

# The Clean Energy Industry and Tennessee: Survey and Outlook

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# The Clean Energy Sector

## Major Divisions within the Sector

1. Biomass
2. Biofuels
3. Geothermal
4. Hydroelectric
5. Solar
6. Wind
7. Tidal and Wave Power
8. Energy Efficiency Improvements

## Growth in Clean Energy Industry, 2003-2007

Table 4. U.S. Electric Net Summer Capacity, 2003-2007						
(Megawatts)						Percent Change
Source	2003	2004	2005	2006	2007	2003-2007
Total	948,446	962,942	978,020	986,215	998,837	5.31%
Renewable Total	96,847	96,357	98,746	101,934	106,554	10.02%
Biomass	9,628	9,711	9,802	10,100	10,313	7.11%
Waste	3,758	3,529	3,609	3,727	3,881	3.27%
Landfill Gas	863	859	887	978	1,034	<b>19.81%</b>
MSW <sup>a</sup>	2,442	2,196	2,167	2,188	2,204	-9.75%
Other Biomass <sup>b</sup>	453	474	554	561	643	<b>41.94%</b>
Wood and Derived Fuels <sup>c</sup>	5,871	6,182	6,193	6,372	6,432	9.56%
Geothermal	2,133	2,152	2,285	2,274	2,294	7.55%
Hydroelectric						
Conventional	78,694	77,641	77,541	77,821	77,833	-1.09%
Solar/PV	397	398	411	411	498	<b>25.44%</b>
Wind	5,995	6,456	8,706	11,329	15,616	<b>160.48%</b>
Nonrenewable Total	851,599	866,585	879,274	884,281	892,284	4.78%
<sup>a</sup> Includes total capacity whose primary energy source is MSW.						
<sup>b</sup> Agriculture byproducts/crops, sludge waste and other biomass solids, liquids and gases.						
<sup>c</sup> Black liquor, and wood/woodwaste solids and liquids.						
MSW=Municipal Solid Waste.						
Note: Totals may not add due to independent rounding. Data for 2007 is preliminary.						
Sources: Energy Information Administration, Form EIA-860, "Annual Electric Generator Report."						

Source: Energy Information Agency

# National Clean Energy Employment Data (Number of Jobs by Sector)

- Wind Power – 300,000
- Solar Photovoltaics – 170,000
- Solar Thermal – 624,000
- Biomass/Biofuels – +1 million

# Renewable Electricity Profile - Tennessee, 2006

- Capacity: 2821 megawatts (7<sup>th</sup> in nation)
- Generation: 8274 megawatt-hours (9<sup>th</sup> in nation)
- (Washington State ranks 1<sup>st</sup> nationwide, with 22,343 megawatts of capacity and 84,510 megawatt-hours of generation)
- Statewide, renewable electricity accounts for 13.5% of capacity and 8.8% of generation.
- Largest sources of renewable power:
  1. Hydropower - 12.6% of total capacity, 8.3% of total generation
  2. Wood/wood waste – 0.7%, 0.5%
  3. Wind – 0.1%, 0.1%

# Current Economic Conditions in Tennessee

- Real Gross State Product (GSP), 2007: \$207 billion
- Growth in Real GSP, 2006-2007: 0.85%
- Unemployment Rate, June 2008: 6.5%
- Change in Unemployment Rate, June 2007-June 2008: +1.9% (about 47,000 lost jobs)
- Leading Industries in Tennessee (% of 2007 Real GSP)
  1. Manufacturing – 18.71%
  2. Retail Trade – 10.23%
  3. Real Estate – 9.32%
  4. Health Care – 8.36%
- Average Annual Growth Rate in Real GSP, 1998-2007: 2.46%
- Change in Unemployment Rate, June 1998-June 2008: +1.9%

# The Two Halves of the Clean Energy Industry – Supply and Demand

## Output Supply - Production of Clean Power

- facilities operated by utilities (solar, wind, hydroelectric, biomass, etc.)
- generated by private sector firms (solar, biomass, biofuels)
- generated by households (solar, biofuels)

