Reaching our Energy Efficiency Potential and Our Greenhouse Gas Objectives - Are Changes to our Policies and Cost Effectiveness Tests Needed?

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ABSTRACT

The objectives of many energy efficiency programs are being expanded beyond capturing short-term "least-cost" energy resources, to achieving long-term climate change objectives. In some circles energy efficiency programs are seen as the primary way in which climate change objectives will be achieved over the short-term (next 15 to 30 years). However, our field's current approaches for assessing program benefits and costs limits realization of the majority of the potential for both energy efficiency and carbon reduction. In addition, these same approaches practically assure that carbon based energy supplies will remain the fuel of choice, even when efficiency can meet energy needs more inexpensively. New cost effectiveness tests are needed that allow policy makers to set choice guidelines for when programs need to accomplish multiple and often competing objectives (least-cost vs. carbon reduction). What should these tests look like? This paper does not attempt to answer this question, although each of the authors have their ideas for what that test should look like and how it should perform. Instead, this paper examines four aspects of the way we currently compare the benefits and costs of energy efficiency programs. This paper is provided to help policy makers consider how they might adjust and apply future cost effectiveness tests. It should be noted that the authors of this paper do not always agree on how these four changes should be configured or how they should be structured to influence the results of the applied tests. But the authors do agree that the aspects discussed in this paper need to be carefully considered within our new policy environments that focus on using energy efficiency as an approach for carbon emission reductions.

Another purpose of this paper is to challenge the reader to think about energy efficiency and the way in which we compare the costs and benefits of carbon and non-carbon-based energy supplies. The paper asks the reader to consider current approaches, in which our benefit cost tests represent simple investment choices similar to how an individual would choose between personal investment opportunities or a business compares their corporate investment options. Alternatively, policy makers may structure their benefit cost assessments differently to better recognize the full value of energy efficiency relative to traditional energy supply choices, and to achieve overriding public climate change objectives. Enabling investment in all cost effective energy efficiency is important because it can achieve both least-cost short-term and long-term energy supplies and provide significant climate change benefits.

Introduction

Recently, two key publications[1] (the Stern Report and the Plan B Report cited below) authored by well established and respected economists and peer reviewed by literally hundreds of respected confirming

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[1] Brown, Lester R., Plan B 3.0, Mobilizing To Save Civilization, The Earth Policy Institute, W. W. Norton & Company,

scientists and scientific organizations, have indicated that the long-term costs of climate change will be a far greater cost to society than the purchase price of energy supplied via traditional carbon-based supplies.

As a result of these publications and many like them, states and countries are searching for policies to guide future energy investments toward supplies that do not adversely impact the climate. In both the Stern and the Plan B reports, energy efficiency is seen as one of the few viable methods for slowing climate change in the next 20 to 30 years. Yet energy efficiency program policy decision markers continue to use benefit cost approaches that, in the opinion of the authors, not only limit the amount of energy that can be saved, but also assure that the least first-cost carbon-based supply choices remain the dominate resource of choice.

Even in states that have legislatively set sustainable energy supplies as the energy supply of choice, benefit cost tests continue to work against that objective. These conditions prompt the question; Are our future energy supply choice policies consistent with the tests we currently use to decide which energy paths to take? If they are not, what changes are needed? Do we need to maintain our least supply cost policies and agree that carbon-based emissions are acceptable and conclude that climate change is not a significant concern until the time that energy efficiency or renewable energy become cheaper to generate than traditional supplies? Or do we change the tests to capture the full value and allow more resources from carbon free supplies? Are we holding energy efficiency to a different standard than renewable energy? Have we required renewable energy to be generated at a lower cost than carbon based generation before construction costs can be incurred or facilities approved in rate cases? If not, why not? Why must policy require that energy efficiency supplies be less expensive to generate than burning carbon?

All benefit cost tests for energy efficiency programs are, at their foundation, the same. That is, forecasted benefits are divided by projected costs to give a benefit cost ratio. For example, if the benefits from an energy efficiency program total $4.00, and the costs to achieve that benefit total $1.00, then the benefit cost ratio is 4:1. This ratio is typically abbreviated by dropping the second half of the ratio (cost part) and expressing the ratio as a number (4.0). If the ratio is 1.0 or more, the present value of the benefits exceeds the present value of the cost. If the ratio is less than 1.0 the costs exceed the benefits. Policy makers have typically required implementers to offer efficiency programs (or portfolios) that have benefit cost ratios greater than 1.0. Typically this means that the program costs to achieve the efficiency are less than the costs to generate and distribute that same amount of energy from conventional power plants. Thus, efficiency is implemented only if it is less expensive than projected future traditional energy supplies.

