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FEASIBILITY OF INVESTMENT TESTS TO DETERMINE ADDITIONALITY FOR GHG PROJECT-BASED MECHANISMS

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FEASIBILITY OF INVESTMENT TESTS TO DETERMINE ADDITIONALITY FOR GHG PROJECT-BASED MECHANISMS

Increasing attention at the national and international levels has been given to various forms of emissions trading and project-based mechanisms to reduce greenhouse gases (GHG) in a cost-effective manner and promote other goals such as sustainable development. For most of these mechanisms, a key concern is to adequately ensure that the reductions from these mechanisms are "real" — i.e., would the emissions reductions or removals claimed for the project have otherwise occurred? This concern is typically referred to as ***Additionality***. A number of approaches to determine Additionality have been offered, including:

- ***Baseline Emissions Test.*** Is there a significant difference in the magnitude of the emissions or removals for the proposed project, relative to what would be expected to occur in the "baseline?" This is oftentimes addressed by establishing a project specific "counterfactual" condition). An alternative approach is to establish an emissions-based GHG performance standard that reflects emissions performance that is significantly better than average compared to an historical reference set.

- ***Regulatory or Institutional Screen.*** Are the emissions reductions or removals already directly or indirectly required by regulations, guidance or industry standards?

- ***Technological Test.*** Is the carbon performance of the proposed project superior (e.g., does it involve a technology or practice that goes beyond convention)?

- ***Financial Test.*** Is the source of funding new or does it instead divert governmental funding that is already available for such purposes?

- ***Barrier Test.*** Does the project overcome barriers (both financial and non-financial) to implementation as compared to other possible projects that could deliver the same products or services, such as resistance to new technologies, lengthy development processes, etc.?

- ***Investment Test.*** Would the investment occur anyway in the absence of the mechanism (i.e., without the added financial benefit from GHG crediting)? This is often determined by comparing the project to a set of feasible alternative investment scenarios or by comparing the expected financial performance of the project to an alternative project that is most likely to occur.

This paper examines issues associated with assessment of investment/financial performance and addresses the feasibility of the ***Investment Test for determining additionality in project-based mechanisms***.

There has been extensive effort to develop a variety of approaches for the Baseline Emissions Test, ranging from establishing GHG Performance standards (sometimes referred to as "multi-project," "top down" or "standardized" approaches) to project-by-project baseline approaches (sometimes referred to as "bottom up" or "nonstandardized" approaches):

- *GHG Performance Standards* develop emissions benchmarks for specific project types which then serve as the counterfactual for comparison with a proposed project's emissions. Such performance standards can be developed at varying levels of granularity, to represent sectors or subsectors, project types or subtypes, as well as global, regional, countries, or regions within countries. These approaches have the lowest transactions costs to the project developer, however, initial costs to the program administrator may be high.

- *Project-Specific Baseline Emissions Tests* develop a project-specific counterfactual(s) to which the proposed project emissions are compared (e.g., what activity would have occurred that delivers the same product or service). The basis for establishing the alternative project against which the proposed project is compared can include investment analysis to identify the most financially viable alternative (including the project itself as the most likely investment). These approaches have the highest transactions costs to project developers, however, verification costs to both the project developer and the program administrator can also be high.

It is clear that application of the project-by-project approach for all projects would be daunting (and for smaller projects, wholly impractical). Therefore, there has been increased attention to the option of applying different levels of tests to different types of projects, ranging from relatively simple tests for smaller, fast track projects (as in the Clean Development Mechanism) to more demanding tests for larger projects. A number of different approaches for the different Baseline Emissions Tests are under development. Apparently, these approaches are expected to provide acceptable results -- this paper does not address issues or tradeoffs that may be associated with these alternative approaches for the Baseline Emissions Test.

Several approaches for the Investment Test have been proposed and are being developed for several GHG project schemes (e.g., CDM, PCF). These tests require the project developer to assess investment and financial parameters for their proposed project and compare these to an alternative project (or projects). As with many proposed approaches for determining additionality, these tests are still in development and the outcomes are unclear.

- *"Multi-Project" Investment Tests*[1] typically compare a point estimate of one direct financial measure, typically the internal rate of return (IRR), for the project of concern to a multi-project "threshold" or "baseline" value as the means for evaluating whether a project would be built in the absence of GHG crediting. Proposed projects must demonstrate that their IRR (or other financial measure) is lower than the baseline IRR in order for the project to be considered additional.

  For this type of test, we conclude that, while relatively simple to calculate, a point estimate for any measure of financial performance is misleading because the potential financial performance of a project is in fact a distribution based on a range of assumptions reflecting a broad set of potential outcomes. As such, a project developer would have substantial latitude to select a point estimate from the distribution that is below the financial threshold for the test. Further, such tests rely on the presumption that appropriate investment thresholds can be developed, when in fact they are difficult to set and prone to material error. Finally, direct financial measures (whether the test is comprised of a single measure or a group of measures) are an incomplete proxy for the project decision-making process because they do not reflect many other key factors that also guide investment choice, such as risk, opportunity cost, strategic objectives and more. Investment decisions are tough to make and invariably involve many, often judgmental, considerations – they are tougher for a third party to second guess. Overly simplistic approaches are bound to be prone to error and susceptible to gaming.

[1]For example, the Multi-Project Threshold IRR approach has been suggested by various negotiating parties (see language of CRP .2/Add. 1, 63(c)) and in the literature by the Center for Clean Air Policy, Center for Sustainable Development in America, and the Joint Implementation Network.

- *"Project-Specific" Investment Tests*[2] consider in more detail the investment decision made by the investor, typically involving financial analysis of the alternatives for the proposed project. To date, this approach has been applied in three ways. First, the approach has been used as a means by which to identify the most likely alternative, from a set of alternative scenarios, to the project being proposed (what would otherwise occur) to establish a baseline. Second, the approach has also been used as a means to compare the expected rate of return (with and without the carbon benefit) of the proposed project to an alternative project in order to assess additionality (i.e., that the project would not have proceeded without the carbon benefit. Third, the expected financial performance of the project is compared to the investor's minimum requirements for financial return (an investor-specific financial threshold typically referred to as the "hurdle rate" or "opportunity cost") to determine additionality. Although this approach can be limited to evaluating IRR, it can also include other direct financial measures such as net present value (NPV), as well as other key considerations, such as risk, market barriers, etc.. Expert judgement can play an important role in evaluating the information and analyses to arrive at a determination as to whether the proposed project would proceed anyway in the absence of GHG crediting.

  Overall, we find that the investment decision-making process is so complex, judgement-laden, and investor-specific, that it is extremely difficult to accurately second guess investor behavior and therefore verify the results. Even an approach that commits both substantial resources and sophisticated analysis to evaluate project-specific circumstances can contain material potential for both error and gaming. Consequently, even the most comprehensive and intensive investment test can fail to be reliable or definitive.

Certainly, investment tests, nor any other tests, should not be expected nor required to be perfect – every policy, regulation or decision has some inherent potential for error. Nonetheless, an adequate investment test must achieve acceptable reliability, transparency, and resistance to gaming, using practical procedures that can be applied within realistic resource constraints. We conclude that to the extent it is feasible to develop and apply an adequate investment test, it may only be feasible for a relatively small set of circumstances :

- less intensive evaluations, particularly of the multi-project genre, have questionable value because they are subject to both significant error and gaming; and,
- more intensive evaluations, particularly of the project-specific genre might generally be reasonably adequate, but could be applied only to projects that are of sufficient scale to tolerate the expense.

This paper does not address the question of whether investment tests are worthwhile in view of their expense, uncertain reliability, and the degree of assurance regarding additionality that might already be obtained through credible Baseline Emissions Tests in combination with the other subsidiary tests.

This paper is organized as follows:

- ***Critical characteristics of the Investment Decision*** describes why this process is inherently complex and difficult to evaluate.

[2]For example, a project-specific approach is being used by the World Bank to evaluate projects for the Prototype Carbon Fund. Guidance for the CERUPT program (Netherlands) also recommends this approach, although projects to date have not applied the approach particularly to investment additionality.

- ***Susceptibility of Single Value Investment Tests to Gaming*** applies a financial model to illustrate the potential for the project applicants to manipulate investment tests.

- ***The Project-Specific Investment Test*** describes how this approach addresses many, but not all, of the problems posed by other approaches, albeit at a higher cost per project evaluated.

- ***Feasible Options for Considering Investment Additionality*** describes a practical and realistic strategy for reasonably evaluating this criterion.

CRITICAL CHARACTERISTICS OF THE INVESTMENT DECISION

Over the past thirty years, we have performed numerous financial impact analyses for both the U.S. Environmental Protection Agency and for private industry. These analyses addressed the potential for the cost of new pollution control requirements to cause existing plants to shut down or to inhibit investment in new plants. This is just the "flip side of the coin" for the additionality question, requiring the same types of analyses: i.e., will a plant shut down (or a new plant not be built) if required to incur the cost of new pollution control requirements versus will a plant still be built if denied the benefit of GHG credits? The difficulties that we encountered in performing these financial impact analyses suggest that there would be similar problems when attempting to apply investment tests to determine additionality. In particular:

- In our experience, we have found that even within the same industrial sector in the U.S., different combinations of financial measures and requirements are used by different companies to make investment choices. We've also found that even in the same industry sub-sectors in the U.S., there is significant variability in the financial performance of plants, even among those that are relatively new.

  Within the context of the approaches being considered for additionality tests, a standardized, multi-project approach would not yield reliable results in these cases.

- We've performed as exhaustive a financial analysis as might be conceivably performed to determine whether the cost of new pollution control requirements might impair the financial viability of a specific plant. We performed a very detailed financial analysis of the plant within the context of a comprehensive industry subsector analysis. The conclusion of that intensive analysis was that the plant's profitability after complying with new pollution control requirements would be reasonably typical for the industry sub-sector. However, the continued viability of the plant depended on the firm's opportunity cost and its business strategy, neither of which we were able to reliably assess. In the end, we could not provide a definitive conclusion as to whether or not the firm would close the plant if required to incur the cost of the new pollution control requirements.[3]

  Within the context of the approaches being considered for additionality tests, a project-by-project approach would not have yielded a definitive result in this case.

- The industry participants went to great lengths to assure the confidentiality of their data. They would not have cooperated had there been any concern at all about the measures taken to ensure the confidentiality of their data.

