

Economic Developer's

GUIDE TO THE RENEWABLE ENERGY INDUSTRIES Vol 4 | Spring 2010

THE GREEN
ECONOMY IS
HUNGRY

NOT
RARE IN
NORTH
CAROLINA

EDITOR'S NOTE

In the *Economic Developer's Guide to the Renewable Energy Industries Volume 4*, we dig deep into the green economy to find opportunities that are truly unique to North Carolina.

The first of two feature stories in this issue presents natural resources of North Carolina which are found nowhere else in the world. The preservation of these mysterious and wonderful carnivorous plants, and their nearly extinct Canidae counterparts is being facilitated with investments made possible by the rapidly growing voluntary carbon markets.

An avoided conversion project adjacent to the Alligator River National Wildlife Refuge will sequester carbon dioxide for the next century or more, preventing farmland and development from encroaching the habitat of the world's only wild population of the Red Wolf. A landfill gas project funded partially by a carbon market investment will support a biotechnology business incubator - the first tenant of which will likely propagate the Venus fly trap in an effort to reduce the illegal poaching that threatens the world's only wild populations of this well-known carnivorous plant.

The second feature article travels back a century to explore the mining roots of the state's rare earth and lithium ore extraction industries. Monazite, a rare earth element-rich mineral containing Cerium, Lanthanum, and Neodymium, was last mined in North Carolina during the early 1900s. At the time, Monazite placers were highly valued for the energy applications of thorium, a radioactive element used as the filament in gaslights. Today, surging lithium demand is driving economic development in the King's Mountain area, home to about 80% of domestic lithium reserves.

This issue features an expanded news section, and some new twists on the regular industry pages, including an overview of high technology's role in energy and an expanded section on travel and transportation. Also unique to this volume is a special focus paid throughout to the expanding influence of China and India on renewable energy markets and technology development.

NORTH CAROLINA Economic Developer's GUIDE TO THE RENEWABLE ENERGY INDUSTRIES

ISSN 2155-7292 (Print), ISSN 2155-7306 (Online)

Published by the Appalachian Energy Center,
Appalachian State University



Jason W. Hoyle, Editor

John Lehman, Contributing Writer

Galen Monahan, Staff Writer

Joey Mosteller, Staff

Darin Webb, Staff

For their comments, thoughts, and time reviewing and revising, additional mention is due to Dr. Jeff Ramsdell, Bruce Davis, and Stan Steury.

Also, this issue would not have been possible without the contributions of photographic images from Skip Pudney, John Ennis, FLS Energies, Consert Inc., Cree Inc., and others.

PDF version available at:
www.energy.appstate.edu/econdev/

About

This document is produced by the Appalachian State University Energy Center with funding provided by the State Energy Office, North Carolina Department of Commerce. However, any opinions, findings, conclusions, recommendations, or errors herein are those of the author and do not necessarily reflect the view of the State Energy Office, the North Carolina Department of Commerce, or Appalachian State University. This public document was printed at a cost of \$3,365 for 5,000 copies at \$0.673 per copy.

CONTENTS

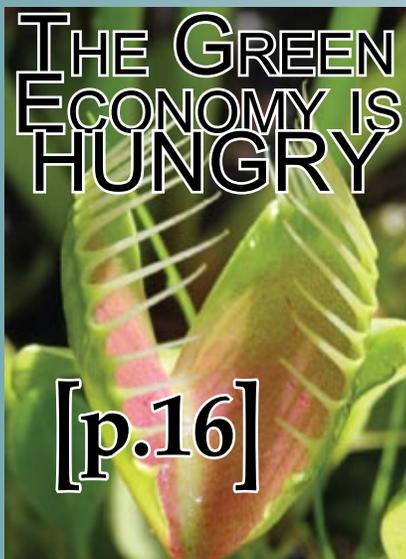
Competing for the Green.....	4
News & Headlines.....	6
Policy Matters.....	10
Green Power	13
Greenhouse Gas Rules.....	14
Sustainability & Competitiveness.....	15

TECHNOLOGY

High-Tech & Energy	22
Travel & Transportation.....	24
Energy Efficiency.....	26
Solar Energy.....	27
Wind Energy.....	28

SPECIAL FEATURES

NC-RETS.....	12
Smart Grid.....	10
State Funding Map.....	30



The “jaws” of the Venus flytrap clamp down on unsuspecting insects when movement activates the carnivorous plant’s hair trigger. Native only to the area surrounding Wilmington, these rare and unique plants are threatened by illegal poaching and habitat loss.

Supported by a carbon market investment in the local landfill gas project, an entrepreneur graduate of the BioNet program at Southeastern Community College will have access to low-cost energy and greenhouse facilities in which to start a business propagating these plants using tissue cultures to help curtail illegal wild poaching.

NOT RARE IN NORTH CAROLINA

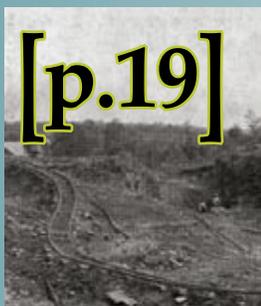


Image from Durwood Barbour Collection of North Carolina Postcards at UNC-Chapel Hill

North Carolina has, at some point during the past century, led the world in production of rare earth metals, lithium, and high-purity silicon (as quartz). Today, demand for these elements and minerals has been re-invigorated by their use in green energy technologies.

ASIA AWAKENS

The emerging economic powerhouses of Asia - India and China - receive special attention throughout this issue for both their new clean energy leadership as well as their massive market potential.



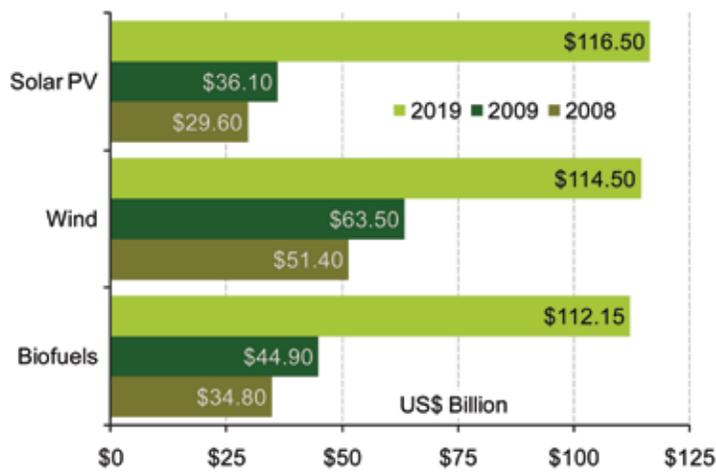
COMPETING FOR THE GREEN

Green has become the undisputed king of buzzwords. The “green” concept has been applied virtually everywhere. As a concept, the widespread characterization of greening is not incorrect – there are very few, if any, areas of the modern global economy where natural resources could not be used more productively or where pollution intensity could not be reduced.

With the massive global move towards a greener path, going green itself no longer instills the advantage it once did. Today, targeting green economic opportunities is a necessity for any local area seeking to merely maintain its status quo level of competitiveness. The means of increasing local economic competitiveness are the same for the green economy as any other.

The most successful economic areas will still be the ones which optimize the allocation of their limited resources to opportunities which maximize the productive use of local economic resources – capital, raw materials, and labor. Green economy development is less about how the green economy fits a local area than it is about how a local area fits into the green economy.

Clean Energy Global Markets & Projection



Data Source: Clean Edge, Inc. Clean Energy Trends 2009, 2010

Is Green Gold?

According to the Pew Center’s 2009 Clean Energy Economy report, clean jobs in North Carolina increased by 15.3% from 1998 to 2007 – 2.4 times the rate of overall job growth. Globally, clean energy markets have maintained rapid growth rates, even during the economic downturn of the past few years.

Global markets for solar photovoltaic cells, wind and biofuels combined for

a total value of about \$144.5 billion in 2009 – nearly 25% more than in 2008, according to market research firm Clean Edge. Over the next decade, these three clean energy markets are projected to grow about 138% to a projected value of \$343.4 billion by 2019.

One strong indicator for the future potential of a growing clean technology industry is the continued increase of venture capital activity in clean technology companies. Venture capital investments in U.S.-based clean energy companies were over \$2.2 billion in 2009. The percentage of total venture investments that was received by green energy companies has risen from

less than 1% in 2001 to a peak of over 12% in 2009.

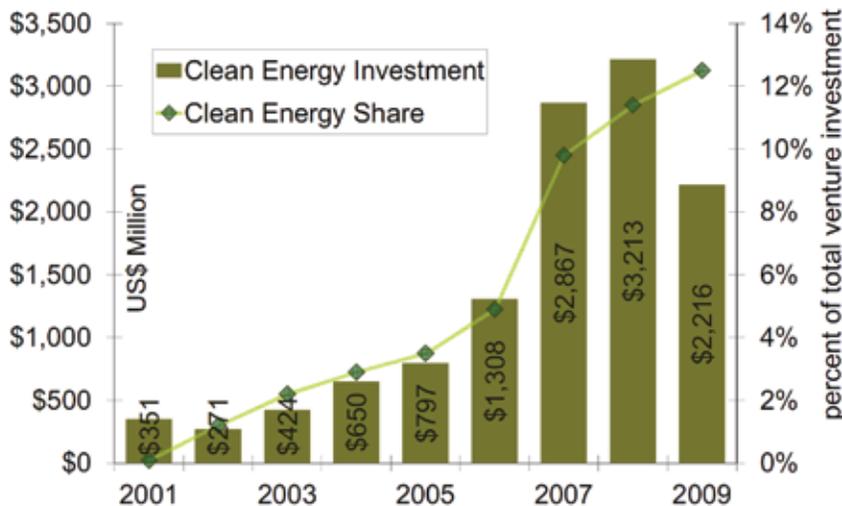
The 2009 North Carolina Renewable Energy and Energy Efficiency Census conducted by the NC Sustainable Energy Association found green energy companies located in every county in the state. In total, respondents to the survey reported 10,250 employees in green energy activities, and more than \$3.5 billion in revenue. Perhaps even more importantly, responding firms anticipated a 36% increase in employment during 2010.

Place-based Value

Clean technology growth is virtually unprecedented on a global scale. Economic opportunities exist to some degree for all industries, all occupations, and all places. As a first step towards understanding how a local area may benefit from green economy opportunities, these opportunities can be grouped into their corresponding economic cluster types: local cluster, natural endowment cluster, or traded cluster.

The portfolio of green economy development options for all places includes strategies that involve one or more of these cluster types. A place rich in wind resources, for example, would naturally consider electricity generated by wind turbines as a potentially exportable product and local driver of job creation – likewise for solar, coal, oil, biomass, or natural

Venture Capital Investment, U.S. Clean Energy Companies



Data Source: Clean Edge, Inc. Clean Energy Trends 2010

gas. Similarly, a place where semiconductor manufacturing industries employed a large concentration of the labor force would naturally turn to solar photovoltaic cell production as a potential source of growth because the pre-existing traded cluster can be leveraged as an advantage.

One strategy available to all places is improving energy efficiency. For existing companies in the traded or natural endowment cluster groups, these activities may improve the competitiveness and profit margins of local facilities, providing stimulus for growth or possibly resistance against losses during an economic downturn. For local cluster businesses and residences, improved energy efficiency means less money is exported from the area for energy, disposable income is increased, and exposure to the risks of future energy price increases or volatility is decreased.

Less obvious, perhaps, is determining how much time, effort and money to invest in a strategy, particularly when that investment comes at the cost of investing in another strategy. Efficiency strategies

for local cluster industries, for example, will provide immediate returns, but will not likely have a significant impact on long-term wealth creation and prosperity in a community. While investments in developing natural resources or increasing activity in traded cluster industries may have far greater long-term returns in the form of new jobs and economic competitiveness, but they will not likely provide much benefit in the near term.

An appropriate portfolio of green economy development strategies for any place is largely dependent on the unique characteristics of the area. What natural endowments are available; in which traded cluster industries is the area currently competitive; how much could be saved from greening local cluster companies? Coupling these green economic demographics with locally driven priorities (e.g. short-term job creation, long-term industry growth, etc.) will point every local economy towards green development strategies that leverage local resources to best meet local needs.



Photo Credit Bill Timmerman and NREL PIX

A Dish Sterling Solar concentrating solar device generates electricity with a Sterling engine by concentrating heat from Arizona's vast solar resource. In addition to using local resources for power, Arizona is using the sun to fuel growth in solar power businesses, creating new jobs and building an economic culture founded on innovation.

ASIA AWAKENS: CHINA & INDIA IN THE GLOBAL MARKET

Special attention is given throughout this issue to the rising economic power of the world's two most populous countries, starting with this background on India's and China's growth and energy outlook.

In mid-2008 the World Bank estimated 36.8% of the world's population was in China and India. The world's most populous countries also have the fastest growing economies – and the fastest growing energy demands.

China has consumed 9.3% more energy each year since 2001, according to the National Bureau of Statistics of China. The country is rapidly increasing its dependence on foreign sources of energy, despite its substantial domestic energy resources. During 2006 and 2007, China imported coal, oil, and liquid natural gas at record levels.

China is already the leading market for many renewable energy technologies. Nearly 1 in 10 households have a solar water heater. The Chinese wind market has become the largest in the world as of 2009, with the Global Wind Energy Council reporting 13 GW of new capacity – about 30% greater than U.S. wind capacity additions. China also leads the world in PV manufacturing and exports the majority of production from their 1.8 peak-GW (GWp) of manufacturing capacity.

While China has several of the fastest growing markets for renewable energy, India likely has the fastest growing need for new sources of energy. The fourth-ranked energy consumer in the world, India, only consumes about a third as much energy per capita as its Asian neighbor, China. Yet, India had a electricity supply deficit equal to 12.3% of peak demand in 2006.

According to the US Commerce Department's Clean Energy Exporter's Guide to India, "Market assessments indicate that India could eventually be the largest renewable market in the world, given its abundance of renewable energy resources." The importance of and opportunity found in Asia's emerging economies is increasingly clear, and renewable energy markets – today, tomorrow, and during the foreseeable future – are no exception.

ECONOMIC CLUSTERS

Local Cluster

The bulk of jobs in most places can be found in the local cluster – industries such as gas stations, home building trades, grocery stores, education, etc., that serve local demand and provide services which typically can't be imported from outside areas.

Natural Endowment Cluster

Rural places especially, benefit economically from industry development related to their natural endowment cluster group. Natural resources such as sunlight, wind, forests, or minerals support local employment and can increase the wealth of an area by providing a source of raw materials for export or value-added processing.

Traded Cluster

Finally, the jobs that typically increase the wealth of a place and for which most communities compete are jobs within the traded cluster group. Traded cluster industries produce goods or services to export, meaning that income earned by these employees often comes from outside the local area.

NEWS & HEADLINES

By: Galen Monahan

PRODUCTION, MANUFACTURING & BUSINESS INVESTMENTS

BUEHLER MOTOR OPENS NORTH AMERICAN HEADQUARTERS

October 2009 - Germany-based Buehler Motor has established its new North American headquarters and Technology Center in Morrisville, NC. The company has operated in the state since 1969, and designs energy-intensive mechanical and electronic parts, including the coolant pumps for the new Chevy Volt, a plug-in electric vehicle. Buehler is expected to add between 30 and 45 engineering, sales, and R&D jobs during the next three years paying between \$60,000 and \$100,000 per year.

-News & Observer

CREE ANNOUNCES 575 NEW JOBS

October 2009 - Durham-based semiconductor technology company, Cree, Inc., announced plans to increase its staff by more than 50%, adding 575 new jobs. The company was formed to commercialize solid-state semiconductor technology - light-emitting diodes (LEDs) - developed at N.C. State University, and produces highly efficient LED lights and other semiconductor solutions for wireless and power applications.

