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Energy Indicators to Assess Sustainable Development at the National Level: Acting on the Johannesburg Plan of Implementation

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ABSTRACT

When world leaders met at the World Summit on Sustainable Development (Johannesburg, 2002), energy was a central theme of deliberation in the context of both socio-economic development and environmental protection. The resulting Johannesburg Plan of Implementation highlights access to energy as central to facilitating poverty eradication and to changing unsustainable patterns of consumption and production. While countries face different challenges in implementing sustainable development objectives, a common need is the ability to accurately assess current conditions, policy effectiveness and goals for the future.

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The International Atomic Energy Agency and the United Nations Department for Economic and Social Affairs, in cooperation with other energy and environment agencies, have developed a core set of energy indicators useful as an effective monitoring mechanism of the Johannesburg Plan of Implementation. The energy indicators package is consonant with Agenda 21 objectives and aims to provide countries, and in particular developing countries, with a statistical analysis tool for assessing energy systems status and trends within the context of sustainable development. A handbook with detailed guidelines and methodologies has been published that can be used worldwide. A number of countries have prepared case studies that illustrate the applicability of this tool. In the long-term, this effort should result in improvements and expansion of national and regional energy statistical databases. This paper summarizes the outcome of this international effort. Specific examples are provided that illustrate the application of energy indicators in selected developing countries.

INTRODUCTION

The provision of adequate and reliable energy services at affordable costs, in a secure and environmentally benign manner, and in conformity with social and economic development needs, is an essential element of sustainable development. Energy is vital for eradicating poverty, improving human welfare and raising living standards. However, most current patterns of energy supply and use are unsustainable. Many areas in the world have no reliable and secure energy supplies, limiting economic development, while in other areas environmental degradation from energy use inhibits sustainable development.

Therefore, it is important for policy makers in countries all over the world to understand the implications and impacts of energy programmes, policies and plans on the shaping of their development and on the feasibility of making this development sustainable through time. A core set of energy indicators for sustainable development represents an effective tool for policy makers to evaluate and design programmes and strategies and to monitor progress towards a more sustainable future.

This international effort, initiated by the International Atomic Energy Agency (IAEA) in 1999, has two major objectives: (1) to complement the overall UN Work Programme on Indicators of Sustainable Development[1] by providing a consistent set of universally applicable energy indicators to assess progress towards a sustainable energy future, and (2) to foster energy and

[1] United Nations Department of Economic and Social Affairs, *Assessing Progress Towards Sustainable Development*, 2nd edition, United Nations, New York, 2001, and updated at: < http://www.un.org/esa/sustdev/natlinfo/indicators/isd.htm>

statistical capacity-building needed to induce energy sustainability. The project was presented at the ninth session of the UN Commission on Sustainable Development in April 2001[2] and in 2002 was officially registered as a Partnership with the World Summit on Sustainable Development (WSSD).

The agreement reached at WSSD, the Johannesburg Plan of Implementation (JPOI), places energy firmly on the agenda of sustainable development as vital for both the eradication of poverty and changing consumption and production patterns. Moreover, energy issues underlie many decisions taken in other areas including on atmosphere, air pollution, and health. It was in light of the growing prominence of energy in the international debate and the importance of energy in efforts to implement the WSSD agreement at the national level, that a number of international and regional organizations continued to work on the development of an integrated set of indicators that could be used by countries, especially developing countries, to measure progress on energy and sustainable development at the national level.

BACKGROUND ON ENERGY INDICATORS

Earlier work on developing and improving energy data for analytical purposes focused on disaggregating data to better understand trends in individual energy consuming sectors at the national level.[3] Analysts equipped with disaggregated data would be better equipped to understand often complex relationships between behavioural and technical components of energy use, and thus be in a better position to undertake effective energy policy. Disaggregated methods were applied successfully and are still used in OECD and European Union (EU) countries to analyze household energy use, CO_2 trends and energy efficiency in the industry and transport sectors. Organizations actively involved in the development and use of disaggregated energy indicators include the International Energy Agency (IEA), the Statistical Office of the European Communities (Eurostat) and the European

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[2] IAEA/IEA, Indicators for Sustainable Energy Development, presented at the 9th Session of the CSD, New York, April 2001.

