Green Policies, Climate Changes, and New Jobs: Separating Fact From Fiction

Mark Partridge
Amanda Weinstein
J. Clay Francis
AED Economics, Ohio State Univ.
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Email: partridge.27@osu.edu
weinstein.74@buckeyemail.osu.edu

Swank Program website:
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Overall issue

• Using clean energy to increase job growth falls under various sectoral efforts to support economic development. Pick fast growing firms/sectors for a local economy.
  – It assumes that decision makers not only know the hot industries, but also the geographical location where they will thrive. E.g., Clusters fall under this rubric

• Economists are very skeptical that politicians, development ‘experts’, or bureaucrats (or regional economists or financial market titans) are good at picking sectors. E.g., weren’t financial derivatives based on housing mortgages the smart pick?

• Economists view:
  – Governments can’t pick winners
  – Losers know how to pick governments
  – The authors believe ‘communities’ should build an environment that:
    – The eventual ‘Winners’ will pick your community.
Motivation

• Environment is one of the most important concerns for US and the world.
• The U.S. and Midwest are gradually shifting to alternative (clean) energy environments with many positive outcomes:
  – Energy Security: Acquire energy independence from Middle East oil supply and finite fossil fuel supplies worldwide (Oil sands and coal)
  – Environment: Acquire independence from fossil fuel and address possible global warming
The Drawback of Green Jobs

• Many advocates of mitigating climate change believe that supporting ‘clean’ energy will spur massive job creation. Many/most of us live in places trying to be leaders in this wave.
  – We will argue for many reasons that this is not realistic.
  – Would alternative energy producers be competitive and sustainable if bloated with high employment/labor costs?
  – Is an economic development strategy mimicking everyone else very strategic? Is it likely to succeed everywhere? Ditto for claims about building supply chains when everywhere else is doing it.
The Drawback of Green Jobs

– Advocates typically ignore displacement costs from higher taxes, losses elsewhere in the economy or simple relabeling of jobs from dirty to clean. E.g., energy efficient dishwashers.

• What we do:

• Through regional & macroeconomic theory, industry shift-share, case studies of wind power for the U.S. and rural America, case studies of California and Michigan, we show that green jobs are unlikely to be an economic development panacea, much as any sector-based strategy.
What about the reverse?

• Finally, does the downsizing of the fossil fuels economy ‘destroy’ large numbers of jobs? E.g., cap-and-trade.

• One possible concern about cap-and-trade for Americans is possible job losses in coal mining and other sectors of the economy that intensively use energy (e.g., manufacturing).
  
  • We discuss some evidence on the effects of cap-and-trade.
Subsidies & Incentives, Tax Credits have Opportunity Costs!

• There is no Santa Claus or Tooth Fairy who will pay for these schemes.

• Whether building the latest fads such as “clusters,” bio-tech, creative class, value-added, etc. etc. etc., politicians are quick to respond w/o any research basis by offering tax incentives.

• Shifting money from taxpayers to favored activities have opportunity costs.
  – At the federal level, the money has to be paid back to the Chinese as well as other opportunity costs.
Subsidies, Incentives, Tax Credits have Opportunity Costs!—cont.

• At the state and local level:
  – Local economic developers often focus on “cutting deals” and not on the well-being of their community (for total job promotion vs ‘landing’ a firm)
  – Subsidies to favored firms imply that someone else has to pay the taxes or services have to be cut.
  – Politicians ignore “displacement” effects—e.g., a subsidy to attract Wal-Mart will lead to closure of nearby hardware, grocery stores, and other businesses. A subsidy to clean energy will reduce employment in ‘brown’ energy, etc.
  – The result is the rest of the economy is less competitive and/or households have a lower quality of life— “Race to the Bottom” is usually ineffective.
Subsidies, Incentives, Tax Credits have Opportunity Costs!—cont.

• New businesses will lead to higher wages and land-costs—depressing expansions for existing businesses and deter the location of new businesses. E.g., a company producing battery cars will displace traditional supply chain for cars.

• Impact studies of job creation are too often way overstated—e.g., casinos to trains—and the supply-chain job creation from clean energy.

