GAINS ASIA

GETTING STARTED WITH GAINS-ONLINE

Tutorial

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The GAINS-Asia model integrates a number of established economic and environmental models developed by international experts at the following institutions:

IIASA
International Institute for Applied Systems Analysis
Laxenburg, Austria

ERI
Energy Research Institute
Beijing, China

TERI
The Energy and Resources Institute
Delhi, India

JRC-IES
Institute for Environment and Sustainability of the Joint Research Centre of the European Union
Ispra, Italy

UBERN
The University of Bern
Bern, Switzerland

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Executive Summary

By selecting a smart mix of measures to simultaneously cut air pollution and greenhouse gas emissions, countries can reduce air pollution control costs as well as cut greenhouse gas emissions. The Greenhouse gas – Air pollution Interactions and Synergies (GAINS) model harvests synergies by integrating multiple pollutants and their multiple effects to identify their most cost-effective control.

GAINS is a scenario-generating device that helps users to understand the impacts of future actions—or inaction—and to design strategies to achieve long-term environmental goals at the lowest possible cost.

Scientists, civil servants, politicians, and other non-technical users can pose any number of "what-if" questions to GAINS: How much would it cost to reduce air pollution levels to a given standard for all of India? For the worst-affected areas only? What is the cheapest way to reduce the health impacts of air pollution on China's population? What air pollution controls maximise the reduction of greenhouse gases? Fed with the relevant data GAINS gives answers to such questions within short time.

This tutorial provides step-by-step instructions to the key features of the GAINS-Asia Internet software.

The GAINS model is accessible at the Internet at http://gains.iiasa.ac.at.

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1 Introduction

The Greenhouse Gas and Air Pollution Interactions and Synergies (GAINS) model is an integrated assessment model dealing with costs and potentials for air pollution control and greenhouse gas (GHG) mitigation, and assessing interactions between policies.

The GAINS model grew out of the RAINS model which has been developed at IIASA over some 20 years. The RAINS model is an air pollution emission and impact model that can model policy implications on emissions of major air pollutants (SO_2, NO_x, VOC, PM, NH_3) at the national scale, as well as of major environmental impacts associated with the emissions (acidification, eutrophication, ozone, health). GAINS is the extension of the RAINS model to include major greenhouse gases, i.e., CO_2, CH_4, N_2O and the F-gases. The modelling work brings together a multinational team of experts who develop a state-of-the-art disciplinary model to assess the co-benefits of air pollution and greenhouse gas emission reductions, furthermore, to evaluate technical and market-based policies that maximize synergies within the co-benefits policy area.

The purpose of this tutorial is to give an introduction on the basic concept of the GAINS model and to enable users with viewer privileges to derive data from the online model interface in the form of tables or maps. No special analytical skills or advanced knowledge in environmental and social sciences is required to use either the web interface or this guide. We hope that it will be useful for policy-makers, journalists or students from all disciplines to use modeled data on the co-benefits reduction strategies from air pollution and greenhouse gas sources. Should you need a more advanced guide to GAINS online, note that a more detailed version of this tutorial will be available shortly or check out our recent list of publications.

The GAINS web interface allows on-line access to the latest model implementations for various world regions. It provides interactive access to input data, emission projections and cost implications of alternative emission control scenarios, as well as to the environmental impacts these imply. The current version (September 2008) allows access to:

- emission inventories, emission projections and control costs for air pollutants (SO_2, NO_x, VOC, PM, NH_3),
- emission inventories and emission projections for greenhouse gases (CO_2, CH_4, N_2O and the F-gases),
- projections of underlying activity data,
- control measures and emission control costs of cost-optimal policy scenarios,
- display of air quality indicators (ambient concentrations and deposition),
- computation and display of health and environmental impacts.

All results are calculated on the fly to ensure that the most recent data set is used at all times. The interface enables display and download of all input data and scenario results.

2 Accessing GAINS online

The web interface of the GAINS model can be accessed via http://gains.iiasa.ac.at/web-apps/apd/gains/index.html.

GAINS models available are: GAINS Europe, GAINS India & South Asia and GAINS China & East Asia, GAINS Rest of the World. Comprehensive documentation of the model methodology is provided at the web site. In this tutorial we demonstrate the elements and functions of the Gains India and South Asian interface.

In order to login to the web interface of GAINS China & East Asia, you will need to register for a username.

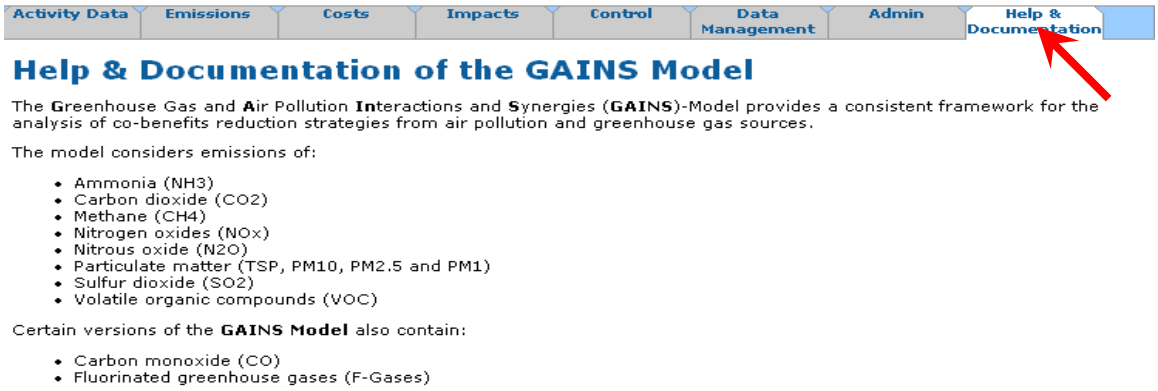
Why do I need to register?

