Electricity Indicators for Cape Cod

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The Energy Present

Consumption: *Growing Demand*

Metered electricity consumption on Cape Cod is increasing steadily. Residential and total demand in Barnstable County each rose by more than 20% from 1998-2004, and per capita consumption increased to more than 8 megawatt-hours/year.

Fuel Sources: *Dirty Mix*

Cape Cod depends largely on fossil-fueled plants such as the Canal Station in Sandwich to generate its electricity. In 2004, gas-, oil-, and coal-fired units produced more than 60% of the power purchased by local consumers.

Power Supply Costs: *Rising Rates*

The price of each kilowatt-hour purchased from the Cape's primary power suppliers has more than doubled in recent years. In 2006, residents and businesses served by the Cape Light Compact have been enduring the highest rates in the continental United States.

Emissions Footprints: *True Costs*

During 2004, Cape Cod's purchases of electricity accounted for the release of more than 40 pounds of air pollution and over 4 tons of greenhouses gases for each Barnstable County resident. Air emissions like these degrade air and water quality and contribute to public health problems and global climate change.

The Energy Future

Photovoltaic Systems: *Courses of Action*

Solar PV systems are helping an increasing number of homeowners, businesses, and institutions reduce their dependence on electricity generated by fossil fuels and, when conditions are right, spin their electric meters backwards and infuse Cape Cod's power grid with green electrons.

Municipal Wind: *Signs of Progress*

Two 1.65-MW wind turbines were scheduled to begin supplying emissions-free power in Orleans by the end of 2006, but they've been sent elsewhere. Other local communities are at varying stages in the involved process required to capture wind resources on municipal property, with economic and institutional obstacles remaining to be resolved.

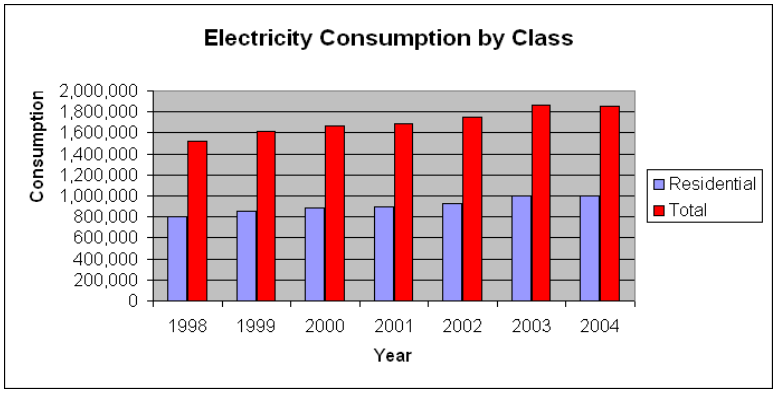
Wind & Ocean Energy Development: *Paths to Independence*

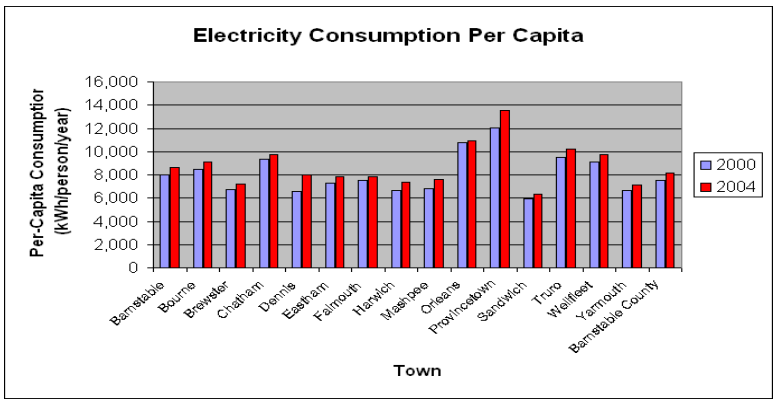
Wind and ocean energy resources remain largely untapped. At maximum capacity, proposed renewables projects would transform the Cape into a net exporter of green power, even during peak demand periods. The regional resource base is sufficient to make Cape Cod electricity independent and, eventually, energy independent.

