Comments invited on:

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(c) How project participants can demonstrate that their project activity with a potential for high profitability without CER revenues still faces barriers?

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A CASE STUDY OF ENERGY DEMAND PROJECTS REGISTERED IN INDIA: USE OF HYPOTHESIS TESTING FOR BARRIER ANALYSIS EVALUATION

Motivation

The current study is motivated by the growing concerns regarding the efficiency and effectiveness of CDM. Increasingly a number of studies have pointed out that projects in China and India may not be additional as demonstrated in the PDD. Mention ably:

1. Michael W. Wara and David G. Victor, "A Realistic Policy on International Carbon Offsets" :
   - "At root, the CDM and other offset schemes are unable to determine reliably whether credits are issued for activities that would have happened anyway while also keeping transaction costs under control and assuring investor certainty."

2. Axel Michaelowa, Pallav Purohit, "Can Indian CDM project developers outwit the CDM Executive Board?":
   - "The detailed case studies of two projects show that additionality assessment by the CDM Executive Board varies; if the project developer can obfuscate the attractiveness of the project, it is more likely to pass."

Methodology

For the current study, all "energy demand" projects have been chosen such that:

1. They are "registered".
2. The "host country" is India.
3. An Annex I "other party" is also listed.

Only the following 7 projects fit all above criteria. Interestingly, if only a criterion (1.) is changed to "rejected"; there is no such project!

S.NO.	Registered	Title	Host Parties	Other Parties	Methodology	Reductions
1	18-Nov-06	Improvement in Energy Consumption of a Hotel	India	United Kingdom of Great Britain and Northern Ireland	AMS-II.B. ver. 7 AMS-II.E. ver. 7	2987
2	14-Apr-06	Demand-side energy efficiency programme in the 'Humidification Towers' of Jaya Shree Textiles	India	United Kingdom of Great Britain and Northern Ireland	AMS-II.C. ver. 7	3393
3	12-Jan-07	Optimization of steam consumption at the evaporator	India	United Kingdom of Great Britain and Northern Ireland	AM0018 ver. 1	52247
4	24-Dec-06	Optimization of steam consumption by applying retrofit measures in blow heat recovery system	India	United Kingdom of Great Britain and Northern Ireland	AM0018 ver. 1	22587
5	15-Apr-07	Reduction in Steam Consumption through Revamping of Ammonia Plant of Indian Farmers Fertiliser Cooperative Ltd (IFFCO) plants	India	Japan	AM0018 ver. 1	295308
6	2-Jun-06	Reduction in steam consumption in stripper reboilers through process modifications	India	France	AM0018 ver. 1	34807
7	14-Jan-06	Energy efficiency through installation of modified CO2 removal system in Ammonia Plant	India	Switzerland, United Kingdom of Great Britain and Northern Ireland	AM0018 ver. 1	24449

Further, these projects have been summarized into the following table, with information extracted from their PDD and validation report.