  Within the context of the investment test, maintaining confidentiality is critical to the investor, however, confidentiality directly conflicts with the principle of transparency.

The following discussion reflects this experience, describing why adequate investments tests are difficult to perform, and why they should not be expected to necessarily yield reliable, definitive results.

[3] However, this result allowed EPA to take the position that if the firm closed the plant, it would be doing so for its own financial gain, not because the cost of controls would make the plant uncompetitive in its business sector. Subsequently, the firm agreed to comply with the new requirements, perhaps because it could no longer as easily blame EPA for forcing it to close the plant, or perhaps because it intended to do so all along but hoped to negotiate more lenient requirements.

Financial Decisions are Complex and Involve Judgment

Investment decisions involve consideration of numerous complex quantitative and qualitative factors:

- ***Direct Financial Measures.*** Projected financial performance of the project is, of course, important. Some of the many direct financial measures used to evaluate the financial performance of a project, including net present value (NPV), internal rate of return (IRR), and discounted payback period are briefly described in Attachment 1. Each measure illuminates different financial characteristics of the potential investment. Investors may use several such measures, giving each differential weight.

- ***Critical Factors.*** In addition to direct financial measures, inter-related factors such as risk, opportunity costs, market barriers, strategic objectives, capital rationing, and portfolio management also play critical, often decisive, roles. These are also described briefly in Attachment 1.

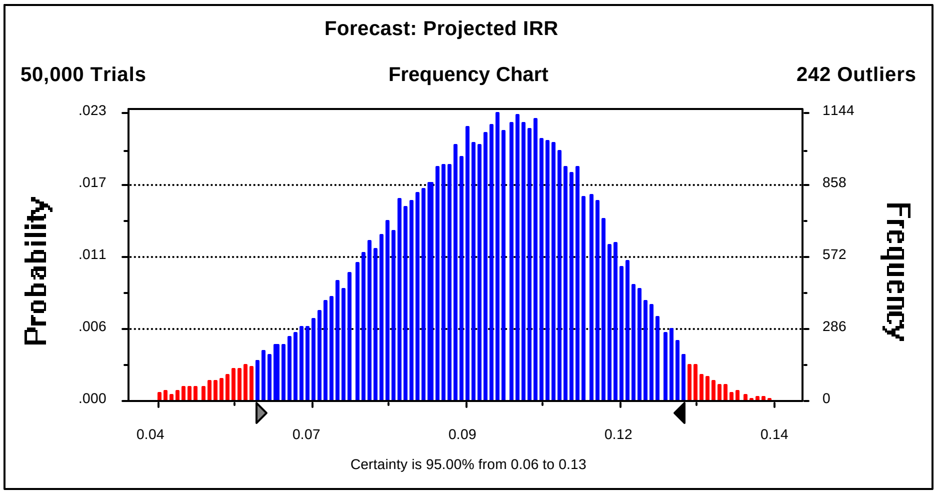
Although the direct financial performance of the project is obviously important, it is not realistic to assume that any single financial measure or critical factor is generally sufficient to clearly determine whether an investor will proceed with a project. In the end, the decision represents a fusion of all of the considerations described above, involving substantial judgment on the part of the investment decision-maker. In recognition of the difficulty in weighing all of these measures and factors, multi-criteria decision methods are increasingly being employed to assist decision-makers in using judgment to combine qualitative and quantitative considerations when making investment decisions.

Due to Uncertainty, Financial Performance Can't Realistically be Reduced to a Single Number

Even if it were reasonable to reduce an investor's decision to one direct measure of financial performance, such as IRR, reliably predicting the investor's decision would still be a conundrum. Typically, investment tests that are based on a single measure, such as IRR, also propose to represent the projected project performance as a single point estimate – perhaps this is implicitly intended to represent the "average" case or the "most likely" case for the project. However, investors will typically evaluate the potential performance of projects more comprehensively than focusing only on one case. The reason is that it is difficult to predict the future: there will be uncertainty regarding future fixed and variable costs, the price of product and its trajectory, demand and its trajectory, as well as the impact of competition, country-specific risks, program-specific risks, etc.. At a minimum, investors will typically consider a range of scenarios spanning from "plausible worst case" to "plausible best case." In fact, sometimes the extremes by themselves can be pivotal: e.g., the upside potential is so good that even though it has a relatively low likelihood, it is worth the maximum downside risk; or, even though the worst case is unlikely, its consequences are so bad that it is not considered prudent to proceed with the project.

Increasingly, investors use more sophisticated analyses, such as Monte Carlo analysis (described in Attachment 1), to more fully portray and consider the uncertainty in the potential financial performance of an investment. The result is a distribution for the financial measure, as illustrated in Exhibit 1. Using the projected distributions for components of revenues and costs over time, a large number of simulations of the proposed project results in a distribution of the potential IRR for the project prior to GHG crediting. In this hypothetical example, the resulting average IRR is 9%, the median IRR is 10%, and the mode (i.e., the most likely IRR) is in the range from 9-10%. The results indicate a 95% certainty that the IRR will be between 6% and 13%, and a 60% certainty that the IRR will be between 8% and 11%.

Exhibit 1
Example IRR Distribution Prior to GHG Credits



Source: Environomics

Whether through scenarios or more sophisticated representations as shown in Exhibit 1, investors will consider the full range of potential outcomes for an investment. It seems likely that investment tests that fail to consider the full range for project performance will fail to provide realistic results.

Realistic Representations of Potential Project Performance are Tough to Evaluate

Unfortunately, realistic representations of potential project performance as shown in Exhibit 1are tough to evaluate. From the perspective of evaluating the results of an investment test, when confronted with a range of outcomes for a project, what shall we conclude is the potential financial performance for the project, and what does this tell us about whether or not an investor would proceed with the project in the absence of GHG crediting? The following discussion assumes that appropriate "thresholds" for the financial tests are available – the adequacy of such "thresholds" is addressed in the next section.

For Multi-Project Investment Tests

If we are applying a Multi-Project Investment Test, let us assume for now that it focuses on the financial measure of IRR and that an appropriate threshold IRR has been established for the proposed project. In the example shown in Exhibit 1, if the threshold IRR for the investment test for this project type is, say, 10%, what should we conclude for this project? There certainly isn't an obvious answer: the expected average IRR of 9% is below the threshold, but half of the potential outcomes are above the threshold; and there's a 60% certainty that the IRR will be between 8% and 11% (with a 35% chance it could be below that range down to 6% and higher than that range up to 13%). Thus, even when only a single financial measure (such as IRR) is used by an investor, it is not necessarily clear what the investor's decision will be, what factors the decision is based on, or how to apply and evaluate simple investment tests.

For Project-Specific Investment Tests

Project-Specific Investment Tests will face similar challenges as the Multi-Project Investment Tests when interpreting realistic portrayals of the proposed project's financial performance. The relative strengths of Project-Specific Investment Tests include more realistic portrayals of the projected financial performance for both the proposed project and its possible relevant counterfactual(s). However, the availability of realistic financial projections and counterfactuals was also (unrealistically) assumed for the discussion of the multi-project type investment test above. Greater realism for the projected project performance and for the counterfactual does provide greater reliability in terms of the inputs to the test, but does not necessarily address the difficulties in interpreting the results of a realistic portrayal of the project's potential financial performance.

For All Investment Tests

To illuminate the difficulty of considering realistic representations of project performance, we have assumed that a single measure dominates the investment decision, that we know what that measure is, that we actually know what Exhibit 1 looks like, that our version is the same as the investor's, and that our "threshold" for the measure is accurate for the investor. Even in this implausibly ideal case, the results are difficult to interpret, whether for a Multi-Project or a Project-Specific Investment Test. It is even harder to have confidence in our determination if we consider the potential disparity between our understanding and the investor's understanding of the project's potential performance, how it is evaluated in conjunction with all of the other investment measures and critical factors that the investor would actually bring to bear when making the investment decision, and how it is evaluated in view of actual opportunity cost.

Difficulty of Establishing Appropriate Baselines

The previous section addressed the challenges associated with evaluating realistic portrayals of the potential financial performance of the proposed project, assuming that the counterfactual was also realistic. However, the development and evaluation of realistic counterfactuals is also problematic.

For Multi-Project Investment Tests

The Multi-Project Investment Test requires the development of an appropriate baseline value, such as for IRR, to use as a threshold when evaluating whether the IRR for the proposed project is sufficiently low to be eligible for participation in the project-based mechanism. Relatively little attention has been given to the fundamental issues associated with collecting sufficient data to establish the necessary baselines.

To reflect the wide range of economic and political factors that impact investment decision-making, separate multi-project baselines would likely need to be developed for each participating country, region, sector, subsector, project type and sub-type. To develop each of these baselines, financial and operational information is needed on relevant existing and planned projects for each country and sector. Not only is it likely that this data collection effort will be large and logistically difficult, very often the data required to develop a baseline estimate (for example, for IRRs), including revenue and operating cost data, will be considered confidential and may not be disclosed – why should non-participants volunteer to provide their confidential information? Even at this level of granularity, there will be variability that will likely be implicitly assumed away through a simplifying procedure such as averaging. It seems likely that even an extensive data collection effort would not yield sufficient cost and revenue data to construct meaningful multi-project baseline IRRs that could be relied upon to reasonably distinguish between additional and non-additional projects.

The multi-project approach also fails to address project-specific factors that can make these baselines irrelevant. These factors are described below, in the discussion on the Project-Specific Investment Test.

For Project-Specific Investment Tests

Project-Specific Investment Tests have greater potential for developing and applying more realistic baselines, and for evaluating whether the proposed project would proceed anyway in the absence of the benefits of GHG crediting.

It should be noted, however, that it generally would not be sufficient to rely solely on the financial analysis that might already be performed as part of a Project-Specific Baseline Emissions Test. There is an important distinction between the *emissions alternatives* to the proposed project and the *investment alternatives* to the proposed project. The alternative projects for the Project-Specific Baseline Emissions Test would generally have been selected from the perspective of evaluating the *emissions alternatives* to the project. The results of a financial analysis to determine the most likely *emissions alternative* may not be appropriate for a determination of investment additionality for two reasons:

- it is possible that even though the proposed project provides the best return even relative to its alternatives, none of the alternatives are acceptable to the investor in the baseline, because they fail to provide an acceptable financial return; and/or,
- the emissions alternatives might not necessarily be among the projects that the developer considers to be the proposed project's *investment alternatives* (these projects might even be in a different country or of a different type).