Photos, from top: Canal stack, PV system, wave generators (credit: Ocean Power), wind turbine (credit: GE), tidal turbines (credit: MCT)

Electricity Consumption by Class & Per Capita

Metered electricity consumption on Cape Cod continues to increase steadily on both an overall and per-capita basis, according to data made available for this project. This is occurring despite sustained investments in energy efficiency and initial market entry for consumer-side distributed resources.





Residential and total consumption in Barnstable County each increased by more than 20% from 1998-2004. Continued load growth represents a disturbing trend for the near term, given current reliance on finite sources of fuel that have adverse impacts on local communities, must be imported from elsewhere, and are subject to global demand pressures.

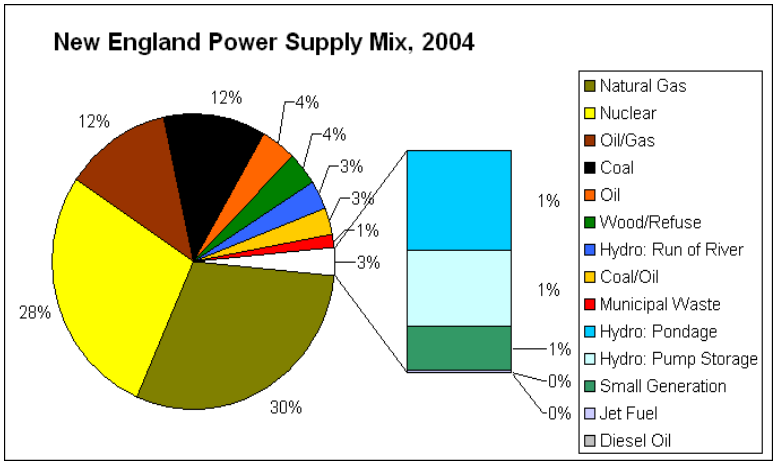
Over the longer term, however, increased power consumption could underlie the transition to an energy economy appropriate for the carbon-constrained future. Reliance on abundant and inexhaustible renewable resources that reduce the local "emissions footprint" associated with electricity use would also support a switch to emissions-free technologies in the transport and heating sectors.

Sources: Data on consumption by class and by community from Cape Light Compact; data on population from US Census Bureau.

Electricity Sources by Fuel

Cape Cod depends largely on fossil fuels to meet its needs for electricity. On behalf of local consumers, the Cape Light Compact and NStar enter into contracts with power suppliers that own the rights to electricity generated by facilities located throughout New England. These agreements define the "contract path" for most of the power purchased by local consumers.

On the contract path, the fuel supply mix for local consumers is equivalent to that for the entire New England electricity system. This "system power" mix is dominated by fossil fuel plants, including the Canal Electric Plant in Sandwich, the Brayton Point Station upwind of Cape Cod, and numerous other facilities that together supplied more than 60% of total New England generation in 2004.



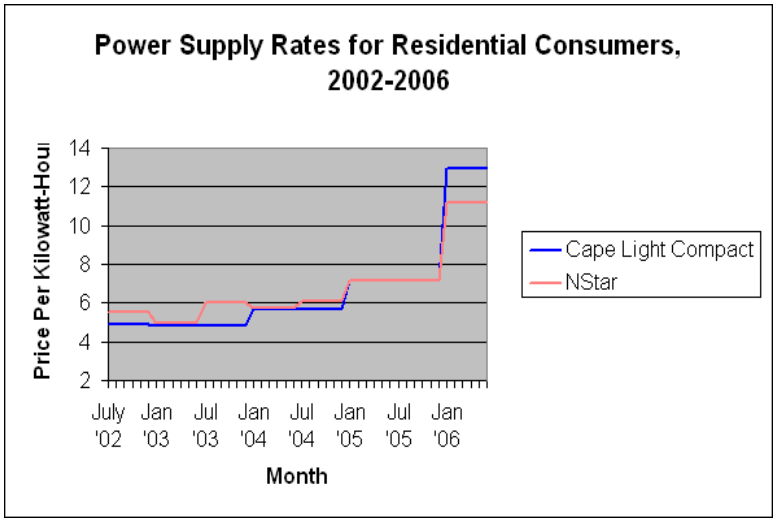
Nuclear power plants, including the Pilgrim Plant in Plymouth, accounted for 28% of the regional mix. Facilities considered renewable (but not necessarily environmentally benign), including large-scale hydro units and