[3] See for example, Schipper L. J., Indicators of energy use and human activity: Linking energy use and human activity, IEA, Paris, 1997; Howarth, R., Schipper, L.J., and Andersson, B., The Structure and Intensity of Energy Use: Trends in Five OECD Nations, Lawrence Berkeley Laboratory Report, LBL-32431, Berkeley, CA; Schipper, L. and Haas, R., "The Political Relevance of Energy and CO_2 Indicators – An Introduction", Energy Policy, 25(7), pp 639-649; and, Unander, F, Ettestøl, I, Ting, M and Schipper, L, "Residential energy use: an international perspective on long-term trends in Denmark, Norway and Sweden", Energy Policy, 32(12), pp 1395-1404.

Environment Agency (EEA). These organizations continue their efforts in applying energy indicators with the ultimate goal of promoting directed and effective energy, environmental and economic policies and measures.[4] Not only has this approach met with success in facilitating policy analysis, it has also provided incentives to collect more detailed and more consistent energy data in some countries.

The disaggregated approach has also been used to analyze energy patterns in developing countries, with varying degrees of success including in Mexico, India and China.[5] However, the approach requires a level of detailed data that does not exist in many developing countries. Moreover, the inter-country comparative approach, often used for better insights in OECD and EU countries, is not as appropriate for UN use or for developing countries with widely differing economic and energy structures, even at the regional level.

The energy indicators project presented here takes a slightly different approach in that, while the use of disaggregated or individual indicators is accommodated, the focus is on presenting an integrated look at energy within the framework of sustainable development. Applying the entire set of indicators, will provide an overall picture of the state of energy and sustainable development in a given country, and can be used to measure progress in achieving sustainable development over time.

AN INTERNATIONAL INITIATIVE

This international initiative consisted of two phases. The major objective of the First Phase was to define a conceptual framework that incorporates and identifies specific indicators for sustainable energy development. The Second Phase aimed to test and to provide assistance to countries in the development and use of energy indicators for monitoring progress and for developing energy strategies in conformity with the national objectives of sustainable development.

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[4] IEA, Oil Crisis and Climate Challenges: 30 Years of energy use in IEA countries, OECD/IEA, Paris, 2004; Eurostat, Energy and Environment Indicators, 2002 edition, Luxemburg, 2002; Eurostat, Measuring Progress Towards a More Sustainable Europe: Proposed Indicators for Sustainable Development, Luxemburg, 2001. EEA, Energy and Environment in the European Union, Environmental Issue Report Number 31, Copenhagen, 2002.

5 See for example, Sheinbaum, C. and Rodriguez V, L, "Recent trends in Mexican industrial energy use and their impact on carbon dioxide emissions," Energy Policy, 25(7-9), pp 825-831; Zhang, Z.X., "Why did the energy intensity fall in China's industrial sector in the 1990's? The relative importance of structural change and intensity change", Energy Economics, 25(6), pp 625-638; and Sun.J.W., "Three types of decline in energy intensity – an explanation of energy intensity in some developing countries," Energy Policy, 31(6), pp 519-526.

The objectives of the First Phase (Definition) have been fulfilled. Issues and parameters relevant to energy sustainability were identified. A set of major energy indicators was derived for assessing these issues. Conceptual frameworks were designed that considered the main dimensions of sustainable development and the major themes and sub-themes. An inter-agency report was published that provides guidelines and methodologies for the development and worldwide use of energy indicators for sustainable development.[6] This work was led by the IAEA in cooperation with the UN Department of Economic and Social Affairs (DESA), IEA, Eurostat and EEA. These organizations are leaders in statistical analysis and in the development of energy and environmental indicators, and are actively involved in fostering the implementation of principles of sustainable development at national and regional levels. This harmonised endeavour was intended to eliminate duplication of efforts by international organizations and provides users with a single set of energy indicators applicable worldwide.