Therefore, even for a project that is already subject to a comprehensive Project-Specific Emission Test, extra resources will likely be needed to apply the investment test.

Simplification May Make the Test Easier to Apply, but with Less Reliability and More Gaming

Simplifying the test by relying on a simplistic representation of the investor's decision might make the test easier to apply, but also brings into further question the reliability of the test. Fundamentally, simplification does not eliminate the issues, it only sweeps them under the rug. We can establish any number of decision rules that drastically simplify the evaluation (such as the threshold IRR is compared only to an estimate of the average IRR rather than to its distribution) to more readily provide a "definitive" result. Although electing to rely on a point estimate of a single investment measure for the project's financial performance for the investment test may simplify the evaluation and provide a definitive result, there is no reason to expect it to be reliable. If simplistic approaches provided reliable results, there would be no need for investors to apply more sophisticated analytic methods in their investment analyses, but they clearly do.

Importantly, simplification also enhances the ability of the project developer to game the test. In the example in Exhibit 1, if we only asked for a single IRR estimate, wouldn't the project developer reasonably provide and support an IRR that would allow the project to be deemed additional? Since the potential financial performance of a project is actually a distribution, a project developer can have substantial leeway to reasonably select a value from within the distribution as needed to pass simplistic investment tests. For example, if the threshold were set at 10%, the project developer could easily rely on the assumptions leading to the lower range of estimates (6% - 9%) to argue that the IRR for the project would reasonably be expected to fall below the threshold. Given the ambiguous nature of the future performance of projects, it is not at all clear that such responses by project developers to simplistic tests should even be considered "gaming." However, it is certainly clear that the potential for gaming for those that wish to exploit the vulnerability of simplistic tests is indeed significant.

Given these issues, the value of simplistic investment tests is dubious.

We Should Expect To See Projects That Are Hard To Evaluate with the Investment Test

There are a number of additional uncertainties and risks associated with participating in project-based mechanisms that investors will carefully consider. These include: the price of credits (since supply and demand is highly uncertain), the price trajectory over time, and risks arising from program design and stability (will project baselines be subject to re-evaluation, will the rules of the game change later, etc.). The greater these uncertainties, the greater the pressure for project developers to select projects that reduce downside risk. Thus, investors may find certain project characteristics more attractive, such as those that require only relatively low capital outlays and are easily terminated, projects with shorter payback periods, etc.. Especially in the initial years, developers may also seek out projects that are as profitable as possible while still qualifying for the project-based mechanism, as a means to control downside risk. Further, if carbon prices remain relatively low as they have been, then this will place further pressure on developers to offer projects that are as profitable as possible while remaining under the threshold for the investment test. Consequently, to the extent this scenario plays out, we should expect to see projects that are very difficult to evaluate from an investment test standpoint.

Ideally, Investment Tests Should Accommodate "Grey" Projects

Many of the papers on investment tests assume that the test should yield a binary outcome: the project is either additional or it isn't. However, it is clear that the projected financial performance of a project is a spectrum of possibilities and there are other critical factors that can affect the investor's decision. Thus, the outcome of a realistic investment analysis might not always be definitive; in fact, in general, the result from a realistic investment test shouldn't be expected to be black or white. For a portion (perhaps a significant portion) of the projects (perhaps for all projects or perhaps for particular types of projects) the outcome of an investment test might be grey. Several sources have suggested other factors, such as risk, opportunity costs, or barriers, be considered as a means to allow for "grey" projects.[4] Rather than rejecting a grey project in its entirety, perhaps an acceptable option might be to allow a portion of the eligible emissions to be credited. The other factors could be used as the basis for a judgment-based procedure for adjusting the available credits, rather than outright disqualifying projects whose determinations are either "borderline" or "ambiguous."

SUSCEPTIBILITY OF SIMPLE, SINGLE-VALUE INVESTMENT TESTS TO GAMING

As previously discussed, analyses that predict financial performance are based on underlying forecasts of many detailed financial elements for:

- *initial investment costs*, including planning, procedural costs (e.g., permitting and other requirements such as for the project-based mechanism), construction, equipment, contingency costs, etc.; and,

- *trajectory for annual after-tax net cash flow*, the result of combining trajectories for annual revenues (resulting from projections of price, quantity produced, and quantity demanded) and annual expenses (resulting from projections of operating costs, general and administrative expenses, etc.).

[4]Jacobson, L. and Schumacher, A. 1998. *The Clean Development Mechanism: Private Sector Perspectives on Investment*. For The Business Council for Sustainable Energy.

Meyers, S. Lawrence Berkeley National Laboratory. 1999. *Additionality of Emissions Reductions From Clean Development Mechanism Projects: Issues and Options for Project-Level Assessment*. For the U.S. Environmental Protection Agency. Contract Number DE-AC03-76SF000098.

Because these elements are predictions of the future, their estimation is subject to a considerable amount of judgment within standard engineering, financial and accounting practices. A realistic portrayal of future financial performance of a project would be a spectrum of many potential scenarios with varying likelihood. Consequently, project developers will have considerable leeway in developing estimates that would allow a proposed project to pass simple investment tests that focus on a single value for a single measure, such as IRR.

The following goes into some detail to illustrate the susceptibility of simple single-value investment tests to gaming, by showing that relatively small "adjustments" in forecasted variables can have material impact on the resulting forecasted IRR for a project. For this analysis, we examine the performance of simple single value investment tests that evaluate a single point estimate for IRR – we assume this would be explicitly proscribed to be a specific statistic for IRR (such as its mode, average or median value) so that it can more meaningfully be compared to the corresponding statistic developed for the baseline IRR. We evaluate two different types of single value investment tests, in an effort to more fully assess the characteristics of simplistic tests, and to begin to explore whether such tests might be combined to adequately reduce the potential for gaming.

Two Types of Simple, Single-Value Tests

We evaluate the Multi-Project Baseline IRR Investment Test that we discussed earlier in this paper, and which appears to be the primary candidate for simple, single-value Investment Tests. We also evaluate a second set of simple, single-value investment tests which we term the "Relative IRR" Investment Tests, based on whether GHG crediting makes a material difference in the financial performance of the proposed project:

- ***Relative IRR*** (Percent Increase and/or Delta IRR). These tests focus only on how the projected IRR of the proposed project is altered due to GHG credits rather than comparing the project's IRR to a multi-project baseline IRR or to the IRR of other projects. Assuming that information about the emissions-based additionality for the proposed project is available and using a standard assumption about the value of credits, the focus is on whether the value of the resulting credits are material from a financial standpoint: what is the percent increase in IRR or the absolute increase in IRR that results from GHG crediting? Presumably, if GHG crediting doesn't make a material difference, then it is harder to argue that the proposed project is indeed additional – note that this could still be a grey project, however. Materiality would require a policy decision regarding the percentage increase in IRR (Percent Increase) or the absolute increase in the IRR (Delta IRR) needed before a proposed project can be considered additional from an investment perspective.

  These relative tests require less resources than the Multi-Project Baseline IRR Investment Test because baseline IRRs are not needed, and might also be less susceptible to gaming to the extent that relative changes in IRR are harder to manipulate.

Of course, since the Multi-Project Baseline IRR and the Relative IRR tests still rely on point estimates for IRR, they remain especially susceptible to gaming as discussed previously. The following generalized model quantitatively evaluates the susceptibility of such single-value tests to gaming for different project types.

A Generalized Model to Evaluate Potential for Gaming

The Model

To evaluate the potential for gaming and its relationship to project type, we chose to characterize projects based on two factors: their project life and their capital intensiveness, i.e, the amount of initial investment needed in comparison with annual cash flow. These two characteristics encompass a diverse set of project types, from quick payback projects such as energy efficiency improvements to large infrastructure projects, such as a facility to generate electricity. We developed a simple, but informative, generalized model of investments specifically designed to evaluate the additionality tests:

Let *alpha* = the mode for the ratio of the annual after tax cash flow to the initial capital investment (after tax cash flow/initial capital investment), and

Let *lambda* = the mode for the life of the project (in years).

The capital intensiveness of a project is indicated by alpha: projects with a lower alpha will tend to be relatively more capital intensive and vice versa. Note that for this analysis we could have just as easily defined alpha or lambda to be the median or expected value rather than the mode.

It is straightforward to determine the associated IRR for projects with different combinations of alpha and lambda. Accordingly, Exhibit 2 provides the "true" mode for the IRR for projects with 10, 20 and 30-year lives for alpha's that range up to 0.35.[5] We picked 10, 20 and 30-year lives because we thought they would be broadly representative of projects eligible for crediting, but the analysis can be done for any lambda. We only showed results for alphas's up to 0.35 because that is equivalent to an undiscounted payback period of less than 3 years, which is likely to be an unusually short-duration payback for a project – note that an alpha of 0.1 is equivalent to a project with an undiscounted payback period of 10 years. The IRR behavior shown in Exhibit 2 is as expected:

