Federal Ministry
of Education
and Research

Future
Megacities
Megastädte von morgen

Ignis - Income Generation & Climate Protection by Valorising Municipal Solid Wastes in a Sustainable Way in Emerging Megacities, Addis Ababa, Ethiopia

Overview and Findings to Date

The majority of the world's fast-growing cities is located in the developing nations near or south of the equator. Their national priorities are economic development and alleviation of poverty. But, both population growth and economic growth are associated with increased energy demands. Because energy supply in most countries is largely based on fossil fuels, carbon emissions tend to grow rapidly with development, particularly among countries with relatively low levels of per capita income.

In Africa, Addis Ababa, the capital city of Ethiopia, is one of the fastest growing cities. In Ethiopia as in most developing countries a highly accelerated urban growth rate is naturally being reflected in the rapid spatial expansion of the existing urban centres. Ethiopian cities and particularly Addis Ababa are presently facing a plethora of problems, among others insufficient solid and liquid waste management, and a growing problem of unemployment and poverty. The general objectives of the project, income generation and improved waste management, meet the national Millennium Development Goals, and also explicitly the Addis Ababa city authority goals.

Objectives of the Project

Main objective of the IGNIS project is to valorise municipal solid waste. This will contribute to job creation and will have positive effects on greenhouse gases and other emissions. The approach comprises different parts correlating with each other. The bases of the IGNIS project are pilot projects. The majority of the pilot projects will be small-scale projects such as composting, anaerobic digestion, recycling, improved collection, etc. on a decentralised level. These pilot projects will be set into effect and analysed scientifically in terms of technology, throughput, greenhouse gases (GHG), emissions, and also regarding socio-economic, occupational safety and health related aspects. The analyses of the pilot projects will generate basis data applicable for modelling and simulation. Scenario simulation based on scientific analyses is another core aspect of the project.
By means of the simulation we intend to find out which of the pilot projects might be useful regarding the above mentioned aspects. Simulation will also provide the possibility to see what will happen if we would distribute a range of those pilot projects in the city and link them to the actual waste disposal. In this context some of the crucial questions for characterising the effects are: Will this be successful for job creation and have positive social effects? Can the projects contribute substantially to proper waste treatment? Are there positive effects regarding GHG and emissions? And what would happen by upscaling the pilots technically? And last but not least, can the IGNIS simulation tool contribute to improve perceptively waste management in megacities?

Expected Contributions to an Energy and Climate Efficient Development of Future Megacities

Knowledge, Technologies and Performance

For Addis Ababa and many cities in Africa, dealing with the environmental costs of rapid growth and urbanization represents a phenomenal challenge. This is particularly true in the area of solid waste management. While cities are generating an ever-increasing volume of waste, the effectiveness of their solid waste collection and disposal systems are declining. In the urban centres, often less than half of the solid waste produced is collected. Many urban centres in Africa have parallel but separate systems that handle solid waste. The first, which is formal, is administered by the government and tends to be costly and inefficient. The second, that is informal, involves communities of waste workers that compensate for the lack in municipal services by collecting, sorting, recycling and selling waste.
Waste treatment through waste valorisation includes another interesting aspect – the effect on GHG and emissions. Existing waste management practices can provide effective mitigation of GHG emissions from this sector: a wide range of mature, environmentally-effective technologies are available to mitigate emissions and provide public health, environmental protection, and sustainable development co-benefits. Collectively, these technologies can directly reduce GHG emissions (through landfill gas recovery, improved landfill practices, engineered wastewater management) or avoid significant GHG generation (through controlled composting of organic waste, expanded sanitation coverage). In addition, waste minimization, recycling and re-use represent an important and increasing potential for indirect reduction of GHG emissions through the conservation of raw materials, improved energy and resource efficiency and fossil fuel avoidance.

Applicable Instruments, Tools and Methodologies

The general methodology of this research project is to develop and use experimental pilot projects for creating a reliable data base. In order to enforce the ownership of the pilot projects they have to pass TOC before being implemented. TOC means „Theory of

constraints“ and is a helpful method to detect crucial bottlenecks and to enforce and strengthen cooperation between the stakeholders. Implementing this method will make sure that all relevant stakeholders are involved in decision processes.
When set into effect, the experimental pilot projects will be scientifically analysed. For the scientific analyses methodologies and guidelines must be developed. Direct measurements will be carried out whenever feasible and possible. According to the scientific analyses, the pilot projects will be evaluated to find out whether they are successful.
The results from data gathering and scientific analyses will be transformed into models that will be incorporated in the simulation program and planning tool.
For simulation we will use different scenarios. The first scenario will be the reference scenario „business as usual“. This scenario calculates the most likely development in waste management of Addis Ababa, in the absence of CDM projects (pilot project). This simulation will consider important requirements of a baseline scenario for potential CDM waste projects including the approved tools when feasible.
A further scenario will calculate the effects when – hypothetically – introducing and multiplying many of the successful pilot projects.
The IGNIS project intends to provide an instrument that can be applied also by other emerging megacities to assess the effects when introducing similar waste management and treatment steps. The simulation

