

Changes of [Invert 3.7.16](#) compared to the previous version [3.6.15](#) of [Invert](#):

- New output tables according ‘Solar thermal DHW’ systems. If you select ‘Create comprehensive Portfolio for Heating, DHW, and Cooling’ at the simulation window a detailed solar thermal report will be shown in the portfolio representation in folder DHW\Details.
- Increased precision of the DHW solar thermal algorithm. This change results in slightly different solar thermal results compared to previous versions.
- Removed function ‘Step Backward’. At the ‘simulation’ window where you can set all the simulation parameters was a button called ‘Step Backward’. This button was a relict from very early [Invert](#) versions and did not work properly. This button is removed in the new [Invert 3.7.16](#) version.

Changes of [Invert 3.6.15](#) compared to the previous version [3.5.14](#) of [Invert](#):

- Enhanced ‘Bonus Model’. Starting with [Invert+](#) 3.6.15 the tool allows to specify guaranteed bonus payments for a certain time. The number of years for the guaranteed payments can be specified in promotion scheme window ‘Bonus System’. The ‘Bonus Model’ is only available in [Invert+](#). To apply for such an [Invert+](#) license please contact invert.licence@eeg.tuwien.ac.at.

Changes of [Invert 3.5.14](#) compared to the previous version [3.5.13](#) of [Invert](#):

- Internal system update and improved country / regional specific program stability.

Changes of [Invert 3.5.13](#) compared to the previous version [3.4.12](#) of [Invert](#):

- Modified ‘Bonus Model’ which also considers the costs for solar thermal DHW systems (see also ‘Total Amount [k€year]’ in the portfolio table ‘Buildings’ in folder ‘Bonus System’). The final energy demand for solar thermal system energy carriers in the portfolio table ‘Energy Carriers DHW’ is per definition always zero. Solar thermal is distinguished from other DHW technologies in the definition of the ‘Final Energy Demand’. The ‘Final Energy Demand’ has to be always zero. The reason is the energy carrier ‘sun’. A calculation of final energy demand for ‘sun’ would result in misunderstandings of the results in the portfolio sheet. Therefore, we defined the ‘Final Energy Demand’ for ‘Solar Thermal’ with zero. However, for the ‘Bonus Model’ we have to assign a final energy demand to be able to represent the bonus costs for the DHW solar thermal systems. Therefore, we defined – only for the ‘Bonus Model’ - the change in final energy demand for the underlying primary DHW system before installation and after installation of solar thermal as final solar thermal energy demand. However, in table ‘Energy Carriers DHW’ the final energy demand for solar thermal systems is still zero. The ‘Bonus Model’ is only available in [Invert+](#).
- Removed minor error in the portfolio window. Till [Invert 3.4.12](#) numbers less than 1 were displayed in the English format style instead of the selected regional settings of the operating system. This means the comma was represented by a ‘.’ and the thousand point was represented by a ‘,’ This mistake is removed by [Invert 3.5.13](#).

Changes of [Invert 3.4.12](#) compared to the previous version [3.2.10](#) of [Invert](#):

- Additional feature ‘Value Modification’ for the ‘Bonus System’ in the building sector. Starting with [Invert+](#) 3.4.12 you can specify different bonus values depending on the reached biomass level in a certain year. Please note, if the used energy carrier is not a defined biomass energy carrier with a given potential in table ‘Biomass Potentials’ no modification takes place. In such a case the tool always uses the basic value. In other

words the tool assumes a reached potential of 0. Permitted numbers for the ‘Value modification’ have to be less or equal than 0% and greater or equal than -100%.

- New feature ‘Adjust Data Corruption’. Database files can be corrupted because of data modification problems (e.g. system crash during saving operations). These problems can result in duplicate table entries. For example: Table ‘Service Factors for Heating Systems’ can contain the same ‘Building category’ twice because of such data corruption. As long as you enter the same service factor for the two entries no problem occurs, but if you enter two different values it is not clear which service factor is used. This problem can result in confusing situations. This problem can be fixed with the new feature. However, it is recommended to save your database file with a different name as a backup file; Your actual opened file will be changed in course of this process.
- Removed minor error in the DHW demand calculation. In Version 3.2.10 (and lower) little DHW demand numbers (‘Final DHW Demand [GWhfinal/yr.]’) are neglected. This mistake results to some zero values instead of little numbers for technologies with weak demand in column ‘Final DHW Demand [GWhfinal/yr.]’. This problem is removed by version 3.4.12. The correction of this error might result in slightly different DHW results.
- Removed error in table ‘Biomass prices for the building sector’. Till *Invert+* 3.2.10 the values in column ‘Exogenously given price with Bonus System [€/MWhprim]’ were wrong. This problem does not affect the results and affects only *Invert+* versions; it was solely a display problem. This problem is removed by *Invert* 3.4.12.