S.No.	Name	Project type	Project Siz	References to independent sources	Barriers listed	Detail in common practice analysi	Public availability of information	Validators evaluation	Public comments
0	Improvement in energy consumption of a Hotel - ITC Welcomgroup	Energy Demand	Small scale	x	investment barrier: amount of significant investment(INR 5.95 million), spent only to save marginal amounts of energy. investment made did not result into appreciated returns(lower than expected savings) . Energy conservation-initiatives of replacement and retrofit nature is not a common practice in the hospitality sector as it involves large capital investment against low returns Technology Barrier:operational features are unique in the sector and not commonly practiced in the hospitality sector of the host country. equipment imported from USA, due to nascent stage of technology in host country Barrier due to prevailing practices: no regulatory requirement for energy conservation in hospitality sector	High	Yes	Investment barrier: essentially same as claimed by ITC welcomgroup in the PDD Technological barrier: cite imports of technology and studies, which had to be conducted Prevailing practice: Not a common practice within a group or the industry Other barriers: lack of knowledge and expertise	perumal, CMC Pvt Ltd,Kolkata : the project has a payback of only 7 months which is quiet attractive(he has done numerical financial analysis in comments). Hence it is not additional
1	Demand-side energy efficiency programme in the 'Humidification Towers' of Jaya Shree Textiles	Energy Demand	small scale	x	Barriers due to prevailing practice : Survey results concluded that the project activity energy efficiency measure is not a common /prevailing practice in the industry. Technological Barriers : performance uncertainties , no sufficient policy, or other incentives exist locally to foster its implementation	High	Yes	Additionality analysis is not very clear and conclusive. Statements are not supported by documented evidence ; "Additionality analysis seems weak"	No comments received
2	Optimization of steam consumption at the evaporator- ITC Paperboards & Specialty Papers Division (PSPD)	Energy Demand	Large	x	investment barriers: INR 178.7 million was invested. IRR without CDM benefits has been calculated as 14.5% for 15years (average life time of the project) which is not considered an appreciable return on investment by the project proponent and IRR with CDM benefits has been calculated 20% for a 10 year crediting period. Technological barriers: equipment had to be tailor made Barriers due to prevailing practice:cost sensitive manufacturing sector, increased "solids" % than previous implementors	low	Yes	The company's benchmark hurdle rate, fixed at 20% has been verified through ITC Corporate Finance Guidelines Plan 2002. Thus, the project activity is deemed not attractive for the company without the CDM registration and its benefits. Technology barriers : No other paper and paper product manufacturing industry in the country has attempted to achieve such efficiencies and solids content.	No comments received
3	Optimization of steam consumption by applying retrofit measures in blow heat recovery system	Energy Demand	Large	x	Technological barriers: special consultant required, Main equipment was imported from UK , custom designed cyclone separator Based on decision tree analysis without CDM revenue, a net loss of INR 3million was predicted. Barriers due to prevailing practice:first of its kind in India	low	yes	investment at INR 6.5 million had to be incurred on a first-of-its-kind technology whose outcome was uncertain, entire investment becoming a sunk cost (supported by decision tree analysis), estimated at INR 3 million project activity is not a common practice	Considering the availability of the existing blow house recovery system prior to the year 2000, the proposed cdm project may be majorily a part of the capacity addition than towards sustainability
4	"Reduction in Steam Consumption through Revamping of Ammonia Plant" of Indian Farmers Fertiliser Cooperative Ltd (IFFCO) plants	Energy Demand	Large	x	Investment Barrier:The project activity requires huge initial investment of about US$ 90 million . gaining minimal monetary returns from implementation of energy efficiency retrofit schemes under the present fertilizer policy, Indian government refunds only lowest cost fuel ; Prevailing practice : implementation of such a capital intensive energy efficiency schemes are not a common practice,"first of its kind" in Indian fertiliser industry. Technological barrier : operational and nascent technology related issues	Moderate	yes	essentially same as listed barriers. But, validators agree that it is not fully demonstrated that IFFCO would be gaining minimal monetary returns from energy efficiency retrofit project and the investment incurred for retrofitting the ammonia plant, cannot be fully realized because of subsidy policy of GOI.	No comments
5	Reduction in steam consumption in stripper reboilers through process modifications	Energy Demand	Large	x	Technological Barriers: perceived risk of operational difficulties in case of failure of equipments or control logic. The financial gain due to energy saving is very less as compared to such losses ; proposal was submitted to the Technology provider for further study which suggests operational risks ; employee inexperience Barriers due to prevailing practice: not a prevailing practice in Indian refineries to carry out such modifications in the process on ground of energy conservation alone, but only on recommendation of technology supplier	Low	Yes	Technology barrier: "The introduction of process modifications always adds additional risks to a smooth production" Prevailing practice barrier: This specific production modification has to date not been introduced at any other refinery in India.	No comments
6	Energy efficiency through installation of modified CO2 removal system in Ammonia Plant	Energy Demand	Large	x	Barrier due to prevailing practice: The project is not the prevailing practice in fertilizer industry in India (and even other countries) with similar technologies, 'first of its own kind' in the Indian fertiliser industry. Technological barriers: risk of project not synchronising with the prevailing production process, Risk of plant shutdown, employee inexperience and operational risks due to possibilities of equipment damage	Moderate	Yes	The project activity being "first of its kind" as per letter from Technology supplier . Technological Barrier: "some of the equipments within the CDM project boundary are critical and whose operation is monitored regularly. The risks related to the stoppage and under what conditions needs to be explained within the Draft CDM PDD"	No Comments

Questions Posed

(a) What are the criteria for a highly profitable project activity?
(b) What project activity types can potentially be highly profitable without CER revenues and as such should be subject to an enhanced barrier test?
(c) How project participants can demonstrate that their project activity with a potential for high profitability without CER revenues still faces barriers?

