The Assessment, Transfer and Uptake of Environmentally Sound Technologies: Background to and Overview of Environmental Technology Assessment (EnTA)

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Background

There is growing recognition of the importance of applying technologies that support the national and sub-national development process in an environmentally sound and sustainable manner. This requirement was highlighted in Agenda 21 and is now being addressed in many international, regional and national initiatives, including the International and Regional Round Tables on Cleaner Production.

New technologies, and more effective and efficient use of existing (including indigenous) technologies, are essential to increasing the capabilities of countries, especially developing countries, to achieve sustainable development, sustain the world's economy, protect the environment, and alleviate poverty and human suffering. Achievement of these goals requires improvements in the technologies currently in use and their replacement, when appropriate, by more accessible and more environmentally sound technologies.

Environmentally sound technologies (ESTs) protect the environment, are less polluting, use all resources in a more sustainable manner, recycle more of their wastes and products, and handle residual wastes in a more acceptable manner than the technologies for which they are substitutes. ESTs are more than just the specific application of know-how. Such technologies are the total systems that include know-how, technical procedures, goods and services, equipment, and organisational and managerial procedures. Consequently, the assessment, transfer and assimilation of these technologies involves consideration of such requirements as human resources development and other local capacity building needs. Moreover, ESTs are compatible with nationally determined socioeconomic, cultural and environmental development priorities.

Sometimes the environmental, cultural and human health and safety impacts of a proposed technology investment are overlooked by those advocating the use of a new or upgraded technology. An important aspect of implementing such policies is the ability to recognise the most appropriate ("cleaner") technology among all the options under consideration. Without an appropriate method for evaluating technology options in terms of their environmental and related impacts, the process of technology transfer may not result in the best environmental and related outcomes.

Environmental technology assessment (EnTA) is a systematic procedure to assess technology options at the pre-investment stage, with a focus on their relative environmental performances, the implications for sustainable development and the likely cultural and socio-economic consequences. EnTA helps planners, decision makers in government, the private sector, communities and other stakeholders, to reach a consensus on the technology intervention that is expected to be the most environmentally sound, socially acceptable and economically viable, for a specified location and application.

EnTA is being developed and promoted by the United Nations Environment Programme's (UNEP) Division of Technology, Industry and Economics, and specifically by its International Environmental Technology Centre (IETC) and its Production and Consumption (P&C) Unit, as well as by other international governmental and private sector organisations.

Now that a comprehensive suite of EnTA methodologies, tools and materials is in place, there is a need to optimise application of these resources, consistent with the view that EnTA is an integral part of a dynamic, evolving process of assessment, transfer, uptake and verification of ESTs

(Figure 1). All dimensions of the process need to be developed and applied in a rational and coherent manner in order to achieve widespread and sustained use of ESTs.