plants burning wood, construction debris, and municipal wastes, generated most of the rest of the power. Wind and solar energy installations dispersed throughout New England, including some in local communities, produced a negligible amount of electricity.

Sources: Data on power sources from Cape Light Compact and NStar; data on regional supply mix from New England Independent System Operator.

Electricity Supply Costs Through Aggregation

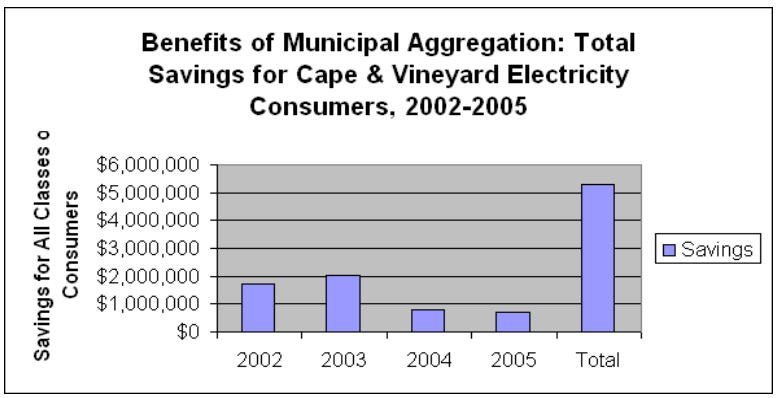
Electricity is becoming an increasing drain on Cape Cod's economy: The price of each kilowatt-hour purchased by residential consumers through the Cape's primary power suppliers has more than doubled over the past 3 and a half years, boosting the region's total electricity bill from on the order of $200 million annually to on the order of $300 million in 2005 and likely around $400 million in 2006. Skyrocketing commodity prices for all classes of consumers reflect recent events as well as global demand pressures that have driven up the out-of-pocket costs of fossil fuels, even as the "true costs"—the economic, environmental, and social impacts—borne by local communities have become more evident.



Most consumers on the Cape and Martha's Vineyard are served by the Cape Light Compact, which was created in 1997 to protect their interests during the restructuring of the Massachusetts electricity industry. If it provides access to lower-price power, then the Compact's municipal aggregation program supports Cape Cod's economy: Dollars that otherwise would be exported to corporations headquartered elsewhere are freed up for other uses—a critical issue for residents with low or fixed incomes, businesses with narrow profit margins, and communities with tight budgets.

In early 2006, electricity rates for the Compact's consumers were the highest in the continental United States because bad luck compounded the effects of poor judgment: The Compact did not hedge risks in the power supply marketplace, leaving its retail consumers exposed to price shocks in the aftermath of Hurricane Katrina. Relative to NStar's rates, the aggregate impact of this mistake will likely exceed $10,000,000 by the end of this year.

During 2002-04, when the Compact began buying power from competitive suppliers on behalf of a subset of local consumers, aggregate savings totaled more than $4.5 million, relative to out-of-pocket costs that would have been incurred by purchasing power through NStar, the incumbent utility. In 2005, the transition to full retail competition, as defined by the Massachusetts Electric Restructuring Act of 1997, ended. As the number of consumers served by the Compact grew, the price gap between the Compact's and NStar's residential service offerings narrowed. Over this period, savings for individual consumers were modest, but the Compact's retail aggregation program reduced the overall 2005 power supply bill of Cape & Vineyard residents and businesses—and municipal taxpayers—by a total of more than $700,000. All of these gains have been lost in 2006.