The Second Phase (Implementation) of the project started in 2002 with participation of 7 countries (Brazil, Cuba, Lithuania, Mexico, Russian Federation, Slovakia and Thailand). These countries have defined their energy and sustainable development priorities, selected relevant sets of energy indicators and have applied these indicators to the analysis of energy policies geared to attaining priority goals.

The seven research teams have successfully tested the proposed indicators set and advanced their particular research interests, covering the following:

1. Review of their energy systems including status, main issues and future plans,
2. Review of their energy and environmental statistics capabilities,
3. Assessment of main energy and environmental issues and priority areas using the indicators set,
4. Evaluation of the effectiveness of policies currently in place to address priority areas,
5. Formulation of potential energy policies and strategies to help achieve sustainable development objectives.

Although most of the teams encountered problems with data availability and consistency for a number of indicators in the proposed set, all of the teams were able to construct case studies using most of the energy indicators

[6] International Atomic Energy Agency (IAEA), United Nations Department of Economic and Social Affairs (DESA), International Energy Agency (IEA), Eurostat, European Environment Agency (EEA), Energy Indicators for Sustainable Development: Guidelines and Methodologies, Vienna, 2005.

and to prepare reports with information and analysis of significant importance to their sustainable development objectives.

These country case studies have already sparked a number of initiatives that correspond to the goals of Agenda 21 and the JPOI. Countries have reported efforts (already ongoing) to improve their national energy statistics capability and joint ventures with other energy or statistical offices to develop databases on energy indicators for sustainable development. Three participating countries had reported changes already in the existing national statistical procedures and databases resulting from this experience or definite plans for the future incorporation of these indicators in their national energy and environmental statistical programmes.

Spin-offs from this experience have also been reported by some of the research teams including related research activities at local universities and implementation of the indicators set at the state or country regional levels. The outcomes from this initiative confirm that the successful cooperation among participating countries and international organizations has resulted in the transfer of valuable "know how" and in the improvement of related databases and statistical procedures. A regional Asia project was launched in early 2005 by the IAEA to replicate the efforts of this implementation phase with similar country case studies in 14 Asian countries.

ENERGY INDICATORS FOR SUSTAINABLE DEVELOPMENT

Not merely data, energy indicators expand beyond basic statistics to provide a deeper understanding of the main issues and to highlight important relations that are not evident by using basic statistics. Moreover, they reflect causal relationships between energy trends and policies and so are key tools for policy makers and for promoting institutional dialogue.

The preliminary core set of energy indicators for sustainable development (Table 1) includes 30 indicators, classified into the 3 major dimensions of sustainable development (social, economic and environmental), 7 themes and 19 sub-themes. The package includes 4 indicators in the social dimension, 16 in the economic dimension and 10 in the environmental dimension.

The list of energy indicators was selected based on discussions held with experts from international organizations that are partners in this project and from lessons learned from the implementation phase in participating countries. The list is not exhaustive, but is manageable for most analysts, and addresses the most important energy related issues of interest to countries worldwide. The selection criteria included considerations about data availability in developing countries and the feasibility to collect additional data considered essential to the development of important indicators.

Table 1: Energy Indicators for Sustainable Development

Social				
Theme	***Sub-theme***	***Energy indicator***		***Components***
Equity	Accessibility	SOC 1	Share of households (or population) without electricity or commercial energy, or heavily dependent on non-commercial energy	-Households (or population) without electricity or commercial energy, or heavily dependent on non-commercial energy -Total number of households or population
	Affordability	SOC 2	Share of household income spent on fuel and electricity	-Household income spent on fuel & electricity -Household income (total & poorest 20% of population)
	Disparities	SOC 3	Household energy use for each income group and corresponding fuel mix	-Energy use per household for each income group (quintiles) -Household income for each income group (quintiles) -Corresponding fuel mix for each income group (quintiles)
Health	Safety	SOC 4	Accident fatalities per energy produced by fuel chain	-Annual fatalities by fuel chain -Annual energy produced