-News & Observer

DUPONT ANNOUNCES 2ND EXPANSION OF FAYETTEVILLE WORKS FACILITY FOR PV

August 2009 - DuPont expects to add 10 new permanent jobs plus over 200 construction jobs from its second \$50 million-plus expansion in three years at its Fayetteville Works facility where the company manufactures components for photovoltaic (solar) cells. The current facility, which straddles the Bladen-Cumberland County line, employs about 500 people.

The 10 new permanent jobs will pay an average annual wage of \$36,278 - about 40% more than the average wage in Bladen County. The recently announced \$55 million expansion was supported with a \$50,000 grant from the One North Carolina Fund and local incentives.

-News & Observer, NC Dept. of Commerce, and Fayetteville Observer

GREEN BUILDING MATERIALS MANUFACTURER ANNOUNCES 105 NEW JOBS

March 2009 - Foam and Technology Associates Inc. (FASTA), a Virginia-based company, will create 105 new jobs paying an annual average wage nearly 11% more than the average wage in Halifax County. The company will manufacture green building materials and invest \$2.5 million in machinery and equipment. The company received a \$300,000 grant from the One North Carolina Fund, and has been hiring in advance of its planned opening on June 1, 2010.

-Roanoke Rapids Daily Herald, Littleton Observer

PPG GLASS FURNACE RE-OPENS

April 2010 - After being idled by the recession, glass fiber demand driven partly by wind energy markets has prompted the restart of a glass furnace at PPG's Lexington, NC facility.

-Composites Technology

\$8 MILLION INVESTMENT IN NEXTREME

July 2009 - The Durham company Nextreme has obtained \$8 million to increase production and product development over the next 2 years. The company produces thermoelectric products designed to increase both the efficiency and longevity of electronic devices. Their products are designed to help cool devices while also converting heat into electricity.

-News & Observer

\$6.5 MILLION SEMPRIUS INVESTMENT

May 2009 - Durham-based Semprius, Inc. had raised \$6.5 million by mid-2009 with the aim of commercializing their solar photovoltaic technology. The company employs about 20 people in the Durham area, and expects to have their innovative line of concentrating PV technology developed within the next year.

-Triangle Business Journal

\$11 MILLION INVESTMENT FROM SUSTAINABLE TEXTILES GROUP

May 2009 - Sustainable Textiles Group will invest \$11 million into a new facility in China Grove (Rowan County). The plant will produce fabric from pre-consumer textile waste, and is expected to employ 223 people at an average annual wage of \$29,141 over the next two years. The company received a \$300,000 grant from the One North Carolina Fund and local incentives.

-Salisbury Post, Charlotte Business Journal

300 NEW JOBS ANNOUNCED AT BATTERY MAKER

March 2010 - Charlotte-based Celgard LLC has announced 300 new jobs - a 75% in-state employment increase - will be created over the next five years as a result of a \$91 million-investment to expand its Charlotte operation and construct a new manufacturing facility in Concord. The company makes separators for lithium-ion batteries, and in addition to receiving \$49.2 million in federal stimulus money in August 2009, the company may also receive up to \$18.6 million in state and local incentives from the One North Carolina Fund and the Job Development Investment Grant program of North Carolina. The company estimates that these investments will indirectly create about 1,000 new jobs among its contractors and suppliers, and was praised for their investment in renew-

1,240

indirect and construction jobs from announced projects and business expansions

\$304

million dollars of investment announced in projects and new business activity

2,219

direct, permanent jobs from announced projects and business expansions

able energy technologies with a visit from President Obama in April 2010.

-Charlotte Observer, Business Journal, News & Observer, and Celgard Press Release

STATE'S FIRST ETHANOL PRODUCTION PLANT ANNOUNCES OPENING

March 2010 - North Carolina's first fuel ethanol plant had hired 41 workers by February and announced production would start in Spring of 2010. The Dundarrach, NC (Hoke County) plant is expected to produce 60 million gallons per year of ethanol and 175,000 tons of dried grain for animal feed. The facility added 2.5 miles of new rail lines which will enable shipments from both the Norfolk Southern and the CSX lines. About 20% of the corn will be sourced from local farmers, with the remaining 80% shipped via rail and truck.

-Ethanol Producer Magazine

PET RECYCLER ANNOUNCES 100 NEW JOBS AT LARGEST FACILITY ON CONTINENT

May 2009 - Clear Path Recycling LLC announced it would build a plant capable of recycling 5 billion plastic (PET) bottles each year in Cumberland County's industrial park. The company is a joint venture between Charlotte-based DAK Americas LLC and Shaw Industries Group Inc. and will employ an estimated 100 people. Recycled plastic from the facility will be used by DAK and Shaw as raw materials for

their plastic products manufacturing. The facility will be the largest PET recycling facility on the continent, according to a DAK spokesperson.

-Fayetteville Observer

SIEMENS BECOMES CHARLOTTE'S LARGEST MANUFACTURER

April 2010 - Siemens Energy Inc. will invest \$135 million and bring 825 jobs to Charlotte, making it the city's largest manufacturer. The natural gas-turbine factory will bring the total number of Siemens AG (parent company of Siemens Energy) employees in the county to 1,800 within 5 years, and will pay an average annual wage of about \$64,000 - over 30% higher than the county's average wage.

-Business NC

POWERSECURE INTERNATIONAL PURCHASES TWO LED SUBSIDIARIES

April 2010 - PowerSecure International of Wake Forest is buying its way into the LED lighting market with two recently announced acquisitions. PowerSecure paid \$4.4 million for a majority stake in the Morrisville, N.C.-based Innovative Electronic Solutions Lighting and maintains an option to purchase the entire 19-person company for about \$10 million. PowerSecure also announced it had acquired the outstanding interest in its South Carolina-based lighting subsidiary EfficientLights.

-News & Observer

LITHIUM EXPLORATION IN WNC

August 2009 - Rockwood Holdings' lithium company, Chemetall Foote was awarded \$28.4 million in stimulus funds for expanding and upgrading its lithium materials manufacturing facilities, including the company's Kings Mountain, NC facility.

-Chemical Week

INNOVATION

ALGAE HARVESTING PILOT USING SEWAGE TREATMENT PLANT

November 2009 - Alganomics LLC will harvest algae from its pilot plant located at the Oak Island (Brunswick County) sewage treatment plant as proof of concept and validation of the technologies it is using to grow algae as a source of raw material for biofuel. The project is supported in part by a \$59,500 grant from the federal stimulus-supported third round of the North Carolina Green Business Fund.

-Wilmington StarNews

MICROCELL SPINS OFF FIRST HYDROGEN, INC.

March 2010 - Microcell Corp., a development-stage maker of microfiber PEM-type fuel cells founded in North Carolina, announced the creation of First Hydrogen Inc. - a spinoff dedicated to development and commercialization of an innovative hydrogen generation technology. The company anticipates its nano-scale technology will provide safe and cost-

effective distributed hydrogen generation from commonly available, renewable, and non-fossil energy sources.
-Fuel Cell Today

WAKE FOREST UNIVERSITY SOLAR SPINOFF AWARDED PV PATENT

April 2010 - The fiber-based solar cell technology developed at Wake Forest University's Center for Nanotechnology and Molecular Materials was awarded its first patent by the European Patent Office. Spin-off company FiberCell has licensed the patent and technology from the university and will produce plastic solar cells which collect energy from the sun at a much greater range of angles than traditional flat solar technology, potentially doubling the electricity output of standard cells covering the same area.
- Triad Business Journal

\$3.5 MILLION FOR SMART GRID TRAINING AWARDED TO NCSU

April 2010 - With \$3.5 million in federal stimulus grant money, NCSU will create a new engineering master's program for electric power systems. The award was one of 54 smart-grid projects funded by the US Dept. of Energy.
- News & Observer

FIRST OFFSHORE WIND PILOT IN U.S.

October 2009 - A pilot project in the Pamlico Sound which will likely be the nation's first offshore wind turbine installation was announced in late 2009. In partnership with researchers from the University of North Carolina-Chapel Hill, Duke Energy plans to invest \$35 million to install three large-scale wind turbines in the shallow waters of North Carolina's coast.
-Seeking Alpha

NC'S LARGEST WIND TURBINE

November 2009 - A student-funded initiative held the ribbon cutting ceremony for the state's largest wind turbine. The 100 kW turbine is installed on the campus of Appalachian State University.
- Renewable Energy World

COMMUTER RAIL IN CHARLOTTE

November 2009 - Two years after the successful launch of the Charlotte Area Transit System (CATS) 9.6-mile light-rail line at least three new connecting projects are at some stage of planning. CATS may extend light rail 11 miles to the University area at a projected cost of \$1.12 billion. A 25-mile commuter rail line may run north to Davidson no earlier than 2011, at a projected cost of \$375 million. A nearly 100-year-old rail line may be used to connect Gastonia to Charlotte which, according to a recent study, could cost up to \$300 million. And the hub of this mass-transit system is in the works as well, with planning ongoing for the estimated \$100 million multimodal Charlotte Gateway Station that could connect the light rail system with Amtrack and multiple commuter lines.
- Charlotte Business Journal

PROJECTS & INSTALLATIONS

PERSON COUNTY 650kW PV PROJECT

August 2009 - A 650kW solar photovoltaic project was launched in Person County. Electricity produced from the project's 3,420 photovoltaic panels will be purchased by Progress Energy under a 20-year agreement. The \$4 million project will produce enough electricity to power around 60 homes.
-News & Observer

O2ENERGIES ANNOUNCES 21MW IN TWO PV PROJECTS

September 2009 - With the August 2009 announcement of two new solar projects, a former executive with North Carolina-based solar company Sencera unveiled a new NC-based solar business venture, O2energies. The two projects are expected to install a total of 21 mega-Watts of solar electricity generation capacity onto the state's grid, and will likely use Sencera components.
-Charlotte Business Journal

FT. BRAGG OPENS BIOFUELS STATION

February 2010 - A \$1.5 million alternative fuel station offering E-85 and B-20 opened on Fort Bragg in February. The station will serve the post's growing fleet of alternative fuel vehicles, including troop buses, school buses, and diesel-powered forklifts; and through the NC Military Business Center is working to secure in-state biofuel suppliers. The station's building, awning and concrete apron are designed to minimize heating costs by reflecting sunlight, and energy for perimeter lighting is provided by photovoltaic panels mounted on 27-foot poles.
-Fayetteville Observer

2.3MW PV PROJECT IN SCOTLAND COUNTY

August 2009 - A planned 2.3MW solar photovoltaic facility in Laurinburg, NC (Scotland County) is expected to create between 30 and 50 new jobs. The facility is being developed by Progress Energy and MP2 Capital, and at the time of its announcement was the 6th project slated to deliver solar power to Progress Energy customers.
-Triangle Business Journal

VINEYARD GOES SOLAR TO SAVE MONEY

January 2010 - Thin-film solar photovoltaic cell manufacturer Sencera, based in Charlotte, has installed a 10.4kW system at RayLen Vineyards and Winery in Mocksville, NC. The system is expected to save RayLen between 50% and 60% of the cost of its energy bills after including renewable energy incentives. Sencera's thin-film cells use only about 1/600th of the silicon found in more traditional photovoltaic designs, and when installed at the winery occupied an area equal to about 1/20th of an acre.

-WCNC TV, Wines & Vines

HYDROELECTRIC POWER - FROM LAKES?

October 2009 - As early as summer 2010, electricity generated by the small hydroelectric plant at Jordan Lake will power about 1,700 homes. A separate project is being considered for development at Falls Lake by Vermont-based Community Hydro that may involve placing six turbines along the lake bottom and will generate enough power for about 1,200 homes. Progress Energy would buy electricity and RECs from both projects.

-News & Observer

ORBIT ENERGY ANNOUNCES 2ND BIOGAS POWER PLANT

March 2010 - By the end of 2010, Raleigh-based Orbit Energy plans to have their second power plant in operation near the Charlotte airport. The \$12-million facility will use gas from the anaerobic digestion of food and animal waste instead of natural gas to fuel the 3.2-MW plant and intends to sell the power to Duke Energy. Currently, the company has one 1.6 MW facility located in Clinton, NC which will begin generating electricity once a contract is signed with Progress Energy, and has plans to grow nationwide with

the installation of 60 similar facilities over the next decade.

-News & Observer

FLS ENERGY SELLS SOLAR THERMAL CREDITS

October 2009 - Duke Energy and FLS Energy, an Asheville-based solar thermal energy company, have reached an agreement under which Duke will purchase solar thermal credits from FLS for 10 years. Each renewable energy credit represents one mega-Watt worth of solar energy created by FLS-developed solar thermal projects. FLS plans to install over 3,000 solar thermal panels in schools and businesses in North Carolina during the next three years, including installing solar thermal units on dormitories and the dining hall of Mars Hill College

-Charlotte Business Journal

DUKE ENERGY SOLAR INVESTMENT

October 2009 - Duke Energy has announced that it plans to invest about \$50 million for 10 MW of solar electricity capacity - enough to power about 1,300 homes - to be installed this year at sites in Mount Holly, Greensboro, Salisbury, and Charlotte. These sites were chosen because of both their solar generation potential as well as their location on Duke's electricity distribution grid.

-YahooFinance, Renewable Energy World

WOOD BURNING PLAN ANNOUNCED BY PROGRESS ENERGY

November 2009 - Progress Energy has announced its plans to build a wood-burning power plant with a generation capacity between 45 and 75 mega-Watts. The company currently purchases wood-fueled electricity from a 25MW plant in Duplin County.

-News & Observer

3RD ANNIVERSARY OF WORLD FIRST LED CITY®

February 2009 - The City of Raleigh and Durham-based LED maker, Cree Inc., celebrated the 3rd anniversary of Raleigh becoming the world's first LED City®. Raleigh now has over 40 installations of high-efficiency LED lighting in government buildings, on streets, and in parking garages. The city estimates it saves about \$200,000 per year in electricity from its conversion to LEDs.

-Cree Inc. Press Release

STATE REACHES HIGHEST RECORDED UNEMPLOYMENT RATE

March 2010 - February 2010 marked a milestone in the state's economy with 510,774 people unemployed - 11.2%, the highest rate recorded since the current methodology was adopted by the state in 1976. While ominous sounding, the record-high unemployment rate was graced not only by 11,000 more job seekers entering the market, therefore being counted in the unemployment rate, but also by a gain of 2,836 jobs in the state - finally breaking the state's 22-month streak of uninterrupted job losses.

-News & Observer

TWO DUKE ENERGY WIND POWER PROJECTS ONLINE

October 2009 - Duke Energy's 70-MW project in Pennsylvania and its 42-MW project in Wyoming began generating electricity in late 2009. By year-end the company was expected to have about 733 MW of wind energy generation online. That figure could increase to nearly a GW of wind capacity with the completion of the company's 200-MW Top of the World Windpower Project in Wyoming.

-Transmission & Distribution World

POLICY MATTERS

By: John Lehman

Three policy issues have emerged in North Carolina that will receive significant interest in the coming year: feed-in tariffs, smart grid development, and the Renewable Energy Portfolio Standard (REPS).

With feed-in tariffs generating widespread interest nationwide, the question of whether such a program could be implemented in North Carolina is beginning to be asked more earnestly. Reporting requirements and information exchange related to smart grid deployment has prompted the North Carolina Utilities Commission (NCUC) to propose that utilities file a “smart grid technology plan.” And finally, as the state’s Renewable Energy Portfolio Standard enters the first compliance year, significant uncertainty surrounds some of the REPS’s most innovative requirements – set-asides for energy from poultry and swine wastes.

Smart Grid Resource Planning

Hoping to increase the exchange of information about the effects of smart grid technology on electricity demand, time of use and other factors, the NCUC determined that utilities should file a “smart grid technology plan,” as part of its biennial resource plans. The utilities have resisted submitting such plans and have instead offered a counterproposal that would seek to report primarily on just the “impacts” of their technological smart grid deployment.