• The net result is economic activity is only modestly affected and may even decline in certain cases.
  – (see Goetz et al., 2009; Gabe and Kraybill, J. of Regional Science. 2002; Edmiston, 2004.)
Everyone wants to be Green Energy Leader

• It seems like all 50 states, 3,000+ counties, and about every advanced economy wants to be the leader of green/clean energy. This is typically the case in fad-based economic development.

• Very Very few will win. It is not strategic to copy everyone else just because it is the latest fad.
  • Reminds me of how every place wanted to be the next Silicon Valley in the 1980s and 1990s.
Ohio’s Green Policies?

• Ohio faces massive challenges including the loss of over 600,000 jobs between June 2000 and Aug. 2010.
  • Source Bls.gov, September 29, 2010.

• ohiorecovery.gov Nov. 19, 2009 Press Release:
  - Ohio will conduct a "green jobs survey" of Ohio employers, to better identify the number of green jobs available in the state, and the skills required to fill them.

• We have very little idea of the size of Ohio’s or almost any state’s green economy or whether it is creating jobs. BLS is working on that. But:

• Green strategies are developed on the fly with very little research basis or data.
STATE OF THE UNION

ON THE SPOT, OBAMA TRIES TO PUSH ISSUES

President Barack Obama will give his first official State of the Union speech at 9 tonight. He'll address a Congress resistant to his most-significant proposals, and a nation saddled with 10 percent unemployment.

Story, Page A3

RECALL RAMIFICATIONS

Toyota.

STATE OF OPTIMISM

With coffers bare, Strickland made pared promises, while Republicans focused on his past performance

yesterday to offer an optimistic view of the state's economic future forged with new "green" jobs.

With no major funding available after a tumultuous budget year, the governor did not propose sweeping initiatives such as the education overhaul and billion-dollar stimulus plan he announced in previous speeches.

Rather, the governor offered a host of more modest initiatives funded with existing resources to create jobs, including re-
Ohio’s Green Policies

• Governor Strickland in his state of the state address:
  - "We are shaping Ohio's future by strengthening our advanced energy economy today. Supporting the growing wind and solar industries creates jobs, creates energy and reduces costs for hard-working Ohioans..."
  - Ohio will become "America's Energy Gateway".
  - Creation of Energy Gateway Fund.
    - As Ohioans, we hope he is right, but even assuming he is right, will this create many jobs?
• The Ohio Dept. of Development is providing $12 million of incentives and the Federal Gov’t will provide $50.7 million worth of tax credits.
• For 80 jobs, this works out to a subsidy $784,000 per job that could have spent on programs that have high job-producing results.
• The Governor also spoke of a Bio-refinery that will soon open in Ohio.
• The Director of ODOD stated that they “expect” a new-bio-refinery will break ground in the next couple of years and will create 40-80 jobs.
  • Compare these job totals to the 600,000 lost jobs since 2000
Estimates of tax-expenditure costs per green job created through government subsidies

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<th>Company</th>
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Why Green/Clean Energy Cannot Employ Large Numbers. Competitiveness of Green Energy

- To be sustainable green/clean energy has to be competitive on a cost basis with fossil fuel.
- It can be say 30-40% more expensive than traditional fossil fuel because of lower social costs. It can’t be many times more expensive. If so, alternative energy will not be sustainable.
- A bloated alternative energy sector won’t be competitive.
The Competition:
Fossil Fuels: Coal-based Electricity

• To make this point, I assess fossil fuel productivity to grasp what green/clean energy is competing against.
• Whatever the source, we will have some sort of distribution network. I focus on the base source.
• My example is Montana & Wyoming Coal Mining
• Compare this briefly to wind turbines.
Coal Mining Employment—We are efficient at producing fossil fuels!

<table>
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<tr>
<th>State</th>
<th>#Employees in coal 2006*</th>
<th>Total State employees 2006</th>
<th>% total that are in coal mining</th>
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<tr>
<td>Montana</td>
<td>942</td>
<td>630,288</td>
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<tr>
<td>Wyoming</td>
<td>5,837</td>
<td>375,047</td>
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<td>U.S.</td>
<td>82,959</td>
<td>177,815,600</td>
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Total state and U.S. employment is from the U.S. Bureau of Economic Analysis.
Fossil Fuels vs. Green Energy

• Only, 6,800 coal miners in MT and WY produce coal that supplies 21% of U.S. electricity!
  – A key reason that we are ‘addicted’ to fossil fuels is that we are so remarkably productive at it.