Economic				
Theme	***Sub-Theme***	***Energy Indicator***		***Components***
Use & Production patterns	Overall-Use	ECO1	Energy use per capita	-Energy use (total primary energy supply, total final consumption and electricity use) -Total population
	Overall Productivity	ECO2	Energy per unit of GDP	-Energy use (total primary energy supply, total final consumption and electricity use) -GDP
	Supply Efficiency	ECO3	Efficiency of energy conversion and distribution	-Losses in trans-formation systems including losses in electricity generation, transmission & distribution
	Production	ECO4	Reserves-to-production ratio	-Proven recoverable reserves -Total energy production

		ECO5	Resources-to-production ratio	-Total estimated resources -Total energy production
	End Use	ECO6	Industrial energy intensities	-Energy use in industrial sector and by manufacturing branch -Corresponding value added
		ECO7	Agricultural energy intensities	-Energy use in agricultural sector -Corresponding value added
		ECO8	Service/commercial energy intensities	-Energy use in service/commercial sector -Corresponding value added
		ECO9	Household energy intensities	-Energy use in households and by key end use -Number of households, floor area, persons per household, appliance ownership
		ECO10	Transport energy intensities	-Energy use in passenger travel and freight sectors and by mode -Passenger-km travel and tonne-km freight and by mode
	Diversification (Fuel Mix)	ECO11	Fuel shares in energy and electricity	-Primary energy supply & final consumption, electricity generation & generating capacity by fuel type -Total primary energy supply, total final con-sumption, total electricity generation & total generating capacity
Use & Production patterns		ECO12	Non-carbon energy share in energy & electricity	-Primary supply, electricity generation and generating capacity by non-carbon energy -Total primary energy supply, total electricity generation and total generating capacity
		ECO13	Renewable energy share in energy and electricity	-Primary energy supply, final consumption and electricity generation & generating capacity by renewable energy -Total primary energy supply, total final consumption, total electricity generation & total generating capacity
	Prices	ECO14	End-use energy prices by fuel and by sector	-Energy prices (with and without tax/subsidy)
Security	Imports	ECO15	Net energy import dependency	-Energy imports -Total primary energy supply
	Strategic Fuel Stocks	ECO16	Stocks of critical fuels per corresponding fuel consumption	-Stocks of critical fuel (e.g. oil, gas, etc.) -Critical fuel consumption

Environmental				
Theme	***Sub-theme***	***Energy Indicator***		***Components***
Atmosphere	Climate Change	ENV1	GHG emissions from energy production & use per capita & per unit of GDP	-GHG emissions from energy production & use -Population & GDP
	Air Quality	ENV2	Ambient concentrations of air pollutants in urban areas	-Concentrations of pollutants in air
		ENV3	Air pollutant emissions from energy systems	-Air pollutant emissions
Water	Water Quality	ENV4	Contaminant discharges in liquid effluents from energy systems including oil discharges	-Contaminant discharges in liquid effluents
Land	Soil Quality	ENV5	Soil area where acidification exceeds critical load	-Affected soil area -Critical load
	Forest	ENV6	Rate of deforestation attributed to energy use	-Forest area at 2 different times -Biomass utilization
	Solid Waste Generation & Management	ENV7	Ratio of solid waste generation to units of energy produced	-Amount of solid waste -Energy produced
		ENV8	Ratio of solid waste properly disposed of to total generated solid waste	-Amount of solid waste properly disposed of -Total amount of solid waste
		ENV9	Ratio of solid radioactive waste to units of energy produced	-Amount of radioactive waste (cumulative for a selected period of time) -Energy produced
		ENV10	Ratio of solid radioactive waste awaiting disposal to total generated solid radioactive waste	-Amount of radioactive waste awaiting disposal -Total volume of radioactive waste

