[Wyoming Law Review](https://scholarship.law.uwyo.edu/wlr)

Volume 12
Number 2 *Land & Water Law Symposium*

Article 4

January 2012

Roles for Legal Scholarship in the Design of Meta-Interventions for Energy Efficiency and GHG Abatement: Lessons from Cost-Benefit Analyses of Low-Emission Development Strategies in China, Mexico, Colombia, and Beyond

William A. Ward

WYOMING LAW REVIEW

VOLUME 12 2012 NUMBER 2

ROLES FOR LEGAL SCHOLARSHIP IN THE DESIGN OF META-INTERVENTIONS FOR ENERGY EFFICIENCY AND GHG ABATEMENT: LESSONS FROM COST-BENEFIT ANALYSES OF LOW-EMISSION DEVELOPMENT STRATEGIES IN CHINA, MEXICO, COLOMBIA, AND BEYOND

*William A. Ward**

Abstract

Rapid economic growth in emerging market countries makes them the largest current source of Green House Gas (GHG) increases. The author has developed cost-benefit models for the World Bank and client countries to analyze project portfolios for abating or mitigating GHGs, including the first major study in China (1992–1994) shortly after the Global Environment Facility (GEF) was formed and more recent studies in Mexico (2007–2009) and Colombia (2011–2012). This article uses these studies to explain that all such portfolios have some projects in which non-GHG benefits exceed total costs, resulting in net negative costs for reducing GHGs via those particular options. This article shows that some of these negative cost projects are true projects, while others are not. Instead, some are pure technologies that are not implementable because of inadequate identification of market barriers. Still others are chimera—neither one thing nor another—that have too few attributes of a true project to be implementable. This

* William A. Ward holds a Ph.D. from Michigan State University and is a professor of economics at Clemson University. He has held senior positions at the World Bank, serves as cost-benefit expert to the World Bank Inspection Panel, and has co-written project analysis guidelines for five countries and three international organizations. He has analyzed more than one hundred investment operations in more than forty countries and has authored or co-authored three books and dozens of articles on economic analysis of policies and projects. He also is the author of a forthcoming book on cost-benefit analysis of energy efficiency projects and low-emission development strategies.

article develops a fourth project form called "meta-interventions" in which market barriers and market failures are identified so that mechanisms can be designed which make markets work better, leading free market activity to better support reducing GHGs. Institutional and organizational change will be an important aspect of meta-interventions, which will demand cadres of lawyers trained to work with economists, engineers, and other professionals.

INTRODUCTION

This article focuses on studies in China (1992–1994), Mexico (2007–2009), and Colombia (2011–2012) that applied cost-benefit analysis (CBA) methods to low-emissions development strategies (LEDS) for rapidly-growing, emerging-market countries.[1] This article draws lessons from those studies and uses them to lay out core principles for identifying market-facilitating, public sector activities—in particular, those designed to improve energy efficiency (EE) and to abate or mitigate greenhouse gas (GHG) emissions. Identifying public interventions that improve EE and reduce GHG emissions is important because evidence from LEDS studies reveals substantial scope for improvement. Of particular importance in achieving the needed improvements will be the meta-interventions[2] that improve the environment for markets to spontaneously find solutions to EE and GHG problems and to do so without further public sector involvement.

This article advocates for meta-interventions by presenting four related points. First, substantial opportunities for EE and GHG improvement exist in the form of negative cost (a.k.a. no regrets and win-win)[3] alternatives to business-as-usual (BAU) technologies and procedures. But many alternatives that have been identified as negative cost options in LEDS studies are false options. These false options occur in two forms—as naked technologies, and as chimera, introduced into the LEDS literature via this article—which should not be allowed to cloud the work that needs to be done in substituting meta-interventions in place of these two forms of project imposters in LEDS planning. Second, there is substantial

[1] The author designed the cost-benefit methods used in these three studies (as well as a number of similar studies in other countries) and supervised the training and the research conducted by the sector analysts (forty-eight sector experts in China, forty-nine in Mexico, and twenty-two in Colombia).

[2] "Meta" is a word (commonly used as a prefix) of Classical origin—used both in ancient Greece and in ancient Rome—that in modern usage has widely differing meanings in each of the sciences. The author introduces it in combination with intervention to form a new term for use in the context of LEDS portfolio analysis to mean "more comprehensive or fundamental." Meta-interventions, as this new term defines them, are underrepresented on GHG Marginal Abatement Cost (MAC) curves, while "naked technologies," and "chimera" are overrepresented in the MAC curve juxtaposition with true "projects." This article uses the term "projects" as proxy for all three of the regular (*i.e.*, not meta-) interventions (projects, programs, and policies).

[3] These terms are used interchangeably in referring to cost-effectiveness calculations of projects, programs or policies to improve energy efficiency, abate greenhouse gas emissions, or sequester gasses already emitted.

variety in not only the nature of the real negative cost options, but also in the physical and socio-cultural environments that produce them. The third point of this article explains that substantial variation in causes and outcomes means that EE and GHG problems in differing countries cannot be solved by the standard approach of identifying one-size-fits-all projects to be replicated time-after-time and in place-after-place. The fourth point concludes that the LEDS interventions must solve the market failure and policy failure problems and remove the market barriers that lead to energy inefficiency and GHG emissions by allowing markets to work better. If EE and GHG problems are to be resolved, it will not occur by direct production interventions. Instead, well-functioning markets that use energy efficiently and do not emit large volumes of GHGs will be required if these two problems are to be resolved.

The article develops the concept of meta-interventions that involve identifying the market-making activities and designing the projects to implement them. Taking this proposed new approach of focusing LEDS upon meta-interventions will require relatively large cadres of lawyers, engineers, and economists working together to combine a broad range of understanding of not only technologies but also law, markets, and institutions.[4] The objective of this article is to introduce lawyers to the concept of meta-interventions and to the kind of training they will need in order to become active participants in emerging applications in sustainable development.

LESSON ONE: WIN-WIN OPTIONS ARE FOR REAL . . . SOMETIMES

Win-win projects in EE and GHG abatement are defined as those projects that meet the stated EE or GHG objective while also being fully compensated by other positive impacts that typically are called "co-benefits." Co-benefits can be "private," "social," or both and can include both private income from related sales by project implementers and reductions in other forms of negative externalities (public) such as sulfur dioxide (SO_2) or particulate matter.

Negative cost EE options were identified on a large scale by a study of EE and GHG emissions in China (the China study)[5] conducted as the first major LEDS research project after the GEF was established in 1991. The China study was funded by the GEF and the World Bank and was carried out during 1992.

[4] In New Institutional Economics (NIE), "institutions" are defined as societal rules governing human interactions. "Informal" institutions arise from cultural mores and traditions. "Formal" institutions commonly are codified—explicitly (as in Napoleonic law) or implicitly (as in the common law)—into the legal structures of their respective societies. *See* Douglass North, *Institutions*, 5 J. ECON. PERSP., no. 1, 1991 at 97.

[5] *See generally* WILLIAM A. WARD ET AL., ENERGY EFFICIENCY IN CHINA: CASE STUDIES AND ECONOMIC ANALYSIS (The World Bank 1994) [hereinafter CHINA STUDY], *available at* http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2003/05/30/000094946_02100104010040/Rendered/PDF/multi0page.pdf.

The author designed the cost-benefit and cost-effectiveness methods used for the China study as well as for later studies in Mexico and Colombia. The author also assisted in designing the cost-effectiveness methods applied in a number of other EE and GHG studies as well. A number of important lessons were learned from each of these activities. The first set of lessons relates to methods for setting up and conducting the CBA and cost-effectiveness (C/E) analysis.[6] A forthcoming book will discuss these lessons and will describe best-practice procedures for conducting similar studies in the future.[7]

The second set of lessons relates to the project development process itself. Direct involvement in designing and conducting the studies in China, Mexico, and Colombia—combined with meta-analysis of comparable LEDS research conducted by other scholar practitioners—leads to a number of additional lessons regarding the identification and design of the interventions that make up the LEDS portfolios being pursued in an increasing number of large and rapidly-growing emerging market countries. Of all the LEDS studies undertaken, the industrial EE component of the China study—the first of these studies—provided the greatest surprises and largest number of valuable learning experiences.[8]

The China study began with a number of standard assumptions that grew naturally out of environmental economics[9] models and out of models for dealing with prices that are distorted by inappropriate government policies.[10] The most important of those presumptions were that GHGs occurred as externalities[11] and that the producer of the externalities sought to maximize firm or individual income (even though that behavior may have imposed external costs upon other citizens). That first presumption led to a second presumption that reducing GHG production would involve higher costs (internalizing the externalities) borne by the producer of the externalities.

