Clean Energy Priorities

Roger Duncan
Deputy General Manager
Austin Energy
"By awarding the Nobel Peace Prize for 2007 to the IPCC and Al Gore, the Norwegian Nobel Committee is seeking to contribute to a sharper focus on the **processes and decisions** that appear to be necessary to protect the world’s future climate, and thereby to reduce the threat to the security of mankind. Action is necessary now, before climate change moves beyond man’s control."

Norwegian Nobel Committee, Oslo, 12 October 2007
Global Warming Demands

- Quick and effective action from public and private sectors or as Al Gore stated in his response to being named a winner of the Nobel Peace Prize, “We must go far quickly.”
- That we de-carbonize electricity production as well as the transportation sector
- Early **effective** action
Governments, businesses, and individuals are working to reduce their footprint.

Policies considered:
- Cap and trade
- Allocation v. Auction
- Input and output based allocations
- Carbon tax
Utilities, Businesses, and Governments Must Make Energy Project Choices

- Should the utility build a wind farm, a nuclear power plant, or invest in DSM programs?
- Should the corporate board of directors allocate its resources to green power programs, on-site renewable energy, or energy efficiency? And what kind of energy efficiency program is best suited?
- Should the local government provide incentives for building codes or energy efficient transportation?
If Doing All of The Above is not an Option...

- What do I do first?
- How do I allocate limited money?
- How can I get the most carbon reduction for the least amount of money?
What energy projects will provide the largest reduction in GHG emissions in the shortest time at the least cost with the greatest public consensus?
This project aims to provide a tool that assists utilities, businesses, governments, and individuals in choosing energy projects with the goal of reducing carbon.
The difference between good and optimal in prioritizing energy projects could mean the difference in tens or even hundreds of billions of dollars.

Choosing the most effective projects early could mean the difference between saving or losing decades in stabilizing carbon concentrations in the atmosphere.
Identifying and Choosing the Correct Project is Key

- 80/20 Rule
- A rapid response should be available to address changes in technology
- Expeditious decisions are necessary to keep costs down and energy reliable
- New policies may require new projects
- Prioritization isn’t always obvious
Primary Technologies

- DSM
- Oil
- Natural Gas
- Coal
- Nuclear
- Solar
- Wind
- Geothermal
- Biomass
- Ocean
Allocating Energy Reducing Measures

- CFLs
- Conventional Hybrid Autos
- Plug-in Hybrid Vehicles
<table>
<thead>
<tr>
<th>Example Target Markets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seattle</td>
</tr>
<tr>
<td>and</td>
</tr>
<tr>
<td>Cleveland</td>
</tr>
</tbody>
</table>
Option 1: Split measures evenly between markets

Measures
- CFLs
- Hybrids
- PHEVs

Target Markets
- Seattle
- Cleveland
Option 2: Split measures to curb the most carbon emissions in each market

Measures
- CFLs
- Hybrids
- PHEVs

Target Markets
- Seattle
- Cleveland
Clean Energy Priorities May Vary Due to:

- Fuel Mix
- Renewable Inventory of Region
- Supply Availability
- Public Consensus
- Water Resources
- Time Constraints
Prioritizing your Energy: Criteria for Comparison

- If a central purpose is to reduce carbon, then a key calculation is the carbon return on investment (CROI)
- CROI – how much carbon is removed from (or not placed in) the atmosphere for each dollar spent
# Carbon Return On Investment: Austin Energy’s Experience

<table>
<thead>
<tr>
<th>Generation Type</th>
<th>Estimated Expense</th>
<th>Est. Annual MWh</th>
<th>Net Annual Cost in $</th>
<th>Tons of CO₂ Displaced</th>
<th>Net Cost per Ton</th>
</tr>
</thead>
<tbody>
<tr>
<td>DSM</td>
<td>$23,254,971</td>
<td>92,448</td>
<td>$2,392,680</td>
<td>60,766</td>
<td>($39.98)</td>
</tr>
<tr>
<td>Wind</td>
<td>$18,175,646</td>
<td>665,531</td>
<td>$9,615,241</td>
<td>453,131</td>
<td>($21.22)</td>
</tr>
<tr>
<td>Landfill Methane</td>
<td>$3,369,283</td>
<td>85,040</td>
<td>$936,960</td>
<td>51,391</td>
<td>($18.23)</td>
</tr>
<tr>
<td>Solar</td>
<td>$2,670,588</td>
<td>1,135</td>
<td>$108,074</td>
<td>690</td>
<td>$156.57</td>
</tr>
</tbody>
</table>

*Austin Energy 2006 Budget Report Data*
## Using the CROI

<table>
<thead>
<tr>
<th>Efficiency Measures</th>
<th>CO₂ CROI ratio</th>
<th>Life lbs.</th>
<th>Payback Years</th>
<th>Your Savings lbs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eliminate 90% of vampire power</td>
<td>269.3</td>
<td>33,664</td>
<td>1.2</td>
<td></td>
</tr>
<tr>
<td>Purchase efficient cookware</td>
<td>152.4</td>
<td>4,571</td>
<td>1.4</td>
<td></td>
</tr>
<tr>
<td>Off-grid rural wind power installation</td>
<td>60.2</td>
<td>71,301</td>
<td>3.0</td>
<td></td>
</tr>
<tr>
<td>Replace electric stove with natural gas stove</td>
<td>38.5</td>
<td>20,392</td>
<td>12.7</td>
<td></td>
</tr>
</tbody>
</table>

*The Carbon Buster’s Home Energy Handbook: Slowing Climate Change and Saving Money,*