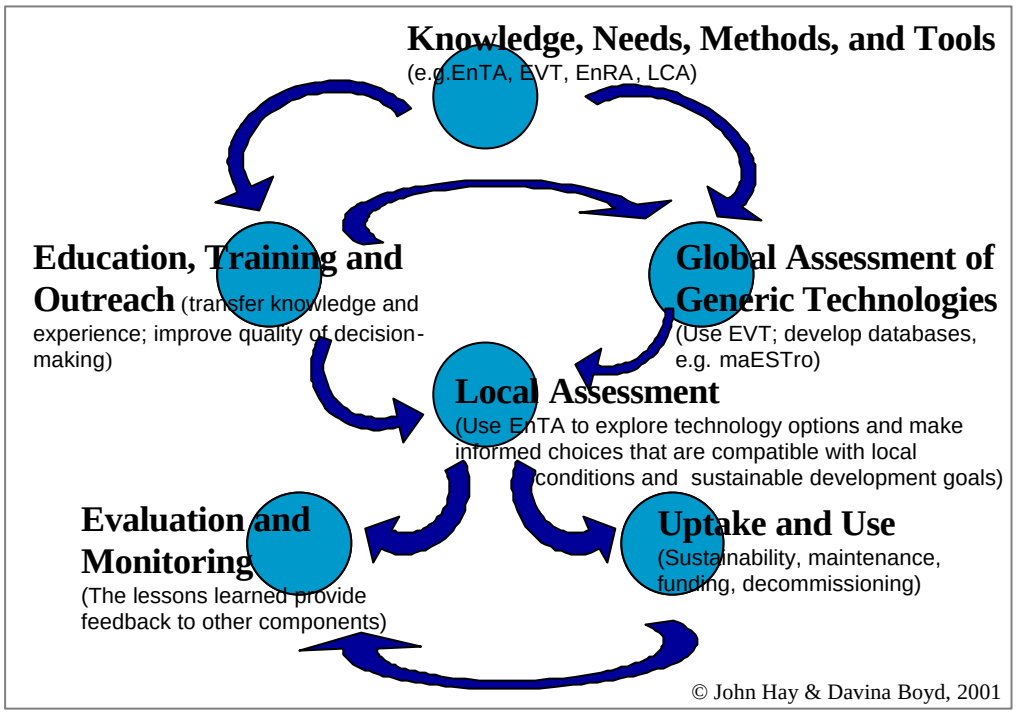

Figure 1. The process of assessing, transfer, uptake and verification of environmentally sound technologies.

Environmental Technology Assessment (EnTA)

As EnTA is a descriptive assessment of a technology, different stakeholders - anyone who uses, or will be effected by, a technology-related decision - can use it in a variety of ways. Potential users include:

- Decision makers and managers in industry – to recognise the wider environmental implications of their actions and avoid costly problems and legal difficulties;
- Development planners and other government officials – to ensure that the impacts of technology-based development can be identified and planned for in advance;
- Community and other non-governmental organisations – to help ensure that the rights and responsibilities of individuals and communities are given due recognition when technology-based developments are being considered;
- All individuals and groups with a commitment to sustainable development – to help ensure that the best possible environmental outcomes are contemplated, and implemented, whenever a new technology intervention is proposed.

The key and differentiating characteristics of EnTA are:

- a largely qualitative tool that minimises the need for detailed technical data;
- designed to facilitate multi-stakeholder dialogue leading to consensus decision making;
- intended to be used to prevent environmental problems, rather than solving them after the have become apparent;

- multidisciplinary – technical, economic and environmental conditions and processes can often be complex; therefore many different skills are required in assembling, combining, interpreting, and communicating information;
- involves simplifying both the relationships between the technology and its environment, and the consequences of those interactions; and
- examines the environmental effects of the entire technological system including the resources used and the wastes produced, over the full life cycle of the technology.

A fuller description of the principal characteristics of EnTA is provided in Table 1.

Table 1. Summary of the characteristics of EnTA

EnTA is:

- ***technology focussed;***
- ***focussed at enterprise level rather than national policy level;***
- ***designed to ensure consideration of alternative technology interventions;***
- ***simplifying, flexible, largely qualitative and often subjective;***
- ***designed to involve, and reflect the interests of, multiple stakeholders;***
- ***a scoping tool - to be used at the "idea stage", rather than after development of a formal/full proposal when it is more appropriate to undertake an environmental impact assessment;***
- ***a proactive environmental management tool;***
- ***multidisciplinary in approach;***
- ***comprehensive and integrated – with respect to the full life cycle and broad implications of the technology system;***
- ***identifies if more sophisticated assessment tools should be used; and***
- ***voluntary – it is not considered to be a regulatory tool.***

EnTA and Other Environmental Assessment Tools

EnTA is not intended to replace other assessment tools already in use, including Environmental Impact Assessment (EIA), Environmental Risk Assessment (ERA) and Life Cycle Assessment (LCA). EnTA has a different focus since it is totally oriented to identifying and evaluating both specific and broader environmental impacts, is predominantly qualitative and comparative, and examines the wider technological process over its entire life cycle. Table 2 compares EnTA with some other commonly used environmental assessment and management tools.