---

[6] C/E analysis is a form of CBA in which the objective functions (benefits) are left in unvalued quantitative units and the cost-per-unit is then compared between alternatives. In LEDS applications, the C/E analysis measures the cost per tonne of CO_2 equivalent abated or mitigated by each project compared to its alternative or business-as-usual case.

[7] *See generally* WILLIAM A. WARD, ROBERT P. TAYLOR & TODD M. JOHNSON, ECONOMIC ANALYSIS OF ENERGY EFFICIENCY PROJECTS AND LOW-EMISSION DEVELOPMENT PORTFOLIOS (The World Bank forthcoming 2012 or 2013).

[8] *See generally* CHINA STUDY, *supra* note 5.

[9] The standard reference is TOM TIETENBERG AND LYNNE LEWIS, ENVIRONMENTAL ECONOMICS AND POLICY (6th ed. 2009). Externalities are costs borne by individuals outside the accounting stance of the firm or the individual responsible for producing the GHGs.

[10] *See* WILLIAM A. WARD & BARRY J. DEREN, THE ECONOMICS OF PROJECT ANALYSIS: A PRACTITIONERS' GUIDE (1991).

[11] Pigou is generally credited with introducing the concept of "externalities" and its accompanying term. *See generally* A. C. PIGOU, THE ECONOMICS OF WELFARE (1920). *See also* James M. Buchanan & W. C. Stubblebine, *Externality*, 29 ECONOMICA, no. 116, 1962, at 371–74 (explaining the concept of externalities).

The industrial EE component of the China study analyzed opportunities to improve energy-use efficiency in twenty-five manufacturing industries throughout the country. The study began with three expectations. First, it would be more profitable to the industrial enterprises to emit high levels of GHGs than not to emit those same levels (the normal case presumed in environmental economics models, as outlined above).[12] Thus, the study constructed financial accounts to reflect the "enterprise only" perspective to facilitate comparisons between private financial accounts and societal economic accounts. Second, it was expected that the above financial accounts would be incorrect in terms of "real" (economic) values because of price distortions that remained from the heritage of formerly-planned economy (FPE) central planning.[13] Thus, the author also designed models that would substitute economic values (economic shadow prices) in the enterprise accounts and the related project accounts for the twenty-five energy-efficiency projects. This second form of analysis was termed "economic analysis." Third, it would be necessary to further correct the above economic values by costing the non-GHG environmental externalities associated with energy use[14] that would be lessened as a co-benefit of the EE projects.[15] This third form of project and enterprise analysis was termed "environmental economic analysis."

The above three expectations allowed the calculation of three internal rates of return for each industrial EE project: (1) a financial internal rate of return (FIRR); (2) an economic internal rate of return (EIRR); and finally, (3) an environmental economic internal rate of return (EEIRR).[16] The beginning assumption was that each of the EEIRRs would exceed its respective EIRR simply because the only difference would be the co-benefits from reducing the GHG-associated pollutants.[17] This logical assumption turned out to be correct.

The relationship between the EIRRs and their respective FIRRs, on the other hand, was not easy to predict. Some of the price distortions affecting the difference between FIRR and EIRR would benefit the finances of one particular enterprise or individual while harming the finances of another. For example, subsidized steel prices would benefit industries that use steel intensively while reducing the competitiveness of industries that produce equipment made from materials other

---

[12] *See* CHINA STUDY, *supra* note 5.

[13] *Id.*

[14] These externalities would include such things as damages from particulate matter, SO_2, and other emissions arising from burning large quantities of high-sulfur, low-quality coal.

[15] *See* CHINA STUDY, *supra* note 5.

[16] *Id.* The internal rate of return (IRR) is defined in discounted cash flow analysis as the interest rate that will make the discounted present value of the benefits equal to the discounted present value of the costs. It is the highest interest rate that the project could pay and still break even. If the cash flow values are in financial terms, then the calculated IRR is the FIRR. If the cash flow values are economic, then the calculated IRR is the EIRR.

[17] *Id.*

than steel. The same would be true of energy prices such as electricity and oil. The initial expectation was that the act of taking any subsidies off the energy prices would tend to result in EIRR being greater than FIRR for most of the projects. That expectation was largely confirmed by the study results. The EIRRs were higher than the FIRRs, but they were not substantially higher.[18]

Cases Where Win-Win (No Regrets) is Very Real

Contrary to the *ex-ante* expectations, the 1992–1994 China study revealed high FIRRs on potential industrial EE projects. The research team had expected to find low FIRRs on each project (i.e., lower than the cost of capital). Otherwise, as the standard environmental economics theory taught, those projects presumably would have been undertaken already.[19] With that standard theory in mind, the China research team had expected to follow up with a project funded by GEF and the World Bank to subsidize (incentivize) the projects where the FIRR was low but the EEIRR was high.

Finding that the FIRRs already exceeded the cost of capital in China undermined the project concept of incentivizing the financial returns on projects where low FIRRs were paired with high EEIRRs. The high FIRRs suggested that sufficient incentives already were present. A major research finding was that there were financially profitable investments in the industrial sector of China that were available and not being undertaken.[20]

Twenty-three of the twenty-five industrial EE projects analyzed in the China study showed negative costs in private financial terms for each tonne of GHG reduction.[21] It was not necessary to add the social benefits of GHG reduction to those twenty-three project accounts in order to justify investing in the projects.

The high FIRRs and negative private costs described above surprised the designers of the China study. The follow-up analysis[22] identified several reasons

[18] China already had begun the market liberalization process that would bring financial prices into much closer alignment with real economic values, though serious distortions continue via an exchange rate for the renminbi that is seriously undervalued and via relaxed enforcement of environmental regulations. Barry Eichengreen & Hui Tong, *The External Impact of China's Exchange Rate Policy: Evidence from Firm Level Data* (IMF, Working Paper No. WP/11/155, 2011), *available at* http://www.imf.org/external/pubs/ft/wp/2011/wp11155.pdf; *see also* Zhichao Zhang, *Real Exchange Rate Misalignment in China: An Empirical Investigation*, 29 J. COMP. ECON., no. 1, 2001, at 80–94.

[19] Neoclassical economic theory teaches that, if there had been any $10 bills on the sidewalk then the bills would have been picked up. *See* Michael E. Porter & Claas van der Linde, *Toward a New Conception of the Environment-Competitiveness Relationship*, 9 J. ECON. PERSP., no. 4, 1995, at 97–98 (discussing a new paradigm of international competitiveness).

[20] *See* CHINA STUDY, *supra* note 5.

[21] *See id.*

[22] This additional step in the analysis was conducted by the author and included in the report as Section VII of Part 1 of the China report. *See id.*

companies failed to implement EE projects that would have saved much more money than they cost. First, the rapid growth rates in China exacerbated the capital shortages. Companies would invest in projects that increased output, but they would not invest in projects that simply reduced costs.[23] The solution was to provide them with technologies that did both. Second, project financing institutions have the same bias. These institutions are accustomed to lending for output and revenue expansion but are unaccustomed to lending for cost saving projects.[24] Third, while some of the EE projects were very small (electric motors, for example) in comparison to the enterprise as a whole and, thus, were not able to attract management's attention, they had very high rates of return on investment.[25]

Negative Cost and the General Principle of Structure and Increment

While the author identified several more factors affecting specific industries, the most profound lesson came from the following observation. Generally, the projects with the highest rates of return on investment were designed for the enterprises that were the most poorly managed. From this experience, the author postulates in this article the general principle of structure and increment which states that the *ex-ante* rate of return on an efficiency-oriented project will be inversely related to the efficiency of the enterprise within which the project is to be implemented.[26] The more inefficiently managed the enterprise, the greater the opportunity to find efficiency-improving projects in that enterprise. The same is true in macroeconomic management terms: the more poorly managed the country, the more likely one is to find large numbers of high-return projects in that country. The same principle holds for enterprises and for countries, each of which constitutes the structure in the structure-increment analogy. The major reason for the prevalence of negative cost (a.k.a. high return) projects in the industrial sector of China was that the sector had been managed very inefficiently for a long time.[27]

---

[23] *See id.*

[24] *See generally* ROBERT P. TAYLOR ET AL., FINANCING ENERGY EFFICIENCY: LESSONS FROM CHINA, INDIA, BRAZIL AND BEYOND (2008) (describing several case studies to suggest a new model for energy efficiency retrofits).