This is an interesting approach for achieving a national policy. It essentially means that pursuing more energy efficiency is fine as long as it is less expensive than our current supply choice. However, these tests are almost always structured in ways that do not count all benefits (economic, societal and non economic) and typically require comparisons to be based on the cost of existing carbon-based energy resources rather than new renewable energy resources. In essence, energy efficiency has to compete with pre-existing carbon based supplies that do not include environmental costs to society, such as climate change and mercury deposition. The current approach in most states requires energy efficiency to be cheaper than carbon-based resources before they can be approved, thus moving energy efficiency to a minor position in the supply mix.

Put another way, the current approach for our benefit cost tests blocks energy efficiency programs from becoming effective climate change mechanisms. According to the Stern Report and Plan B (cited above), this approach substantially increases future costs. It is a self-defeating approach that we will be handing off to our children to repair. However, with policy-based changes to the way in which benefit cost

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2008.
Stern, Lord Nicholas, The Economics of Climate Change - The Stern Review, Cambridge University Press, January 2007

tests are applied, energy efficiency can not only achieve far greater energy supply impacts than current programs, efficiency can also substantially reduce carbon emissions.

According to both the Stern report and the Plan B report we must rely on energy efficiency to capture from about 40 to 80 percent of the carbon reduction needed in the next 40 years. To achieve this goal we essentially have to make every building in the United States consume about from 60 to 75 percent less energy. Technically it is achievable. We have the technology to capture most of this savings today, with only minor adjustments to our current energy technologies and marketing approaches needed to achieve the rest. However, the current approach for calculating the benefits and costs of measures, programs and portfolios will block this achievement. In the opinions of the authors, under current policies, we are leaving about 60 to 80 percent of the available building-associated savings un-touched *after* our energy efficiency programs have completed their work. The remaining potential does not fit within the current benefit cost calculation approach regardless of the program's energy or climate change benefits.

This condition reigns not because the savings are not achievable, not because the technologies to capture it do not exist, but because most policy makers have set program approval approaches so high that new energy resources must be "cheaper" than the fossil fuels our climate change policies want to avoid. Our benefit cost decision approach is essentially helping to guarantee our climate change failure.

Over the last few years, some policy makers have incorporated minor changes in how to count costs and value energy impacts. Some jurisdictions have also included adjustments to reflect the value of one or more non-energy benefits achieved by a program. But this paper is not about the accuracy or reliability of our previous assessments. While this in itself would be a worthwhile objective, that water has already passed under the bridge. Instead, this paper looks forward and examines four key concepts on which our current benefit cost assessments rest.

The authors make no recommendation about these concepts, nor do we suggest that any specific approach is better than another. For this paper we wish to remain neutral in this regard and present only potential change concepts for consideration and debate. While we each certainly have our opinions as to which approach is best, these opinions are not consistent within the authors, and for the sake of objectivity we leave this decision to the reader. Only through reasoned discussion, debate and peer review can we come to an agreement on the right approach or reach reasoned compromises. This paper is not the forum for that debate, but is a forum for bringing initial concepts to our peers in order to push that debate forward.

The four concepts addressed in this paper include the following:

1. The way avoided energy supply costs are valued in our tests,
2. The way discounting is applied,
3. The way carbon values are assessed, and
4. The way effective useful life is used in these tests,

The remaining sections of this paper will discuss the four changes to be considered. Within each of these sections we present the change to consider and provide illustrations of how each change will impact a benefit cost calculation. This allows the reader to see the implications of each change.