EnTA can in fact complement these other tools, helping to focus the initial assessment, and thereby promoting a better understanding of the effect a technology has upon the environment. EnTA provides a particularly valuable tool for determining whether a technology will meet specific performance criteria. It highlights steps in the process where Cleaner Production techniques (such as Pollution Prevention (P2) and Toxic Use Reduction (TUR)) and tools such as Cost-Benefit Analysis and Social Impact Assessment may be applied with advantage.

Table 2. Comparisons between EnTA and selected other environmental tools

	Environmental Technology Assessment (EnTA)	Environmental Impact Assessment (EIA)	Environmental Risk Assessment (ERA)	Life Cycle Assessment (LCA)
Purpose	Assesses implications of a technology and guides choices of technology	Identifies and predicts the environmental impacts of a project, policy or similar initiative; provides basis for decision on acceptability of the likely impacts	Risks to the environment and public health are estimated and compared in order to determine the environmental consequences of the initiative under consideration	Evaluates the environmental burdens associated with a product, process or activity, explicitly over the entire life cycle
Scope	Implications for human health, safety and wellbeing, and for natural resources and ecosystems; costs of the technology intervention and the monetary benefits	Impacts on natural resources, ecosystems human health, safety and wellbeing	Assessment of risks to the environment and human health	Implications for human health, safety and wellbeing, and for natural resources and ecosystems
Initiator	Proponent of technology; investor; stakeholders who may be impacted	Applicant for regulatory approval	Proponent of project or other initiative; investor; stakeholders who may be impacted	Proponent of project or other initiative; investor; stakeholders who may be impacted
Approach	A systematic, comprehensive and qualitative comparison of the pressures on the environment and the resulting impacts	Requirements often prescribed by regulatory authority, including identification of impacts, mitigation and monitoring measures and consultation	Hazard identification, dose-response and exposure assessments, risk characterisation	Life cycle inventory of energy and material requirements and wastes produced; impact analysis and improvement analysis
Timing	Scoping tool at the pre-investment stage, before the development of a formal/full proposal	Prior to decision whether or not the initiative should proceed	At any time, as determined by the initiator	At any time, as determined by the initiator
Regulatory Status	None – often used to screen options before more detailed assessment	Often required under environmental protection legislation, especially for larger projects or for proposed projects in environmentally sensitive areas	None – may be used to give support to conclusions of assessments required by law	None – typically used by producers or consumers to assess the environmental merit of the product, process or activity.

Overview of EnTA

Technologies do not exist in isolation, but are affected by the environment within which they function. And in turn they affect their surroundings. The approach taken in an EnTA is to identify, in a systematic and transparent manner, both the resources demands and environmental pressures generated by a technology, and then determine the likely implications for the environment. The sequence is described by the acronym "DICE":

- **Describe** the proposed technology intervention, any alternatives, their requirements, and the operating environment;
- **Identify** the *pressures* the technology places on the environment;
- **Characterise** the environmental *impacts* these pressures may cause; and
- **Evaluate** the overall *consequences* of the impacts, in light of local conditions.

Each demand a technology generates (Figure 2) has an impact upon aspects of the wider environment. Some of these impacts will be beneficial and some will not. In an EnTA several impact 'end-points' (or environmental outcome categories) are considered. These are Human Health, Local Natural Environment, Global Environment, Social and Cultural Disruptions and Resource Consumption. The use of such end-points assists in assessing the potential impacts of a technology on the wider environment.