[25] *See* CHINA STUDY, *supra* note 5, at xi.

[26] Though the general principle stated in this article grew originally from the China research, it is not clearly formulated as such in that write-up. Later work makes clear that such statements as the following imply a more general principle to be applied in the identification of projects and meta-interventions: "Enterprise viability is a project financing issue for the state enterprises analyzed by the present study. This implies that an analysis that looks beyond model project analyses is in order in assessing possible GEF financing of these energy efficiency improvements. . . . These non-viable enterprises can be left for structural reform programs, which—this analysis further suggests—probably should be the primary focus in dealing with inefficient state enterprises." *Id.* at Part 1, ¶ 7.25.

[27] *Id.*

Barry Tunnah, the leader of the engineering consultants employed to identify the technology alternatives in the China study, was not surprised by the results described above.[28] He replied that engineers were encountering negative cost options for EE on a regular basis in the industrial sectors of not only the developing and emerging market countries but also in industrialized countries such as the United States.

The fundamental question of why the win-win options in EE and GHG abatement are frequently not implemented became the subject of *Operational Program Number* 5 *Barriers to Energy Efficiency* issued in the mid-1990s by the GEF.[29] The question of win-win options and the related quest to identify barriers to market efficiency became core topics in EE and LEDS programs in the 1990s and spawned vibrant debates that have waxed and waned but have never gone away completely, as indicated by Jaccard:

> During the oil price crisis of the 1970s, many energy technologists and efficiency advocates argued that great improvements in energy efficiency are economically efficient, a win-win that would increase profits while reducing energy use. Many economists, however, disputed this claim, arguing that analysis indicating the existence of profitable opportunities for energy efficiency must be overlooking some real, but perhaps intangible, costs for consumers and firms. . . . The McKinsey (2007) consulting firm has contributed to the [resurgence of this] issue by producing recent estimates of energy efficiency profitability for the United States and other countries, estimates which imply that substantial reductions of GHG emissions could be realized at little or no cost. Policy-makers who want to reduce GHG emissions are understandably attracted to this

[28] Mr. Tunnah is a well-known expert in industrial EE who has provided advisory services in China and a number of other countries for more than three decades for the World Bank and other clients. In a series of conversations both in the field and while compiling and analyzing data in Washington and Clemson, Mr. Tunnah pointed out that industrial engineers were accustomed to businesses making choices that seemed uneconomic when viewed solely in energy efficiency terms. These conversations preceded the GEF OP5 statement on "barriers to energy efficiency" which had been preceded by the works of C. B. Blumstein, et al., *Overcoming Social and Institutional Barriers to Energy Efficiency*, 5 ENERGY 355, 355–72 (1980); and Kenneth Train, *Discount Rates in Consumers' Energy-Related Decisions: A Review of the Literature*, 10 ENERGY 1243, 1243–53 (1985). Meanwhile, Amos Tversky and Daniel Kahneman already were demonstrating seemingly-irrational behavior by consumers (and businesses) in seminal works in the emerging field of behavioral economics, for which Kahneman would later receive a Nobel Prize in Economic Science. *See* Amos Tversky & Daniel Kahneman, *Rational Choice and the Framing of Decisions*, 59 J. OF BUS. S251, S251–S278 (1986); Amos Tversky & Daniel Kahneman, *The Framing of Decisions and the Psychology of Choice*, 211 SCIENCE 453, 453–58 (1981).

[29] GLOBAL ENV'T FACILITY, OPERATIONAL PROGRAM NUMBER 5: REMOVAL OF BARRIERS TO ENERGY EFFICIENCY AND ENERGY CONSERVATION, *available at* http://www.thegef.org/gef/sites/thegef.org/files/documents/document/OP_5_English.pdf (last visited Apr. 7, 2012).

> analysis as it suggests that such reductions may be cheap and easy. However, for energy analysts aware of the history of this debate, it's déjà vu all over again.[30]

In conclusion, negative cost options do exist. Some options appearing in GHG MAC curves, however, are incorrectly presented as such. Many of the real negative cost opportunities arise because the social benefits that are unaccounted for in the private financial analysis are larger than the private costs. Many of the false negative cost options, on the other hand, purport to present private benefits that exceed the private costs, as was the case in the China industrial EE projects discussed above.

The transport improvement options that were analyzed in Mexico[31] and Colombia[32] involved important co-benefits—some of which were social and some of which were unexpressed private benefits (discussed further, below). In the absence of substantial co-benefits, the projects would be expected to have positive C/E ratios and would be arrayed above the horizontal (zero cost) axis in the related MAC diagram, indicating that each tonne of carbon dioxide equivalent (CO_2e) abatement via those options would come at a positive real cost.[33] In addition to reducing energy use and reducing GHG emissions, however, many of the transport projects also provide social co-benefits via reductions in emissions of health-damaging pollutants such as SO_2 and particulate matter.[34] Moreover, some of the transport options also provide substantial additional private co-benefits from time-savings accruing to passengers.[35] Because the combined private and social co-benefits sometimes exceed the total cost of the transport improvement, a part of the GHG reduction objective can be achieved at negative net (social or

---

[30] Mark Jaccard, *Paradigms of Energy Efficiency's Cost and their Policy Implications: Déjà Vu All Over Again*, *in* MODELING THE ECONOMICS OF GREENHOUSE GAS MITIGATION: SUMMARY OF A WORKSHOP 42, 42 (2011).

[31] Todd M. Johnson et al., *Low-Carbon Development for Mexico* (The World Bank 2009), *available at* http://siteresources.worldbank.org/INTLAC/ Resources/Medec_final_Oct15_2009_Eng.pdf.

[32] The official report on the Colombia study is in the process of being drafted and is expected to be available for general distribution by the World Bank in late 2012 or early 2013. Individual cost-benefit analyses are on file and available from the author (hereinafter Individual Cost-Benefit Analyses).

