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Clean Energy Project Exchange

Most now agree that global warming requires quick and effective action from both the public and private sector. Because carbon accumulates in the atmosphere and remains for such long periods of time, setting clean energy priorities to reduce and eliminate carbon is one of the most important issues of our time. The electricity and transportation sectors account for two thirds of all U.S. carbon emissions and thus the costs of reducing these emissions will cascade through the entire economy. Therefore, it is imperative that projects to reduce carbon be the most cost-effective.

Policy-makers, businesses, utilities and individuals are currently faced with making smart choices to reduce their carbon footprint. Congress and many early-acting states are considering a variety of policies to mitigate climate change that will directly affect energy project decision-making. A utility will be faced with whether to build new generation or invest in demand-side management (DSM) programs to reduce the need for electricity. A corporate board of directors will have to determine whether to allocate its resources to green power programs, on-site renewable energy, or energy efficiency. Local governments and policy-makers will need to decide whether to provide incentives for more efficient transportation or change the building codes. While it may appear that the answer to mitigating climate change would be doing all of the above, realistically, one must decide what to do first and how best to allocate limited money.

The question we need to answer is: What energy projects will produce the greatest amount of carbon reduction in the shortest period of time for the least amount of money? The difference between a good project and an optimal project will mean the difference of tens or even hundreds of billions of dollars spent effectively over the coming decades. Quickly being able to determine what project is the most effective in reducing carbon, means we can begin to stabilize carbon concentrations in the atmosphere sooner. Time is of the essence.

Prioritizing Clean Energy Projects is Complex

Setting clean energy priorities requires more than arranging the most common energy generating technologies and fuels in some priority order based on personal, business or political preference. Demonizing or glorifying energy projects fails to offer productive solutions to decision-makers. We do not need to argue “energy theology” as Milt Copulos, President of the National Defense Council Foundation notes.

Clean energy choices in the real world are complex decisions that must transcend biases. A public utility manager must consider many factors including cost, energy reliability, carbon footprint, supply availability, time constraints, and public concerns. Consequently, choosing the best energy projects to reduce carbon can vary significantly.

Consider this example: The goal is to reduce the greatest amount of carbon in two target markets – Seattle and Cleveland, by allocating compact fluorescent light bulbs (CFLs), incentives for conventional hybrid automobiles, and a demonstration program for new plug-in hybrid autos. All of these measures generally reduce energy use and therefore carbon, so why not divide the measures equally between the two target markets?

In this case, dividing the measures equally would fail to reduce the greatest amount of carbon in both markets because Seattle is primarily a hydro-based electric system and Cleveland's electricity is produced primarily from coal. Both cities have petroleum based transportation systems. The best strategy to reduce the greatest amount of carbon would be to send all of the CFLs to Cleveland, the plug-in hybrid program to Seattle, and divide the incentives for conventional hybrids between the two cities.

Changing out light bulbs in Seattle does many good things. It reduces consumer bills, avoids new power plants, and potentially saves water resources, but when electricity is generated from hydropower, changing light bulbs does little to reduce carbon. And even though plug-in hybrids are a good choice in any area – even with coal-based utilities – there is no doubt that more carbon is avoided when they are plugged into a carbon-free energy source such as hydropower. Finally, incentives for conventional hybrids should be split between the cities because both have petroleum-based transportation systems and the same amount of carbon would be avoided in both markets with this measure.

This example was based on the fuel mix of a region. There are many other factors that affect priorities including the renewable inventory of the region, supply availability, water resources and public concerns.

Carbon Return on Investment

If the central purpose in choosing an energy project is reducing carbon, then a key calculation is the Carbon Return On Investment (CROI). That is, how much carbon is removed from the atmosphere – or not placed in the atmosphere – for each dollar spent.

At Austin Energy, we use a simple calculation to determine the cost per ton of CO_2 per displaced dollar spent in our Demand Side Management (DSM) and renewable programs. Since we know our fuel usage according to time-of-day and the times that the different DSM measures operate, we can calculate the carbon displacement of each measure. As a result, Austin Energy allocates most of its climate change budget to DSM and then to wind, biomass and solar. Godo Stoyke uses a similar calculation in his book The Carbon Buster's Home Energy Handbook: Slowing Climate Change and Saving Money by determining which personal strategy for reducing carbon will pay back your investment the fastest.

