces odors.
- Storm water intrusion from covered anaerobic lagoons provides wastewater treatment savings.

The system includes a synthetically lined and covered anaerobic basin with gas collection piping, blowers, condensate system, gas pipeline, flare and dedicated biogas fuel trains for the boilers. The boilers also operate using natural gas. This technology has been in use at the Tar Heel facility since the 1990s.



Images and Source: Smithfield-Farmland Tar Heel, NC Covered Anaerobic Digester. Smithfield-Farmland Tar Heel, NC Biogas System diagram from SCADA

Case Study: Procter & Gamble – Biomass Burner

Procter & Gamble (P&G) has a successful biomass burner at its Albany plant in Georgia. The plant is located in an excellent region for both woody wastes and agricultural residues. P&G direct fires pecan hulls, peanut shells, pallet scraps, sawdust, and other forestry residues, procured from several local companies, in a stoker-type boiler. The plant uses the steam that is produced from the biomass burner for the manufacturing of paper products. The biomass boiler has been in place since the 1980s and delivers strong cost savings when compared to natural gas combustion.



Image: Procter & Gamble's largest renewable energy installation is a biomass boiler in Albany, Georgia.

Source:

http://www.pg.com/en_US/sustainability/environmental_sustainability/renewable_resources/renewable_energy.shtml



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Case Study: Perdue Farms, Inc. – Solar Installation Partnership

Perdue Farms, Inc. partnered with a utility and a solar integrator in 2011 to develop two solar projects at its corporate offices in Salisbury, Maryland (1.3 MW) and a feed mill in Bridgeville, Delaware (1.6 MW). Perdue entered into a power purchase agreement (PPA) where it provided land, and third parties financed, installed, and maintained the project. Perdue purchases all power. In addition to being financially beneficial and providing a strong price risk management tool, Perdue views the projects as a key part of their overall renewable portfolio and sustainability initiatives. The projects also contribute to a compelling and visible corporate message regarding its commitment to renewable fuels.



Images: Perdue Farm, Inc.'s corporate headquarters in Salisbury, MD; Perdue's Bridgeville, Delaware grain facility and feed mill
Source: www.beckermorgan.com/project/perdue-solar/; photograph taken by James Whitaker, Energy Procurement and Risk Management Director, Perdue Farms, Inc.

Case Study: BNSF Railway – Solar Array

The BNSF Railway Stockton Solar Array is located in Stockton, CA on land owned by BNSF Railway. The solar array was placed in service September 2013. It is an 800 kilowatt (kW) ground-mounted solar system that includes more than 3,330 photovoltaic (PV) solar panels covering approximately 3 acres. BNSF Railway's Stockton energy use is 1.8 million kilowatt-hours (kwh) annually, with 75% of this energy used at night. The energy generated from the solar array is estimated at 1.3 million kwh annually. Net metering and variable pricing optimize BNSF's financial returns, with surplus energy generated by the solar array during the day sold at premium rates, and lower cost energy purchased from the grid at night.



Image and Source: BNSF Railway Stockton Solar Array is located in Stockton, CA



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Case Study: Procter & Gamble Deep – Geothermal Well

Procter & Gamble (P&G) has a successful deep geothermal well at its Xiqing, China plant. The project was considered relatively low risk due to numerous existing geothermal wells that were already used for winter heating. A well at a depth of 3,000 meters extracts 80 degrees Celsius water which is run through a heat exchanger and used for heating process water, including boiler make up and building heating lines. The cooled geothermal fluid is then returned to the reservoir through a nearby injection well.



Image: Drilling a geothermal well in 2012 at the Procter & Gamble plant in Xiqing China
Source: Procter & Gamble

Case Study: FedEx – Fleet Portfolio

For more than a decade, FedEx has evaluated the right vehicle portfolio for each of its operating companies. In doing this, the company follows a three-tiered approach to improve vehicle fuel efficiency – Reduce, Replace, and Revolutionize - which allows it to help develop vehicle technologies while making the best use of the conventional vehicles.



Image: FedEx plugged is an all-electric pickup and delivery van.
Source: www.invencity.org/97/ March 2, 2014

- Reduce – optimizing routes and driving more efficiently to reduce miles on the road and vehicle emissions.
- Replace – upgrading the vehicle fleet with more efficient, advanced technology diesel vehicles.
- Revolutionize – utilizing alternative fuel vehicles, investing in the development of cleaner technologies and advocating for fuel-efficiency and greenhouse gas standards.