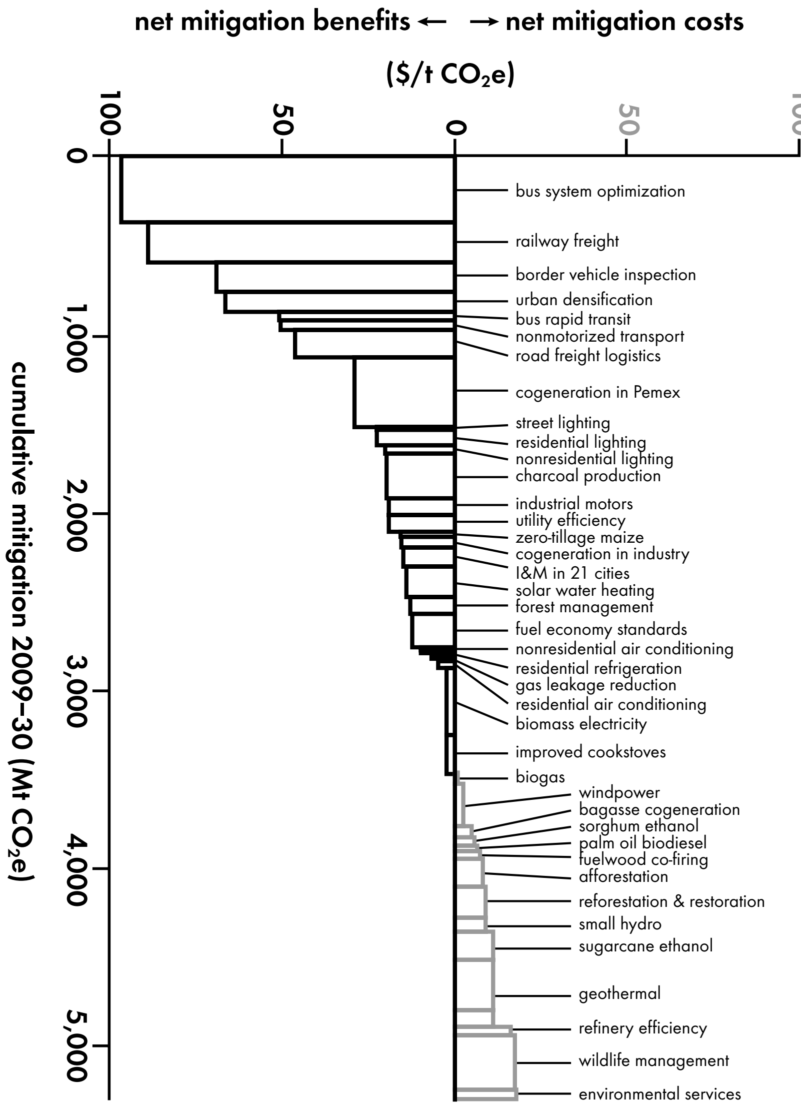
[33] *See infra* figs. 1 & 2.

[34] Luis Sanchez Catano et al., *MEDEC: Reporte Final–Sector Transporte* (CTS-Mexico and EMBARQ-WRI Working Paper, 2008) (on file with author).

[35] Note the importance in the CBA of not double-counting the time saved by riders by adding to the CBA accounts their willingness-to-pay for the time savings if that value already is reflected in higher fares paid.

economic) costs per tonne of CO_2e abatement via some of the projects that go into the MAC portfolio.[36]

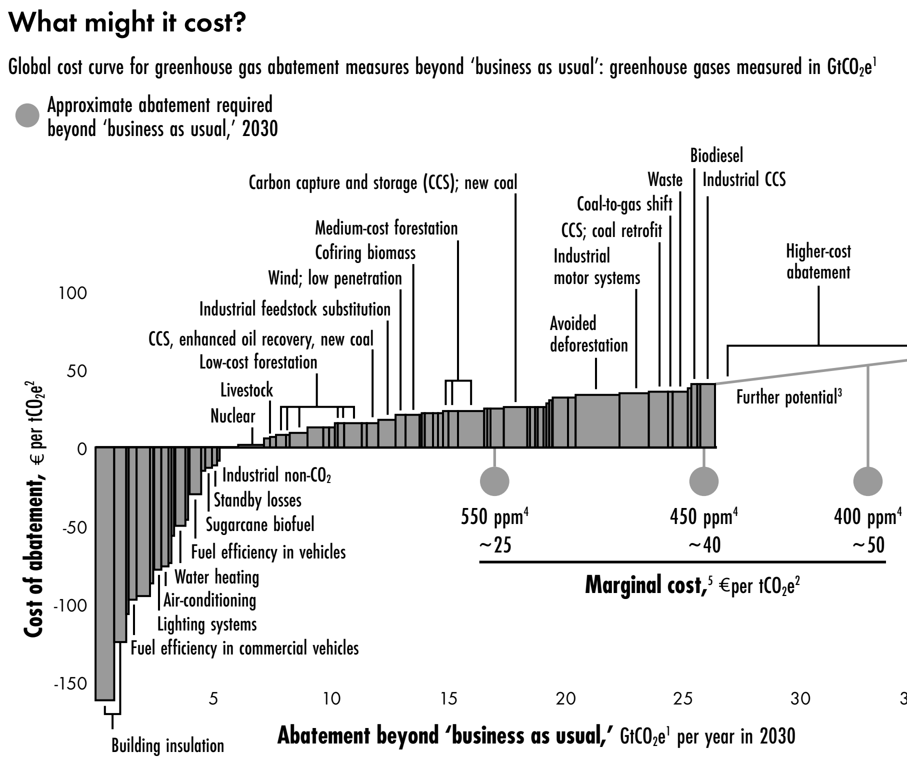
Figure 1. GHG Marginal Abatement Cost Curve for Mexico[37]



[36] The GHG abatement options that occur below the horizontal axis in the MAC figure represent the so-called win-win options. Those above the horizontal axis have remaining costs after consideration of co-benefits. Some projects have no co-benefits to account for. No doubt, some co-benefits—including, perhaps, some negative "co-benefits"—remain unaccounted for in some of the interventions, as suggested by various economists. Adrien Vogt-Schilb & Stéphane Hallegatte, *When Starting with the Most Expensive Option Makes Sense: Use and Misuse of Marginal Abatement Cost Curves* (World Bank Sustainable Dev. Network, Working Paper No. 5803, 2011).

[37] Johnson et al., *supra* note 31.

Figure 2. McKinsey & Company Global MAC Curve for GHG Abatement Potential (2007)[38]



[1] $GtCO_2e$ = gigaton of carbon dioxide equivalent; "business as usual" based on emissions growth driven mainly by increasing demand for energy and transport around the world and by tropical deforestation.
[2] tCO_2e = ton of carbon dioxide equivalent.
[3] Measures costing more than €40 a ton were not the focus of this study.
[4] Atmospheric concentration of all greenhouse gases recalculated into CO_2 equivalents; ppm = parts per million.
[5] Marginal cost of avoiding emissions of 1 ton of CO_2 equivalents in each abatement demand scenario.

The McKinsey GHG MAC curve (Figure 2) shows numerous win-win opportunities in not only electricity, but also in other GHG abatement and mitigation programs. This is similar to other MAC curves generated from a range of approaches that were pigeon-holed by Kesicki into the following groupings:[39] (1) Model-based MAC curves, including (a) top-down models built by economists, and (b) bottom-up models built by engineers and technologists; and (2) Expert-based MAC curves, also built primarily by engineers and technologists.

---

[38] Per-Anders Enkvist, Tomas Nauclér, & Jerker Rosander, *A Cost Curve for Greenhouse Gas Reduction*, THE MCKINSEY Q., no. 1, 2007, at 35–45, Exhibit I.

[39] Fabian Kesicki, *Marginal Abatement Cost Curves for Policy Making–Expert-Based vs. Model-Derived Curves* (June 2010) (unpublished student paper, University College London), *available at* http://www.homepages.ucl.ac.uk/~ucft347/Kesicki_MACC.pdf.

It is Important to Distinguish between Private and Social Win-Win Options

The McKinsey and Company global MAC curve for GHG abatement demonstrates the global nature of win-win presumptions.[40] Among the no regrets options appearing in Figure 1 and Figure 2, the options involving social co-benefits (a.k.a. externalities, such as the SO_2 referred to previously) are readily explainable—they occur as true externalities that are difficult to internalize into regular market transactions. These options represent pure examples of Pigouvian externalities.[41]

A second kind of win-win option, on the other hand, for which the co-benefits come in the form of private gains accruing to the same individuals who bear the cost of the respective option, are more problematic.[42] These are problematic because the net private costs are negative, as indicated by the FIRRs that exceeded the cost of capital. Thus, the failure to implement more energy efficient technologies seems illogical in the absence of extenuating circumstances, such as the structure-increment principle, capital shortages, or small projects relative to enterprise management capacity, as outlined above. Still others will sometimes contain the implementation solution within the CBA itself, such as improved bus services in Mexico and Colombia, where the externality of passenger time savings might readily have been captured (i.e., internalized) via a bus fare increase.[43] The simple answer in this third case is to use the CBA as a market study to determine bus fare adjustments reflective of service improvements to be provided by the project, and thus to turn the (social) win-win public service project into a straightforward market transaction between the travelers and the bus company.