You need to register so that IIASA can trace back downloads, uploads or modifications when problems encounter. You will need a valid email account on which an activation code will be sent after your registration. Should you not receive an activation code within 15 minutes (also **check your spam** mailbox), please contact the administrator. Registration is free.

When you register, you automatically get a **viewer status**, which allows you to download and view data in form of tables and maps. Upon request, IIASA collaborators can obtain the **user status,** which grants permission to update and modify data.

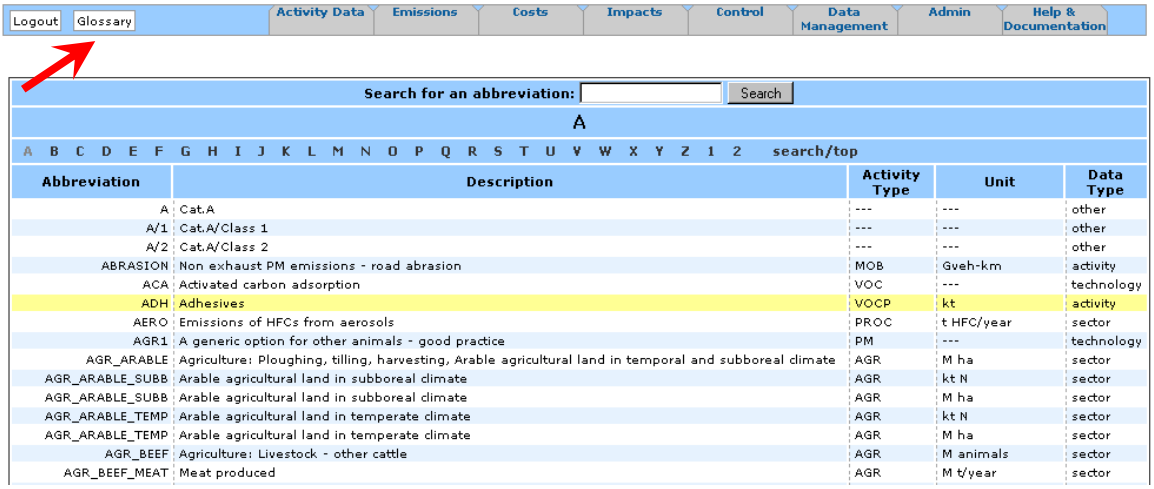
3 Once you are IN

Once you have successfully logged in, you will see the following page on your screen:



When you log in for the first time, the Help and Documentation page appears automatically on your screen, which is the last tab on the top, also indicated with the red arrow. Here you can read a short introduction on the GAINS model. You may find it useful to read these pages before proceeding with the next steps. On the left side you can also check the **Change Log**, which lists the most recent changes that have been made in the model.

In the top left corner you can find a link to **Logout** and next to it a link of the Glossary, which leads you to a comprehensive list of abbreviations the model uses: sectors, technologies, activities, or other. In the snapshot of the Glossary main page below, you can see that the tables are structured by abbreviation, description, activity type, unit and data type columns.



Abbreviation	Description	Activity Type	Unit	Data Type
A	Cat.A	---	---	other
A/1	Cat.A/Class 1	---	---	other
A/2	Cat.A/Class 2	---	---	other
ABRASION	Non exhaust PM emissions - road abrasion	MOB	Gveh-km	activity
ACA	Activated carbon adsorption	VOC	---	technology
ADH	Adhesives	VOCP	kt	activity
AERO	Emissions of HFCs from aerosols	PROC	t HFC/year	sector
AGR1	A generic option for other animals - good practice	PM	---	technology
AGR_ARABLE	Agriculture: Ploughing, tilling, harvesting, Arable agricultural land in temporal and subboreal climate	AGR	M ha	sector
AGR_ARABLE_SUBB	Arable agricultural land in subboreal climate	AGR	kt N	sector
AGR_ARABLE_SUBB	Arable agricultural land in subboreal climate	AGR	M ha	sector
AGR_ARABLE_TEMP	Arable agricultural land in temperate climate	AGR	kt N	sector
AGR_ARABLE_TEMP	Arable agricultural land in temperate climate	AGR	M ha	sector
AGR_BEEF	Agriculture: Livestock - other cattle	AGR	M animals	sector
AGR_BEEF_MEAT	Meat produced	AGR	M t/year	sector

For example, the abbreviation ADH stands for Adhesives and – as can be seen from the last column is referring to an activity (in contrast to a sector or technology). The unit of this activity is kilotons (kt) of product being produced while the production of volatile organic compounds (VOCP).

You can browse the list, which is in alphabetic order or you can use the search option to find a specific abbreviation. However, if you fail to give a fully correct abbreviation or just give the first letters into the search, you will get no results. A more sophisticated collection of the GAINS terminology can be found in the glossary of definitions (to be online soon).

4 Elements of the Interface

Now that you have read the introduction of the model, browse the elements of the menu bar. You can choose from: ***Activity Data, Emissions, Costs, Impacts, Control, Data Management, Admin and Help and Documentation***. Let us go now through them step by step.

Activity Data. This option displays data on emission generating anthropogenic activities that are used by the GAINS model for calculating emissions. The model contains activity data on energy-use, industrial processes, agriculture and transport, both for past and future years. Furthermore, the database holds additional data that supplement the activity projections.

