Expression of Interest
Integrated Project
Solving several environmental, economic a society problems

Sustainable Management of Solid and Liquid Waste SUMAWA

1. The rationale for proposing the research action

- Soil degradation still increasing.
- Unsustainable waste and wastewater management.
- Renewable organic material in wastes and fuel crops is combusted, meanwhile bioconversion is poorly developed.
- Use of synthetic chemicals in agriculture and in society as a whole.
- Use of fossil energy sources instead of promoting renewable alternatives.
- Ongoing research on concept "WASTE 2002" shows new possibilities (Tab. 1).
- There were at the 1st January 2002, exactly 376 461 772 inhabitants in EU. The total amount of **renewable organic material** (ROM) in waste together with human excreta was about 753 000 tonnes per day. This ROM contains per year, plant nutrients NPK (nitrogen, phosphorus and potash) to the value of approximately 3.8 billion euros, and at least 825 TWh of bioenergy. To this figure can be added the greater amount of NPK and bioenergy in ROM, from industrial waste and in residues from agriculture, horticulture, forestry and green areas. Imagine that bioenergy in this ROM is transformed biologically and **recovered** (about ⅓) **as biogas**, and **recycled** (about ½) **as ROM, including plant nutrients in biofertilisers**. A great amount of water, chemicals and energy from fossil sources are used today for getting rid of ROM from all these sources.

Table 1: Treatment of solid waste and wastewater in Sweden (Svensk avfallshantering 2001).

	Present Situation		**Concept "WASTE 2002"**	
Solid Waste	Incineration (produces 25-30 % toxic ash)	38.5%	Bioconversion of ROM (biological recycling)	70%
	Dumping in landfill sites	22.8%		
	Recycling	28.7%	Recycling	20%
	Old fashioned composting and rotting	9.5%	Dumping in landfill sites	5%
	Toxic waste	0.5%	Incineration and detoxification	5%
Waste-water	Grey water	85%	Grey water	100%
	Blackwater	14.5%	Blackwater (does not appear)	
	Human excreta	<0.5%	Human excreta (to bioconversion)	

2. The objectives

The objectives of this project are

- to reduce present environmental and social problems concerning soil degradation, pollution of water and air, waste management, use of synthetic chemicals and fossil fuels, unemployment and poverty, by development and implementation of novel, economic viable facilities on the concept "WASTE 2002" dealing with "Integrated Waste and Wastewater Management"
- to make results easily available for researchers, students, planners, designers, architects, politicians, manufacturers, decision makers and for the public.

Prepared by Ruzena Svedelius AgrD, NGO – Aktion Skåne-Miljö (Soil Protection) ~~ruzgaj@usa.net~~
rsvedelius@hotmail.com

Scientific objectives

*To investigate the **function** of "Integrated Waste and Wastewater Management" for housing areas according to concept WASTE 2002 (Fig. 1).
*To **evaluate the economic, environmental and social impacts** of "Integrated Waste and Wastewater Management" on sustainable development.
*To maximise the utilisation of energy and elements (plant nutrients) from **renewable organic material** in solid and liquid waste and in fuel crops when producing biogas and biofertilisers.

*To investigate the survival of plant, animal and human **pathogens and weeds,** during various methods of bioconversion of high solid substrate in batch bioreactors with modern control systems.
*To study factors affecting the highest yield and lowest emissions from bioconversion and thus affecting **hygienic aspects**.

Technological objectives

*To build several mobile **RTD plants adapted to local needs** and compare their economical, environmental, and social impacts.
*To test novel equipment for the collection, transportation, pre-processing and processing of organic solid waste and human excreta.

* To improve the system for separation, collection, pre-processing and equipment for aerobic and anaerobic **bioconversion, storage and utilisation of products** by innovation or re-engineering or technology transfer.
*To create experiments where various substrates are processed under **controlled conditions,** and where several variables can be modified during processing.

*To manufacture equipment for biogas and biofertilisers including storage, distribution and usage.