The three forms of analysis used in the China study allowed the analysts to conclude that economists should distinguish between private win-win options versus social win-win options. The China study was conducted with the expectation of finding options that were win-win in social terms but not in private terms. As such, economists expected the need to subsidize private behavior to achieve social objectives. Instead, the China study revealed that there were both social and private win-win options. As a result, in the later studies in Mexico, Colombia, and other countries, the team began redesigning the analysis to look for specific differences between private and social win-wins among the negative cost options. For the private win-wins, the team began developing methods for determining whether they were false win-wins because of under-consideration of non-GHG attributes. In cases where non-GHG attributed reduced the

---

[40] *See supra* Figure 2.

[41] *See generally* Harold Demsetz, *The Core Disagreement Between Pigou, the Profession, and Coase in the Analyses of the Externality Question*, 12 EUR. J. OF POL. ECON., no. 4, 1996, at 565.

[42] *See* CHINA STUDY, *supra* note 5.

[43] *See* Johnson et al., *supra* note 31.

attractiveness of the lower-emissions alternative, sector experts were instructed to seek (design) alternatives that provide the fuller range of attributes sought by users of the technology. In cases where the barrier is outside the product itself and is in the market, then those false win-wins might be convertible into true win-wins by identifying and designing meta-interventions that remove the market barriers and market failures impeding the development of those options.

Beyond the impact on the design of the CBA approaches in Mexico and Colombia, the above conclusions led to dropping the GEF proposal to subsidize differences between financial and economic returns. Instead, the GEF focused on identifying the meta-interventions in China needed to correct the market barriers and market failures impeding rational market behavior. A number of World Bank and GEF projects and programs followed, including training programs for energy service company (ESCO) executives coupled with assistance in forming an association of ESCOs,[44] financial sector loans targeted at financing EE,[45] etc. The World Bank Operations Evaluation Department (now the Independent Evaluation Group) report on the Bank's program in China concludes that:

> With none of 20 completed projects rated unsatisfactory and only one of the 19 ongoing projects rated a problem project, the performance of the China energy portfolio is without equal. . . . [A]ll [projects] shared a strong emphasis on technology transfer and capacity building. Projects were targeted to a few selected sector institutions and geared to maximize their demonstration effect to the rest of the sector, particularly in terms of the benefits to be derived from modern technology and management methods, international procurement, and resettlement approaches.
>
> . . . This approach had extremely successful outcomes, the sector made remarkable progress in assimilating new technologies and technical skills, and increasing efficiency of project management and operation. The latter was critical to China's ability to rapidly expand energy supply in order to sustain a booming economy. . . . [T]he institutional development impact of the Bank's program for this initial period is thus rated substantial. These early physical and institutional achievements were fully sustainable and, indeed, paved the way for the more ambitious

---

[44] Robert P. Taylor, *Achieving Sustainability in World Bank Energy Efficiency Projects: Lessons Learned Developing ESCOs in China*, 29 STRATEGIC PLANNING FOR ENERGY AND THE ENV'T, no. 1 (2009) at 32–41.

[45] The list of related project documents of World Bank energy efficiency financing loans to China can be seen at http://www.worldbank.org/projects/P084874/china-energy-efficiency-financing?lang=en.

> policy reforms of the mid- and late 1990s. The performance of the Bank is rated fully satisfactory, particularly for the solid technical advice and support it provided in the context of project preparation and implementation. . . .[46]

One of the important lessons drawn from the activities that followed the China study was that

> *Internal Bank factors are critical to building up and sustaining an effective long-term sector dialogue.* The Bank's successes in power, energy efficiency, and renewables in China have much to do with staff continuity, the high caliber of individual task managers, the existence of a dedicated pool of expertise on specialized aspects, and management's willingness to invest resources in quality, highly participatory sector work.[47]

A number of analysts pay insufficient attention to the distinction between social win-wins and private win-wins. Accordingly, they tend to argue over the logic of win-wins projects, with some going so far as to totally deny their existence. In the work reported by Jaccard that is focused upon electricity sector demand-side management (DSM) and related issues, private win-win options are the primary concern.[48] Naturally, these private win-win options also draw the attention of Transaction Cost Economics (TCE) theorists who cannot imagine that individuals would ignore money-saving options, unless the transaction costs were higher than the apparent net benefits. Most of the transport options in the Mexico and Colombia studies, on the other hand, address alternatives in which the win-win status is primarily social in nature. The social win-win factors include true externalities (e.g., health damages from sulfur emissions) that are difficult and costly to capture or to avoid by private individuals who are transacting independently.

Private and Social Win-Win Options Can Arise From Policy Failures

Win-win options also exist in cases where policies distort choices that individuals face. The time savings from improved bus services may well provide a stellar example falling into this third category. For example, it is altogether

[46] Anthony Churchill & Cordula Thum, *The Bank's Assistance to China's Energy Sector* 1–2 (The World Bank Operations Evaluation Dep't, No. 32898, 2005), *available at* http://lnweb90.worldbank.org/oed/oeddoclib.nsf/DocUNIDViewForJavaSearch/8353511BC9753A1185256FF00058E8CB/$file/china_cae_energy.pdf.

[47] *Id.* at 2.

[48] *See generally* Jaccard, *supra* note 30.

possible for regulated (low) bus fares, unaccompanied by offsetting municipal budget transfers to the bus company, to prevent a municipal bus service from implementing win-win options that save passengers time.[49] Co-generation opportunities in refineries—to use waste heat to generate electricity beyond the refinery's own internal needs—represent still another option falling into this third category.[50]

A fourth category of win-win options includes, simply, opportunities that are poorly analyzed. The poorly analyzed options lead to MAC curves on which the projects are not equal in caliber. Some options are exceptionally well-identified and well-prepared and deserve the title "project." Others are simply technologies that have been identified as potential alternatives to continued BAU technologies or procedures but have not been fully specified as to all their attributes and how these compare in terms of consumer acceptability. The poorly analyzed options deserve the title of "naked technologies," implying that they are less-than-project-quality. Others are better prepared and do not deserve to be called naked technologies, but they are not fully-developed projects either. Since these are neither, these deserve their own name, and the author has chosen to call them "chimera." Finally, the fourth category of intervention, that at present is seldom represented on MAC curves, is the meta-intervention that consists of a fully-developed project that is focused on removing some barrier to full market functioning or on adding some institution or mechanism whose absence impedes market functioning.

LESSON TWO: ENVIRONMENTS VARY AS MUCH AS 'BELIEFS' ABOUT TCE

Countries are different in many ways: physically, climate-wise, culturally, etc. Additionally, their socio-economic institutions differ.[51] Thus, the continuation of the tendency in economic development circles to try to design one-size-fits-all development projects and programs is remarkable.

Physical differences can lead to institutional differences. Both physical and institutional differences imply a requirement for specificity in finding solutions to local problems. Sometimes one size fits all, but often in the economic development

---

[49] Johnson et al., *supra* note 31, at 65 (providing information from the transport section of the Mexico study); Individual Cost-Benefit Analyses, *supra* note 32 (providing the draft C/E analyses of transport sector options in the on-going Colombia study).

[50] Johnson et al., *supra* note 31, at 38 (providing information from the Mexico study in the section on "Co-Generation in PEMEX").

[51] *See* North, *supra* note 4, at 99–102 (discussing the effect of economic development on different societies); Douglass North, Econ. Historian, Wash. U., St. Louis, Nobel Prize Lecture: Economic Performance Through Time (Dec. 9, 1993) (transcript available at http://www.nobelprize.org/nobel_prizes/economics/laureates/1993/north-lecture.html).

process it does not. In economic development projects, unlike commercial bank projects, replication of the same model seldom works well.

