HELIO INTERNATIONAL

Sustainable Energy Watch
2005/2006

The Ultimate Challenge: Energy for Global Ecodevelopment

A Global Report Covering:

- Bangladesh
- Benin
- Brazil
- Cameroon
- China
- Democratic Republic of Congo
- European Union
- France
- Haïti
- India
- Iran
- Mali
- Mexico
- New Zealand
- Russia
- South Africa
- Tanzania
- Tunisia
- USA

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"Richer by our differences we can converge towards the universal"[1]

Léopold Senghor (1906-2006)

Preface

This report is the third independent global report produced by HELIO[2] International and the second one using the Sustainable Energy Watch methodology. Aimed at policy-makers, business people and concerned citizens, these reports are based on eight indicators selected for their relevance, clarity, balance and timeliness; using these as benchmarks, the country-level analysts impart their experience and provide an independent view of the energy scene in their own country. Their reports can then be used by governments and other stakeholders to better promote ecodevelopment via comprehensive energy policies.

As early as the Rio Earth Summit (1992), it was obvious that in order to have a better understanding of the impact of energy on the globe, information collection and analysis had to be truly objective and that the process had to follow a bottom-up approach. A group of independent energy analysts from around the world made a commitment to carry out periodic reviews of their countries' energy development. The first, comprehensive report series was presented at Rio+5.; the accompanying global report was titled *"Is Energy Actually Contributing Positively to Ecodevelopment?"* The second series was published for the Johannesburg World Summit on Sustainable Development (2002).

This 2006 Global Report is based on 18 national reports and one regional report, prepared by local reporters in cooperation with regional coordinators. This work has also been conducted in cooperation with members of the major world energy and environmental organisations such as the Climate Action Network, the International Institute for Sustainable Development, and with the financial support of the French Foreign Affairs Ministry. May they all feel that they have contributed to a valuable effort.

Hélène CONNOR and Laura WILLIAMSON, Global Report authors

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All reports, including this one, are available at: www.helio-international.org

[1] Traduction hcl de : "S'enrichir de nos différences pour converger vers l'universel".
[2] HELIO stands for Hydro, Eole (wind), Light, Insulation, Organomass.

About HELIO International

Founded in 1997, HELIO International is an independent, international network of leading energy analysts whose objective is to identify, assess, measure and publicise the contribution of energy systems and policies to sustainable and equitable development. These experts carry out independent evaluations of national energy policies and inform decision- and policy-makers about their value and effectiveness. They constitute the Sustainable Energy Watch (SEW). They also analyse and advise on ecodevelopment and climate stabilisation.

HELIO International is a non-profit organisation based in Paris, France. It is an accredited observer to the United Nations Framework Convention on Climate Change (UNFCCC) and to the United Nations Environment Programme (UNEP)

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Executive Summary

> … even if globalisation started a long time ago – in the energy field in particular – it still needs to be better understood and to be humanised. Despite the continuing deterioration of the environment and of the human condition in many parts of the world, people are not reacting as they should. The potential consequences of ill-founded energy policies do not seem to concern them or to wake up people like they did ten or thirty years ago when the environmental movement was born. For most people and countries, it is still "business as usual".
>
> What must be done? We must recapture and share our instinct for survival. Those of us who are aware of the world's energy-related problems and their possible solutions have the responsibility to relay this concern and the information that we have to our fellow citizens. That is what HELIO observers are doing. As Martin Luther King once said: "We must learn to live together like brothers, otherwise we'll die together like fools".
>
> HELIO International's Global Report for Rio + 10, 2002

Most countries have developed formal energy policies. These can vary from a simple statement of objectives and priorities to a detailed action plan. Some countries actually state that their energy policies are "sustainable energy strategies". Some of the strategies deal only with energy supply issues while others are integrated with energy demand and industrial development concerns. Regardless of a country's energy resource base, in order to contribute to sustainable development, energy systems should be:

- **Consistent with environmental sustainability**: The pollutants related to energy should be fully part of a natural cycle and not exceed the absorptive capacity of environment media (air, water, land) as determined by scientific standards based on local experience.

- **Consistent with economic sustainability**: All foreseeable lifecycle costs of energy, including externalities, must be accounted for in order to determine the feasibility of projects. Support for unsustainable systems is counterproductive and should be phased out.

- **Consistent with social sustainability**: The development and use of energy should not harm people's health or welfare; it should not involve massive lay-offs or involuntary resettlement, but contribute to quality job creation, poverty alleviation, increased democracy and social equity.

- **Consistent with technological sustainability**: Efficiency and diversity are key to the longevity and viability of energy sources and systems. Technology choices also determine the type of society people live in, so energy planning should be done with the valid participation of all concerned stakeholders.

Methodology and Countries Studied

To measure and analyse the impact of energy systems on development, HELIO International developed a methodology based on eight indicators to monitor national or local energy policies. The set of indicators developed by HELIO International's *Sustainable Energy Watch* (the "SEW indicators") is well suited to test whether energy policies are dealing with the issues outlined by the United Nations' initiative: WEHAB (water, energy, health, agriculture and biodiversity).

HELIO's partners around the world – respected academics and other experts in the energy field – have monitored progress in achieving sustainable energy development against this set of indicators divided according to the four pillars of energy ecodevelopment: environment, society, economy and technology. The country reports use the indicators to measure the change between 1990 (the base year for the UN Framework Convention on Climate Change) and the year with the latest available data (generally 2003 but sometimes 2004). This allows for analysis of the impacts of national policies over a period of time.

This report surveys 18 countries from all regions of the globe to better understand how ecodevelopment principles are being integrated into energy and other related domestic policies. It is designed to contribute to the body of evidence to support more robust, comprehensive policies for long-term ecodevelopment. The report also includes the European Union as a whole because Europe is one of the main drivers in policies to promote sustainable energy and its impact is felt well beyond its borders.

These 18 countries represent an important cross-section globally: eight are from low-income economies[3], four from lower-middle-income economies[4], three from upper-middle-income economies[5] and three from high-income[6] economies[7]. The two largest countries by population are included: China and India. What happens in those countries will have major impact in terms of resource availability, energy security and the global environment. The world's richest economy, the United States, is included because of its impact on global energy trends, since its energy use per capita dwarfs any other country and its overall carbon emissions have such a global impact. There are six countries from Sub-Saharan Africa because, if they fail to be more sustainable, they will endure even greater hardship and will have even greater problems reducing poverty, achieving and sustaining economic growth and maintaining political stability. These countries (and several others from Asia and Latin America) desperately need more modern and better-adapted energy services, but on a sustainable basis.

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[3] Bangladesh, Benin, Cameroon, Democratic Republic of Congo, Haïti, India, Mali, Tanzania.
[4] Brazil, China, Iran, Tunisia.
[5] Mexico, the Russian Federation, the Republic of South Africa.
[6] France, New Zealand, United States.
[7] This is using the World Bank's classification of countries by income (see http://web.worldbank.org). Income group: Economies are divided according to 2004 GNI per capita, calculated using the World Bank Atlas method. Amounts are in US dollars. The groups are: low income, $825 or less; lower middle income, $826 - $3,255; upper middle income, $3,256 - $10,065; and high income, $10,066 or more.

All of these countries have tried to make sustainability part of their policies and actions. All made some international commitments and were proud to have their efforts recognised at Rio (1992) and Johannesburg (2002). However, their approaches to achieving ecodevelopment are as varied as are their results. Some have risen to the challenge presented at Rio while others seem to pay little more than lip service to integrating the concept of sustainability into their energy systems.

Summary of Indicators

The SEW indicators assess the quadruple bottom line: environment, society, economy and technology.

