Harnessing Solar Energy for Broiler Production

University of Delaware Photovoltaic Poultry House Project

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Biofuels Research

- Biomass genomics will facilitate the use of woody plant tissue for bioenergy and biofuels.
- MicroRNAs of Brachypodium distachyon is one of 11 projects totalling $8.3 million funded by DOE and USDA.
- The goal is to reduce US gasoline consumption by 20% in 10 years.
Harnessing Solar Energy for Broiler Production
Project Goals

- To determine the economics of installing, operating, and maintaining solar cells as sources of power for poultry houses
- To define and guide legislation that may be necessary to make this technology practical and viable
Delmarva Poultry Industry Statistics*

- 2000 Delmarva growers
- 5,500 - chicken houses
- 133,155,700 - chicken capacity
- 571,141,000 - chickens raised per year

*From DPI, Inc. www.dpichicken.org
Delmarva Poultry Industry Statistics*

- 14,000 company employees
- $159 million paid to growers
- $337 million integrator payrolls
- $1,652,309,000 - wholesale value of chickens

*From DPI, Inc. www.dpichicken.org
Poultry Dominates Delmarva Agriculture

- 76% of DE cash farm income is poultry
- 8% of DE cash farm income is corn (161,000 acres) and soybeans (177,000)
- Sussex County leads the US in density of poultry production
- 36% of Maryland cash farm income is poultry
- 20% of Virginia cash farm income is poultry
Figure 1.
Flow Chart of a Typical Integrated Broiler or Turkey Operation

- Raw Ingredient
  - Feed Manufacturing
    - Breeder Chicks or Poults
      - Parent Breeders
        - Hatching Eggs
          - Hatchery
            - Chicks or Poults
              - Growout
                - Live Haul

- Equipment, Supplies
- Processing
- Further Processing
- Storage
- Distribution

North Carolina Cooperative Extension Service
College of Agriculture & Life Sciences
A Typical Poultry House

- 66 x 600
- $9.48/sq ft
- $375K/house
- Includes generator and non cost-share portion of manure shed
System Design

- 42 kW solar power system, including data acquisition and monitoring equipment
- Ground mounted
- Two separate systems
  - Net metering (12 kW)
  - Demand management (30 kW)
Solar Photovoltaic Panels: GE PV-200

- Each panel measures 5 ft. x 3.2 ft and weighs 39 lbs
- Wind-bearing potential is 50 lbs/ft²
- Hailstone impact resistance is 1” at 50 mph
- Each panel generates 200 W at peak power
- Net-metering array has 60 panels → 12 kW DC
- Demand management array has 150 panels → 30 kW DC
Inside the Container
Net-Metering (12 kW)

- This array generates power for the electrical distribution system.

- When the output by the PV system exceeds the power needed by the poultry house, the excess is sent to Delmarva Power.

- When the output by the PV system doesn’t meet the power needed by the poultry house, the balance of the power is supplied by Delmarva Power.
Demand Reduction System (30 kW)

- 3 Key Components ........
  - PV electric generation
  - Battery storage: increased during middle of day
  - Programmed limits on electricity used from Delmarva Power

- Strategy: Cut demand charges by using PV electric to trim “peaks” of demand.
Economic Incentives

- Delaware Green Energy Fund
- Federal Investment Tax Credit (30%) in the Energy Policy Act of 2005
- USDA Renewable Energy Grants
- Renewable energy credits (RECs)
- Savings on energy payments
Delaware Green Energy Fund

- 50% of the cost of the system can be rebated, up to $250,000
- Equipment must be installed in Delaware
- In Delaware, only DP&L customers are eligible for the rebate at this level
- Poultry facilities are considered non-residential
- Purchaser may request that the rebate be paid directly to retailer or installing contractor
Federal Investment Tax Credit

- Dollar-for dollar reduction of an entity’s tax burden
- 30% of eligible property can be claimed
- In general, equipment must be new
- Tax credit can be claimed the year the equipment is put into service, or it can be carried back one year or carried forward for twenty years
- Legislation expires at the end of 2008
- Sounds good, but the tax burden for a typical poultry grower may not be sufficient to make this a strong incentive
Federal Investment Tax Credit

- State rebates, grants, buy-downs, other incentives, and other taxes paid do not decrease the amount eligible for this tax credit as long as federal income tax is paid on these incentives.

- Tax depreciation is separate from tax credit, BUT

- Tax depreciation claimed must be reduced by 50% of the federal tax credit.
USDA Rural Development Grants

• Farm must be located in a rural area (any area other than a city/town with a population greater than 50,000)

• Provides 25% of the system costs up to a grant maximum of $500,000.

• A simplified application process is available for projects with total costs less than $200,000.
USDA Rural Development Grants

- 50% or greater of the income of the grantee must be from agricultural operations.
- The grant applicant must own the system.
- The project must be technically feasible.
- USDA grant funding must be deducted from the system cost before the Green Energy Fund grant is determined.
Renewable Energy Credits (RECs)

- Energy distribution managers for the northeast grid (PJM) will certify the system as a green energy generator
- The purchaser will accrue RECs
- RECs can be sold as commodity
Energy Savings

- Energy output factor is 1336 kWh/kW/year*

- A 42 kW system will generate 56,112 kWh

- The DP&L rate schedule for Allen’s is $0.135/kWh

- Annual savings is expected to be $7,575.00

*Based on National Renewable Laboratory Data, including monthly maximum temperature, inverter efficiency, and wire losses; elevation is 9 meters; array tilt is 24.88 degrees; Latitude is 39.88; Longitude is -75.25
Project Monitoring Plan

- Energy use by the poultry house
- Electricity generated by the solar cells
- Electricity drawn from the utility
- Combined effects of both net metering and demand management
Project Timeline

- July 2006 - Project cooperators committed
- Oct 2006 - Allen’s became involved
- Dec 2006 - Contracts signed
- Dec-Jan 2007 - Solar panels installed
- Jan-Feb 2007 - System operational
- 2007- present - Data collection
Project Status

- The Green Energy Fund rebate was paid directly to WorldWater & Power

- The system was certified as a green energy generator in November 2007

- Chickens have been placed on the farm for several grow-out cycles

- The system is working well
Questions

- What snags can we expect?
- How easy is it to apply for and get the incentives (Green Energy Fund rebate and investment tax credit)?
- How marketable are the RECs?
- How easy is it to obtain USDA grant funding?
- How much is the DP&L bill reduced?
- How long will it take for the purchaser to recover the investment?
Payback Period

Based on $6000/kW system cost
## Other Solar Projects in Delaware

<table>
<thead>
<tr>
<th>Project</th>
<th>System Type</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>DuPont-Chestnut Run</td>
<td>40-kW ground-mounted</td>
<td>$512,000</td>
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<tr>
<td>DNREC/DE National Estuarine Research Reserve</td>
<td>15-kW roof-mounted</td>
<td>$104,000</td>
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<tr>
<td>Center for the Inland Bays</td>
<td>4.8-kW with 6.2-kW expansion</td>
<td>$75,000</td>
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<tr>
<td>Private residence</td>
<td>6-kW roof-mounted</td>
<td>$45,000</td>
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