IDENTIFY: IMPROVING INDUSTRIAL ENERGY EFFICIENCY AND MITIGATING GLOBAL CLIMATE CHANGE

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The use of energy in the industrial sectors of nations with both industrialized and developing economies will continue to be, a major source of greenhouse gas (GHG) emissions, particularly carbon dioxide. The patterns of industrial-sector energy use—energy provided primarily by the combustion of fossil fuels—have shifted both within and between countries in recent decades. Projections of future energy use and carbon-dioxide (CO_2) emissions suggest continued shifts in these patterns, as industrial production in developed countries stabilizes and declines, while industrial output in the developing world continues to expand.

This expansion of industrial-sector activity and CO_2 emissions in developing countries presents both a *challenge* and an *opportunity*. The challenge is to reduce global GHG emissions without denying developing countries the benefits of economic development. The opportunity is to use the substantial potential for improvements in industrial energy efficiency, particularly in the developing world, as a vehicle (though certainly not the only one) to allow and even spur economic development while helping to mitigate the environmental impacts of industrial energy use.

To seize this opportunity and contribute to international efforts to mitigate global climate change, the United Nations Industrial Development Organization (UNIDO) recently initiated a two-phase effort to help improve the efficiency of energy-intensive industries (iron and steel, chemicals, refining, paper and pulp, and cement) in developing countries. As part of the Phase 1, we reviewed industrial sector scenarios and to initiated development of a software-based toolkit for identifying and assessing GHG mitigating technologies. This toolkit, called IDENTIFY, is comprised of a technology inventory and a companion economic analysis tool. In addition, UNIDO commissioned institutions in India, South Africa, and Argentina[1] to review energy use patterns and savings opportunities in selected industries across nine developing countries, and contribute to the development of the IDENTIFY toolkit. UNIDO is now preparing to launch Phase 2, which will focus on full development and dissemination of the IDENTIFY toolkit through seminars and case studies around the world.

This paper describes Phase 1 of the UNIDO project. We begin with a brief overview of current and projected energy use and carbon emission patterns across the industrial sectors of industrialized, developing, and transitional (Eastern Eŭrope and former Soviet Union) economies. Second, we discuss some illustrative analyses that suggest the scale of opportunities to improving energy efficiency in selected developing countries. We then describe the current structure and features of the prototype IDENTIFY toolkit. Finally, we touch on likely directions for Phase 2 of the UNIDO initiative.

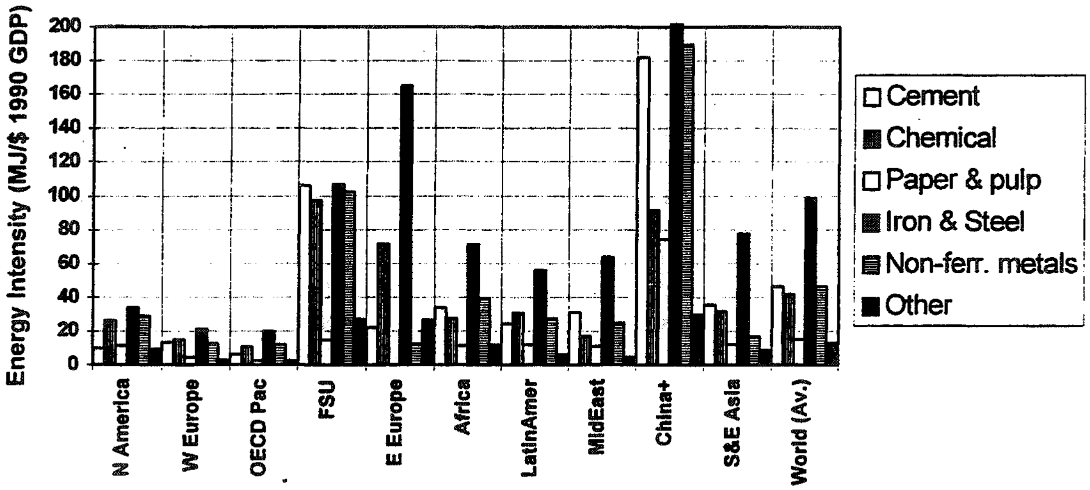
INDUSTRIAL GREENHOUSE-GAS EMISSIONS FROM DEVELOPING COUNTRIES

In 1990, the industrial sector accounted for approximately 35 percent of global economic activity (measured as GDP—SEI-B, 1995), roughly 44 percent of global primary energy demand (WEC, 1995), and a similar percentage of carbon-dioxide emissions. The same year, the Organization for Economic Co-operation and Development (OECD) member countries and the transitional economies accounted for about three-quarters of the world's industrial energy use. Five sub-sectors—iron and steel, chemicals, petroleum refining, pulp and