The United States' reputed love affair with personal freedom involving big cars, spread-out living arrangements, and long drives is evidenced by its high fossil fuel and energy use in comparison to the other countries listed.[52] In Colombia, by contrast, extensive rainforests, related land-use conversion, and heavy use of hydroelectric generation (two-thirds of the overall capacity in its electric power production system) contribute to a vastly different EE/GHG profile compared not only to that of the United States, but also compared to China and Mexico.[53] Brazil appears as a caricature of the South American profile hinted by Colombia and, thus, stands in even starker contrast to the United States' GHG profile.[54] All of the countries mentioned above have played important roles in the EE and GHG studies previously conducted and mentioned herein.[55]

While the United States, Mexico, and China generate more than two-thirds of their GHG emissions from fossil fuel combustion, Colombia generates only slightly more than one-third of its GHGs from energy generation and use.[56] Meanwhile, the caricatured country, Brazil, generates only 17% of its GHGs from fossil fuel combustion.[57] These differences are highlighted in Figures 3–7, below (each drawing from a different but reasonably comparable data source).

---

[52] ENERGY INFO. ADMIN., DOE/EIA-0573 (2001), U.S. DEP'T OF ENERGY: EMISSIONS OF GREENHOUSE GASSES IN THE UNITED STATES 2001 1–12 (2002) [hereinafter DOE EMISSIONS STUDY].

[53] IDEAM, Comunicaciones Nacionales (reported in Dec. 2011, but exact reference date is not known by the author).

[54] Carlos Clemente Cerri et al., *Brazilian Greenhouse Gas Emissions: The Importance of Agriculture and Livestock*, 66 SCI. AGRIC., no. 6, 2009, at 831, 840 (rounding figures up accordingly).

[55] These countries have played a vital role in those studies; especially when one includes the work on the book by Robert Taylor et al. *See generally* TAYLOR ET AL., *supra* note 24.

[56] *See* Jaccard, *supra* note 30, at 2 (reporting that "[t]he global energy system is over 80% dependent on fossil fuels . . ."). Specific percentages for the United States, Mexico, China, and Colombia are 82%, 70%, 68%, and 37%, respectively. For data sources, see *infra* Figs. 3–7 and related notes.

[57] Cerri et al., *supra* note 54, at 831, 840.

Figure 3. USA Sources of GHG Emissions[58]

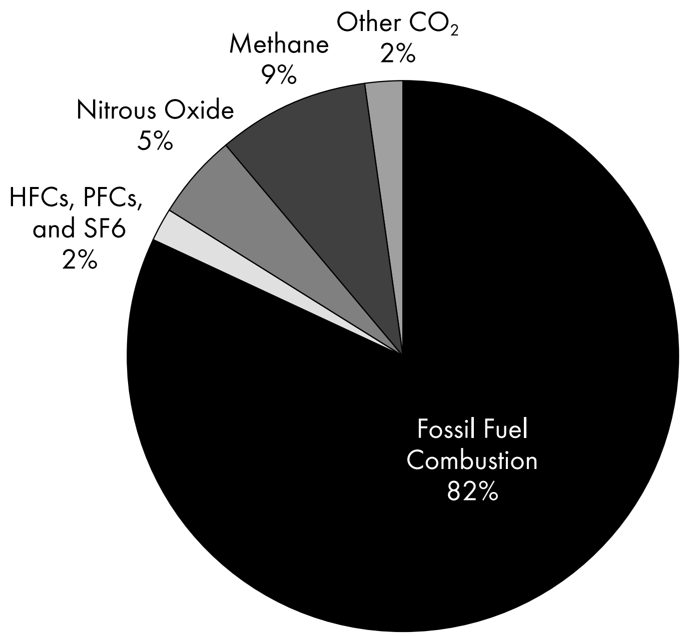
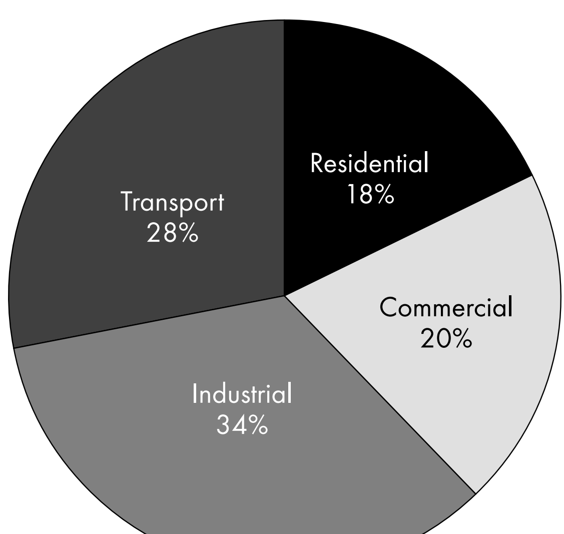


Figure 3A. USA GHG Sources by Sector[59]



[58] DOE EMISSIONS STUDY, *supra* note 52 (rounding values up or down accordingly).

[59] *Id.*

Figure 4. Mexico Sources of GHG Emissions[60]

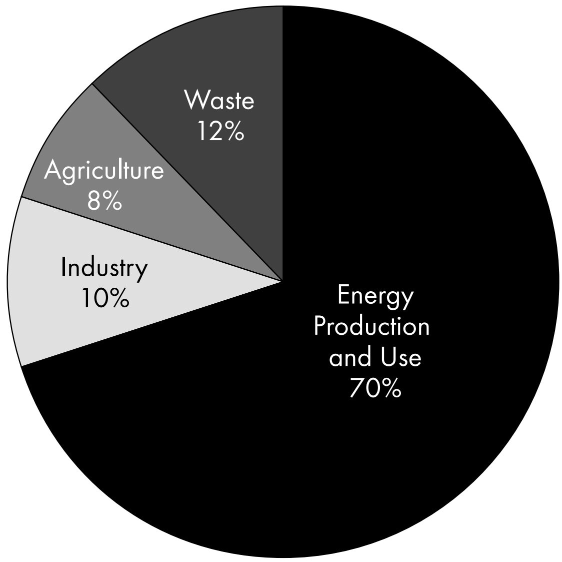
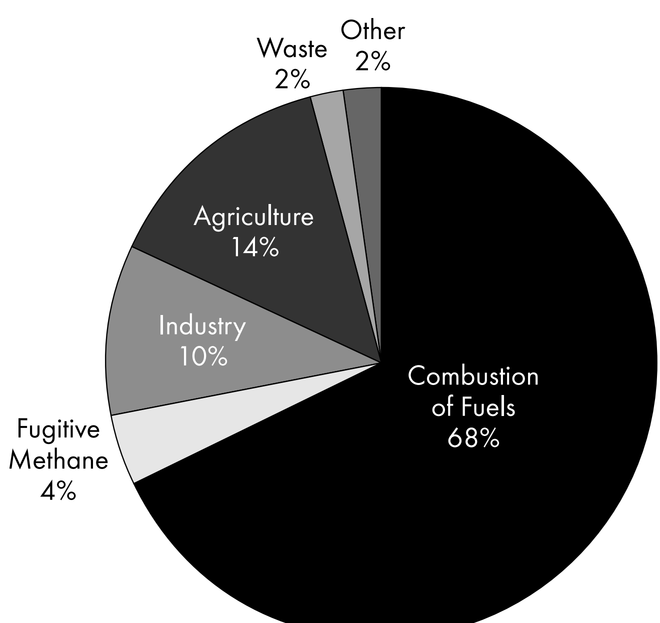


Figure 5. China Sources of GHG Emissions (2005)[61]



[60] José Luis Luege Tamago [Sec. Env't. & Nat. Resources] et al., *National Greenhouse Gas Inventory 1990–2002* (Report of Mexico: Executive Summary).

[61] IDEAM, Comunicaciones Nacionales, Presentation by Departmento Nacional de Planeacion (Sept. 26, 2011), *in* Colombia Low Emission Development Strategy.