• Green energy needs to be at least ‘nearly’ as productive as coal to be sustainable.
  • We cut it slack if it is ‘clean’—i.e., properly pricing carbon.
  – But, the numbers of jobs should be thought of in the tens of thousands, not the millions.
  – We need a green-energy sector that employs few workers to be competitive, not one that employs ‘millions’ of workers. The latter is not sustainable.
Sustainable Green Energy needs

• A punch line is that green energy will not be some sort of a major jobs creator if it is to be competitive.
• A national energy policy is not the same as good local economic development policy!
Example from Macroeconomics

- Regardless of your energy policy views, the same number of Americans will be employed in the long-run.

- Simple macroeconomics: Long-run employment is set by the natural rate of unemployment and the number of people in the U.S. labor force. While wages adjust due to productivity, this is why ‘sector’ policies do not really affect U.S. employment.
  - Labor Demand shifts downward with (say) a cap-and-trade program or higher taxes to fund green subsidies.
  - Wages experience a slight decrease—probably 2%.
Graphical Illustration of the Long Run

- US Labor Market ~ 160 million workers
- Natural Unemployment Rate ~ 5%

1. Number employed = 152 million workers
2. Wages and prices adjust to reestablish “full employment” with slightly lower wages
3. “Green energy” or cap & trade will not affect long-run total U.S. employment.

Labor Demand without GE or C&T
Labor Demand with GE or C&T
US Example

CHANGE IN ENERGY GENERATION JOBS, 1998-2007

Solar energy generation jobs
+19.1%

Wind energy generation jobs
+23.5%

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U.S. example

• “According to AWEA, an estimated 85,000 Americans are currently employed in the wind power industry and related fields.” This includes all elements of the supply chain and would likely be optimistic as it is an industry advocacy group BLS, see notes.
  
  – Let’s say wind grew at what would be a wild rate: 15% for the next 5 years, 10% for the following 10 years, 5% for the following 10 years (it would slow after the initial construction boom).
  
  – This would create 637,000 jobs.
  
  – [This would make wind much bigger employer than oil, mining, and refining which currently has about 235,000-240,000 jobs. Wind would have high labor costs in my scenario!]
  
  – Over the next 25 years, the U.S. economy would need to create on the order of 45million jobs to keep unemployment constant (150,000 jobs a month, which may be low due to growth).
  
  – Wind would create less than 1.5% of the needed growth in jobs for the national economy to keep unemployment constant
Michigan’s Example

Michigan Green Jobs Report

Occupations & Employment in the New Green Economy
Michigan Example

- Overall green-cluster jobs accounted for 385,000 jobs in 2008 (haz mat cleaners, sewage treatment facilities, solid waste collection, indirect employment, support etc). It lost 18.5% from 2004-09

- Between 2004 – 2008 Renewable Energy Production employment growth equaled 7.1% (or an annualized growth rate of 1.7%). Total employment in renewable energy cluster (broadly defined) was 18,139 in 2008. There were 8,843 direct renewable energy jobs (p.22)


- For renewable energy production (cluster) jobs to absorb this loss growing 1.7% per year, it would take 230 years

Michigan Green Jobs lost 18.5% employment between 2004-2008

**Figure 15: Change in Employment for Green-Related Clusters, Michigan 2004 to 2008**

Michigan's Competitive Employment Performance in Green-related Industries

A few green-related industries have grown more rapidly in Michigan than in the United States. To better understand this, we take up a measure of Competitive Employment Performance. This variable measures the level of local job growth in an industry which is above the increase that would have been realized had that local industry simply matched the national industry trend. Competitive Employment Performance sectors include statewide industries that are adding jobs faster in Michigan than nationally, and may indicate that an industry sector enjoys a regional competitive advantage. Figure 17 identifies a few green-related sectors in which job gains in Michigan have outpaced national trends.