Avoided Costs

Most current cost benefit tests set the value of the cost that is avoided through energy efficiency at the cost of the current energy delivery system. In most cases avoided costs are carbon based costs (fossil fueled generated electricity or natural gas supplies). Avoided costs are often set to be equivalent to an energy mix grounded in a coal fired generation system or a system that is coal-fired supplemented with natural gas facilities to meet demand above a base load condition, or based on the current market based sales and supply mix for a given area. Some states include other fuel types in this mix to some degree, such as nuclear energy. There are several different approaches used to set the avoided cost within a specific supply system. Some of these systems try to balance the avoided costs over both carbon and non-carbon supplies. However, in general, almost all avoided cost approaches continue to be focused largely on carbon based supplies. If climate change is a national objective, why are avoided costs premised on a future energy scenario with extensive use of carbon based fuels? Renewable energy supplies appear to be a more likely policy option for new energy generation. As a result, should renewable supplies form the basis for avoided cost calculations in an environment where carbon-based options are moving off the table?

Currently, in most states, carbon based supplies drive the avoided cost value, and therefore carbon burning becomes the supply of choice unless energy efficiency is less expensive. Policy makers appear to be setting climate change objectives, and then selecting an avoided cost approach that cannot achieve that objective. Should the avoided cost be set at the cost of the carbon free supply system of the future so that our supply choices move forward instead of being tied to the current generation mix? If a coal based plant can generate energy at $0.06 cents per kWh and a renewable energy facility to be constructed to supply future energy will cost $0.18 per kWh, under a climate change objective, what is the cost that is avoided, the coal plant's generation costs or the cost not needed for the carbon free renewable energy facility and the energy it would have provided? Should we be looking backwards or forwards in how we set avoided costs for energy efficiency programs?

The difference between these two approaches is striking (Table 1.). If a CFL costing $7.00 per bulb to install via a direct install energy efficiency program has an effective useful life of 7 years, saving 75 kWh per year at a real discount rate of 4 percent per year, the difference in the benefit cost ratio between a carbon based avoided cost at $0.06 and a renewable based avoided cost at $0.18 is a 300% difference. That is, the benefit cost ratio of the CFL at $.06 cents is 3.9 while the ratio at $0.18 is 11.6. The change from a coal based avoided cost to a renewable energy avoided cost, in this example, makes the energy efficiency choice much more desirable. The CFL is 3.9 times more cost effective than supplying that energy from a coal based resource, but is 11.6 times more cost effective than providing that energy from a renewable facility.

Table 1. Avoided Cost Comparison: Direct Install CFL

	Carbon Based	Renewable Based
Real discount rate (%)	4	4
Effective useful life (years)	7	7
Avoided cost ($)	$0.06	$0.18
Value of carbon per ton ($)	0	0
First cost of measure	$7.00	$7.00
Annual kWh savings (kWh)	75	75
Cost effectiveness ratio	3.9	11.6

In several states utilities are already required to spend in order to increase their energy efficiency and renewable energy portfolio. In Wisconsin for example, energy efficiency is to be used as the first choice supply option, followed by renewables, and fossil fuel alternatives. However, for the energy efficiency component of this priority loading mix traditional cost effectiveness tests are used to determine what should be supplied. This policy essentially places efficiency to be a preferred choice only when it is cheaper than coal, the state's primary generation approach.

If utilities have to install more capacity to meet needs, energy efficiency may be more cost effective than renewable energy, however, it does not get the chance to be selected because of the benefit cost approach for energy efficiency. Yet, for the renewables currently being installed under Wisconsin's Portfolio Standard there is no policy or state law requiring renewable energy to be cheaper than coal. Further, in most states, even the avoided cost of electricity is underestimated because it is based on the cost to generate electricity in the state rather than the normally higher cost for market purchased electricity often required to meet both peak and non-peak demand.

Discounting

The purpose of discounting is to bring all costs and returns at different points in time to a net present value, so that different investment choices with different costs and returns can be compared. This type of comparison allows for more informed, and frequently (but not always) better investment decisions. This makes perfect sense when considering two different approaches for determining which investment strategy provides the highest financial return. But does it make sense for all decisions, especially when environmental goals are not adequately considered in investment calculations?