[1] IDEE/Bariloche Foundation, Argentina (Daniel Bouille), Tata Energy Research Institute, India (Pradeep Dadich), and Energy Research Institute, South Africa (Mark de Villiers).

paper, and cement—are the most energy-intensive, using sizable shares of the sector's overall energy demand at the global, regional, and, usually, national levels (World Energy Council, 1995). As Figure 1 indicates, there is substantial room for reducing the energy intensities of these industries in developing and transition economies (especially China), through investments in retrofits—installing energy-efficient technologies and applying know-how. This is true even taking into account variations in the quality of domestic fuels and in the profitability of the commodities produced by each sub-sector. Lack of access to capital is a clear barrier to such investments in most of these countries.

Figure 1: Industrial Energy Intensity By Sub-sector, 1990

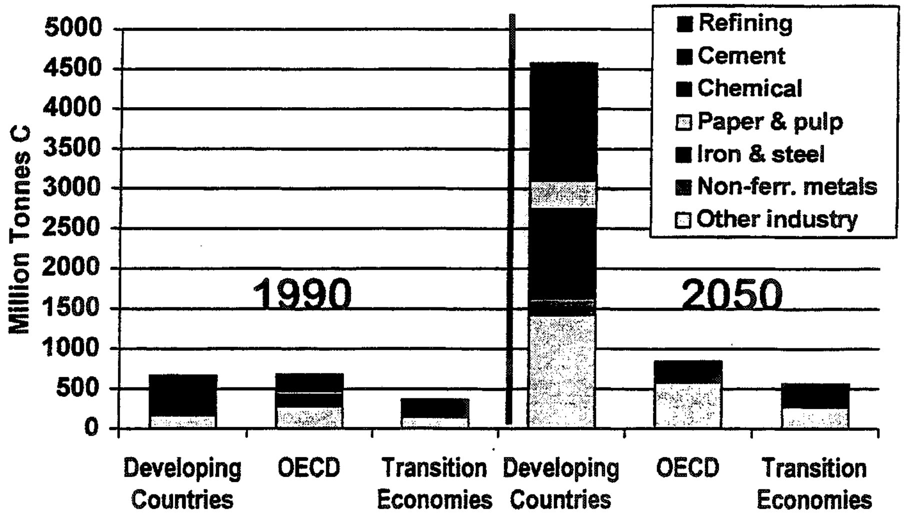


Opportunities for investment in more energy efficient and lower GHG emitting technologies are likely to increase greatly in the next two decades, as new productive capacity is needed in developing nations and as international efforts to mitigate emissions (such as joint implementation or Global Environmental Facility support) continue to develop. The scenarios of the Intergovernmental Panel on Climate Change (IPCC) show the geographical distribution of industrial energy use changing markedly in the future, with developing nations responsible for over 40 percent of global industrial-sector energy demand by 2020, and about 60 percent by 2050. In Raskin and Margolis' (SEI-B, 1995) Conventional Development Scenario (CDS), the developing-country dominance of industrial-sector energy use is even more complete, reaching nearly 70 percent of global use by 2050.[2]

Although energy is used in the industrial sector to produce and manufacture a vast array of materials and products, there are a few major sub-sectors that can be singled out as using sizable shares of the sector's overall energy demand at the global, regional, and, usually, national levels. The World Energy Council (WEC, 1995) lists five sub-sectors in particular—iron and steel, chemicals, petroleum refining, pulp and paper, and cement—as being the five most energy-intensive, accounting for about 45 percent of total world industrial primary energy use in 1990. Together with the non-ferrous metals sector, these industries are the major contributors to energy-related carbon dioxide emissions, as illustrated in Figure 2 below.

[2] For a fuller description of the CDS and IPCC scenarios, and their assumptions and methodology, see Raskin and Margolis (1995) and IPCC (1992). The IPCC example cited here is scenario IS92a. The CDS is built on the same macro-level assumptions (GDP and population growth) as the IPCC scenario, but embodies a more detailed and disaggregated analysis of energy demand. The CDS scenario projects that developing countries, as per capita income increases, will follow a similar path in materials use and energy intensity change by subsector. This path reflects a rapid increase in activity, followed by reduction in energy intensity (per unit GDP), and saturation of material demands. A similar "convergence paradigm" is also utilized in Lazarus et al., 1993.

