Öko-Institut e.V.
Institut für angewandte Ökologie
Institute for Applied Ecology

# *Kurzbericht zu*

# *- UNEP-DDP Issue-based Workshop*

# *- Anpassung der EM website*

# *- Vorschläge zur Weiterarbeit*

**Darmstadt, Dezember 2004**

***erstellt von***

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# 1 Einleitung/Vorbemerkung

Das Öko-Institut wurde im Frühjahr 2003 von der GTZ beauftragt, beim Workshop "Comprehensive Options Assessment of Dams and their Alternatives" der UNEP-DDP vom 22.-24. September 2003 teilzunehmen[1] und dort u.a. das mit Unterstützung der GTZ entwickelte EM (kurz für ENVIRONMENTAL MANUAL FOR POWER DEVELOPMENT) im Rahmen eines Vortrags bekannt zu machen sowie zur methodischen Diskussion um „Comprehensive Options Assesssment" beizutragen.

Weiterhin sollte im Rahmen dieser Arbeiten auch die EM-website aktualisiert und in das GEMIS-website integriert werden.

Schließlich sollten Vorschläge zur Weiterarbeit am Thema „Comprehensive Options Assessment" und zur Weiternutzung des EM bzw. GEMIS formuliert und mit der GTZ diskutiert werden.

Der vorliegende Kurzbericht erläutert die durchgeführten Arbeiten und dokumentiert die erzielten Ergebnisse.

# 2 Kurzbericht zum UNEP-DDP Workshop

Beim Workshop wurde am 1. Tag unter dem Präsentationstitel *The Environmental Manual for Power Development (EM): A Tool for Comprehensive Options Assessment in the Energy Sector* vom Autor ein Plenarbeitrag zur Session 3 (Assessment Tools) gehalten (vgl. Anhang 1+2 sowie Bericht zum Vortrag aus den Workshop-Proceedings[2] im Anhang 4).

Am 2. Tag nahm der Autor an der gleichnamigen Arbeitsgruppe 3 teil und erläuterte dort einige der Erfahrungen mit EM/GEMIS.

Das extended abstract (Anhang 1) sowie die Präsentation (Anhang 2) und der entsprechende Eintrag in die UNEP-DDP-Datenbank (Anhang 3) wurden mit der GTZ (Frauke Neumann-Silkow) abgestimmt.

Generell war der Eindruck des Autors zum Workshop, dass es sich um ein *sehr heterogenes* Publikum mit wenig realen Erfahrungen bei der Energieplanung und dem Einsatz von (EDV-)Werkzeugen handelte. Dies war insbesondere bei den Arbeitsgruppen am 2. Tag zu bemerken.

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1 Die Originalplanung sah den Workshop unter dem Titel „Comprehensive Options Assessment for Sustainable Water Resources Development" in Nairobi im Juni 2003 vor.

2 vgl. UNEP (United Nations Environment Programme) - Dams and Development Project (DDP) 2004: Comprehensive Options Assessment of Dams and their Alternatives – Proceedings of a Workshop held on September 22–24, 2003, Geneva, Switzerland (supported by GTZ, SIDA, The World Bank) – siehe http://www.unep-dams.org

Die Diskussionen um den offenen Punkt „needs assessment“ zeigten, dass es hierzu noch keine besondere Vorbereitung durch das UNEP-DDP-Sekretariat gab, ebenso war die Frage des Folgeprozesses offen.

Da auch die meisten der Teilnehmer relativ wenig praktische Erfahrungen bzw. Einfluß auf die Gestaltung von Planungsprozessen hatten, war die Diskussion entsprechend allgemein. Aus den Diskussionen bei den Plenarsitzungen sind aus Sicht des Verfassers folgende Punkte herauszustellen:

- Die Notwendigkeit zur Differenzierung zwischen „strategic assessment“ auf den Ebenen „regional“ – „ basin“ – „sectoral“ – hier sind die Zuständigkeiten und Schnittstellen unklar, es gibt *keinen strukturierten Prozess*, der als roadmap für Anwendungen dienen könnte
- Die Rolle von Options Assessment (OA) im Rahmen (zunehmend) liberalisierter Energiemärkte – hier wurde darauf verwiesen, dass OA *implizit* die Energiemärkte der Industriestaaten beeinflußt und im dortigen politischen Prozess breit angewendet wird (Steuern, Quotensysteme, Vorrang- und Einspreiseregelungen)
- Die (zu geringe) Verfügbarkeit von Ressourcen für OA in Entwicklungsländern
- Die Nutzung von OA zur Priorisierung von öffentlichen Geldern (ODA-Mittel)

Die Diskussionsleitung hat bei den Plenarbeiträgen relativ wenig strukturiert, es war mehr ein allgemeiner Austausch.