On the indicator for CO2 emissions, low-income countries are not only still below the world average but are doing worse, even at a very low per capita level. The most prolific emitter, the United States, improved somewhat but at a per capita level five times higher than the world average. When HELIO researchers were asked to monitor the most relevant energy-related pollutant in their countries, most chose suspended particulates, produced from such sources as vehicles, burning at landfill sites and wood burning. Most data indicate improvements. However, countries such as Benin showed much increased carbon monoxide emissions, as did both New Zealand and China.

There is a general increase in access to electricity, with remarkable exceptions such as the Democratic Republic of Congo where households with access to electricity increased from 5% in 1990 to barely 6.2% in 2003. Most countries did not generate enough investment in clean energy to create a significant number of new jobs. Improvement in this indicator will signal when the energy challenge is being properly addressed.

Economic indicators were equally discouraging. Energy demand for road transport has risen sharply and is coupled with deterioration in energy security that is met increasingly through imports. Even smaller countries that import less are in trouble because proportionately the burden of their imports is high. On the other hand, there is evidence – based on limited data – that governments are diverting funds from conventional energy supply to energy efficiency and renewables. This is one of the few positive developments.

Energy productivity is improving somewhat in OECD[8] countries as well as in South Africa and China, But often these improvements are against a very high level of inefficiency, especially in the United States. Results in countries outside of the OECD are uneven. China does provide one of the most successful examples of decoupling economic growth from energy use but, like the United States and New Zealand, China has made insufficient progress in increasing their reliance on diverse sources of renewable

[8] The Organisation for Economic Cooperation and Development, based in Paris. See www.oecd.org.

energy, Only Brazil seems to have had the stamina of developing robust alternative solutions both for fuel and vehicles[9].

Key Conclusions

Over the last ten years, problems linked to energy have increased and become globalised. Pollution from road transport is endemic worldwide and is exacerbated in developing countries by the use of out-dated, polluting technologies. Climate change is occurring, but decision-makers remain in a state of denial, as if anesthetised; they know what is happening, are aware of their collective responsibility but are incapable of taking action.

Overall the conclusions drawn from the country-level monitoring vary with the level of development stages of the countries studied:

- The low-income economies are struggling for survival and are the most vulnerable.

Most countries reported significant environmental and economic deterioration due to the energy systems used with all them becoming more dependent on expensive imported fossil energy. They have poverty reduction strategies that include energy factors such as access to electricity but the results are slow to materialise. The energy services are improving but from a very small base. In many localities, the increasingly unsustainable use of biomass is threatening people's ability to meet their basic needs. India is the exception because of its size and rate of economic expansion but even so, its energy services are being delivered only to a narrow segment of the population and there are significant environmental problems.

- The lower-middle income economies show much promise but also many problems.

This group is led by China, which by its very size raises global concerns. Brazil, China and Tunisia have put in place some innovative initiatives but, by and large, they are piecemeal. Comprehensive sustainable policies and programmes are needed. China, for example, has some good policies and programmes in energy efficiency and renewables but, simultaneously, it is expanding its electricity generation capacity at a frantic pace using sub-optimal technology for coal or nuclear. The rate of increase in carbon emissions is simply not sustainable. The country has gone down a path of rapid economic development without a full assessment of the negative consequences, both nationally and globally.

- The upper-middle income economies present mixed results.

They are all experiencing rapid growth. Mexico and the Russian Federation are major oil producers with their energy sectors as one of the major engines for economic development. Unfortunately the environment is given a lower priority than economic expansion. South Africa has emerged

[9] A key hurdle is ensuring a steady supply of ethanol. Production levels fluctuate due to seasonal changes.

from its apartheid past to become one of the most important role leaders in Africa. It is a country where there have been some excellent examples of innovative environmental work.

- The higher income economies have wealth, access to every energy service, and political weight.

They are in a position to provide global leadership or they can choose to act alone. Undoubtedly, the United States is the main concern because it has the greatest impact, but it also has much to offer in terms of technology development and resources to put towards sustainable energy options and reduction in emissions. It could provide a major impetus in fostering a sustainable development policy globally but seems to have decided to leave the leadership to the European Union. France and New Zealand, as well as the European Union have uneven records. Industrialised countries are historically, responsible for many of the problems that are occurring worldwide. Lip service is paid to the goal of ecodevelopment but the current actions of these countries continue to contribute to the down-ward spiral of pollution and social instability.

Table 1: Summary Scorecard of Progress[10]

	Higher Income Countries	**Upper-Middle Income Countries**	**Lower-Middle Income Countries**	**Low-Incom Countries**
Environment				
Indicator 1 = per capita carbon emissions from the energy sector	C	D	B	D
Indicator 2 = most significant energy- related local pollutants	B	C	B	E
Society				
Indicator 3 = households with access to electricity or % of household income spent on energy	B	B	B	B
Indicator 4 = investment in clean energy	C	D	D	D
Economy				
Indicator 5 = energy security/energy trade	E	C	C	D
Indicator 6 = burden of public energy investments	B	C	C	B
Technology				
Indicator 7 = energy productivity	B	D	B	C
Indicator 8 = renewable energy deployment	C	D	D	D

Note: A: very good, B: good, C: passable, D: poor, E: very poor, F: fail

[10] Grades are attributed globally and do not pretend to be statistical accurate. They are a simple indication of the level of effort noticed in the countries studied within each category.

Main Lessons Learnt

- Overall, the record is pretty dismal as improvements are on an unsustainable basis.

With the passing of time, ecodevelopment is becoming ever more elusive. Whether the planet will remain liveable is now a recurring question that is publicly aired[11]. Governments everywhere are perceived as playing a waiting game, even while they denounce their own addiction and inaction. Nowhere are they truly listening to their constituents, whose survival instinct is reviving and who want action[12]. What informed people want is a green (ecological), lean (efficient) and clean development for themselves and future generations

- The most worrying results are in the countries with global impact: the United States, China, India and the European Union.

These countries can do most to affect the sustainability of the rest of the world. While they should serve as an example to developing countries, there is no single 'rich country' formula that is readily adaptable to the developing world, especially in a context prone to privatisation and liberalisation. But the OECD countries, in particular, being more affluent, must provide guidance and support.

- If leadership from the industrialised countries is essential, developing countries have much to learn from themselves.

The developing world can evolve best through examples of progress from its counterparts. South-South technical cooperation is also in the interest of industrialised (Northern) countries who should invest more in international ventures to assist developing countries in initiating their own capacity-building[13] – the best way of ensuring successful technology transfer.

- The indiscriminate use of powerful technologies has introduced an era of global problems: current crises do not vary widely from country to country and solutions are often similar, if not linked.

Thanks to international conferences, associations and projects, and new means of communications, information is now better shared and understood by those concerned, resulting in improved coordination of responses and more open dialogue.

- It is becoming ever more evident that in all countries, a sustainable future will lie in energy solutions that are more closely geared to

[11] For example, see "The Revenge of Gaïa", by James Lovelock, Ed. Penguin, Feb. 2006.
[12] In India there is a People's Plan for Power Sector Reform (2002). It was tested for the Andhra Pradesh province and provided prima facie calculations that showed that a people's plan was feasible and required a lower subsidy from the government. Bengali communities have developed blueprints but they lack funding for implementation.
[13] One such example is the SouthSouthNorth Project based in South Africa, the group works with Bangladesh, Brazil and Indonesia with financial support from The Netherlands. www.southsouthnorth.org

the way people, themselves, see the benefits, the risks[14], the possibilities and the future.

