GEMIS - GLOBAL EMISSION MODEL FOR INTEGRATED SYSTEMS

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INTRODUCTION

The main mission of the energy sector is a balanced approach to energy security and other needs with regard to friendliness towards the environment and human safety. To be determined size greenhouse gas emissions are used a numerous methods and programs. In this article is described one of these system, are GEMIS.

1. ABOUT GEMIS

The GEMIS database covers processes for energy (fossil, nuclear, renewable), materials (metals, minerals, food, plastics…), and transport (person and freight), as well as recycling and waste treatment processes. The database covers all EU-27 countries for energy plus AU, CA, NO, RU, US, and various developing countries (BR, CN, IN, MA, MX, ZA). Material conversion processes are based on EU data, with regional differentiation for extraction (AU, CA, RU, ZA), and processing (e.g. for aluminium, steel). Transport processes are based on EU and US data, with special processes for developing countries. Currently, about 10,000 data entries exist in the process database, and some 1,000 products (especially energy carriers with ultimate analysis, and costs).

GEMIS is a database system: It offers environmental and cost data for energy, material, and transport systems, including their life-cycles. The environmental data cover air emissions ($S0_2$, NO_x, particulates, CO, HC1, HF, H_2S, NH_3, NMVOC), greenhouse gases ($C0_2$, CH_4, N_2G, HFC, PFC, SF_6), liquid effluents (AOX, BOD, COD, N), solid wastes (ashes etc.), and land-use. The cost data concern investment, fixed annual, and variable cost, as well as externality factors for air emissions, and GHG. Further data are stored for "meta" information: comments and description, references, data quality indicators, location and statistical grouping.

GEMIS is an analysis system: It determines full life-cycle impacts of energy, transport, and material technologies, see fig. 1.

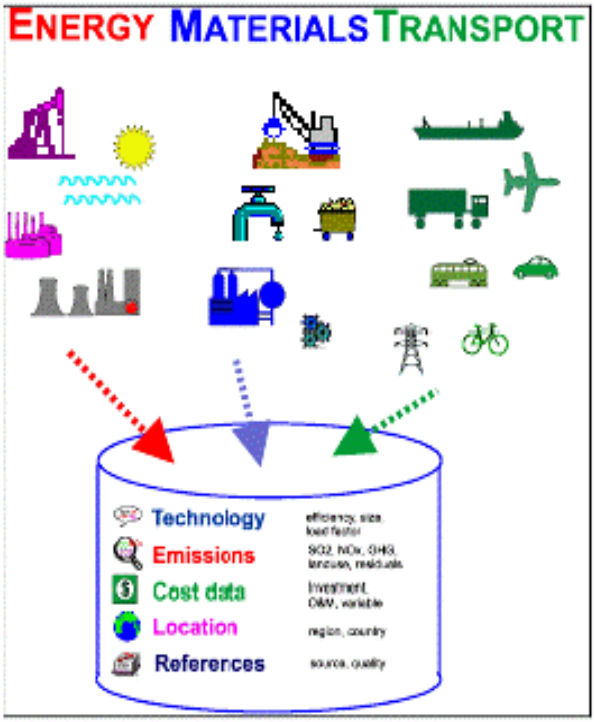

Figure 1. Data structure of technological process.

In addition to the totals, GEMIS also gives the individual contributions of all processes to a calculated result (breakdown), and can determine results for selected system boundaries (e.g. a special location, in- or exclusion of material acquisition, crediting).

2. PRACTICAL USE OF PROGRAM GEMIS

GEMIS is an effective tool for economic and environmental management and planning in energy, transport and manufacturing industries. Allows in particular:

- implementation of industrial processes, proof of compliance with the requirements of EU Directive No. 96/61/EC on integrated pollution prevention and control,
- facilitating communication between businessmen, politicians and the public,
- transparency of control and management within the enterprise is an appropriate complementary tool for quality management (ISO 9000), environmental management (ISO 14000) and

life-cycle assessment (LCA - Life Cycle Assessment) products and services,

• use in marketing, as it contains information on competing technologies, heat and electricity, use of integrated information base,

• Economic analysis of business in the whole chain from production to consumption with regard to product life cycle,

• International comparison of technical parameters and operational efficiency, access to standard databases GEMIS other countries.