Changes of *Invert* 3.2.10 compared to the previous version 3.1.8 of *Invert*:

- New Promotion Scheme ‘Bonus System’ for the building sector. Starting with *Invert+* 3.2.10 the simulation allows to consider money transfers between ‘Bonus receiver’ and ‘Bonus Payer’ energy carriers. *Invert+* allows to define any energy carrier in the building part as receiver of subsidies. The subsidies are paid by the ‘Bonus Payer’ energy carriers. To define ‘Bonus Payers’ and ‘Bonus Receivers’ please open table ‘Bonus Category’ in folder ‘Building\General Definitions’. The amount of bonus received can be specified in the promotion scheme window ‘Bonus System’ in the folder ‘Promotion Schemes\Building’. Depending on the energy demand in year n and the specified bonus the total costs for promoting the ‘Bonus Receivers’ are calculated and have to be paid by the ‘Bonus Payer’ technologies in year n+1. Two different cost distribution options exist.
 - Volume weighted and
 - CO₂ emissions weighted.

You can select between these two options at the ‘Simulation’ window before you start a simulation.

Volume weighted:

$$Costs_{y,n} = \frac{Volume_{y,n}}{\sum_y Volume_{y,n}} \times \sum_x Costs_{x,n}$$

$$\Delta Price_{y,n+1} \approx Costs_{y,n} \times \frac{1}{Volume_{y,n}}$$

x... ‘Bonus Receiver’ Index

y... ‘Bonus Payer’ Index

n... Index year

The costs [€] are distributed according the volume distribution of the ‘Bonus Payer’ energy carriers in year n. This means the specific changes in costs [€/MWh] are equal for each ‘Bonus Payer’. The price changes for year n are used as estimates for year n+1.

CO₂ weighted:

$$Costs_{y,n} = \frac{Volume_{y,n} \times EmissionsCO_{2,y,n}}{\sum_y (Volume_{y,n} \times EmissionsCO_{2,y,n})} \times \sum_x Costs_{x,n}$$

$$\Delta Price_{y,n+1} \approx Costs_{y,n} \times \frac{1}{Volume_{y,n}}$$

x... ‘Bonus Receiver’ Index

y... ‘Bonus Payer’ Index

n... Index year

The costs [€] are distributed according the CO₂ emissions of each ‘Bonus Payer’ in year n and this results in different price changes [€/MWh] for each ‘Bonus Payer’ according the CO₂ emissions. Energy Carriers with less CO₂ emissions pay less. The price changes for year n are used as estimates for year n+1.

Please note the linkage between the ‘Relative Supply Curve’ (introduced in version 3.1.8) and biomass ‘Bonus Receivers’. The ‘Relative Supply Curve’ increases the biomass price and the bonus system decreases the biomass price for biomass ‘Bonus Receivers’. Therefore, **Invert+** provides you with the possibility to turn of the bonus system for biomass ‘Bonus Receivers’ when a certain level of biomass demand is reached. You can specify the ‘Biomass frontier’ at the ‘Simulation’ window at frame ‘Bonus System’.

Please note if frame ‘Bonus System’ is disabled you do not possess an **Invert+** version or no ‘Bonus Receiver’ and/or ‘Bonus Payer’ is defined in table ‘Bonus Category’.

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- Removed problem in the ‘Biomass Restriction’ (‘Relative Supply Curve’) section. Till **Invert+** 3.1.8 there was a problem with the endogenously calculated biomass price when you changed any ‘Promotion Scheme’ during a simulation run. E.g. let us assume a simulation period till 2020 and changed promotion schemes in 2010. In such a case the endogenously calculated biomass price jumped in 2010 exactly to the original entered price (in table ‘Price Series Energy Carriers’, ‘Fuel Price Times Series for Renewables without CHP’, and ‘Fuel Price Times Series for Renewables with CHP’). After 2010 the endogenously calculated prices return to the correct values. If you simulate all years (e.g. till 2020) without any change in the promotion schemes settings the problem does not occur. This problem impacts only **Invert+** versions and is removed by **Invert** 3.2.10.
- Updated Help file.
- Internal system updates and additional error routines.