In der Diskussion der Arbeitsgruppe 3 (Assessment Tools) war aus Sicht des Verfassers folgendes relevant:

- Der *potenziellen Voreingenommenenheit* bei der Anwendung von Bewertungssystemen (scoring, screening) in Bezug auf die Gewichtung durch die AnwenderInnen kann nur durch *Transparenz und Beteiligung der stakeholder* begegnet werden
- Der Zeithorizont von OA muss mit der realen Planung von Strategien bzw. Projekten abgestimmt werden – hier ist die *Zuständigkeit offen*
- Die Relevanz von OA für die reale Entscheidungsfindung für Projekte ist aufgrund der *fehlenden Verankerung in den Prozess* und die geringe „ownership“ der shareholder am Projekt *tendenziell fraglich*
- Bei Wasserkraft sind die möglichen Auswirkungen des *Klimawandels* besonders unsicher, entsprechend sind beim OA die Fragen der *Resilienz* von Energiesystemen gegenüber *natürlichen Einflüssen* und die Sensitivität der Ergebnisse gegenüber Unsicherheiten wesentlich
- Die *finanziellen Risiken* von Projekten können *durch OA gesenkt* werden, sofern der Prozess mit transparenten Verfahren durchgeführt und öffentlich verankert ist.

Die Gruppe stellte heraus, dass grenzüberschreitende und kumulative Effekte bislang nicht adäquat im OA einbezogen werden können.

# 3 Erläuterung der Aktualisierungen an der EM Website

Parallel zu der Vorbereitung des Workshop-Beitrags wurde das EM-website in das allgemeinere GEMIS-Projekt-website integriert und auf der bisherigen EM-Adresse www.oeko.de/service/em eine automatische Umleitung auf die neue Adresse www.oeko.de/service/gemis/en/em eingerichtet. Damit sind Zugriffe auf die alte Adresse der EM-website weiterhin möglich.

Das EM-website ist nun ein Unter-website von GEMIS, was durch die Integration der EM-features in das allgemeinere GEMIS-Programm gerechtfertigt ist.

Die innere Struktur der bisherigen EM-website wurde beibehalten, jedoch der Einführungstext aktualisiert und einige obsolete links gelöscht.

Nun wird auch explizit darauf hingewiesen, dass das EM in das Werkzeug GEMIS integriert wurde und nicht mehr eigenständig als Modell weitergeführt wird.

Zur weiteren Information der EM-AnwenderInnen wurde Ende 2003 eine email mit entsprechenden Hinweisen an alle bekannten (registrierten) NutzerInnen verschickt.

Die aktualisierte EM-„Teil“-website hat seit Oktober 2003 etwa 100 hits monatlich, die Mehrzahl davon aus dem asiatischen und afrikanischen Raum (soweit mit web-Monitor erkennbar). Downloads der EM-Software finden praktisch nicht mehr statt, da auf der download-Seite auf das aktuellere GEMIS-Modell hingewiesen wird.

GEMIS wird mit ca. 100 downloads pro Monat weiterhin recht aktiv nachgefragt, die aktuelle Version 4.2 wurde allein seit Mitte November 2004 über 500 mal heruntergeladen. Soweit der web-Monitor dies erkennen kann, sind davon etwa 15% hits von usern aus Entwicklungsländern[3].

Aus der Registrierung neuer GEMIS-AnwenderInnen (allein rund 600 in 2004) läßt sich schließen, dass ebenfalls etwa 10-20% einen Kontext zu Entwicklungsländern haben.

[3] email-Adressen unter domains wie yahoo oder acror lassen sich nicht nach Ländern/Institutionen auflösen.

# 4 Vorschläge zur weiteren Vorgehensweise und Nutzung des EM

Wie schon beim UNEP-DDP-workshop direkt mit Frauke Neumann-Silkow besprochen, erscheint aufgrund der unspezifischen Beteiligung von Institutionen eine direkte Weiterarbeit aufgrund von Kontakten beim Workshop wenig sinnvoll.

Als entscheidend schätzt der Verfasser die praktische Erprobung und Demonstration von „needs assessment“ in mehreren Beispielländern ein. Hieran sollte dann ein schlankes, EDV-gestütztes OA anschließen können.

Wesentlich hierfür ist es, dass bi- und/oder multilaterale Geberorganisationen entsprechende Arbeiten zu NA/OA unterstützen bzw. für ihre geförderten/finanzierten Projekte verlangen – erst dann wird es praktische Relevant und Interesse auf Seiten der Partnerinstitutionen gewinnen.