After 35 years[15] of warning with increasing urgency the risks (pollution, and climate change) associated with inefficient energy use, it has become obvious that the solution lies in far greater and earlier involvement of concerned and informed citizens – voters, householders, consumers, and particularly women – in the energy planning process both at local and national levels. Worldwide, improved energy governance with adequate institution-building is sorely needed. The time has clearly come to institutionalise a more participatory process of energy planning and decision-making. New approaches, new energy alternatives, and new institutions will be the path to ecodevelopment.

[14] These problems and risks are well explained in "Brittle Power", by Amory and Hunter Lovins, 1981. This book shows that the best response to terrorism is to eliminate big energy targets, such as nuclear plants, megahydro projects, oil/gas terminal, pipelines or other major energy infrastructure.
[15] 1970 marks the real collective awakening of communities worldwide to the urgency of ecological problems. The United Nations Conference on the Human Environment held in Stockholm 1972 formalised the growing concern about the global environment.

Policy Context for a Sustainable Energy Strategy in the XXIst Century

Much is happening in 'policy terms' to promote sustainable energy. Possibly the most ambitious international conference ever held was the Earth Summit in Rio (1992) where there was a strong endorsement of 'sustainable development', defined as meeting the aspirations of the present population without compromising the ability of future generations to meet their own needs[16]. Rio's work programme, Agenda 21, did not have a specific chapter on energy but throughout there were implications of the effects of energy use. Rio introduced the United Nations Climate Change Convention (UNFCCC) which was the first worldwide attempt at internalising some environmental costs into energy planning and decision-making. The application of the sustainable development concept to the climate change issue placed energy in the limelight. Yet, the energy-side of the climate change debate focused only on the contribution of fossil fuels to the formation of greenhouse gases. Other main polluting aspects of energy production, transmission and use are still largely outside the purview of international environmental conventions[17].

The 9th Session of the UN Commission on Sustainable Development, meeting in April 2001[18], stated:

> "The main goal of energy for sustainable development should be poverty eradication. International efforts to achieve this goal should be guided by the principle of common but differentiated responsibilities. Given the wide diversity of country conditions, energy resources, knowledge and experience, many speakers felt that the ninth session of the Commission should not be prescriptive with regard to energy policies and technologies. It was generally agreed that countries should be free to choose from a menu of different options for energy policies, taking into account their special conditions, needs and national priorities for sustainable development."

The 9th Session raised many challenges and recommendations on accessibility of energy, energy efficiency, renewable energy, advanced fossil fuel technologies, nuclear energy technologies, rural energy, energy and transport, and overarching issues from R&D to capacity building to international cooperation.

The UN Framework Convention on Climate Change (UNFCCC) has been bolstered by the Kyoto Protocol, which after years of preliminary work, came into force in February 2005. Wide-spread awareness now exists that climate change policies get to the heart of sustainability. This evolution in thinking was illustrated during official negotiations at COP11 to delineate post-2012 carbon budgets.

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[16] See World Commission on Environment and Development, *Our Common Future*, Oxford University Press, Oxford, UK, p. 8.
[17] There are efforts to support greater access to energy services and the environmental implications of that support should be integrated in any bilateral or multilateral efforts.
[18] United Nations Economic and Social Council Commission on Sustainable Development, Report on the Ninth session, E/2001/29, E/CN.17/2001/19, 5 May 2000 and 16-27 April 2001.

At the international level, policy is also influenced by the Millennium Development Goals (MDGs). The MDGs has eight goals. First, is the need to eradicate extreme poverty and hunger, halving between 1990 and 2015 the proportion of people whose income is less than $1 per day. The seventh goal is to ensure environmental sustainability and one of its targets is to integrate the principles of sustainable development into country policies and programmes and to reverse the loss of environmental resources[19]. Three of the indicators for this MDG target relate to energy: energy use per unit of GDP, carbon dioxide emissions per capita and proportion of the population using solid fuels.

Internationally, several organisations such as the International Energy Agency (IEA), the Organisation for Economic Development and Co-operation (OECD), various UN bodies, the World Bank and other international financial institutions (IFIs), have contributed to the development of sustainable energy policies. Unfortunately these policies are often contradicted by multilateral banks' actions as they primarily funds unsustainable fossil fuels projects. The European Union has done much to integrate sustainability into its region-wide energy policies and these have influenced policies outside its borders. A statement by EU ministers and government representatives who met at the Beijing International Renewable Energy Conference 2005 (BIREC) noted that:

> "Experience has shown that successful actions for scaling up the use of renewable energy, include: (1) creating supportive policy and institutional frameworks; (2) securing public sector commitment, including for R&D and procurement policies; (3) levelling the playing field; (4) promoting private sector involvement; (5) supporting the establishment of national renewable energy industries including small and medium enterprises; and (6) providing access to affordable finance and consumer credit mechanisms."

At the national level, several countries have approved sustainable energy policies and there is also much, if not more, activity at the local level. In some countries and regions, there are sustainable cities networks and a wide array of sustainable energy initiatives.

International oil prices have increased significantly over the past two years and there is every indication that they will continue at these high levels for the foreseeable future. What these high prices do, however, is raise awareness about the benefits of energy efficiency and stimulate the rapid development and deployment of renewable energy technologies. The result can create a "virtuous circle": increased use of renewable energy technologies renders them more cost-effective in turn making them more attractive as energy alternatives. Greater emphasis is also being given to energy security because of the high energy prices and the growing dependence on energy imports. Again, energy efficiency and renewable energy top the list of policy options.

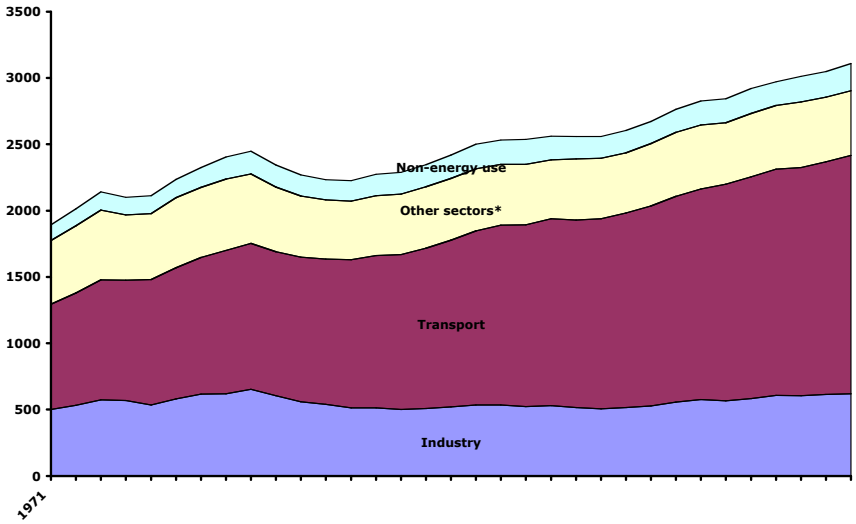
[19] Not all the goals relate to energy.

The Numbers Provide Some Clues

The following graphs give an indication of the trends in the dynamics of global energy systems. The trends are not sustainable and give an idea of the urgency and of the magnitude of the efforts needed to adopt the path towards ecodevelopment.

The pattern in the growth of oil product consumption globally since 1971 shows a dip in the 1980s, but since the mid-1980s there has been a steady increase.