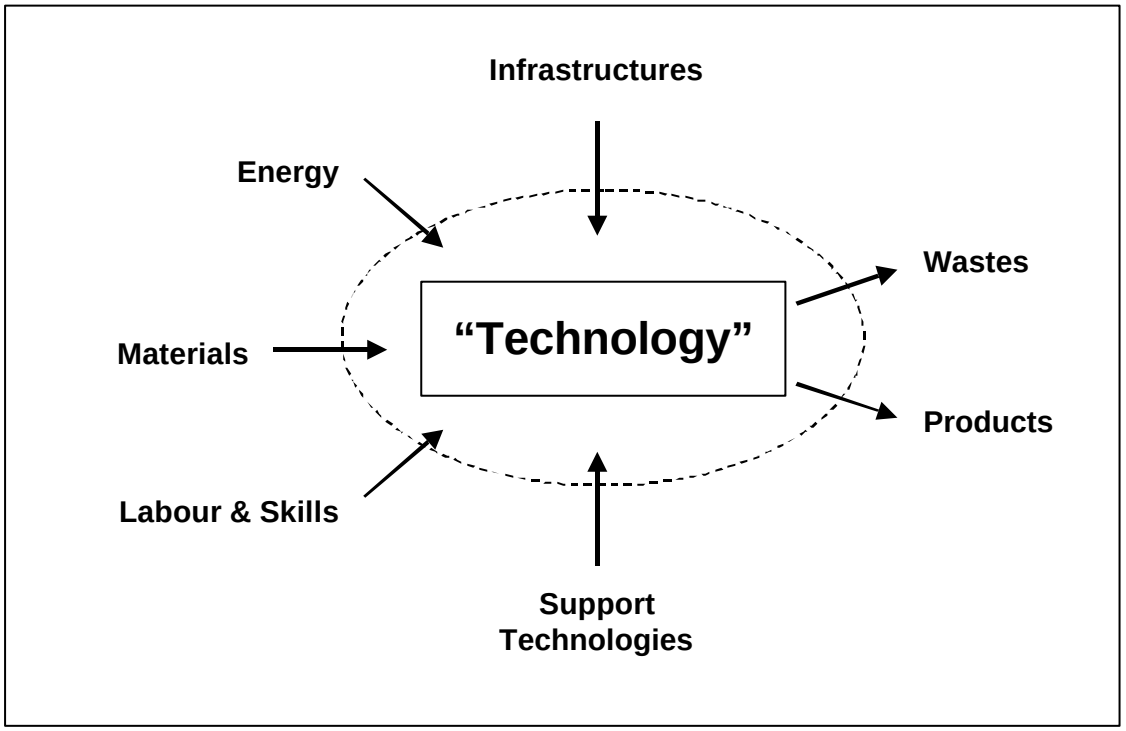

Figure 2. Components of a technological system that can influence environmental quality

Steps in the EnTA process

To help ensure the success of an EnTA it is appropriate to develop an action plan for undertaking the assessment. Such preparations will help guarantee an orderly and effective progress through the five linked steps of the assessment (Figure 3). Completion of the five steps is followed by reporting and other appropriate follow-up activities.

The procedures for conducting an EnTA should not be viewed as a "recipe" that must be followed on a rigorous basis. The assessment process can be modified and supplemented to reflect and suit local conditions. Importantly, the EnTA procedures should evolve in ways that reflect local, national and regional circumstances.

