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Jobs and Energy Efficiency in the Manufacturing Sector
December 13, 2010
(Preliminary)

presented by

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Overview of Green Jobs Definition

• Example: California, Oregon, Washington, Michigan, Bureau of Labor Statistics

• No consensus on the definition of a green job.

• Four principle areas: Energy Conservation
  Renewable Energy
  Natural Resource Conservation
  Pollution Reduction

• Findings: Every definition contains some degree of subjectivity.
  Despite differences, most surveys find that between 2-4% of a state’s workforce is green.
  Standard industry and occupational classifications are not granular enough to give a complete representation of most definitions.

• Unanswered Questions: How important will the “green” economy be in the future?
  What kind of training do states NEED to have to achieve different objectives?
Energy Efficiency in Delaware’s Manufacturing Sector

• Why is this sector important?

• Employs 6.8% of Delaware’s private nonfarm workforce

• Consume approximately 28% (83 BBTUs) of the state’s energy consumption.

  Total Energy Consumption in Delaware

  - Residential - 22%
  - Commercial - 20%
  - Industrial - Manufacturing - 28%
  - Industrial - Non Manufacturing - 5%
  - Transportation - 25%

  Small improvements in energy-intensive sectors are equivalent to large improvements in less energy-intensive sectors.

• The cost of energy as a percentage of material costs.
  - 1998: 3.8%
  - 2002: 4.6%
  - 2006: 4.9%

• Most energy-saving recommendations depend on proven technology.
Delaware’s manufacturing sector includes the most energy-intensive industries.
The Industrial Assessment Center database (Rutgers and US DOE) included more than 14,000 mfg plant energy assessments that have made nearly 100,000 energy-saving recommendations.

We used 5000+ assessments / 35,000+ recommendations since 2000.

**Recommendation Classification**

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Furnaces, Heating, Boilers</td>
<td></td>
</tr>
<tr>
<td>Heat Recovery</td>
<td></td>
</tr>
<tr>
<td>Steam, hot water, process piping, refrigeration, and cooling</td>
<td></td>
</tr>
<tr>
<td>Space heating, ventilation, and conditioning</td>
<td></td>
</tr>
<tr>
<td>Insulating Machines, Equipment, and Piping</td>
<td></td>
</tr>
<tr>
<td>Motors and other electrical equipment</td>
<td></td>
</tr>
<tr>
<td>Air Compressors</td>
<td></td>
</tr>
<tr>
<td>Lights</td>
<td></td>
</tr>
<tr>
<td>Electrical Power</td>
<td></td>
</tr>
<tr>
<td>Windows, Doors, Roofs, Walls, Landscape</td>
<td></td>
</tr>
<tr>
<td>Employee behavior / Administrative</td>
<td></td>
</tr>
</tbody>
</table>

**Payback for Energy Saving Recommendations**

- **More Profitable**
- **Less Profitable**
- **Payback Threshold**

Payback (years):

- Year 0: No payback
- Year 1: Low payback
- Year 2: Moderate payback
- Year 3: High payback
- Year 4: Very high payback
Energy Efficiency in Delaware’s Manufacturing Sector

• We empirically modeled the total potential costs of different energy saving recommendations given the firm’s characteristics.

• The model was applied to each manufacturer in Delaware to estimate the likely recommended expenditures.

• Expenditures were converted to the number of jobs necessary to implement each recommendation with two assumptions:
  1. Labor Intensive Assumption
  2. Capital Intensive Assumption