Following a presentation on benefit cost tests at the 2008 National Association of Regulatory Commissioners (NARUC) in Washington D.C., a utility commissioner asked one of the authors the following question; "*In a global climate, in which climate change impacts will increase each year causing a ton of carbon released in the future to be more destructive than a ton of carbon released today, why is a ton of carbon saved in year 25 not worth more than a ton of carbon saved today?*" This commissioner continued and asked: "*If we are really serious about carbon reduction and our climate future, should the discount rate be a negative number so that its financial importance increases over time rather than decreases?*" These two questions reflect a deep sense of thinking not about economic modeling of discount rates, but about the impact of the choices associated with the way in which we discount, and the consequences that occur as a result. If climate change is a national policy objective, does it make sense to discount the future worth of the anticipated impacts as if they were a simple alternative financial investment decision? What function does discounting serve in a national policy environment if the discounting effect is to neutralize national policy? Are we making policy that is only to be achieved if the right discount rate allows that policy to be achieved? Are we to resign ourselves to the concept that we cannot stop climate change because our discounting approach does not support it? Using the current approach we end up discounting the value of future savings to be essentially worthless after the 25th year? Are we building an environmental house of cards under the guise of appearing to make sound limited-focus short-term economic decisions?

As noted by the question (above) from the Commissioner, discounting is especially problematic when the discount rate is not being applied to the value of increasingly severe projected global impacts or applied to all costs and all future benefits. Some of the authors have heard suggestions that the discount rate for climate change purposes should be negative, resulting in a higher value allocated to future energy savings. A point made by the Commissioner's question. Economists are advising that using discounting in half an inaccurate equation may be better than not discounting at all. However, historically, discounting is not applied to national policy objectives that have a magnitude similar to the climate change challenge. What was the discount rate for other national policy decisions, such as the decisions to go to war (1775, 1917, 1941, 1950, 1961, 1991, and 2003)? What was the discount rate for the decision to go to the moon? What was the discount rate used to determine if it was cost effective to help people after Katrina? Are there any key national policy objectives in which discounting has been used to determine the approach for obtaining important national policy objectives similar to the way we now use discounting for energy efficiency program effects that reduce carbon emissions?

Every deferral of an energy efficiency measure means that the corresponding carbon emissions will linger in the atmosphere for years or until we spend additional money to remove it with technologies yet to be developed. The damage will affect the current population somewhat, but it is projected to affect future generations even more. These impacts are not only excluded from our discounting approach, they are excluded from our benefit cost tests, even though research presented in the Stern and the Plan B Reports show that it is far less expensive to do more sooner. [2] Even if these costs were included in the decision calculation, the discounting function would set their value in that decision to be worthless because the severity of the impacts occur after the 25th year.

If energy efficiency is simply a net present value supply choice equation to allow the least expensive energy resource to be provided in an environment in which costs and benefits are well understood, most professionals agree that discounting makes perfect sense. But what is the role of discounting future energy efficiency supplies when it becomes a national objective in order to reduce greenhouse gas emissions under conditions in which the future impacts are not even recognized by some of the bodies setting benefit cost calculation policy? That question is yet to be answered.

What can be answered now is how much discounting affects our program choice decisions. Taking the CFL example above, using the $7.00 installation cost, 75 kWh per year savings for 7 years, avoided cost of $0.06 per kWh with a 4% real discount rate provides a benefit cost ratio of 3.9. That ratio moves to 4.5 if the future benefits are not discounted. If the discount rate moves to a negative -.4% the benefit cost rate moves to 5.3.

Similarly, discounting has a strong effect on how "cost effective" and HVAC replacement appears (Table 2). If we were to replace a HVAC system with an incremental cost of $800 and annual energy savings of 3,000 kWh over a 20 year life at 4% real discount rate and $0.06 avoided costs, the benefit cost ratio is 3.1. If we move the discount rate to zero the ratio becomes 4.5. If we use a negative discount rate of -.04% the rate becomes 7.1. Between a discount rate of 4% and -4% there is a 230% difference in the benefit cost ratio.

Table 2. Discounting Effects Comparison: HVAC System

	+4% Discount	0% Discount	-4% Discount
Real discount rate (%)	4	0	-4
Effective useful life (years)	20	20	20
Avoided cost ($)	$0.06	$0.06	$0.06
Value of carbon per ton ($)	0	0	0
First cost of measure	$800	$800	$800
Annual kWh savings (kWh)	3,000	3,000	3,000
Cost effectiveness ratio	3.1	4.5	7.1

Value of Carbon Saved

Several states have already begun to include or consider including carbon values in their benefit cost tests. However, no state is setting carbon values at the projected value of the benefit over the predictable future (partly because these are highly uncertain). Instead these states are using policy based assignments of value. In some cases these value assignments are tied to a traded value of carbon or an expected traded

[2] Carbon Dioxide Information Analysis Center of the U.S. Department of Energy. "Recent Greenhouse Gas Concentrations" by T.J. Blasing. Updated September 2008. http://cdiac.ornl.gov/pns/current_ghg.html

value. Others are based on an agreed value after regulatory discussions focusing on what that value should be with a compromise reaching negotiation. This approach in itself indicates that the results of the benefit cost calculation are less about estimation accuracy and more about policy advances in a political world. If policy makers are setting the value of carbon, and their policy is not tied to the expected cost of the environmental impacts, then the benefit cost calculation is a policy grounded calculation rather than a real benefit and real cost grounded calculation. This means that the outputs of the calculation are already a policy metric rather than a benefit cost metric.