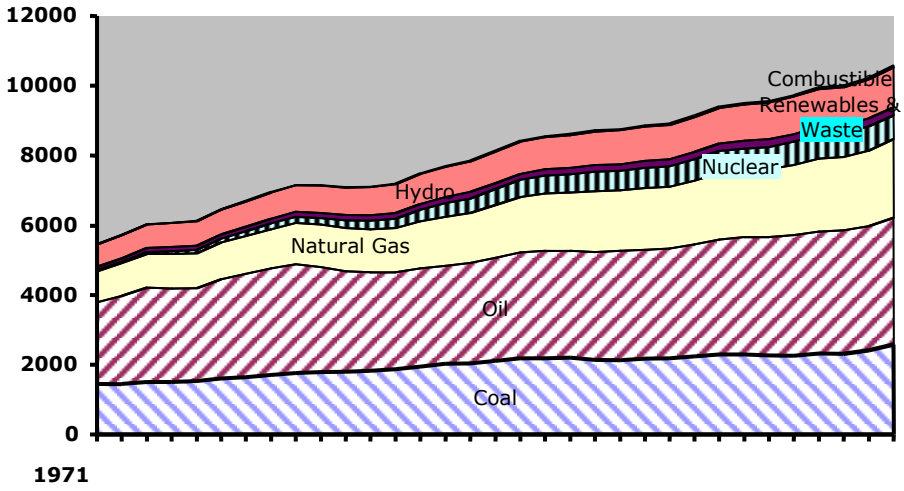
Figure 1: Evolution of Worldwide Oil Product Consumption by Sector, 1971-2003



*"Other sectors" comprise agriculture, commercial & public service, residential and non-specified.
Source: International Energy Agency

Figure 2 compares the global growth in Total Primary Energy Supply (TPES) over the same period. What is important is to view the overall growth. The bottom three bands represent coal, oil and natural gas. Their combined share in the energy mix continues to increase – unsustainably.

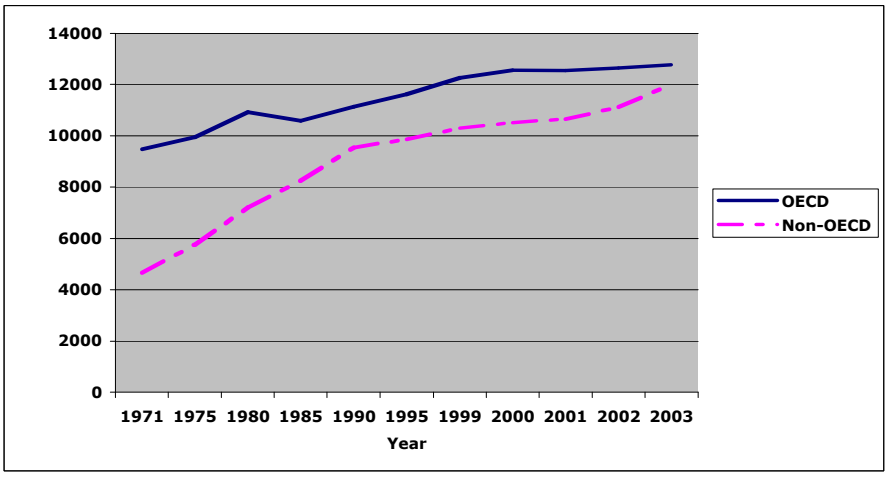
Figure 2: Evolution in Global Total Primary Energy Supply, 1971-2003 (in million tonnes of oil equivalent - Mtoe)



Source: International Energy Agency

The following graph shows the evolution of CO2 emissions since 1971, split between OECD and non-OECD countries. Since 1990, carbon emissions have increased by 25.8 % in non-OECD countries and by 14.8 % in OECD countries. Since 1990, Kyoto Parties have seen a total drop of 8.2 %.

Figure 3: Evolution of Carbon Emissions (Reference Approach), 1971-2003

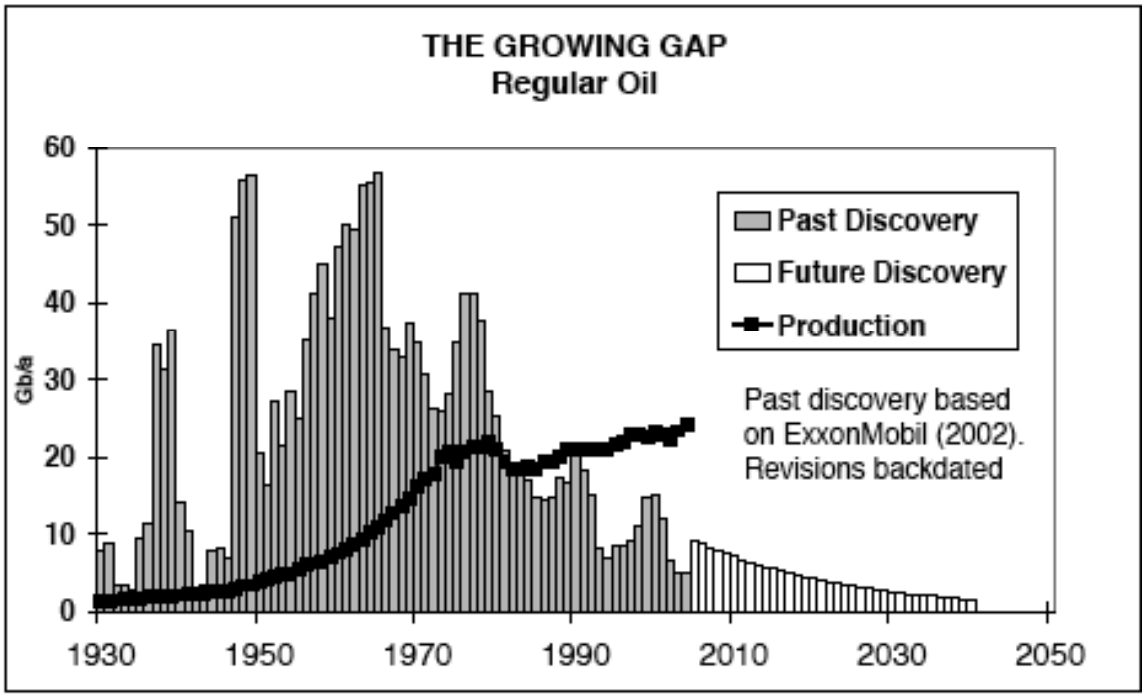


Source: International Energy Agency.

An earlier-than-expected advent of peak oil would bring a drastic change in the level of production as suggested by the calculations made by the Association for the Study of Peak Oil and Gas (ASPO)[20] and illustrated by the following graph.

[20] See: www.peakoil.ie/

Figure 4: Predicted Oil Production



Source: ASPO Newsletter n°60, December 2005.

Obviously only countries having organised their ecodevelopment strategies to draw on a broad range of renewable energies would escape the damages of a brutal rupture in fossil energy supplies.

Results of the 2006 SEW Survey of Countries

The eight indicators were calculated by HELIO reporters within the 18 countries and one region surveyed. A variety of data sources were used but most of them were available nationally. Quality of data may, however, be uneven in some countries. This is where the country reporters play an important role in securing and interpreting data. The main results are divided according to the four pillars of sustainability.

Environmental Indicators

Indicator 1: Per Capita Carbon Emissions from the Energy Sector

Global environmental impact is measured by carbon dioxide (CO2) emissions per capita (actual carbon in the CO2). Each nation's per capita emissions are compared to the 1990 global average. Climate experts estimate that the stabilisation of the climate may require a 60-80% reduction in CO2 emissions.

If the general analysis is that reductions in the range of 60-80% are needed to achieve sustainability, then the work has barely begun. There have been only small improvements in the United States and the European Union between 1990 and 2003. The United States improved only 0.5 % over the entire period and the European Union only 2.4 %. Both the Russian Federation and South Africa saw good improvements, although their emissions per capita are still unsustainably high. Concern persists with China, which has deteriorated by more than 52 % since 1990: although per capita emissions are significantly below the global average, at the current rate of growth and with the sheer size of the country, its impact will be substantial. Some countries like New Zealand are trying innovative ways of dealing with the problems created by methane from livestock.