Areas of relative strength for Michigan's green-related industries were concentrated in the Increasing Energy Efficiency, Miscellaneous Green Manufacturing, and Renewable Energy Production clusters. The single best Competitive Employment Performance industry in Michigan included firms in the business of producing Semiconductor and related devices. From the second quarter of 2004 to the same quarter in 2008, this industry added 835 jobs in Michigan. During the same period, the industry nationally shed an estimated 11,500 jobs. It is likely that Michigan's comparatively good performance reflects growth of employment in solar manufacturing whereas the larger national reduction of jobs reflects primarily non-green production cutbacks, such as chips for computers.
• Moral: Green/clean economy is simply too small to be an engine of growth. For jobs, we need a broad-based engine of growth across the entire economy. Generally problem with for most sector based strategies.
U.S., MI, and OH Shift-Share Example from Electricity Generation
Total carbon emissions per kWh generated by energy source

Life Cycle Emission Rates (lbs CO2/kWh)

- Coal: 2.082 lbs CO2/kWh
- Natural Gas: 1.244 lbs CO2/kWh
- Nuclear: 0.034 lbs CO2/kWh
- Hydroelectric: 0.036 lbs CO2/kWh
- Biomass: 0.092 lbs CO2/kWh
- Wind: 0.028 lbs CO2/kWh
- Solar Photovoltaic: 0.078 lbs CO2/kWh
- Geothermal: 0.03 lbs CO2/kWh

Note: Life cycle emissions rates includes the total aggregated emissions over the life cycle of the fuel to include extraction, production, distribution, and use.

Source: Meier, 2002.
Energy production costs by energy source

2016 U.S. Average Levelized Cost (2008 cents/kWh)

Note: The average levelized cost is the present value of all costs including building and operating the plants.
Estimates of the number of jobs required to produce a kWh by energy source

Average Facility Employment (Jobs/kWh)

Source: Kammen, et al., 2004.
Effects of Replacing Coal with Wind

• Cost Effects of Replacing 25 percent of coal with wind

<table>
<thead>
<tr>
<th></th>
<th>2009 Total kWh</th>
<th>2009 Total Coal kWh</th>
<th>Changes in Total Emissions (lbs)</th>
<th>Total Annual Cost (Millions)</th>
<th>Total Cost Per Household (dollars/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>US</td>
<td>3,951,117,000,000</td>
<td>1,764,486,000,000</td>
<td>-906,063,561,000</td>
<td>$21,571</td>
<td>$191.93</td>
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<tr>
<td>MI</td>
<td>101,642,000,000</td>
<td>67,822,000,000</td>
<td>-34,826,597,000</td>
<td>$829</td>
<td>$215.66</td>
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<tr>
<td>OH</td>
<td>135,949,000,000</td>
<td>113,824,000,000</td>
<td>-58,448,624,000</td>
<td>$1,391</td>
<td>$308.78</td>
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</tbody>
</table>

• Labor Effects of Replacing 25 percent of coal with wind

<table>
<thead>
<tr>
<th></th>
<th>Total Coal Jobs Based on Total kWh</th>
<th>Employment Change (low)</th>
<th>Employment Change (high)</th>
<th>Employment Change Share (low)</th>
<th>Employment Change Share (high)</th>
</tr>
</thead>
<tbody>
<tr>
<td>US</td>
<td>203,440</td>
<td>-15,107</td>
<td>89,634</td>
<td>-0.012%</td>
<td>0.068%</td>
</tr>
<tr>
<td>MI</td>
<td>7,820</td>
<td>-581</td>
<td>3,445</td>
<td>-0.015%</td>
<td>0.089%</td>
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<tr>
<td>OH</td>
<td>13,124</td>
<td>-975</td>
<td>5,782</td>
<td>-0.019%</td>
<td>0.114%</td>
</tr>
</tbody>
</table>
Energy Efficiency Costs

• Energy efficiency is the lower cost way of reducing emissions. It should be pursued if the real goal is environmental.

• Smart grid and a better inter-regional grid is needed for many alternative energy technologies. Distribution and logistics have been greatly shortchanged in these discussions.

