Renewable Energy Resources and Systems:
What’s available and what works?

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Wednesday, June 3, 2009
Schuyler Planning and Zoning
“There are two spiritual dangers in not owning a farm. One is the danger of supposing that breakfast comes from the grocery, and the other that heat comes from the furnace.”

-Aldo Leopold (1949)

Excerpt from “Good Oak,” an essay in A Sand County Almanac
The voice of the present...

~8,700 farms

26% of these farms lost money in 2002 and 2003

USDA Ag Census data, 2003.

3.6% decline in farms between 1997 and 2003.
Electricity prices?

Average electricity cost (cents per kWh):

United States: 11.03
New York: 17.46

Residential energy usage - 900 kWh/month:
US Avg.: $1188/year
New York: $1886/year

DOE/EIA-0226 (2009/05)
Crude oil prices?

Bureau of Labor Consumer Price Index

- Nominal price
- Inflation adjusted
What’s to be done?

• Before ANY energy system (renewable or not) is considered, ALWAYS address efficiency first.

• Efficiency is the ratio of energy input to useful energy output.

• For example, an incandescent light bulb is 10% efficient (only 10% of the electricity used to power the bulb is returned as useful light).
Is it worth it to buy those absurdly expensive CFLs?

(1) 60-watt incandescent bulb that is on for 8 hours per day requires:

\[
60W \left( \frac{8 \text{hrs}}{\text{Day}} \right) \left( \frac{365 \text{Days}}{\text{Yr}} \right) \left( \frac{1 \text{kWh}}{1000 \text{Wh}} \right) \left( \frac{\$0.1746}{\text{kWh}} \right) = \$30.59 / \text{yr}
\]
Is it worth it to buy those absurdly expensive CFLs?

(1) 13-watt CFL that is on for 8 hours per day requires:

\[
13W \left( \frac{8\text{hrs}}{\text{Day}} \right) \left( \frac{365\text{Days}}{\text{Yr}} \right) \left( \frac{1\text{kWh}}{1000\text{Wh}} \right) \left( \frac{$0.1746}{\text{kWh}} \right) = $6.63/\text{yr}
\]

This saves you $23.96 per year (for a $1.50 CFL).

How many bulbs are in your house or office?
Efficiency – Home energy use

Scheckel (2005), p.31

- Space heating: 47%
- Water heating: 21%
- Space cooling: 6%
- Lighting: 7%
- Wet cleaning: 3%
- Refrigeration: 5%
- Electronics: 3%
- Cooking: 4%
- Other: 4%
• ONLY after efficiency (and conservation) is addressed, should we look at new systems

Nonrenewable sources provide 87% of NY’s energy production

Of the renewables, NY is:
- 10th in the U.S. in electricity from biomass
- 15th in the U.S. in wind potential
- in 2008, 425 MW installed
- just entered the “Gigawatt club” for wind

New York State Energy Fact Sheet (2008)
Wind systems

New York State Wind Resource Explorer
Wind systems
World PV market in 2007, 2826 MW total

- Germany: 47%
- Spain: 23%
- Japan: 8%
- USA: 8%
- Rest of world: 8%
- Rest of EU: 6%
Solar systems

- Generate electricity
- Good incentives (both state and federal)
- Residential and business incentives
- In CNY, expect about 1500 kWh offset for each 1 kW of PV installed (optimal systems)
  - About 125 kWh/month
  - Typical home uses between 800 and 1000 kWh per month
- Can be grid tied (net metering)
Solar systems – hot water

Solar thermal system for domestic hot water

- Fast payback
- Relatively inexpensive
- Work in freezing climates
- Straightforward installation
- Very few incentives
- Flat plate collectors

Images courtesy of John Siegenthaler
Solar Thermal for DHW and space heating

- Efficient
- Expensive
- Nice payback on investment
- Few installers
- Radiant heating options
- Evacuated tube collector
Micro hydroelectric systems

Madison County Hydrology
Micro hydroelectric systems
Micro hydroelectric systems

- Inexpensive systems
- Constant energy production
  - Not intermittent
- Highly resource-specific
- Cannot be net metered
- No incentives (USDA REAP?)
- Permitting process (DEC, ACOE)
Geothermal systems

DHW and space heating options
Very efficient (heat pump systems)
Good incentives

Expensive up-front costs
Often requires extensive site work
Few installers with experience
Biomass systems

Wood Pellets (e.g. NEWP)

Waste wood biomass systems
Densification and uniformity
High efficiency space heating
Opportunities for bioenergy crops
(willow, switchgrass)
Biomass systems

Marginal and fallow lands can be used for biomass energy crops.
Biomass systems

Reasons for Anaerobic Digestion

- Treatment of organic wastes and odor control
- Biogas generation and energy production
- Environmental and economic benefits
Biomass systems

Waste Management Renewable Energy
Meeting the demand for green energy.