Changes of **Invert 3.1.8 compared to the previous version 3.0.5 of **Invert**:**

- Biomass restrictions. Starting with **Invert+** 3.1.8 the simulation also considers the *impact* of biomass supply restrictions. In contrast to fossil based energy carriers the biomass price will be influenced by the *regional* available biomass. The new table ‘Relative Supply Curve’ in folder ‘Biomass Potential’ (sub-folder ‘Data’) contains additional information according the price change - depending on the regional calculated biomass needs. For more information please refer to the manual or the window ‘I have additional

information for you' at the 'Price Elasticity' table. To apply for an **Invert+** license please contact invert.licence@eeg.tuwien.ac.at.

- Improved 'Automatic File Conversion' (CTRL +J) to be able to import older **Invert** files.
- Removed error in the 'New project template' file. If you create a new **Invert** 3.0.3/3.0.4 or 3.0.5 project and change the simulation years in 'Table Simulation Years' an error occurs. This error is removed by **Invert** 3.1.8.
- The maximum allowed number of rows in **Invert** database tables was increased from 500 to 512.
- If you define a 'Heat pump' technology in table 'Heating Systems' or 'Domestic Hot Water technologies' you always have to use the name 'Heat pump', 'Heat pumps', 'Heatpump' or 'Heatpumps'. Starting with **Invert** 3.1.8 you can also use the German word 'Wärmepumpe'.
- Removed problem for table updates. If you change - in older versions of **Invert** - the name of a heating technology ('Heating Systems'), a DHW technology (table 'Domestic Hot Water technologies') or a cooling technology (table 'Cooling Systems') the entry in table 'Promotion Schemes for Buildings' does not change. This circumstance results in a loss in promotion scheme settings in table 'Promotion Schemes for Buildings'. Please check your promotion schemes settings to make sure that you have not lost data in table 'Promotion Schemes for Buildings'. If you recognize a problem with the promotion scheme settings in table 'Promotion Schemes for Buildings' please send the database file (*.idf) to invert.licence@eeg.tuwien.ac.at, we will fix it manually for you; there is no automatic way to solve this problem, even if you upgrade to the newest version of **Invert**. If there is already a problem in the database file, **Invert** 3.1.8 can not remove it. If you upgrade to **Invert** 3.1.8 and if you use a new database file (generated with 3.1.8) or an old imported database file without any problem the error does not occur. For more information please feel free to contact stadler@eeg.tuwien.ac.at.
- Enhanced precision of the DSM simulation algorithm. This change might result in different DSM results compared to runs performed with older versions of **Invert**.
- Version 3.1.8 uses an enhanced 'new building' calculation module. This modification results in slightly different outcomes compared to runs performed with older versions. However, this change impacts only **Invert+** versions.
- Removed minor input problem in table 'Simulation Years'. In older versions it was possible to enter non integer values for simulation years. This error is removed by **Invert** 3.1.8.
- Improved DHW simulation algorithm which increases the accuracy. This modification results in different outcomes compared to runs performed with older **Invert+** versions. However, this change impacts only **Invert+** versions.
- Internal system updates

Changes of **Invert 3.0.5 compared to the previous version 3.0.4 of **Invert**:**

- Removed input problem in table 'Heating system data' and 'Cooling system data'. Previous versions of **Invert** deliver a wrong error message and disable the 'Apply' button despite a valid input data set. This mistake is removed by **Invert** 3.0.5.

Changes of **Invert 3.0.4 compared to the previous version 3.0.3 of **Invert**:**

- Additional internal system feature.

Changes of *Invert* 3.0.3 compared to the previous version 2.0.6 of *Invert*:

- From now on *Invert* is available with two different licence types. The regular *Invert* will be further developed in terms of error removals and improved user interfaces. In contrast to this version *Invert+* contains additional features (e.g. consideration of the ‘Demolition rate’ in the building simulation). The regular *Invert* allows to see all new additional features (e.g. tables), but does not consider the according input data from the *Invert+* tables in simulation runs. For example: You are able to enter data for the demolition rate in table ‘Building classes’, but without an *Invert+* licence you will get following message ‘Warning: You have to apply for an *Invert+* licence to consider the demolition rate in simulation runs.’ at the bottom of the program. To apply for such an *Invert+* licence please contact invert.licence@eeg.tuwien.ac.at.
- *Invert+* free trial function. To learn the new features of *Invert+* you are allowed to start *Invert* as *Invert+* version up to 25 times. Click on ‘*Invert+* Free Trial’ in the ‘Simulation’ menu and a window will show up giving you information about the remaining numbers of *Invert+* free trials. Click on ‘Switch to *Invert+*’ and *Invert* switches to the Plus modus. If ‘Switch to *Invert+*’ is disabled all free trials have been used and you have to apply for a regular *Invert+* licence. To apply for such an *Invert+* license please contact invert.licence@eeg.tuwien.ac.at.
- *Invert+* 3.0.3. is able to consider the demolition rate of buildings. In table ‘Building classes’ the column ‘Demolition rate per year’ now affects the building simulation in case that you have an *Invert+* licence. To get an *Invert+* license contact invert.licence@eeg.tuwien.ac.at. However, the demolition rate affects only the ‘original’ entered data set in table ‘Building classes’. This means *Invert* calculates internally new building classes as a result of the DSM simulation (these data are hidden). Anyway, all buildings with new insulation or windows due to a DSM simulation get a demolition rate of zero assigned. Therefore, for renewed buildings the demolition rate does not apply.
- *Invert* 3.0.3. contains two new additional result tables in ‘\Building Sector\Building Stock based on...’. These tables deliver the change due to the demolition rate / new buildings for each building class and building category. For more information please refer to the manual of *Invert*.
- *Invert* 3.0.3. contains improved data input handling for ‘Building Types DHW’. If you open ‘Building Types DHW’ you will also get an additional information window with guidelines for the DHW data input according combined hot water/heating as well as stand alone DHW/single stove systems. For more information according the linkage between heating systems and hot water production please refer to the manual of *Invert* (‘Linkage between heating systems and hot water production’ and ‘DHW Simulation Algorithm’).
- Removed minor import problem for the ‘Automatic File Conversion’ (CTRL +J). In some cases the ‘Automatic File Conversion’ function did not save the new converted file. This problem is removed by version 3.0.3.
- Removed minor view problem in table ‘Bio Fuel Generation Data’. Till *Invert* 3.0.3 it was not possible to show sub-tables for the different defined ‘Bio Fuel Technologies’. This problem is removed by *Invert* 3.0.3.
- Removed error in window ‘I have additional information for you’. *Invert* provides additional information for data input according table ‘Heating System Data’, ‘Domestic Hot Water Data’, and ‘Cooling System Data’. If you click on the red ‘Click me’ button *Invert* shows you the interpolation curve for heating, domestic hot water, and cooling systems for the efficiency, investment, and OM costs. Till *Invert* 3.0.3 the shown interpolation curve for the OM costs was wrong. This mistake is fixed by version 3.0.3.

- Additional zoom feature in the window 'I have additional information for you' for table 'Heating System Data', 'Domestic Hot Water Data', and 'Cooling System Data' (after clicking the red 'Click me' button). You are able to zoom the interpolation curve up to four times.
- Improved error handling for errors caused by missing input data in table 'Building Classes', 'New Building Data', 'Heating System Data', and 'Cooling System Data'.

Changes of [Invert 2.0.6](#) compared to the previous version [2.0.5](#) of [Invert](#):

- Enhanced Live Update feature. Now [Invert](#) contains an automatic Live Update function which remembers you to update the program.
- Removed minor problem in the CO₂ emission calculation for district heating in the building sector for the first simulation year. This problem affects only the first simulation year. [Invert 2.0.6](#) removes this problem.

Changes of [Invert 2.0.5](#) compared to the previous version [2.0.4](#) of [Invert](#):

- Updated Manual.

Changes of [Invert 2.0.4](#) compared to the previous version [2.0.3](#) of [Invert](#):

- Removed comma view problem at the 'Show Simulation Parameters' window. This comma view problem results to wrong shown numbers till version 2.0.3. However, this problem does not affect the calculations and results. This problem is removed by [Invert 2.0.4](#).

Changes of [Invert 2.0.3](#) compared to the previous version [2.0.2](#) of [Invert](#):

- Additional internal system feature.