Figure 2: Current and Projected Industrial CO_2 Emissions from Energy Use (Conventional Development Scenario, SEI-B, 1995)



Source SEI-B, 1995

Figure 2 illustrates that conventional development patterns—population and economic growth assumptions from IPCC (1992) combined with a continuation and extension of industrialized country lifestyles and patterns of production and consumption—could lead to a seven-fold increase in carbon emissions by the year 2050 from 1990 levels. Under such a scenario, industrial-sector CO_2 emissions from the developing nations would increase to over three-fourths of the global total, with emissions from a single sub-sector—iron and steel—nearly equaling the total industrial CO_2 emissions from the OECD and transition economy nations combined.

The Conventional Development Scenario shown in Figure 2 reflects a shift in energy- and emissions-intensive industries (including iron and steel, cement, paper and pulp, chemicals, and oil refining) from the OECD to the currently developing world. In OECD countries the industrial subsector with the highest emissions by 2050 is "other industries," reflecting a shift in industrial production in developed nations away from traditional "smokestack" industries and toward high-technology industries, such as electronics and biotechnology.

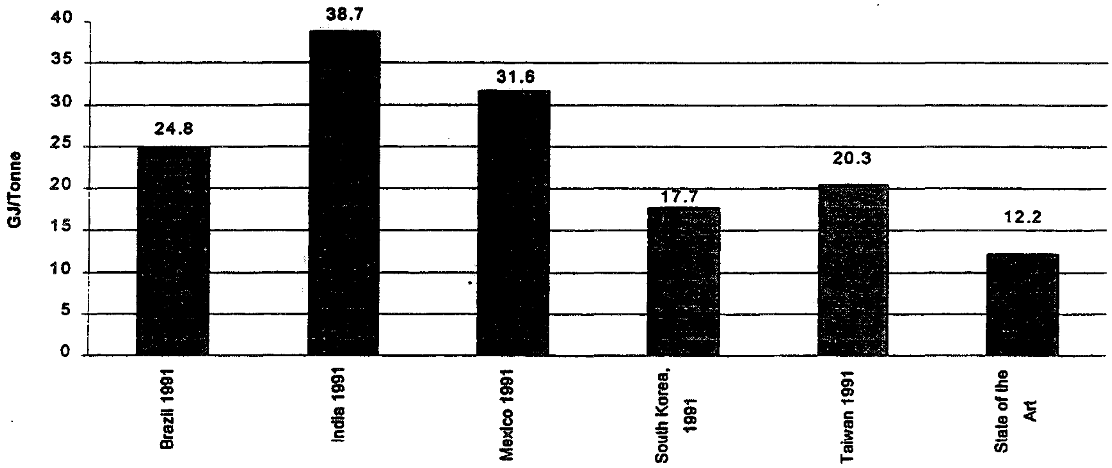
These shifts in emission patterns reflect the interplay of two dynamics.[3] First, the integration of the global economy facilitates the relocation of industrial production to developing countries where labor costs are far lower. Second, the demand for energy-intensive materials (e.g. steel and cement) needed for infrastructure development and production of many consumer goods (cars, refrigerators, etc.) increases rapidly on a per capita basis during the industrialization process, and then levels off, as demand is saturated (Williams, Larson, and Ross, 1987). During the 1980s for example, crude steel production nearly doubled in China and increased markedly in India as well. In contrast, annual steel production in Japan was stagnant during the decade, and production in the United States declined by about one quarter. A similar pattern of shifting production occurred during the 1980s in the cement industry. Cement production in China and India nearly tripled during the decade, almost doubling their share of global output, while production in Japan and the United States were primarily in modest decline, with the share of world production from those two countries falling by over 20 percent.

[3] For a detailed discussion of the dynamics of shifting energy use patterns, see Schipper and Meyers, 1992.

OPPORTUNITIES FOR INVESTMENTS IN INDUSTRIAL ENERGY EFFICIENCY IN DEVELOPING COUNTRIES

Under business-as-usual assumptions (no major interventions), growth in carbon emissions from industrial energy use, are likely to be very robust, and centered almost entirely in developing nations. As a consequence, if future global greenhouse-gas emissions are to be significantly reduced, the investment opportunities that would ensure efficient industrial energy use and the use of renewable fuels in developing economies need to be captured. Depending on the technologies adopted, there is a wide variation in the amount of energy that could be required to meet the needs for industrial output from new industrial plants. This range is illustrated with examples of energy intensity for steel production in several countries and for the best current practice ("State of the Art") in Figure 3. The energy efficiency of the new plants will in large part determine the level of industrial-sector carbon emissions for many years to come.

