

e!Sankey

v5.1

User Manual

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1 Introduction

e!Sankey is a software tool that helps you draw so-called Sankey diagrams.

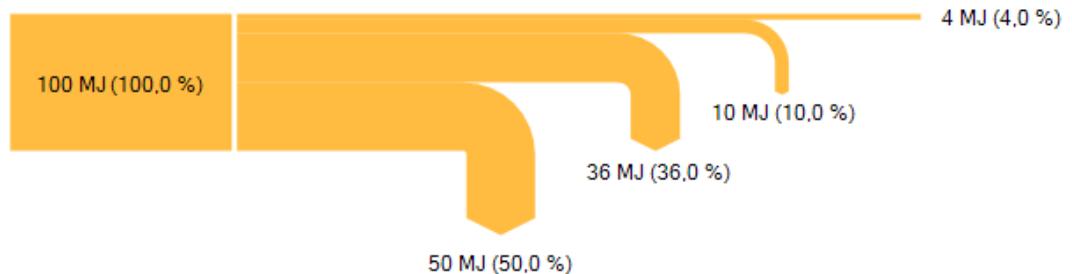


Figure 1: A simple Sankey diagram

Sankey diagrams are directed graphs, where the magnitude of the arrow line represents the quantity of flow. Today, Sankey diagrams are used for a variety of flow visualizations. These are not limited to energy or material, but indeed to any (real or virtual) matter that flows "from" a source "to" a destination.

"Sankey diagrams are a specific type of flow diagram, in which the width of the arrows is shown proportionally to the flow quantity. They are typically used to visualize energy or material transfers between processes." (Wikipedia)

Sankey diagram visualizations draw the viewer's attention to the largest flows, while at the same time showing the proportions of the flows among each other and indicating a "from-to" flow direction. In that sense they convey efficiency of transformation processes and also allow to assess the balance of input/output streams.

Sankey diagrams are named after Captain Matthew Henry Phineas Riall Sankey, an Irish engineer (1853-1925).

The software e!Sankey is a member of the Umberto software¹ family. While e!Sankey simply allows drawing Sankey diagrams, the Umberto software tools are fully-fledged modelling tools where material, energy and cost flows are determined based on process specifications. The Sankey diagrams in Umberto are one of the display options to visualize the calculated flows and environmental impacts.

We hope you enjoy working with e!Sankey!

¹ <http://www.umberto.de>

Further Reading on Sankey Diagrams

Schmidt, Mario (2006) Der Einsatz von Sankey-Diagrammen im Stoffstrommanagement. Beiträge der Hochschule Pforzheim Nr. 124 (in German)

Schmidt, Mario (2008) The Sankey Diagram in Energy and Material Flow Management. Part I: History. *Journal of Industrial Ecology* 12 (1), 82–94

Schmidt, Mario (2008) The Sankey Diagram in Energy and Material Flow Management. Part II: Methodology and Current Applications. *Journal of Industrial Ecology* 12 (2), 173–185

Links

http://en.wikipedia.org/wiki/Sankey_diagram

<http://www.sankey-diagrams.com>

<http://www.e-sankey.com>



A hint or additional advice.



Cross-reference to a related topic within the user manual

2 Installation

Administrator rights are required to install e!Sankey on your computer. Contact your administrator, if you only have limited rights on your machine.

System Requirements

To install and run e!Sankey the following requirements have to be met:

- Operating system Windows 7² SP2, Windows 8.1, or Windows 10
- Microsoft .NET Framework 4.8³
- Memory 1 GB RAM or higher
- Available hard disk space: at least 250 MB
- Monitor with at least 1280 x 1024 px resolution (recommended) and up to 1920 x 1080 px resolution⁴

Running the Installer File

Run the installer file by clicking on the downloaded executable (the file is named 'esankey.exe' or 'esankey5.exe'). You need administrator rights on your local machine for the installation.



The installation will by default be performed in the language of the system locale of the Windows operating system.

If an older version of e!Sankey is found, the installation routine will offer to uninstall the older version prior to continuing the installation of the new version.

It is possible to enter a license key for activation already during the installation. However, if you don't have a license key you can leave the field empty and install e!Sankey as a trial version instead.

By default, the installation directory for the application is "C:\Program Files\ifu Hamburg\e!Sankey 5.0". You may of course opt to choose to install to a different directory by clicking on the 'Change...' button.