Emissions displays air pollutant and greenhouse gas emissions for selected scenarios *(combination of activity pathway and emission control strategy)*, and provides details on the emission-relevant input data used for the calculations. Emissions are aggregated by the CORINAIR SNAP1, UN-ECE NFR1 and UN-ECE NFR2 emission reporting standards (http://www.unece.org/env/eb/Air_Pollutionwithcover_15_ENG.pdf).

Costs displays emission control costs computed by the GAINS model for a selected emission scenario (= combination of energy pathway and emission control strategy), and provides details on the cost-relevant input data used for the calculations. All costs are presented in Euro 2000.

By choosing Impacts one can display computed air quality and the resulting health and environmental impacts of selected emission control scenarios in graphical (maps) and numerical form (tables with country-specific data). You can display:

1. Air quality indicators,
2. Concentrations of fine particulate matter (maps and tables) ,
3. Concentrations of ground-level ozone (tables only) ,
4. Deposition of sulfur and nitrogen compounds (maps and tables) ,
5. Health impacts attributable to PM2.5 exposure (maps and tables) ,
6. Health impact indicators for ground-level ozone ,
7. Excess of critical loads for acidification and eutrophication, for forests, semi-natural ecosystems and for freshwater catchment areas.

With the Control option you can view data sets that are used by GAINS for computing emissions. Here you have the option to check the **Control Strategies**, which basically define the temporal evolution of the application of the available emission control measures. Control strategies are independent of country and activity projections. They can be seen as legal frameworks that specify for all emission sources in a country the required emission controls, independent from the extent to which such emission sources exist in a particular country at a given time. This approach facilitates the analysis of the implications of different activity projections under a constant set of emission control requirement. You can also check the **Emission Scenarios** that describe for each country, the combination of activity projections and control strategies, which basically determines the level of actual emissions.

The **Data Management** option, where users can modify, create, and/or update data under their ownership and stored in the database, are NOT available for viewers, as they need special privileges.

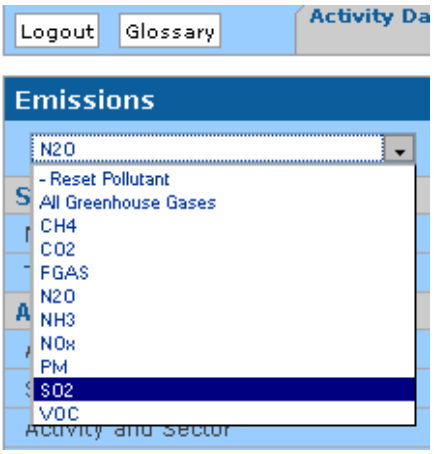
Special privileges are also required to for the **Admin** directory, where users have the option of updating and modifying their personal user data.

A comprehensive explanation on the GAINS methodology and interface can be found in the extended version of the GAINS user's guide (to be online soon).

5 Example: displaying a table with emission data

5.1 Selection of the desired output type

By choosing the option **Emissions** you can display emissions for a selected scenario, and can display details on the emission-relevant input data used for the calculations.



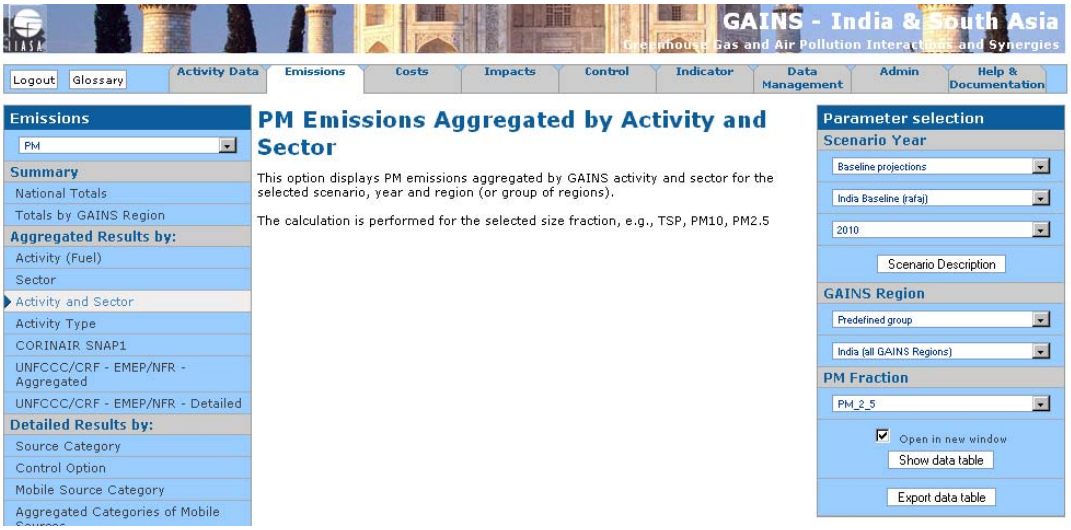
On the left side you can find a scroll menu box with all the options you can select. The model calculates emission data on all greenhouse gases or on CO_2, NH_3, SO_2, NO_x, VOC, FGas, N_2O, NH_4, PM individually, both for past and future years.

Select the pollutant of interest and then choose a display option from the bar menu on the left.

By clicking on one of the emissions from the scroll-down menu box, e.g. PM (particulate matter), you can display PM-relevant input data used for calculations in GAINS. On the left side you will find emission data in many categories. In most cases you can go into further details in specifying the emission data for a chosen pollutant. However this option is mainly dependent on a specific scenario, activity or emission.

5.2 Specifying parameters for the query

If you click on one of the options given on the left box (e.g. Activity and Sector), a second window: **Parameter selection** will automatically appear on the right side of the screen. Now you should see the following:



Let us take a closer look at this parameter selection window, which you will probably use most frequently within the GAINS web interface. In this window you can further specify the scenario and the region for which you would like to view the data. Scenarios are grouped, typically by a report or a project.