Von deutscher Seite wäre hier insbesondere die KfW als relevanter Akteur zu nennen. Aufgrund bisheriger Erfahrungen kann dies aber nur durch eine sehr klare „Botschaft“ des BMZ in Richtung KfW realisiert werden – hierfür sollte sich die GTZ (und ggf. auch NRO) einsetzen.

Das EM bzw. nun GEMIS könnte im Rahmen einer aktuellen Beispielstudie zu OA eingebracht und so seine Funktionsfähigkeit insbesondere für das „screening“ von nicht-Wasserkraft-Ressourcen dargestellt werden.

Weiterhin wäre es sinnvoll, wenn die GTZ die Nutzung von GEMIS als public-domain-Werkzeug in ihrer eigenen Arbeit einsetzt und so gegenüber Consultants und Auslandspartnern die Nutzbarkeit des Werkzeugs demonstriert. Hierzu wären Projekte im Rahmen von CDM/JI sowie bei der Energieplanung mit Partnerländern/Regionen geeignet, wie schon beim bisherigen EM-Einsatz demonstriert.

Über entsprechende Erfahrungen wäre dann auf der EM-Teil-website bzw. auf der GEMIS-website zu berichten.

# Anhang 1: Extended Abstract zum UNEP-DDP-Workshop

## Extended Abstract Submitted for the

UNEP-DDP ISSUE BASED WORKSHOP

**COMPREHENSIVE OPTIONS ASSESSMENT**

FOR SUSTAINABLE WATER RESOURCES DEVELOPMENT

Nairobi, June 2-4, 2003

## Title:

The Environmental Manual for Power Development (EM): A Tool for Comprehensive Options Assessment in the Energy Sector

## Authors:

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## key words:

energy systems, energy/environment models, life-cycle analysis, environment-cost-tradeoffs

## Geographical and socio-economic background of the region:

From 1992-1995, the so-called Environmental Manual for Power Development (EM) was developed as a computerized tool for the environmental and cost assessment of options in the energy sector of developing countries. This work was sponsored by GTZ, DGIS, and the World Bank.

Between 1995 and 2001, the EM was used and applied in a variety of case studies (sponsored by GTZ, DGIS, DfID, the EU, and the World Bank) in the following countries: Botswana, Croatia, Czech Republic, China, Fiji, India, Indonesia, Mexico, Moroc, Philippines, Poland, Romania, Russia, South Africa, Vietnam, Zimbabwe

## Institutional framework and setting. Factors triggering the options assessment.

The EM was used within existing decision-making processes concerning energy systems, e.g., system expansion planning of utilities (Philippines, China), development of national strategies by ministries (India, Moroc, Philippines, Vietnam), screening of options in competitive bidding schemes (Fiji), the assessment of power pooling in Southern Africa with respect to greenhouse-gas mitigation (Botswana, South Africa, Zimbabwe), and environmental assessment of energy options, especially district heating (Croatia, Czech Republic, Poland, Romania, Russia).

## Identification/ characterisation of the options, and assessment of alternative options scenarios:

The "Environmental Manual for Power Development" (EM in short) is a computerized tool for the inclusion of environmental and cost data into the decision-making for energy projects in developing countries. Since 2002, the EM is integrated into the more general GEMIS software (Global Emissions Model of Integrated Systems) which is used world-wide.

EM/GEMIS track down the emissions and costs of e.g. the existing power supply system in a country, region, or of a specific energy project, and compares those to *alternative options* to deliver the same energy service, e.g. electricity, or process heat, or transport services.

To do so, EM/GEMIS maintain a comprehensive database on the environmental and cost impacts of energy technologies, and determines environmental impacts for so-called *life-cycles*: All impacts from mining, transport, conversion etc. can be accounted for. To consistently handle all life-cycles, the EM/GEMIS database offers a variety of *pre-defined* fuel-cycles to work with.

## The EM/GEMIS database covers generic energy technologies in developing and industrialized countries, especially

- all fossil-fueled electricity and heating systems, cogeneration, renewable energies, selected energy efficiency technologies, nuclear power systems, as well as
- data for "upstream" activities like mining, fuel benefication, transport, and emission control technologies like flue-gas desulfurization, ESP, SCR, etc.

The EM/GEMIS *analyze and compare* airborne and greenhouse gas emissions, solid wastes, and land use, as well as *internal and external costs* associated with the *investment and operation* of all energy technologies, including their life-cycles (upstream fuel-cycles, material acquisition).

EM/GEMIS help to check the *compliance* of energy processes with given *air emission standards:* the database offers such standards for various countries and regions, and users can test if emissions from a process are in accordance with such regulations - if not, processes can be adjusted by *adding emission control technologies*, or change fuel characteristics.

