1st German-Hungarian Conference on
Research for Sustainability
Budapest 10th - 11th June 2008

Environmental Technologies

Overview and Key Issues

Research Focus: Water protection

Dr. Nicola Hartlieb

Institute for Technology Assessment and Systems Analysis
Research Centre Karlsruhe

This Presentation is based on the Project „Roadmap Environmental Technologies 2020" funded by the German Ministry of Research and Education

Roadmap Environmental Technologies 2020

Executing Organisation:	PT Umweltforschung und -technik im DLR
Carried out by:	Forschungszentrum Karlsruhe, Institute for Technology Assessment and Systems Analysis (ITAS)
Project Management:	Prof. Dr. Armin Grunwald Jens Schippl (Dipl.-Geographer)
Project Team :	Christian Dieckhoff (Dipl.-Ing. Mechanical Engineer) Nora Gronwald (Dipl.-Ing. Environmental Scientist/Process Engineer) Dr. Nicola Hartlieb (Dipl.-Geoecologist) Juliane Jörissen (Dipl.-Ing. Spatial planning) Ursula Mielicke (Dipl.-Ing. Chemical Engineer) Dr.-phil. Oliver Parodi (Dipl.-Ing. Civil Engineer) Dr.-Ing. Tim Reinhardt (Dipl.-Biologist) Dr. Volker Stelzer (Dipl.-Geographer)
In Cooperation with:	Fraunhofer Institute for Chemical Technology (ICT) Prof. Dr. Thomas Hirth Dr.-Ing. Jörg Woidasky Rainer Bolduan (Dipl.-Geoecologist) Ansilla Franck (Dipl.-Ing. BA) Dr. Gudrun Gräbe

ITAS at a Glance

Interdisciplinary scientific institute within the Forschungszentrum Karlsruhe (Research Centre Karlsruhe)

Largest TA unit within Helmholtz Association (HGF), Germany‘s largest public research organization

Mission: Comprehensive analysis and evaluation of the development and application of technology and its interrelationship with processes of societal change

Currently three research areas:

- Environment and resource management
- Innovation processes and technology impacts
- Knowledge society and knowledge policy

About 90 staff

Operates the TA units of the German Parliament (TAB, since 1990) and the European Parliament (STOA, as part of a consortium since 2005)

Roadmap Environmental Technologies 2020

The project „Roadmap Environmental Technologies 2020" aims to explore middle to long-term developments and pathways in the field of environmental technologies

Overall Objective: Identification of strategic options for research and development activities and for the transfer of technologies into practice

Important points of reference: “High-Tech-Strategy for Germany”
“Masterplan Environmental Technologies”

Time horizon of the Roadmap will be the year 2020

Environmental Technologies: Background

Industrial countries: progress has been made over the last decades; but still many problems

Emerging countries: decoupling of economic growth and environmental impacts needed

Recently, the economic perspective of ecological changes is discussed in a more visible way (Stern Report; McKinsey Studies in Germany; Media reports on the scarcity of resources and increasing prices for raw materials)

Increasing environmental problems ask for considerable improvements in technologies > strong need for technological progress and innovations

R&D activities + political regulations support innovations and the development of lead-markets

Environmental & Economical & Social perspective on environmental technologies > all pillars of sustainable development

Environmental technologies > link between innovation and sustainability

Structure of the project

The project is carried out in two phases :

Phase I: Scoping-Phase > State-of-the-Art-Report ✓

The state-of-the-art in the field of environmental technologies; identification of relevant technologies; technological potentials; state of transfer of technologies into industrial applications.

Phase II: Roadmapping-Phase > Roadmap 2020

A Road-Mapping-Process will be carried out on basis of surveys and workshops. With experts from Science, Industry and Politics relevant development pathways as well as lead markets will be identified.

How to get to the Roadmap?

In many cases new technologies are a necessary but not a sufficient factor for successful environmental innovations. A wide range of non-technical factors is relevant as well (Regulations and Directives, markets, demand patterns, social acceptance etc.)

Basically, what is needed for a Roadmapping-Process is a combination of

1. a problem-oriented methodology
   (“market pull”: which environmental problems require solutions?)

2. a technical-oriented approach
   (“technology push”: which options and applications will be offered by technological progress?)

Selected Areas of Research

- Climate Protection
- Air Protection
- **Water Protection**
- Soil Protection and Sustainable Land-Use
- Protection of Limited Resources
- Waste Management
- Biodiversity

Selected areas of research

Climate Protection > apart from energy-related technologies, CCS and transport also optical technologies (LED, OLED), industrial processes, adaptation

Air Protection > apart from energy conversion, main sources are industrial processes, organic solvents, agriculture. Technology transfer is crucial

Soil Protection and Sustainable Land-Use > decontamination and redevelopment, reduction of erosion, salination, sealing > always underestimated

Protection of Limited Resources > technologies regarding material efficiency, substitution, extension of product life, design for recycling

Waste Management > logistics, treatment / processing (mechanical, biological, thermal, chemical-physical), disposal > sorting technology

Biodiversity and protection of nature > mainly related to regulations and management > monitoring, precision farming, reduction of emissions