3. DATABASE STRUCTURE GEMIS

The data file is divided into four groups:

• products (fuels, other energy carriers, materials, primary sources of energy and raw materials),

• processes (extraction, transformation of energy and materials, combustion, transport, dispatcher, handling of waste)

• scenario (modeling case studies through the compilation process chains),

• references (information about data origin).

These sections may be selected using menu data and filters. Filters allow you to narrow the scope of the data file and thus speed up their selection for the compilation of individual processes and scenarios.

3.1. Products

Program GEMIS defines the products as inputs and outputs of processes. Products contain the necessary information for calculating the energy and environmental characteristics of processes. Standard database GEMIS version 4 includes features over 750 basic types of products.

Types of products are defined as:

- Carriers of Energy - products entering or leaving a process, other than fuel, it can be electricity, steam, hot water,

- Solid and Liquid Fuels (Solid / liquid fuels) - the type of energy carrier

- Materials - products entering or leaving a process than carriers of energy (chemical compounds, building materials, industrial and agricultural products, semi-finished products, food, drinks, etc.)

- Resources - products that can be converted into energy or materials (fuel, water, wind, ore bearing materials), also contain information about the quality of environmental influences,

- Gases - Sub-Categories fuels (natural gas, LNG, LPG),

- Gaseous emissions (Emissions into air) - Theoretical GEMIS calculated pollutant emission from fuel element analysis,

- Waste (Residuals) - solid or liquid waste products of processes, data on the major waste are listed in the database, the user can also freely enter your own data on five types of waste.

Each product has its own code name, which must briefly comment on the nature of the product and through which are defined inputs and outputs of processes. Two different products may not have the same name. List of products includes the names of products in different colors to distinguish the data source.

3.2. Processes

GEMIS defines a process as a specific activity, which aims to transform the input product for the product output. However, it may be used other auxiliary input products (such as auxiliary power), and may occur in the secondary outputs (eg emissions of harmful substances). Like processes, products can be detected by filters, which greatly facilitates the work as the standard version 4.3 includes over 9500 processes.

GEMIS includes the following basic types of processes:

• transformation of energy (Energy conversion), combustion, heat exchangers, turbines, etc.

• conversion of material (conversion), production of steel, chemical products, etc.,

• incineration (Combustion)

• mining and acquisition of materials (Extraction), such as oil, ores, fuels,

• transport of goods, persons (Freight transport service, transport Person)

• handling of waste (Waste treatment facility

• cash (Monetary services)

• dispatcher (Mixer) - not a real process, but the sum of several processes, the contribution of the main process is quantified (in%), such mix of electricity produced in power plants of various types and used as the entry product in the primary process.

GEMIS analyze the above processes all sub-processes that chain, auxiliary energy consumption and consumption of materials. For these processes are in the data base characteristics and constants, like the products:

Each process has its own code name, which must briefly comment on the nature and process by

which the compiled script. Two different processes may not have the same name. Process list contains the names of processes in different colors to distinguish the data source.

4. EXEMPLE

As an example we can calculate emissions for a car produced in Germany in 2000 with good characteristics.

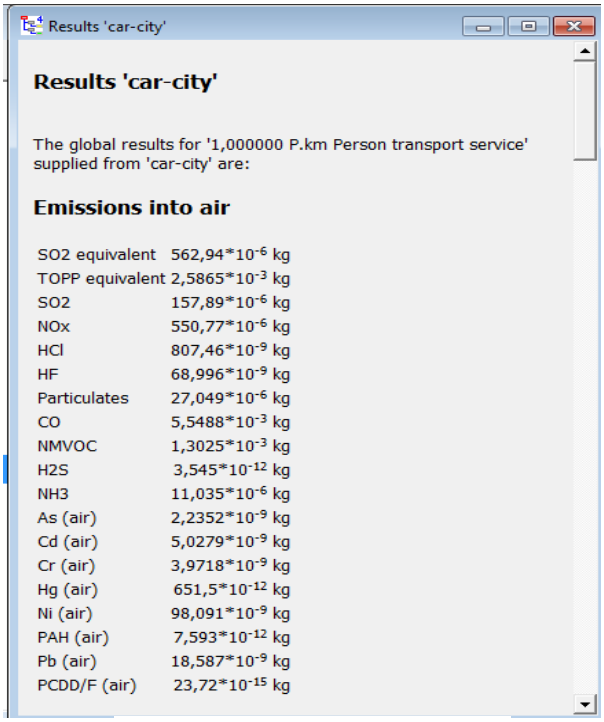

Figure 2. Results data of emissions into air.