Contextual Answers

(a) , (b) Fundamentally, the nature of an energy demand project is profitable; typically barriers related to technology, operations or risk would prevent its implementation. Interestingly, Examining the above 7 PDDs, we find that none of them have conducted **Step 2. Investment analysis** in their PDDs and have opted for Barrier Analysis alternatively.

(b) A few very interesting insights can be drawn from a comparative analysis of these 7 projects, as outlined on the basis of comprehensively drawn questions from the "Additionality Tool" .

	Questions	0	1	2	3	4	5	6
Row	***Sub-step 3a***	**Answers**	**Answers**	**Answers**	**Answers**	**Answers**	**Answers**	**Answers**
a	1. Is it a private entity;	Yes	Yes	Yes	Yes	No	Yes	Yes
b	Have Similar activities have only been implemented with grants or other non-commercial finance terms?	Not answered	Not answered	Not answered	Not answered	N/A	Not Answered	Not Answered
c	2. Is no private capital is available from domestic or international capital markets due to real or perceived risks as demonstrated by the credit rating of the country or other country investments reports of reputed origin?	Not answered	Not answered	Not answered	Not answered	Not Answered	Not Answered	Not Answered
d	3. Are Skilled and/or properly trained labor to operate and maintain the technology available?	"Additional training by the external resources has been conducted and detail in additional responsibility for the operators."	"The application of this technology calls for sophistication of operational practices and skilled manpower for maintenance"	Not answered	"Further, number of employees deputed for operation of the BHRS were sent for external training and visit to M/s APPM at Rajamundary to understand the system operation. Also during the implementation phase the consultant employed provided onsite training to the operators on the new system."	"Hence there lies huge risk due to unfamiliarity of the new technology and risks associated with the unforeseen circumstances could not be identified. The plant personnel are not trained in the aspect of handling these risks."	"The people at RIL are not trained in the aspects of handling these risks.""The time lapsed during such production shutdown is likely to be high because RIL employees are neither experienced nor trained to handle such issues."	"The time lapsed during such production shutdown is likely to be high because IGFL employees are neither experienced, nor trained to handle such issues."
e	4. Is there a Lack of infrastructure for implementation and logistics for maintenance of the technology ?	Not answered	"The application of this technology calls for sophistication of operational practices and skilled manpower for maintenance"	Not answered	"There is no reputed manufacturer in India, who can supply tailor made equipment to meet PSPD requirements. The overall system design was carried out by PSPD internally by hiring the services of a specialized consultant, Thakur Associates, Pondicherry for the thermal design part."	mentioned in detailed technical terms	Not Answered	Not Answered
f	5. Is the process/technology failure risk in the local circumstances significantly greater than for other comparable technologies?	"with uncertainties to failure and lack of knowledge on the new technology to be implemented", "the investment made did not result into appreciated returns and incentive from CDM is still unknown.", "more while intervening into the existing system such as HVAC, boiler, hot water generator, the hotel always run a risk of affecting guest comfort."	"Therefore there is an element of risk associated to the reduction in the electrical energy consumption due to project activity over the crediting period."	"As a result, new technology penetration in this sector is not easy to come by. ITC PSPD had to bank upon the financial and technical resources to tide over the shortcomings of the new type of evaporator."	"in conventional design of blow heat recovery system, there is no provision for effective removal of fibers in blow vapours, which in turn adversely affects the heat recovery performance."	"Urea Fertiliser plants are based on complex and integrated processes and retrofitting energy efficient equipments in existing operating system has high risk as this may affect the existing process parameters and equipments and may lead to malfunctioning of equipments and disruption in operation." "There are many perceived risks in retrofitting LT Shift guard in existing process such as risk of operating parameters not getting synchronized with prevailing production process / parameters like CO slip, flow, temperature and pressure of process gas etc." "Hence there lies huge risk due to unfamiliarity of the new technology and risks associated with the unforeseen circumstances could not be identified."	"considering the risk involved in the project implementation, the decision to implement the project was delayed."	There are two equipments which are critical for proper and un-interrupted operation of modified CO2 removal system which contribute to operational risks.
g	6. Is the particular technology used in the proposed project activity is not available in the relevant region?	"Although the most of the technology measures implemented under the CDM project activity are available in elsewhere in other industrial sector" ; Technology partly imported from the USA	"The present application of variable frequency drive is the new technology in India and relatively incurs higher cost"	"As mentioned above till date only few paper mils have installed FF evaporator of different design specification."	"Main equipment was imported from UK to meet the operational requirements, which is first of its kind of installation in India."	"The technology adopted in IFFCO is patented by M/s PME. There are only three plants in the world using this technology."	Not Answered	"This state-of-the-art modification project technology is new to India and has now been achieved and implemented for the very first time for a fertiliser plant in India"
h	7. Is the project activity is "first of its kind"?	Partly	"JST was one of the first textile industries in the Eastern Region to identify the areas where the VFD technology could be adopted and electrical energy consumption and its associated emissions could be reduced."	"As mentioned above till date only few paper mils have installed FF evaporator of different design specification.However, FF evaporator is yet to find its place in all 20 largest mills." "However, ITC is the first to have FF evaporator of 70% solids that required additional investment."	"Installation of a system to heat clean soft water for pulping process from 100% recovery of waste heat of steam vapours from digester blows is first of its kind in India." "The cyclone's functioning to remove fibre was not predictable at time of installation and hence there was a credible risk of the entire investment becoming a sunk cost"	"The combination of various schemes proposed by IFFCO for energy saving in ammonia plant is unique and first of its kind in India."	"It is also not a prevailing practice in Indian refineries to carry out such modifications in the process on ground of energy conservation alone." "It is learnt through interaction, at different forums, with representatives from leading companies in the country and also with the experts in the field of energy conservation that it is very uncommon to take any innovative process modification steps for energy conservation."	"The project activity is of the 'first of its own kind' in the Indian fertiliser industry."
i	8. Other Barriers?	Not a part of core business obligations, consultants and additionalstaff required; risk of intervening in Guest comfort.	Not answered	Not answered	Not answered	Not answered	Not Answered	Not Answered
j	***Sub-step 3b***							
k	1. Do the identified barriers prevent the implementation of at least one of the alternatives? (should be answered 'No')	The only other alternative is BAU	The only other alternative is BAU	The only other alternative is BAU	BAU is the only such alternative. The other two alternatives are prevented by barriers.	BAU is the only other alternative.	BAU is the only other alternative.	"The alternatives are relatively more common practices and less risky, as it is proven across the world and there are Indian credentials as well. The identified barriers do not prevent the wide spread implementation of the project alternative."