Specifically, the utilities sought to remove requirements that they should report on how they would “provide real-time interactive technologies that optimize operation of customer-owned devices and appliances,” and what control options would be offered to customers. The counterproposal offered by the utilities is currently under consideration by the Commission.

Feed-In Tariff

In March 2009, Gainesville, FL became the first U.S. city to offer a feed-in tariff program to attract renewable energy development. The program, which has since been developed in Sacramento, CA, Washington State and Vermont, was implemented through the Gainesville Regional Utility and sought to increase solar electricity generation by offering subsidy payments to offset the higher cost of new technology, such as photovoltaic (PV) cells. In Europe, Germany in particular, feed-in tariff policy has been attributed to significant renewable energy deployment. With financing concerns for renewable energy projects in the wake of last year’s economic crisis, feed-in tariffs could be poised for a strong uptick.

While several groups in North Carolina, such as the North Carolina Sustainable Energy Association (NCSEA) and the Appalachian State University Energy Center are investigating feed-in tariff options for North Carolina, some of the roadblocks to development of feed-in tariffs were

SMART GRID PILOT PROJECT SHOWS PROMISE IN FAYETTEVILLE

A smart grid pilot project resulted in a 20% decline in average electricity consumption for the 100 Fayetteville residents and businesses that participated. The project was a joint effort between Raleigh-based Consert Inc. and IBM undertaken in the electricity service area of the Fayetteville Public Works Commission (PWC).

The project utilized controllers on water heaters, air conditioners and pool pumps that were configured to exchange information wirelessly with the electricity grid. Consert’s smart grid equipment provided real-time electricity consumption data to the PWC, and allowed electricity customers to pre-set connected devices so that electricity consumption and cost were minimized without sacrificing comfort or performance.

Smart grid technology not only reduces electricity consumption and cost; by communicating energy consumption data from large demand loads back to the power provider, the PWC was able to identify the least energy-efficient buildings and plumbing in the pilot group. So, Fayetteville’s PWC smart grid program not only produces substantial savings from reduced electricity demand and reductions in peak demand, but now the utility also has the information necessary to develop efficiency programs targeted to customers for whom increased efficiency would be of the greatest benefit.



Image courtesy of Consert, Inc.

A smart-grid technology installation by Consert, Inc. that enables the homeowner to pre-set operational controls for the heat pump.

outlined in the 2009 NREL publication, “Renewable Energy Prices in State-Level Feed-in Tariffs: Federal Law Constraints and Possible Solutions.” Essentially, the report clarifies that feed-in tariffs are legal at both the municipal and state levels; however there is still a fairly intricate legal maze through which they must navigate.

States and municipalities may offer feed-in tariffs under the Public Utility Regulatory Policies Act of 1978 (PURPA) which requires that utilities must offer qualifying facilities (QFs) payments equal to each utility’s “avoided cost.” Payments in amounts greater than the avoided cost can only be made for renewable energy credits, cash grants, production-based incentives, or with a tax credit of equivalent value.

Other options may become available pending action by the Federal Energy Regulatory Commission (FERC), or if the U.S. Congress amends PURPA or the Federal Power Act of 1935 (FPA).

Renewable Energy & Energy Efficiency Portfolio Standard (REPS)

Electric power suppliers must submit their annual REPS compliance plan by September 1 of this year, including their compliance with the mandated solar set-aside (0.02% of 2009 retail sales). By 2012, the required set-asides for poultry and swine waste energy use will be in effect. However, a joint motion from electric utilities filed with the NCUC in

August 2009 questioned whether compliance with set-asides for swine and poultry waste-fueled energy was realistic.

Progress Energy Carolinas, Duke Energy Carolinas, Dominion North Carolina Power, North Carolina Electric Membership Corporation, North Carolina Eastern Municipal Power Agency and the North Carolina Municipal Power Agency filed a joint motion seeking modification of poultry and swine waste set-aside requirements as well as clarification on each electricity provider’s obligations.

Three basic issues outlined in the joint motion are:

1. Set-asides requiring energy from swine and poultry waste were established for total statewide retail electricity sales and do not specify the portion of the set-aside for which each utility is responsible. The requirement for energy from poultry waste, in particular, is challenging in this regard as it specifies a fixed quantity of electricity, instead of a percentage of retail sales as found in the other set-asides. Swine waste energy requirements (a percentage of retail sales) may also present a longer-term problem, because the number of swine in the state would have to increase in proportion to retail electricity sales growth.

2. A more fundamental issue cited in the utilities’ joint motion is that “there are no entities currently offering to deliver material amounts of renewable energy from swine waste.”

3. Perhaps even worse than having no willing suppliers of swine waste energy is having only one supplier offering poultry waste energy. According to the joint motion, “there

SMART, AS IN INTELLIGENT?

Compared to tomorrow’s “Smart Grid,” today’s electrical grid is about as adjustable as an old-fashioned light switch. Tomorrow, remote controls will not only switch on and off the light, they will also offer dimmers, timers, and real-time cost data.

According to the US Dept. of Energy’s Smart Grid Primer, the smart grid decentralizes power supply and control, enables power to flow into the grid as easily as out of it, and provides a two-way flow of information to enable interactive decision making by all parties connected by the grid.

Smart grid technology creates the intelligence and capability to optimize reliability, security, economics, efficiency, environment, and safety. However, even though the electrical grid has information, it will never operate with more intelligence than the people who control it provide.

“Information, Innovation and Integration will rule the industry.”

- National Energy Technology Laboratory, 2030 Distributed Electricity Environment

SMART GRID: KEY TECHNOLOGY AREAS

1. **Integrated Communications:** make the electric grid dynamic and interactive with high-speed, two-way communications;
2. **Advanced Components:** increase efficiency of the electrical grid by actively improving the way the grid functions;
3. **Advanced Control Methods:** improve event response, enable rapid diagnostics and facilitate market pricing and enhanced asset management;
4. **Sensing and Measurement:** technologies increase available power system data and its conversion to information, enabling equipment monitoring and consumer choice and demand response;
5. **Improved Interfaces and Decision Support:** enables interaction with real-time grid data, supporting both power system operators as well as consumers.

- Source: *Compendium of Smart Grid Technologies*, National Energy Technology Lab

was only one entity offering to deliver material amounts of renewable energy from poultry waste,” and that entity dealt only with the two largest investor-owned utilities. According to the joint motion, the lone source of poultry waste energy – Fibrowatt, Inc. - offered electricity at a price that would consume a significant portion of the REPS cost cap, insisted on a 25-year power supply agreement, and sought contract provisions allowing the company to increase the wholesale price if electricity generation costs were higher than planned.

Hearings, comments, and negotiations continued from August well into the winter. As of early December 2009, the NCUC granted an extension of time for negotiations with Fibrowatt. The issue of allocating set asides for swine waste energy appeared to be nearly concluded in late January 2010 when an agreement for a pro rata allocation of the aggregate swine waste obligation and a shared request for swine waste generation were filed with the NCUC.

Policy References & Information

Renewable Energy and Energy Efficiency Portfolio Standard:
NCPUC Docket E-100 Sub 113

NC-Renewable Energy Tracking System (NC-RETS):
NCPUC Docket E-100 Sub 121

Net Metering: NCPUC Docket E-100 Sub 83

NC Public Utilities Commission: www.ncuc.net

NC-RETS: www.ncrets.org

North American Renewables Registry:
<http://narenewables.apx.com>

CASHING IN ON CLUNKERS

When the innovative “Cash for Clunkers” program came to a halt at the end of August 2009, it was widely perceived as a success in the media and by politicians who championed and supported the program. Driving the optimistic perception was the wild foray of consumers who stormed dealer showrooms and used government vouchers so quickly that the program had to be halted mid-stream, so that legislators could find more money to fund the program.

60% increase in fuel economy (miles per gallon) for new vehicles purchase versus those for which they were traded

8 number of years since consumer spending increased by 1.3% in a single month as it did during Cash for Clunkers

Nationwide, over 690,000 vouchers for “clunkers” were submitted by dealers, worth about \$2.88 billion. About 18,850 vouchers – 2.73% of the national total, worth about \$78.6 million – were submitted from North Carolina, and represented an increase in statewide consumer spending of approximately \$465 million.

RENEWABLE ENERGY TRACKING SYSTEM (NC-RETS)

RENEWABLE & EFFICIENCY PORTFOLIO STANDARD

Electricity providers in North Carolina must report the amount of renewable energy or energy efficiency they provide each year in order to comply with the state’s Renewable Energy & Energy Efficiency Portfolio Standard (REPS). To ensure accuracy and accountability in reporting, each mega-Watt hour (1,000 kWh), or Renewable Energy Credit (REC) of renewable energy or energy efficiency must be registered in a tracking system, called a registry, that operates similarly to a bank account.

In early Feb. 2010, the NC Utilities Commission selected APX, Inc.’s North American Renewables Registry™ for the state’s renewable energy tracking infrastructure. The system, called the North Carolina Renewable Energy Tracking System (NC-RETS), tracks power suppliers’ accounts against the statutory requirements, including compliance with specific provisions such as minimum requirements for swine, poultry, and solar energy credits.

Generators of renewable energy register their project with the NC-RETS and are given an account where each systems’ RECs are deposited. Through a contractual agreement - perhaps eventually in an open-market exchange - power suppliers purchase RECs from generators, and the RECs are then transferred to each supplier’s compliance account. At the end of each year, all RECs used for compliance by the electricity suppliers are deducted from each supplier’s account.

REGISTERED RENEWABLE ENERGY FACILITIES

The NCUC has received registration information for 149 renewable energy facilities as of March 31, 2010. The facilities have a combined generating capacity of more than 3.638 GW of capacity - 11.2% of which is actually located in North Carolina.

Within the state there are 32.875 MW of solar photovoltaic systems registered, 21 solar thermal projects registered, 4 kW of wind power (from two turbines owned by the Madison County School System), 310.285 MW of biomass power (2/3 of which is from wood waste), and 65.14 MW of hydroelectric generation capacity registered.

GREEN POWER

NC Green Power (NCGP), founded in 2003, is the first statewide multi-utility voluntary retail green power program in the country. The program's mission is to improve the quality of the environment by encouraging the development of renewable energy resources and the mitigation of greenhouse gas emissions through consumers' voluntary funding.

NCGP allows residences and businesses the opportunity to support green energy by purchasing blocks of renewable electricity generated in the state. In Oct. 2008, the program began offering carbon offset products as well. Purchases of NCGP products are voluntary and tax deductible. The green power product is eligible for a LEED point, and is counted towards Green-E certification.

References & Information

NC Green Power: www.ncgreenpower.org

EPA Green Power Partnership: www.epa.gov/grnpower/

12,069 total subscribers as of 3/31/2010

20,190 monthly blocks of renewable energy subscribed

24,228 MWh of renewable electricity-generated per year

535 monthly subscriptions of carbon offset blocks

1,459 metric tons of GHGs reduced annually

TOP GREEN POWER PARTNERS

Five of the state's leading participants in the EPA's Green Power Partnership program. Combined, these companies purchase more than 46,000 MWh of green energy each year.

29,167 MWh

Pepsi Bottling Ventures, LLC

5,087 MWh

Performance Bicycles

4,400 MWh

Warren Wilson College

4,016 MWh

Burt's Bees

3,360 MWh

Santa Fe Natural Tobacco Co.

THE GREEN POWER PARTNERSHIP PROGRAM

The Environmental Protection Agency's Green Power Partnership Program is a voluntary effort that supports the purchase of renewable energy by organizations. The program offers expert advice, technical support, tools and other resources to help lower transaction costs, shrink carbon footprints, and communicate energy leadership to stakeholders.

ncGreenPower
Balance your impact on the environment.

NC GreenPower Generators

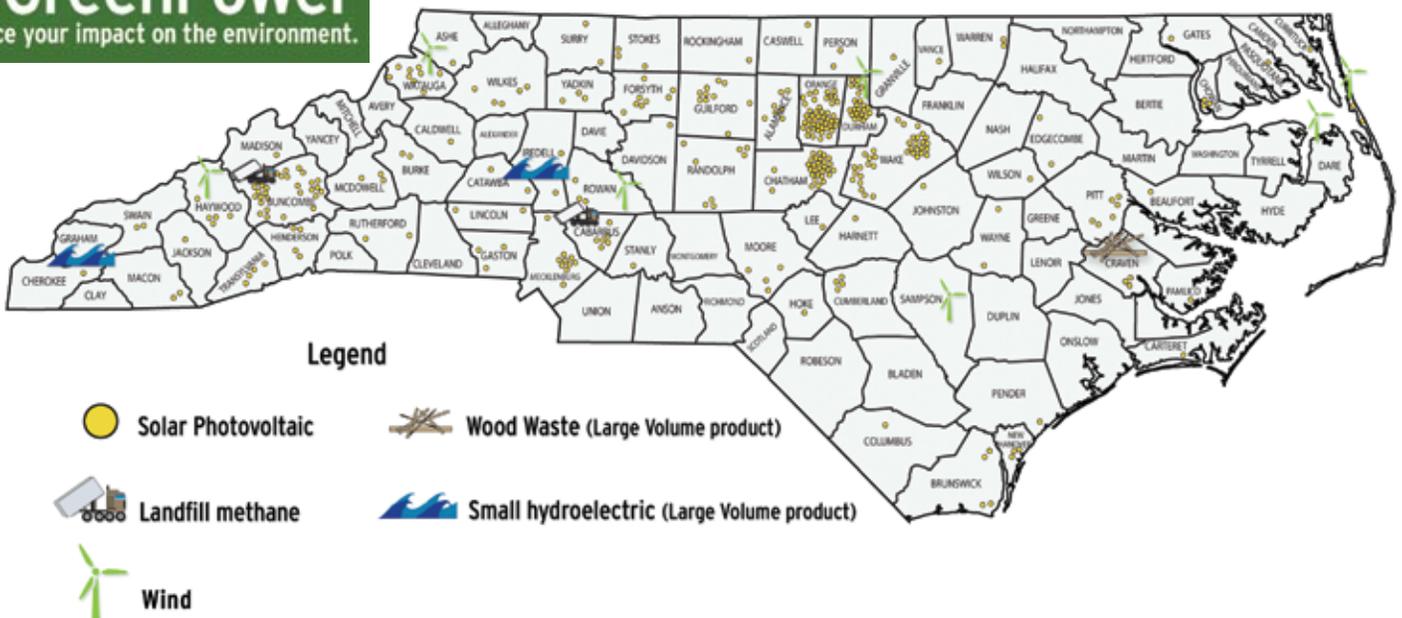


Image credit: N.C. Green Power

GREENHOUSE GAS RULES

Effective Dec. 29, 2009, the EPA's Mandatory Reporting of Greenhouse Gases Rule requires suppliers of fossil fuels or industrial greenhouse gases, manufacturers of vehicles and engines, and facilities that emit 25,000 metric tons or more per year of GHG emissions to submit annual reports to EPA. Reporting is required by 25 GHG source categories, 5 types of fuel and industrial GHG suppliers, and suppliers of motor vehicles and engines (except light duty sector). First electronic reports are due March 31, 2011; no GHG emissions control is required, however.

Facilities must evaluate each source category to determine if the mandatory re-

porting rule applies. Facilities having any activity falling under the "All-in" source category must report all GHG emissions, but facilities having activity falling under the "Threshold" source category are subject to reporting under the mandatory rule if the sum of GHG emissions from all sources in the "Threshold" category is greater than 25,000 metric tons of CO₂-equivalent (MtCO₂e).