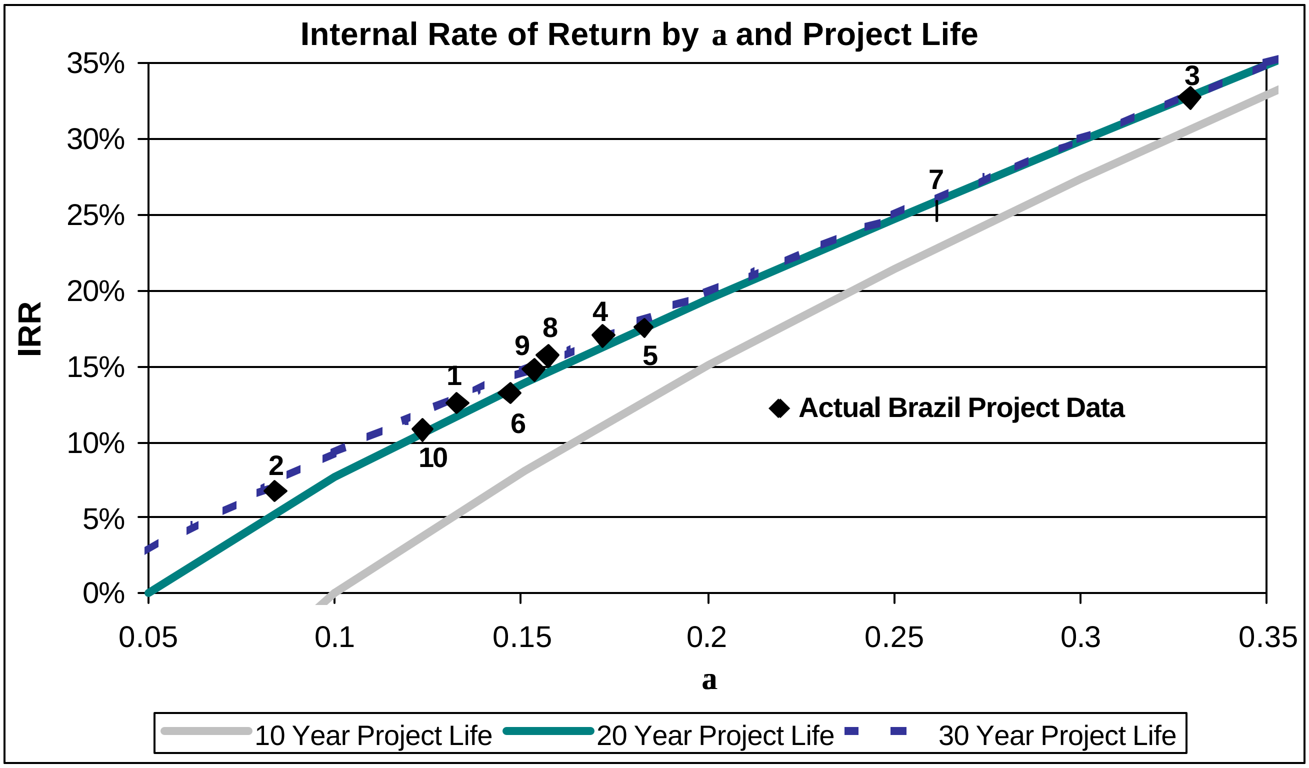
- The longer the project duration, the less important is the size of the initial capital investment, and the greater the return.

- For a given alpha, projects with shorter duration have lower IRRs.

- For a given investment life, more capital intensive projects (based on the definition we use in this paper) have lower IRRs than less capital intensive projects.

[5] Of course there are a number of corollary simplification assumptions, most prominent of which is the assumption of even cash flows. For projects with uneven cash flows, it would be necessary to annualize them.

Exhibit 2



To analyze the relative investment tests for additionality, we required an additional parameter reflecting the significance of the cash flows associated with the value of GHG credits, as follows:

Let *beta* = The value of annual GHG credits as a percentage of net annual after tax cash flow.

Thus, for example, a beta of 0.1 means that the value of GHG credits increases the annual net cash flow by 10%.

For some perspective on how these parameters relate to potential Clean Development Mechanism (CDM) projects that have been evaluated, Exhibit 2 also includes 10 such projects in Brazil and Exhibit 3 provides the underlying data (see Meyers et. al., 2000). Note that the data were not always available in the appropriate detail to provide all of the parameters (alpha or beta) or the IRR, and we estimated these using simplifying assumptions consistent with the available data when possible – accordingly, we were able to develop the needed estimates for 10 of the 14 potential CDM projects described. For this set of projects, with a couple notable exceptions, alpha tends to range from about 0.1 to 0.4, beta tends to range from about 5% to 40%, and the IRR without GHG credits tends to range from about 5% to 30%.

When comparing the IRRs in Exhibit 3 to those we might expect based on the generalized model (Exhibit 2), we obtain a close correspondence. The first five projects have even cash flows, so the model could readily be applied to them. The second half of the projects (the eucalyptus and plantation projects) typically involved lumpy cash flows with initial delays, so it was necessary to annualize these cash flows to apply the generalized model. Note, however, the objective of the generalized modeling is not to provide a short-cut for estimating IRRs, but rather to evaluate the differential potential for projects with different characteristics (investment and cash flow patterns) to game alternative investment additionality tests. The comparison to actual potential projects is to provide some perspective on the actual potential ranges for the values of alpha and beta.

Exhibit 3
Potential Projects in Brazil

Project ID and Name		Life (yrs) *(reported)*	alpha *(estimated)*	beta *(estimated)*	IRR* *(reported)*
1	*Small Hydro in Golias (X)*	*25*	*0.13*	*0.05*	*12.6%*
2	*Wind Farms in Northeast Brazil (XI)*	*25*	*0.08*	*0.04*	*6.8%*
3	*Electricity Cogen from Sugarcane (XIII)*	*20*	*0.33*	*0.04*	*32.8%*
4	*Hydro Generation in Amapa (XIV)*	*30*	*0.17*	*0.05*	*17.0%*
5	*Electricity Cogen from Sawmill Residues (XV)*	*20*	*0.18*	*0.07*	*17.6%*
6	*Eucalyptus Charcoal for Pig Iron (XIX)*	*14*	*0.15*	*0.21*	*13.2%*
7	*Eucalyptus Woodfuel for Ceramics (XX)*	*18*	*0.26*	*0.32*	*25.3%*
8	*Rubber Plantation in Moto Grasso State (XXI)*	*30*	*0.16*	*0.10*	*15.7%***
9	*Oil Palm Plantation in Para (XXII)*	*30*	*0.15*	*0.06*	*14..8%***
10	*Babacu Plantation for Charcoal (XXIV)*	*20*	*0.12*	*0.81*	*10.9%***

Sources: Environomics estimates using data from Meyers, et al. 2000.
** IRR without value for emission reduction credits*
***Not reported, estimated by Environomics based on data presented for the projects.*

Potential for Gaming for the Multi-Project IRR Test

Within this framework, it is straightforward to test the impact on IRR of changes in projected capital investment and/or annual net after tax cash flows. We evaluated the impact of a relatively modest effort to artificially lower (i.e., game) the estimated IRR for a project:

- increasing the overall investment cost by 10%, and also
- dropping the overall annual net cash flow by 10%.

It is straightforward to evaluate more aggressive efforts to game the test, but it is clear that the test is susceptible to significant gaming by even modest adjustments.

Exhibit 4 provides the results for projects with 10, 20 and 30-year lives. As shown in the exhibit, relatively small changes in financial forecasts of capital requirements and annual net cash flow can result in potentially material differences in the IRR from the perspective of investment additionality. For example, a project with a 10-year project life and an alpha of 0.2 has a "true" projected IRR of 15%. By increasing the investment costs by 10% and lowering the annual cash flow by 10%, the IRR is dropped to 10%, a reduction of 5 percentage points (a 1/3 drop). In fact, for a wide range of alpha's for projects of varying duration, it's possible to decrease the project's projected IRR by about 5%, just by increasing forecasted capital expenditures by 10% and decreasing forecasted annual net cash flow by 10%.

The implication of this sensitivity is that a project developer has a considerable amount of legitimate leeway when estimating an IRR that does not involve changing project design but simply involves modestly changing the forecasted inputs to the calculations. If a project developer needs to be below a specific IRR threshold, a relatively significant adjustment is likely straightforward to achieve and hard to detect by modifying key input forecasts within typical professional discretion. Although, at some point, the magnitude of such adjustments become obvious and detectable, project developers will likely have considerable latitude to meaningfully depress the IRR of their projects without a reasonable prospect for detection. In terms of project characteristics, shorter duration projects seem to have more pronounced potential drops in IRR due to gaming. In addition, less capital intensive projects seem more subject to gaming (i.e., annual net cash flow is significant compared to the investment).

Note that the Multi-Project IRR test also depends on the development of a baseline IRR to use as a basis to evaluate the forecasted IRR for the project. As discussed previously, the feasibility of establishing appropriate baseline IRRs is problematic even with expenditure of substantial resources.

Potential for Gaming for the Percent IRR Test

The Percent IRR test would require that credits increase the proposed project's IRR by a material percentage[6] to be additional – the material percentage increase in IRR needed would be determined by the administrative authority (a policy decision). Exhibit 5 (a, b and c) shows the results for the Percent IRR Test, assuming a beta of 10%. Note that the exhibit shows *percent change* in the project's IRR due to the value of credits (rather than the projected IRR for the project as shown in Exhibit 4).

As for the Multi-Project IRR, shorter duration projects are more easily gamed with the Percent Increase in IRR Test. However, unlike the Multi-Project IRR, it appears that for projects that are less capital intensive and longer duration, the test is less subject to gaming. Clearly, the magnitude of the percentage change is directly related to the magnitude of the beta for the project – however, this cannot be gamed if emissions additionality is already determined by another means, and the administrative authority would dictate the assumptions to use regarding the unit value of credits for this test.

Note that Percent IRR test does not require the development of a baseline IRR.

Potential for Gaming for the Delta IRR Test

The Delta IRR test would require that the value of credits increase the project's IRR by a material absolute amount[7] – the material increase in IRR needed is a policy decision by the administrative authority. Exhibit 6 shows the increase in IRR, assuming a beta of 10%. Note that the exhibit shows the *difference* in the IRR for the project due to the value of credits (IRR w/ credits less IRR w/o credits). Unlike either of the previous tests, the Delta IRR seems less easily gamed for shorter duration projects. In addition, the Delta IRR Test seems more stable and harder to manipulate over a broad range for alpha.

Like the Percent IRR test, the Delta IRR test does not require development of a baseline IRR.