Figure 3: Process Energy Use for Steel Production. National Averages Compared to State of the Art[4]



Examples of the potential to apply industrial energy-efficiency options are described in the results of initial GHG mitigation analyses for a number of developing nations performed under the auspices of the UNEP/RISØ GHG Abatement Studies. In these studies, abatement scenarios were used to explore industrial CO_2 emission-reduction potentials through efficiency improvements and fuel-switching measures. Although they represent only initial, incomplete surveys of industrial-sector CO_2 abatement options, the potentials identified represent substantial fractions of reference-case industrial emissions: 47% for Brazil, 47% for Egypt, 56% for India, 25% for Venezuela and 79% for Zimbabwe (UCCEE, 1994). In a separate study on energy efficiency opportunities in North Korea, von Hippel and Hayes (1995) estimated that industrial boiler and furnace improvements *alone* could save about 12 percent of the nation's annual output of coal, compared to 1990 production levels, with a savings in carbon-dioxide emissions of about 15 millions tonnes per year.

Achieving energy-efficiency improvements in existing plants will require both the application of know-how, in the form of better procedures and management schemes, and new technologies and fuels. Improvements can be achieved relatively quickly through better management practices. While such changes involve little to no technology investments, the transaction costs associated with making them happen may represent opportunities for high-payback joint implementation (JI) investments.

A survey of 304 industries in India revealed the savings potentials shown in Table 1. Opportunities for reducing energy intensities in small and medium-sized industrial firms in Brazil have been identified through audits by the National Technological University in a program entitled, "Optimization of the Rational Use of Energy" (RUE). According to the assessment made under this program, the total annual energy consumption in the 543 firms audited was 409 Mtoe/year. The technically-feasible savings identified was 49 Mtoe per year, or

[4] Data shown in this figure are derived from the Technology Inventory produced as a part of this project.

12% of the total energy used. Table 2 shows the breakdown of potential savings by measure. This assessment found that 50 percent of the potential savings would require technology investments while 50 percent could be achieved through "house keeping."

Table 1: Energy Saving Potential in Indian Industries (% of total energy consumption)

Industry	Without significant investment (%)	With significant investment (%)	Total (%)
Foundries	15	10	25
Aluminum	8	2	10
Cement	4	4	8
Fertilizer	12	2	14
Paper	6	12	18
Glass	5	5	10
Textiles	10	5	15

Source: Proceedings of the conference on energy savings in industry organized by FICCI, Bombay, India (1988).

Table 2: Energy-savings Potential in Small and Medium-size Brazilian Industries

Energy Efficiency Measure	TOE per Year Savings	Percentage of Total Savings
Boiler combustion	22302	46
Furnace combustion	3753	8
Insulation	8084	17
Use of steam	3267	7
Use of condensates	2497	5
Energy recovery	5987	12
Process	356	1
Lighting	390	1
Electricity	623	1
Energy management	1375	3
Fuel substitution	166	0
TOTAL	48945	

THE ROLE OF IDENTIFY

The UNIDO Industrial Development Energy Technology Investment Framework (IDENTIFY) toolkit can play a significant role in catalyzing energy efficiency and GHG reduction by assisting in the identification and comparison of industrial investment opportunities. As many previous studies have pointed out, developing countries require access to specific information describing the technological options available for harnessing efficiency and fuel-switching opportunities as well as tools to allow for their evaluation and comparison. The World Resources Institute, for example, illuminated developing countries' need for impartial information on available energy-efficient technologies in the energy chapter of their 1992-93 annual publication (WRI, 1992). The IPCC elaborated on this theme in 1996, calling for "concerted efforts to disseminate information" on GHG abatement techniques and technologies (IPCC, 1996).

The software tool IDENTIFY has been developed as a concrete effort to contribute to addressing these needs. IDENTIFY can be used to assess energy-efficiency and fuel-switching measures that can reduce fossil-fuel consumption, thereby reducing greenhouse-gas emissions and, in many cases, providing overall economic benefits as well. The package consists of an **Analysis Tool** and an **Industrial Technology Inventory**, each designed to complement the other but be useable, if desired, on a stand-alone basis. Together they are designed to answer two principal questions:

- To what extent can improved industrial technologies and practices reduce greenhouse-gas emissions in a given developing country?
- What other impacts such as costs and non-economic benefits would result from the implementation of such measures?