Rule modifications proposed by the EPA in early 2010 would require reporting of additional information about each facility's ownership - a change that would require about 80 minutes of labor in the first year and 40 minutes in subsequent years for single-owner facilities.

SOURCE CATEGORIES

ALL-IN SOURCE CATEGORIES

Electricity generation, aluminum production, ammonia production, cement production, HCFC-22 production, lime manufacturing, nitric acid production, petrochemical production, phosphoric acid production, soda ash production, titanium dioxide production, MSW landfills, and manure management systems (starting in Oct. 2011)

THRESHOLD SOURCE CATEGORIES

Stationary combustion units, ferroalloy production, glass production, hydrogen production, iron and steel production, lead production, pulp and paper manufacturing, and zinc production

SOURCE CATEGORIES UNDER REVIEW

Electronics manufacturing, ethanol production, fluorinated GHG production, food processing, magnesium production, industrial landfills, and wastewater treatment

References & Information

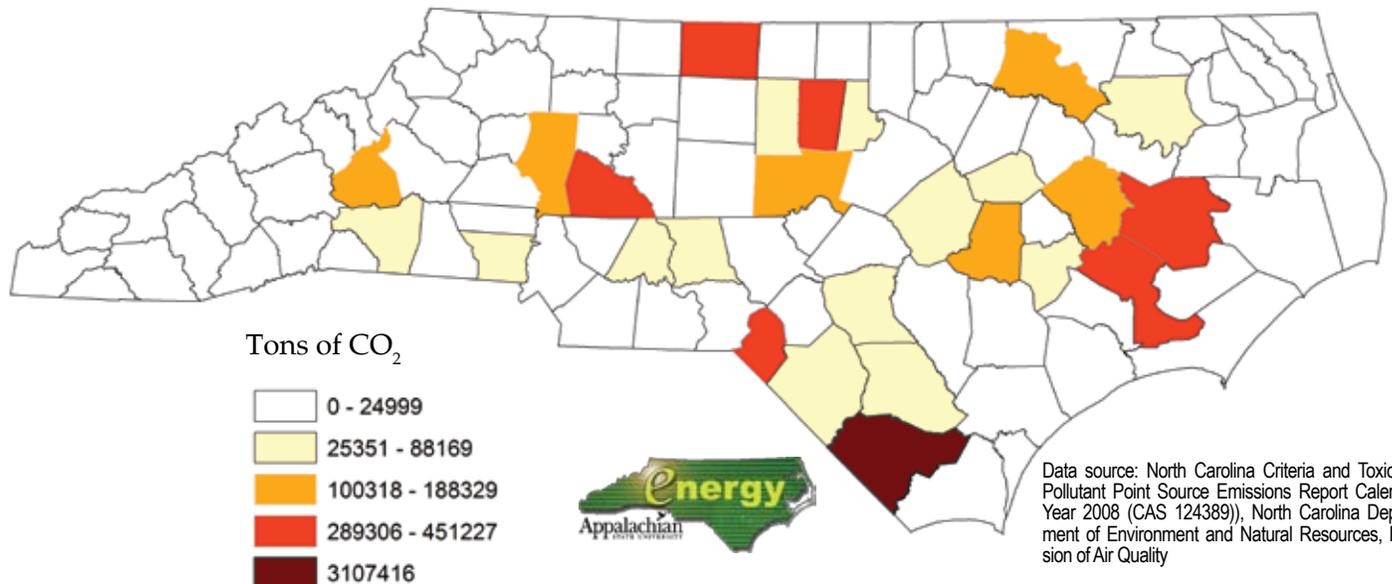
- EPA Climate Change: www.epa.gov/climatechange/
- Climate Action Reserve: www.climateactionreserve.org
- Chicago Climate Futures Exchange: www.ccfex.com
- NYMEX Green Exchange: nymex.greenfutures.com

9,868 US facilities affected by the EPA's Mandatory GHG Reporting Rule

13,157 estimated national labor hours to report under the Mandatory GHG Rule in year one

October 30, 2009, the final rule was published in the Federal Register (www.regulations.gov) under Docket ID No. EPA-HQ-OAR-2008-0508-2278, and can also be found in 40 CFR Part 98.

TOTAL CARBON DIOXIDE EMISSIONS BY COUNTY FOR POINT-SOURCE PERMITTED FACILITIES, 2008



SUSTAINABILITY & COMPETITIVENESS

For a century American businesses could rely on cheap fossil fuels and with virtually no concern over the external costs of using fossil fuels, such as greenhouse gas emissions. This is no longer the case; today, fuel is expensive, and the cost of continued fossil fuel use may be the stability of the climate system.

“Over the next few decades, virtually every economic activity - from the way we manufacture goods to the way we design our transportation systems - will have to be re-engineered to reflect a carbon-constrained world,” said US Secretary of Commerce Gary Locke.



Impacts from implementing energy efficiency measures and other sustainable practices can be felt immediately in the form of lower operating costs. Sustainability measures include activities which increase the productivity of natural resource use, including water, land, and energy.

The Organization for Economic Co-operation and Development (OECD) has begun implementing a sustainable manufacturing toolkit. The toolkit focuses on facility performance by targeting materials and products.

Compatible with mainstream initiatives, the OECD toolkit estimates the costs and benefits of improving environmental performance using a set of interrelated core indicators. The toolkit is essentially a “how to” guide for non-technical, or non-expert, managers seeking green solutions to common manufacturing challenges.

www.oecd.org/sti/innovation/sustainablemanufacturing

Green Suppliers Network

Working in collaboration with the U.S. Department of Commerce, the EPA established the Green Suppliers Network to help small and medium-sized manufacturers learn effective strategies and techniques to integrate Lean and Clean improvements into their manufacturing operations. We call this approach the Lean and Clean Advantage - helping companies stay competitive and profitable while reducing their impact on the environment.

Large manufacturers are eligible to join as Corporate Champions and help facilitate their suppliers' participation in



Use of this logo does not imply EPA endorsement.

**GREEN SUPPLIERS
NETWORK**

Lean and Clean technical reviews. Small and medium-sized manufacturers may join as Partners and receive customized, hands-on technical assistance and training by participating in an onsite Lean and Clean review. Partners receive a set of confidential recommendations that, when implemented, will result in production efficiencies, environmental improvements, and significant cost savings.

Green Suppliers Network

Information Central

Green_Suppliers@epa.gov

www.greensuppliers.gov

NC GREEN BUSINESS FUND

In two rounds of funding, the NC Green Business Fund awarded over \$2.3 million in grants to 32 businesses, governments and non-profits in 23 cities across the state in 2009.

The Green Business Fund was established by the state legislature in 2007 as a source of competitive funding to support innovation in biofuels, green building, and other clean technology areas.

“North Carolina continues to position itself as a leader in the emerging green economy with these kinds of smart investments in promising technologies and products,” said Gov. Perdue. “These creative entrepreneurs and businesses are turning green into gold by growing new companies and creating jobs.”

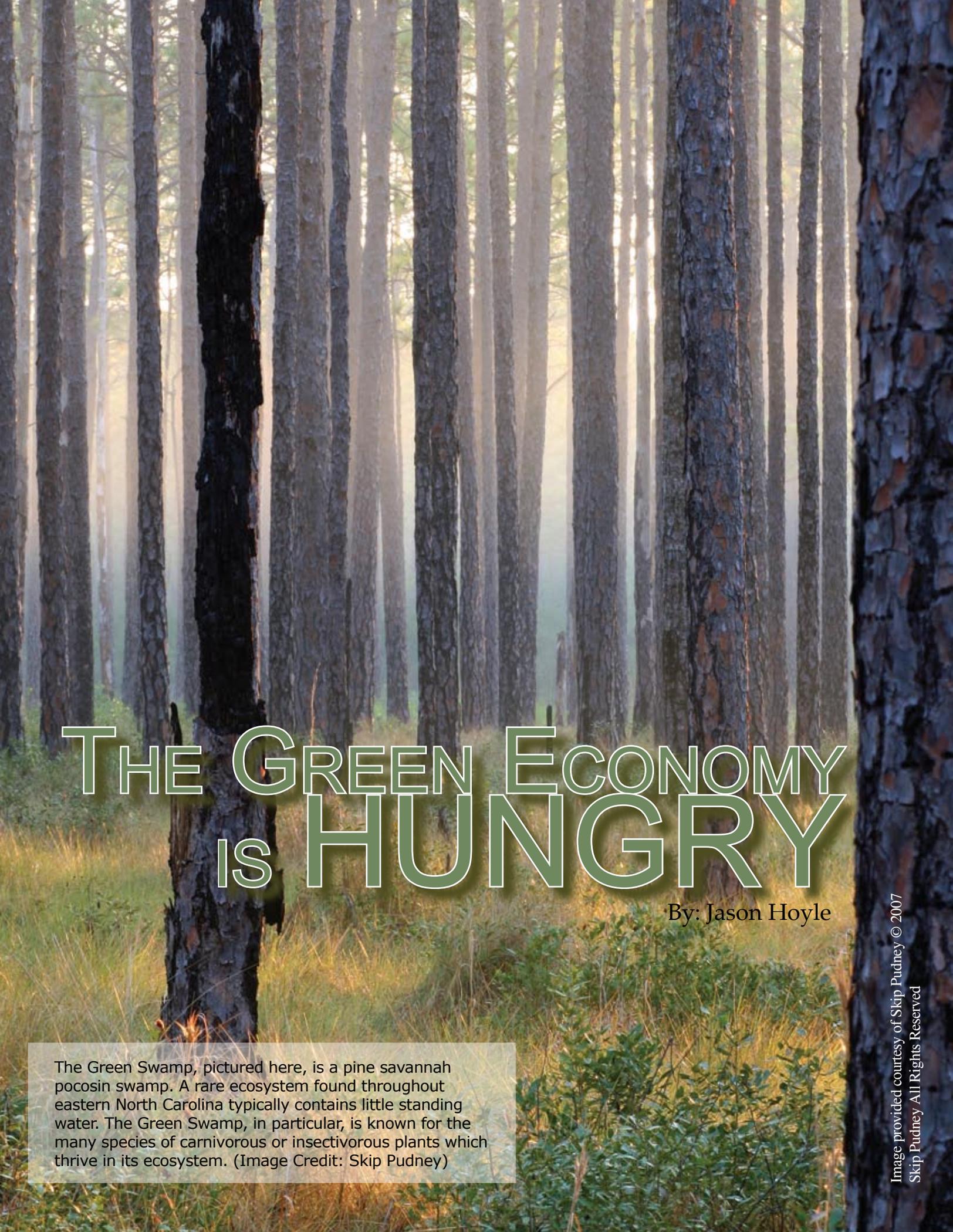
The second round of awards made in 2009 were funded by the American Recovery and Reinvestment Act, and created an

estimated 200 private-sector jobs. The first round of funding came from state appropriations.

The biofuels priority area received about 17% of fund awards in 2009, or \$400,625. Green building awards totaled \$695,502 – 30% of awards. Over half of the awards, totaling more than \$1.2 million were made to a large variety of companies and projects in the broader clean technology priority area during 2009.

The grant process begins with submission of a pre-proposal letter, which is typically due sometime in December. From the pre-proposal letters a number of applicants are selected to submit full proposals by mid-spring, and awards are announced during the summer.

Solicitations and other program information are available at <http://ncscitech.com/gbf>.



THE GREEN ECONOMY IS HUNGRY

By: Jason Hoyle

The Green Swamp, pictured here, is a pine savannah pocosin swamp. A rare ecosystem found throughout eastern North Carolina typically contains little standing water. The Green Swamp, in particular, is known for the many species of carnivorous or insectivorous plants which thrive in its ecosystem. (Image Credit: Skip Pudney)

Carnivores, from both the plantae and animalia kingdoms, found nowhere else in the world exemplify the wealth of biodiversity in North Carolina. When green first meant something more than a color, the term generally referenced efforts to conserve and preserve the natural environment.

True to its roots, economic opportunities branching from the sprouting green economy are being leveraged as a tool not only to create jobs and income, but also to support the continued survival of the world's only wild populations of the red wolf and the Venus fly trap. Besides their appetite for meat, these one-of-a-kind natural resources also share a common source of support – the voluntary carbon market.

Venus Fly Trap

The carnivorous plant famous the world over for its snapping jaws is found only in nitrogen-poor sandy and peat soil surrounding Wilmington. The Venus fly trap (*Dionaea muscipula*) is among a rare group of plants which receive nutrition by consuming insects and spiders, and unique within this group for the way it clamps its prey between two leaf-like jaws.

The Green Swamp (where else!), which straddles the border between Columbus and Brunswick Counties in southeastern North Carolina, is home to not only the bald eagle and the American alligator, but also the most diverse concentration of carnivorous plants in the world, including the state's official carnivorous plant – the Venus fly trap. The Green Swamp is a pocosin swamp featuring small amounts of surface water and large swaths of longleaf pine savannas covering about 140 square miles.

While the Venus fly trap has a thriving commercial cultivar business with millions of plants estimated to survive in cultivation, native populations were rapidly diminished as specimens were collected from the wild – often for commercial sale – and as few as 38,500 plants may remain in the wild. Using tissue culture technology, or micro-propagation, a landfill gas project in Columbus County aims to support the protection of what the NC General Assembly called “a mysterious and wonderful natural



Photo Credit: Skip Putney

Right: Pitcher plants found in the Green Swamp, along the borders of Columbus and Brunswick Counties. The Green Swamp is home to one of the world's largest concentrations of different carnivorous plants.

Above: Image of the Venus Flytrap, a carnivorous plant so rare that in all the world it is found only in the area around Wilmington, NC.

resource” when it adopted the Venus fly trap as the Official Carnivorous Plant of the State of North Carolina in 2005.

Through the efforts of a taskforce in Columbus County, established by the County Commission and led by the Cape Fear RC&D Council, gas from the closed county landfill will be used as fuel for electricity generation. Waste heat from electricity generation will be captured and used in a greenhouse grow-out facility which will enable entrepreneur-graduates from Southeastern Community College's BioNet-funded micro-propagation program to establish their business at a minimal up-front cost.

GREEN SWAMP SCENIC BYWAY

An officially designated Scenic Byway travels 52 miles through the area, and the Nature Conservancy maintains the Green Swamp Preserve. The Preserve covers 15,907 acres and is home to 14 carnivorous plant species, several rare animal species and a number of rare orchids.

The Preserve began with the donation of 13,850 acres to The Nature Conservancy by the Federal Paper Board company in 1977. A parking area for the Green Swamp Preserve is located 5.5 miles north of Supply, NC on state highway 211.



Image provided courtesy of Skip Putney ©2009 Skip Putney. All Rights Reserved

The first such business will focus on propagating the Venus fly trap and reducing pressure on wild populations threatened by illegal poaching. Other business prospects include reducing import of invasive species by providing feedstock of native plants for nurseries and serving the needs of farmers producing local agricultural staples such as sweet potatoes.

Gas created by trash decomposing in a landfill is basically half-strength natural gas – 50% methane and 50% carbon dioxide plus a potentially wide variety of trace contaminants.

Columbus County's landfill is not required by law to install a gas collection system, so making use of this green energy resource costs considerably more than using landfill gas from a larger and newer landfill that is required by federal law to collect and burn landfill gas. However, this financial barrier is falling as landfill gas has become a favored low-cost source of greenhouse gas reduc-



Photo credit: John Ennis

An abundance of animal and plant life is found in the Alligator River Refuge, including these Tundra Swans and the Savannah Sparrow. Other species found in the Reserve include the American Alligator and the Bald Eagle.

tions in the US voluntary carbon market.

Lacking both investment capital and the risk tolerance necessary for carbon market speculation, Columbus County partnered with Environmental Credit Corp., a carbon wholesaler and project development firm, to install the collection system. From this partnership, the county will receive a portion of the revenue from sales of carbon credits as well as an extremely low-cost source of green energy.