Changes of [Invert 2.0.2](#) compared to the previous version [2.0.1](#) of [Invert](#):

- Removed error in the 'Multiple Simulation Run' modus. In case that you are using 'Multiple Simulation Runs' with different 'Reference Files' the 'Reference File Based Results' might be wrong. Till version 2.0.1 [Invert](#) used always the last specified 'Reference File' in the 'Multiple Simulation Runs' instead of the according 'Reference File'. This problem is removed in version 2.0.2. Now it is possible to specify different 'Reference Files'.
- Removed view error for the entire 'Cumulated Promotion Scheme Efficiency (CPSE) for 'Building' in the table 'Reference File Based Results\Overview'. In case that 'Heating', 'DHW', 'Cooling' or 'DSM' is simulated simultaneously with 'RES-E' the shown value for the 'Cumulated Promotion Scheme Efficiency (CPSE) for Building' is wrong. The values shown for 'Heating', 'Cooling', 'DHW', 'DSM', 'RES-E', 'RES-CHP' and 'Transport' are correct. In case that you use the results for Building you have to simulate the according files (also reference file) again to obtain the right values. This problem is removed by [Invert 2.0.2](#).
- Removed problem with the 'Lifetime Promotion Scheme Efficiency' (LPSE) in combination with 'Soft Loans' for DSM. This problem is removed by [Invert 2.0.2](#).
- Additional internal system feature.

Changes of [Invert 2.0.1](#) compared to the previous version [2.0.0](#) of [Invert](#):

- Internal program update

Changes of [Invert 2.0.0](#) compared to the previous version [1.9.12](#) of [Invert](#):

- Additional feature ‘Multiple Simulation Runs’. The ‘Multiple Simulation’ gives you the possibility to run simulations of different (up to 20) database files (*.idf) fully automatically. For further information please take a look to the manual (use the search function at the help window and search for ‘Multiple Simulation’).
- Additional feature ‘Evaluation Function’. The calculation of the ‘Promotion Scheme Efficiency’ in the ‘Portfolio’ neglects the gain in CO₂ reductions obtained after the simulation period. E.g. let us assume a simulation period till 2020. In case of investment subsidies and use of a new measure in 2019 the entire costs get considered, but the CO₂ reductions get considered only for two years (2019 and 2020). This circumstance results in an underestimation of the ‘Promotion Scheme Efficiency’. Due to this circumstance an estimation function for the real ‘Promotion Scheme Efficiency’ is provided (Lifetime Promotion Scheme Efficiency). For further information please take a look to the manual (use the search function at the help window and search for ‘Lifetime Promotion Scheme’).

Changes of [Invert 1.9.12](#) compared to the previous version 1.8.11 of [Invert](#):

- Increased performance of the RES-E/RES-CHP simulation. Furthermore, the precision of the RES-E/RES-CHP simulation was increased. This improvement might change the RES-E/RES-CHP results compared to simulation runs performed with old versions.

Changes of [Invert 1.8.11](#) compared to the previous version 1.8.10 of [Invert](#):

- Removed minor stability problem for the RES-E/RES-CHP simulation caused by the [Invert 1.8.10](#) update. This problem results in a simulation error with following message: ‘**Error: Simulation error reason: Subscript out of range**’. [Invert 1.8.11](#) removes this problem.

Changes of [Invert 1.8.10](#) compared to the previous version 1.7.9 of [Invert](#):

- Till [Invert 1.7.9](#), there was minor problem in the RES-E and RES-CHP simulation. If you change the promotion scheme strategy during a simulation the ‘Transfer Costs’ might be wrong. However, this problem was never observed in simulation runs. [Invert 1.8.10](#) removes this error.
- A removed minor graph view problem in the ‘Graph Wizard’.
- Additional internal system features.

Changes of [Invert 1.7.9](#) compared to the previous version 1.6.8 of [Invert](#):

- Removed error for the building sector and insulation with a subsidy in ‘€/m²’ living area. If you select an investment subsidy in ‘€/m²’ living area for the insulation and if you simulate more than one building part (wall, ceiling, floor) the results for insulation are wrong. This mistake occurs only if you use ‘€/m²’ and not in case of using ‘%’! This problem is removed in [Invert 1.7.9](#).
- Additional feature to change the font size for ‘Title’, ‘Axis’, ‘Data Points’, and ‘Legend’ at the ‘Graph Wizard’ window.
- Additional feature ‘Subsidy values depend on the U-value of building’ at the ‘Promotion Schemes for buildings’ window.
- Additional feature ‘Automatic File Conversion’ to import automatically files from [Invert 1.6.8](#) to [Invert 1.7.9](#).
- Increased performance of [Invert](#) during promotion scheme input.
- Improved language/regional support according the database.