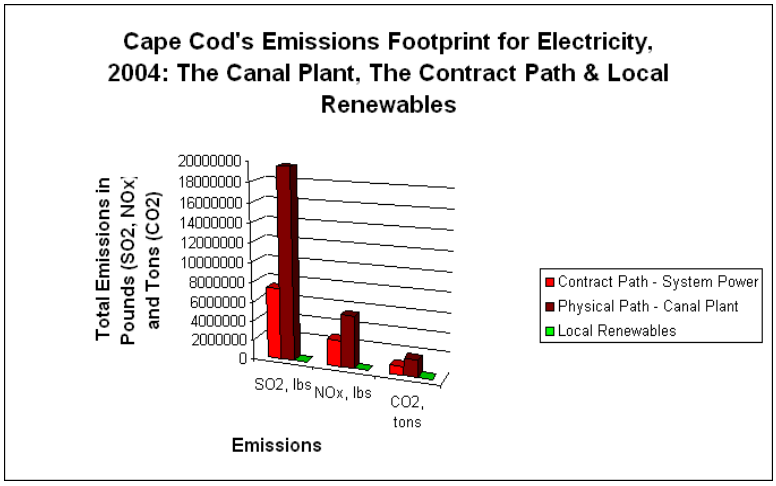


Going forward, the Compact's ability to offer favorable pricing and contract terms across all consumer classes remains uncertain due to institutional, regulatory, and market factors. Approaches for addressing these issues are being actively pursued, including the possible formation of an energy cooperative that could buy power at the wholesale, rather than retail, level.

Sources: Data on supply rates from Cape Light Compact and NStar; data on benefits of municipal aggregation from Cape Light Compact.

Electricity Emissions By Source & Per Capita

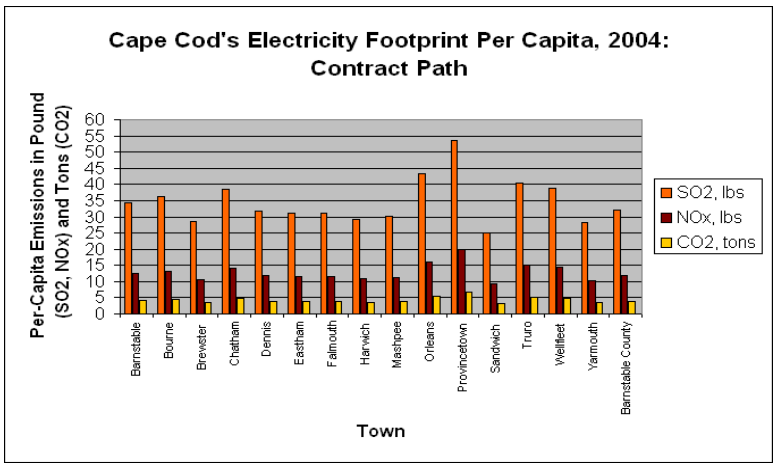
By relying on electricity generated by fossil fuels, every Cape Cod consumer has an "emissions footprint" reflecting "true costs"—the adverse environmental, economic, and social impacts that do not show up on electricity bills but are experienced within local communities.



The electricity infrastructure, most notably the Canal Electric Plant in Sandwich, defines the "physical path" footprint calculated based on average air emissions from this predominantly oil-fired facility. If the Cape had relied solely on the Canal plant to meet its electricity needs, then in 2004 this facility would have released almost 20 million pounds of SO_2, more than 5 million pounds of NO_X, and more than 1.7 million tons of CO_2 in order to satisfy local demand. Because the plant produces far more electricity than the Cape consumes, these data represent only a fraction of its total emissions into local environments in 2004. Emissions like these degrade air and water quality, contribute to public health problems, and add to the unprecedented atmospheric accumulation of greenhouse gases.