There are several predefined groups of regions, e.g., Bangladesh, Bhutan-Nepal-Sri Lanka, India and Pakistan but you can also choose to work with single regions like a state in India or a province in Pakistan.

5.3 Generating a table

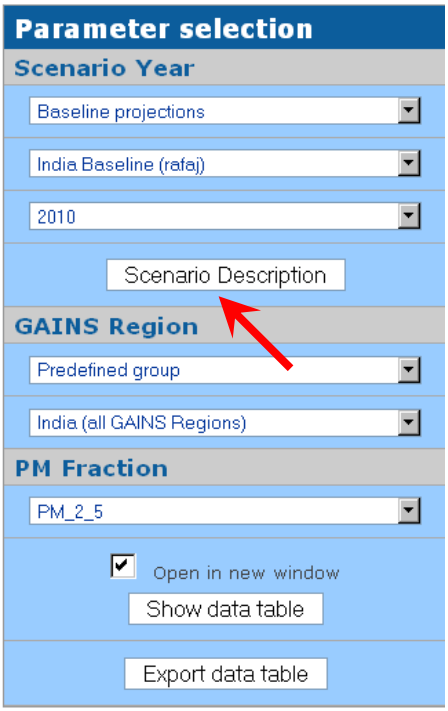
Let us now start using the GAINS model web interface for generating our first table.

Suppose we would like to know the *how much small-fraction particulate matter emissions will be generated by e.g. buses in India in 2010*.

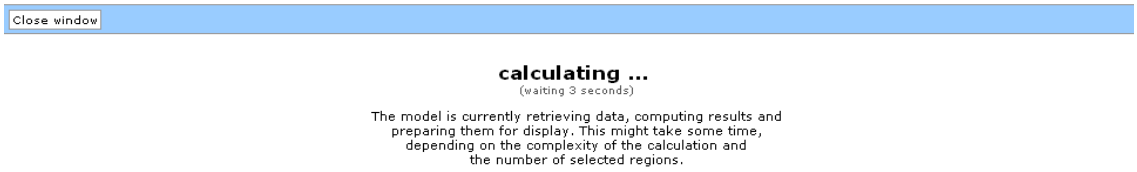
Let us go step by step. For this exercise, we need to display PM emissions aggregated by GAINS activity and sector for the selected scenario, year and region (or group of regions).

1. Chose the Emissions tab from the horizontal panel on the top of the screen and from the scroll-down menu-box at the left side of the screen chose PM.
2. Click on *Activity and Sector* within the Aggregated Results section on the left and notice the Parameter Selection window that appeared on the right side of the screen.
3. From the top scroll-down box, choose the scenario group **Baseline projections**, then from the scroll-down box below choose the scenario **India Baseline** and finally choose the year **2010** from the box below.

   Note the **Scenario Description** icon that appeared below the scroll-down boxes you have been just using. By clicking on it, a new window will appear with a brief explanation on the scenario India Baseline. Here you can also choose to read a pdf document of a comprehensive scenario description.