Changes of *Invert* 1.6.8 compared to the previous version 1.6.7 of *Invert*:

- No additional features
- Removed problem for Solar thermal: In some cases it can happen that the ‘Reduction in CO₂ emissions due to additional Solar Thermal systems’ and ‘Entire DHW CO₂ Emissions’ are wrong displayed in the ‘Portfolio for DHW’ by the program. You can indicate this problem by checking these columns for each year in the portfolio file. If the sum of these two columns do not match the displayed ‘Overview/Summary’ values the mentioned problem occurred. However, in this case also the ‘Reference Scenario’ results are wrong. This problem is removed by *Invert* 1.6.8.

Changes of *Invert* 1.6.7 compared to the previous version 1.5.6 of *Invert*:

- Additional ‘Simulation Settings’ Information in ‘Show Simulation Parameters’. If you start a simulation *Invert* saves also ‘Simulation Settings’ (e.g. start year, end, year of simulation, simulated sectors, simulates sub-sectors, used soft barriers,...). This feature gives you the possibility to compare the performed runs in an easier way. Note: the according information will be shown only after the first simulated year! Furthermore, the gathering of information and formatting of the ‘Show Simulation Parameters’ window takes less time than in previous versions.
- Additional feature ‘*%?Show all items?%*’ at the ‘Graph Wizard’. If you click on ‘*%?Show all items?%*’ *Invert* adds all items from the selected list box to the graph view. However, if the number of items exceeds ten you will get a message and the adding will be stopped. More than ten items can not be clearly arranged.
- Additional feature ‘Stakeholder Payback Time’ for the building sector (Heating, Cooling, DHW, Insulation, and Windows). *Invert* 1.6.7 gives you the possibility to use individual stakeholder payback times instead of the ‘standard technology specific’ payback times specified at the according technologies (E.g. Heating systems, Cooling systems, Insulation,..). If you click on ‘Use stakeholder payback time’ at the ‘Simulation Options’ window *Invert* uses the ‘Stakeholder payback time’ instead the ‘standard’ payback time (See also help file of *Invert* 1.6.7).
- Additional feature to choose between ‘% of the investment costs’ and ‘€m²’ for the ‘Investment Subsidy Insulation’ in the promotion scheme window for buildings.
- Improved error control system according to the ‘Interpolation algorithm’ for ‘Operation and Maintenance (OM)’ costs. See also to the ‘I have additional information for you’ window and ‘Click me’ when you open the table ‘Heating system data’, ‘Domestic Hot Water Data’, or ‘Cooling System Data’.
- The data according to the ‘Soft barriers’ were shifted into the ‘Stakeholders’ folder.
- Updated Help File
- Increased stability
- Increased compatibility

Changes of *Invert* 1.5.6 compared to the previous version 1.4.5 of *Invert*:

- Removed sort problem for cells containing Boolean items.
- Till *Invert* 1.4.5 it was not possible to show the selected data in the ‘Graph Wizard’ as table to be able to export the data to Excel. Click on ‘Switch to Grid View’ and the table containing all data shown in the graph will appear. However, first you have to create a graph and then you can switch to the ‘Grid View’. In the ‘Grid View’ you can not change

the selected data. You have to switch back to the 'Graph View' to be able to change the selection of data.

Click on 'Copy Sheet to Clipboard' to copy the entire sheet from the 'Grid View' to the clipboard for copy/paste reasons. This 'Grid View' is very important if you want to create cumulated results. For example: If the predefined output of *Invert* does not satisfy your needs you can create a table and copy this table to Excel where you can create for example a cumulated CO₂ reduction curve.

- Improved error control system for the supply data sheets (Heating system data, Cooling system data, and Domestic Hot Water data) to avoid invalid input according to the interpolation process. At the 'I have additional information for you' window at the right side a red button is located which is very important for you. If you click this red button a window appears in which you can show the 'Interpolation curve' for each technology. Furthermore, you can validate the data with a help tool located in this window. This is very important to give you an overview about the defined data sets in the database to avoid interpolation troubles during the simulation.
- Refined interpolation process for the DHW, Heating and Cooling part. This refined interpolation process leads to different results compared to elder versions of *Invert* in cases of big deviations in the efficiencies of 'old' and 'new' systems.