Observations:

(1) There is a low degree of specificity in the details mentioned in the PDDs. Eg,

   a. Cell d1: "The application of this technology calls for sophistication of operational practices and skilled manpower for maintenance".

(2) In demonstrating technology barriers, a clear demarcation between mere capacity expansion / renewing obsolete equipment related energy savings and focused energy efficiency is absent. Eg,

   a. Cell g1: “The present application of variable frequency drive is the new technology in India and relatively incurs higher cost”

(3) Only 2/7 projects recognize alternatives other then BAU (Business as Usual) scenario. The alternatives offered too are not supported by adequate reasoning, as seen from the PDDs.

(4) A glaring example of “curious coincidences of language in responses”:

   Cell d5 : "The time lapsed during such production shutdown is likely to be high because RIL employees are neither experienced nor trained to handle such issues."

   Cell d6 : “The time lapsed during such production shutdown is likely to be high because IGFL employees are neither experienced, nor trained to handle such issues."

   It is mentionable here that had the statements been "The time lapsed during such production shutdown is likely to be high because *out of x1 or x2 employees*, only y1 or y2 are experienced to handle such issues”, the author would not have claimed plagiarism.

(5) The evidences offered in support of reasoning are generally very vague:

a. Cell h5: "It is learnt through interaction, at different forums, with representatives from leading companies in the country and also with the experts in the field of energy conservation that it is very uncommon to take any innovative process modification steps for energy conservation."

b. Cell d0: "Additional training by the external resources has been conducted and detail in additional responsibility for the operators."

APPLICATION OF HYPOTHESIS TESTING TO BARRIER ANALYSIS

The author propose that to reduce subjectivity in barrier analysis, certain key questions be answered in the PDDs. These questions have been drawn from the Barrier Analysis section of the "Additionality Tool":

Sub-step 3a

1. Applicable to private entities only: Have Similar activities have only been implemented with grants or other non-commercial finance terms?
2. Is no private capital is available from domestic or international capital markets due to real or perceived risks as demonstrated by the credit rating of the country or other country investments reports of reputed origin?
3. Are Skilled and/or properly trained labor to operate and maintain the technology available?
4. Is there a Lack of infrastructure for implementation and logistics for maintenance of the technology?
5. Is the process/technology failure risk in the local circumstances significantly greater than for other comparable technologies?
6. Is the particular technology used in the proposed project activity is not available in the relevant region?
7. Is the project activity is "first of its kind"?