Even though their total emissions are low, countries such as the Democratic Republic of Congo have to be careful because its emissions grew 21 % over that period and in Tunisia, emissions per capita grew 31 %. While it may not have much of a global impact, it could have a knock-on effect for the country's environment and economy.

Coal and oil are responsible for most CO2 emissions and road transport has become the main growing and polluting sector the world over. **Except in a few countries determined to develop railways (India) or shipping, it is difficult to see any long-term progress in CO2 reduction** which will meet the target of 2°C temperature maximal increase, a goal now largely accepted as a first step towards a possible stabilisation of the climate shift.

Indicator 2: Most Significant Energy-related Local Pollutant

The most significant energy-related pollutant that strongly impacts local human or environmental health is chosen by HELIO reporters. Such pollution sources are frequently related to industry, mining, fuel refineries, manufacturing, or electric power plants. The most common energy-related pollutants are sulphur dioxide, nitrogen oxide and ozone. Factor 10 is used as a goal.

Asked to identify the most relevant significant local pollutant in their country, most reporters identified suspended particulates (PM10). Others reported sulphur dioxide (SO2) or carbon monoxide (CO) and the United State reporter provided a basket of pollutants. Overall the results are encouraging, with decreases from 30 to over 60 % in many countries. There were exceptions, including Benin and New Zealand where there were significant increases in CO and particulates, respectively. In China the indicator for SO2 and CO decreased substantially. Even though the indicator for SO2 showed important progress, China's levels remain dangerously high; the country still has 7 of the world's 10 most air-polluted cities. China has, however, closed down a large number of urban enterprises that used outdated technologies, were high energy consumers or caused serious pollution. However the problem is not fully addressed as a number of these polluting enterprises have been re-located to rural areas, merely shifting the pollution rather than fundamentally reducing it.

France identified nuclear energy as the most significant local pollutant, mainly because of the unsolved wastes disposal problem, but also because of routine air and water emissions, as well as the associated risks (locally and globally), vandalism or terrorist theft. In Mexico, industry was the main polluter but the growth of the vehicle stock has lead to vehicles being the main source of urban air pollution. Generally **rampant urbanisation and motorisation have increased pollution everywhere.** Indiscriminate urbanisation also breeds unemployment and consequently poverty, thus multiplying problems. Most of the developing countries suffer from all the same problems created by oil in industrialised countries, only more severely because of their lack of resources to escape from their predicament. Sub-Saharan countries like Cameroon and Benin for instance, are still importing second-hand vehicles which are inefficient and polluting.

Deforestation, soil erosion, desertification, and air pollution from industrial effluents and vehicle emissions are all seen as environmental issues that require immediate attention in India. In Benin, vehicles often pose the greatest hazard to health and are difficult to mitigate without a massive switch to clean public transport. Mali is concerned about the steady degradation of the urban and rural environment despite the stated policies of the government. In Tanzania overgrazing, ground fires and felling of trees, in large part for home cooking and heating, are reducing the regeneration of plants and animals. Some 60 % of the total land mass is classified as dry lands and is threatened by desertification.

Efforts made in energy efficiency improvements will drastically diminish local pollution.

Social Indicators

Indicator 3: Households' Access to Affordable Electricity

> Access to electricity is considered a social good—it helps spread literacy and education, it contributes to improved health through refrigerated storage of food, medicines, and increased levels of communication and awareness. The task is to find the number of households with access to reliable and affordable electric power, either through the transmission grid or by stand-alone systems.
>
> Countries with 100 % access look at the percentage of household income spent on energy.

In industrialised nations, access to electricity is virtually achieved. However, in much of the world, this is not the case. Access is improving overall but very slowly in many cases. For example, in the Democratic Republic of Congo, the percentage of the households with access to electricity increased from 5% to 6.2% between 1990 and 2003. In Benin, the percentage increased from 8.6 % to 22.1% and in Haiti from 19% to 20%. In Haiti, access to electricity and the consumption of electricity remain very low. Consumption is at 75 kWh per capita per year, which is 31 times less than neighbouring Jamaica and 41 times less than Trinidad. Moreover, the electricity losses amount to 50%: 20 % because of technical losses in the transmission and distribution system and 30 % because of theft.

Tunisia's access to electricity increased to 89.9% from 85.9% during the period studied and, interestingly, 11,500 homes were electrified by solar photovoltaics. India's *National Rural Electricity Infrastructure and Household Electrification Programme* aims to provide access to all households in five years. All Chinese provinces have electricity.

Electricity must be available, accessible, but also affordable. It is, therefore, not the price that matters as much as the burden on households. In the European Union, the electricity bill represents 4.1% of household expenditures. In the US, low-income households (defined as those earning less than $10,000) spent 10% of their income on energy while in New Zealand the burden increased 2% from 6.1% to 8.1%. One explanation for this increase is that energy companies that have been privatised raised their prices and exported the profits overseas, in turn negatively affecting the national balance of payments. In other countries,

the jury is still out on the benefits and disadvantages created by the privatisation of energy assets[21].

A system for fair pricing is being proposed in India called *Demander Pays Principle*: those who have small power demands pay less (using production from already-built equipment) than those with large demands which require new investments by the generator. These new, big "demanders" would therefore have to pay the marginal cost, not the average cost. All that is needed is a simple system to discriminate between already-built and needed new production equipment.

Indicator 4: Investment in Clean-energy Jobs

Investments in clean energy create more jobs and faster growth than comparable investment in conventional energy. Detailed data on employment gains are not available in most countries. A substitute indicator has been selected for which data are generally available: investment in renewable energy and energy efficiency.

It is fundamental that a sustainable energy approach helps the economy, and particularly assists in job creation. Several studies show that investment in clean energy — renewable energy and energy efficiency — generates a wider range of jobs and a greater diversity of skills leading to faster economic growth than comparable investment in conventional energy. Heavy investments for geological sequestration are generally not considered viable technologies as they are unproven, expensive and perpetuate the reliance on fossil fuels[22].

China is paying a heavy toll for its accelerated development with an estimated 100,000 the deaths due to accidents in coal mines in 2004[23]. In China the *Renewable Energy Development Promotion Law*, which took effect in January 2006, plans to make a major push in the field of renewables. The law stipulates that 70% of the wind equipment has to be manufactured internally (this rate is 60% in Brazil). The hope is that efforts to improve energy efficiency and promote renewables will have social, economic, and environmental benefits.

The most striking and beneficial development is Brazil's major initiative to further exploit its renewable energy potential biomass for road transport. The push towards the deployment of renewables stopped in the 1990s as fossil fuels increased markedly in the energy balance; however there has

[21] In Norway and Australia "intelligent" meters are used to inform householders of real-time prices, allowing for the structuring of tariffs that reward price-responsive demand. Consumers are therefore able to adapt their consumption according to financial priorities.
[22] Furthermore a study by Greenpeace indicates that the "storage" of fossil fuel-derived carbon dioxide in the water column, at the seabed or beneath the seabed from vessels or platforms would be contrary to the London Convention (1972) and, in the North East Atlantic region, to the OSPAR Convention (1992)
[23] In 2004, China produced 1.956 billion tons of raw coal at the price of over 100,000 deaths, representing a rate of around 50 lives for per 1 million tons of coal production

been a significant turnaround in recent years that is very encouraging. Ethanol from sugarcane has been in use since 2003 in flex-fuel vehicles[24]. These vehicles can be adopted in any country able to produce the necessary biofuel and could contribute to the reduction of road transport pollution. Biofuels production has started in several countries with suitably vast arable lands such as Benin[25].