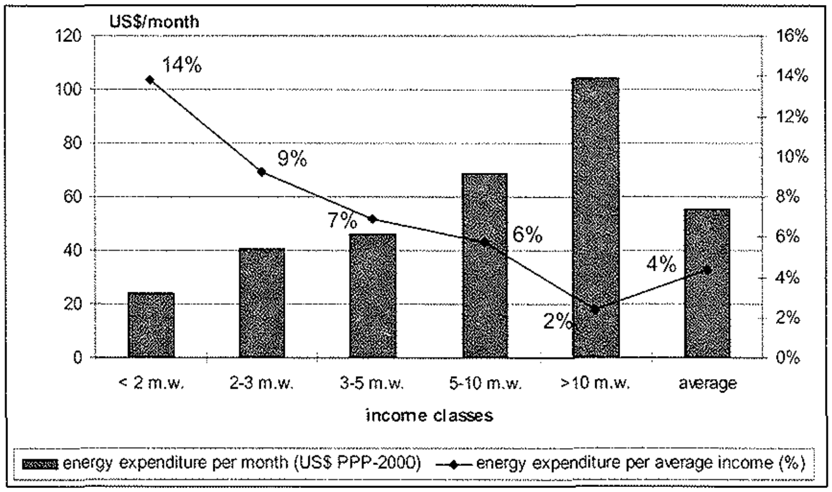
Social Dimension

The social dimension of sustainable energy development reflects the need for people all over the world to have access to basic energy services in the form of commercial energy at affordable rates. There are major social issues linked to energy use, including poverty, quality of life, education, demographic transition, indoor pollution, health, and gender and age related implications. Energy indicators of the social dimension are particularly important to many developing countries that still have considerable shares of population without modern energy services.

Two themes are considered under the social dimension - equity and health. Social equity is one of the principal values underlying sustainable development, with people and their quality of life being recognized as a central issue that is greatly affected by energy services. The issue of equity is addressed under the sub-themes of affordability, accessibility and disparity. Lack of or limited access (accessibility) to energy services marginalizes poor people and seriously limits their ability to improve their living conditions, and this is highlighted in the Johannesburg Plan of Implementation. Lack of electricity usually means, among other things, inadequate illumination, limited telecommunications, no refrigeration and limited possibilities for home or cottage based industries. Limited income (affordability) may force households to use traditional fuel and inefficient technologies. Disparity in accessibility and affordability of energy services are also important problems affecting many countries all over the world. Health impacts and safety are sub-themes addressed by energy indicators of the social dimension. At the household level, families in poor communities may be exposed to fumes from the combustion of traditional or non-commercial fuels used for cooking and heating. Fire accidents are also common from the use of candles for lighting. The production of energy can involve accidents at different steps of the fuel cycle.

Figure 1 illustrates the implementation of the energy indicator "Share of household income spent on fuel and electricity" (SOC2) for Brazil. The indicator addresses the issues of affordability and disparity under the theme of social equity. Monthly energy expenditures are shown for five different levels of income (bars). The classification of incomes is based on monthly incomes measured as number of "Minimum Wages" (m.w.). The figure also shows the share of income that is spent on energy services at each level of income. The data for Brazil indicates that the segments of the society with lower incomes not only spend limited resources on energy services but that they need to use a larger share of their monthly income to satisfy their basic energy needs. Energy costs thus have an impact on how basic needs can or will be satisfied: how much disposable income is available for education or health care, for example. This figure also suggests that where subsidies exist or are contemplated, they may not be sufficient or appropriately targeted to improve this condition appreciably.

Figure 1
Monthly Household Energy Expenditures by Income levels, Brazil



Source: Energy Planning Program, COPPE, Federal University of Rio de Janeiro.