As the energy is put to economically productive uses the county will also earn income from the sale of electricity and renewable energy credits. And,

of even greater long-term benefit to the local economy, are the job and business-creation impacts of entrepreneurs bridging the gap between the local community college's biotech curriculum and establishment of a profitable enterprise which will strengthen one of the county's strongest economic sectors.

The Columbus County project is one of several projects in the state which leverage landfill gas as both a green energy resource and a driver of local economic development. Particularly unique however, is the project's ability to leverage biotechnology, green energy, and carbon markets to support the preservation of native plants found nowhere else in the world.

CARBON MARKET TRANSACTIONS

Globally, carbon markets were valued at about US\$122 billion in 2009 - about a 2% increase over 2008. Domestic carbon markets (regional, state and voluntary programs in the U.S.) only account for about 1% of this value.

The carbon market investment made in Columbus County and in the Alligator River area is driven by these projects' voluntary reductions in greenhouse gas emissions. By reducing methane emissions and avoiding the loss of carbon-sequestering forestland, carbon credits (or offsets) resulting from these projects are sold to emitters of greenhouse gases as a low-cost source of greenhouse gas reductions.

Reductions from each project will be tracked in a *Registry* (like a bank account for carbon assets). In order to become listed in a registry, the project must meet the quality, reliability, and permanence levels defined in the *Standard* or *Offset Protocol* used by the registry to define what qualifies as a greenhouse gas reduction.

Offset credits earned by the project are *Verified* by a registry-approved independent party before they may be sold. In order for the carbon credit buyer to claim the reductions from the project, the credits must be *Retired*, or delisted from the registry so that they can not be used again. Often transactions in the voluntary carbon market are conducted using intermediary specialist companies which may develop projects or broker credits on behalf of a project.

Red Wolf Habitat Preservation

Officially declared extinct in the wild as of 1980, the red wolf survived only in captivity until successfully reintroduced in 1987 at the Alligator River National Wildlife Refuge, located in Dare County. The Alligator River Refuge, established in March of 1984, occupies 152,195 acres on the mainland portion of Dare and Hyde Counties and spans about 28 miles North-to-South and about 15 miles East-to-West.

Like the Green Swamp, the Alligator River Wildlife Refuge is home to several threatened and endangered species, including the bald eagle, American alligator, and the red-cockaded woodpecker. The refuge receives 45,000 visitors annually and is a major driver of tourism in the local area through its red wolf howling programs.

In Oct. 2009, Goldman Sachs and Blue Source, LLC announced a \$12 million carbon offset transaction, a portion of which ensured about 2,500 acres adjacent to the refuge would not be converted into farmland. This project was the first forest sequestration project located outside California to be registered with the Climate Action Reserve.

NOT RARE IN NORTH CAROLINA

By: Jason Hoyle and Joey Mosteller

Rare earth elements, lithium, mica, silicon, phosphorous are all mineral resources important for their use in energy technologies for which North Carolina has been a leading source at some time during the past century and a half.

Beyond their potential economic development value from mining operations, the cluster of knowledge and innovation that can develop around the extraction of these resources is a sustainable competitive advantage which can continue to drive economic development decades after mining operations have ended.

Since becoming the first state to fund its own geological and mineralogical survey in 1832, North Carolina's mining industry has grown into a billion-dollar business employing over 3,000 people. The state's unique geological reserves are perhaps most widely known for emeralds and other gemstones, but these reserves also include some of the world's purest quartz (silicon dioxide), the country's largest reserves of lithium, and rich deposits of elements used in batteries and motors, called rare earths.

Rare Earths: Monazite

"...they discovered a very heavy bright yellow or bluish sand, that remained or settled to the bottom with the gold," reported the New York Times on May 16, 1895. The sand, it turned out, was more valuable than the gold since it contained thorium – a rare earth element prized in the late 1800s for its use in manufacturing burners for incandescent gaslights.

Monazite, the rare earth from which thorium – a key component in 'high-tech' gaslights of the late 1800s, also contains elements crucial for use in today's emerging energy technologies, such as Cerium, Lanthanum, and Neodymium. Cerium (Ce) is used in making ductile cast iron for wind turbines and as a doping agent in the production of white LEDs. Lanthanum (La) is a key component in nickel-metal hydride batteries widely used in today's hybrid-electric vehicles. Neodymium may be especially valuable as a rare earth magnet which is used to reduce weight and increase performance of electric vehicle motors and wind turbine generators.



Postcard image of the British Monazite Mine operation, near Shelby, NC circa 1906. Original image from Durwood Barbour Collection of North Carolina Postcards at the University of North Carolina-Chapel Hill.

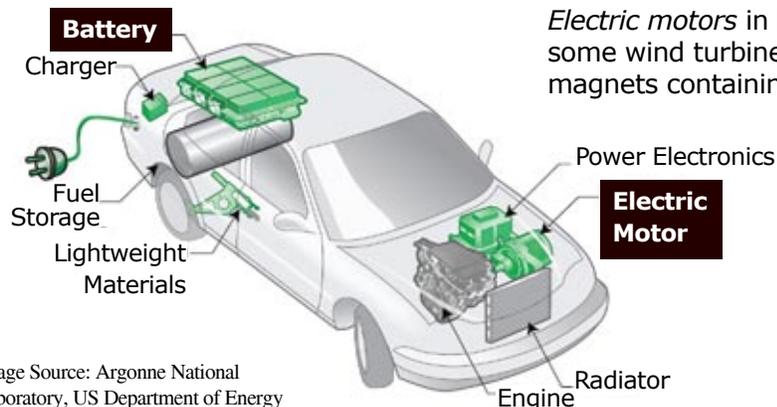
ELEMENTS, MINERALS & ENERGY

Element Name	Symbol	\$/kg ¹	Uses
Lithium	Li	--	energy storage, Li-ion batteries
Cerium	Ce	\$8.80	metal alloys, rechargeable NiMH batteries
Lanthanum	La	\$7.45	rechargeable NiMH batteries
Yttrium	Y	\$45.00	advanced composite materials
Neodymium	Nd	\$50.50	permanent magnet for small motors
Samarium	Sm	\$12.50	permanent magnets for small motors
Europium	Eu	\$630.00	Phosphors/LEDs, semiconductors
Dysprosium	Dy	\$125.00	permanent magnets, semiconductors
Lutetium	Lu	\$8,000.00	catalyst, semiconductors

¹ Prices shown for metal >99% purity, end of 2007; Source: Naumov, A.V. Review of the World Market for Rare-Earth Metals. Russian Journal of Non-Ferrous Metals. Vol. 49, No. 1. 2008.

CRITICAL MINERALS FOR HYBRID VEHICLES

NiMH batteries used in today's hybrid-electric vehicles (HEV) contain both Cerium and Lanthanum, rare earth elements found in North Carolina. The highest selling HEV, Toyota's Prius, can use 30 lbs of Lanthanum per vehicle. Future generations of HEVs may use Lithium in Li-ion battery packs.



Electric motors in both HEVs and some wind turbines use powerful magnets containing Neodymium, a rare earth element found in Monazite alongside Cerium and Lanthanum.

Image Source: Argonne National Laboratory, US Department of Energy

Monazite prices have risen by 48% from a 2004 price of \$0.59 per kilogram to \$0.87 per kilogram in 2008, according to the US Geological Survey's (USGS) Mineral Commodity Survey. While North Carolina produced nearly 9.3 million pounds of Monazite between 1893 and 1911 and was the only known Monazite-producing state from 1893 until 1902; production operations ceased in 1911 as foreign supplies began to dominate the market.

North Carolina is one of the few places in the world known to have reserves of several of these rare but critical elements. The economic opportunity lies not only in the extraction and processing of these scarce minerals and elements but also in the innovation, development and commercialization of the technologies that depend on the availability of these elements.

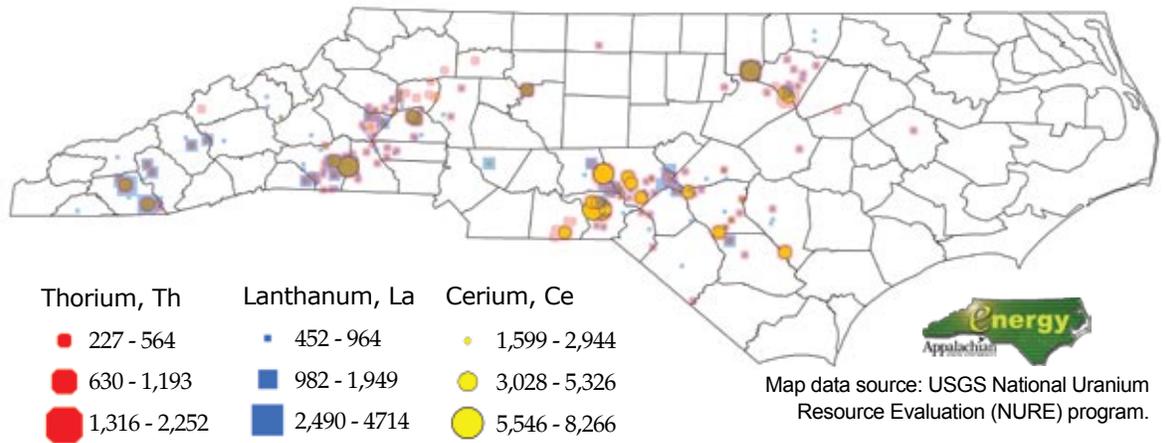
According to a Government Accountability Office report (GAO-10-617R), China produced about 97% of the world's supply of rare earth oxides in 2009. Refining these minerals into high-purity metals also occurs almost exclusively in China.

Prices for rare earths have been increasing recently, largely due to changes in Chinese trade policy. New domestic production quotas, decreased export quotas, and a recent increase in export taxes (now between 15% and 25%) have placed non-Chinese competitors at a disadvantage.

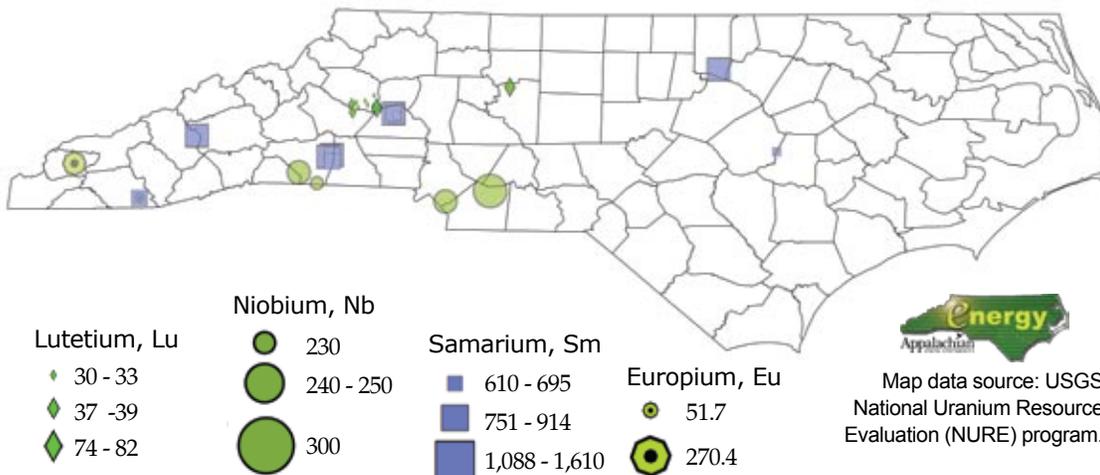
Efforts to re-establish mining, refining, and other rare earth production capacity began in earnest last year in the U.S. and other countries after China proposed banning all exports for 5 of the 17 rare earth elements. While the ban has not been enacted, the implications are significant enough to justify the re-opening of the U.S.'s last-producing rare earth mine at Mountain Pass, CA.

Lanthanum (La), Cerium (Ce) and Neodymium (Nd) are key component elements of the mineral Monazite (no data are available for Neodymium). A 1956 analysis (Murata, Rose, et al.) including a half-dozen NC samples revealed La concentrations of between 15% and 24%, Ce concentrations between 33% and 51%, and Nd concentrations between 14% and 18%. The samples however, also contained thorium (problematic for its radioactivity) in concentrations between 6.7% and 17.5%.

Location of Rare Earths: Th, La, Ce (parts per million)



Location of Rare Earths: Sm, Nb, Lu, Eu (parts per million)



Lutetium (Lu), Niobium (Nb), Samarium (Sm), and Europium (Eu) are rare earth elements which have only come into favor in recent years - mostly due to their use in semiconductors and advanced materials. Lutetium and Europium, in particular, are exceedingly rare in extractable quantities. The largest concentrations of Lu in the state are near Hickory, and high concentrations of Eu are located in Graham County.

Lithium

Kings Mountain, NC was the world's primary source of lithium for almost a half century starting in the 1950s when Foote Mineral Corporation (FMC) purchased the rights to extract lithium from mines in the region. When the founder of FMC developed a lower-cost process using brines to produce lithium carbonate – the type used in Lithium-ion batteries – lithium production from North Carolina's ore-based pegmatite reserves ceased.

Perhaps ironically, it was the introduction of the Lithium-ion battery by Sony in 1991 which marked the beginning of the end for NC's lithium reign. As the electronics industry boomed in the 1990s, South America emerged as the undisputed global leader in lithium with more than 80% of the world's estimated reserve base for the lightest elemental metal. Bolivia has the largest reserve base with an estimated 5.4 million metric tons, and Chile is the world's leading pro-

ducer of the metal providing 12,000 of the world's 28,000 metric-ton supply in 2008, according to the 2009 Mineral Commodity Surveys of the USGS.

The dramatic fall in lithium prices that accompanied the entry of Chile into the global supply of lithium in the late 1990s left a single U.S. producer of lithium that mines a brine-type resource similar to that found in South America from hectorite clays in Nevada. North Carolina's lithium reserve base, estimated by the USGS at 2.6 million tons, is more than 10 times the size of the estimated reserves at the Nevada site, and represents about 80% of U.S. lithium reserves.

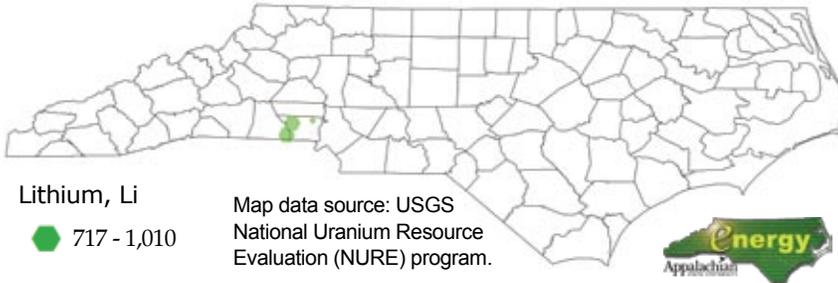
Kings Mountain lithium reserves were recognized as early as 1906, but only became of significant value with the rise of the nuclear age in the early 1940s.

Formerly known as FMC, the Chemtall Foote Corporation, a subsidiary of Rockwood Holdings Inc. originally develop lithium processing expertise at its Kings Mountain facility. While local lithium production has ceased, the knowledge remains and lithium processing and new product development continue at the country's oldest lithium plant.

While lithium mining in NC ceased about a decade ago, Vancouver-based North Arrow Minerals – through their wholly owned subsidiary Carolina Lithium Inc. – has been drilling core samples at their Beaverdam project site located on 420 acres in Gaston County about 44 km northwest of Charlotte. Samples drilled during 2009 revealed 14 of 16 test assays with greater than 1% lithium oxide (Li₂O) and three samples with greater than 2.5% Li₂O. The company is continuing its exploratory drilling program during Spring 2010.

“...processing and new product development continue at the country's oldest lithium plant.”