EM/GEMIS can run *scenarios* to compare single powerplants or boilers, but also whole electricity generation or transport systems of a region or a country, and can identify the *emission and cost tradeoffs* between different options to meet future demands.

*Stakeholders participation: how stakeholders had been identified and involved in the process*

Stakeholders participated as partners in the case studies.

*Applications of EM/GEMIS in Comprehensive Option Assessment for Hydropower*

EM/GEMIS offer generic and country-specific data for various hydropower plants with different size, and technologies (micro hydro, ROR, large dams). This data concerns cost, and life-cycle emissions (from materials for construction, and estimated GHG emissions from operation), as well as land use (inundated area).

For system expansion planning or to evaluate utility investment strategies, the EM/GEMIS software can compare hydro projects with alternative options such as local thermal generation from fossil fuels or biomass, cogeneration, wind or solar plants, and energy efficiency schemes. The results are computed for internal and external costs, emissions, solid wastes, and land use. The presentation will discuss opportunities and limits of applying EM/GEMIS in a strategic and project level options assessment process.

*EM/GEMIS Applications World-Wide: Summary Table*

| **Country** | **Type of Application** |
|---|---|
| Austria | utility planning; environmental evaluation of projects; GHG mitigation in cities/regions |
| Botswana | GHG Mitigation with Power Pooling, utility planning |
| Brazil | environmental evaluation of energy options (biomass) |
| Czech Republic | utility planning; environmental evaluation of energy options; GHG mitigation in cities/regions |
| China | utility planning; emission reduction strategies; technology evaluation: coal briquettes |

| | |
|---|---|
| Colombia | GHG Mitigation; CDM project assessment |
| Fiji | utility planning; environmental evaluation of competitive bidding |
| France | environmental evaluation of energy options; GHG mitigation in cities/regions |
| Germany | utility planning; environmental evaluation of energy options; GHG mitigation in cities/regions |
| India | technology evaluation: cooking; GHG Mitigation |
| Indonesia | technology evaluation: DSM |
| Italy | GHG mitigation in cities/regions |
| Kyrgyzstan | utility planning |
| Luxemburg | environmental evaluation of energy options; GHG mitigation in cities/regions |
| Mexico | Emission reduction strategy for Mexico City (incl. transport) |
| Morocco | developing national emission standards for thermal powerplants; local agenda 21, incl. Transport |
| Namibia | GHG Mitigation Power Pooling, utility planning: wind vs. gas-CC powerplant |
| Philippines | national energy strategy; utility planning; GHG mitigation; Sectoral Environmental Assessment |
| Poland | investment screening; university curriculum |
| Romania + Russia | investment screening: district heating |
| South Africa | GHG Mitigation with Power Pooling; utility planning; technology evaluation: solar stoves |
| UK + USA | GHG mitigation in cities/regions |
| Vietnam | utility planning; national energy strategy; GHG Mitigation |
| Zimbabwe | GHG Mitigation with Power Pooling, utility planning; CDM project assessment |

# Anhang 2: Präsentation beim UNEP-DDP-Workshop

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## Tools for Comprehensive Options Assessment in the Energy Sector:

## Environmental Manual (EM) and Global Emission Model of Integrated Systems (GEMIS)

**Uwe R. Fritsche, Öko-Institut (Institute for Applied Ecology)**

**Frauke Neumann-Silkow, GTZ (Deutsche Gesellschaft für Technische Zusammenarbeit GmbH)**

presented at the UNEP-DDP Workshop
Comprehensive Options Assessment for Sustainable Water Resources Development
Geneva, Sept. 22-24, 2003