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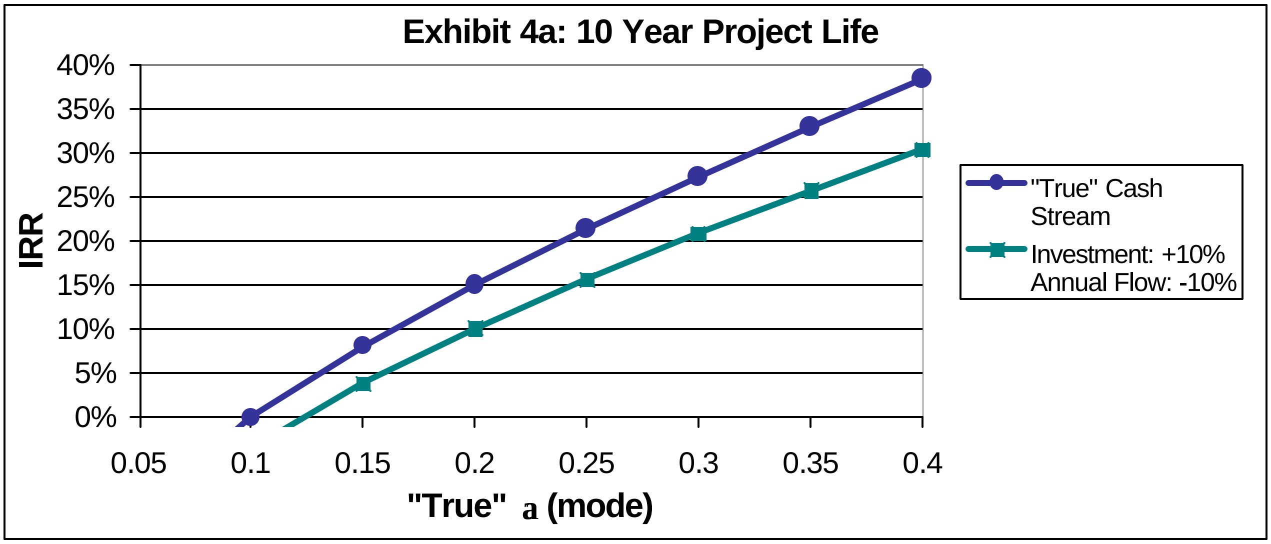
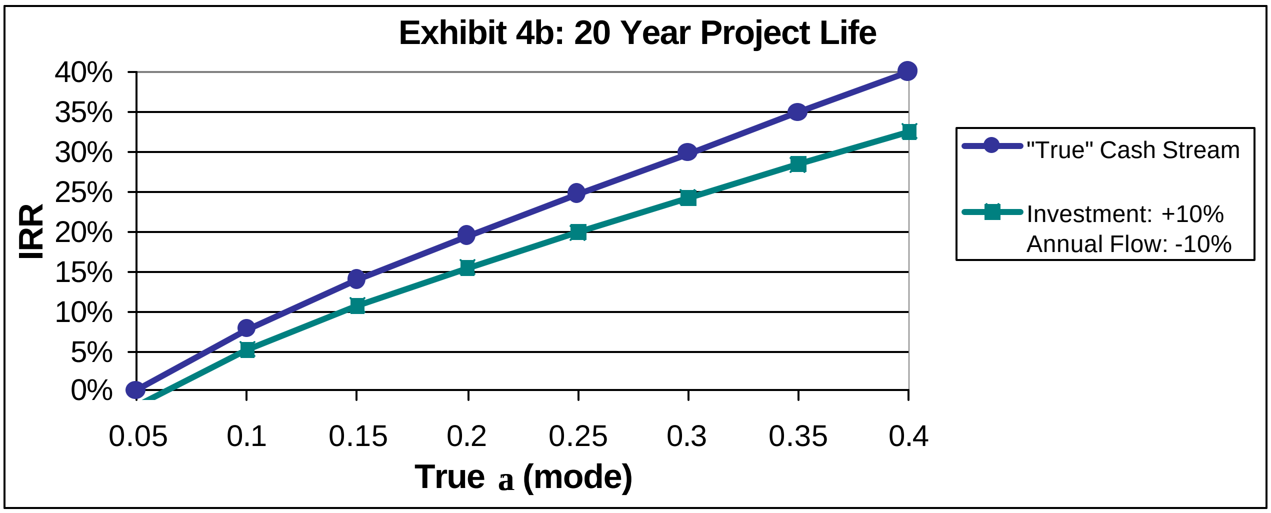
[6] Percent change in IRR due to credits = (IRR w/ credits) / (IRR w/o credits) - 1

[7] Absolute change in IRR due to credits = (IRR w/ credits) - (IRR w/o credits)

Exhibit 4: Analysis of Sensitivity of Multi Project Baseline IRR Approach





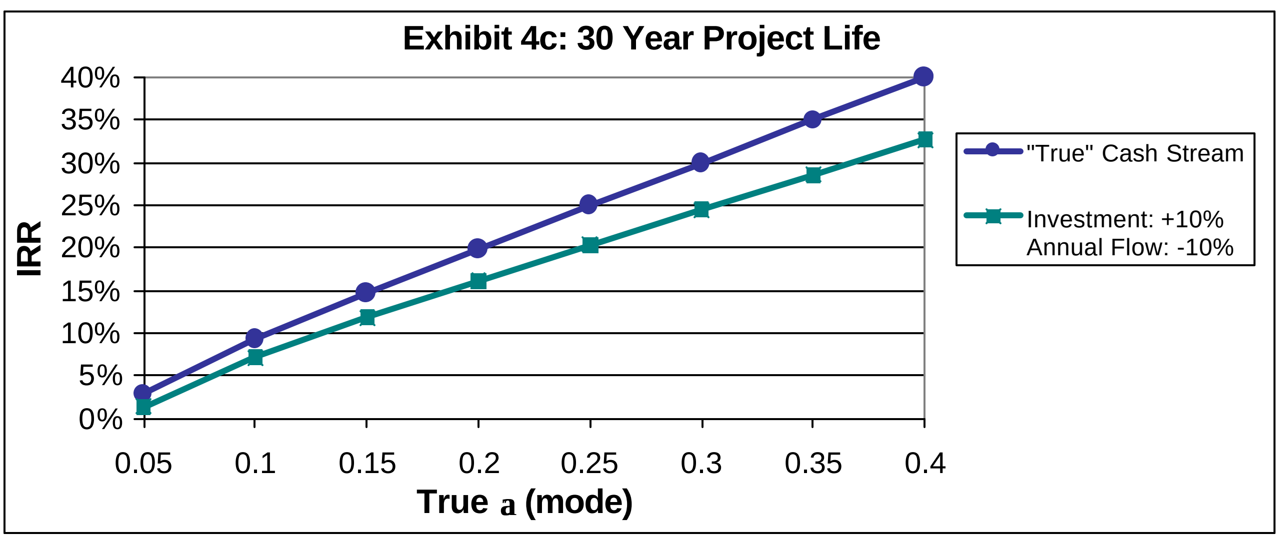
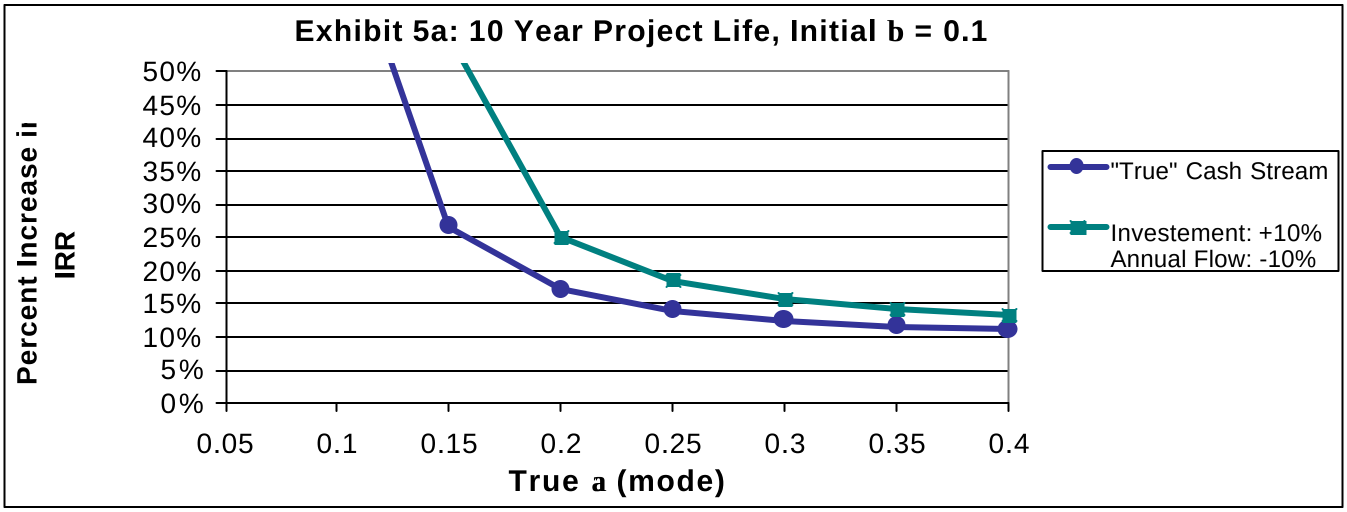
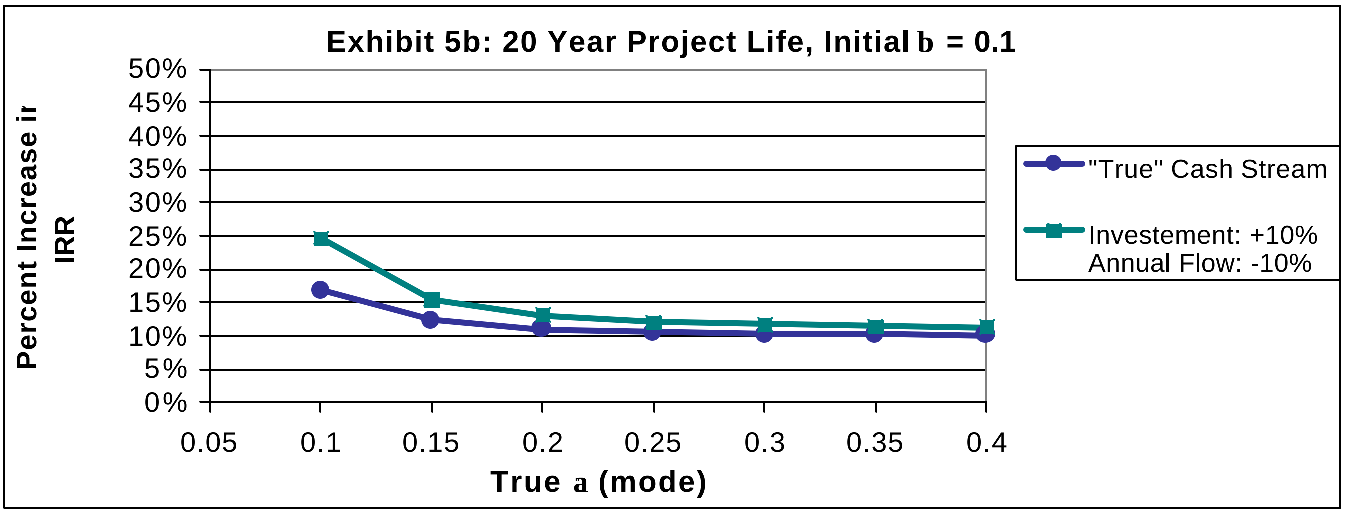


