# Overview of Methodology

## Defining Ecodevelopment with Regards to Energy

To be conducive to ecodevelopment, 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.

In practice, not all of these can be accommodated all at the same time. Trade-offs will often be necessary. The important thing, however, is to make the environmental, economic and social implications transparent to civil society, and to take into consideration all these effects in policy making. Trade-offs should be determined through a multi-stakeholder process involving all interested and affected parties. In this process, costing for different purposes (environmental, economic, and social) can be used as an instrument to identify the effects and facilitate discussions, even though the final decision should not and will not be based only on such monetary valuation.

To assess non-quantifiable impacts, qualitative approaches such as opinion polls, media information and other techniques used to take non-monetisable impacts and externalities into account.

## Assessing the Contribution of Energy to Overall Ecodevelopment

Sustainability has to be checked "transversally", on the ecological, social, economic, technological and cultural/political dimensions. It also has to be checked "vertically" since energy sustainability criteria must address the whole energy life-cycle, from extraction through to the disposal of wastes.

On the upstream side, the first point to assess the extent to which the energy supply is renewable. A rough indicator could be the share of mini-hydro + solar + wind + renewable biomass in the national energy budget. Biomass from the destruction of forests must be excluded.

Environmental and developmental impacts and risks of the whole chain of energy production must also be assessed; R&D, prospecting, extraction of the resource, conversion, storage, transport, distribution and disposal of wastes (including waste heat). This includes the impacts and risks of the energy chains on the dimensions described above. Some interesting indicators include:

- the amount of land, water and non-renewable energy resources used;
- emissions of air pollutants : CO, SOx, NOx, HC, CO2;
- liquid effluents including organic matter, radionucleides and heavy metals;
- solid wastes generated with special focus on hazardous wastes;
- risk assessment: possible environmental disruption due to accidents, based upon historical records and mean expected values as well as on technological risk assessments;
- capital intensity of investments and financial consequences due to the opportunity cost of capital and eventually by the debt generated;
- employment generation including both direct and indirect jobs created;
- distributional aspects: transfer of economic resources to the beneficiaries of government subsidies and soft loans for energy production; scale of production (large or small, centralized or decentralized) and nature of producers (public or private, large or small groups);
- impacts on the balance of payments: imports/exports of energy and of capital and technology associated to the energy chains, amount of foreign exchange disbursed, saved or generated;
- degree of technological self-reliance in the energy production;

- diversity of energy sources and technologies available and put to use; and
- vulnerability to fluctuations and structural changes of international energy markets.

On the downstream side (the use of energy), the main questions are :

- who are the main energy consumers; and,
- for what is the energy used.

The answers are strongly correlated to the income distribution on both a personal and a spatial basis.

The degree of concentration of energy consumption across regions and income classes should also be highlighted. This would allow for identifying the main beneficiaries of energy production who are consequently the predominately responsible for the environmental impacts and the risks associated to the energy chains.

Another crucial indicator is the efficiency in the end-use of energy, in different economic sectors, regions and income classes. The ratio of useful energy to primary energy provides insight into the degree of wastefulness of energy consumption patterns and of the opportunities for energy conservation.

## Policy Issues Affecting the Pursuit of Ecodevelopment

In addition to cataloguing criteria, we should flag some of the main questions and issues surrounding the transition from fossil fuels to renewables, i.e. the road leading to sustainable energy systems:

- What is the best manner to internalise all the relevant social and environmental costs so that they can be reflected in prices and planning processes?
- How can we deal with the past "ecological debt" accumulated over decades to the satisfaction of all countries? (This issue keeps G77 countries pitted against OECD countries.)
- How can all subsidies and other forms of support to the polluting forms of energy be identified and dealt with. How can clean public transportation be promoted?
- What is the extent to which governments should get involved, i.e. should modify markets to accelerate the transition process?
- Should governments use "technology push" (R&D) or "market pull" (provide commercialization subsidies)? Perhaps we should compare successful with unsuccessful national efforts[1].

[1] The United Kingdom Non-Fossil Fuel Obligation (NFFO) program, though small, has promoted both technology development and cost convergence with fossil fuels. The US program, though larger, has

- How to bring about transfer of renewable technologies to developing countries? The prospects for large-scale overseas development assistance may not bring the expected results. Using market mechanisms, technology cooperation and foreign direct investment, incentivized by programs such as joint implementation, sponsor government loan guarantees, and support from the World Bank and regional development banks remains to be assessed.
- How to decide between centralized versus decentralized power generation? Developed countries will no doubt complete their centralized gas and electricity grids; however, developing countries can and should avoid the financial and administrative burden of large grids. Many renewables technologies can be deployed as decentralised, small-scale sources yet provide the necessary services.
- How to solve the inefficiencies created by the lack of concentration of energy consumption in developing countries and in most urban areas?