Most countries have abundant local renewable energy resources and wind energy is now profitable without subsidies in a number of localities. Oil prices stability at a high level make solar passive and active energy an attractive solution in most developing countries.

Overall, however, **investment in clean energy jobs remain disappointingly low** with the only major statistical improvement occurring in New Zealand (wind, wood pellets and firelog production) and minor improvements in South Africa. In central Africa where the need is the most dire, only very small projects are being funded by international organisations and NGOs despite the impetus expected from the Kyoto Protocol, via the Clean Development Mechanism. Congo and Russia, for instance, have totally neglected their vast renewable energy resources. Hopefully international meetings of concerned clean energy advocates will generate interest from investors and capital flows for new projects in the near future.

The most profitable investments remain in energy efficiency especially as government decision-makers realise that most of these technologies have a "negative cost" meaning that they can pay for themselves in less than a year. Energy efficiency improvements create valuable employment, but the numbers are not officially recorded in most countries.

The G8 Renewable Energy Task Force 2001 Report lists some key facts concerning the economic benefits of renewable energy:

- Continuing cost reductions occur through increasing scale of manufacturing and deployment
- Costs are not affected by swings in fossil fuel prices
- Modularity, low operating costs
- Installation of distributed generation units helps reduce pressure to build new power grid generating capacity and transmission lines
- Very short construction times give much greater flexibility in energy planning and investment
- Local employment and income generation result from manufacturing, project development, servicing, and utilisation

If countries were turning towards genuine ecodevelopment, this indicator would show strong increases. As the numbers indicate, this is not yet the case.

[24] A flex fuel vehicle can use either gasoline or an alternative fuel in varying proportions as its power source.
[25] Project "Fourniture des Services de l'Energie", financed by the World Bank. One of its components is the production of ethanol using beans of Malacca (in French: "pomme d'anacarde").

Economic Indicators

Indicator 5: Energy Security/Energy Trade

Many countries are highly dependent on imported fuels and the threat of supply interruption is real. A more universal threat is the price and exchange rate fluctuations that can destabilize both importing and exporting nations.

Separate metrics have been selected for import-dependent and export-dependent countries. In order to provide a sustainability incentive for net energy importers without discouraging imports of renewable energy, imports of non-renewable energy are measured as a fraction of non-renewable energy consumption. Importing countries can improve sustainability by reducing either imports or consumption of non-renewables or by increasing imports or consumption of renewable energy.

For the energy importing countries, the results are disturbing. There is a general decrease in energy self-sufficiency. This is happening, regardless of the size or state of development of the country. Many of the smaller African countries have warned of the adverse effect this is having on the balance of trade but also on their growing dependence on fossil fuels. Globally, China, India and the United States, in particular, but also the European Union, are seeing a major dependence on imports that can create increased vulnerability. Energy security concerns are growing and several countries, including the United States, are renewing their commitment to reduce dependence and improve sustainability.

Cameroon, which is a net exporting country, saw total exports decline between 1990 and 2003, while the import and domestic consumption of oil products increased substantially. Its overall sustainability has been seriously eroded. Worse, **several countries formerly net energy-exporters are now net energy-importers**, e.g. Tunisia and China. In the United States, while many states are undertaking creative clean energy initiatives, there has been no active engagement on sustainability issues at the national level. Dependence on imported fuel is increasing and affecting global energy markets. In New Zealand, the rapid decline in the Maui gas production has led to a significant increase in coal-fired generation and the future shape of New Zealand's primary energy supply is now very uncertain.

Some encouraging efforts are noticeable however. Mali has created rural markets for fuelwood supply that will improve forest management and sustainably provide more wood to urban markets. Brazil's oil imports have decreased from 83% of its consumption in 1980 to 23% in 2003, and should be reduced zero in 2006 thanks to a clear substitution policy and a strong political commitment. Lofty speeches are heard in many circles, but only political will can make the difference.

Indicator 6: Burden of Public Sector Investments in Energy

This indicator compares government investment in non-renewable energy supply to total GDP as a measure of the burden of energy development on the economy. The primary purpose of this indicator is to get public funds out of the energy supply sector and to promote better investment

Vast energy resources are not necessarily a blessing. They usually require large investments in exploration, development, exploitation and large investments in maintenance which can be a drain on the economy. Over the past two years in Mexico, there has been a series of incidents involving underground oil ducts and in some cases considerable oil spills into rivers. Others have involved explosions causing human and material losses. This is a result of an ageing pipeline infrastructure and reduced spending on its maintenance, but also because PEMEX, the national oil company that owns and operates the pipelines, is heavily taxed, leaving little room for new investments.

Several countries in this report series (China, France, India, Iran, Russian Federation, and the United States)[26] are building or considering a renewed expansion of nuclear energy capacity without the necessary analysis of full life-cycle costs, health risks and long-term waste management. This investment will likely be undertaken by public or semi-public monopolies that are free to charge and tax users without having to respond to user demands and their advice as citizens-tax-payers. Such unprofitable, forced investments are contrary to ecodevelopment.

Furthermore the crowding-out effect of excessive public investment in energy may prevent investments in health, education, or favour productive sectors, such as manufacturing, which is more likely to support a balanced development of the country. Investments in the educational and health systems are often the first victims of overinvestment in energy resources[27]. When non-renewable energy development is undertaken by the private sector, or when formerly public-owned energy infrastructures are taken over by private corporations, it is important that the sector be **re-regulated to insure that public service is properly continued** and that preoccupations with short-term profits do not hinder the upkeep and maintenance of equipment.

For a sustainable energy strategy to be effective, **government support in the energy sector has to shift away from conventional (fossil) energy supply towards improved energy efficiency and new renewable energy**. Currently results are relatively good and there seems to be a well-advertised shift towards renewables and energy efficiency in several countries. Although data from smaller countries is difficult to

[26] China has plans to add 32 new plants to its existing 11 by 2020 and India, with its 14 plants, wants to triple its total capacity in six years. "Nuclear gets a boost on energy agenda, but hurdles are high," by Katrin Bennhold and Dan Bilefsky, International Herald Tribune, January 25, 2005, p. 11.
[27] Connor, Helene, "Societal Impacts of Utility Overinvestment: the James Bay Hydroelectric Project", in Utilities Policy, Vol.1, N°1, October 1990.

obtain, available data indicate promising trends. This is one indicator that seems to point out the hoped-for turn around towards more sensible energy investments.

Technology Indicators

Indicator 7: Energy Productivity

This indicator measures each nation's progress in terms of obtaining more economic activity per unit of energy consumed. While this indicator is not perfect, it can be used as a proxy for overall progress in improving energy efficiency and restructuring away from energy-intensive practices. Counting GDP output at current exchange rates works better for comparing industrialised countries than for comparing developing countries. In the latter cases, purchase power parity accounts of GDP are more appropriate.

It is fundamental that energy be used wisely and sparingly. For the past three decades or more, many countries have actively attempted to reduce the energy intensity of their economy in order to break the link between increased economic growth and a parallel increase in energy consumption. There was a significant improvement in the 1970s and 1980s after the first two oil crises, but progress since 1990 has been relatively modest despite policy statements.

From 1978 to 2004, China maintained an annual GDP growth of 9.4% while its annual energy consumption only grew at an annual speed of 4.8%. From 1980 to 2000, China's energy intensity decreased by an average annual rate of 5.32 %. Most countries have targets to improve their energy efficiency, but unfortunately none as ambitious as China's, which is paradoxical given that such a reduction is feasible with current technologies. Tunisia has adopted a sustainable energy strategy that will reduce energy intensity by 1 % per year and will vigorously promote the use of renewable energy. However, since 1% is the natural rate of increase of efficiency due to normal technical improvements in new equipment, it is likely that most countries will do much better and could even emulate China.