• Total job requirements were added across firms for each type of recommendation.
<table>
<thead>
<tr>
<th></th>
<th>Assumption 1</th>
<th></th>
<th>Assumption 2</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>More Profitable</td>
<td>Less Profitable</td>
<td>More Profitable</td>
<td>Less Profitable</td>
</tr>
<tr>
<td>Furnaces, etc.</td>
<td>51.8</td>
<td>174.9</td>
<td>31.1</td>
<td>88.4</td>
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<tr>
<td>Heat Recovery</td>
<td>94.4</td>
<td>156.1</td>
<td>57.1</td>
<td>87.5</td>
</tr>
<tr>
<td>Steam, hot water, etc.</td>
<td>13.2</td>
<td>13.4</td>
<td>5.7</td>
<td>4.6</td>
</tr>
<tr>
<td>Insulating, Equipment,</td>
<td>8.5</td>
<td>16.3</td>
<td>7.2</td>
<td>12.3</td>
</tr>
<tr>
<td>Space heating, etc.</td>
<td>10.8</td>
<td>3.7</td>
<td>6.8</td>
<td>2.4</td>
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<tr>
<td>Electrical Power</td>
<td>0.1</td>
<td>48.8</td>
<td>0.1</td>
<td>18.1</td>
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<tr>
<td>Lights</td>
<td>10.4</td>
<td>24.2</td>
<td>5.2</td>
<td>9.9</td>
</tr>
<tr>
<td>Motors</td>
<td>6.3</td>
<td>29.0</td>
<td>6.3</td>
<td>11.1</td>
</tr>
<tr>
<td>Air Compressors</td>
<td>1.8</td>
<td>124.4</td>
<td>2.0</td>
<td>81.8</td>
</tr>
<tr>
<td>Other Facility</td>
<td>26.7</td>
<td>2.3</td>
<td>13.0</td>
<td>1.7</td>
</tr>
<tr>
<td>Total</td>
<td>224.1</td>
<td>593.2</td>
<td>134.4</td>
<td>317.9</td>
</tr>
</tbody>
</table>

817 jobs  
452 jobs
Energy Efficiency in Manufacturing

What are the Implications of this Research?

• Average expected employment needs: 630 FTE’s

• **Heat Recovery**: 198 FTE’s

• **Combustion Systems (e.g. boilers and furnaces)**: 173 FTE’s

• **Air Compressors**: 100 FTE’s

• **Power and electrical systems**: few “more profitable” opportunities.

• Other job creation not in this analysis

• Low hanging fruit for saving energy.
Understanding Green Skills

• Workforce “skill” usually refers to the level of education.

• We use the term to describe the work activities, knowledge, skills and work contexts.

• Data


  Employment, unemployment, education, demographic information, etc.

  ONET Online database v. 13 & 14: 900 occupations x 135 “skills”

  Skill descriptions, green jobs and green tasks identified
Understanding Green Skills
Employment in the U.S.
Analyzed by the Importance of Computer Interaction
Understanding Green Skills

Employment Composition of the Utilities

Analyzed by Engineering and Technology x Education

- L.T. High School
- High School
- Some College
- Baccalaureate +
Understanding Green Skills
Trends in the Employment of the Utilities
Analyzed by High-Skilled Engineering and Technology

![Graph showing trends in employment of high-skilled engineering and technology across different years (2004, 2006, 2008, 2010). The x-axis represents the importance levels (Important, Very Important, Extremely Important), and the y-axis represents the number of employees (ranging from 0 to 50,000).]
Understanding Green Skills
Unemployment Rates in the Construction Sector
Analyzed by Repairing & Maintaining Mechanical Equipment Skills

<table>
<thead>
<tr>
<th>Not important</th>
<th>Somewhat Important</th>
<th>Important</th>
<th>Very Important</th>
<th>Extremely Important</th>
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</thead>
<tbody>
<tr>
<td>0%</td>
<td>5%</td>
<td>10%</td>
<td>15%</td>
<td>20%</td>
</tr>
<tr>
<td>20%</td>
<td>15%</td>
<td>10%</td>
<td>5%</td>
<td>0%</td>
</tr>
</tbody>
</table>

- 2004
- 2006
- 2008
- 2010
Understanding Green Skills
How are skills changing in the workforce?