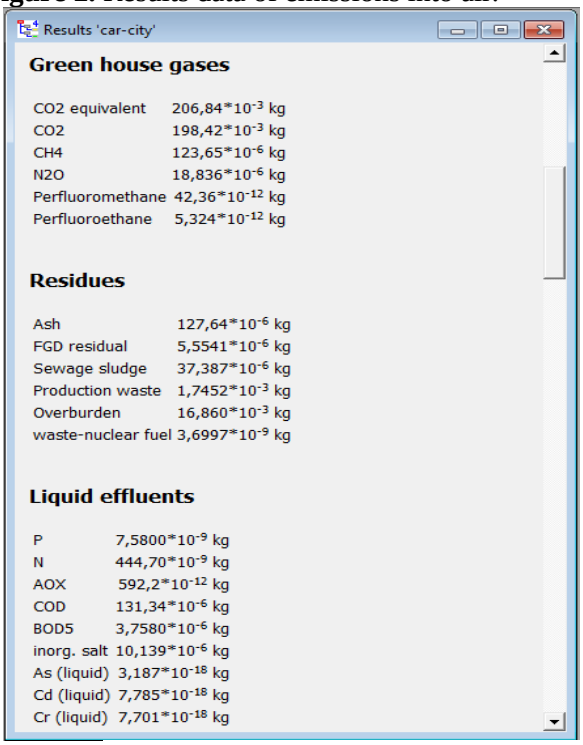

Figure 3. Results data of emissions of green house gases.

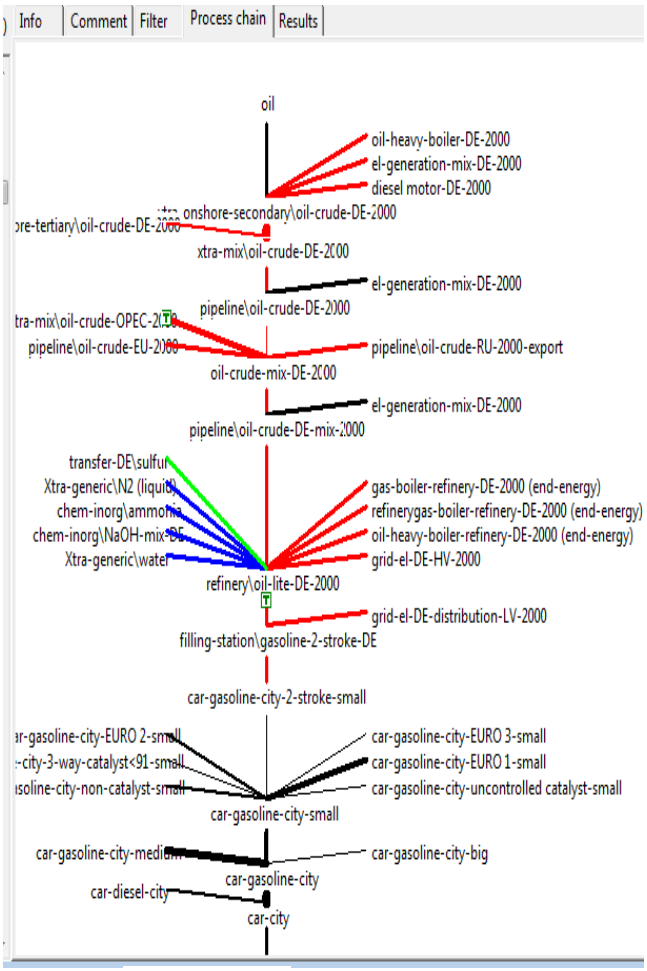

Figure 4 .Process chain.

In conclusion I would like to say that there are many methods for calculating greenhouse gas emissions, technical methods, and computerisat. In this work I wanted to get acquainted with one of them. What is known and used in much of the world countries.

Bibliografie

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