*Godo Stoyke, Appendices P.135, 2007*
Simple Version of CROI

- \( X - Y \)
- \( \frac{K}{X} \)
- \( X = \) current amount of carbon produced from a certain fuel/technology
- \( Y = \) carbon expected to be produced from the cleaner fuel/technology
- \( K = \) cost of the energy project
Clean Energy Prioritization: Two Tools Offered

- (1.) Customized Carbon Calculator
- (2.) Clean Energy Priority Tool
Customized Carbon Calculator

- Must distinguish carbon footprint based on specific fuel mix, not a national averaged figure
- Transportation should consider specific vehicle type
## Clean Energy Priority Tool:
Energy matrix lists costs used for comparison and generating technologies

<table>
<thead>
<tr>
<th>Generating Technology</th>
<th>CROI</th>
<th>$/kW</th>
<th>Fuel Cost</th>
<th>LCOE</th>
<th>Capacity Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Natural Gas</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nuclear</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wind</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solar</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Further examples of criteria for comparison

<table>
<thead>
<tr>
<th>Generating Technology</th>
<th>Time to Construct</th>
<th>Supply data</th>
<th>Water Consum.</th>
<th>Environ. Impacts</th>
<th>Regulatory Incentives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Natural Gas</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nuclear</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wind</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solar</td>
<td></td>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>
# Getting Specific: Narrowing down each technology

<table>
<thead>
<tr>
<th>Generating Technologies</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IGCC</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>IGCC w/CCS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solar</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>CSP</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>PV</td>
<td></td>
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</tr>
<tr>
<td>Silicon</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Thin-film</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DSM</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CFLs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Generating Technology</td>
<td>CROII</td>
<td>$/kW</td>
<td>Fuel Cost</td>
<td>LCOE</td>
</tr>
<tr>
<td>-----------------------</td>
<td>-------</td>
<td>------</td>
<td>-----------</td>
<td>------</td>
</tr>
<tr>
<td>PC Coal</td>
<td></td>
<td></td>
<td>1.54/MMBtu^1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>^1 EIA, “Coal Production in the U.S.-An Historical Overview October 2006”</td>
<td></td>
</tr>
<tr>
<td>Nuclear</td>
<td>1,849^2 to 1,510^3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>^2 Steve Specker, EPRI, “Generation Technologies in a Carbon-Constrained World”</td>
<td></td>
</tr>
<tr>
<td>Wind</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conc. Solar</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Natural Gas</td>
<td></td>
<td></td>
<td>6.39¢/k Wh^6</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>^6 Gas Turbine World, January-February 2007, P. 54</td>
<td></td>
</tr>
</tbody>
</table>

^2 EIA, EIA, “Coal Production in the U.S.-An Historical Overview October 2006”
^3 Steve Specker, EPRI, “Generation Technologies in a Carbon-Constrained World”
^5 Gas Turbine World, January-February 2007, P. 54
# Prioritizing the Criteria

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<th>Fuel Cost</th>
<th>LCOE</th>
<th>Capacity Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>29% - 44% (by 2010)</td>
</tr>
<tr>
<td>Nuclear</td>
<td></td>
<td>1,849 to 1,510-1,840</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Conc. Solar</td>
<td></td>
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</tr>
<tr>
<td>Natural Gas</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>65.399¢/kWhWh</td>
</tr>
<tr>
<td>PC Coal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.54/MMBtu</td>
</tr>
</tbody>
</table>
Will rate the different technologies on the amount of carbon displaced in reference to a standard (carbon emissions from a standard PC plant)

Matrix would automatically sort by this index, listing highest CROI to the lowest, unless otherwise specified
Data

- Will be public, transparent, updatable
- User will be able to determine bias based on their knowledge of data source
- If multiple values are given, user may select the one preferred
- Over time, data will be refined and accuracy increased as multiple sources converge
Matrix Characteristics

- **Updatable**: add new information and make corrections continuously as it becomes available

- **Transparent**: sources are open, frank, and candid and information easily traceable/located

- **Interactive**: give immediate results and responds to user activity

- **Rigorous**: accurate and peer-reviewed
Specific Bids and Scenarios

- Interactive – User can take a value from a column, like the LCOE and insert their own value based on real offer.
- Scenario analysis – will take into account limiting factors and rank according to user’s preference (CROI, or capital cost).
Similar Working Projects

- **Power Across Texas**
  - University of Texas at Austin
    - Texas Online Energy Tool

- **The Millennium Institute – T21 USA Model**
  - Collaboration with Association for the Study of Peak Oil and Gas
  - USA and State University of New York’s College of Environmental Science and Forestry
    - A quantitative tool for comprehensive policy planning - understand energy issues and to show how those issues relate to society, economy and the environment

- **The Carbon Buster’s Home Energy Handbook**, Godo Stoyke
  - Carbon Busters
    - Personal strategy for slowing climate change and saving money
Versions Available:
Useful as a tool for decision-making and scenario analysis

- Version 1 – Data Base
- Version 2 – Interactive
- Version 3 – Scenario Analysis
- Allow utility to quickly prioritize energy choices based on specific criteria and actual bids
- Rank generating technologies by CROI potential or other prioritized criteria
- Communicate with customers on actual data, new technology investments and carbon reduction achieved
Business Tool

- Provide a cost/benefit tool to assist in energy efficiency measures and carbon reducing solutions
- Compare feasibility of different solutions for energy needs
- Provide current legislation affecting businesses and relevant carbon regulations
Provide up-to-date information on energy regulations and legislation with special attention on carbon

Identify financial incentives and limitations for different technologies

Highlight market barriers to technologies and carbon reducing potential

Provide a framework to enhance energy related policy decision-making
Questions