Changes of *Invert* 1.4.5 compared to the previous version 1.3.4 of *Invert*:

- Till *Invert* 1.3.4 the program allowed only lifetime values up to 50 years. However, in case that you want to simulate only DS measures you have to enter very high numbers for the lifetime for all supply systems in table 'Heating system data' or 'Cooling system data'. This means that the average exchange rate of heating or cooling systems is 1/lifetime of the according supply system. In other words if you use 1000yrs for the lifetime only 0.001 buildings per year get a new supply system. If you enter very high lifetime values you get roughly a situation where 'no' supply system gets replaced by a new one, only the DS-measures are considered. *Invert* 1.4.5 allows lifetime values up to 10⁹. To eliminate the influence of supply systems in big regions it is suggested to use lifetime values higher than 10⁶.
- Additional feature 'Format Simulation Information' in frame 'Simulation Information' (colors): *Invert* provides the possibility to format the information given in the frame 'Simulation Information' at the bottom of the main window (Errors: red, Information: blue,...). However, in cases of old PCs this might take a while. Therefore, *Invert* 1.4.5 gives you the possibility to disable this feature. See also 'Format simulation information (colors)' at the 'Simulation Option' window (Click on 'Simulation' and 'Start' to get the 'Simulation Option' window).
- Improved interpolation algorithm with a higher precision. This improved algorithm might result in different results for simulations performed with *Invert* 1.4.5 and higher compared to elder versions of *Invert*.
- In *Invert* 1.3.4 a minor problem with the 'Reference Scenario Analysis' exists: For the 'RES-E', 'RES-CHP', and 'Transport' part the sign of the 'CO₂ Reduction is wrong'. *Invert* 1.4.5 removes this problem.
- Updated help file: Please take a look to chapter 2.3.1 and 5.18.2 of the new help file!

Changes of *Invert* 1.3.4 compared to the previous version 1.2.3 of *Invert*:

- Additional feature 'Show Simulation Parameter Settings': For further information see also help file for *Invert* 1.3.4.

- *Invert* 1.3.4 removes a scrolling problem in the Promotion Schemes for the ‘Building’ and ‘Transport’ sector if the window is very small.
- In *Invert* 1.2.3. it is not possible to print the ‘Readme’ file. *Invert* 1.3.4 removes this restriction.
- Removed problem with linked tables: if you copy into a ‘definition table’ new definitions (e.g. from Excel or with the ‘Import Tool’) and the original number of definitions is higher than you want to copy a problem with the linked tables occurs. In the linked tables you might find some items twice and therefore you are not able to ‘Apply’ the data. This problem is removed in *Invert* 1.3.4.
- Removed problem with ‘Slave’ linked tables. In the case that a ‘Slave’ linked table contains two identical items in a row an update might result in a problem and an error message ‘Unable to identify sheet data...’ might occur. This problem is removed in version *Invert* 1.3.4.
- Removed minor problem with table ‘Biomass Potentials’.
- Updated Help File
- Increased stability

Changes of *Invert* 1.2.3 compared to the previous version 1.1.2 of *Invert*:

- Additional feature ‘Biomass Potential Check’: Now, *Invert* is possible to check the used biomass potential in a certain region and warns you if the available biomass potential is exceeded. For further information see also help file for *Invert* 1.2.3.
- Scenario analysis feature: One of the key ideas for *Invert* was to compare the spent money and achieved CO₂ reduction in a certain region for different measures (scenarios). Now, *Invert* gives you the possibility to perform such comparisons. For further information see also help file for *Invert* 1.2.3.
- Soft barriers (application barriers) in the building sector: The decisions made in the building sector by the consumers are less ‘rational’ and ‘money’ orientated as in the electricity sector. Therefore, *Invert* 1.2.3 provides the possibility to take these ‘irrational soft barriers’ into account and modifies the decision making process. For further information see also help file for *Invert* 1.2.3.
- Additional Promotion Scheme ‘Soft Loans’ in the building sector: *Invert* 1.2.3 provides the possibility to consider ‘Soft Loans’ for the building sector (Heating, Domestic Hot Water, Cooling, and Solar Thermal). For further information see also help file for *Invert* 1.2.3.

Changes of *Invert* 1.1.2 compared to the previous version 1.0.1 of *Invert*:

- New feature Live Update: *Invert* 1.1.2 provides the possibility to update *Invert* with a Live Update tool located in the ‘Additional’ menu of *Invert*. This tool updates your program automatically to the newest version without the necessity to remove the old version and enter a new license key.
- Removed problem with spaces in the input sheets: E.g. ‘test 1’ (there is only one character after the space!) results in an error messages ‘Unexpected Error during updating...’ when hitting ‘Apply’. This problem is removed in *Invert* 1.1.2.