Economic Dimension

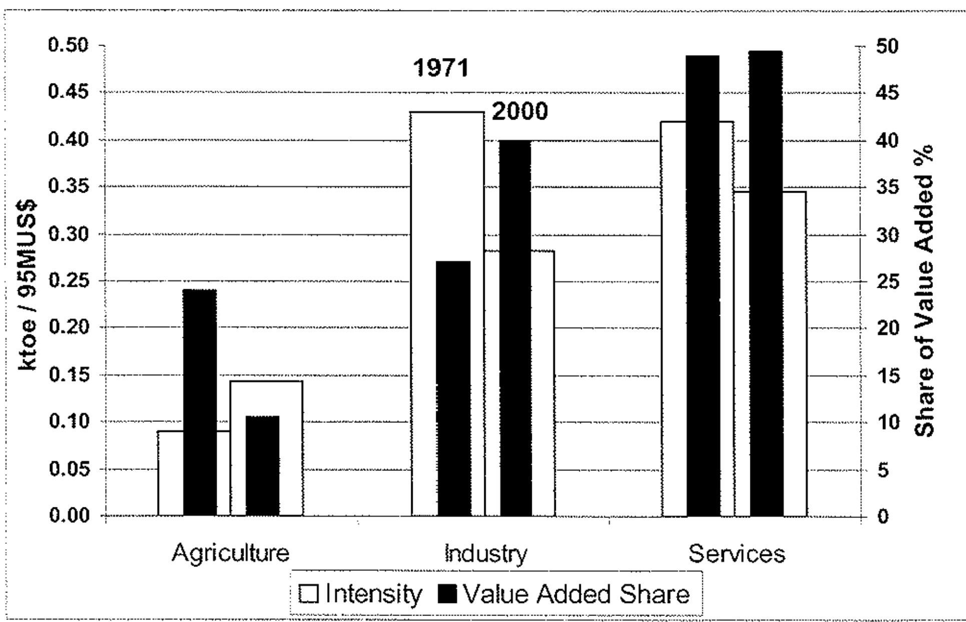
The availability and reliability of energy services is indispensable for securing economic growth. All sectors of the economy -- including the residential, commercial, transportation, service and agricultural sectors -- depend on secure, sufficient and efficient energy services. Job availability, industrial productivity, urban and rural development and all major economic activities are strongly affected by energy input. Electricity particularly is an important and sometimes irreplaceable input to modern productive activities, communication, dissemination of information and other service industries.

The energy indicators in the Economic dimension consider two themes: use and production patterns, and security of supply. Within the theme of use and production patterns the following sub-themes are addressed: overall use and productivity, supply efficiency, production, end-use, diversification (fuel mix) and prices. The security theme includes dependency on imports and strategic fuel stocks.

Efficiencies and intensities are important issues affecting energy systems and defining sustainability trends. By reducing quantities of energy consumed, improvements in energy efficiencies translate into progress towards sustainable development since investments in energy infrastructure and expenses in fuel costs can be reduced. Efficiency improvements can be achieved by changes in energy related technologies and processes. Improvements in energy intensities are realized by energy efficiency improvements and by shifts in economic structures, in the fuel mix and in consumer behavior.

Figure 2 shows energy intensities and corresponding shares of value added for 1971 and 2000 for the main economic sectors of Thailand. The figure illustrates the implementation of energy indicators related to "intensities" (ECO6-ECO10) under the sub-theme of end-use productivity. The data for the agricultural sector indicates a major drop in the share of value added for agriculture during the 28-year period accompanied with an increase in the corresponding energy intensity of about 55%. Conversely, the industrial sector shows a major increase in its share of value added between 1971 and 2000 that was achieved while the industrial energy intensity decreased by almost 35%.

Figure 2
Energy intensities by sectors and corresponding value added share, Thailand



Source: Data from IEA and World Bank.

The data for the industrial sector points towards possible improvements in technology efficiencies due to changes in energy systems and in the fuel mix used in major industries, or a major shift in the structure of the industrial sector in Thailand. The structural change could have been from an emphasis on production of energy intensive products in 1971 to the production of less energy intensive products in 2000. The trend is similar for the Service sector, although the increase in the share of value added is only about 1% while the energy intensity dropped by about 17%.

The different trends observed in these sectors indicate a need for further analysis. Clearly not all of the value added can be necessarily ascribed to improvements in energy efficiency. World prices for agricultural and other commodities, for example, will also affect the value added regardless of energy efficiency gains. Further investigation and implementation of disaggregated energy intensity indicators would allow determining more precisely the reasons for the changes observed in the intensities. The comprehensive analysis of the energy and economic changes by means of energy indicators should be useful to policy makers in monitoring progress and in assessing the effectiveness of current and future energy policies.