Water Protection - Background

Many problems worldwide are associated with the lack of clean, fresh water:

- 1.2 billion people do not have access to safe drinking water;
- 2.6 billion people have little or no sanitation

The supply of all humans with clean drinking water and the treatment of waste water is one of the vital challenges of international environmental and development policy

Water related problems are expected to increase in the coming decades even in regions which are currently considered as being water-rich

To solve water-related problems a sustainable water management is necessary (= integrated management of all artificial and natural water cycles)

Addressing these challenges calls for a high amount of ‘water technologies‘

Water production

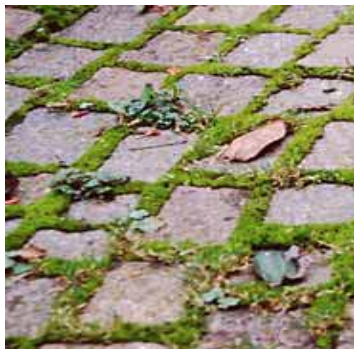
The production of water as drinking and process water:

- Innovative drilling technologies
- Groundwater replenishment
- Artificial groundwater recharge
- Bank filtration

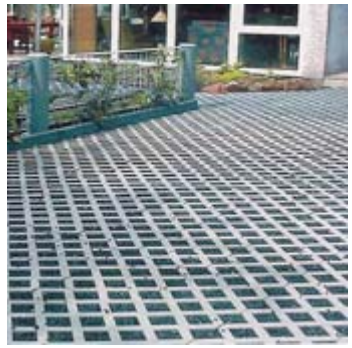
- Rain water management
- Decentralized water supply
- Water catchments, reservoirs
- Roof catchments
- Infiltration and seepage systems

- Sea water desalination

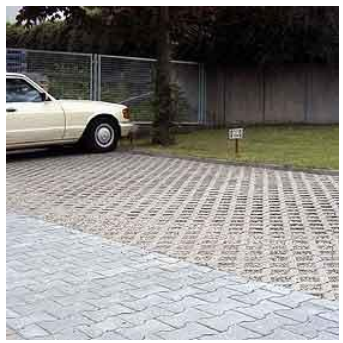
Green Roof Surface Area



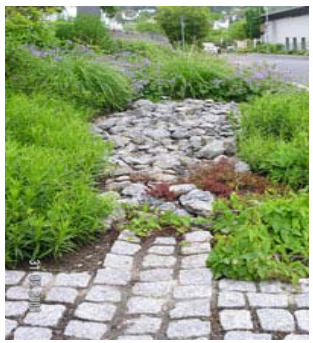
Lawn case paver



Grass paver



Surface Seepage



Trough Seepage

Water treatment

Necessity to prepare raw water for drinking water standards

Mechanical, chemical, physical, biological treatment

- Removal of undesirable substances by

  Sedimentation, Filtration, Flocculation and Precipitation, Disinfection, Decalcification, Reverse osmosis, Ion exchange etc

- Supplementation of substances and the adjustment of water parameters like pH, conductivity etc.

The trend goes towards less chemical treatment and more physical-mechanical processing > membrane technologies

Adaptation of technologies for the conditions of developing countries

Efficiency – related technologies

The reduction of the water consumption and the waste water production is one possibility to protect water resources

Minimised water consumption

- Economized devices in sanitary facilities (stop-button)
- Efficient water utilization in agriculture (innovative irrigation technologies)
- Recycling of water as process water (industry)

Management of water loss (up to 50% loss)

- Detection of leakages (sensor-based pipe inspection)
- Sanitation of the sewer pipes (pipe in pipe technique; in-situ survey)

High potential for innovations

Waste water treatment

Sustainable waste water treatment > coupling of material flows > waste water as a resource > recycling of water

Decentralised management concepts for Households

- Separate collection and treatment of urine, wash water, black water
- Reed bed
- Nutrient recovery

For Industry

- Zero-waste-water-production
- Recycling and re-use of process waters (cascade scavenging)
- Membrane technologies: reverse osmosis, nano- ultra- microfiltration

Micro pollutants (pharmaceuticals)
Heat recovery (Heatliner)

Adaptation to the local terms and condition (resilient technologies, staff training, low maintenance, electricity independent..)

Water and Sea protection

- Coastal zone management (utilization conflicts, loss of area)
- Warming and acidification of oceans (preventive measures, protection areas)
- Climate change and flood protection (dams, detention reservoirs, embankments…)
- Aquacultures (open ocean or land-based) versus offshore farming

Concluding Remarks

Innovations in environmental technologies and the transfer of technologies are crucial for a sustainable development. Especially in the environmental sector, a wide range of non-technical factors are relevant for successful innovations.

German technologies are internationally present in all sectors of water supply and waste water treatment. As a market leader regarding the export of water technologies mainly present in the domestic market.

For an opening to the international market various aspects are of importance:

- Companies are traditionally medium-sized companies with a regional orientation
- Technologies are not well adapted to local terms and conditions
- Developing countries require simple, resilient, flexible and affordable technologies
- High-tech solutions need attendance (combination of technology and service) (integrated concepts)

Those technologies or approaches which **create more value with less impact** will be the technologies of the future