could be a really powerful tool for waste management planning in rapidly emerging megacities. The tool helps to identify the costs and effects, when establishing treatment and recycling measures. The simulation will help to show the actual situation as compared to the situation when new waste treatment, etc. is introduced.
Evaluating the simulation results will clearly identify all effects of the IGNIS approach. Whether the approach is suitable also for other (emerging) megacities must be found out by transferability studies. These studies will be done in close co-operation with cities located in Africa, Asia and South-America, which have already signalled their interest.

Result of the previous steps: Suggestion of measures to be implemented. Capacity Building, Integration and Networking of Institutions

During the pre-phase we learnt that support of the local stakeholders is an important pre-condition for each research project. Projects may fail when the idea is not communicated and discussed with all relevant stakeholders. It is very important to bring these stakeholders of the IGNIS project together to discuss and exchange their different points of view. Relevant stakeholders include youth/ women groups, city authorities, international organisations, such as the World-bank, ILO, UN-organisations, etc. For that reason "Theory of constraint" workshops will become an important aspect of the project in order to strengthen the ownership of the IGNIS project. The workshops will also make networking between different stakeholders necessary and provide a platform for direct exchange. Thematic discussions during the workshops will highly contribute to the capacity building process of all stakeholders.
Including as many city authorities as possible in discussion during the pre-phase was very helpful to detect interdisciplinary pilot projects including, beside waste related aspects, also aspects on waste water, energy, urban farming, and erosion prevention. As Addis Abba city authorities have a genuine interest in these topics additional pilot projects at interfaces to other sectors e.g. erosion, energy, wastewater will become more and more important in future for strengthening synergies among treatment options to obtain the biggest possible benefit for the city and its citizen. Financial, organisational, or practical contribution will be provided by the respective authorities.

Generally, there is a huge lack in specialists for waste management in developing countries and qualification of people is one of the biggest challenges. During the project phase we will establish a competence and training centre to directly qualify people working with waste on private and public level and also the persons on management level. Running this competence centre means that different institutions will be integrated and beworking together.

Socio-Economic, Integrative and Overall Sustainability Aspects

The IGNIS project deals with income generation from valorising waste due to improved waste treatment. So, the project can directly contribute to poverty reduction, an important Millennium Development Goal.
In view of the rapid growth in population in Ethiopia it is urgently necessary to create new workplaces and income possibilities beyond agriculture in the urbane centres. The pilot projects will be operated by youth groups, women groups, or interested persons who want to introduce a business. IPCC states, that via various diversion and small-scale recycling activities, those who make their living from decentralized waste management can significantly reduce the mass of waste. The Addis Ababa city

council supports groups/ women etc. to start small businesses. The city founded its own Micro-Finance Institute to support small and medium enterprises and the informal sector with favourable financing instruments.
Projects, particularly in developing countries, do not end by merely establishing the technology. There must be accompanying measures to give people the chance to follow the project, even if difficulties and problems occur. The training- and competence centre will provide theoretical and practical courses for qualifying the youth/women groups and also future operators when extending and distributing the pilot projects. Collectors, recyclers, compost producers, etc. will be trained in technical, and management skills and with a focus on occupational safety and health to make their lives and businesses sustainable.

The IGNIS project directly links scientific and economic interests. The scientific work will pave the way for technical and economic development. There are some German companies involved in the project; they have serious interest to learn from the project and also integrate in their know-how and experience. The project approach is a know-how transfer in both directions from the south to the north and vice versa. We also expect technology transfer from urban to rural areas that might contribute to reducing migration.

German Partners

- AT-Verband / AT-Association
- Institute for Sanitary Engineering, Water Quality and Waste Management (ISWA), University of Stuttgart, Faculty of "Civil and Environmental Engineering"
- Institute for Future Energy Systems (IZES)
- Federal Institute for Occupational Safety and Health – FIOSH

Cooperative Partners in Host Country

- ENDA – Environmental Development Action in the Third World
- Addis Ababa University RLDS
- Addis Ababa University Faculty of Civil Engineering
- Addis Ababa Environmental Protection Agency (EPA)

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