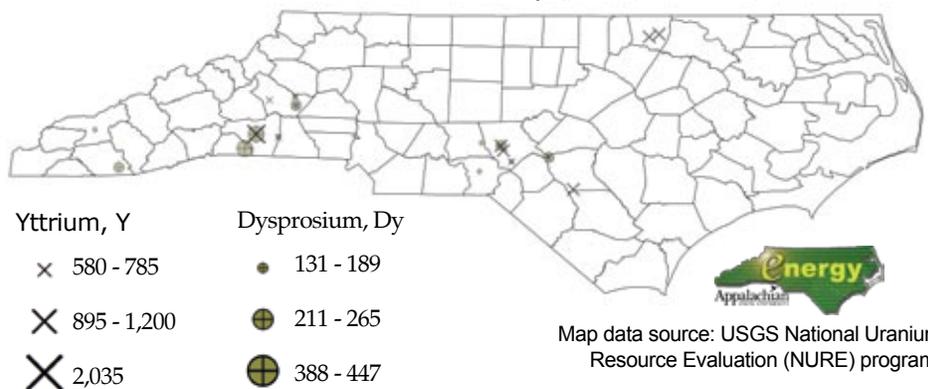
Location of Lithium, Li (parts per million)



Lithium (Li), a mineral resource used in high-powered batteries for many electronic devices, is found near Kings Mountain, NC. About 80% of the US's Li reserves are located in the area of the Gaston-Cleveland County line. These reserves are found in Spodumene, a mineral also known to contain the rare gemstone Hiddenite. Growth in electric vehicles has rekindled interest in securing a domestic supply of lithium for the production of Li-ion batteries.

Yttrium (Y), while not classified in the lanthanide group, is still considered a rare earth element and is always found in the presence of other rare earth elements in nature. Another heavy lanthanoid metal, Dysprosium (Dy), is very similar in chemical reactivity to Yttrium, and they are found together in several places in North Carolina. Yttrium is important for the production of red phosphors, which are used in LEDs. Dysprosium is used in special cement for cooling spent nuclear fuel rods.

Location of Rare Earths: Y, Dy (parts per million)



Cree, Inc. announced it plans to add 575 jobs at its plants in Durham, NC and China (Photonics Spectra, Jan. 2010)



HIGH-TECH & ENERGY

Light-Emitting Diodes (LEDs)

The widespread adoption of light-emitting diodes, or LEDs, could save \$120 billion in energy costs over the next 20 years, according to estimates from the US Department of Energy. While traditional incandescent bulbs convert only 2%-5% of the energy they consume into light (the remainder is heat), LEDs can convert 10% to 20% of consumed energy into light.

LEDs are small, solid semiconductors. First there were red LEDs and then green LEDs, but it wasn't until Durham, NC-based Cree, Inc. developed the blue LED in the late 1980s that LEDs were feasible for use in most lighting applications which require white light.

Today, LEDs are used in common products such as appliances, electronics, vehicles, and outdoor space lighting. A recent market research report projects LEDs to represent half the \$4.4 billion commercial lighting market within the next decade. The City of Raleigh has installed over 40 LED fixtures during the past three years and estimated savings to the city are more than \$200,000 annually.

LED technology is commercializing rapidly. Current products are estimated to last as long as 40,000 hours - nearly 3 times as long as compact fluorescent bulbs. While prices for LED bulbs that fit standard sockets today are as high as \$40 to \$50 per 60 Watt-equivalent, prices are expected to fall significantly.

Nano-scale Materials

Extremely small materials are changing the ways we produce, consume and store energy. Hardly visible with the naked eye, nano-scale materials are measured in billionths, so 1 nanometer = 0.00001 meter.

The US DOE operates five nanoscience research centers, and about 1/5 of scientific papers published on environmental and energy technologies in 2006 involved nanotechnology research. So, what's the big deal about something so small?

Nanomaterials are used to add strength while reducing weight in automobiles, reduce the amount of valuable

metals and other elements needed for reaction-based technology components such as catalysts, and to improve conductivity and safety of electrolytic technologies such as batteries.

Mazda, for instance, has used nanotechnology to reduce the amount of platinum-group metals in catalytic converters by between 70% and 90% without sacrificing performance of exhaust purification systems. Nanotechnology is also used in advanced battery applications to increase the amount of time a battery can supply energy without increasing the amount of electrode materials used.

In addition to the improved battery performance - especially useful as more vehicles are converted to electric-based platform technology such as hybrids - nanotechnology, in the form of carbon nanotubes (a cylinder of graphite a single atom thick), can increase the strength of body panels by a factor of 40 or more while simultaneously reducing weight by a factor of 6 times compared to steel.

Fiber-Reinforced Polymer Composites

Plastic can be made stronger and lighter when fibers are integrated into the material. The most common reinforcement fibers are made of glass, but natural fibers and carbon fibers are also used in some applications.

Carbon fiber, in particular, has the potential to drastically reduce the weight

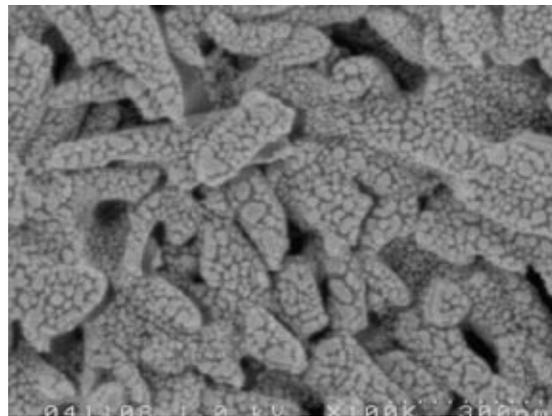


Image of gold nanoparticles, which could be used as a catalyst, at 100,000X taken on S-5000 Ultrahigh Resolution Field Emission Scanning Electron Microscope in a physics lab at Appalachian State University.

of a material while improving the strength. Because of their relatively high costs, carbon fibers have yet to make significant headway into wind turbine blade markets, with the notable exception of some uses where the low weight-to-strength ratio is extremely valuable, such as for blade tips or along the blade spar.

However, market projections reported in the March 2010 issue of High Performance Composites indicate that within the next decade the market demand for carbon fiber in wind energy applications will increase by at least 10-fold from today's demand, estimates of which range between 3,100 and 3,900 metric tons.

While the use of carbon fiber has performance advantages, production is energy intensive, requiring between 25 kWh and 75 kWh per pound to produce, according to estimates by Boeing Corp. Recycled carbon fiber however, can be produced using less than 5% of the energy of raw virgin fiber, and at about half the cost.

Companies such as Fletcher, NC-based Materials Innovation Technologies, or Firebird Advanced Materials of Raleigh contribute to the growing array of technology that will enable recycled carbon fiber to be produced at a cost of \$8-\$12 per pound, compared to as much as \$30 per pound for virgin fiber.

Carbon Fiber Recycling

Materials Innovation Technologies LLC

Fletcher, NC - www.emergingmit.com

Firebird Advanced Materials

Raleigh, NC

TRAVEL & TRANSPORT

Transportation, communication and energy are the blocks upon which the modern world economy is founded. The impacts of transportation system decisions are long-term and far-reaching, determining many aspects of local economic equality. Within every community, transportation decisions impact access to economic opportunity, health and air quality, exposure to economic risks from fuel price volatility and inflation, among other factors.

With the exception of 3.9 miles of light rail track in Charlotte, North Carolina's transportation occurs on the state's 103,500 miles of roadway. Nearly 80% of commuters in the state drive alone in a vehicle to work every day, 12.5% carpool, and nearly 2% walk to work. Public transit systems only serve 1% of the commuting population, according to the Bureau of Transportation Statistics.

The state's first high occupancy vehicle (HOV) lanes opened in December 2004 along north I-77 in Charlotte. The HOV lanes were expected to provide a more reliable commute time by reducing the number of cars on the road during congested times and allow for future traffic growth in the state's largest urban area.

Transit & Rail Investment

North Carolina's economy is highly vehicle dependent, and therefore exposed to all the risks of oil dependency, vehicular pollution, and the problems of increasingly congested roads. The state's transport systems are slowly changing, as evidenced by the successful introduction of light rail in Charlotte and the planned high-speed rail corridor. However, the dominance of roads will not be challenged in the foreseeable future.

The federal stimulus has provided seed funding for the future of transportation in the state with \$545 million awarded for high-speed rail development. Another \$103 million was allocated to the NC Department of Transportation for urban and rural transit projects. Twenty-one urban transit systems will receive more than \$70 million for 77 projects, and the additional \$33 million is split among 63 rural transit projects and 3 statewide projects.

2 Truck Stop Electrification sites in North Carolina. The EPA estimates annual fuel savings per truck parking space of up to \$3,240 per year.

4 electric fueling stations in North Carolina, including three public stations - all of which are located in the Triangle area.

141 biodiesel fueling sites in North Carolina.

19 ethanol fueling sites in North Carolina

16 natural gas fueling stations in North Carolina

The high-speed rail corridors Richmond-to-Raleigh and Raleigh-to-Charlotte won funding in a competitive process. These projects are expected to create 4,800 jobs through more than 30 projects in 11 counties. The projects are part of the \$3 billion Southeast High Speed Rail (SEHSR) Corridor which will traverse 1,274 miles across four states. High-speed trains travel at speeds of up to 110 mph, average about 85 mph, and are expected to provide a competitive option to airplane or vehicle travel over distances between 100 and 500 miles.

Access to Alternatives

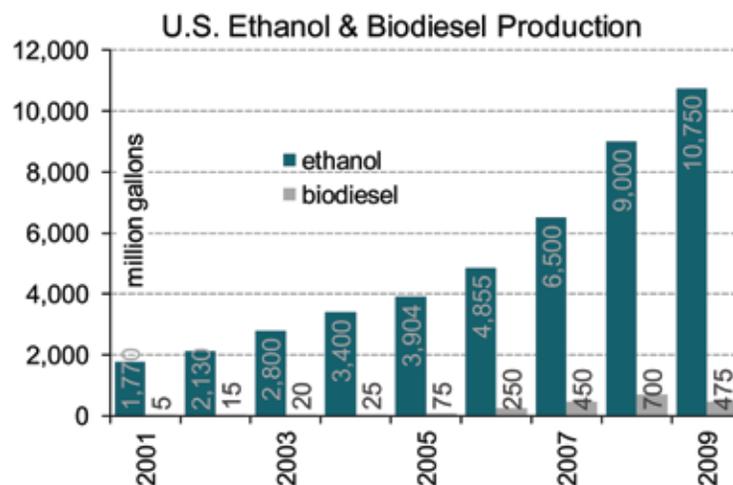
In addition to the new jobs and industry potential from development of new rail and transit systems across the state, there are many economic impacts associated with the state's transportation systems. First and foremost is the diversification of vehicle fuels away from exclusively petroleum-derived gasoline and diesel fuels to the increasing use of bio-based fuels and other alternative fuels.

As of April 2010, North Carolina ranks 5th among all states for the number of alternative fuel retail stations with 240 alternative fuel stations. The

state has regained its top position for the number of stations offering a 20% biodiesel blend, called B-20, with 145 stations. In addition to alternative fuels distribution, the state boasts 2 of the nation's 12 electrified truck stops.

Biofuel Production

As transportation technology changes, opportunities for new fuel producers and manufacturing facilities emerge. The production of biofuel has had a mixed history in North Carolina with a strong grassroots movement - largely led by Piedmont Biofuels - driving biodiesel production capacity to its present 44.5 million gallon-per-year level, according to the National Biodiesel Board. Ethanol production, on the other hand, has experienced a much more tumultuous history with nearly a half-dozen failed or indefinitely delayed production facilities - even



Data Source: Renewable Fuels Association, National Biodiesel Board

a bribery scandal in one case. However, with Clean Burn Fuels' 60 million-gallon-per-year facility coming online this spring in Hoke County the production of fuel ethanol finally has established a home in North Carolina.

Electric Vehicles

Electric-drive vehicles continue to gain market share from their traditionally powered counterparts. Since the first hybrid-electric vehicle (HEV) was released by Honda in 1999, over 1.6 million have been sold. From 2007 through 2009, 14 new HEV models were added, bringing the total number of available HEV models available to 24.

In 2009 over 290,000 HEVs were sold – nearly half were the Prius model from Toyota, according to the US Department of Energy's Alternative Fuels Data Center. Additionally, electric-drive buses are gaining acceptance with 5,400 of the total 7,400 electric and hybrid transit buses having been added to the US fleet between 2006 and 2008, including the addition of 2,500 in 2008 alone.

As this transition continues to gather momentum, a number of opportunities await the development of new technology

and the establishment of new production facilities. Electric vehicles require new fueling infrastructure, ever-more higher performing batteries, motors and generators, as well as lightweight yet strong vehicle body materials. Much of the production for these facilities is only beginning to be located, and North Carolina has substantial strengths with which to compete for these new facilities.

Trade Associations

Electric Drive Transportation Association:

www.electricdrive.org

Electric Auto Association:

www.eaaev.org

National Biodiesel Board:

www.biodiesel.org

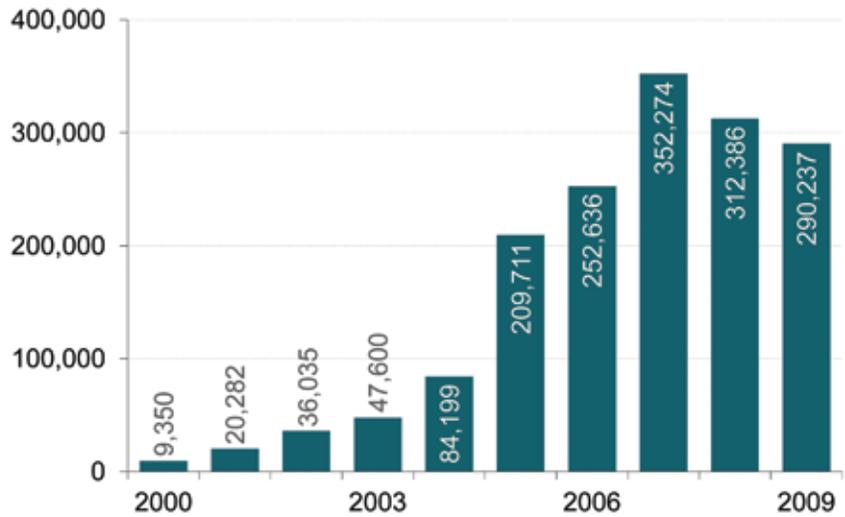
Renewable Fuels Association:

www.ethanolrfa.org

American Coalition for Ethanol:

www.ethanol.org

U.S. Annual Hybrid Electric Vehicle Sales

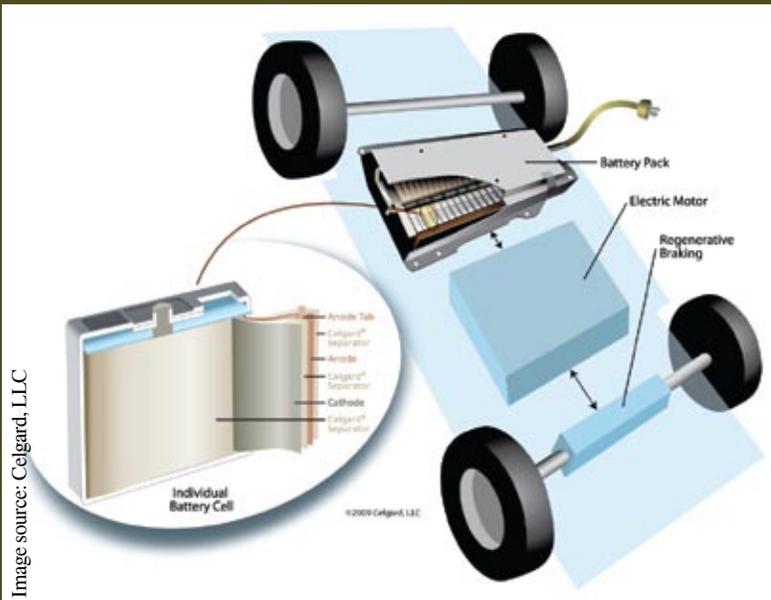


Data Source: Alternative Fuel Data Center, US Department of Energy

ECONOMIC POWER OF BATTERIES

With a \$91-million investment, Li-ion battery component maker Celgard will expand an existing facility and add a new facility, bringing 300 new jobs to the state. Celgard is a global leader in the development and production of specialty microporous membranes, and is one of the largest suppliers to the lithium battery industry. Celgard® battery separators are highly engineered and are used in disposable and rechargeable lithium-ion batteries for personal electronic devices such as notebook computers, mobile telephones, digital cameras, and power tools and are emerging in applications including electric drive vehicles and reserve power and electricity grid management systems.