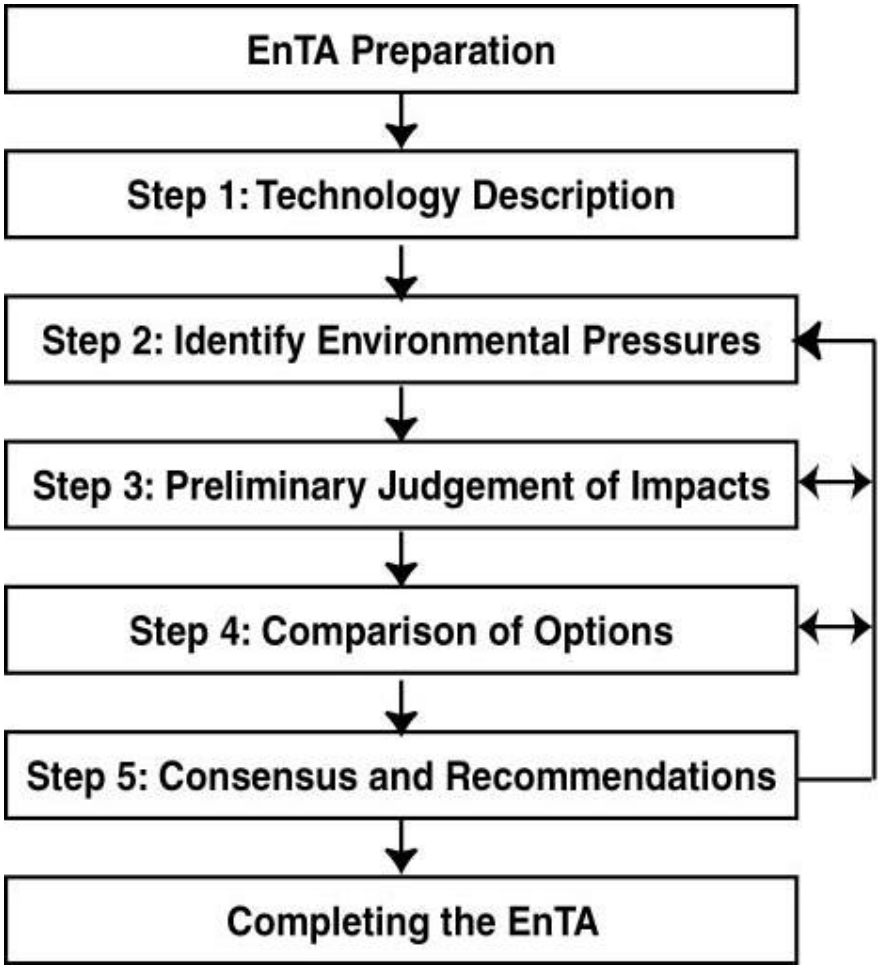

Figure 3 Steps in environmental technology assessment.

Preparation for the assessment:

Preparations for an EnTA include the assessment team establishing the *assessment goals*, developing an appropriate framework for meeting the goals, securing the commitment of key players, and identifying the resources that are available to the team. Consistent with the scale of the assessment, this phase might also involve establishing the tasks, responsibilities, timetable and a detailed budget.

Step 1. Describe the technology:

This step includes describing the proposed technology by defining the technology options being considered, identifying the goals the technology is intended to satisfy, identifying the stakeholders and characterising the operation and development of the technology. Consultation with stakeholders and other key players is an important part of this step.

Step 2: Resource and other requirements, and their pressures:

This step involves identifying the raw materials, land, energy, labour, infrastructure and supporting technologies required for the technology to operate, and the wastes and any hazardous products generated by the technology. The potential environmental and related pressures associated with each of these components are also characterised in this step. All inputs and outputs associated with use of the technology are considered over the life cycle of the technology, including decommissioning.

An example of pressures arising from the re-processing of used lead acid batteries, and the impacted endpoints, is presented in Figure 4.

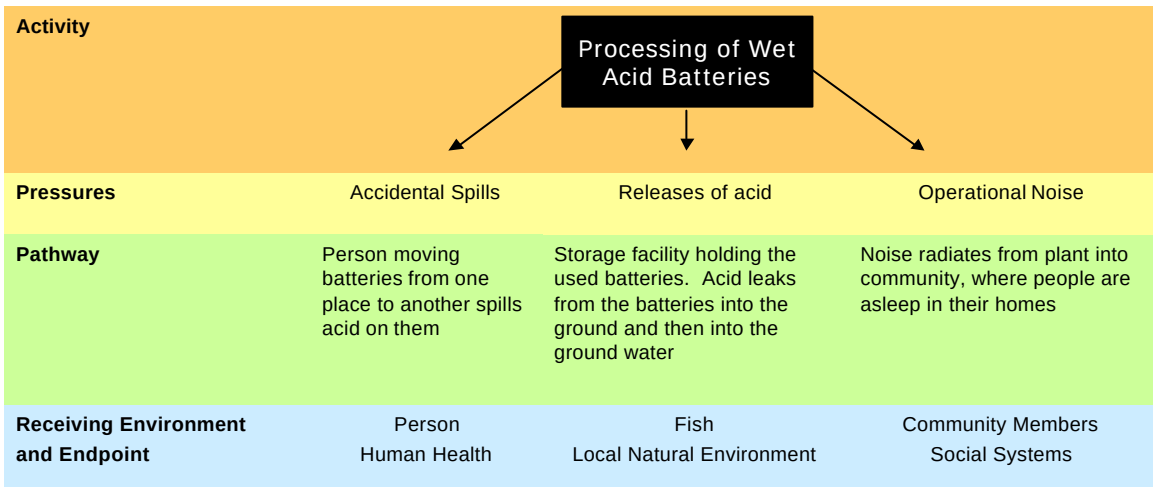

Figure 4. Examples of the environmental pressures, pathways and impacted endpoints as a result of processing used lead acid batteries.