• We are willing to bet it is more labor intensive and could employ more moderate-skilled Americans.
Comparison of costs per ton of carbon emissions reduction

<table>
<thead>
<tr>
<th>Region</th>
<th>US$/tC avoided</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-400</td>
</tr>
<tr>
<td></td>
<td>-200</td>
</tr>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>+200</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Buildings / appliances</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Residential sector</td>
<td>OECD/EIT</td>
</tr>
<tr>
<td>Dev. cos.</td>
<td></td>
</tr>
<tr>
<td>Commercial sector</td>
<td>OECD/EIT</td>
</tr>
<tr>
<td>Dev. cos.</td>
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<table>
<thead>
<tr>
<th>Transport</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Automobile efficiency</td>
<td>USA</td>
</tr>
<tr>
<td>Biomass for coal</td>
<td>Global</td>
</tr>
<tr>
<td>Biomass for gas</td>
<td>Global</td>
</tr>
<tr>
<td>Wind for coal or gas</td>
<td>Global</td>
</tr>
<tr>
<td>Co-fire coal with 10% biomass</td>
<td>USA</td>
</tr>
<tr>
<td>Solar for coal</td>
<td>Annex I</td>
</tr>
<tr>
<td>Non-Annex I</td>
<td></td>
</tr>
<tr>
<td>Hydro for coal</td>
<td>Global</td>
</tr>
<tr>
<td>Hydro for gas</td>
<td>Global</td>
</tr>
</tbody>
</table>
Case-Study of California’s green heritage: Has it created jobs?

Total per capita electricity use

Source: Rosenfeld (2008)
California Example—cont.

2003 US electricity generation

Biomass (71%)
Wind (13%)
Solar Thermal and PV (<1%)
Geothermal (16%)

Fossil Fuels 71%
Nuclear 20%
Hydro 7%
Non-Hydro Renewables 2%

2003 California electricity generation

CA-US 1999-2009 Job Growth, 1999=100
Moral—California is no panacea.
Rural Example—SW Minnesota/NW Iowa

• Many politicians argue alternative/green energy is especially good for rural economic development.

• Rural economies would be more sensitive to the effects of any economic shock.
  – SW Minn and NE Iowa is a good case study. I will show that alternative energy has not been a game changer when looking at their broad economy.
Ethanol production capacity in nonmetro counties, May 2007

Calculated by ERS using data from the Renewable Fuels Association and other sources.
Map 1. Wind farms in the United States, as of year-end 2009

SOURCE: National Renewable Energy Lab, Department of Energy
Nonmetro population change from net domestic migration, 2005-06

Source: Calculated by ERS using data from the U.S. Census Bureau.
But does cap & trade and downsizing the fossil fuel economy kill jobs?

• Answer—not really.
Sulfate deposition changes between the late 1980s and the late 1990s as a result of the 1990 Clean Air Act.
Will “Cap-and-Trade” wipe out the economy?

- Cap and trade in the 1990s helped clean the environment, but at what economic cost?
- Instead of grievous economic harm (as feared), it delivered sharp reductions in pollution without noticeable effects on jobs.
- What about the proposed House climate change and cap and trade?
- CBO estimates a GDP loss ranging from 0.5% - 3.8% by 2030 for the cap-and-trade program.
- EPA/IGEM-REF estimated the a 2.6% GDP loss by 2020 as a result of the cap-and-trade program.
  - i.e., slow income losses that eventually total a permanent reduction of 2.6% to GDP.
    - This is like losing an average year’s growth in the economy.
Coal mining employment changes with and without acid rain cap and trade

![Bar chart showing coal mining employment changes with and without acid rain cap and trade from 1970 to 2010. The chart includes two sets of bars: one for employment with Title IV and one for employment without Title IV. The years 1990 and 1994 are marked with specific events related to Title IV. The chart is sourced from the U.S. Department of Energy, Energy Information Administration (EIA) (2000). Energy Policy Act Transportation Rate Study: Final Report on Coal Transportation.]
What should communities do if green/clean jobs are not the solution to economic woes?

• This is a whole webinar to itself, but.....
• Better local government and regionalism
• Entrepreneurship and treat all industries and firms the same. Not picking winners and losers because we don’t know the winners and losers
  – Economic development needs to be broad-based across all sectors.
• Whatever will be the hot industries, knowledge workers and education will be the key.
Conclusion

• The climate change debate has produced a lot of hot air with claims and counter claims about job gains and job destruction.

• Both sides of the debate appear to have greatly overstated their claims.

• In my opinion as a professional economist, the net impact on employment from green/clean energy initiatives and proposed cap and trade is a few lost jobs in the fossil fuel sector and manufacturing that would be offset by a few new jobs in alternative energy sector (though temporary jobs in energy conservation).
Fad Based Economic Development

SOUTH KOREA

• U.S. weekly *Newsweek* named the South Korean President Lee Myung-bak “one of the new green leaders.”