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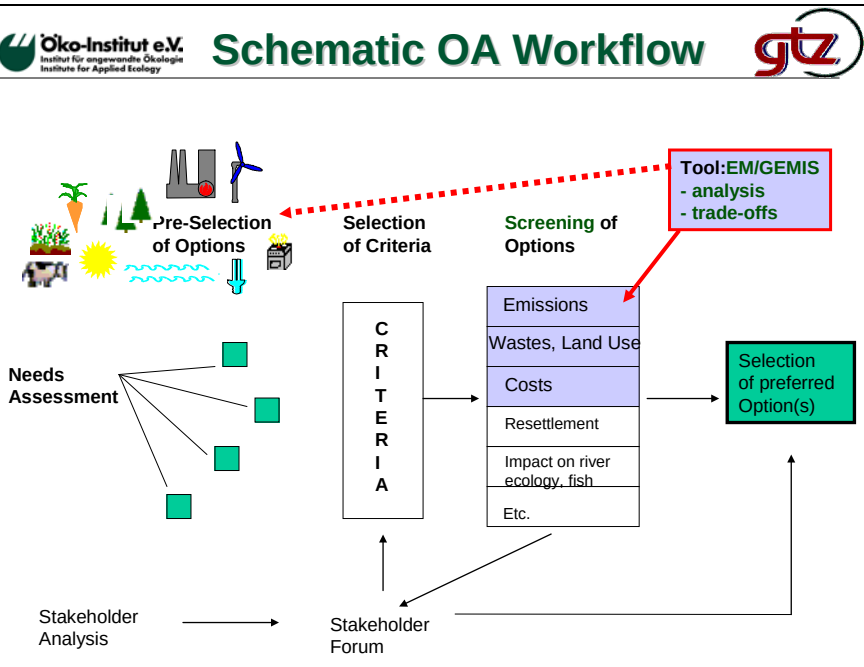
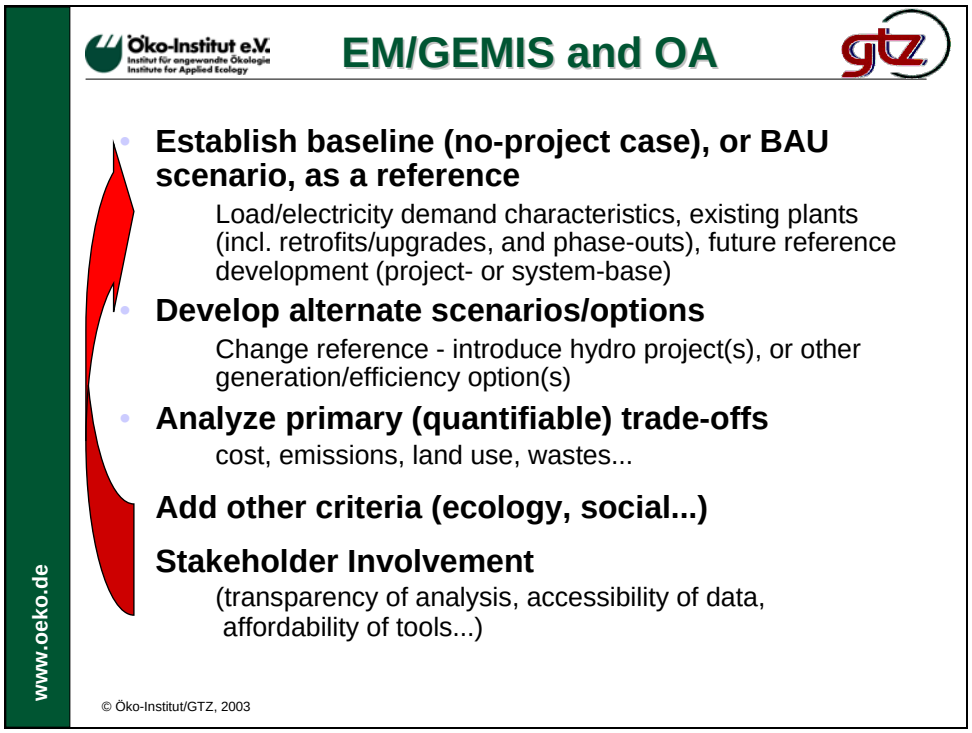
## Schematic OA Workflow