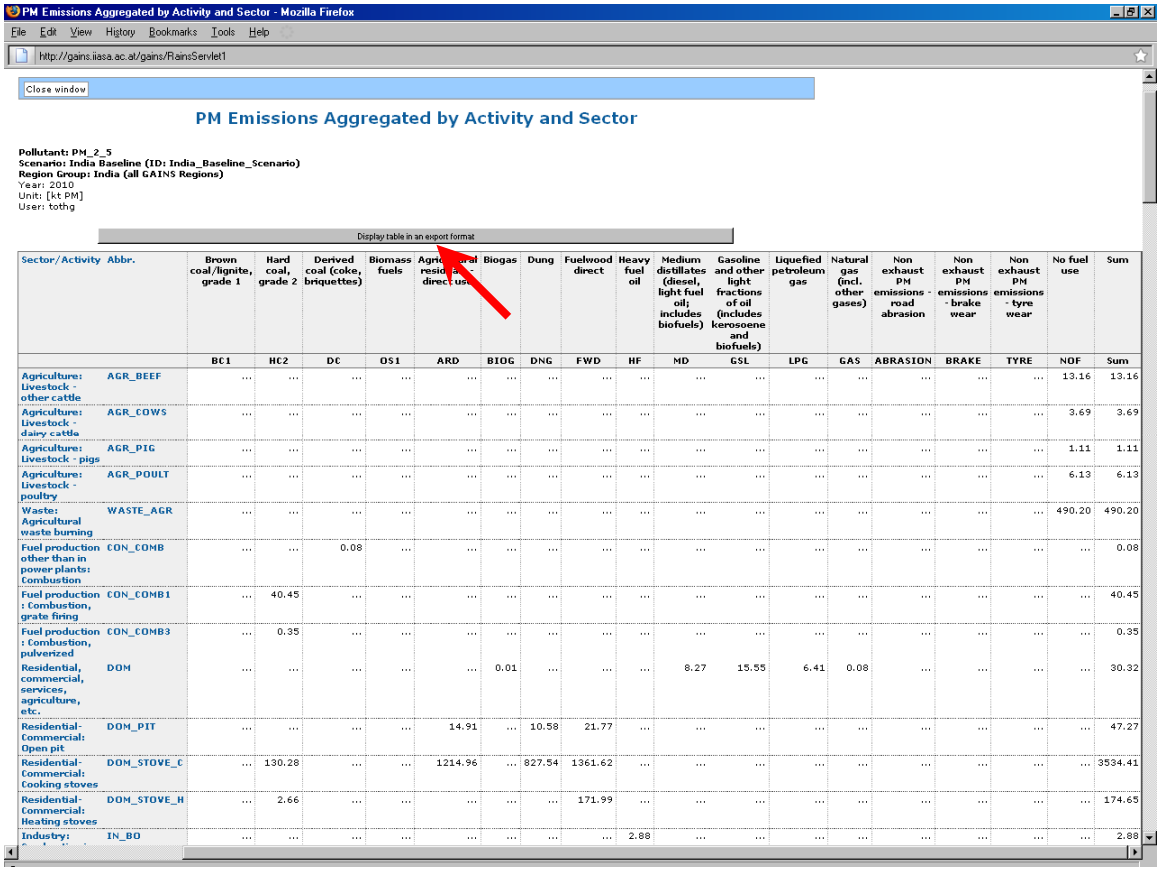


4. From the GAINS Region scroll-down box choose **Predefined group** and below that choose **India** (all GAINS Regions).
5. Select the PM size fraction (e.g., TSP, PM10, PM2.5) for which you want to display data. For now let us choose: **PM_2_5**.
6. Tick the box: **"Open in new window"** and click on "**Show data table**". Notice the window on your screen:



The message on your screen says that GAINS is retrieving the requested results from the database server at IIASA. All results are calculated on the fly to ensure that the most recent data set is used at all times. Be patient, other users may be requesting model results at the same time.

Once the calculation is finished, a new window appears on your screen, which should look like this:



Sector/Activity	Abbr.	Brown coal/lignite, grade 1	Hard coal, grade 2	Derived coal (coke, briquettes)	Biomass fuels	Agricultural residues direct use	Biogas	Dung	Fuelwood direct	Heavy fuel oil	Medium distillates (diesel, light fuel oil; includes biofuels)	Gasoline and other light fractions of oil (includes kerosoene and biofuels)	Liquefied petroleum gas	Natural gas (incl. other gases)	Non exhaust PM emissions - road abrasion	Non exhaust PN emissions - brake wear	Non exhaust PN emissions - tyre wear	No fuel use	Sum
		BC1	HC2	DC	OS1	ARD	BIOG	DNG	FWD	HF	MD	GSL	LPG	GAS	ABRASION	BRAKE	TYRE	NOF	Sum
Agriculture: Livestock - other cattle	AGR_BEEF	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	13.16	13.16
Agriculture: Livestock - dairy cattle	AGR_COWS	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3.69	3.69
Agriculture: Livestock - pigs	AGR_PIG	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1.11	1.11
Agriculture: Livestock - poultry	AGR_POULT	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	6.13	6.13
Waste: Agricultural waste burning	WASTE_AGR	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	490.20	490.20
Fuel production other than in power plants: Combustion	CON_COMB	...	...	0.08	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.08
Fuel production : Combustion, grate firing	CON_COMB1	...	40.45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	40.45
Fuel production : Combustion, pulverized	CON_COMB3	...	0.35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.35
Residential, commercial, services, agriculture, etc.	DOM	...	...	...	...	...	0.01	...	...	...	8.27	15.55	6.41	0.08	...	...	...	...	30.32
Residential-Commercial: Open pit	DOM_PIT	...	...	...	...	14.91	...	10.58	21.77	...	...	...	...	...	...	...	...	...	47.27
Residential-Commercial: Cooking stoves	DOM_STOVE_C	...	130.28	...	...	1214.96	...	827.54	1361.62	...	...	...	...	...	...	...	...	...	3534.41
Residential-Commercial: Heating stoves	DOM_STOVE_H	...	2.66	...	...	...	...	...	171.99	...	...	...	...	...	...	...	...	...	174.65
Industry:	IN_BO	...	...	...	...	...	...	...	...	2.88	...	...	...	...	...	...	...	...	2.88

The first horizontal row of the table indicates the several **activities**, which are mostly fuels. In the first column on the left a number of **sectors** are listed in which the specified fuels are used while generating PM2.5 emissions. Next to the sectors, in the second column you will find the abbreviation of the specified sectors (Conversion combustion = CON_COMB, Industry Boilers = IN_BO, etc…details on the web in the Glossary). Furthermore, in the second horizontal line you will find the abbreviations of the several fuels and activities that produce PM2.5 (Brown Coal grade 1 = BC1, Gasoline = GSL, etc…more in the online Glossary).

Let us take a closer look at “Heavy duty vehicles – buses” (TRA_RD_HDB), which you will find if you scroll further down in the table. If you read the values from the left to the right, you can see that 7.90 kt PM is emitted by buses while running on diesel (MD – medium distillate). Further PM 2.5 will be produced from burning natural gas (0.03 kt) and from non-exhaust sources such as: road abrasion (ABRASION): 0.56 kt, brake wear (BRAKE):0.42 kt and tyre wear (TYRE): 0.11 kt. As indicated in the SUM column of the table, the answer to your query is that 9.02 kt of PM2.5 is projected to be emitted in Austria by heavy duty buses in 2010.

You can repeat this exercise if you are interested in other emissions, for a different year and country or even group of countries.