The Revolutionize component allows the company to engage in a variety of cross-sector and public-private collaborations to identify and pilot new technologies to improve fuel efficiency. In the past, FedEx has worked with the Environmental Defense Fund to engineer the first commercially-viable hybrid-electric vehicles for

company and commercial use. This led to FedEx calling for the first-ever fuel efficiency and greenhouse gas standards for conventional commercial vehicles in the U.S. and subsequently, the passing of the Energy Independence and Security Act of 2007, which legislated fuel efficiency and greenhouse gas regulations for medium- and heavy-duty vehicles.

Today, the company is working with manufacturers to further advance the industry. Beyond vehicle testing, technological innovations include making hybrid and electric drivetrains more affordable and scalable, improving the fuel economy of conventional internal-combustion-engine vehicles and developing an infrastructure for vehicle electrification. Pilot programs include liquefied natural gas Class 8 trucks at FedEx Freight, hydraulic hybrid pick-up and delivery vehicles at FedEx Ground, and hydrogen fuel-cell baggage tow tractors at FedEx Express, along with other projects and technologies.



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Case Study: Union Pacific – Long-term Fueling Options

Union Pacific has always looked for the best approach to long-term fueling options because fuel is a substantial portion of operating expenses. This effort included alternative energy long before it became a mainstream topic. Union Pacific is the only major railroad worldwide with extensive gas turbine experience, kicking off a project for gas turbine-electric locomotives as far back as 1952.



Image and Source: Union Pacific diesel hybrid-switch locomotive

In 2002, Union Pacific tested the world's first diesel-battery, hybrid-switch locomotive, and in 2005 Union Pacific acquired its first Green Goat. Similar in concept to a hybrid automobile, which relies on both a gasoline engine and a battery-powered electric motor, the Green Goat depended entirely on its small diesel-powered engine to charge onboard storage batteries. Funding purchases on its own and in collaboration with governmental agencies, Union Pacific brought 21 Green Goat locomotives on property in California and Texas. After more than a decade of testing and use, Union Pacific discontinued operation of the Green Goat due to reliability

issues. Even so, the company sees Green Goats as another valuable building block to finding the optimal fuel

mix for emissions and operational performance. Knowing that each fuel has a different impact on various emissions, Union Pacific anticipates a combination of fuels and technologies will power tomorrow's railroad.

Case Study: Procter & Gamble – Wind Turbine

In 2011, Procter & Gamble (P&G) installed its first wind turbine at a P&G Petcare place in Coevorden, Netherlands. P&G owns the 2.1 megawatt hour turbine and installed it on company land. The project had an internal rate of return that met P&G internal hurdles for capital spending. The electricity is sold to the grid to take advantage of the local feed-in tariff incentive. RECs are repurchased so the plant continues to own the environmental attributes.



Image: Procter & Gamble wind mill installed at the Coevorden plant in the Netherlands

Source:

http://www.pg.com/en_US/sustainability/environmental_sustainability/renewable_resources/renewable_energy.shtml



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ABOUT GEMI

GEMI is a global leader in developing insights and creating environmental sustainability solutions for business. Since 1990, GEMI has captured the vision and experience of global corporate environmental, health and safety (EHS) and sustainability leaders from diverse business sectors through the development of a wide range of 30+ publicly-available, solutions-based tools and Quick Guides designed to help companies and organizations to improve the environment, their operations and add business value. Topics of these tools and GEMI activities focus on renewable energy, alternative energy, climate change, sustainable development, supply chain, water sustainability, environmental management systems, and more.

Through the collaborative efforts of its members, GEMI also promotes a worldwide business ethic for EHS management and sustainable development through example and leadership. GEMI is unique in that it provides a way for companies in a wide range of industrial sectors to work together in a cost effective manner. Members address strategic and tactical issues impacting progressive corporate environmental, health and safety activities in their companies around the world.

The guidance included in this document is based on the professional judgment of the individual collaborators listed in the acknowledgements. The ideas in this document are those of the individual collaborators and not necessarily their organizations. Neither GEMI nor its consultants are responsible for any form of damage that may result from the application of the guidance contained in this document. This document has been produced by the Global Environmental Management Initiative (GEMI) and is solely the property of the organization. This document may not be reproduced nor translated without the express written permission of GEMI, except for use by member companies or for strictly educational purposes.

The **GEMI Solution Tools Matrix™** is an interactive, web solution for users around the world to access the +30 publicly-available, solutions-based tools designed to help companies & organizations in their own pursuit of EHS and sustainability excellence to improve the environment, their operations and add business value. The Matrix guides users around GEMI's diverse portfolio of solutions-based tools that the organization has developed since 1990.



FOR MORE INFORMATION

GEMI mission is Business Helping Business Achieve Environmental Sustainability Excellence. If you would like more information about this Quick Guide, or if you have any questions or suggestions for this guide or future guides, please contact info@gemi.org.

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