Environmental Dimension

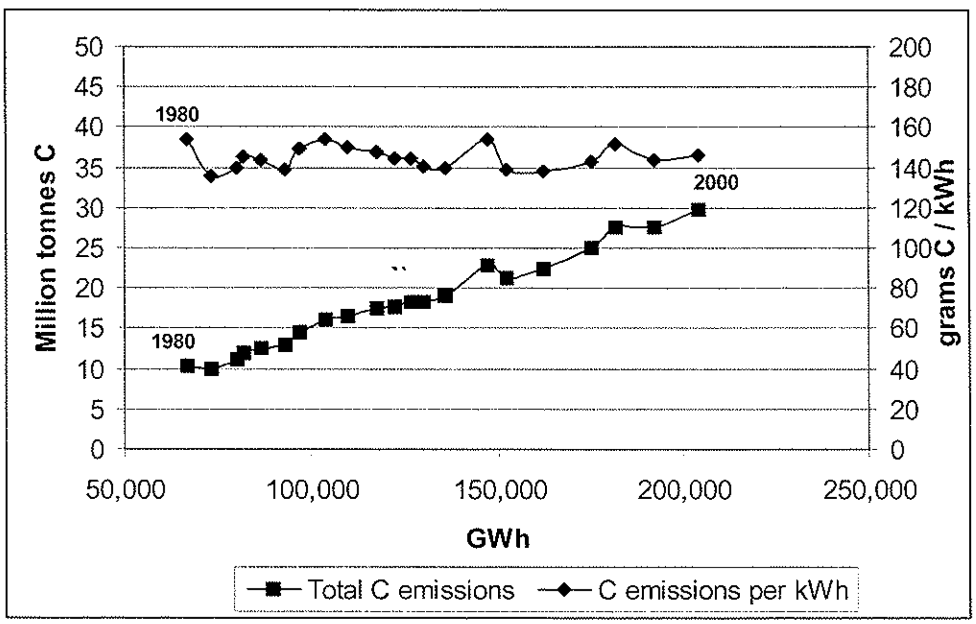
Energy production, transport and use lead to some of the most important anthropogenic pressures on the environment, ranging from climate change, deforestation, air, water and soil pollution and nuclear waste. Many of the environmental effects from energy- related activities are long-term and have irreversible consequences for future generations. The environmental impacts from energy use can occur at all levels – household, workplace, community and city, national, regional and global. Energy-induced air pollution, water contamination and land degradation are some of the negative consequences. Environmental impacts of energy activities vary greatly depending on how energy is produced and used, the fuel mix, structure of the energy system and related energy regulatory actions and pricing structures.

The energy indicators of the environmental dimension address the themes of energy-related impacts on the atmosphere, water and land. For assessing the atmosphere, greenhouse gas emissions, linked to climate change, and pollutants that degrade air quality are considered. The theme of water specifically covers water quality as determined by contaminant discharges. The land theme addresses soil quality directly as well as deforestation and waste generation and disposal.

At the global level, the trend of increasing greenhouse gas emissions is a major environmental consideration with potential long-term consequences for the earth's climate. Figure 3 shows carbon emissions from the power sector in

Mexico as a function of electricity generation. This figure illustrates the implementation of the indicator "GHG emissions" (ENV1). Electricity generation increased at a rapid pace during the 20-year period from around 67,000 GWh in 1980 to more than 204,000 GWh in 2000. A corresponding increase in the total carbon emissions from the power sector is observed for the same time period from about 10 million tonnes of carbon emissions in 1980 to 30 million tonnes of carbon emissions in 2000. However, the emissions of carbon per unit of electricity produced remained relatively stable at about 150 grams of carbon emissions per kWh of electricity produced during the 20-year period. Therefore, the energy-environmental situation with respect to carbon emissions per unit of electricity did not deteriorate during this time period indicating some improvements in technologies and/or changes in the fuel mix used to generate electricity. Nevertheless, the indicator points towards the need for further improvements so that the emissions of carbon per unit of electricity produced start to decline and a partial decoupling between carbon emissions and electricity generation can be achieved.