## Input Supply – Materials and Capital Manufacturing for Clean Power Employment

- solar panels
- wind turbines
- polysilicon

## Output Demand – by End Users, i.e. households, firms, public sector

- preferences
- price of related goods (“traditional” power)
- Improvements in energy efficiency

# Strategies for Green Energy Investment and Jobs in Demand

Strategies for Investment	Jobs in Demand
Building Retrofitting	Electricians, Heating/Air Conditioning Installers, Carpenters, Construction Equipment Operators, Roofers, Insulation Workers, Carpenter Helpers, Industrial Truck Drivers, Construction Managers, Building Inspectors
Mass Transit	Civil Engineers, Rail Track Layers, Electricians, Welders, Metal Fabricators, Engine Assemblers, Production Helpers, Bus Drivers, First-Line Transportation Supervisors, Dispatchers
Energy-Efficient Automobiles	Computer Software Engineers, Electrical Engineers, Engineering Technicians, Welders, Transportation Equipment Painters, Metal Fabricators, Computer-Controlled Machine Operators, Engine Assemblers, Production Helpers, Operations Managers
Wind Power	Environmental Engineers, Iron and Steel Workers, Millwrights, Sheet Metal Workers, Machinists, Electrical Equipment Assemblers, Construction Equipment Operators, Industrial Truck Drivers, Industrial Production Managers, First-Line Production Supervisors
Solar Power	Electrical Engineers, Electricians, Industrial Machinery Mechanics, Welders, Metal Fabricators, Electrical Equipment Assemblers, Construction Equipment Operators, Installation Helpers, Laborers, Construction Managers
Cellulosic Biofuels	Chemical Engineers, Chemists, Chemical Equipment Operators, Chemical Technicians, Mixing and Blending Machine Operators, Agricultural Workers, Industrial Truck Drivers, Farm Product Purchasers, Agricultural and Forestry Supervisors, Agricultural Inspectors

Source: Political Economy Research  
Institute

# Clean Power Firms in Tennessee

## Output Supply

- Big Frog Mountain (Chattanooga) – clean energy equipment sales and installation
- Solar Pathfinder (Linden) – solar site shade analysis device
- Approximately 40 solar sales and installation firms statewide