Note:

1. ***As per the CDM additionality guide: Both sub-step3a and 3b need to be satisfied. The suggested questions are a broad outline, and all of them need not be answered. But they must be answered well enough to establish that these sub-step is "satisfied".***
2. Answer to Question 2: This question might ordinarily be left unanswered, until and unless the country has been allotted a below investment grade rating. Eg, 'BBB-' rating allotted to India currently by S&P. Such a rating is considered satisfactory for investments, but may be downgraded in the future.
3. As recommended by CDM EB in the additionality tool , the acceptable evidence must be one of the underlined:

EVIDENCE NEEDED FOR THE ABOVE SUB-STEPS (at least one of them)

- Relevant legislation, regulatory information or industry norms;
- Relevant (sectoral) studies or surveys (e.g. market surveys, technology studies, etc) undertaken by universities, research institutions, industry associations, companies, bilateral/multilateral institutions, etc;
- Relevant statistical data from national or international statistics;
- Documentation of relevant market data (e.g. market prices, tariffs, rules);
- Written documentation from the company or institution developing or implementing the CDM project activity or the CDM project developer, such as minutes from Board meetings, correspondence, feasibility studies, financial or budgetary information, etc;
- Documents prepared by the project developer, contractors or project partners in the context of the proposed project activity or similar previous project implementations;
- Written documentation of independent expert judgments from industry, educational institutions (e.g. universities, technical schools, and training centers), industry associations and others.

Proposed Changes in Barrier Evaluation Methodology

The key question here is how to evaluate the information obtained in the form of answers to these questions, so that the overall aim of realizing objectively measurable parameters is recognized? The proposed measure should

- Be unbiased towards any particular hypothesis/claim
- Allow the evaluator to assign a numerical value to the evaluated score
- Allow the evaluator to change the numerical value of score , as required, without introducing any error because of the change

Bayesian Inference and Hypothesis testing:

To review the current situation: A set of answers is available to the questions put forward in barrier analysis evaluation, and we wish to find out a way, to evaluate additionality of a project based on the (preferably numerical) evaluation of these answers . The author suggests the use of the Bayesian approach.

The Bayesian Model applied to barrier evaluation

Bayesian Approach	*Application to barrier evaluation*
Parameter θ is uncertain, has distribution g(θ)	Parameter of interest is 'additionality', which has some distribution (not necessary binary in nature)
Data X are unknown before observation, and are known after observation	Answers are known after the PDD is filed, and are not known before it
Inference consists of conditioning on X to find g(θ|X)	The probability of the project being additional, given the answers

The author proposes the use of Hypothesis testing to evaluate the i^{th} answer. As explained,

$$P\left(\frac{H}{E}\right) = \frac{P\left(\frac{E}{H}\right)P(H)}{P(E)}$$

Where

H represents a specific hypothesis, which may or may not be some null hypothesis. In this case, the null hypothesis is" the project does is not additional" and alternate hypothesis is "the project is additional".

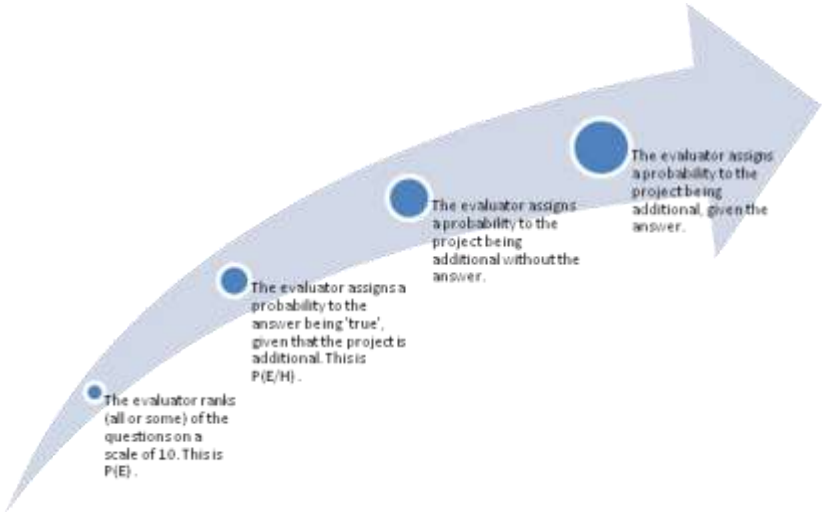
$\boldsymbol{P\left(\frac{H}{E}\right)}$ is the *probability* of *H* given a certain evidence. In this case, it is the probability that" the project does is not additional" given the i^{th} answer to the question.