Changes of *Invert* 1.0.1 compared to the previous version 1.0.0 of *Invert*:

- Removed problem of the generic sort function in combination with numbers: Sometimes the generic sort function of *Invert* 1.0.0 does not sort numbers in the right order. This problem is removed in *Invert* 1.0.1.
- Removed problem with building categories and error message *'Unable to calculate average number dwellings, useful energy demand, and DHW load for solar thermal systems in the DHW part.'*: This problem occurs in *Invert* 1.0.0 if you define building categories and do not use all of them in table 'Building classes'. *Invert* 1.0.1 removes this problem and you are able to define more building categories than used in table 'Building classes'.
- Problem with the import tool and linked tables: In *Invert* 1.0.0 the program does not check the first data column and label row of linked tables according to wrong values or strings. In *Invert* 1.0.0 it is possible that you import wrong data for a column or row due to changed database structure. This problem will be fixed by *Invert* 1.0.1.
- Problem of data input in sub-tables (sub-tables: see Figure 1). In *Invert* 1.0.0 it is possible that data which were entered in sub-tables is doubled after hitting 'Apply'. This doubled data sets result to error messages like 'Insert UNIQUE strings in cell...'. This problem will be fixed by *Invert* 1.0.1. Now it is possible to enter data also in sub-tables and not only in the overall table.
- In *Invert* 1.0.0 sometimes (if the manipulation is the first operation after the opening of the table) the 'Cancel' button is not enabled after data 'Manipulation' (addition, subtraction,...). This problem will be fixed by *Invert* 1.0.1.
- Additional warning feature if you open an outdated *.idf file with *Invert* 1.0.1: *Invert* 1.0.0 does not warn you if you open an outdated *.idf file or a newer *.idf file than the program version. This missing feature in *Invert* 1.0.0 might result in misunderstandings. Therefore, *Invert* 1.0.1 will warn you if the program or the *.idf file is outdated.
- Problem with regional settings: *Invert* 1.0.0 does not accept a 'space' as a thousand 'sign' for numbers (e.g. in the Polish regional settings). In *Invert* 1.0.1 this problem is fixed and the program accepts also a 'space' as a thousand sign.

Notes to *Invert*:

- Please note that the 'Import data from other INVERT files' is only enabled if a table is shown **and** the selected table is **not a sub-table** (see Figure 1).

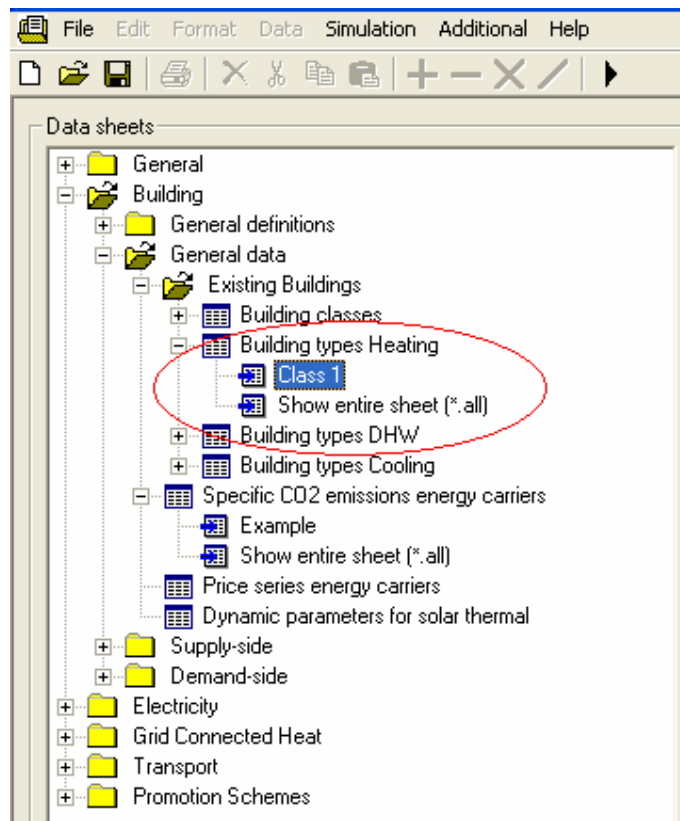


Figure 1: Sub-tables

In case that you have selected a sub-table like in the figure above 'Import data from other INVERT files' is *not* enabled.