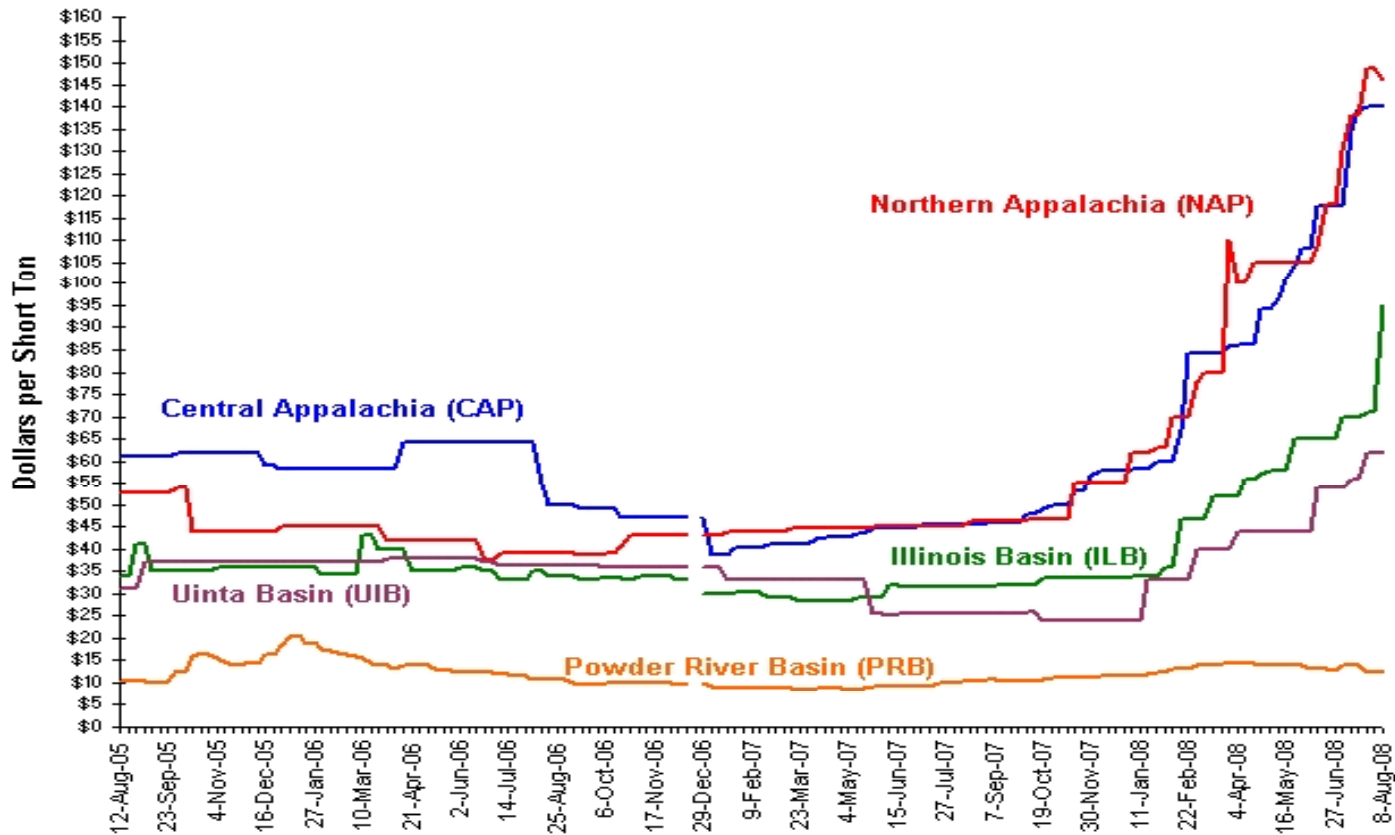
## Input Supply

- Sharp (Memphis) – solar panel manufacturing, 200+ jobs
- Aerisyn LLC (Chattanooga) – wind tower production, 150+ jobs
- AFG Industries (Kingsport) – solar glass manufacturing, 1200+ jobs

# Benefits of Attracting/Developing Clean Energy Industry in Tennessee

- **Increased Jobs**  
Construction of new facilities, operation and maintenance of existing facilities; high- and low-skilled jobs
- **Exploiting Agglomeration Economies**  
Clustering is profitable; like firms can share common customer base or supply of essential resource
- **Increased Tax Revenue**  
From increased business activity, enhanced property values, sales of final goods to consumers.
- **Enhanced Human Capital among State's Labor Force**  
Increased skills in employment categories desired by clean energy firms
- **Reducing Negative Externalities**  
Less pollution from coal-fired facilities; reduced health costs from pollution
- **Cost Savings for Consumers**  
Home-produced and utility-generated clean power
- **Less Reliance on "Outside" Energy**  
From other states and other countries: imported coal, petroleum products
- **Diversification = Reduced Risk**  
Less exposure to fluctuations in the price of coal and oil
- **Exploiting Economies of Scale**  
Reduced average costs of production -> reduced costs to consumers

# Average Weekly Coal Commodity Spot Prices (Dollars per Short Ton)



## Key to Coal Commodities by Region<sup>1</sup>

Central Appalachia:	Big Sandy/Kanawha 12,500 Btu, 1.2 lb SO <sub>2</sub> /mmBtu	Powder River Basin:	8,800 Btu, 0.8 lb SO <sub>2</sub> /mmBtu
Northern Appalachia:	Pittsburgh Seam 13,000 Btu, <3.0 lb SO <sub>2</sub> /mmBtu	Uinta Basin in Colo.:	11,700 Btu, 0.8 lb SO <sub>2</sub> /mmBtu
Illinois Basin:	11,800 Btu, 5.0 lb SO <sub>2</sub> /mmBtu		

Source: Energy Information Administration

# Costs of Attracting/Developing Clean Energy Industry in Tennessee

- Sacrificed Tax Revenue

For subsidies, tax abatements, investment incentives to consumers, commercial firms, industry, and so on

- “Reallocated” Resources

Any time we decide to produce more of some good or service (and thus less of another) we require that resources be reallocated.