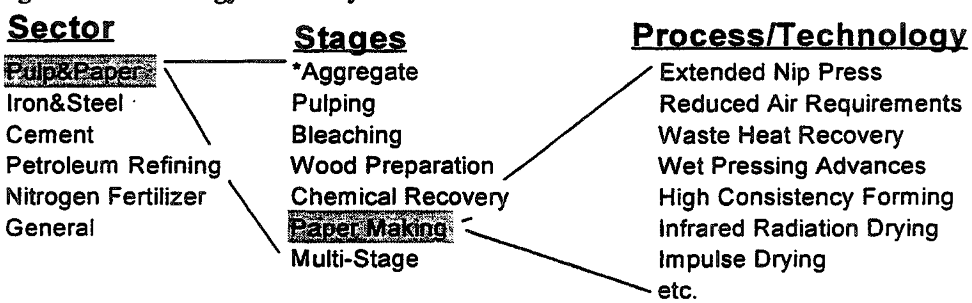
The Technology Inventory

The IDENTIFY **Technology Inventory** is a spreadsheet-based database which provides quick and easy access to information about technological options for reducing greenhouse-gas emissions in the industrial sector. It contains a wide range of efficiency and fuel-switching measures (both technologies and processes) that represent good current practice in developed countries in the selected industrial sectors. Inputs from regional experts have been used to incorporate successful developing-country experiences.

Information on greenhouse-gas mitigation options for the industrial sector can be found in a wide array of sources. Considerable research effort is often needed to collect the books, reports, and other literature that can help to identify promising technologies, to determine where they have been used, and to show the benefits that can be achieved through their application. A primary goal in creating the Inventory was to enable access to the data available from many disparate sources and to present them in a cohesive, consistent manner.

To allow for quick access to data sources, the Inventory has been structured in three hierarchical layers labeled: *Sector*, *Stage* and *Process/technology*, as shown in Figure 4. The Inventory currently spans five energy-intensive industries or "sectors." An additional sector, "general," contains cross-cutting technologies applicable across a range of industrial processes and applications, as such motor drive systems, lighting, and fuel switching. The final level in the hierarchy is labeled "Process/Technology." All data records in the Technology Inventory are specified at this level.

Figure 4: Technology Inventory Structure



The data for each sector is broken down by stages, which differ for each sector, as shown in Table 3. The "Aggregate" stage lists total energy consumption per unit of product. The "Multi-stage" classification lists technologies spanning more than one production stage, such as medium consistency processing in the pulp and paper industry.

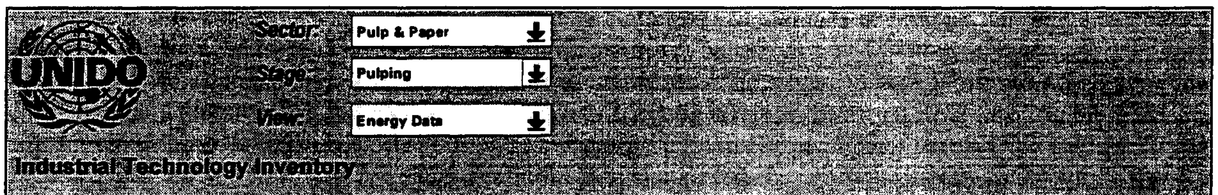
Table 3: Inventory Sectors and Stages

Sectors	Pulp & Paper	Iron & Steel	Cement	Petroleum Refining	Nitrogen Fertilizer	Aluminum	General
Stages	•Aggregate	•Aggregate	•Aggregate	•Aggregate	•Aggregate	•Aggregate	•Aggregate
	•Pulping	•Agglomerization	•Raw Material Preparation	•Separation	•Reforming	•Alumina Refining	•Fuel Switching
	•Bleaching	•Coke Making	•Clinker Production	•Conversion	•Synthesis	•Aluminum Smelting	•Cogeneration
	•Wood Preparation	•Iron Making	•Finish Grinding	•Reforming	•CO_2 Removal	•Holding, Casting, Melting	•Lighting
	•Chemical Recovery	•Steel Making		•Finishing	•Multi -Stage		•Motor Drive
	•Paper Making	•Secondary Refining					•Pumps & Fans
	•Multi-Stage	•Casting					•Other
		•Forming & Finishing					

The Inventory contains four categories of information: energy data, cost data, non-energy impacts, and references. Energy data include process energy use and estimated energy savings per unit of output. Cost data include capital costs, operation and maintenance costs, cost of saved energy, and financial indicators, such as simple payback, net present value and internal rate of return. Non-energy impacts include changes in product quality, productivity, or work environment. The database also contains references that direct the user towards important contacts and more detailed literature.