The company is headquartered in Charlotte, North Carolina, USA and has battery separator manufacturing facilities in the United States, Korea, and China; and is a subsidiary of Polypore International (PPO).



ENERGY EFFICIENCY

Energy efficiency is often considered the low-hanging fruit of green energy improvements. Some of that fruit however, may not be as ripe as it appears. Spending a thousand dollars upgrading old windows won't do much in a building that has air leaking in from outside through gaps in the surrounding envelope.

The options for improving energy efficiency in a building are limited only by the number of items which use or affect the use of energy in the building – a virtually limitless range of possibilities. These options can be as simple as changing a lightbulb, or as complex as re-insulating behind walls, floors and ceilings.

The cost of selecting a particular efficiency improvement in which to invest may be much higher than just the installation and equipment cost of the actual improvement – it may also include the cost of improvements not made. The benefits, likewise, may be more than just the financial return on investment - many efficiency improvements also provide returns in the form of enhanced comfort, safety, and health.

Knowing which energy efficiency investment will save the most energy without sacrificing safety and comfort, and provide the highest return on investment requires information. Buildings are a system, and the efficiency of a building may well be less than the sum of the efficiency of its parts. Making wise long-term deci-

sions which maximize the productivity of investments in energy efficiency improvements requires information about energy use characteristics of not only the individual components of the building system, but also information about the effectiveness of the entire building system.

The so-called “smart grid” technologies are integral to providing this information about the effectiveness with which a building uses energy. Smart grid-type instruments can report on usage patterns and quantities for individual appliances or other specific energy loads within a building, and when connected to the rest of the “smart grid” these technologies can assist in comparing the energy use of one building to the use of similar buildings nearby.

Ultimately, this information can be used not only to assist building occupants with making productive investments, but also by energy service providers in tailoring assistance programs or incentives to the specific needs of their customers. However, even in today's information-limited decision environment, there are many ways to save energy, such as using advanced lighting, sealing ducts and closing air gaps.

Smart Grid Information

www.sgiclearinghouse.org
www.smartgrid.gov

According to a Jan. 2010 report by Zpryme, the Chinese government invested \$7.32 bill. in smart grid technologies, outranking the \$7.09 bill. US government investment. Combined, US and China's smart grid investment is 3.6 times greater than the remaining top 10 government investors put together.

\$21.4 bill.

estimated size of domestic market for smart grid in 2009; projected to be worth \$42.8 billion by 2014

\$63.9 bill.

estimated size of global market for smart grid in 2009; projected to be worth \$171.4 billion by 2014

\$79 bill.

estimated cost of power grid service interruptions per year to the U.S. economy in a 2006 LBNL study

\$593.3 mill.

2009 venture capital investment in energy efficiency - nearly half of which occurred in the fourth quarter

INFORMATION TECHNOLOGY & THE SMART GRID

Headquartered in Raleigh, NC, Consert Inc. is a leader in the design and implementation of intelligent distributed energy resource management systems. Recognized as a finalist in the Innovation Competition at the smart grid industry's seminal conference GreenBeat 2009 and named by Smart Grid News as one of the 10 Smart Grid Companies to Watch in 2010, Consert demonstrates that intelligent energy management provides the most reliable, flexible and economical source of green energy.

Consert's Software-as-a-Service system gives energy conservation the attributes of generation. It empowers consum-



ers to monitor and reduce their energy consumption helping them to save money and the environment, while concurrently granting public utilities dynamic permission to adjust customers' loads and obtain real-time data. This data collection helps utilities improve reliability, add valuable new services and reduce capacity constraints and operating costs to preserve and enhance cash flow.

Consert's patent-pending method to measure, aggregate and verify the carbon savings at the device level generates the world's most accurate carbon credits and provides potential new revenue streams for utilities. Consert's technology also assists utilities in complying with state and federally mandated renewable energy portfolio standards.

SOLAR ENERGY

For solar photovoltaics (PV), the global recession primarily manifested in the form of a large price decrease. The notable exception in 2009 was Germany, which accounted for 63% of global PV demand in 2009 – likely due to the upcoming cut to the country's Feed-In Tariff (FIT) rate, according to IMS Research.

Global PV market growth of 7 GW during 2009 was largely driven by European FIT policy, and mostly occurred in the fourth quarter. According to Solarbuzz analysts, PV prices fell about 22% between the first and fourth quarter of 2009.

The solar industry in the US is projected to regain strength as more manufacturers continue to enter the market. Greentech Media projects 38 domestic

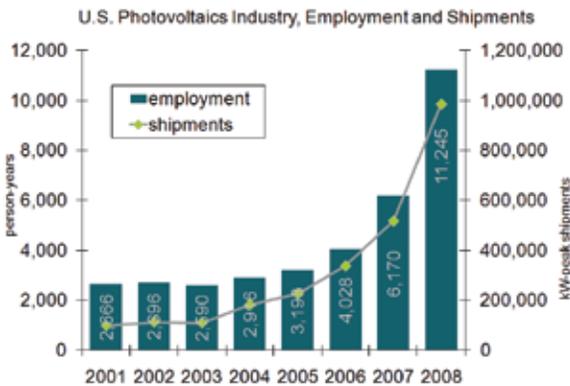
production plants in operation by 2012 – an increase of nearly 50% over the 26 which were operating at the beginning of 2009. As a result, up to 20,000 new jobs are projected to be created during coming years.

During 2009, the US market was estimated as the fourth largest in the world during 2009 with 475 MW installed, and is expected to maintain its strength during coming years. Markets for PV remain highly policy-dependent, with European growth projected to slow once existing incentives are reduced. While projections indicate strong future growth in the US market, the pipeline for projects in China and India is fully loaded, and a PV boom is expected during the next few years.

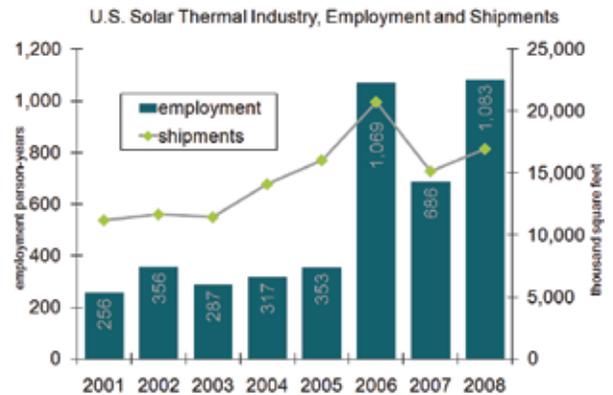
India's Solar Water Heater potential est. at 140 mill. m²; of which only 1.9 mill. m² are installed. China has nearly 60% of all Solar Water Heaters in the world, and over 3,500 SWH makers.

China's PV production capacity in 2006 was 370 MWp, but domestic use was only 10 MWp.

India is the 4th largest energy consumer in the world, yet had a recorded deficit of 12.3% of peak electricity demand during 2006.



Data Source: Energy Information Administration, US Department of Energy



Data Source: Energy Information Administration, US Department of Energy



Left: Camp Lejeune, NC - a few of the 900, single-panel systems currently being installed by FLS Energy

Right: Marriott Courtyard, Greenville, SC - FLS Energy Installation Crew putting in the 60-panel solar thermal system



SOLAR ACROSS THE STATE

FLS Energy, based in Asheville, NC, is a solar energy generation company whose mission is to establish solar as a mainstream technology. FLS has brought together a team of solar energy specialists and experts to provide our clients with over 100 years of clean energy and sustainability experience, and specializes in solar energy systems that provide hot water and electricity to provide our clients a hedge against rising energy costs and a clean source of energy.

FLS Energy has an ongoing training program for its employees including in-house, online and instructor based manufacturer's training. Among FLS staff are two of only nine installers in NC who have been certified as a Solar Thermal Installer by the North American Board of Certified Energy Practitioners (NABCEP), the national certification agency for solar installers.

FLS Energy works in partnership with customers from Fortune 500 companies to small businesses to design, develop and install systems that will meet their particular needs.

WIND ENERGY

Wind installations in the US grew by 18.7% in 2009 with about 10 GW of new capacity installed, according to the American Wind Energy Association. Worldwide, the wind energy industry accounted for 563,577 direct and indirect jobs and \$63.5 billion in investment during 2009, according to research firm Clean Edge. An estimated 85,000 people were employed by the wind industry in 50 states during 2009.

The price for installed wind turbines fell more than 11% from 2008 to 2009, dropping from \$1.9 million to \$1.69 million per MW, and is projected to continue its decline to \$1.5 million per MW within the next decade, according to Clean Edge.

The Global Wind Energy Council reported that at the end of 2009 there were over 158 GW of wind capacity installed around the world, and projected that number to rise to over 400 GW by 2014 – an average growth rate of 21%, which is conservative compared to the 29% average annual growth the industry experienced over the past decade.

The new leader in wind power as of 2009 is China. With world-leading installations of 13.8 GW during 2009, China has surpassed Germany as the country with the second highest amount of wind power capacity (25.9 GW).

Offshore Wind

While the world's first floating wind turbine prototype was towed out to sea in late summer 2009, The US's first "offshore" prototypes were being planned for placement in the Pamlico Sound off the coast of North Carolina. A joint project between Duke Energy and UNC-Chapel Hill plans to install three utility-scale turbines about 10 miles west of Avon, NC.

Researchers at UNC-Chapel Hill reported that offshore wind resources of North Carolina could generate as much as 55 GW of electricity – about 130% of the state's electricity demand. The turbines planned for North Carolina are relatively small compared to their European counterparts. Germany's first offshore project features a dozen 5 MW turbines which will use a tripod base.

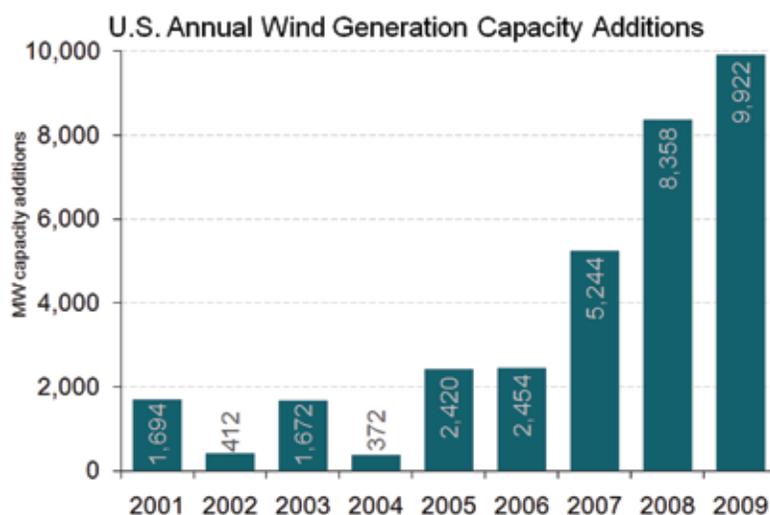
36 states
have large scale wind farms

14.2%
of electricity in Iowa is provided
by wind power

15 billion
gallons of water saved annually by
wind farms displacing water used for
cooling by fossil fuel power plants

39%
five-year annual average growth
rate for wind installations in U.S.

China's national policy is that 70% of wind turbines must come from domestic manufacturers; in 2008 there were 80 generator manufacturers and 200 project developers. Four of the top 10 wind turbine manufacturers in 2009 were located in China and India, and together claimed nearly 30% of the global market.



Data Source: Energy Information Administration, US Department of Energy

After several years of contentious debate within the state, the US's first offshore project - Cape Wind, off the coast of Massachusetts, announced it had received a federal environmental permit in late April 2010. Construction of the 130-turbine 468-MW project is anticipated to begin by the end of 2010.

The potential for wind power generation offshore is tremendous for coastal states, and the Cape Wind project may mark a milestone in the development of this technology. It wasn't until the Energy Policy Act of 2005 that federal legislation first addressed offshore wind, and it took several additional years to clarify the roles of the various federal agencies involved.

In their final compromise, the US Department of Interior's Minerals Management Service has exclusive authority to issue leases for renewable projects along the Outer Continental Shelf (OCS), and the Federal Energy Regulatory Commission issues licenses and exemptions for OCS projects.

The economic impact of offshore wind development is substantial, according to a Department of Energy report which examined the possibility of 20% of the nation's electricity coming from wind by the year 2030.

The development of 10,440 MW of offshore wind is projected to result in a total economic benefit of \$22.2 billion dollars, create 45,000 jobs during construction, and provide 9,100 long-term jobs over a 20-year operating life span.

Offshore Pilot Project

A pilot offshore project to be located in the North Carolina sound is being put together through a partnership between Duke Energy and the University of North Carolina at Chapel Hill. This project could be the first water-based wind turbine project in the country.

Plans for the \$35-million project include installing three utility-scale turbines in the shallow waters of the Pamlico Sound. The turbines will be located about 7-10 miles from the Outer Banks in water up to 20-feet deep, and likely spread over a three square mile area. Each turbine should produce enough energy to power about 1,000 homes.

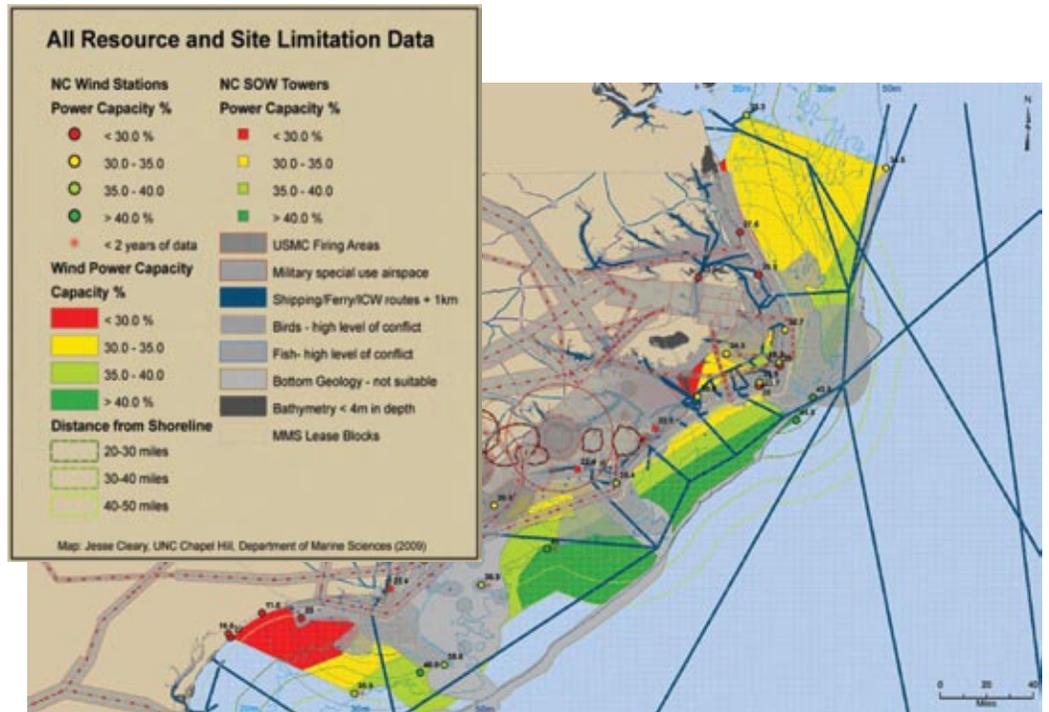


Image source: Jesse Cleary, UNC-Chapel Hill, Department of Marine Sciences (2009)

79.5%

of survey respondents to an Elon University poll supported wind power from NC's mountains

79.1%

of survey respondents to an Elon University poll supported wind power from NC's coastal areas

Siting wind turbines offshore requires considerations of a large array of variables, including: wind speeds, seafloor geology, shipping routes, military training flight paths, bird and animal migration paths, coastal reefs and other sensitive aquatic life, and proximity to electric grid interconnection infrastructure.