Some countries, such as France, have adopted the Factor Four concept. Demonstrations on Factor Four and Ten, and examples given in "The Natural Capital"[28] prove that a **large number of energy efficiency measures are usually costless and have an immediate payback**. Except in very few countries, this potential is practically untapped. The initiative launched in June 2005 by the European Parliament: 'Energy Efficiency Watch', is a step in the right direction. It is set up to monitor EU and national performances. EU Commissioner for Energy, Mr. Andris

[28] Amory and Hunter Lovins, Paul Hawken, "The Natural Capital", available free at www.naturalcapital.org

Piebalgs, is also very much committed to energy efficiency and launched in June 2005 a plan to cut 20% of EU energy consumption by 2020 – half of which could be achieved by merely implementing existing (voluntary) legislation. Analysts are hopeful that worthwhile efforts undertaken by such supranational bodies will be influential in other countries and, via globalisation, will promote ecodevelopment worldwide.

Indicator 8: Renewable Energy Deployment

> Availability of multiple forms of renewable energy is the best form of supply security. Global use of renewable energy is growing faster than the use of fossil fuels and electricity. Fossil fuels and nuclear power —heavily subsidised and politically favoured for decades— still generate a large fraction (approximately 4/5) of the world's electricity. Yet the market is changing, as is both political and popular support. Renewable costs are falling rapidly and therefore competitive without counting the multiple benefits of clean, environmentally advantageous energy supply and improved energy services to many disadvantaged regions of the world.

The results are mixed, with countries such as China, New Zealand and the United States failing to increase the share of renewables in electricity production. The European Union saw only a modest change. Benin saw a sizeable deterioration because of a switch to fossil fuels. In most countries, priority is still given to economic growth over every form of sustainability, including health. China's share of renewable energy has decreased from 25 % of total energy consumption in 1990 to 21.2 % currently (mega-hydro included). Coal and oil have gained at the expense of renewables in the rush towards greater industrialisation and urbanisation. High population density, rapid industrialisation and urbanisation, low technology level and the lack of wastewater and solid waste treatment facilities, as well as ineffective environmental law and regulation enforcement, have led to severe air, water and soil pollution and other externalities. Bangladesh has identified 5 reasons for the lack of renewable energy development:

1. The true potential has not been determined;
2. The prevalence of extreme poverty in precisely the areas of the country where renewable energy can be deployed;
3. Subsidized or "no tax" fossil fuel supply;
4. Lack of capacity within the country to deploy new and emerging technologies; and,
5. Neglectful attitude of the Government.

There is some encouraging news from countries who have decided to be pro-active and cooperate with other governments and their members of civil society: the Democratic Republic of Congo is starting to realise the enormous energy potential (hydroelectricity, geothermal, solar) that exists within its geographically large country. However, action is hampered by the lack of local appropriate institutions and legal framework that exist in

industrialised countries. Bangladesh is involved in the South Asia Regional Initiative for Energy Cooperation and Development to build mutually beneficial energy linkages among the countries of South Asia. In South Africa, there are a few projects being undertaken to promote sustainable development, including environmental management and monitoring. Tanzania has 159 community-based organisations and NGOs devoted to environmental issues, many of which are involved in community-based energy and environment projects. In the USA, action is noticeable at the state level within local communities and NGOs such as the Apollo Alliance[29] that launched an initiative to massively promote renewable energy in an effort comparable to the space program of the same name. Such initiatives have to be nurtured with economic and fiscal tools. In developing countries, and especially in Africa, there is also a need for better-allocated, substantial, multilateral funding.

[29] The Apollo Alliance, with the tag line "Three Million New Jobs. Freedom from Foreign Oil." is a coalition of labor, environment, business, and some government leaders. The Alliance emerged in 2003 to present a compelling vision of the USA as an energy leader instead of an energy dependent country.

Main Findings and Lessons

Integrating the concept of ecodevelopment into the production, transmission and use of energy is paramount if we are all to lead healthy and productive lives. Rising to this challenge demands that we drastically rethink our approach to energy policy and thoroughly review our economic systems. It requires vision to make those changes, but also patience, persistence and a willingness to dispel inertia. The attitudes and behaviour, built up over decades, need to be changed. But to transform these past practices, clearly presenting the arguments as to why a sustainable energy approach is fundamental to our future must occur.

Below is a synthesis of some interesting findings and lessons to be learnt from the countries analysed:

Despite efforts undertaken since the first oil shock (1973), energy policies are still reductionist in approach: They remain mostly supply-side oriented and impervious to the environmental and social externalities created.

- Energy efficiency policies and measures are still not receiving the priority needed nor are they sufficiently geared towards providing energy services. The potential role of energy supply and distribution companies in providing demand side management has not been filled due to perverse financial and regulatory incentives. There also needs to be a much bolder approach in arresting the growth of greenhouse gases emissions.

- There is still the widespread perception that a change in energy consumption patterns means a decrease in life-style choices or opportunities. The psychological link that economic growth depends on more energy (virtually at any cost) has not yet been broken despite ample proof to the contrary.

- Too many forget that a key element of sustainable energy policy is energy security. However, energy security does not mean increasing the capacity of major energy suppliers whose generation systems are detrimental to the environment. Energy security means eliminating polluting and vulnerable systems, and favouring the efficient, clean, safe energy production.

There is still a lack of knowledge about the wide range of energy sources, technologies and possible strategies. Thus energy decisions remain distorted and reinforce the use of outdated technologies and processes.

- It is counterproductive to passively wait for some miracle technological breakthrough instead of doing the 'simpler' cost-effective measures with the technologies that exist and the means that are already available.

- There is so much money to be made in energy supply (oil, gas, electricity) that governments have too often been reluctant to challenge the leaders of the energy supply industries into taking a more integrated, sustainable approach. There has not been the necessary decoupling of consumption and production – technically (in design and production processes) and politically (via incentives, penalties, etc.). Governments have also been too narrow in promoting economic growth without undertaking a proper and complete assessment of the long-term costs and benefits of such developments and comparing them with the whole range of alternatives energy resources.

- There are some excellent examples of what can happen to develop sustainable energy practices. Those 'champions' need to be better explained and disseminated to others. This can best happen when local institutions and specialised NGOs work together across borders; In most developing countries, however, there is a critical lack of physical and institutional capacity.

The contribution of energy to ecodevelopment requires improved governance and genuine citizen involvement.

- Energy policy has traditionally been made by decision-makers who almost entirely rely on their own acumen. There is a need to make energy policy more community-based, decentralised and in-line with the needs and concerns of citizens. This requires institution-building both in industrialised and developing countries ; the creation of citizens boards (CUBs)[30] can contribute directly to energy decision- and policy-making;

- Marginalisation of women has been proven to be a brake on ecodevelopment (Mali). Countries like Bangladesh and others have policies and quotas, such as reserved seats for women on important committees to ensure that policies address the needs of the people for which they are designed. Micro-credit has also been institutionalised to help break the cycle of poverty and increase financial stability.

- Consumers and citizens in general need to be encouraged to become more involved in energy planning at local, regional and national levels. As users they can provide guidance to energy companies in terms of the services needed and how they should be provided. Citizens' empowerment is one way to balance the influence of big business consumers and energy suppliers. All stakeholders need to be better informed and more involved in managing the energy scene. Although energy policy is not a technical issue decision-makers at all levels need to have a

[30] Citizens Utility Boards (CUBs) are present in some US states (Oregon, Illinois). See also EnergyWatch in the United Kingdom.

much better grasp of the opportunities and implications so that they can make more enlightened and effective policy decisions.