In some cases, the Inventory contains data about the specific processes within a particular stage of production. In other cases, the use of processes may not be applicable, so that data will only be available for the stage as a whole or for typical technologies (*e.g.* current, state-of-the-art, advanced, etc.). For example, some data sources may record the costs and energy use of specific machines in a steel plant, while others may simply record the total energy used in milling or other stages of production. For this reason, the Technology Inventory has been structured in a generalized fashion allowing data to be recorded either for a stage as a whole, or, if available, for more specific processes or technologies. As an example, consider the pulping stage of the pulp and paper industry. Several processes separate and treat wood or recycled paper fibers when producing pulp. These include: Kraft (chemical), mechanical, thermo-mechanical, and biological. Processes may be further classified by technology. For example, batch and continuous digesters are used within the Kraft process. Figure 5 illustrates a sample Technology Inventory entry for the pulping stage of the Pulp & Paper sector, where in 1988, the US national average for the pulping process was 10.53 GJ per ton of paper.

Figure 5: Technology Inventory Energy Data



Process/	Country &	Process	-- Net Savings --		---------- Units ----------			Plant	Reference
Technology	Year	Energy Use	Mid/Low	High	Energy	Physical	Form	Capacity	Energy Use
National Avg.	U.S., 1988	10.53			GJ per	ton paper	p		
State of the Art		3.24			GJ per	ton paper	p		1988 U.S. Average.
Advanced		3.63			GJ per	ton paper	p		1988 U.S. Average.
Chemical Kraft,National Avg.	U.S., 1988	8.30			MBtu per	ton pulp	p		

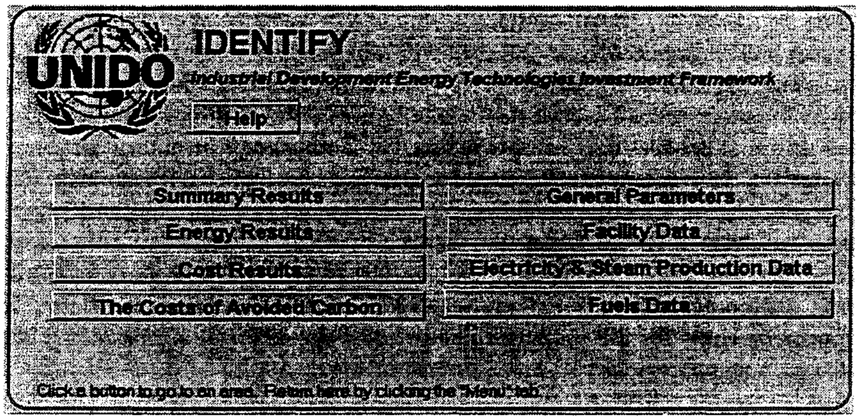
As shown here, energy data are recorded in one of two ways: (1) process energy use and (2) net savings relative to standard or reference technologies. Process energy use may be given as the absolute amount of energy used for a certain process or as a percentage of the aggregate energy use. Net savings may also be presented as an absolute energy saving or as a percent of energy used in the reference technology. Saving estimates are often presented as a range, thus we have provided "high" and "low" estimated savings fields. In cases where the source provides only one savings estimate, the entry appears under the "low" savings estimate field. Reference and Cost data are presented on separate screens, as are non-energy impacts in terms of production or emissions effects.

The Analysis Tool

The Analysis Tool provides a means for assessing the costs and benefits of industrial greenhouse-gas mitigation strategies. The tool can be useful to anyone with an interest in analyzing industrial greenhouse-gas mitigation options: government planners, researchers, NGOs, consultants or industry managers. The tool is implemented as an Excel spreadsheet, making it easy to use but also flexible and simple to adapt to different user needs and data requirements. It walks the user through the steps needed to evaluate the greenhouse-gas emissions, energy-consumption patterns and costs of different industrial technologies (including both new plants and retrofits) by performing cost-benefit analyses of energy-efficiency and fuel-switching investments.