Some of these issues will be somehow already reflected in the choice of indicators and articulated in the report.

## General Methodological Approach

SEW's general methodological approach can be summarised as follows:

1. Choice of indicators;
2. Estimation of the indicators in the country studied;
3. Comparative analysis of indicators using 1990 as the base year[2] and comparing with latest available data;
4. Identification of factors explaining the changes within the period whenever possible;
5. Recommendations of measures to stop the decrease in sustainability where deterioration of sustainability is shown. Such recommendations could be alternative energy projects, efficiency improvements and tools for their implementation (policy and measures);
6. Evaluation of factors explaining success stories and lessons to be publicised and disseminated, in the cases where we have indicators showing an improvement in sustainability.

produced uneven results because it has not been applied with a steady hand. It is too vulnerable to national and state politics. ALTENER is a big disappointment because it is under-funded and its funding is spread thin on small projects, many of which are of limited interest.

[2] 1990 was the base year for the UN Framework Convention on Climate Change

## Selecting a Limited Number of Representative Indicators

The above-mentioned enumeration of energy indicators and of related issues is fairly comprehensive. The challenge is, therefore, to select a few simple, meaningful and transparent set of indicators, related to everyday life, and which would measure progress and reflect long-term sustainability.

It is important to note that, since we want to measure progress, the absolute figure is not crucial. What is important is assessing improvement over time. We will, therefore, compare the evolution of indicators within a nation, rather than the absolute numbers between different nations. Assessing progress using relative changes rather than absolute values (i.e. change in emissions per capita rather than the emissions themselves) can also minimize the problem of insufficient data.

For every year, the indicator formula will measure, per capita, the negative impacts of the energy system on the three dimensions of sustainability:
IMP/POP = GDP/POP x E CONS/GDP x E PROD/E CONS x IMP/E PROD

Impact level = wealth x energy productivity x environmental impact
where:

IMP = Negative impacts of the three dimensions of sustainability: environmental, social and economic, as defined by the checklist of indicators
POP = Number of inhabitants
GDP = Gross Domestic Product
E PROD = Total energy production and energy imports in the country (or region)
E CONS = Total energy consumption of the country (or region)

This formula will give us an evaluation of the impacts from the changes in the structure of energy balances, using a quantitative estimation of IMP according to the checklist of indicators outlined in section 2 above and to qualitative evaluations.

The selected indicators will be:

1. energy efficiency = ENERGY PRODUCTION/ENERGY CONSUMPTION. The change in energy own productivity will supply a rough measurement of how energy efficiency has changed from 1990 to current year; and
2. change in shares of energy sources in the energy supply as indicators of increasing or decreasing energy supply sustainability and diversity:
   - Coal
   - oil
   - natural gas

- conventional hydro power (large plants)
- nuclear power
- conventional biomass (non renewable)
- renewables: solar, wind, mini-hydro, renewable biomass

The analysis of the supply side will use renewability and diversity as the main criteria for two reasons:

1. as fossil fuel reserves start to decline the costs of using them will rise, causing economic shocks unless a variety of renewables can replace conventional sources economically; and
2. the threat of global warming removes the luxury of leaving the transition to renewables to market forces (supply and demand).

Renewables are not necessarily the panacea, as most energy sources impact the environment in one way or another, and the potential of specific technologies varies widely by region. They are, however, more labour-intensive than non-renewables, which may be an advantage in countries having many unemployed workers, and can contribute to economic stability.

On the demand side, the amount of energy used or needed depends on a myriad of factors, including climate, distances, rural versus urban lifestyles, and others. Energy intensity indicators, therefore, have to be used carefully. Some countries will always use energy more intensely than others because of their resource bases and comparative advantages.

## Future Work of SEW as an Independent Body

In addition to providing reports, the SEW Team could further use its assessment and monitoring abilities to provide decision- and policy-makers with information on tools fitting new visions of the future and on means of achieving them. SEW can contribute to better global governance by providing a "control panel" showing where present policies are leading us and by researching what can be done to redress the course.

The following are only a few examples of possible use of SEW :

- suggest policy and measures to increase the percentage of renewable energy in our society energy supply.
- study the implications of the indications given by the IPCC scientists which claim that CO2 emissions should be sharply reduced to achieve long-run stabilisation of greenhouse gases (GHG) at a safe level for the global climate.
- add its voice to that of the scientific and NGO community to enlighten the political apparatus, by providing and helping to disseminate information on these issues.

- introduce non-quantifiable aspects of sustainability into energy sustainablity assessments, SEW may lead or commission special inquiries and polls.

SEW can indeed contribute its expertise in many ways and cooperate with other projects and institutions concerned by the intertwined issue of energy and ecodevelopment.