• “Building more small-sized dams to store water in rivers is expected to help both change the climate of the Korean Peninsula and create **thousands of jobs**, which will help the country achieve economic growth.”

• “A total of 100,000 houses will be powered by solar energy by 2012, up from 14,500 houses in 2007, according to the Ministry of Knowledge Economy.”
Fad Based Economic Development

RHODE ISLAND

• In November 2008, the Rhode Island Economic Development Corporation announced its plans to manage the state’s Renewable Energy Fund (REF), making a new commitment to stimulate job growth in green technology/green energy sectors of Rhode Island’s economy.
The Green Energy Act (GEA), will help the government ensure Ontario’s green economic future by: building a stronger, greener economy with new investment, creating well-paying green jobs and more economic growth for Ontario – a projected 50,000 jobs in the first three years; better protecting our environment, combating climate change and creating a healthier future for generations to come.
Gov. Jennifer M. Granholm:

- “By investing in our workforce, manufacturing infrastructure, and natural resources, we can make Michigan the state that helps end our nation’s dependence on foreign oil and create good paying jobs in the process....Michigan is uniquely positioned to diversify its economy and create jobs by growing the renewable energy sector.”

“Diversification into the green economy and training Michigan’s already skilled workers for green jobs is a recipe for economic success”
Fad Based Economic Development

SPAIN

• Spain's Answer to Unemployment: Go Greener*
  - Washington Post Article: “Through a combination of new laws and public and private investment, officials estimate that they can generate a million green jobs over the next decade.”

• Spain forecasts that the contribution to total final energy from renewable sources in the country will be 22.7% by 2020 and 42.3% of electrical power generation

Study of the Effects on Employment of Public Aid to Renewable Energy Sources states: "Spain’s experience (cited by President Obama as a model) reveals with high confidence, by two different methods, that the U.S. should expect a loss of at least 2.2 jobs on average, or about 9 jobs lost for every 4 created, to which we have to add those jobs that non-subsidized investments with the same resources would have created."


i.e., the basic displacement effects I described.
Fad Based Economic Development

DENMARK

• Connie Hedegaard, Denmark’s Minister for Climate and Energy, says: "We, the politicians of the world, have a responsibility to reach a truly global climate change agreement in Copenhagen in December 2009. But it is the business society that can deliver the tools to turn our vision into reality. Businesses can provide the clever solutions to make it possible to live in a both modern and sustainable society. Luckily, this is the path that ensures jobs, growth and the answers on how to use the scarce energy resources in a more intelligent manner. That is why green growth is the only growth we can afford."

• Though as the above quote shows, Denmark does get caught up in the “flavor of the month development.” Denmark does it right. It puts a tax on energy and uses the market to determine alternative energy—less of politicians and bureaucrats picking the winners.
## Years to Make Up for Current Job Losses

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ohio</td>
<td>33,413</td>
<td>5,624,600</td>
<td>5,073,600</td>
<td>551,000</td>
<td>331</td>
</tr>
<tr>
<td>Michigan</td>
<td>21,546</td>
<td>4,676,200</td>
<td>3,876,100</td>
<td>800,100</td>
<td>303</td>
</tr>
</tbody>
</table>
Cap and Trade Product Market Implications

Product Market

- Supply with Cap = Private MC + Societal MC
- Supply = Private MC

Price vs. Quantity

P_2 \quad P_1

Q_2 \quad Q_1

Demand
Cap and Trade Labor Market Implications

Labor Market

Wage

Labor Supply

Labor Demand

Labor Demand with Cap

Employment

W_1

W_2

E_2

E_1
Green Jobs Green Labor Market

Green Energy Labor Market

Wage

Labor Supply

Labor Demand with Subsidy

Labor Demand

W_2
W_1

E_1 E_2

Employment
Green Jobs Brown Industry Product Market

Coal Market

Price

Supply

Demand

Demand with Green Energy Subsidy

Quantity

P_1

P_2

Q_1

Q_2
Green Jobs Brown Labor Market

Coal Labor Market

Wage

Labor Supply

Labor Demand

Labor Demand with Green Energy Subsidy

Employment

E_2

E_1

W_1

W_2
Coal Mining Employment in Ohio and USA between 1998 and 2007

<table>
<thead>
<tr>
<th></th>
<th>1998</th>
<th>2007</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ohio</td>
<td>3,635</td>
<td>2,649</td>
<td>-986</td>
</tr>
<tr>
<td>US</td>
<td>81,272</td>
<td>79,848</td>
<td>-1,424</td>
</tr>
</tbody>
</table>
Non-Farm Employment Share in Coal Mining