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EM/GEMIS and OA
gtz
Establish baseline (no-project case), or BAU scenario, as a reference
Load/electricity demand characteristics, existing plants (incl. retrofits/upgrades, and phase-outs), future reference development (project- or system-base)
Develop alternate scenarios/options
Change reference - introduce hydro project(s), or other generation/efficiency option(s)
Analyze primary (quantifiable) trade-offs
cost, emissions, land use, wastes...
Add other criteria (ecology, social...)
Stakeholder Involvement
(transparency of analysis, accessibility of data, affordability of tools...)
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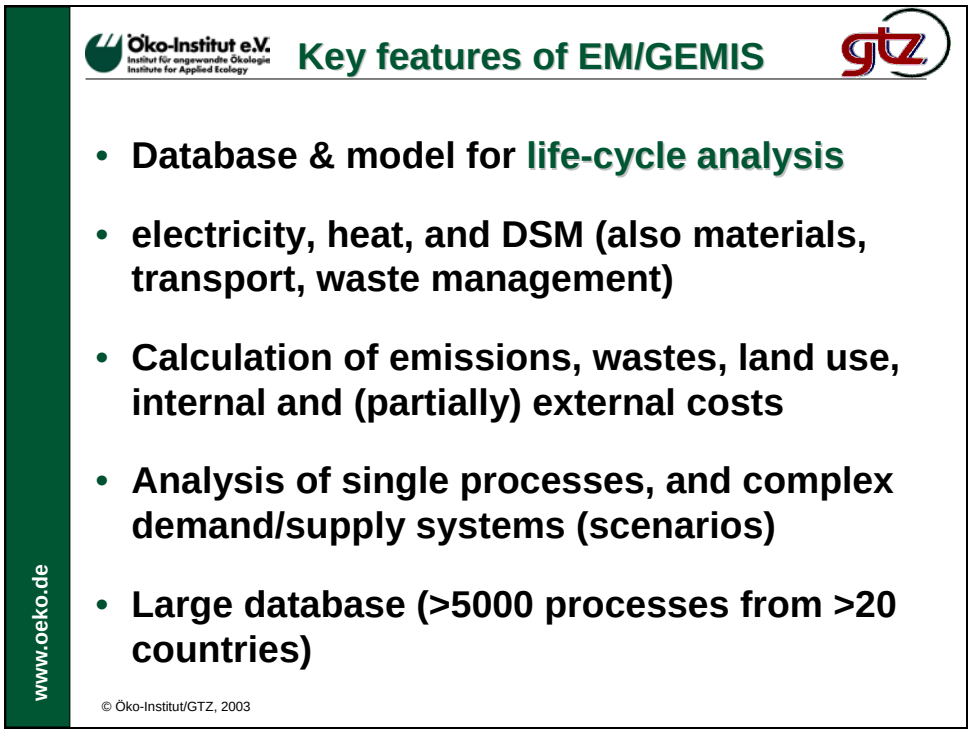
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Key features of EM/GEMIS
gtz
Database & model for life-cycle analysis
electricity, heat, and DSM (also materials, transport, waste management)
Calculation of emissions, wastes, land use, internal and (partially) external costs
Analysis of single processes, and complex demand/supply systems (scenarios)
Large database (>5000 processes from >20 countries)
www.oeko.de
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## EM/GEMIS in OA for Hydro

- Compare impacts from non-hydro project alternatives, or from revised hydro options (e.g., less/more generation)
- Data fully transparent, model in public domain, available freely through Internet
- No analysis/support for modeling of site-specific hydro impacts
- No analysis/assessment support for social, and ecosystem impacts

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## Lessons Learnt

- Generic database useful: benchmark for comparison with project data
- Cost/emission trade-off analysis helps to determine relative option ranking
- Comprehensive tool to support project screening and SEA on PC level needed
- Decision-makers do not value qualitative aspects very much in analysis
- Future: Database updates, internet access to data, more languages!

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## Examples of EM Applications

- **China, India, Philippines:** Environmental Analysis of national power plans, screening of GHG reduction options (1995-1999), incl. hydro
- **Mexico:** Clean Air Transport Policies in Mexico City (2000/2001)
- **Morocco:** National emission standard setting, LA21 in Marakkech (1995-2000)
- **Southern Africa:** Power Pooling for GHG Reduction (1998-2000), incl. hydro
- **World Bank:** Sectoral Environmental Assessment of Power Sector (1996-1998), incl. hydro

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## Access to EM/GEMIS

- **Software available free of charge:**

  **http://www.gemis.de**
  **http://www.gemis.de/em/**

- **Target group: utilities, IPPs, regulating authorities, Development Banks, consultants, NGOs**

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# Anhang 3: Case Study Eintrag in die UNEP-DDP Database

| FORM FOR SUBMISSIONS ON RELEVANT EXPERIENCES & LESSONS LEARNT | |
|---|---|
| ***1. Name of Submitter*** | Frauke Neumann-Silkow, Uwe Fritsche |
| ***2. E-mail address of Submitter*** | Frauke.neumann-silkow@gtz.de, u.fritsche@oeko.de |
| ***3. Title of project or study*** | The Environmental Manual for Power Development (EM): A Tool for Comprehensive Options Assessment in the Energy Sector |
| ***4. Year (or Years) when the case study or experience took place*** | Since 1992 |
| ***5. Name of dam (if applicable):*** | |
| ***6. Name of river (if applicable)*** | |
| ***7. Country(ies) where dam, project, or study is located*** | Botswana, Croatia, Czech Republic, China, Fiji, India, Indonesia, Mexico, Moroc, Philippines, Poland, Romania, Russia , South Africa, Vietnam, Zimbabwe |
| ***8. Choose the Strategic Priorities of the WCD which are most relevant to your example (please tick)***<br><br>***More information on the WCD Strategic Priorities is given at http://www.unep-dams.org/document.php?doc_id=185*** | ☐ Gaining Public Acceptance<br>X Comprehensive Options Assessment<br>☐ Addressing Existing Dams<br>☐ Sustaining Rivers and Livelihoods<br>☐ Recognising Entitlements and Sharing Benefits<br>☐ Ensuring Compliance<br>☐ Sharing Rivers for Peace, Development and Security |
| ***9. Why do you consider this case to be an example that reflects the Strategic Priority(ies) you selected?*** | |
| The Environmental Manual for Power Development (EM) was developed as a computerized tool for the environmental and cost assessment of options in the energy sector of developing countries. | |