Figure 6. Colombia Sources of GHG Emissions[62]

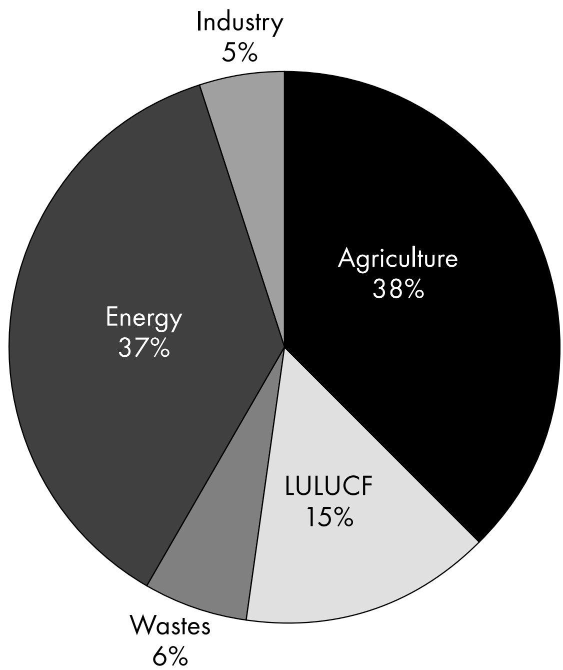
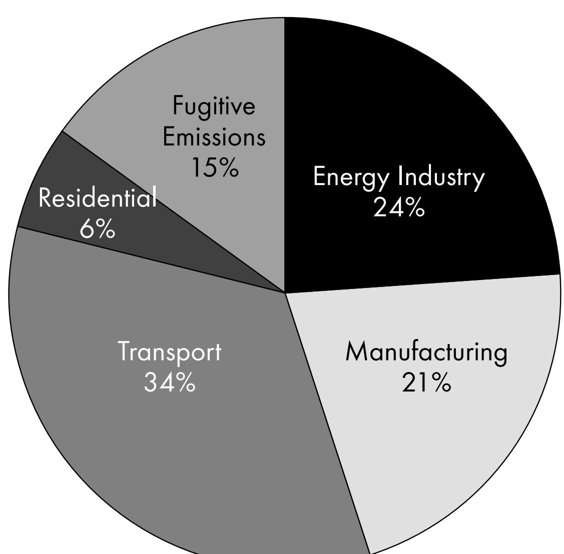


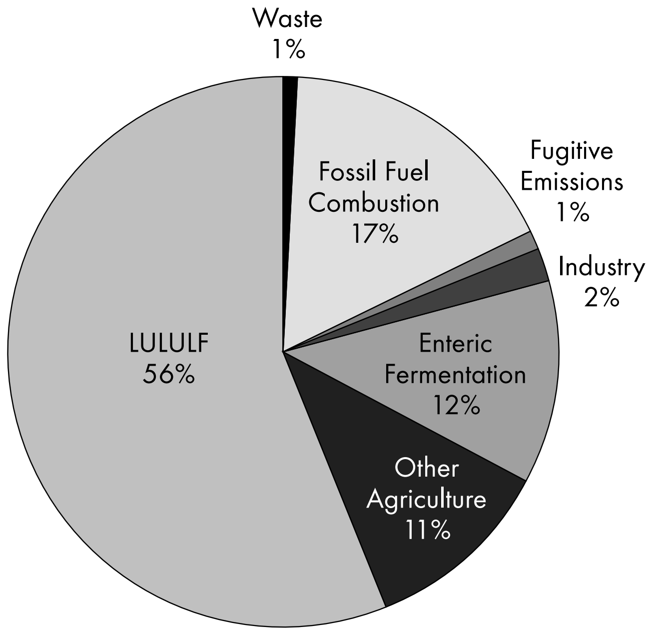
Figure 6A. Colombia Distribution of "Energy" Source of GHGs[63]



[62] *Id.*

[63] Cerri et al., *supra* note 54, at 831, 840 (rounding values up or down accordingly); Jane A. Leggett, Jeffrey Logan, & Anna Mackey, CONG. RESEARCH SERV., RL34659, China's Greenhouse Gas Emissions and Mitigation Policies (2008) (using data provided to CRS by U.S. IEA and rounding values up or down accordingly).

Figure 7. Brazil Sources of GHG Emissions (2005) [64]



N.B.: LULUCF stands for land use, land-use change, and forestry.

The cogent points in this section relate to: (1) the differing sources of the GHGs from country-to-country, with energy playing a large but dissimilar role in each case; and (2) the differing sources of the energy itself—with fossil fuels playing a large role in United States electric power but only a minor role in Colombia electric power, for example.[65]

Land use, land-use conversion, and forestry (LULUCF) and agriculture uses account for approximately 52% of GHG emissions in Colombia, where rain forest destruction, inefficient agricultural production, and methane-emitting livestock (primarily enteric fermentation from cattle) constitute the basic sources of GHG emissions.[66] In Mexico and China, the LULUCF and agriculture sources account for less than 15% of GHG emissions, and in the United States they are not mentioned in the main accounting.[67] The figure for Brazil (keeper of

[64] Cerri et al., *supra* note 54, at 831, 840 (rounding values up or down accordingly); Leggett, Logan, & Mackey, *supra* note 63.

[65] France (not discussed here) gets 80% of her electric power from nuclear.

[66] *See supra* Figs. 3–7.

[67] *Id.*

the largest segment of the Amazon rain forests) shows that almost 80% of its GHG emissions come from the non-energy combination of LULUCF (56%), agriculture other than livestock (11%), and livestock (12%, primarily enteric fermentation). Meanwhile, only 17% of Brazil's GHG emissions come from fossil fuel combustion.[68]

Juxtaposing Colombia's 37% (and caricaturing Brazil's 17%) against the United States' 82% fossil fuel combustion figure for GHG sources highlights the country-by-country differences of Lesson Two. Thus, in spite of the large role played in South America, Africa, and India by agriculture, forestry and LULUCF,[69] the U.S. Energy Information Administration can nevertheless confidently report that "[d]uring the past [twenty] years, about three-quarters of human-made carbon dioxide emissions [globally] were from burning fossil fuels."[70]

The foregoing discussion[71] reveals that the GHG issue is divisible into three segments. Segment one addresses energy-related GHG emissions and the role played by both production[72] and consumption[73]—with the latter commonly (but not always) providing most of the emissions. Segment two addresses land-use conversion and forest destruction, particularly in the tropics where LULUCF tends to dominate the GHG emissions. Segment three addresses a mixture of other GHG sources and possible fixes.[74] Segment three elements dominate in no single country but are present everywhere. Even within the energy-related sources of GHGs,[75] there is great variety both within and between countries.[76]

---

[68] *See* Cerri et al., *supra* note 54, at 831.

[69] This led their representatives at the November–December 2011 U.N. Conference on Climate Change in Durban, South Africa, to object strenuously to inclusion of agriculture in climate change discussions. Interview with Todd M. Johnson, Lead Energy Specialist for Latin America and Caribbean, World Bank (Jan. 10, 2012).

[70] *Greenhouse Gasses, Climate Change and Energy*, U.S. ENERGY INFO. ADMIN., http://www.eia.gov/oiaf/1605/ggccebro/chapter1.html (last visited Apr. 5, 2012).

[71] These examples are sufficient to make the points made in this article, without lengthening the discussion with complementary studies and analyses conducted by the author.

[72] This includes the extraction, transportation, and conversion processes.

[73] This includes the use of energy for household heating and cooling, transportation fuels, and industrial fuels and feedstocks.

[74] This category incudes, for example, fugitive emissions from gas-line leaks and methane production by solid waste landfills.

[75] Energy-related sources are already agreed to constitute 75% of total GHG emissions.

[76] A major thesis of this article is that variation within the Americas alone is sufficient to establish the central point being made here. Note that comparisons of GHG sources in the Americas with those in Africa add new dimensions to the illustration of variety. *See, e.g.*, Ivan Tomaselli, *Forests and Energy in Developing Countries*, (Food and Agriculture Organization of the United Nations (FAO), Working Paper No. 2, 2007), *available at* http://www.fao.org/forestry/13444-0874bf0443b27425a28a3a2f706ad5362.pdf.