Figure 6 shows the main menu of the Analysis tool. From here, the user specifies information about the basic physical, cost and emissions characteristics of alternative industrial-sector mitigation options, and projects how costs might change over time. The tool includes specialized calculations for the emissions produced both by on-site fuel use and by off-site generation of electricity or production of steam.

Figure 6: The Analysis Tool Menu



Two types of analysis can be carried out with the Analysis Tool: project analysis and comparative analysis. **Project Analysis** can be used to examine the economic viability and environmental benefits of a specific AIJ project under consideration. The benefits of the project, comprising the economic value of the products produced by an industrial facility (*e.g.* tonnes of cement or steel), are compared to the costs of building and operating the project. **Comparative Analysis** allows a user to compare any option to a baseline option. This type of analysis can be used to compare alternative approaches to an AIJ project, such as alternative designs for a new facility or alternative retrofits of an existing one. Benefits comprise the cost, energy and emission savings of an option relative to the baseline option. It is important to note that an option which appears favorable under a comparative analysis (for example when compared to a currently operating facility) will not necessarily appear favorable when analyzed using the project analysis described above.

The Analysis Tool projects costs over a 30 year period in order to calculate a range of standard indicators such as the net present value, internal rate of return, and simple payback period for investments. It also calculates key mitigation analysis results including annual avoided carbon emissions, the costs of saved carbon (or benefits, in the case of "no regrets" options), and the cost of saved energy. The spreadsheet reports additional key indicators useful in determining local and global benefits, and identifying financing needs, where needed, to pay for incremental costs. In addition, it displays a range of more detailed reports and graphics including the types of fuels used by each option and the breakdown of costs (capital, operating and maintenance, fuel costs, administration, etc.) for each option. Carbon externality costs can be included in the analysis by simply entering a cost per tonne of carbon emitted, and then clicking on a check box to include this cost in the calculations.

Figure 7 shows a typical graph generated by the tool for an illustrative analysis of a cement plant. It shows the costs of the existing baseline facility versus two potential mitigation scenarios. The first, labeled "Short Term" consists of relatively inexpensive energy-efficiency options with modest capital costs that lead mainly to savings in fuel use (and hence to reduced carbon emissions). The second option, labeled "+ Fuel Switch" goes one step further, by including the short term options and adding in the savings from switching away from the use of coal to a less carbon-intensive and more energy-efficient fuel: natural gas. This option has higher capital costs and leads to further savings in fuel and externality costs.

Figure 7: Option Costs

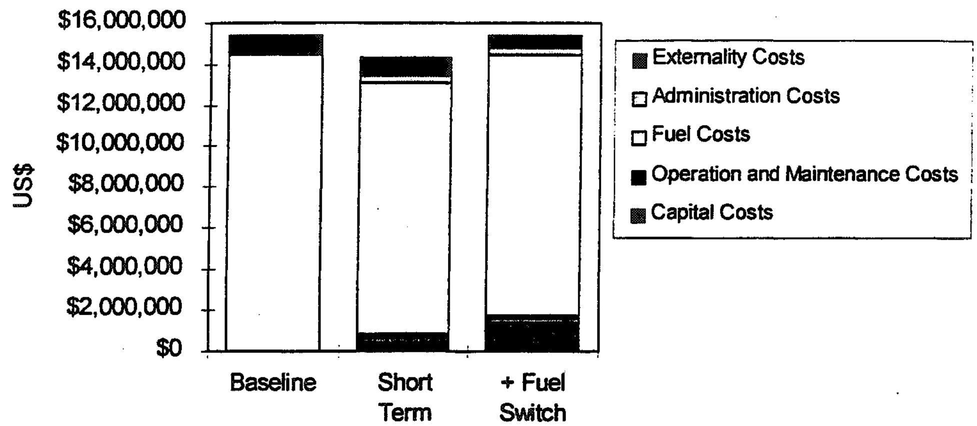


Figure 8 summarizes the major results of a *comparative* analysis for the example described above. The existing facility (the baseline option) is not listed because the analysis is based on comparing each option to the costs of the existing facility. The first option can be labeled a "no regrets" mitigation strategy since it leads to carbon emissions savings (265 tonnes per year), and has a positive net present value. On the other hand, the second set of options labeled '+ Fuel switch' lead to a negative NPV (shown on-screen in red and in parentheses). The IRR for this option is only 3.96%—less than the discount rate of 5%, which was set for the analysis.

Figure 8: Comparative Analysis Results Summary

Discount Rate: 5.00%

Carbon Externality Cost: $30.0 1995 US$/tonne Carbon

☐ Include Externality Cost?