The Cape Light Compact and NStar define the "contract path" footprint, calculated based on average emissions for “system power”—the New England electricity supply mix. This footprint is smaller than the "physical path" footprint, reflecting the regional reliance on natural gas, nuclear power, and other sources with lower emissions than oil.

The “system power” mix purchased by the Compact and NStar may be cleaner than the power generated by Canal, but total emissions on the contract path are still substantial. Cape Cod’s purchases of electricity accounted for the release of more than 30 pounds of SO_2, almost 12 pounds of NO_x, and more than 4 tons of CO_2 per person in Barnstable County during 2004.



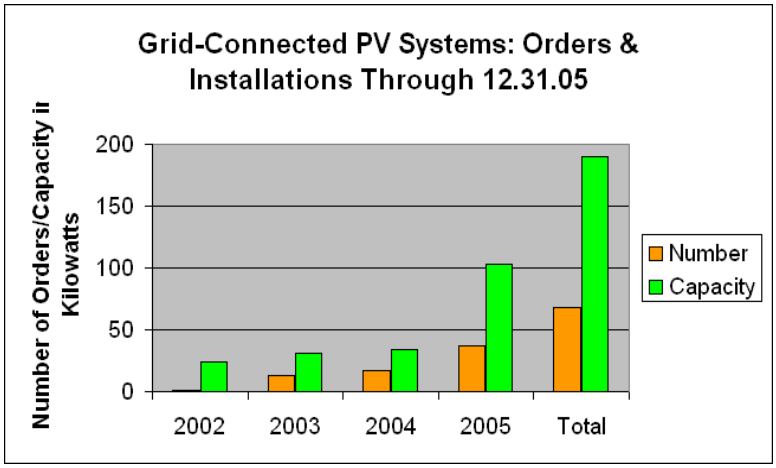
Currently, local solar and wind power systems don't produce much electricity, but they also don’t have an emissions footprint—and their emissions won't ever climb above zero, no matter how many installations occur. Owners of these systems are decreasing the “true costs” associated with their energy consumption.

Green power products available through the Cape Light Compact offer local consumers opportunities to decrease their emissions footprints. Available for a small premium, “boutique green” power is based on output from bioenergy, small hydro, solar and wind energy systems in New England. By going green, consumers offset their reliance on conventional system power products while building demand for alternatives. They do not, however, encourage renewable energy development in local communities.

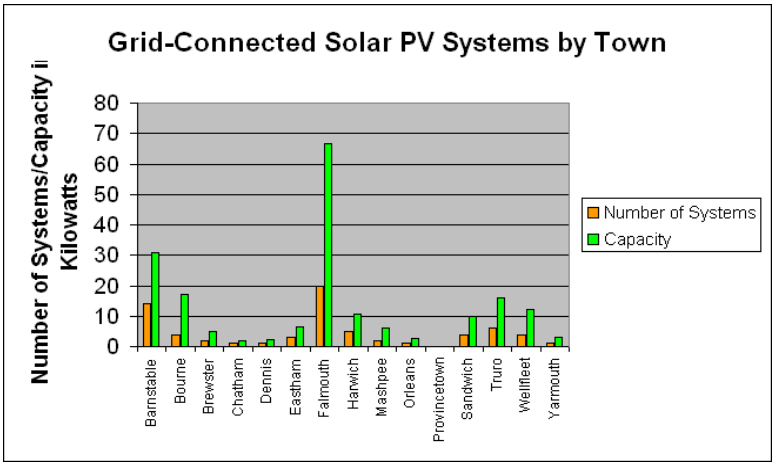
Sources: Data from Cape Light Compact, New England Generation Information System, Mirant, and US Census Bureau.

Grid-Connected Solar Photovoltaic (PV) Systems: Market Penetration

Solar PV systems are helping an increasing number of homeowners, businesses, and institutions reduce their dependence on electricity generated by fossil fuels and, when conditions are right, spin their electric meters backwards and infuse Cape Cod's power grid with green electrons.