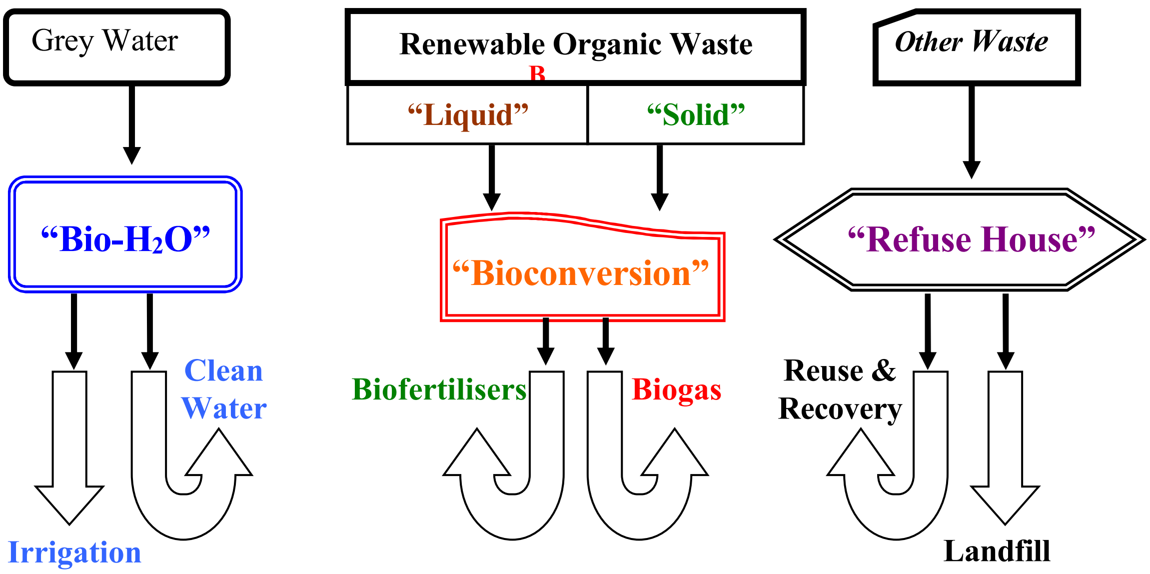

Figure 1. Flows in the "WASTE 2002", a concept for "Integrated Waste and Wastewater Management" when used for localised waste management in a housing area. In the **"BioH_2O"** the grey water will be cleaned biologically. **"Bioconversion"** is a system for efficient transforming of renewable organic materials into biogas and biofertiliser in novel bioreactors. In the **"Refuse House"** wastes of inorganic and non-renewable materials will be sorted and collected and then handled by specialists for reuse, recovery, destruction or burying on landfills.

Localised facilities, including bioconversion systems with combined aerobic and anaerobic treatment, that are high-rate, simple to operate and have reliable performance are needed to make biological transformation of the renewable organic material (from municipal and industrial waste, residues from agriculture, horticulture, forestry, green areas, and from fuel crops) a mainstream waste-to-energy-and-fertilisers conversion technology. Renewable organic materials will be converted by microorganisms, in a series of novel bioreactors into energy-rich microbial metabolite methane in biogas, and into biofertilisers of a high and reproducible quality adapted to cultivation systems. The novel systems will include sub-systems, which are subjected to economically and ecologically efficient, long-term environmentally sound waste management. The system can be modified to meet the local needs and can be implemented in all countries.

Prepared by Ruzena Svedelius AgrD, NGO – Aktion Skåne-Miljö (Soil Protection) ~~ruzgaj@usa.net~~
rsvedelius@hotmail.com

3. The main lines and timetable

Stage I.

1. Build several mobile RTD plants including alternative wastewater treatment "Bio-H2O", equipment for "Bioconversion" and "Refuse House". Design various models of source separation of waste and human excreta. Create suitable equipment for collection, transportation and pre-processing. Manufacture different prototypes of bioreactors. Design storage system for biogas and biofertilisers. Check BAT for use of biogas, improve equipment for application of biofertilisers, and provide cultivation tests for evaluation of quality of biofertilisers. To build mobile RTD plants and make improvements will take 3 years.
2. Provide research, investigations, studies and evaluations (including feed-back) to develop best management practices (BMPs) to reduce the risk. That will go on at the same time and will continue 3 more years.
3. Training and information will go on during all 6 years.

Stage II.