Changes in unemployment rate: recession vs. historical trends

<table>
<thead>
<tr>
<th>Trend</th>
<th>Recession</th>
</tr>
</thead>
<tbody>
<tr>
<td>+0.10%</td>
<td>+1.9%</td>
</tr>
<tr>
<td>none</td>
<td>+1.1%</td>
</tr>
<tr>
<td>+0.10%</td>
<td>+2.5%</td>
</tr>
<tr>
<td>+0.04%</td>
<td>+0.9%</td>
</tr>
<tr>
<td>none</td>
<td>+1.1%</td>
</tr>
<tr>
<td>+0.08%</td>
<td>+1.9%</td>
</tr>
<tr>
<td>none</td>
<td>+1.3%</td>
</tr>
<tr>
<td>+0.09%</td>
<td>none</td>
</tr>
</tbody>
</table>

Occupations with Declining Relative Employment Opportunities
- Controlling Machines and Processes
- Drafting, Laying Out and Specifying Tech Devices, Parts, and Equip.
- Handling and Moving Objects
- Inspecting Equipment, Structures, and Material
- Operating Vehicles, Mechanized Devices, or Equipment
- Performing General Physical Activities
- Repairing & Maintaining Electronic Equipment
- Repairing & Maintaining Mechanical Equipment

Some of these characteristics are the key job tasks of specific green jobs.
(e.g.) Energy Auditors, Electricians, Millwrights, Maintenance & Repair Workers, Installers
### Understanding Green Skills

How are skills changing in the workforce?

Changes in unemployment rate: recession vs. historical trends

<table>
<thead>
<tr>
<th>Trend</th>
<th>Recession</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.06%</td>
<td>-1.8%</td>
</tr>
<tr>
<td>none</td>
<td>-1.2%</td>
</tr>
<tr>
<td>-0.08%</td>
<td>-1.9%</td>
</tr>
<tr>
<td>-0.04%</td>
<td>-1.8%</td>
</tr>
<tr>
<td>-0.06%</td>
<td>-1.5%</td>
</tr>
<tr>
<td>none</td>
<td>-0.6%</td>
</tr>
<tr>
<td>-0.09%</td>
<td>-2.4%</td>
</tr>
<tr>
<td>none</td>
<td>-2.0%</td>
</tr>
<tr>
<td>none</td>
<td>-1.3%</td>
</tr>
<tr>
<td>none</td>
<td>-1.6%</td>
</tr>
<tr>
<td>-0.06%</td>
<td>-1.2%</td>
</tr>
<tr>
<td>none</td>
<td>-2.4%</td>
</tr>
<tr>
<td>none</td>
<td>-2.0%</td>
</tr>
</tbody>
</table>

**Occupations with Rising Relative Employment Opportunities**

- Coordinating the Work Activities of Others 🌿
- Performing Administrative Activities 🌿
- Analyzing Data or Information 🌿
- Interacting with Computers 🌿
- Negotiation 🌿
- Sales and Marketing 🌿
- Writing 🌿
- Mathematics* 🌿
- Science* 🌿
- Economics and Accounting* 🌿
- Thinking Creatively 🌿
- Customer & Personal Service 🌿
- Personnel and Human Resources 🌿

*(e.g.) Various Managers & Engineers, Marketers, Technicians, Trainers, Financial Analysts
Implications:

• Education is clearly important to filling key skills in the green industry.

• There may not be sufficient private sector opportunities for every type of green skill.

• Does the age of the worker influence training type?

• Probability of restructuring after recession affected by previous trend and performance in recession?
Where We are Headed

Skills in Delaware’s Workforce

• Education and skills, combinations of different skills
• Looking within more industries and within Delaware
• Demographic projections

Environmental Business Survey

• Which Delaware businesses claim green goods or services?
• Relevant training programs?
• View energy efficiency?
• Are markets privately sustainable?
Where We are Headed

Delaware’s Educational Pipeline Survey

• Workforce training capabilities
• Student interest, in state vs. out of state
• Important prerequisite skills
• Quality of applicants
• Graduate success, job placement