Comparative Analysis (Option-Baseline)

(benefits comprise the cost, energy and emission savings relative to the baseline)

	Unit	Baseline	Short Term	Fuel Switch
Net Present Value (NPV)	Discounted 1995 US$ (thousands)		$991	($328)
Internal Rate of Return (IRR)	%		14.63%	3.96%
Simple Payback Period	years		8	23
Annual Carbon Emissions Avoided	tonnes C/year		271	818
Annual Energy Savings	GJ/year		14,160	21,160
Levelized Cost of Avoided Carbon	Discounted 1995 US$/tonne C		(121.98)	13.37
Levelized Cost of Saved Energy	Discounted 1995 US$/GJ		$2.83	$3.31

Many options may be considered worthwhile, even with negative NPVs, if they lead to significant and cost-effective carbon mitigation. The Analysis tools allows users to assess the cost-effectiveness of these options by specifying a carbon externality value or *carbon shadow price* (perhaps representing the damage cost associated with the emission, or the willingness of society to pay for reduced carbon emissions).

FUTURE DEVELOPMENTS

The Identify software presently consists of working prototypes of a database inventory of industrial sector greenhouse gas mitigation technologies and a linked analysis framework. UNIDO is presently seeking support for Phase 2 of the IDENTIFY initiative. The objectives of Phase 2 will be:

- to **advance development** of the Analysis Tool to allow for aggregation of plant-level results to the sub-sector and national levels. The Analysis Tool allows for rapid assessment of technological options at the specific plant level, but requires the expertise of an energy analyst to run and does not provide functions for aggregating plant-level analysis to the sub-sectoral or national levels.
- to **expand** the data available in the existing Technology Inventory, thereby creating a comprehensive source of information on energy-efficient industrial technologies. The Technology Inventory currently includes over 300 specific measures, but is not comprehensive. At present, the data cover a limited range of measures for the iron & steel, pulp & paper and cement industries, as well as some measures for the fertilizer and refining industries. As does the current version, the **expanded Inventory** will contain information on the energy use, costs, and GHG emissions associated with selected industrial-sector technologies and practices. State-of-the-art technologies as well as best practices as documented both industrialized and developing countries will be included. Information on technology transfer issues will be included where possible. The expanded inventory will cover seven energy- and emissions-intensive industrial sub-sectors (iron & steel, building materials, non-ferrous metals, pulp & paper, refining, chemicals, and food processing & tobacco), as well as important cross-cutting end-uses and technologies such as lighting, combined heat and power, and motor drives. It will also be designed to allow for linkages to other databases and user-provided information.
- to **link and fully integrate** the Analysis Tool and the Industrial Technology Inventory into one software package which moves beyond the limitations of simple spreadsheets and provides on-line guidance, assisting the user in the analytical process. The new **advanced** version of the **Analysis Tool** will provide direct links to the data contained in the Technology Inventory, allowing users to compare relevant technology options. The integrated tool will also allow the user to move beyond the project-level analysis currently available (and particularly suited for evaluated AIJ opportunities) and work at the aggregate level. Aggregate-level analysis capabilities will provide a broad picture of current and future potential to avoid greenhouse-gas emissions throughout a specific industry or an entire nation's industrial sector. Analyses performed at the project-level can be combined with end-use and economic data for industrial sub-sectors and estimates of technology costs and penetration rates to generate scenarios of energy use and emissions in the industrial sector and the country as a whole. By providing a "big picture" of the industrial sector, the tool will assist in developing national action plans for industrial-sector GHG emissions abatement and prioritizing investments across sub-sectors.
- to **provide training and support** in applying IDENTIFY in studies aimed at identifying and evaluating a range of industrial abatement options that meet the objectives of the FCCC.

The resulting full-fledged operational tool would be straight-forward, readily understandable, and flexible, making it useful to analysts and decision-makers with little computing experience, while powerful enough for more experienced planners, economists, and engineers to conduct comprehensive cost-benefit analyses. Further, the tool would be tested in developing countries and adapted to ensure that it meets their needs.

The ultimate goal of the IDENTIFY initiative is to provide decision-makers and analysts at the national, regional, or facility level with a database and framework to identify and evaluate the financial and greenhouse gas emissions benefits of specific technologies. In doing so, these tools will help to identify "win-win" opportunities or the net incremental costs which would need to supported though activities implemented jointly (AIJ), JI, or other international initiatives, such as the Global Environment Facility.

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