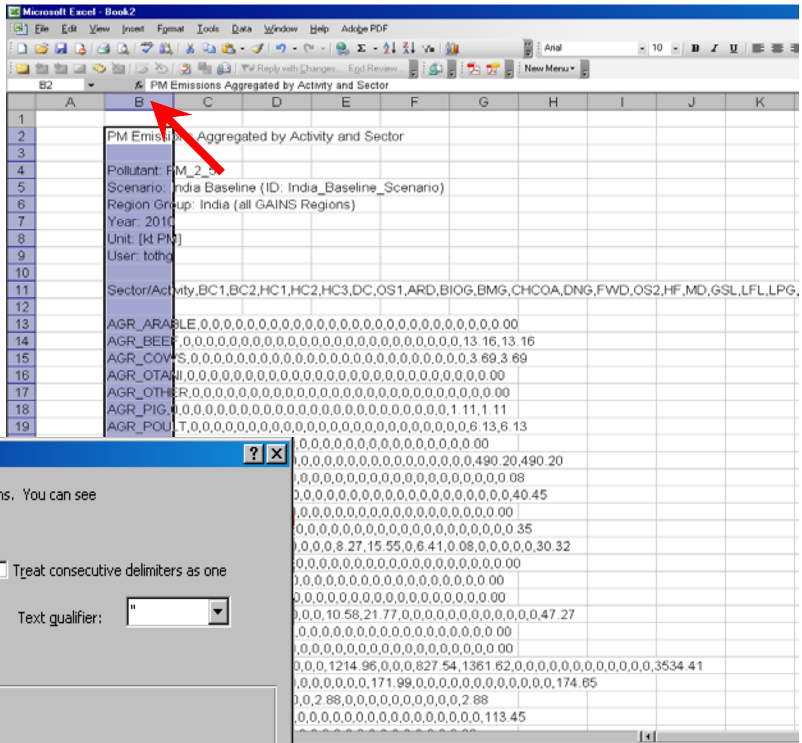
6 Import your GAINS table into an Excel worksheet

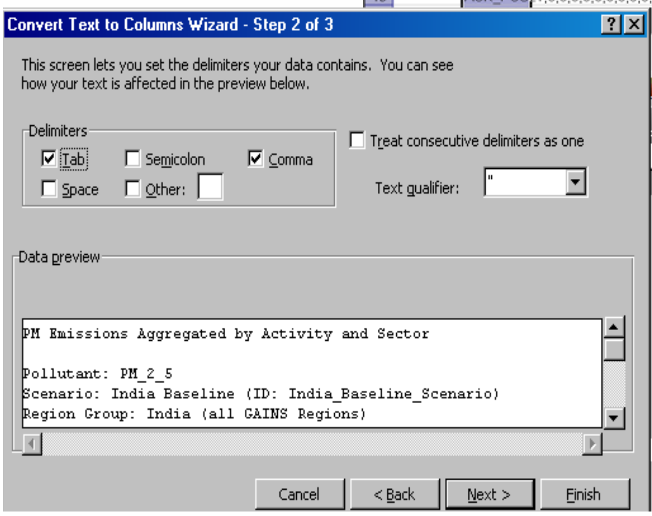
In the previous chapter you have generated a table from the web interface of the GAINS model and now you will learn how to import your table into Excel.

If you look at the bottom of the table you have just generated, you will find a definition of the scenario you selected and an option that allows you to export data from the table into an Excel worksheet. Let us do an example in a few easy steps:

1. Scroll down to the bottom of the table where the scenario definition can be found.

2. Click on the icon.
3. Notice the new window that appeared on your screen. The content of the window is in text format. Highlight the whole page content (ctrl+a) or just the part of it that you need and copy it (with the mouse or ctrl+c).
4. Open a new Excel document and paste the copied data to the location of your choice. With this you have now inserted the data into one column of an Excel worksheet.