1. When mobile RTD plants are well adapted to local needs, full-scale plants can replace them. Full-scale plants can start after approximately four years, and require several years of continuous evaluation and feedback, in order to make improvements to equipment and methods.
2. Investigations, studies and evaluations will continue as well as research and training. It is estimated that it will take totally 10 years to reach satisfactory results.

4. The stages of implementation and the results expected in each one of them

Figure 2 shows the system for the bioconversion of ROM from households. In the same way can be treated ROM from industrial waste, ROM in residues from agriculture, horticulture, forestry, green areas and ROM in fuel crops. Localised plants should always be adapted to local needs.

- Research and technical improvements of biological treatment of ROM – both equipment and methods. Resulting in efficient processing, minimising pollution, in products of high quality, in increased employment and increased social acceptance.
- Research and technical improvement of collection, transportation and pre-treatment of ROM in solid waste, and human excreta is needed to improve logistics and minimise emissions that are polluting losses. Novel systems have to be constructed to improve the environmental impact with regard to emissions, noise and vibrations from present vehicles used for the collection of solid waste, and emissions from the unsustainable sewage systems. Designers, manufactures and planners will use results from the technical improvements.
- Biogas is a renewable energy source, and investigations have to be made on its integration in the energy system, including storage, distribution and use. Results will lead to improvements of infrastructure. Vulnerability of society will decrease.
- Biofertilisers are fresh materials containing living organisms, and thus investigations have to be made on the quality and BAT, including storage, distribution and land application. This is important for measurements, and efforts with an aim to improving the savings and efficiency of the system.
- Effects of biofertilisers on the soils biological, chemical and physical properties needs to be followed-up and evaluated. In addition the soils capture and sequestration of CO2. Results can be used as feedback information, for the improvements of equipment and methods in the system as a whole.

Prepared by Ruzena Svedelius AgrD, NGO – Aktion Skåne-Miljö (Soil Protection) ~~ruzgaj@usa.net~~
rsvedelius@hotmail.com

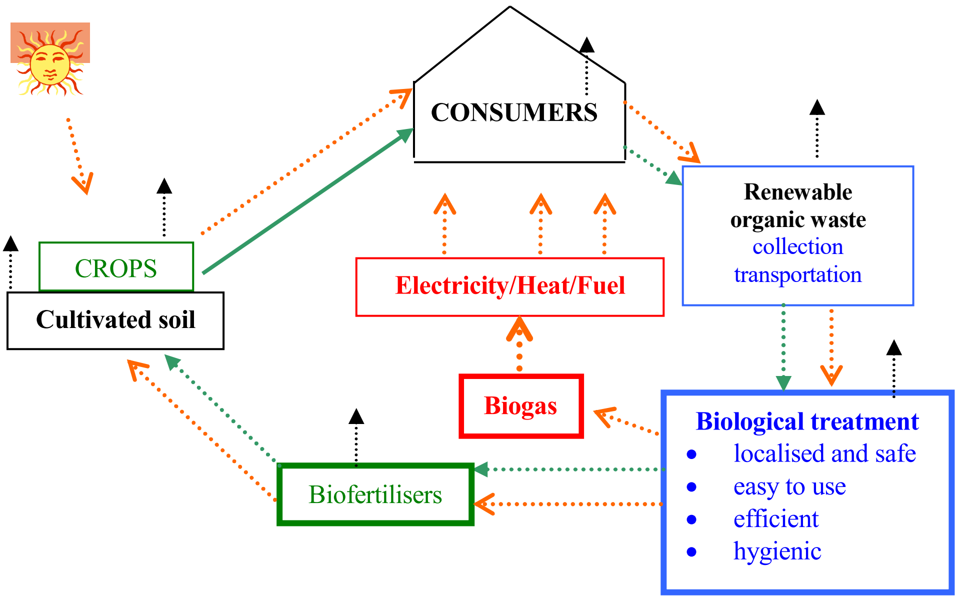

Figure 2. G&G-System (Gas & Gödsel/fertiliser) is closing the loop. Plant nutrients are recycled of and bioenergy is partly recovered as biogas and partly reused in biofertilisers.

Transportation of plant nutrients from soil to consumers.

In the "G&G-System" plant nutrients are transported back to cultivated soil.

Energy from the sun is bound as bioenergy in crops and is firstly used by humans, and then through the "G&G-System" partly reused in biogas, and partly returned to cultivated soil.