Exhibit 5: Analysis of Sensitivity of Percent Increase in IRR Approach





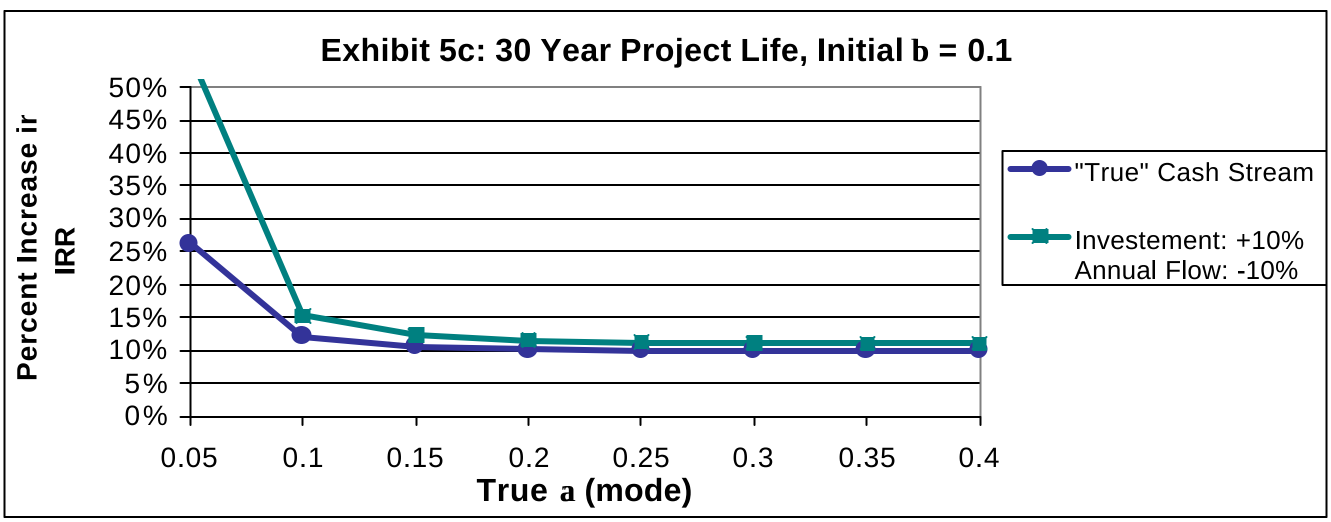
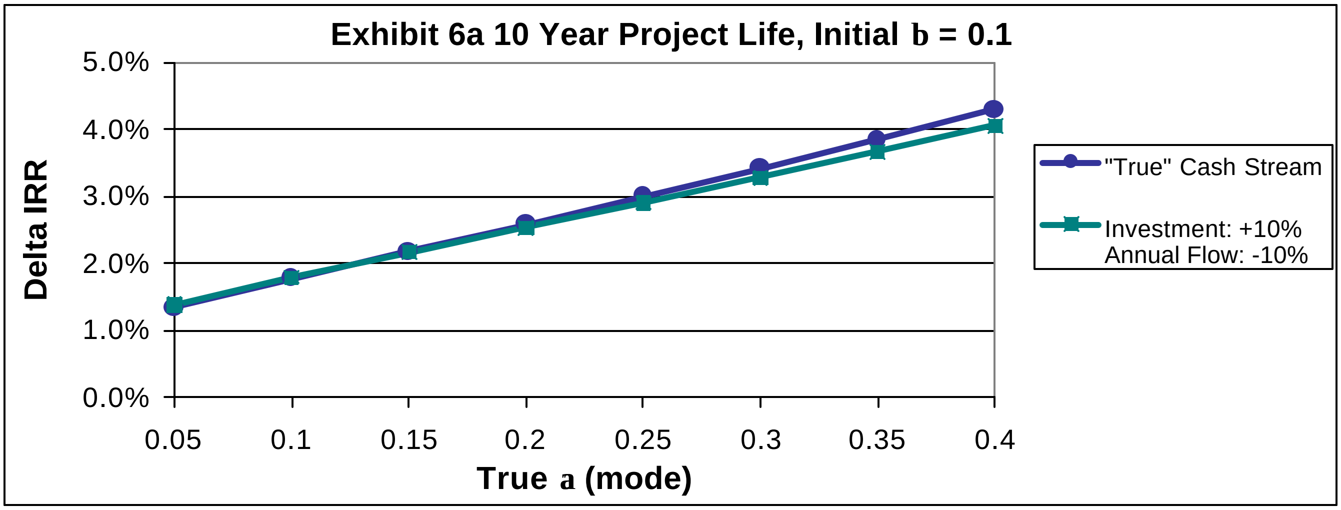
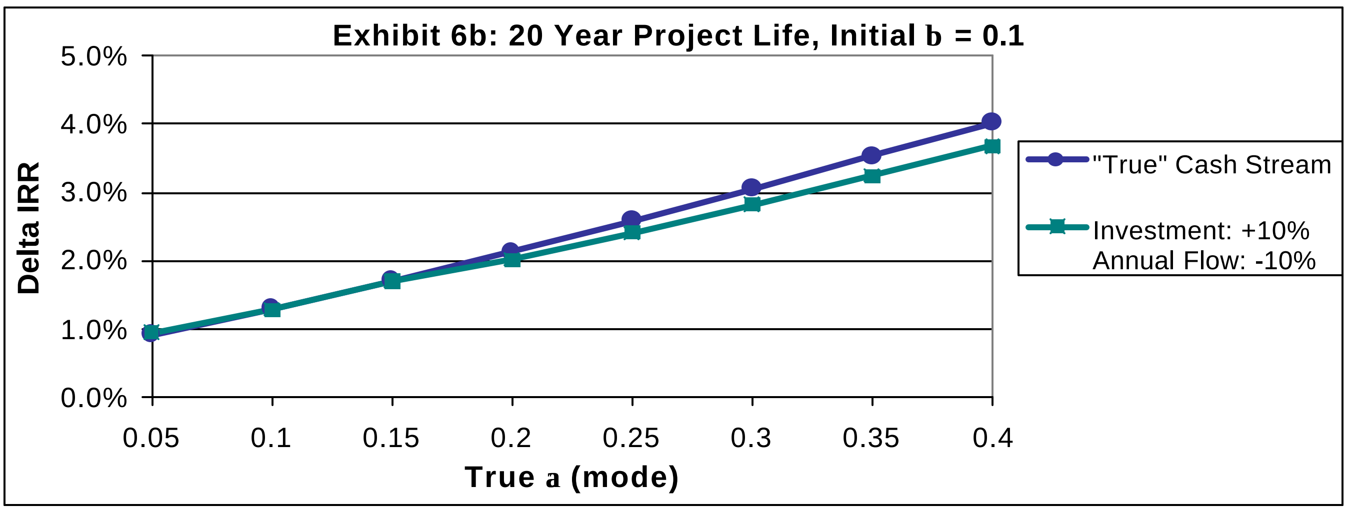
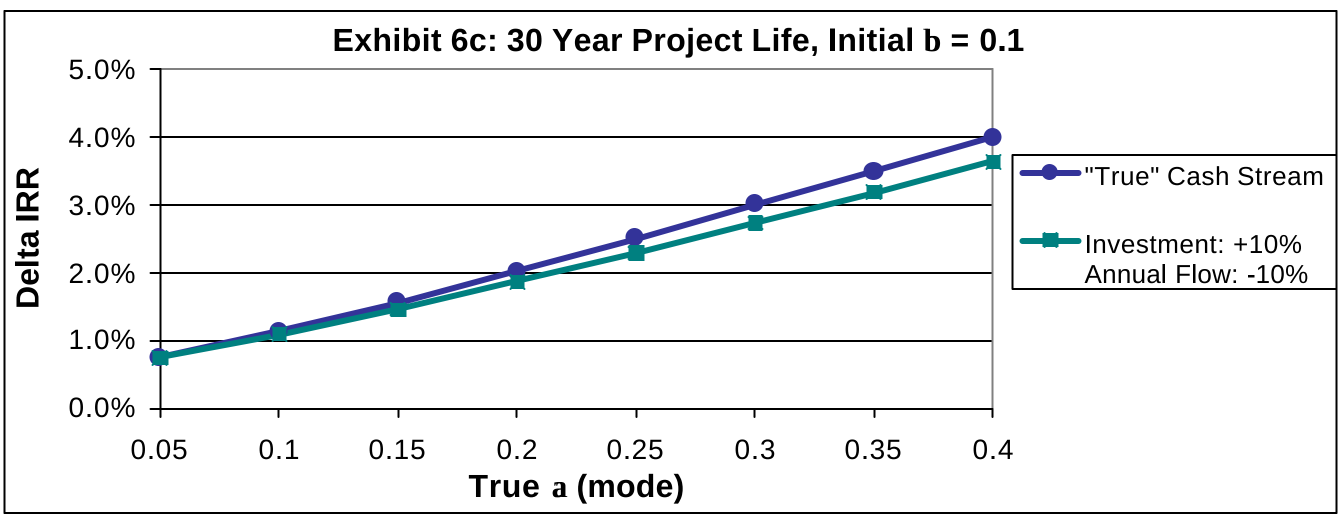


Exhibit 6: Analysis of Sensitivity of Delta IRR Approach







Summary of Relative Susceptibility and Resistance of Single-Value Tests to Gaming

It seems clear that all of the simple, single-value tests examined are readily subject to gaming. The project developer need make only modest adjustments to estimates within normal discretion to make material changes in projected financial performance designed to allow the project to pass a simple, single-value investment test, regardless of the test type.

The initial indications are that different tests may be more or less susceptible or resistant to gaming depending on project characteristics, as summarized in Exhibit 7. Thus, from the perspective of resistance to gaming, as shown in Exhibit 7b, the Multi-Project Baseline IRR Test works best for longer and more capital intensive projects (assuming an adequate baseline IRR can be developed to use with it), the Delta IRR test works best for more capital intensive projects of short duration, and the percent IRR test works best for less capital intensive projects of longer duration. We have not evaluated the extent to which the tests might be usefully combined in some way to reduce the potential for gaming in general.