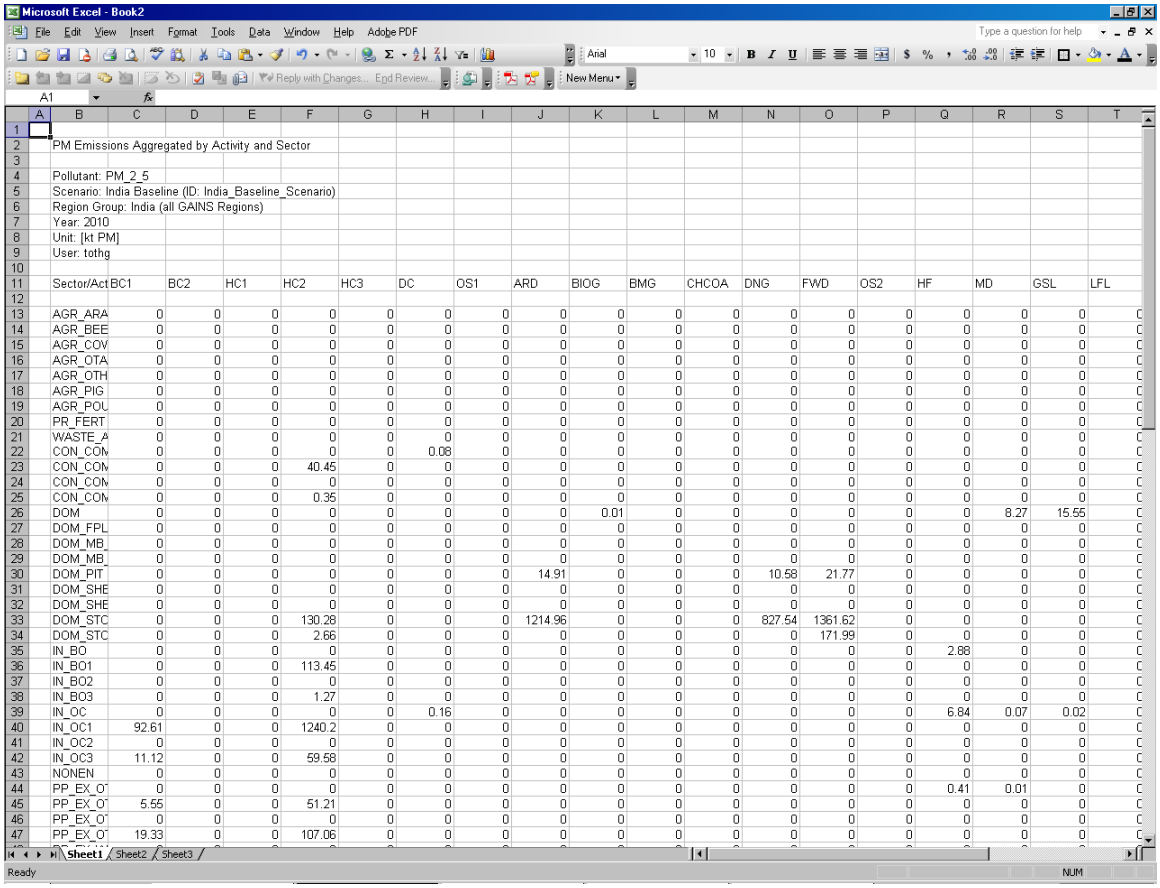




5. Highlight the whole column that you have inserted (as shown in the figure on the right) and use the menu option 'Data'>'Text to Columns' in Excel. Notice the window that appears on you screen.

6. Click Next. In the next window, tick these two: “Tab”, “Comma” (and/or the other options, depending on what separates your data in the table), as shown in the left figure. Then click Next and in the next window click Finish.

7. The table you generated using the GAINS web interface has now been imported into Excel and is ready for use (figure below).



Microsoft Excel - Book2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
1																				
2		PM Emissions Aggregated by Activity and Sector																		
3																				
4		Pollutant: PM_2_5																		
5		Scenario: India Baseline (ID: India_Baseline_Scenario)																		
6		Region Group: India (all GAINS Regions)																		
7		Year: 2010																		
8		Unit: [kt PM]																		
9		User: tothg																		
10																				
11		Sector/Act	BC1	BC2	HC1	HC2	HC3	DC	OS1	ARD	BIOG	BMG	CHCOA	DNG	FWD	OS2	HF	MD	GSL	LFL
12																				
13		AGR_ARA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14		AGR_BEE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15		AGR_COV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16		AGR_OTA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17		AGR_OTH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18		AGR_PIG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19		AGR_POU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20		PR_FERT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21		WASTE_A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22		CON_CON	0	0	0	0	0	0.08	0	0	0	0	0	0	0	0	0	0	0	0
23		CON_CON	0	0	0	40.45	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24		CON_CON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25		CON_CON	0	0	0	0.35	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26		DOM	0	0	0	0	0	0	0	0	0.01	0	0	0	0	0	0	8.27	15.55	0
27		DOM_FPL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28		DOM_MB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29		DOM_MB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30		DOM_PIT	0	0	0	0	0	0	0	14.91	0	0	0	10.58	21.77	0	0	0	0	0
31		DOM_SHE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32		DOM_SHE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33		DOM_STC	0	0	0	130.28	0	0	0	1214.96	0	0	0	827.54	1361.62	0	0	0	0	0
34		DOM_STC	0	0	0	2.66	0	0	0	0	0	0	0	0	171.99	0	0	0	0	0
35		IN_BO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.88	0	0	0
36		IN_BO1	0	0	0	113.45	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37		IN_BO2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38		IN_BO3	0	0	0	1.27	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39		IN_OC	0	0	0	0	0	0.16	0	0	0	0	0	0	0	0	6.84	0.07	0.02	0
40		IN_OC1	92.61	0	0	1240.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41		IN_OC2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
42		IN_OC3	11.12	0	0	59.58	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43		NONEN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
44		PP_EX_O	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.41	0.01	0	0
45		PP_EX_O	5.55	0	0	51.21	0	0	0	0	0	0	0	0	0	0	0	0	0	0
46		PP_EX_O	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
47		PP_EX_O	19.33	0	0	107.06	0	0	0	0	0	0	0	0	0	0	0	0	0	0

7 Let us produce a map with environmental impacts

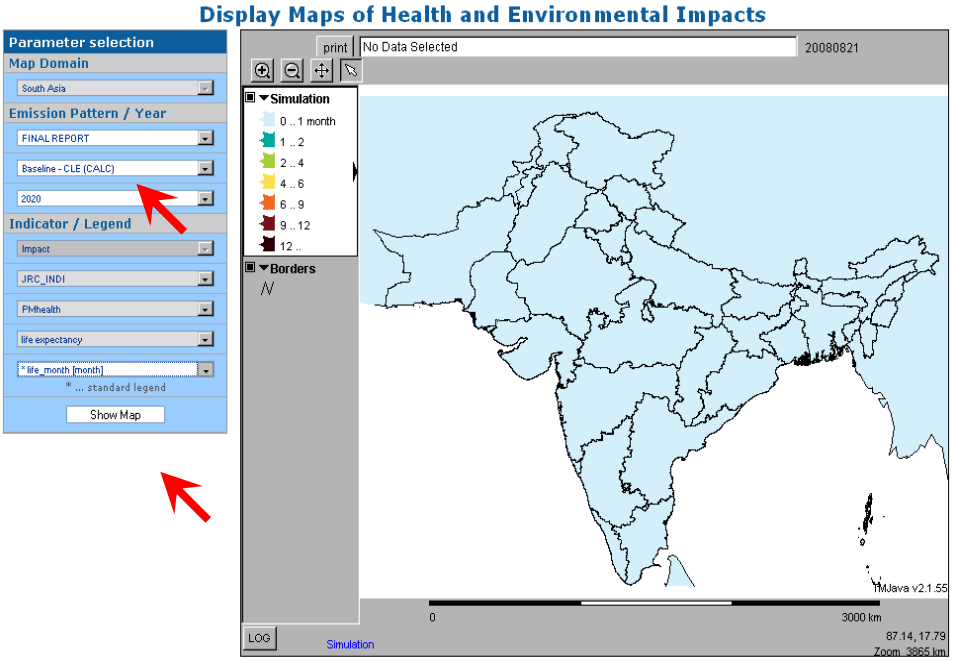
Let us now display our first map using the web interface. In order to display air pollution impacts, GAINS employs an atmospheric dispersion model to compute the chemical transformation and transport of pollutants in the atmosphere and to assess health, acidification and eutrophication impacts. With this example you will display Indian data in 50 km × 50 km grid maps.