By the end of 2005, 68 grid-connected systems had either been installed or ordered, and their aggregate capacity approached 200 kW. The Woods Hole Research Center's PV array was the first to be ordered, and it remained the largest by far, accounting for more than 10% of Cape Cod's total solar electric capacity and for Falmouth's huge capacity advantage over other towns. A comparably sized 2006 installation at Cape Cod Community College's new green building changed this dynamic.



The local PV system base is expanding due to a number of factors. These include the growing interest in sustainable energy solutions among consumers, the rising price of electricity, and the availability of rebates and tax incentives. Cape & Islands Self-Reliance and other participants in the Cape & Islands Renewable Energy Collaborative are playing key roles by leading multifaceted education, training, deployment, installation, and market transformation programs. The “Solarize Our Schools” initiative launched by the Cape Light Compact will make a difference in 2006 by ensuring that every town has at least one more PV installation.

For trends to be sustained, substantial subsidies for this inexhaustible, emissions-free source of power will continue to be required because PV technology remains expensive and the price of electricity generated by conventional sources does not reflect "true cost" considerations. The long-term contribution of PV technology to the region's overall electricity supply portfolio remains uncertain—but for now, it represents the best way for most local consumers to transform natural energy flows into green power.

Sources: Data from Cape & Islands Self-Reliance, Massachusetts Technology Collaborative, and Woods Hole Research Center.

Municipal Wind Projects: Deployment Progress

Summary: Many local communities are actively pursuing the capture of wind resources on municipal property. Orleans is the furthest along in a project development process facilitated by the Massachusetts Technology Collaborative (MTC) under funding provided by electricity consumers, with two 1.65-MW wind turbines planned to supply emissions-free power to the town.

This project and other community wind initiatives promise to help reduce municipal electricity bills and/or to create new revenue streams, thereby stretching town budgets and freeing up resources for other uses. They also will represent highly visible indicators of a future in which Cape Cod relies on renewable resources to supply increasing amounts of energy.

Community wind projects are helping focus attention on multifaceted challenges that must be addressed to ensure that regionally abundant renewables are tapped in ways that maximize local benefits. For these initiatives, the most significant barriers are economic: All wind installations require substantial up-front investments in exchange for long-term returns, but small projects do not offer economies of scale.

At the state level, proposed legislation would improve wind project economics by increasing net metering limits, while participation by Massachusetts in the multi-state Regional Greenhouse Gas Initiative (RGGI) could help level the playing field by providing additional incentives for renewables development and increasing the cost of fossil-fired generation (in December 2005, the Romney Administration opted to withdraw from RGGI). Alternative policy, development, financing, and ownership models also are being examined as possible remedies.

Several challenges relate to the Cape Light Compact. By reducing municipal needs for delivered electricity, community wind projects could undermine the Compact's ability to secure favorable retail power supply contracts for all Cape & Vineyard consumers. These projects could also create conflicts between the Compact, as a collective of local communities seeking to reduce rates through aggregation, and the towns, as independent entities seeking to maximize economic benefits by selling output from wind turbines sited on municipal property. In addition, the Compact's abilities to assist town- or developer-owned wind projects and to buy power from them are constrained by several factors.

Municipal Wind Projects: Status by Town As of 06.01.06

	Project Being Actively Pursued	Meteorological Tower Installed	1 Year of Wind Data Collected	Feasibility Study Completed	Project Development Approved	Project Development Initiated	Green Power Being Generated
Barnstable							
Bourne							
Brewster							
Chatham							
Dennis							
Eastham							
Falmouth							
Harwich							
Mashpee							
Orleans							
Provincetown							
Sandwich							
Truro							
Wellfleet							
Yarmouth							