***10. Abstract / Summary:***

From 1992-1995, the so-called Environmental Manual for Power Development (EM) was developed as a computerized tool for the environmental and cost assessment of options in the energy sector of developing countries. This work was sponsored by GTZ, DGIS, and the World Bank. Between 1995 and 2001, the EM was used and applied in a variety of case studies (sponsored by GTZ, DGIS, DfID, the EU, and the World Bank) in the following countries: Botswana, Croatia, Czech Republic, China, Fiji, India, Indonesia, Mexico, Moroc, Philippines, Poland, Romania, Russia, South Africa, Vietnam, Zimbabwe.

The EM was used within existing decision-making processes concerning energy systems, e.g., system expansion planning of utilities (Philippines, China), development of national strategies by ministries (India, Moroc, Philippines, Vietnam), screening of options in competitive bidding schemes (Fiji), the assessment of power pooling in Southern Africa with respect to greenhouse-gas mitigation (Botswana, South Africa, Zimbabwe), and environmental assessment of energy options, especially district heating (Croatia, Czech Republic, Poland, Romania, Russia).

The "Environmental Manual for Power Development" (EM in short) is a computerized tool for the inclusion of environmental and cost data into the decision-making for energy projects in developing countries. Since 2002, the EM is integrated into the more general GEMIS software (Global Emissions Model for Integrated Systems) which is used world-wide. EM/GEMIS track down the emissions and costs of e.g. the existing power supply system in a country, region, or of specific energy projects, and compares those to *alternative options* to deliver the same energy service, e.g. electricity, or process heat, or transport services.

To do so, EM/GEMIS maintain a comprehensive database on the environmental and cost impacts of energy technologies, and determine environmental impacts for so-called *life-cycles*: All impacts from mining, transport, conversion etc. can be accounted for. To consistently handle all life-cycles, the EM/GEMIS database offers a variety of *pre-defined* fuel-cycles to work with.

**The EM/GEMIS database covers generic energy technologies in developing and industrialized countries, especially**

- all fossil-fueled electricity and heating systems, cogeneration, renewable energies, selected energy efficiency technologies, nuclear power systems, as well as
- data for "upstream" activities like mining, fuel benefication, transport, and emission control technologies like flue-gas desulfurization, ESP, SCR, etc.

The EM/GEMIS *analyze and compare* airborne and greenhouse gas emissions, solid wastes, and land use, as well as *internal and external costs* associated with the *investment and operation* of all energy technologies, including their life-cycles (upstream fuel-cycles, material acquisition). EM/GEMIS help to check the *compliance* of energy processes with given *air emission standards:* the database offers such standards for various countries and regions, and users can test if emissions from a process are in accordance with such regulations - if not,

| | |
|---|---|
| processes can be adjusted by *adding emission control technologies*, or change fuel characteristics.<br><br>EM/GEMIS can run *scenarios* to compare single powerplants or boilers, but also whole electricity generation or transport systems of a region or a country, and can identify the *emission and cost tradeoffs* between different options to meet future demands. Stakeholders participated as partners in the case studies. | |
| ***11. What are the main lessons learned from the example?*** | • EM/GEMIS offer generic and country-specific data for various hydropower plants with different size, and technologies (micro hydro, ROR, large dams). This data concerns cost, and life-cycle emissions (from materials for construction, and estimated GHG emissions from operation), as well as land use (inundated area). |
| ***12. Reference to consistency with any national or international guideline or policy, including WCD Policy Principles*** | WCD Policy Principles 2.1-2.5 |
| ***13. Reference(s) or Source(s) of Additional Information [add hyperlink or attachment if appropriate]*** | www.gemis.de/em |

# Anhang 4: Textauszug aus den UNEP-DDP-Proceedings

*Environmental Manual for Power Development: A Tool for Comprehensice Options Assessment in the Energy Sector*

The next presentation was by Uwe Fritsche on two tools for comprehensive options assessment in the energy sector: the Environmental Manual (EM) and the Global Emission Model of Integrated Systems (GEMIS). Mr. Fritsche explained that he coordinates the energy and climate division of the Institute for Applied Ecology. The institute is an independent, non-governmental, non-profit organization with 100 researchers. The EM/GEMIS project was carried out in cooperation with GTZ, the German development aid agency, and with other bilateral donors from the UK, Switzerland, the Netherlands and the US, as well as the World Bank.