Emissions that are polluting losses.

5. The role of the participants and the specific skills of each of them

The participants intending to form the consortia will come from several countries within EU and associated candidate countries.

a) Members of NGOs will be involved in the **organisation** and responsible for the **implementation and management** of projects. They will also be responsible for implementation of RTD plants and for demonstration of systems, equipment and methods.

b) Researchers will be dealing with and **building-up knowledge**, for example within

- Aerobic and anaerobic bioconversion - when mixture with about 30 % dry matter is processed.
- Plant, animal and human pathogens and weed survival.
- Biogas storage, distribution and use.
- Biofertilisers storage, distribution and use in cultivation systems.
- Evaluation of soil improvements and food quality.
- Transportation and logistics.
- Design and architecture.
- Analyses of environmental, economic and social skills.

c) Technicians will have the responsibility for **practical functions** of the equipment (mechanical, robotics, computers) and for technical improvements.

6. The plan for the dissemination of knowledge and the exploitation of results.

The use of modern telecommunications to spread and share information, through shared databases and websites, papers, seminars, conferences, lessons, workshops, electronic communication networks, meetings, discussions with scientists, contact with manufacturers and the public.

Prepared by Ruzena Svedelius AgrD, NGO – Aktion Skåne-Miljö (Soil Protection) ~~ruzgaj@usa.net~~
rsvedelius@hotmail.com

7. The global budget: 100 million €.

The budget for the different activities	€
Stage I.	
1. To build mobile RTD plants and make improvements	30 000 000
2. Research, investigations, studies, demonstrations and evaluations	30 000 000
3. Training and information	5 000 000
Stage II.	
1. Full-scale plants with several years of continuous improvements	25 000 000
2. Investigations, studies and evaluations, information	10 000 000

8. Financial plan

For financial support we are going to apply to

Swedish Agency for Innovation Systems – VINNOVA
The Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning - FORMAS
The Foundation for Strategic Environmental Research - MISTRA
Swedish Energy Agency
Swedish Business Development Agency - NUTEK
Swedish Environmental Protection Agency

9. Partners

In co-operation concerning the basic and applied research, and interested in applications are involved individuals from universities, companies, other organisations and from NGO:s.
For example:

Lund University, Institute of Technology, Lund, Sweden
Swedish University of Agricultural Sciences, Alnarp, Sweden
Research Institute of Veterinary Medicine, Slovak Republic
University of Economics Prague, Czech republic
TUBITAK-Marmara Research Center, Energy Systems and Environmental Research Institute, Turkey
SWEMOCOMP, Industrial automation
NGO – Aktion Skåne-Miljö in Sweden
NGOs – Sosna, Ekotrend, Ludia a voda, ZI A NECHAJ ZIT, ZIVICA, *SKNET,* Poiplia, Správa Národného parku Nízke Tatry, Zdruzenie Slatinka, Maskov mlyn, APOP and Dubnicka Environmentalna Skupina in Slovak Republic

10. Working group involved in research, technical improvements and planning of implementation of concept "WASTE 2002" in Sweden

Adamsson Bo, teacher, NGO – Aktion Skåne-Miljö
Czemiel Berndtsson Justyna, Ph D candidate, Water resources management
Fredriksson Claes, Tech Dr, Physics
Friberg Camilla, BA in Environmental Studies, NGO – Aktion Skåne-Miljö
Gajdos Tom, MSc CS E, Development Engineer
Grip Elsa, architect, Ph D candidate, Architecture
Hjorth Peder, Assoc. Prof. Docent, Water resources management
Jonsson Lars, Farmer
Morva Josef, Civ.Ing., SWEMOCOMP, Industrial automation
Niemczynowicz Janusz, Prof., Urban hydrology, Water resources management
Svedelius Guy, Agr Dr, Plant protection
Svedelius Ruzena, Agr Dr, Recycling of plant nutrients, NGO – Aktion Skåne-Miljö
Watkin Simon, BA in Business Studies, NGO – Aktion Skåne-Miljö

This Expression of Interest was submitted in response to Call EOI.FP6.2000.

Prepared by Ruzena Svedelius AgrD, NGO – Aktion Skåne-Miljö (Soil Protection) ~~ruzgaj@usa.net~~
rsvedelius@hotmail.com