With a viewer status you can display for a selected emission scenario, maps showing 3 health impacts:

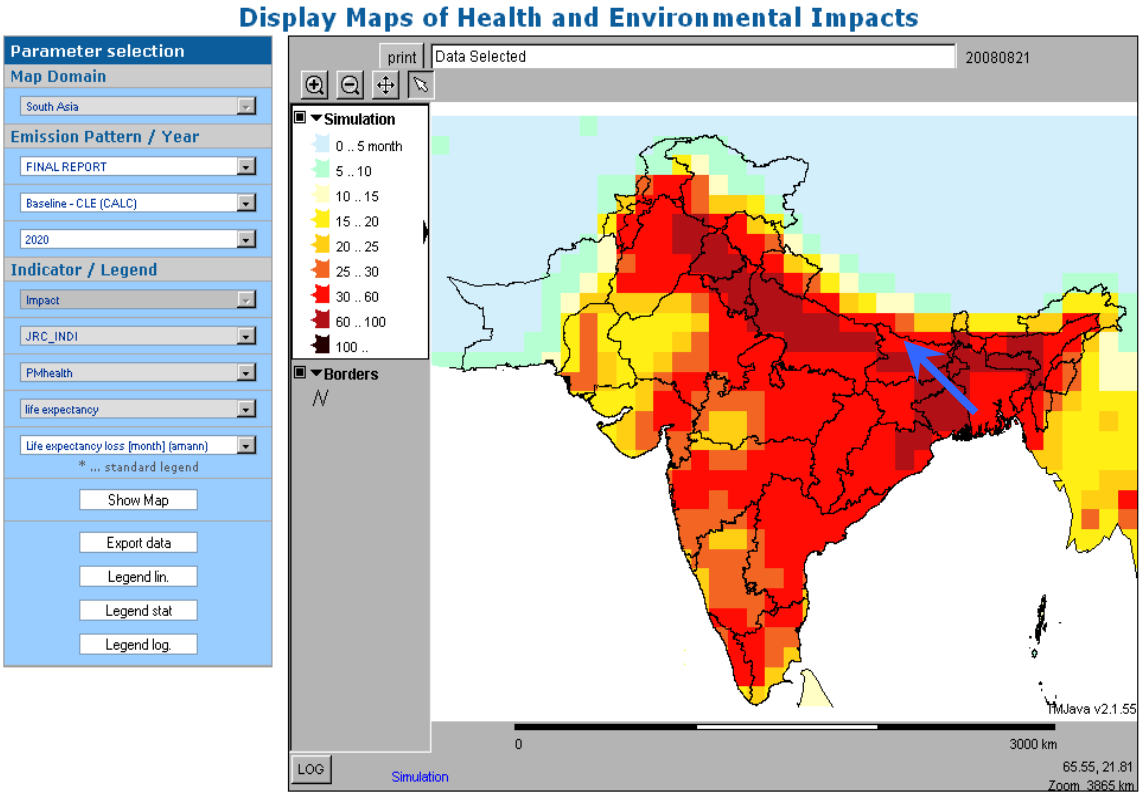
- health impacts attributable to PM2.5 (in terms of reduced life expectancy),
- health impacts from ground-level ozone (in terms of cases of premature deaths),
- excess of critical loads for acidification and eutrophication for forests, semi-natural ecosystems, and catchment areas for freshwater ecosystems.

Suppose we would like to display the losses of statistical life expectancy from exposure to anthropogenic PM2.5 in 2020 following from the "Baseline - CLE" scenario (which is the group of emission patterns in this case).

1. Chose the option **Impacts** from the horizontal panel on the top of the screen and click the option "Health and Environmental Impacts" in the menu-box at the left side of the screen.
2. Notice the **Parameter Selection** window that appeared on the right side of the screen. Choose the map domain Europe and click: "Show map".
3. A blank map will appear on your screen, as seen in the figure below with the Parameter Selection window on the left side:



4. At the "Emission Pattern" options, choose from the scroll-down box "FINAL REPORT", then the "Baseline – CLE (CALC)" emission pattern and finally the year 2020. In the Indicators/Legend section, choose "**PM health**" for the option "**life expectancy loss (month)**" from the menu-box. Now click "Show Map" and notice the new map on the screen:



5. To generate a new query, just change the setting in the scroll-down boxes and click "Show Map".

6. The map you just generated display the losses of statistical life expectancy measured in months from exposure to anthropogenic PM2.5 in 2020. The simulation map tell you that e.g. in the city of Calcutta (location indicated by the blue arrow on the image) there is a life expectancy loss of 60 to 100 months expected by 2020 based on the GAINS Baseline – CLE scenario.

By now you should be able to derive tables from GAINS online. Should you be interested in further details on how the integrated assessment tool works and what are the elements of the model please got to the more detailed version of the GAINS User's Guide.