Figure 3
Carbon emissions from power sector (Total and per kWh) and electricity generation, Mexico



Source: Data from IEA.

USING ENERGY INDICATORS

The set of energy indicators developed and tested is useful to policy makers, energy analysts and statisticians for their assessment of current conditions of energy systems, effectiveness of energy policies in place and in the definition of energy strategies for sustainable development. The effort should eventually translate into improvements in statistical analysis and in the expansion of national and regional energy statistical databases. Also, by raising awareness of the need to take into consideration Sustainable Development principles in the formulation of energy projects, programs and strategies, it will help countries to define an integrated approach towards energy development and sustainability.

It is important to note that the procedures and processes to be followed in developing and using indicators for sustainable energy development vary from country to country, depending on country specific conditions, national energy priorities and sustainability and development criteria and objectives. In addition, the implementation process depends on the existing statistical capability, expertise and the availability of energy data and other related information for decision-making. Because the process requires the allocation of human and financial resources, a pragmatic and cost-effective approach is essential.

Many developing countries need to make an investment in their energy statistical databases and programs to improve and expand their energy data collection, monitoring and analysis both at the national and local levels. These activities might include the establishment of arrangements to collect missing data, modification of current data compilation procedures and training and other capacity-building that may be needed to perform these functions. Governmental and non-governmental organizations may share responsibility for this, and national, bilateral and international programs may support enhancement of a country's energy statistical capacity. This effort should result in the collection of the minimum data necessary for the formulation of energy indicators relevant to sustainable development criteria and in the incorporation of the analysis of these indicators in on-going statistical programs. Also, the extension of the analysis into the future by the use of likely scenarios developed with modelling tools allows a more comprehensive monitor and analysis of sustainability trends and objectives. Expansion of the core set to include additional indicators such as those pointing to the reliability of energy systems could be considered. Nevertheless, countries need to determine the trade offs between costs and benefits resulting from the expansion and enhancement of their energy statistical capabilities.

It is important to understand that each country needs to select the energy indicators within the proposed core set that are most relevant to the country's particular energy system or to the policy priorities and that might be useful in assessing and monitoring the status and progress of specific strategies towards a more sustainable energy future. Furthermore, additional energy indicators specifically designed to address conditions or priorities unique to a given country might need to be developed.

The proposed core set of energy indicators represents a quantitative tool necessary but not sufficient for monitoring progress and for defining long-term strategies. There are a number of issues that are difficult to quantify or are more qualitative by nature and that need to be taken into consideration in any decision making process and in the final formulation of major energy policies. The results of analysis with this tool therefore need to be put into a larger political and policy perspective for effective decision-making.

CONCLUSIONS

The international community has now agreed on the approach to be taken with regard to energy to achieve sustainable development, as evidenced by the JPOI and the results of the ninth session of the United Nations Commission on Sustainable Development. The challenge now is not what to do, but how to do it.

The energy indicators for sustainable development presented here represent an integrated approach to energy and policy analysis at the national level. The indicators can assist efforts to assess progress made in implementing JPOI in the area of energy and can further identify specific areas in which focused measures and policies should be directed. Further the indicators are designed to be utilized with least-cost data available, but it is hoped that this paves the way for more concerted efforts at data collection and coordination among relevant institutions at the national level. The examples provided in this paper are limited illustrations of the applicability of energy indicators for specific issues and areas. As such, they cannot illustrate the benefits of the overall approach used in this project. Case studies have been developed in 7 countries that demonstrate the advantages of using this integrated approach in the formulation and implementation of energy indicators for sustainable development.

Energy for sustainable development will be a major theme of the United Nations Commission for Sustainable Development in 2006 and 2007, and it is hoped that these indicators are helpful to developing countries as they measure their progress in implementing the JPOI in the area of energy and as they consider their options to further selected sustainable development goals.