Variety can increase the conceptual and practical difficulties associated with externalities[77] and, thus, with one of the more misused and misunderstood concepts in economics: the economics of transaction costs (TCE).[78] Transaction costs are accused of not only causing or complicating the problem of externalities, but also of affecting the vision of those who would seek to attack such perceived problems. The remaining task is to find, within the vastly differing environments described above, creative ways to combine deeper understanding of NIE and TCE with the very specific organizational and institutional knowledge that results from diversity as those factors relate to individual markets for energy and for non-energy products that produce GHG externalities as co-products. Again, the central theme of this article is that using combinations of knowledge and creativity to identify and define meta-interventions needs to play a much bigger role in LEDS planning and in developing the resulting MAC portfolios. These meta-interventions commonly will be designed to create markets or to make existing markets work better.

LESSON THREE: TRUE AND FALSE WIN-WINS HAVE LOGICAL EXPLANATIONS

The distinction between naked technologies, chimera, true projects, and meta-interventions explains some of the no regrets options that commonly appear on MAC curves alongside the low-cost, mid-cost, and high-cost options for GHG abatement. For example, some of the no regrets options on the MAC curves are simply technologies (such as co-generation with waste heat from industry). They will not be adopted (or will be limited to electricity generation for intra-plant use by industry) until associated projects or other interventions such as net metering practices by electric power companies or (model) power purchase agreements (PPAs) are developed and implemented. Net metering regulations, model-power purchase agreements, and investments in grid technologies that allow co-generated power to feed into the grid represent excellent examples of the meta-interventions discussed in this article.

The potential candidates for the category of technologies that are not yet projects can be identified from Figures 1 and 2. In Figure 1 (Mexico), the candidates are non-motorized transport (e.g., bicycles), road freight logistics, co-generation in Pemex (Petróleos Mexicanos),[79] residential lighting,

---

[77] Defined long ago by A. C. Pigou as "a divergence between private and social costs." *See generally* PIGOU, *supra* note 11.

[78] *See* Carl J. Dahlman, *The Problem of Externality*, 22 J.L. & ECON. 141, 141–42 (1979) (describing the effect of externalities upon transaction costs).

[79] Petroleum refining creates waste heat, part of which is recycled internally for other uses in the refinery. Also, oil wells often release associated gas that could be used in electricity generation rather than being flared. Regulations prohibiting Pemex from selling electricity not used internally contribute to energy inefficiency and foregone opportunities to reduce GHG emissions elsewhere in the electricity system. *See* Johnson et al., *supra* note 31.

non-residential lighting, charcoal production, industrial motors, zero-tillage maize, co-generation in industry, solar water-heating, forest management, non-residential air conditioning, residential refrigeration, gas leakage reduction, residential air conditioning, bio-mass electricity generation, and improved cook stoves. In Figure 2 (McKinsey, global), the candidates are building insulation, fuel efficiency in commercial vehicles, lighting systems, air-conditioning, water heating, and industrial non-CO_2.

In some cases, the project (intervention) to get a technology widely adopted may be nothing more than simple information campaigns, as suggested by Ostertag in her study of high-efficiency electric motors:

> Causes that explain the persistence of the idle profitable HEM [high-efficiency electric motors] investment opportunity relate to information deficiencies which lead to a collapse of the high quality (efficiency) end of the motor market. The problem lies in quality ignorance and ambiguous energy efficiency indications as well as the problem of ignorance of utility, i.e. of the energy (cost) savings. The problems are such that autonomous market solutions necessarily fail, e.g. because HEM qualify as confidence goods impeding the building up of a good reputation.[80]

Other interventions shown on MAC curves clearly are technologies that are superior in fuel efficiency or in GHG efficiency (only) for the simple reason that the sector analysts have failed to identify options that either meet or exceed all of the other objectives being pursued simultaneously by the user of the technology.[81]

Development of the zero-tillage maize option from Figure 1 provides an instructive example regarding the inclusion of all costs. The LULUCF group in Mexico asked how to handle the fact that zero-tillage involved tractor services, while many of the maize farms were too small to justify or afford tractors dedicated to that farm alone. A basic principle was needed in order to avoid chimera in which project costs were being ignored. The principle that was developed involved estimating the costs that would be present no matter how such services were to be

---

[80] Katrin Ostertag, *Re-Assessing No-Regret Potentials-The Example of High Efficiency Electric Motors* 315 (Fraunhofer Institute for Systems and Innovation Research, 2001), *available at* http://www.eceee.org/conference_proceedings/eceee/2001/Panel_2/p2_3/paper.

[81] The forthcoming book by Ward, Taylor, and Johnson discusses these "other" objectives as having dimensions that include: (1) quantity, (2) quality, and (3) temporal aspects. *See* WARD, TAYLOR, & JOHNSON, *supra* note 7. The forthcoming book points out that correct use of cost-effectiveness analysis requires that any option (technology) that is to be included in the MAC analysis must either meet or exceed all of the foregoing dimensions in comparison with the counterfactual or BAU technology. Alternatively, any divergences (shortages) between the option and the counterfactual within these dimensions may be valued as a co-benefit (co-cost) and combined with the direct cost difference to determine a net cost to go into the bottom of the respective C/E ratio.

performed. In the tractor services application, this involved first calculating the levelized costs (including profit at the opportunity cost of capital) and, secondly, making sure that costs were included in the zero-tillage maize option. In fact, the full project design to achieve widespread adoption of zero-tillage maize technology will eventually include other costs as well. Moreover, it might include other interventions. These might be follow-on projects to eliminate market barriers and market failures standing between zero-tillage and current maize-growing practices in Mexico. That matrix of potential interventions is what constitutes meta.

CONCLUSION: META-INTERVENTIONS ARE A GREAT IDEA, BUT NOT EASY WORK

Meta-interventions focus on the social-economic-institutional environments in which individuals make technological choices and market decisions. Sometimes, a meta-intervention is a single-stage activity (project, program, policy) that repairs a single policy failure, market barrier, or market failure: for example, changing the policy or law that prevents Pemex (Petróleos Mexicanos) from being in the electricity supply business.

At other times, a meta-intervention constitutes a multi-project, multi-year process. For example, overcoming the conflagration of market barriers and market failures that prevented ESCOs from existing in China has taken nearly twenty years following the 1992–1994 China Study.[82]

Success in creating an ESCO industry in China involved not just one intervention but, rather, a long list of projects and institutional interventions ranging from: (1) the emergence of model contracts[83] for energy performance contracting; to (2) finding creative ways to assure contract fulfillment/enforcement in the presence of a weak court system; and to (3) creating lines of bank credit for ESCOs upon which to draw in the absence of well-developed capital markets.[84]

---

[82] Interview with Robert P. Taylor, Former Senior Energy Economist, The World Bank (Jan. 15, 2012). Mr. Taylor is widely recognized as world's leading non-Chinese expert on energy issues in China.

[83] Interestingly, the China ESCO performance contracts tend to be ten to fifteen pages in average length compared to United States ESCO performance contracts that average about sixty pages in length. Some, but not all, of the difference in numbers of pages is explained by the average forty percent shrinkage that occurs in moving from English language concepts in Latin script to Chinese language concepts recorded in Chinese pictographs.

[84] Many of the ESCOs to emerge from the second energy crisis in the USA and Canada developed the capability to re-liquify themselves after each round of energy audits and related project contracts by then securitizing the resulting performance contracts and selling them into the well-developed capital markets of the United States. China does not yet have well-developed capital markets; therefore, ESCO financing still must come via credit lines in the financial market.

Other meta-projects (a sub-set of meta-interventions) that were involved in developing the China ESCO industry included activities such as finding experts from the United States-Canada experiences of the 1980s, and designing training materials and training activities based on their experience and expertise.

Clearly, some of the above work that identified and designed meta-interventions will benefit from lawyers who understand both NIE and business practices and who can put into place legal infrastructure to make markets work. The common law system is derived from the belief that formal institutions of law should stand on the shoulders of informal institutions of history and culture, and accordingly, every institutional environment will be different. To improve the functioning of markets in a particular environment, not only must these meta-intervention analysts possess knowledge across a broad front of law, economics, and business, but these persons will also require extensive knowledge of local history, and local formal and informal institutions. In addition to these requirements, only the creative among the best educated will prove adept in productively applying the foregoing, rare combination of knowledge and ability. Finding and educating such a cadre is a worthy challenge to be assumed by the legal profession.