Step 3: Preliminary judgement:

The significance of the potential pressures identified in Step 2 is elaborated in this step, leading to an overall assessment of the potential environmental impacts. Information gaps and uncertainties are also characterised in this step, ultimately resulting in a decision whether there is sufficient information to reach a conclusion regarding the nature and extent of the impacts, and hence the appropriateness of the proposed technology intervention.

Step 4: Comparative assessment of alternative technologies:

An important part of EnTA is consideration of alternative technologies that may also achieve the goals of the proposed technology investment. Other technologies are assessed in this step, to

determine if they are indeed capable of achieving the same goals, but with lower overall environmental impact.

Step 5: Decide if a consensus can be reached and make recommendations:

The fifth step uses all of the previously acquired information to determine if it is possible to reach a consensus as to the comparative suitability of the proposed technology, and its alternatives. This step also involves identification of any gaps and uncertainties in the assessment process that may prevent development of a consensus regarding the final recommendations.

Post assessment activities:

Completion of the preceding five steps should not be considered the end of the assessment. Important follow-up actions include reporting the findings and recommendations to the interested parties, including decision makers, monitoring the use of the assessment findings and identifying where subsequent assessments might be strengthened on the basis of the recent experience.

EnTA is Not a Linear or One-off Process

Although Figure 3 may be taken to suggest that the five steps of the EnTA process are sequential, this is not the case. In many instances the various steps in the assessment can be undertaken simultaneously, or in a different order to that outlined above, depending upon circumstances such as the timeframe and resources available to the assessment team. Also, EnTA should be an incremental and circular process (as Figure 3 implies), continually incorporating new information and understanding as they become available.

Alternative Approaches in EnTA

An EnTA can be undertaken at two basic levels, depending in part on the resources and time available to the assessment team. The two methods, designated the “short form” and the “long form”, are distinguished by the way in which they examine the impacts associated with the proposed and alternative technological options. The differences in approach are as follows:

In its short form the assessment is undertaken by completing Steps 1, 3 (summary), 4 and 5. The relative impacts of the proposed and alternative technologies are examined in Step 3, in a comparatively cursory manner. If the findings are clear (i.e. few uncertainties and gaps are identified), this may be all that is required by way of an assessment. However, the short form assessment may also highlight the need for a more comprehensive and rigorous assessment (i.e. the long form or an environmental impact assessment or environmental risk assessment) before any decision can be made.

In the long form of the assessment the environmental pressures and impacts are identified for the proposed technology (Steps 2 and 3, respectively) and compared in detail with those for the alternative technologies (Step 4). This approach provides a more thorough analysis of the environmental consequences of the technology options, but requires considerably more time and information.

Concluding Comments

EnTA is an important tool in the environmental management tool box in that it ensures technology investors address three core values:

- environmental sustainability, by building in environmental safeguards;
- integrity, by having the assessments conform to agreed standards; and
- utility, by providing balanced and credible information for decision making.

Furthermore, EnTA facilitates improved environmental outcomes by:

- recognising that the “environment” is wider than ecosystems and living resources, for it includes economic, social, aesthetic and cultural conditions and amenity values;
- adopting proactive management approaches that emphasise problem prevention rather than problem correction;
- adopting an adaptive management approach due to uncertainties in initial identification of potentially adverse environmental impacts;
- considering the wider technological system, rather than the technology itself, in isolation; and
- identifying and assessing alternative technology options rather that just the one advocated by the technology investor.

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