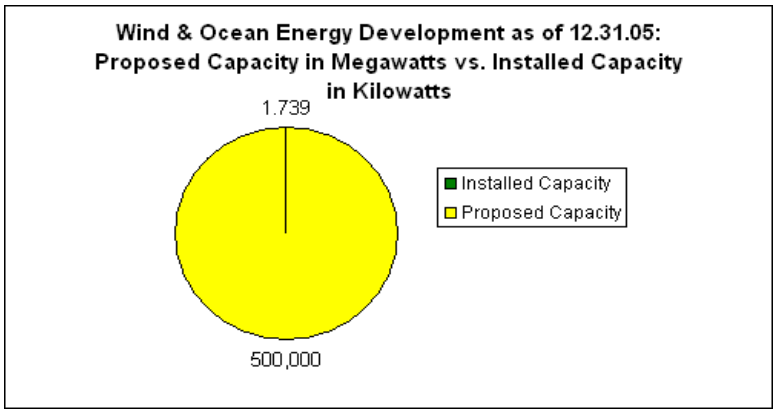
A renewable energy cooperative—such as that being studied by the Compact—could, if properly structured, eliminate these conflicts and limitations. It could help finance individual or aggregated wind projects, enter into public-private partnerships, and allow residents, businesses, and towns to invest in, own, operate, and/or buy wholesale power from renewable energy facilities.

Sources: Data from individual communities, Massachusetts Technology Collaborative, and Cape & Islands Energy Information Clearinghouse (www.cirenew.info/communitywind.htm).

Wind & Ocean Energy Development Activity: Proposed & Installed Capacity

The wind, wave, and tidal energy resource base on and around Cape Cod and the Islands far exceeds present and future demand for electricity within local communities. To date, the resource base remains almost completely untapped.

At Cape Cod Regional Technical High School in Harwich, Cape Cod's first grid-connected wind turbine—a 1.739 kW machine—began generating green power in June 2005. By the end of the year, it had harnessed local energy flows to produce more than 1300 kWh of electricity. Its net generation was equivalent to about 40% of the demand of an average home. Its total fuel cost was zero, as were some of its "true cost" impacts: No pollutants or greenhouse gases were released, and no finite fuel resources were extracted elsewhere and imported to the Cape.



Cape Cod Tech's turbine represents a modest harbinger of the region's energy future: At the end of 2005, more than 500 MW of wind generating capacity remained under active consideration for sites in Nantucket Sound and within almost every town on Cape Cod. In addition, an institutional framework and technology foundation were being created for deepwater wind projects off the Cape, commercial feasibility had been assessed for a 100-MW wave energy farm off Cape Cod National Seashore, and commercial viability was being studied for a tidal current energy project in Muskeget Channel between Martha's Vineyard and Nantucket.

If just the wind projects being actively pursued by private developers and by local communities, institutions, businesses, and residents were to be constructed as proposed, they would on average satisfy some 80% of Cape Cod's electricity demand. At maximum capacity, they would transform the region into a net exporter of green energy even during peak demand periods, and they would ensure that all of the Canal plant's dirty power is consumed elsewhere. Clearly, the regional resource base is sufficient to make Cape Cod electricity independent and, eventually, energy independent. An accelerated transformation of the Cape's energy basis promises major economic, environmental, and social benefits.

In 2006, measured progress is occurring: A 10-kW wind turbine started spinning at Upper Cape Tech in Bourne, and the Cape's first large-scale unit—a 660-kW machine—entered service across the canal at the Massachusetts Maritime Academy. In addition, other land-based wind installations are scheduled, new ocean-based project proposals have been advanced, and myriad regulatory review, development, and precommercial development activities are continuing.

Whether, where, and when large-scale renewable energy projects will be built remain to be determined. The divisive debate over a single project continues to hamper efforts to develop a community-based energy strategy and renewables action plan focused on maximizing possible benefits while minimizing any adverse impacts.

Sources: Data from Massachusetts Technology Collaborative, Electric Power Research Institute, and Cape & Islands Energy Information Clearinghouse (www.cirenew.info/oceanEnergy.htm).