Year

1998 2007

Percentage

Ohio US

0.006 0.005 0.004 0.003 0.002 0.001 0.000

0.006 0.005 0.004 0.003 0.002 0.001 0.000

0.005 0.004 0.003 0.002 0.001 0.000

0.004 0.003 0.002 0.001 0.000

0.003 0.002 0.001 0.000

0.002 0.001 0.000

0.001 0.000

0.000
% Change in Coal Mining Employment: 1998-2007

Ohio

US
Coal’s role in the economy.

<table>
<thead>
<tr>
<th></th>
<th>Share of U.S. Coal Production</th>
<th>Approx share of U.S. Electricity</th>
</tr>
</thead>
<tbody>
<tr>
<td>WY share of US total coal production</td>
<td>38%</td>
<td>19%</td>
</tr>
<tr>
<td>MT share of US total coal production</td>
<td>4%</td>
<td>2%</td>
</tr>
</tbody>
</table>

Source, EIA


Coal Mining Employment—We are efficient at producing fossil fuels!

<table>
<thead>
<tr>
<th>State</th>
<th>#Employees in coal 2006*</th>
<th>Total State employees 2006</th>
<th>% total that are in coal mining</th>
</tr>
</thead>
<tbody>
<tr>
<td>Montana</td>
<td>942</td>
<td>630,288</td>
<td>0.15%</td>
</tr>
<tr>
<td>Wyoming</td>
<td>5,837</td>
<td>375,047</td>
<td>1.56%</td>
</tr>
<tr>
<td>U.S.</td>
<td>82,959</td>
<td>177,815,600</td>
<td>0.05%</td>
</tr>
</tbody>
</table>


Total state and U.S. employment is from the U.S. Bureau of Economic Analysis.
What about Ohio?

Green Jobs Created or Saved by the Recovery Act

*This report details how 13,151.02 green jobs have been created or saved through the American Recovery and Reinvestment Act of 2009.*

The American Recovery and Reinvestment Act (ARRA) of 2009 included funding to stimulate job creation and provide for long term sustainable economic growth by investing in the energy economy. The information included in this report is based on data submitted by state and local governments for the October 10, 2009 Recovery Act reporting deadline. Of the awarding agencies under ARRA, three agencies offered the best scope to identify green jobs created or saved since ARRA’s passage in February 2009: Department of Energy, Department of Labor, and the Environmental Protection Agency.

In order to understand how recipients must report jobs created or saved, please visit www.recovery.gov. This study used a broad definition to include any jobs created or saved by an agency award that contributed to energy efficiency, environmental clean-up and protection, sustainable development, or other related ventures. Projects that have not yet started, but reported jobs created or saved, were not counted.
What about Ohio?

CSG reports that **2,565.73 Green jobs** were created/saved in Ohio under the American Recovery and Reinvestment Act 2009.

Break down of Green Energy Jobs in Ohio, Council of State Governments Report

<table>
<thead>
<tr>
<th># of Jobs</th>
<th>Job Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2296</td>
<td>Weatherization of Homes</td>
</tr>
<tr>
<td>134.44</td>
<td>Clean Water State Revolving Fund</td>
</tr>
<tr>
<td>76.13</td>
<td>Drinking Water State Revolving Fund</td>
</tr>
<tr>
<td>52</td>
<td>Remediation of Uranium</td>
</tr>
<tr>
<td>4</td>
<td>Water Pollution Control</td>
</tr>
<tr>
<td>1</td>
<td>State Energy Program</td>
</tr>
<tr>
<td>1</td>
<td>Environmental Management</td>
</tr>
<tr>
<td>1</td>
<td>Removal Radioactive Materials</td>
</tr>
<tr>
<td>0.16</td>
<td>Fossil Fuel Electric Power Generation</td>
</tr>
</tbody>
</table>