1. Land once used for agricultural goods is used for solar farms.
2. Jobs in the “traditional” energy sector are phased out leading to frictional and perhaps structural unemployment.
3. Investment capital is reallocated to new industries, changing relative rates of return.

# Case Study – Pennsylvania’s Energy Independence Strategy

- Proposed in February 2007 by Gov. Ed Rendell
- Goal: “... to spur the development of alternative and renewable energy technologies and help customers and small businesses take steps to reduce their energy consumption and save money.”
- Total Investment: > \$650 million
- Key Components
  - Alternative Energy Investment Fund
  - Alternative Fuels Investment Fund
  - Pennsylvania Sunshine
  - PennSecurity Fuels Initiative
- Will create 13,000+ jobs, attract \$3.5 billion in private capital, and save consumers \$10 billion in energy costs over 10 years.

# Case Study – Pennsylvania’s Energy Independence Strategy

- **Alternative Energy Investment Fund**

\$650 million fund for investments in renewable energy, solar panels, R&D, startups, aid to low-income families, and pollution control.

- **Alternative Fuels Investment Fund**

\$5.3 million in funding to in-state biofuel producers, for a \$0.75/gallon fuel subsidy

- **Pennsylvania Sunshine**

\$100 million in loans and grants to encourage employment and production of solar energy.

- **PennSecurity Fuels Initiative**

Replaces up to 20% of fuels in PA with locally-produced biofuels.

# Benefits of Improving Energy Efficiency

- More Efficient Use of Resources
- Cost Savings for Firms -> Lower Output Prices
- Improvements in Employment and Statewide Economic Performance
  - Reallocation of Spending
  - Less Spending on Capital-Intensive “Traditional” Energy
  - More Spending on Labor-Intensive Output
  - Greater Return to Labor, More Local Spending

# Case Study – Dow Chemicals Louisiana Division

- Began annual contest to identify energy-improvement opportunities in 1982
- First Year: 27 winners with total investment of \$1.7 million and average ROI of 173%
- Second Year: 32 winners with total investment of \$2.2 million and average ROI of 340%
- 1989: 64 winners with total investment of \$7.5 million and average ROI of 470%

# Potential Job Growth in Tennessee from Growth in Clean Energy Industry

- 17,662 new jobs over ten years – Output and labor demand based on a 15% reduction in global warming emissions; 185,000 MW in renewable capacity (Renewable Energy Policy Project)
- 4300 new jobs – Assuming 20% Renewable Energy Standard (Union of Concerned Scientists)

# Potential Economic Benefits in Tennessee

- Assuming 20% National Renewable Energy Standard by 2020
- \$90 million in Cost Savings to Consumers
- \$538 million in new Capital Investment
- \$1.79 billion in Income to Farmers and Landowners
- \$21 million in new Property Tax Revenue

# Economic Benefits from Improvements in Energy Efficiency

- 20-30% improvement in energy efficiency -> increase in U.S. employment of 500,000 to 1.5 million by 2030 (Laitner and McKinney, 2008)
- 20% reduction in energy consumption -> 1.1 million jobs over 20 year window (Gellar, DeCicco, Laitner, 1992)

# Statewide Policies to Encourage Clean Energy Industry Growth

- Increased Tax Credits and Subsidies for Production – Relocation and Start-Up
- Developing Demand-Side of Local Market
- Renewable Energy Portfolio Standards
- Private/Public Partnerships
- Statewide Building Code