$\boldsymbol{P(H)}$ is the *probability* of *H* that was inferred without the evidence *E*. In this case this is the probability of "the project does is not additional", without the i^{th} answer tendered to this evidence/ question.

$\boldsymbol{P\left(\frac{E}{H}\right)}$ is the *probability* of seeing the evidence *E ,* if the hypothesis *H* happens to be true. This is something which the evaluator can predict based on his prior knowledge of the cause effect relationship between H and E.

$\boldsymbol{P(E)}$ is the probability of the evidence being true . To explain, let us talk of a scenario in which the evaluator scores each question (e.g. 5 out of 10). In this case P (E) = 5/10 = 0.5.

How to evaluate P (E)? The author suggests use of a scoring model developed by experienced CDM evaluators. An example model could be the European model for total quality management (EFQM). A suggested implementation is the one used by CII-EXIM Bank Award for Business Excellence for quality evaluation, which uses a '*scoring matrix*' approach.<http://www.cii-iq.in/pdfs/scoring_summary_sheet.pdf> These scores can then be used as "proxies" for probabilities.



Essentially, any good evaluation is initiated by skepticism, which is the hypothesis P (H/E) in this case. Let us introduce two key errors:

Type I error; the probability of rejecting the hypothesis that the" project is not additional", when the hypothesis is true, i.e. it is actually not additional.

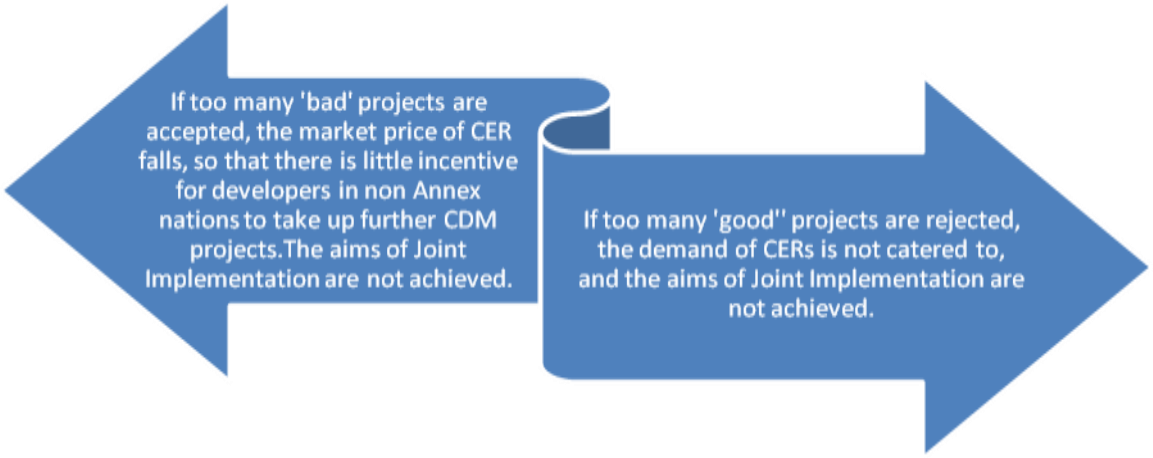
Type II error; the probability of accepting the hypothesis that the "project is not additional", when the hypothesis is false i.e. the project is additional.

Determination of the significance level:

Let us now state 2 broad objectives of the CDM Board.

1. Do not allow any project which is not additional to earn CDM revenues. This is achieved when Type I error is minimized.
2. The overall broad policy measures should lead to an acceptance of a certain level of projects, such that the demand-supply situation of CERs is optimized.

Optimal choice is option with maximum expected utility



Choosing an appropriate significance level is of supreme importance. Clearly,

This parameter will determine the acceptance/rejection of a particular project, and the overall number of projects accepted. The level of significance can be adjusted suitably, and on a dynamic basis so that both 1 and 2 are satisfied. The demand-supply situation can be optimized, by changing the significance level for Type I error. Also, a maximum significance level of Type I error say, 5 %, agreed upon by various CDM stakeholders, can be kept as the ceiling, which will reduce the probability of too many bad projects from being accepted.