The authors of this paper have participated in carbon value discussions that have tried to place a value on saved carbon. These discussions typically end up concluding that the projected value in reports such as the Stern Report or the Plan B report are too high to be politically or economically acceptable. Essentially, the value of avoided carbon would be greater than the cost of the energy provided. Yet in none of these discussions has the foundations of the estimated value of the avoided carbon in the Stern Report or the Plan B Report been seriously questioned. While policy makers might believe that the value of the carbon saved is greater than the cost of the energy provided, this conclusion cannot be drawn for reasons beyond the need for accuracy within the benefit cost calculation.

More often than not, because of the uncertainty of the real costs of carbon induced climate change, policy makers try to find a different approach to estimating the value of carbon reduction. In some cases the value of carbon is pegged to a traded value of carbon or a proxy to represent an expected traded value or an expected average traded value within a cap and trade system, or a value that is a derivative of a traded or expected traded value. Because there is no national cap-and-trade system, these estimates are somewhat subjective. In addition, because cap-and-trade values are more a function of a political cap decision linked to a rate of demand, they do not represent the actual avoided future cost of emitting that carbon. They are in themselves a proxy for an unknown real value that is typically estimated at from 2 to 50 times the traded value or the proxy value. We essentially do not know the real value of avoided carbon emissions. The Stern Report and the Plan B report suggest that the real value may be as high as \$100 to \$300 per ton. Traded values or proxy values are far less than these estimates. However, regardless of the approach used to set a value for carbon reductions, if climate change objectives are to be met with energy efficiency programs, the benefit cost calculation will need to include a value for the carbon not released. This value will need to be as accurate as politically and scientifically possible. A political compromise that lowers the value will allow fewer efforts to go forward, increasing future costs to recover from that error. A decision that increases the value will allow more climate change progress to be made. At the end of the day, consumers are going to have to pay for the costs, regardless of what they are or when they come. Cost projections in the Stern and Plan B Reports indicate that it is most likely less expensive to do it sooner via energy efficiency than later via atmospheric scrubbing. But to exclude a value for carbon reductions from the benefit cost test certainly reflects poor public policy. The more accurate the number is, the better we will be able to respond to the climate change challenge.

In the example of the HVAC system above (Table 2), if we were to keep a real discount rate of 4% with the same cost and energy savings, the benefit cost ratio with carbon values of \$10.00 a ton, \$50.00 a ton and \$200 dollars a ton provide a benefit cost rate of 3.7, 6.2 and 15.8 respectively, instead of 3.1 by not adding a carbon credit. At \$50 a ton for saved carbon, the benefit cost ratio of the measure doubles from 3.1 to 6.2.

Table 3. Carbon Value Effects Comparison: HVAC System

	No Carbon Value	$10 Per Ton	$50 Per Ton	$200 Per Ton
Real discount rate (%)	4	4	4	4
Effective useful life (years)	20	20	20	20
Avoided cost ($)	$0.06	$0.06	$0.06	$0.06
Value of carbon per ton ($)	$0	$10	$50	$200
First cost of measure	$800	$800	$800	$800
Annual kWh savings (kWh)	3,000	3,000	3,000	3,000
Cost effectiveness ratio	3.1	3.7	6.2	15.8

Effective Useful Life

The effective useful life (EUL) of a measure is the period of time that the measure is expected to perform its intended function in a typical installation. Put another way, the effective useful life is the period over which 50% of the measures installed have either failed or been removed. A CFL in a residential installation might be expected to last somewhere between 5 to 10 years depending on application. An HVAC system is typically expected to last from 20 to 30 years. Windows are expected to last from 30 to over 75 years. Building insulation is expected to last from 75 to 100+ years. However, in all states actual EUL are not used in the benefit cost tests. Instead most all tests cap the EUL at between 18 to 22 years regardless of the period of time the measure is expected to perform. This use of a reduced period EUL is a function of several conditions.