The Future Beckons

Most people and societies do not want to live unsustainably but too often they are unaware of the impact of their behaviour on the environment and on future generations. When the momentum of economic development and industrial expansion is building, it is difficult, and is often seen as a low priority, to stand back, listen to reason and assess the full implications of the dynamics underway[31]. Citizens questioning energy policies have little or no real mechanism to make themselves heard. Therefore the "default" position is to continue as usual, and take a chance that the harm will be minimal. There is self-satisfaction in many countries that adding a little extra renewable energy or promoting a new energy efficiency measure is enough. Too often there is a token gesture to ecodevelopment by highlighting one or two "showcase" efforts. Those "laudable" efforts have to be seen in the light of the less-than-sustainable practices that are occurring simultaneously in order to truly assess the commitment to ecodevelopment.

This SEW-2006 study has allowed us to test some countries' course of action towards a better future. Too little has been done so far to promote a genuine sustainable and equitable development for all, but useful knowledge is spreading. And hope, like the phoenix, rises again that the fateful turn towards ecodevelopment has begun. This hope was recently illustrated by the Russian Federation (in its role as host of the 2006 G8 summit) in its claim that solidarity is the best policy[32]:

> "Generally speaking, all of us should recognise and admit that "energy egoism" in a modern and highly interdependent world is a road to nowhere… It is our strong belief that energy redistribution guided wholly by the priorities of a small group of most developed countries does not serve the goals and purposes of global development. We will strive to create an energy security system sensitive to the interests of the whole international community. Basically, all it takes is for mankind to create a balanced potential in order to provide every state with sustainable energy supply, and international co-operation opens all avenues for that".

Easy, isn't it?

[31] These are explained in "Escaping the matrix. How We, the People, can change the world", Richard Moore, published by the Cyberjournal Project, 2005, 209 pages. http://escapingthematrix.org/
[32] 2006 Declaration by Wladimir Putin

Annex 1: HELIO Reporters and Regional Coordinators

REGION/COUNTRY	NAME
EUROPE	
REGIONAL COORDINATOR	Delia Villagrasa
EU	Pieter De Meyer
FRANCE	Yves Marignac
CENTRAL AND EASTERN EUROPE	
REGIONAL COORDINATOR	Peter Tulej
RUSSIAN FED.	Vladimir Karghiev
NORTH AMERICA	
REGIONAL COORDINATOR	Richard (Rick) Heede
MEXICO	Odón de Buen R and Isabel Bustillos
USA	Jennifer Atlee
LATIN + SOUTH AMERICA	
REGIONAL COORDINATOR	Emilio Lebre Larovere
BRAZIL	Ricardo da Costa
HAITI	Jean André Victor
MIDDLE EAST + NORTH AFRICA	
REGIONAL COORDINATOR	Samir Allal
IRAN	Morteza Sabetghadam
TUNISA	Houda Ben Jannet Allal
FRENCH SPEAKING AFRICA	
REGIONAL COORDINATOR	Ibrahim Togola
BENIN	Raoufou Moutaïrou Badarou
CAMEROON	Emmanuel Ngnikam
DEMOCRATIC REP. CONGO	Seraphin Kasemuana
MALI	Cheick Ahmed Sanogo
ENGLISH SPEAKING AFRICA	
REGIONAL COORDINATOR	Pierre Mukheibir
REPUBLIC OF SOUTH AFRICA	Ndumiso Dlamini
ASIA	
REGIONAL COORDINATOR	Ram Shrestha
CHINA	Xianli Zhu and Jiahua Pan
SOUTH EAST ASIA	
REGIONAL COORDINATOR	Sujay Basu
BANGLADESH	Ijaz Hossain and M. Tamim
INDIA	Dipankar Dey
OCEANIA	
REGIONAL COORDINATOR	Ian Shearer
NEW ZEALAND	Molly Melhuish
SEW COORDINATORS	
	Laura Williamson
	Hélène Connor

Annex 2: Summary of Country Indicator Calculations

	Indicator 1: per capita energy sector CO2 emissions		Indicator 2: most significant energy-related local air pollutant(s)		Indicator 3: households with access to electricity		Indicator 4: investment in clean energy		Indicator 5: energy resilience/energy trade		Indicator 6: burden of energy investments		Indicator 7: energy productivity	
Country	**1990**	**latest**[1]	**1990**	**latest**	**1990**	**latest**	**1990**	**latest**	**1990**	**latest**	**1990**	**latest**	**1990**	**latest**
Bangladesh[2]														
Benin	-0.38	-0.31	1.00	3.90	0.91	0.77	n.a.	0.80	0.24	0.59	n.a.	0.25	4.40	4.69
Brazil	0.06	0.23	1.00	1.52	0.45	0.18	1.00	0.98	0.55	0.43	0.06	0.12	1.39	1.48
Cameroon	-0.32	-0.32	1.00	1.24	0.63	0.53	1.00	n.a.	0.05	0.46	n.a.	n.a.	0.85	0.34
China	0.33	0.50	5.79	3.70	0.10	0.02	1.00	1.02	0.01	0.12	0.44	0.25	1.95	0.85
Democratic Republic of Congo	-0.30	-0.36	1.00	1.00	0.95	0.94	-0.35	-0.37	0.09	0.68	n.a.	n.a.	-0.03	-0.08
European Union (EU-15)	2.54	2.47	1.00	0.53	n.a.	n.a.	n.a.	n.a.	0.51	0.56	n.a.	n.a.	0.94	0.58
France	2.70	2.65	5.02[a]	13.38 [a]	0.30[b]	0.31 [b]	1.04	0.80	0.60	0.64	0.69	0.39	0.30	0.28
Haiti	0.66	0.66	n.a.	n.a.	0.90	0.80	1.00	1.30	1.00	1.00	0.01	0.01	3.07	3.70
India	1.08	1.09	3.79	4.79	0.59	0.43	1.00	0.97	0.17	0.30	0.25	0.33	3.13	2.86
Iran	0.85	1.49	1.00	2.39	0.17	0.08	1.00	1.00	0.86	0.80	1.16	1.16	2.04	2.25
Mali	-0.33	-0.38	n.a.	n.a.	0.82	0.88	1.00	1.08	0.60	1.00	0.68	0.45	n.a.	-0.11
Mexico	0.82	0.81	5.78	4.74	0.14	0.04	1.06	1.06	0.25	0.13	0.12	0.09	0.99	0.98
New Zealand	1.82	2.20	1.00	1.26	0.00	0.00	1.00	0.68	0.33	0.60	0.00	0.01	0.35	0.35
Russian Federation	4.80	3.64	1.00	0.44	0.02	0.02	1.00	1.00	0.53	0.55	0.35	0.34	1.32	1.32
Republic of South Africa	2.36	1.96	1.00	1.03	0.65	0.31	1.00	1.00	0.11	0.07	0.06	0.06	2.03	1.67
Tanzania	-0.40	-0.40	1.00	0.89	0.96	0.90	1.06	0.99	0.96	0.40	0.00	0.03	0.77	0.68

Country	1990	latest[1]	1990	latest	1990	latest	1990	latest	1990	latest	1990	latest	1990	latest
Tunisia	0.17	0.36	1.00	1.25	0.25	0.03	1.00	1.00	0.48	0.54	0.22	0.31	0.59	0.51
United States	6.38	6.46	1.00	0.68	0.00	0.00	1.00	0.61	0.18	0.30	0.05	0.06	0.88	0.66

1 = latest year is usually 2003 but may be anything in between 2000 and 2004; refer to individual tables for details
2 = report gives values in physical units, not indicator values
a=alternative indicator: accumulation of nuclear material (a second alternative indicator, % nuclear in electricity, is also provided): 1990 value 4.39; 2004/2005 value 4.61.
b= alternative indicator