DOMESTIC MANUFACTURING

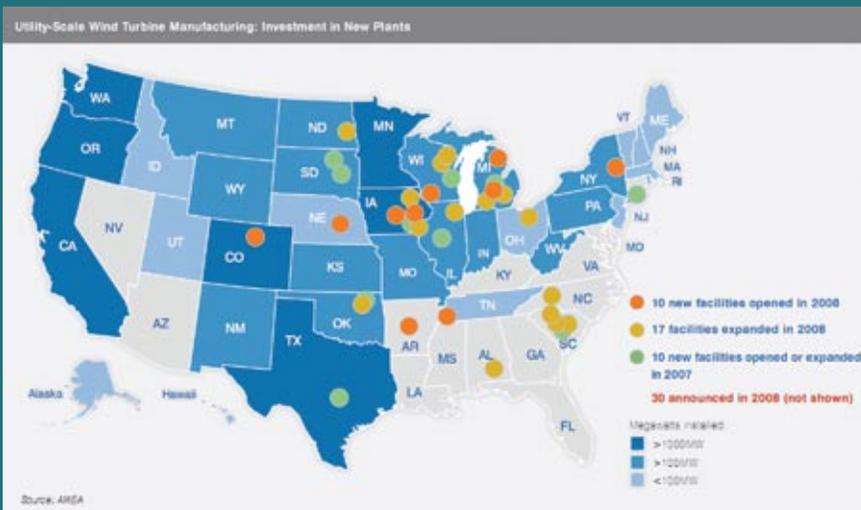
Wind energy provided 1.8% of US electricity generation in 2009, and represented 39% of all new generating capacity installed. While, there are nine turbine manufacturers with facilities in the US according to the American Wind Energy Association, the US Commerce Department reports wind turbine generator sets are largely imported, and in 2008 55%

of the \$2.5 billion worth of wind turbine generating sets imported came from Denmark and Spain.

Despite the majority of turbines being imported into the country, the total number of manufacturing facilities related to wind is more than 200, not including the 39 new, announced or expanding facilities during 2009.

WIND POWER-RELATED MANUFACTURERS IN NC

- Kaydon Bearings, Mocksville
- Klingenberg USA, Salisbury
- Saertex, Huntersville
- ABB, Raleigh
- PPG, Shelby
- 3-Tex, Cary
- Takata, Greensboro
- Reichold, RTP
- Corvid Technology, Mooresville
- Lord Corp, Cary
- Power Partners LLC, Charlotte
- Colbond USA, Charlotte
- MTS Sensors, Cary
- Timken Bearings, multiple



STATE FUNDING MAP

Surry County

Jim Lynch Grading - \$16,012 - National Diesel Emissions Reduction Act (EPA)

Forsyth County

Sparks Contracting - \$17,850 - National Diesel Emissions Reduction Act (EPA)

Forsyth Technical Community College (electrical lineman program) - \$225,000 - Golden LEAF 2009 GLOW

Caldwell County

Foothills Bio-Energies, LLC - \$4,150 - USDA biofuel production funding

Buncombe County

Asheville - \$30,000 - ARRA Diesel Emissions Reduction Projects

FLS Energy Inc. - \$200,000 - Natural Capital Investment Fund

Haywood County

Haywood Community College - \$82,900 - NC Rural Economic Development Center

Graham County

Graham County - \$18,000 - NC Rural Economic Development Center

Macon County

Carolina Wood Pellets LLC - \$250,000 - Natural Capital Investment Fund

Jackson County

Jackson County Schools - \$48,000 - ARRA Diesel Emissions Reduction Projects

Cleveland County

PPG Industries, Inc. - \$741,754 - ARRA Renewable Energy Research & Development

Gaston County

FMC Corp. - \$2.37 mill. - ARRA Renewable Energy Research & Development

Gaston County Solid Waste & Recycling Div. - \$149,992 - National Diesel Emissions Reduction Act (EPA)

Mecklenburg County

Carolina Tractor & Equipment Co. - \$334,272 - ARRA Renewable Energy Research & Development

Alcatel-Lucent, Bell Labs - \$300,000 - ARRA Industrial Technologies Program

Carolina CAT - \$105,000 - National Diesel Emissions Reduction Act (EPA)

Duke Energy - \$45,120 - National Diesel Emissions Reduction Act (EPA)

Stokes County

Stokes County Schools - \$50,000 - ARRA Diesel Emissions Reduction Projects

Chatham County

Piedmont Biofuels Industrial, LLC - \$7,710 - USDA biofuel production funding

Central Carolina Community College "Green Central" - \$200,000 - Golden LEAF 2009 GLOW

Orange County

Thalle Construction Co. - \$18,392 - National Diesel Emissions Reduction Act (EPA)

Davidson County

City of Thomasville - \$51,250 - ARRA Diesel Emissions Reduction Projects

Cabarrus County

City of Kannapolis - \$3,548 - National Diesel Emissions Reduction Act (EPA)



Wake County

Phononic Devices, Inc. - \$3 mill. ARPA-E funding
 IBM, Inc. - \$4,014,351 - ARRA Industrial Technologies Program (2 awards)

Vance County

Vance County Schools - \$50,000 - ARRA Diesel Emissions Reduction Projects

Edgecombe County

Edgecombe Community College "Weatherization Lab" - \$36,000 - Golden LEAF 2010 Open Grants
 Edgecombe County - \$300,000 - NC Rural Economic Development Center

Hertford County

BUDDGilliam Adventures Inc. - \$42,100 - ARRA Diesel Emissions Reduction Projects, Ships & Marine Equipment

Chowan County

Edenton-Chowan County Schools - \$24,000 - ARRA Diesel Emissions Reduction Projects

Currituck County

Currituck County Schools - \$24,000 - ARRA Diesel Emissions Reduction Projects

Camden County

Camden County Green Industrial Park - \$2 mill. - Golden LEAF 2009 Community Assistance Initiative

Wilson County

Triangle Biofuels Industries, Inc. - \$9,150 - USDA biofuel production funding
 Hanson Aggregates Southeast LLC - \$372,336 - National Diesel Emissions Reduction Act (EPA) (includes 3 sites total)

Dare County

Bite Me Sportfishing- \$65,886 - ARRA Diesel Emissions Reduction Projects, Ships & Marine Equipment
 Fisherman's Wharf Fillett - \$92,000 - ARRA Diesel Emissions Reduction Projects, Ships & Marine Equipment

Tyrrell County

Perry W. Beasley & Son Commercial Fishing - \$13,150 - ARRA Diesel Emissions Reduction Projects, Ships & Marine Equipment

Hyde County

Mayhew Clifton Williams, Jr. - \$51,550 - ARRA Diesel Emissions Reduction Projects, Ships & Marine Equipment

Carteret County

Harris Charters - \$47,500 - ARRA Diesel Emissions Reduction Projects, Ships & Marine Equipment

Martin County

Martin County Schools - \$48,000 - ARRA Diesel Emissions Reduction Projects

Craven County

Craven County Schools - \$50,000 - ARRA Diesel Emissions Reduction Projects
 Tammy & Tracey, Inc. - \$28,300 - ARRA Diesel Emissions Reduction Projects, Ships & Marine Equipment

Pender County

Brian Todd, Big Daddy - \$15,643 - ARRA Diesel Emissions Reduction Projects, Ships & Marine Equipment

New Hanover County

The Skeets Winner Corp. - \$102,381 - ARRA Diesel Emissions Reduction Projects, Ships & Marine Equipment

Durham County

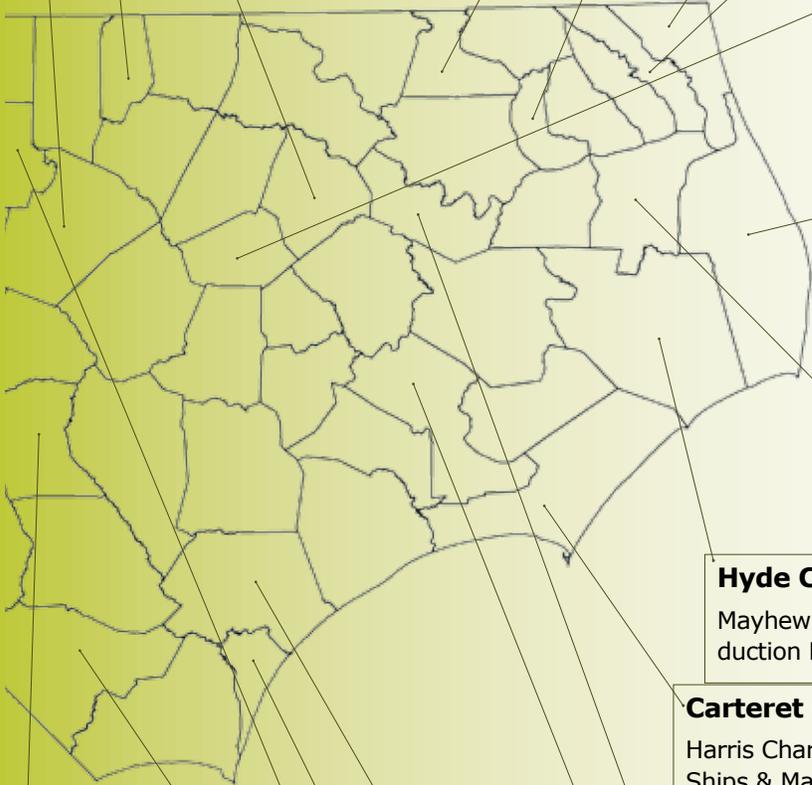
Cree, Inc. - \$2.5 mill. ARRA Conservation Research & Development; \$39 mill tax credit
 Semprius, Inc. - up to \$3 mill. - ARRA Early-Stage Solar Technologies

Columbus County

Southeastern Community College "Green Pathways" - \$85,000 - Golden LEAF 2009 GLOW

Cumberland County

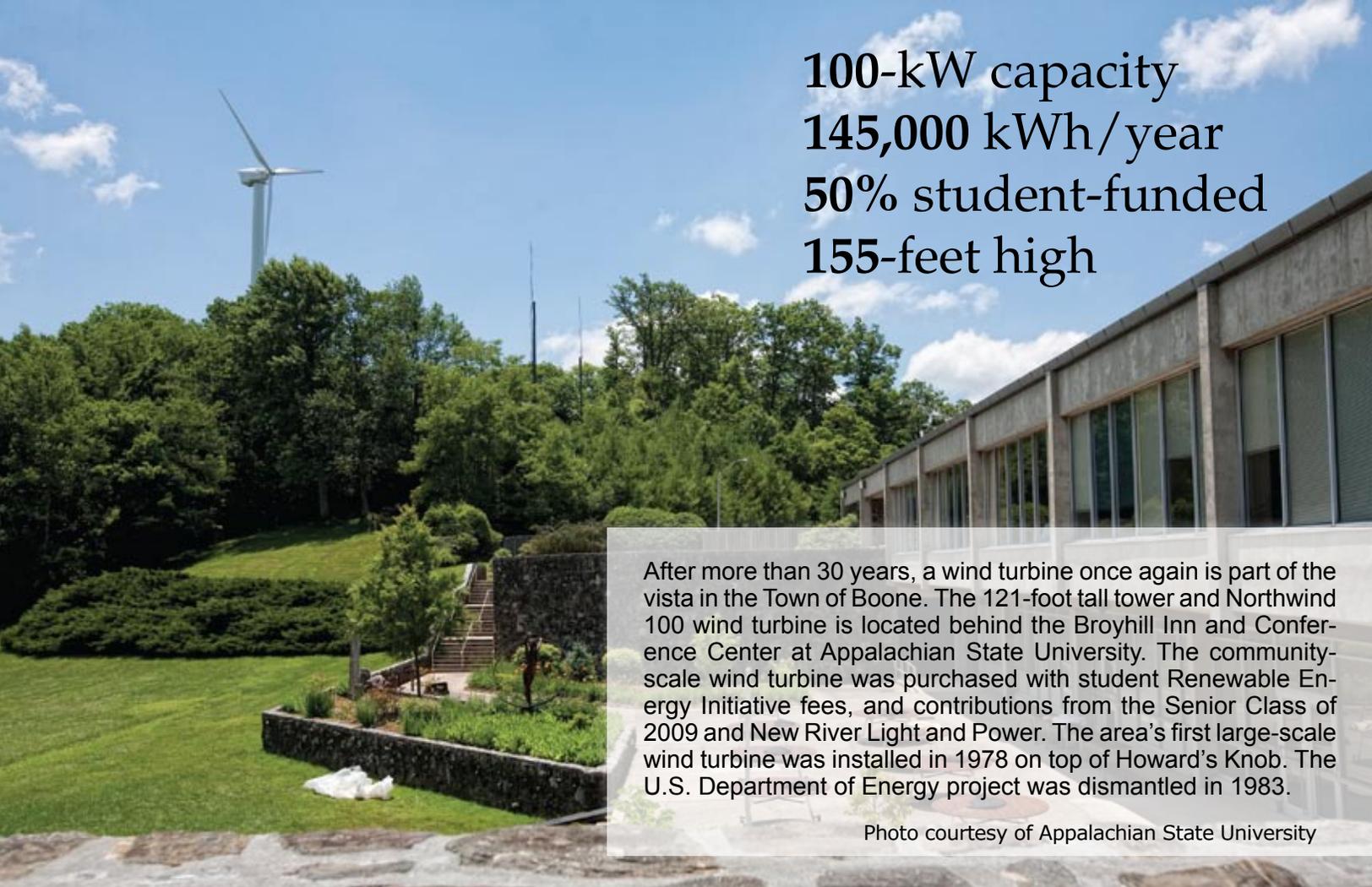
Cape Fear Siteworks - \$21,750 - National Diesel Emissions Reduction Act (EPA)
 Cumberland County Schools - \$50,000 - ARRA Diesel Emissions Reduction Projects



Appalachian Energy Center
Appalachian State University
ASU Box 32131
Boone, NC 28608-2131



NONPROFIT-ORGANIZATION
US POSTAGE
PAID
Boone, NC
PERMIT NO.36



100-kW capacity
145,000 kWh/year
50% student-funded
155-feet high

After more than 30 years, a wind turbine once again is part of the vista in the Town of Boone. The 121-foot tall tower and Northwind 100 wind turbine is located behind the Broyhill Inn and Conference Center at Appalachian State University. The community-scale wind turbine was purchased with student Renewable Energy Initiative fees, and contributions from the Senior Class of 2009 and New River Light and Power. The area's first large-scale wind turbine was installed in 1978 on top of Howard's Knob. The U.S. Department of Energy project was dismantled in 1983.

Photo courtesy of Appalachian State University