First, there is the perceived need by some policy makers to be conservative in the estimation process. This consideration tends to drive decision makers to use EUL that are underestimates of the actual lifetime of measures.

Second, customers will sometimes change their energy technologies before they have reached the end of their expected life. For example this happens when owners remodel or change appliances to meet appearance or functionality requirements.

Third, the mean cost of failure, or the hassles associated with a repair are often high enough that customers will elect to have a unit replaced rather than have it repaired.

Fourth and most important, most discount rates tend to make savings past year 25 essentially worthless regardless of the amount of energy that is actually saved. Thus policy makers say there is not much benefit in using actual EUL for long-lived measures when there is no significant value to the savings after the discount rate has run the savings to zero net present value.

The fourth point illustrates the linkage between various issues discussed in this paper. The linkage introduces a non linear effect since a lower or negative discount rate increases in importance as the EUL is increased. Thus, for many long-life measures our benefit cost policy forces programs to not count the value of the majority of the savings achieved. Vast amounts of savings potential in the United States essentially become worthless in our benefit cost tests when savings occurring past the policy based effective useful life period are not valued as a future energy resource.

In a climate change environment (rather than a least-cost supply environment), these four conditions may no longer make sense. In any benefit cost analysis the focus should not be on setting effective useful lives at a period that is less than their actual expected life. Accuracy should be the over-riding objective. Likewise when the interaction between our effective useful life value and our discounting policy results in the majority of energy efficiency induced climate change impacts being pegged as having no value, it is time to take a serious look at the effects of that approach on our ability to reach our climate change objectives. Essentially our current approach moves many of the market's long-life measures off the table for consideration in our energy efficiency programs. For measures such as windows, insulation, and new building envelopes that have a large climate change potential, the majority of the value from the savings are not even recognized in our benefit cost calculations. We are essentially tossing out some of our longest life and most effective measures and making our programs less effective, not because of what can be saved, but because of our benefit cost calculation approach. For many measures the savings are great and the carbon reductions are large, but they occur too far in the future to be recognized or valued.

An example of this condition can be found in windows. If the cost of a replacement window is $350, saving 300 kWh per year for 20 years at a discount rate of 4% and an avoided cost of $0.06 per kWh, the benefit cost ratio is 0.7. A benefit cost result too low to be included in an energy efficiency program. If the discount rate is excluded, the ratio moves to 1.0. However if the full effective life of the savings are counted by eliminating the discount rate and crediting 75 years of savings, the resulting benefit cost is 3.9.

To show the implications of this change let's examine an example that is currently beyond consideration by any energy efficiency program in the country: a mass-scale program retrofitting large single family homes with new building envelopes to move them to super energy efficient status. In this example the cost is $30,000 to make the home super energy efficient using a modular retrofit approach; the savings are 20,000 kWh per year for this large all electric home. Using a discount rate of 4 percent the benefit cost ratio is 0.54 in 20 years, 0.86 in 50 years, 0.95 in 75 years and 1.0 in 100 years. If we move to a 0% discount rate the 20 year ratio is 1.3, the 50 year ratio is 3.3, the 75 year ratio is 5.0 and the 100 year ratio is 6.7.

As noted in table 4 below, by moving to a full EUL the measure becomes cost effective, however, by not discounting the future energy benefits the measure is cost effective at all EUL periods presented in this example, moving from a ratio of 1.3 at 20 years to 6.7 at 100 years. Yet today, this approach for reducing carbon impacts is not even considered because of our energy efficiency program EUL policy caps and the effects of discounting future benefits; the very opposite of the objectives of our climate change programs (to achieve long term climate stability).