He described the ongoing debate in Germany over the distributional aspects of sustainability. Because these aspects cannot be addressed scientifically, participation in decision-making is essential. Mr. Fritsche said that, in the early 1990s, bilateral donors felt that they had not sufficiently incorporated environmental aspects into their funding decisions. Also, the World Bank wanted a comprehensive approach for analyzing options to apply in some 20 countries. The purpose of the EM/GEMIS project was to develop tools, apply them and learn what the problems associated with the tools are.

He asserted the importance of a needs assessment, but explained that needs were not assessed as part of the options assessment process his institute had designed. The first step in that process is a coarse screening in which options are broadly assessed and certain options are excluded from further study for explicitly stated reasons. Following the coarse screening, the study team chose a set of criteria for evaluating the performance of remaining options. He explained that computerized tools could assess only some of these criteria, such as greenhouse gas emissions, air borne pollutants, liquid effluents,, wastes and land use costs. Other important criteria, such as resettlement, ecological changes, and cultural issues cannot be measured using these tools because they are site-dependent. The value of the EM/ GEMIS approach is that it speeds up the analysis of some of the criteria, leaving decision-makers with more time to focus on the social and environmental aspects that cannot be programmed into computers. He pointed out that the selection of options is not a one-round cycle and that several rounds of assessment are usually necessary to come up with a stable solution.

To assess the options, the study team begins with a baseline scenario based on the assumption that no action is taken to address the identified needs Ð a business-as-usual scenario. Then, the performance of various options or, in the case of scenario development, various patterns of development is assessed against the baseline and against the criteria.

The EM/GEMIS tools incorporate a comprehensive, life-cycle analysis. For a hydropower station, for example, the tools assess the material required for construction, the costs of transport and a host of other aspects in addition to the costs of building the project. A similar analysis is applied to all competing options so that the options assessment is as impartial as possible. This is important because the greatest social and environmental costs of some options, such as solar voltaic cells, are related to their manufacture.

The EM/GEMIS models for both thermal and electricity generation can assess heating and cooling demands and demand-side management as well as sectors other than energy, such as agricultural systems. Mr. Fritsche said that his institute is currently engaged in a project to integrate the energy, food and mineral needs of a society and to examine the interactions between these sectors.

He explained that the tools use a large database to analyze what the consequences of implementing various options would be, whether for an individual project or for a scenario stretching over a longer timeframe. The database contains 5,000 different templates adjusted to 20 different countries, because the costs and efficiencies of technologies will vary from country to country. It is updated every year, and new applications are added to it.

Mr. Fritsche pointed out that, from the perspectives of donors and researchers, transparency is an important feature of the tools. Users can see all the values assigned to various criteria, and test the sensitivity of different options to each criterion by changing these values. He identified the lack of ability to assess site-specific impacts of hydropower projects and the inability to examine social and ecological factors as limitations of these tools. The database is generic and provides basic information such as the costs involved in operating a wind turbine compared with a coal-fired plant or the costs and environmental performance of micro-hydropower schemes. The tools can also assess the trade-offs between costs and emissions, such as the costs involved in achieving a certain emission reduction target, the amount of emissions reduction that each option can achieve per unit of cost, or what the impact of a carbon dioxide tax or a Clean Development Mechanism would be given a certain value applied to each unit of carbon dioxide.

Mr. Fritsche said that another strength of these tools was that they are very easy to use. He said that students are able to use them after working with them for a week. The tool were developed for use by decision-makers in governments, utilities, NGOs, and multi- and bi-lateral banking systems.

He found that one interesting aspect of the application of the tool was that users had little interest in qualitative, subjective information. The model contained a feature that assigned impact values to certain options, but this feature was not seriously used in any of the case studies. He explained that there is a danger in getting stuck on numeric values because many important criteria in options assessment cannot be quantified. Mr. Fritsche recommended that, rather than using EM/GEMIS to confine the assessment of options to quantitative criteria, decision-makers should use the tools to abbreviate the effort expended in assessing quantitative aspects and apply the time saved in doing so to involve stakeholders in an assessment of the qualitative aspects. The EM/GEMIS approach can also be used as a communications tool, to demonstrate that the process is open and transparent. To that extent, it also serves as a bridge for gaining a shared understanding of problems and opportunities.