Exhibit 7a
Relative Susceptibility of Single-Value Tests to Gaming

		CAPITAL INTENSIVENESS	
		LOWER (higher α)	**HIGHER** (lower α)
DURATION	**SHORTER**	***MULTI-PROJECT BASELINE IRR***	***PERCENT INCREASE IRR***
	LONGER	***DELTA IRR***	

EXHIBIT 7B
RELATIVE RESISTANCE OF SINGLE-VALUE TESTS TO GAMING

		CAPITAL INTENSIVENESS	
		LOWER (higher α)	**HIGHER** (lower α)
DURATION	**SHORTER**		***DELTA IRR***
	LONGER	***PERCENT INCREASE IRR***	***MULTI-PROJECT BASELINE IRR***

THE PROJECT-SPECIFIC INVESTMENT TEST

As discussed earlier, the Project-Specific Investment Test is a more comprehensive evaluation of the financial performance of the proposed project and its alternatives. It would typically be performed in conjunction with a Project-Specific Baseline Emissions Test. For example, the World Bank uses a project-specific approach to evaluate projects for the Prototype Carbon Fund, and guidance for the CERUPT program (Netherlands) also recommends such an approach. Comprehensive, project-specific evaluations of additionality (both investment and emissions) have been estimated as costing from $40,000 for relatively simple project to upwards of $100,000 for more complicated projects.[8] From an optimistic perspective, perhaps larger scale projects will have already developed much of the required information anyway, and it is conceivable that in some cases the cost associated with the additionality determination could be at levels that are customarily incurred for permitting such projects. However, as discussed previously, our experience is that the cost for performing reliable investment type tests where gaming is a serious concern could easily far exceed $100,000, and even these intensive efforts can fail to be reliable or have results which are not definitive. However, if such investment tests are needed, Project-Specific Investment Tests are the most reliable approach to take.

There are a number of design parameters for this type of evaluation to be considered:

- ***Who does the analysis?*** A report containing all of the required information and analysis might be provided by the project developer and verified through external third party review; or the analysis might be performed by a third party using verified information from the project developer.

- ***Who selects the baselines?*** The project developer might select and characterize the baselines, or they might be selected and characterized by third party experts. As discussed previously, it will be important to distinguish between *emissions alternatives* and *investment alternatives*.

- ***How comprehensive should the analysis be?*** The analysis might target certain financial measures (such as IRR and/or NPV), or could include all of the direct financial performance measures considered by the project developer, including other key "non-financial" considerations such as market barriers, etc..

- ***How should uncertainty be addressed?*** At a minimum, key uncertainties, projections and assumptions should be explicit, and include an explanation of how they were handled and why, and their impact on the final results. Project developers could also be required to use certain standard assumptions or projections, and/or use scenario analysis (or more sophisticated analysis) to portray uncertainty.

  Project-Specific Investment Tests should be in a better position to address the uncertainty associated with baselines. For example, just as for the proposed project, there is no reason to expect the projected financial performance of the counterfactual to be reasonably represented by a point estimate. If the counterfactual is also portrayed as a distribution, it might be feasible to use the two distributions to estimate a third distribution for the likelihood that the financial performance of the proposed project will

[8] Lazarus, M., Kartha, S., and Bernow, S. 2001. *Project Baselines and Boundaries for Project-Based GHG Emissions Reduction Trading: A Report to the Greenhouse Gas Emission Trading Pilot Program*. Tellus Institute.

be greater than for the counterfactual.[9] This would bring the key question into sharper focus. However, these more refined results (relative to the Multi-Project Investment Test), while helpful, are not likely by themselves to be definitive. For example, what conclusion should be drawn if there is a 25% probability (or a 50% probability) that the proposed project would be built in the absence of GHG crediting? Moreover, it is likely that other quantitative and qualitative factors will provide important context for this decision. Expert judgment would be needed to interpret these results within policy guidelines that would need to be established.

- ***How should grey projects be addressed?*** Since these comprehensive analyses consider a wide range of sophisticated information, they must be performed by experts who can properly evaluate and validate it. In addition, to the extent the results are indeterminant (i.e., the project is "grey"), established procedures could provide a basis for appropriately scaling the allowed emissions for crediting.

FEASIBLE OPTIONS FOR CONSIDERING INVESTMENT ADDITIONALITY

It seems likely that project developers can fairly easily materially manipulate the financial performance of a project to meet simple investment tests by altering assumptions within normal forecasting discretion. Simple, single value tests, including the Multi-Project Baseline IRR test, Percentage IRR test and the Delta IRR tests are especially subject to gaming. The Multi-Project Baseline IRR test is especially problematic because it has the added dimension of requiring the development of a "baseline" value – it is not clear that reliable baseline values can only be developed even with substantial expenditure of resources. This brings into question the validity of simple investment additionality tests and the value of less-than-very-thorough evaluation of the project developer's data and analysis.

Consequently, it may make sense to think in terms of a tiered additionality test requirement, whose sophistication and depth depends on the magnitude of the GHG credits at stake. In this way, the depth of analysis required would increase with the overall risks associated with accepting non-additional projects. In the following illustration, the underlying assumption is that the greatest overall program or environmental risk lies with the largest projects. For example, investment additionality evaluations might be tiered as follows:

- ***Small or fast track projects*** might not be subject to an investment additionality test. This would implement a policy decision that these projects are desirable, should be encouraged, are generally worthy of being credited under the project-based mechanism, and should only minimally be impeded by administrative procedures and costs. However, such projects might still be subject to other, related tests, such as emissions, regulatory or institutional additionality, financial additionality, etc..

- ***Medium size projects*** might be subject to some sort of investment evaluation. This might or might not include consideration of the results of a Relative IRR test (perhaps Percent Increase IRR for projects that are less capital intensive and the Delta IRR for projects that

[9] Such analyses would necessarily incorporate consideration of correlations between the two distributions. For example, even though future energy prices may be uncertain, both the proposed project and the counterfactual may be subject to the same future energy prices so the relative importance of this uncertainty might be diminished or even eliminated. Note, however, that in general, some uncertainties for the proposed project and the counterfactual will be different or uncorrelated. Therefore, it would not be correct to assume that correlations would generally allow the projected differential financial performance of these projects to be reasonably represented by the difference between point estimates of, say, their average IRR.

are more capital intensive, since these tests are relatively easy to perform and don't require the development of any pre-established baselines) and perhaps a limited justification prepared by the developer explaining why the project is additional from an investment perspective. This could provide some degree of assurance that the project is indeed additional, and would likely only result in relatively modest procedural delays and costs. Such projects would also be subject to other, related tests, such as emissions, regulatory or institutional additionality, financial additionality, etc..

- ***Large projects*** with concurrently larger GHG implications might be required to provide a comprehensive project-specific analysis, addressing both emissions and investment additionality. Such projects would also be subject to other, related tests, such as regulatory or institutional additionality, financial additionality, etc..

Other approaches for targeting different requirements to different projects could be developed. Regardless of the approach, it is important to keep in perspective the inherent limitations of investment tests, and to limit or target their use accordingly.

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Attachment 1
Economic and Financial Measures that are Commonly Used to Assess Projects

Investors use a variety of financial measures to make investment decisions, incorporating a number of critical considerations such as risk, opportunity costs, capital rationing, and strategic considerations. The following provides only brief descriptions of many of these measures and concepts – it is intended to be provide a simple introduction to topics whose nuances are covered in great depth in the financial literature. In the attachment, we address:

- common measures for assessing financial performance,
- capital rationing,
- risk, and
- other factors.

Although we address these sequentially, these topics are generally inter-related. We do not suggest that one or another is "best." What is relevant here, is that all of these, to one degree or another, and in innumerable combinations, are in use. This is one of the reasons that it is so difficult to accurately predict what any given investor will actually do. Finally, we also provide some additional perspective based on the financial analyses we have performed over the years.

How is cash flow used to assess project financial performance?

Measuring the financial performance of a project is based on the common sense notion of comparing how much will be spent on the project against how much income will be generated the project. It is also important to know the timing of when the expenditures and income occur so that future values can be discounted to take into account the "time value of money." The time value of money simply refers to the concept that a dollar today is worth more than a dollar a year from now because today's dollar can be invested and earn interest over the next year. Thus, financial analyses of projects begin with estimating or forecasting the spending and income of a project for each year over the life of the project, known as "cash flow." In any given year, a project is likely to have both expenses and income. The term "cash flow" is often used synonymously with "net cash flow," which is the sum of expenses (-) and income (+).

Net Cash Flow for Project A

Year	Outlay (-)	Income (+)	Net Cash Flow
0	$10,000	$0	$-10,000
1	$5,000	$2,000	$-3,000
2	$1,000	$5,000	$ 4,000
3	$1,000	$10,000	$ 9,000
4	$1,000	$7,500	$ 6,500
5	$2,000	$6,500	$4,500

To assess investment additionality quantitatively, a cash flow stream will need to be developed for a project one way or another, since it is fundamental to every method of making investment choices. As discussed in the working memorandum, however, there may be issues with sharing this information (and information used in conjunction with it) publicly.

Payback Period

The first method of assessing project performance using cash flow is the most basic: how long does it take for a project to earn back its initial investment? Payback Period is calculated by using a running total of cash flow for each year of the project. The year in which the running total hits "0" is the payback period. In the example, the running total of net cash flow hits zero in year three, so the payback period is three years. A lower payback period indicates better financial performance. In general, a company or an investor would set a guideline for evaluating all projects, such as, all projects must have a payback of less than 5 years.

Payback Period for Project A

Year	Outlay (-)	Income (+)	Net Cash Flow	Running Total
0	$10,000	$0	$-10,000	$-10,000
1	$5,000	$2,000	$-3,000	$-13,000
2	$1,000	$5,000	$ 4,000	$-9,000
3	$1,000	$10,000	$ 9,000	$0
4	$1,000	$7,500	$ 6,500	$+6,500
5	$2,000	$6,500	$4,500	$+11,000

Payback period is easy to calculate and understand, but it has the fundamental flaws of ignoring the time value of money and cash flows beyond the payback period. Using payback period to choose between competing investments/projects will lead to favoring project with very quick short-term gains at the expense of a project that may in fact be more profitable over the long run.

Net Present Value

Net Present Value is based on discounted cash flow, using the investor's required rate of return. This required rate of return is sometimes considered to be the cost of capital (which focuses on the source of capital), and sometimes it's considered to be the opportunity cost of capital (which focuses on the returns from alternative investments). In either case, the required rate of return is sometimes termed the "hurdle rate."