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A simple version of the Carbon Return On Investment (CROI) calculation is (x-y)/k where x is the current amount of carbon produced from a specific fuel/technology, y is the carbon produced from the cleaner fuel/technology and k is the cost of the energy project. A more complete analysis would account for the full carbon balance calculation for both options. And yet another approach would distinguish between the incremental cost of the new technology and what it is replacing.

Carbon Return On Investment (CROI) is emerging as one of the most important criteria for choosing clean energy projects. However, other criteria could also be the deciding factor on choosing a project. Supply availability can be as crucial as cost. Supply constraints stretch across the entire energy sector – whether it is a lack of pure silicon for solar cells, the availability of wind turbines, building new transmission lines, a shortage of nuclear engineers, or congested rail lines delivering coal. Scarcity of water is also becoming a critical factor in numerous regions across the country. Technologies and fuel sources that require little or no water are sometimes chosen on that basis alone. Criteria used to compare technologies in making clean energy decisions will vary depending on whether the decision-maker is a policy-maker, corporate executive or utility manager. Tools to assist decision-makers in prioritizing their clean energy choices are essential and must take all of these factors into account.

Carbon Return on Investment Matrix

The Carbon Return On Investment (CROI) matrix will work to prioritize multiple energy projects with the goal of reducing carbon. This goal can be further enhanced with the use of a customized carbon calculator that incorporates the specific electricity/fuel mix to each footprint, instead of using a national averaged figure. The matrix is in a simple spreadsheet format with transparent and updateable data sources, ultimately capable of scenario analysis. Along one side of the matrix are all of the major fuel sources with accompanying technologies (e.g. coal, gas, nuclear, wind, solar). The user can click on any of them and reveal the specific technologies for the fuel conversion, such as Integrated Gasification Combined Cycle with carbon capture and storage for coal, or Concentrated Solar Power under solar. All major technology/fuel conversions are included.

At the top of the matrix are several columns with specific information about the fuel/technology that can be used for comparison. Cost factors used for comparison include $/KW for capital cost, levelized cost of energy, and other cost parameters. Energy and carbon balance are listed, as well as relevant regulations and incentives.

In addition to the cost factors there is a Carbon Return on Investment Index (CROII) column. This column ranks the different technologies on the amount of carbon displaced by the technology in reference to a standard, such as carbon emissions from a standard pulverized coal combustion plant. The matrix would automatically sort by this index, listing the energy project options from highest CROI to the lowest.

Limiting constraints are also included with the cost factors along the top of the matrix. A column would have notes on supply issues, showing average time of delivery for a technology. Water consumption would occupy another column, and there could be other relevant factors shown such as emission information or environmental impact notes.

The sources of data for this spreadsheet are the major determinants of its usefulness. Rather than trying to establish an unbiased, objective source of data for each of these parameters, the data should be multi-sourced and transparent. Each data point would be footnoted so the user can see the source and judge for themselves its accuracy. When there are multiple values given, the user could choose the preferred value to prioritize with. Over time, the data would become more refined and accurate as multiple sources converge.

In many cases, the user would have actual offers or bids to be ranked against the displayed transparent data. Accordingly, the tool would be interactive to the extent that the user could take a value like the $/KW, or price of a unit and insert their own value based on a real offer.

Ultimately, this tool should be able to perform scenario analysis by taking limiting factors into account. In the real world, a utility manager may have a limited time frame to meet an energy need, water availability concerns and a specific financial threshold. By incorporating these limiting factors, the tool would be able to discard all options outside those set parameters and sort according to Carbon Return On Investment (CROI) or capital cost or in accordance with some other criteria for comparison.

Additionally, this tool could be customized to the entities using it, with different versions for utilities, policy-makers and businesses. A business owner would be primarily concerned with prioritizing energy efficiency, curbing carbon emissions and on-site generation measures, not power plant options. Policy-makers may be most interested in which measures to promote through incentives, or may be choosing projects for their own consumption.

If the data provided above was displayed, transparent, interactive and updated regularly with a competent scenario analysis algorithm, it would prove extremely useful to utilities and major power consumers in both selecting projects and speeding decisions. Additionally, this tool would be a real exchange of information from actual vendors on energy projects. The site would have the added benefit of allowing the user to contact vendors that provide particular data or advertise their services on the site.

The Clean Energy Project Exchange will assist decision-makers on numerous levels to set clean energy priorities and choose projects quickly and effectively to reduce carbon and meet energy demands.