Landfill Gas-to-Energy Process

1. The cycle begins with the collection of residential and commercial waste. The waste is then transported to waste management facilities for permanent disposal.

2. Miles on site where, anaerobic reactors, paper and cardboard, is organic. Anaerobic digestion is anaerobic, anaerobic fixation digests this organically waste and produces methane gas and carbon dioxide as natural byproducts.

3. The methane gas is recovered via a series of wells drilled into the landfill. These wells are connected by a common pipe system that collects the gas and transports it to a nearby compression facility.

4. At the compression facility, the landfill gas is de-watered, filtered and pressurized.

5. The gas is piped to an electricity generating plant where it is used as fuel to turn engines or turbines to generate electricity. Landfill gas also may be piped with residential customers for use as an alternative fuel source.

6. To complete the cycle, the electricity is delivered via utility transmission lines to residential and commercial customers.

When you think renewable energy,
Think Green: Think Waste Management.
Renewable energy systems are on the rise:

- Energy efficiency standards
- Volatile energy prices
- Economical
- Market trends (it’s cool!)
- Government mandates
- Long-term sustainability

- Renewable energy is for everyone…
Community energy plans are becoming increasingly common

- Brattleboro, VT – pop. 16,000
- Claremont, CA – pop. 37,000
  - Sustainable City Plan (2008)
- Boulder, CO – pop. 92,000
  - Sustainable Energy Plan (2008)
- San Diego Association of Gov’ts, CA – pop. 2.3 million
The Rocky Mountain Institute offers that community energy plans can:

- Lower energy bills for residents and business owners
- Stimulate growth in the local economy
- Reduce pollution and greenhouse gas emissions from power plants and other energy sources
- Potentially avoid the need to construct costly new power plants
- Produce local jobs
- Contribute to a more sustainable future
Some resources for energy planning:

Cities for Climate Protection, ICLEI
www.ICLEI.org

US Council of Mayors Climate Protection Agreement
www.coolmayors.com
www.usmayors.org

EPA Green Communities Program
http://www.epa.gov/greenkit/index.htm

Central New York Regional Planning and Development Board
http://www.cnyrpdb.org/ (Chris Carrick)
Planning examples - Syracuse

- **Street Lighting**
  - 16,101 Luminaries – MV to HPS
  - Energy Savings - $75,751.00 annually
  - 2,525,025 kWh saved, 996 tons of eCO₂

- **Traffic Signals**
  - 354 locations – 10,050 incandescent lights to LEDs
  - Reduced energy by 90%, 3,351,583 kWh, 1,324 tons of eCO₂ (NOx – 3,014 lbs., Sox – 9,203 lbs., VOC – 419 lbs., PM10 – 2,781 lbs.)
  - $537,435.00 NYSERDA Rebate

- **City Hall Commons**
  - 592,794 kWh saved
  - NYSERDA Rebate $137,203.00

- **Parking Garages**
  - Retrofitted lighting in 4 City Parking Garages
  - 256,664 kWh saved, 106 tons of eCO₂
  - NYSERDA Rebate $25,000.00

- **City Hall**
  - 548,121 kWh saved
  - NYSERDA Rebate $108,975.00
  - Designated as an ALL GREEN Building – uses 40% hydro, 40% biomass, 20% wind
Planning examples - Auburn

- Hydroelectric facilities
  - Mill Street dam first site developed (1973)
  - North Division Street dam commissioned (1992)

- Auburn Public Power Authority
  - Energy Program begun by Mayor Paul Lattimore; City Council established Local Law #1 (1980)
  - Mayor Tim Lattimore begins Public Power Task Force; voters approve referendum to create the Auburn Municipal Power Agency (2005)
  - Cayuga County Public Utility Service

- Geothermal
  - Mayor P. Lattimore solicits DOE & NYSEDA funding in early 1980s
  - Memorial City Hall – NYCOM Local Gov Achievement Award (2004)
  - Police and Fire Station

- City Landfill Gas-to-Energy Project
  - Currently producing over 200 million cubic feet/year of quality gas – 42% methane
  - City cost avoidance of ~$800k/year

- NYPA Energy Conservation Project
  - $5.35 M budget – energy audit of all municipal facilities and Energy Master Plan
  - est. savings of $250k/year
Thank You!

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Solar Power as Renewable Energy
Solar PV (basic and advanced)
Solar Hot Water (basic and advanced)
Geothermal Installer (basic)
Small Wind Installer (coming soon)

Green Entrepreneurship Seminar:
A Regional Summer Program for High School Students*
June 29 - July 3, 2009
Morrisville State College
Morrisville, NY 13408

*“I have not failed. I’ve just found 10,000 ways that won’t work.”
~ Thomas Alva Edison