Table 4. Effective Useful Life Value Effects Comparison: Single Family Envelope Retrofit

	EUL=20 $.06/kWh 4% Discount	EUL=50 $.06/kWh 4% Discount	EUL=75 $.06/kWh 4% Discount	EUL=100 $.06/kWh 4% Discount	EUL=20 $.10/kWh 0% Discount	EUL=50 $.10/kWh 0% Discount	EUL=75 $.10/kWh 0% Discount	EUL=100 $.10/kWh 0% Discount
Real discount rate (%)	4	4	4	4	0	0	0	0
Effective useful life (years)	20	50	75	100	20	50	75	100
Avoided cost ($)	$0.06	$0.06	$0.06	$0.06	$0.10	$0.10	$0.10	$0.10
Value of carbon per ton ($)	$0	$0	$0	$0	$0	$0	$0	$0
First cost of measure	$30000	$30000	$30000	$30000	$30000	$30000	$30000	$30000
Annual kWh savings (kWh)	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000
Cost effectiveness ratio	0.54	0.86	0.95	1.0	1.3	3.3	5.0	6.7

A New Life For Energy Service Providers

If a national policy is established that allows energy programs to move beyond the current approved methodology for identifying what is cost effective, and a national funding mechanism is established to capture that potential, the energy efficiency climate change objectives identified in the Stern Report and the Plan B report can be captured. At the same time millions of new jobs would be added to the economy, and new businesses, deployment systems and technical innovations would be developed to accomplish the task. The organizations that can most rapidly establish and deploy these systems would have a clear advantage in the market. Fast acting energy companies (or other organizations) teamed with appropriate funding sources and future thinking policy and regulatory organizations could lead this economic opportunity reaping the associated rewards and helping to solve both the energy and the climate change problems. This initiative could amount to the largest reconstruction initiative ever accomplished in the United States and move our country forward, toward a more energy efficient, reduced carbon future.

With climate change objectives being added to our energy efficiency and energy supply choice decisions, energy efficiency program providers find themselves sitting on a potential economic development gold mine. If only part of the changes to the benefit cost test summarized above can be incorporated into a national financing system which allows programs to capture the savings available from most every building in the United States, current program approaches and current technologies can capture the available efficiency to meet the climate change challenge needed from energy efficiency.

The changes noted above reflect a need to focus on the climate change benefits as well as the energy efficiency benefits. By adding the value of carbon at $50 per ton for carbon based supplies; by eliminating the discount function for future savings so all savings can be valued; by using an EUL of 75 years, using electric energy costing $0.06 per kWh for the building envelope example provided above, the benefit cost ratio of placing a new super high efficiency building envelope on a typical single family home is 6.1 to one. That is, for every dollar put into the change, $6.10 dollars of energy and climate change benefits are returned. By valuing energy at the cost of renewable energy ($0.18) the ratio rises further to 12.1.

For this return on the energy efficiency investment, it is possible to make almost every building in the United States a super efficient structure, reducing energy use by about 60 to 75 percent. In the 1980s the energy efficiency industry constructed super efficient double envelope demonstration homes that were predominantly heated from appliance waste heat and by the use of minimal passive solar energy brought in through windows. These homes needed very little cooling and proved their energy efficiency value time after time. Under a national program scenario it is possible to make every home and small commercial building super energy efficient. But this cannot occur under the current funding approach or the current approach for determining cost effectiveness. Our discounting and valuing approach is blocking the technologically available potential for energy efficiency and carbon reduction. While we note that there are many other barriers to this objective, including customer attitudes, lack of effective marketing, industry infrastructures, available capital, etc., all of these barriers are manageable and can be effectively reduced with well designed programs and national funding priorities. If we do not overcome these barriers, energy efficiency cannot substantially help reach the climate change objectives required from the efficiency industry, and the building stock in the United States will remain energy inefficient when compared to its potential.

Summary and Conclusion

The above text provides some perspectives on the approach we use for conducting benefit cost tests, along with some examples of the impacts of the current approach and the impacts of changes to that approach. Not all people, including the authors, agree with all of the concepts expressed above. However, this paper is provided to generate discussion and a healthy exchange over our current approach and changes to that approach. What we as an industry must examine is how our policy framework, including our benefit cost approaches, are influencing the contributions that efficiency can make for our world, our country, our states, and our communities. Our industry already has the talent, the tools and the techniques. We see it in many locations, from California to New York and many states in between. The past 30 years of energy conservation, demand-side management, and energy efficiency programs have built this foundation. If we fail to build a policy focused benefit cost approach now, we may well pay substantially more for that decision later.

Regardless of the opinions and perspectives presented in this paper, we trust that this discussion has, at the very least, been thought provoking, and in some way will help lead to more effective programs that are capturing more savings and at the same time helping to reduce the climate impacts of our energy choices.

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