Net Present Value for Project A					
Year	Outlay (-)	Income (+)	Net Cash Flow	Present Value (@10%)	Running Total
0	$10,000	$0	$-10,000	$-10,000	($10,000)
1	$5,000	$2,000	$-3,000	$-2,727	($12,727)
2	$1,000	$5,000	$ 4,000	$3,306	($9,421)
3	$1,000	$10,000	$ 9,000	$6,762	($2,659)
4	$1,000	$7,500	$ 6,500	$4,440	$1,781
5	$2,000	$6,500	$4,500	$2,794	**$4,575**

The NPV is the sum of the discounted cash flows at the end of the project. If the sum of the discounted cash flows at the end of the project is a positive value, the project will make more than needed to meet the cost of capital, therefore it's an acceptable investment. If the sum of the discounted cash flows at the end of the project is a negative value, the project will cost more than it makes, i.e., it is not an acceptable investment. In the example, the NPV is $4,575 (i.e., the sum of the present values and the final running total). Projects with the greatest NPV are the most desirable, in the absence of other considerations. However, additional considerations such as risk (and how this is incorporated into the financial modeling and decision-making process), capital rationing, and strategic factors can dominate the final investment choice.

Discounted Payback Period

The next method combines the net present value and payback period methods to address the question of the time period needed before the NPV is zero – i.e., how quickly the project will achieve the investor's hurdle rate. Each year's cash flow is discounted using a chosen discount rate that reflects the cost to borrow money (referred to as the cost of capital). Discounted payback is calculated by using a running total of the discounted cash flow. Again, the year in which the discounted running total hits "0 "is the discounted payback period. In the example, the discounted payback period is 4 years (in comparison with 3 years under the undiscounted payback analysis).

Although using discounted payback addresses the issue of incorporating the time value of money, this method leads to favoring projects with very quick short-term gains at the expense of a project that may in fact be more profitable over the long run. However, where risk is an important consideration and hasn't been adequately incorporated into other aspects of the analysis, discounted payback provides a useful perspective on the length of exposure needed to achieve the minimum required return.

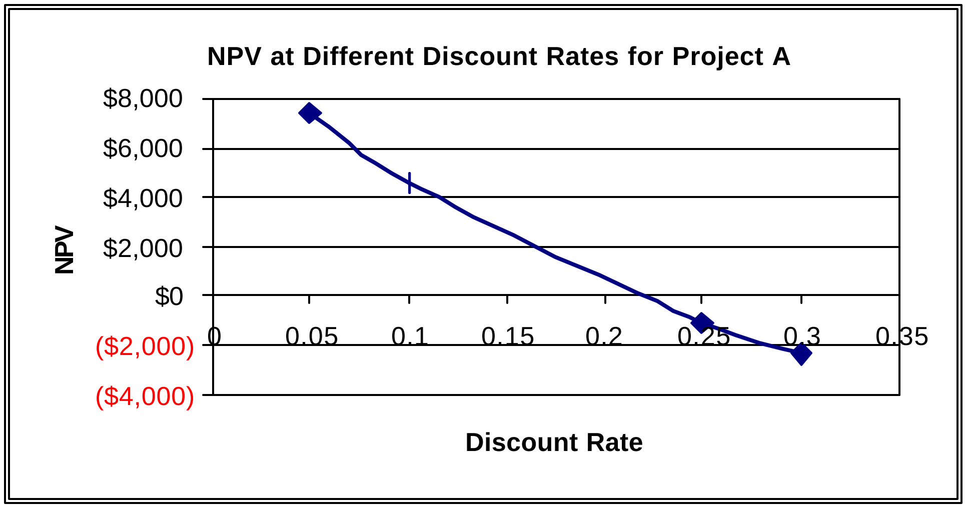
Internal Rate of Return

The internal rate of return (IRR) measures the amount of profit one gets on an annual basis from an investment (expressed as a percentage). The higher the IRR, the more profitable the investment. The IRR is defined as the discount rate at which the value of NPV is 0. Unlike the other measures, IRR can be difficult to calculate because it requires solving a complex equation. Most spreadsheets and financial calculators, however, have built in IRR functions, or there are simple IRR tools available on the internet. The IRR can also be estimated by setting up an NPV calculation in a spreadsheet and changing the discount rate until the NPV is zero. In the example, an IRR of 21.3 percent is calculated using an Excel spreadsheet IRR function.

IRR for Project A			
Year	Outlay (-)	Income (+)	Net Cash Flow
0	$10,000	$0	($10,000)
1	$5,000	$2,000	($3,000)
2	$1,000	$5,000	$4,000
3	$1,000	$10,000	$9,000
4	$1,000	$7,500	$6,500
5	$2,000	$6,500	$4,500
Internal Rate of Return			**21.30%**

The IRR can also be estimated graphically by calculating NPV with a few trial discount rates, then graphing the results, and interpolating where the resulting line crosses 0 – we did this for the example by calculating the NPV in the example for 4 trial discount rates (5 percent, 10 percent, 25 percent, and 30 percent). When graphed and the points connected, the IRR is the discount rate at the point where the line crosses the $0 NPV. In this case, the line crosses between a rate of 20 percent and 25 percent, appearing to be around 21 or 22 percent. As you can see, it can be difficult to interpolate with precision from the graphing technique.

To interpret the meaning of the resulting IRR, you need to establish a "hurdle rate." As discussed earlier, the hurdle rate is the return on the investment that the IRR must be above to justify the investment. The hurdle rate should at least equal the cost of capital (i.e., the discount rate) but can also include other factors such as opportunity cost and risk. Setting an appropriate hurdle rate can be subjective, especially if risk is imbedded. Hurdle rates vary sector by sector (with some sectors such as technology having high rates in comparison with other investments), company by company, and even decision-maker by decision-maker.



The IRR can be problematic to calculate and interpret if the net cash flow changes sign more than once during the project period, resulting in multiple answers for the IRR.

IRR can also be misleading and unreliable when choosing from among mutually exclusive alternatives (e.g., two different energy projects for a city), especially for projects of different scale or projects with different patterns of cash flow. In these cases, it is possible that the project with the higher IRR has the lower NPV, and the IRR is therefore misleading. When selecting from among mutually exclusive projects, generally one maximizes gain by maximizing NPV, not IRR. Alternatively, one can correctly make a decision in these cases based on the IRR by calculating the *incremental* IRR between the projects – however this is a more complicated procedure to get the same result as simply using NPV.

Capital Rationing

Limitations on capital spending are generally a practical constraint on investment. Some may argue that, theoretically, capital is always available at a price. There are market imperfections, resulting in "hard rationing." More commonly, companies that may seem to have unlimited access to capital use budget constraints on their divisions to force managers to select only their best projects – this "soft rationing" is a common approach for handling the propensity for managers to overstate the projected financial performance of the projects they propose. Therefore, it is common for certain techniques to be applied to choose from among the available investments. The use of an opportunity cost of capital (which is higher than simply the cost of capital) in discounted cash flow analysis imbeds a degree of capital rationing by reducing the field of projects that qualify. However, if the available capital is inadequate to fund all of the eligible projects, then capital must be rationed further. There are a number of approaches to accomplish this, all of which are designed to get the "biggest bang for the buck." They tend to be based on maximizing NPV.

Profitability Index

The Profitability Index scales the results of NPV to identify those projects that yield the highest net present value per dollar of initial outlay. The Profitability Index of a project is calculated by dividing the NPV by the initial investment, and then adding 1. In the example, the Profitability Index is 1.4575, meaning that every dollar of the initial investment generates $1.4575 in returns. Projects are then ranked by the index. This gets complicated when constraints over multiple periods are considered.

Profitability Index for Project A
($4,575 / $10,000) + 1 = $1.4575

Linear Programming

More elaborate approaches, such as linear programming, offer the means to optimize NPV taking into account the characteristics of many projects and available capital over a given investment horizon.

Risk

All projects are not equally risky, and so the investment choice should properly reflect risk. Differences in risks might include:

- the risks associated with normal domestic business/market uncertainty regarding cash flows due to uncertain investment requirements, and the trajectory over time of demand, price, and operating costs
- the additional risks associated with new products, especially where there may be limited experience, market barriers, or well-established consumer habits/patterns;
- the risks associated with international business/market operations in developing countries;
- the risk associated with additional uncertainties, such as the impact of future governmental decisions, especially as they relate to the quantity of the product produced (e.g., GHG emissions credits), the quantity demanded (to the extent this depends on governmental actions), and transactions costs.

These risks can be reflected in the investment analysis in many ways and in many combinations:

- risk-adjusted hurdle rate,
- pay-back period requirements,
- use of quantitative/statistical decision-analysis techniques such as sensitivity analysis, break-even analysis, operating leverage (exposure to fixed cost), abandonment value (what happens if you bail out?), Monte Carlo simulation, decision trees, and
- use of qualitative decision-analysis techniques.

Note that in the more sophisticated analyses (as for Monte Carlo analysis), there isn't a "single" result for a project, but rather a spectrum of possibilities that are described in statistical terms.

In addition to incorporating risk into the analysis, the project design itself might be affected (or perhaps only projects with certain characteristics would be considered). For example, risks to projects that rely on GHG crediting for their viability might be reduced by requiring them to have a shorter pay-back period (to reflect the possibility that a periodic re-evaluation of the baseline might result in disqualification of some or all future crediting), and to be as profitable as possible while still qualifying to be eligible for GHG crediting. Risks might also be managed by sharing them (obtaining partners), diversifying them (through a portfolio approach), or transferring them (e.g., insurance) . To the extent this occurs, it may be more likely to result in the "grey" investment additionality determinations described in the working memorandum.

Other Factors

Strategic considerations, in particular, can dominate all other considerations. Projects with important strategic value (such as opening a promising new line of business, strengthening existing business lines, weakening competitors, etc.) may be acceptable even though their financial profile (within the context of the project alone) is weak. Similarly, projects with strong financial profiles, but which are less supportive of the strategic priorities of the company may not be accepted, especially if capital is rationed. Additional factors, such as public image, can also play an important role.

These tests, which address different facets of additionality, are generally inter-related, and any of them can be determinant, depending on the mechanism in question. The key consideration, however, is the result of the Baseline Emissions Test, as augmented by the results of the other, subsidiary tests. The application of subsidiary tests provides further assurance that the results of the Baseline Emissions Tests do in fact represent an additional reduction or removal over the baseline. Of the subsidiary tests, the Investment Test tends to be the most complex and resource intensive