One additional folder "e!Sankey" is installed as subfolder of "c:\My Documents". It is used to store the template files (file extension '.santem'), example files (file extension '.sankey') and clipart files.

Trial Version

When starting up e!Sankey a licensing dialog box will be prompted. If you have already purchased a license, you can enter the key to register your version.

If you do not enter license key, you can run e!Sankey as a trial version for 14 days from the date of first launch of the software. On each program start during the trial phase you can select to test the 'basic', 'pro' or 'calc' variant.

² Microsoft has ended support for Windows 7 in 01/2020. There are no more technical or security updates. Microsoft strongly recommends updating to Windows 10.

³ The Microsoft .NET Framework 4.8 must be installed on your computer. If it is not installed, it will be downloaded and installed, before the installation of e!Sankey proceeds.

The trial version almost has the same functionality as the full version, but the following limitations:

- watermark over the Sankey diagram in the editor
- no export in SVG or EMF format

The trial version prompts for a registration key on start-up. Just leave the license key field empty and hit 'OK'.

Users of the trial version can purchase license keys using the online shop at <http://www.e-sankey.com/en/purchase/> or by contacting an e!Sankey sales representative at ifu Hamburg (sales@e-sankey.com).

License Activation



This section refers to the activation of single-user or multi-seat license packages. Floating licenses have to be activated in a different way. We are providing a separate documentation to administrators, helping them to configure and activate the floating license server.

When launching an unregistered copy of e!Sankey a licensing dialog will be displayed. This dialog can also be launched via the 'Help' menu using the entry 'Enter/Edit License...'.

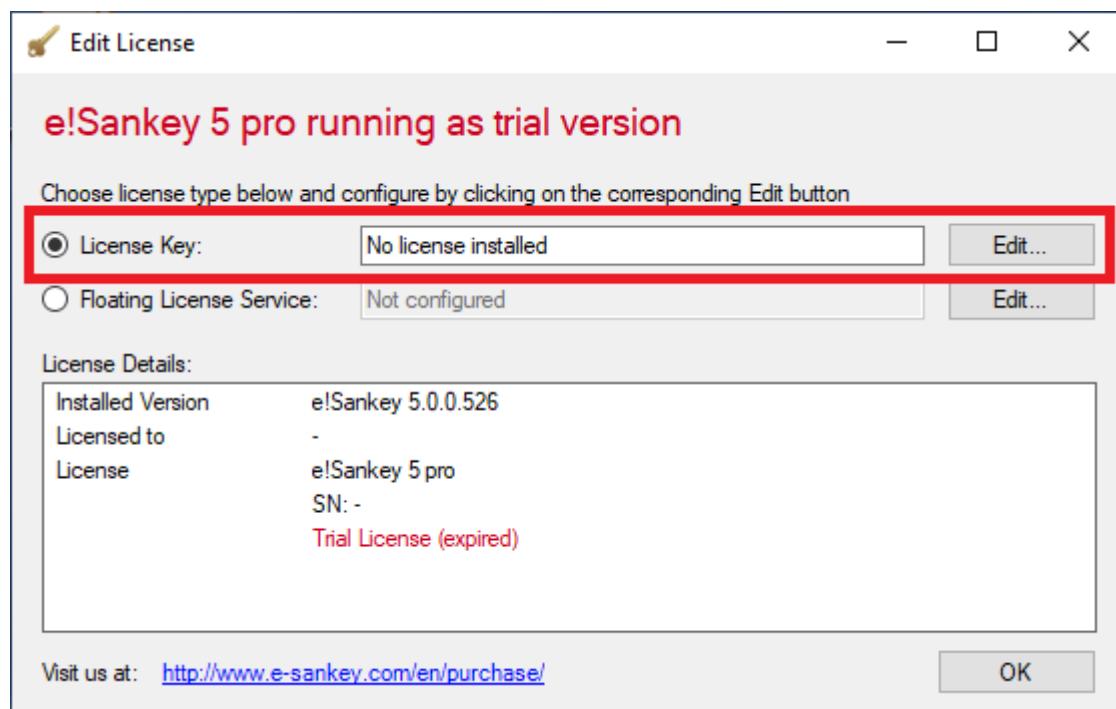


Figure 2: License management dialog, trial version without license key

In the 'Edit License' dialog choose the option 'License Key' in case you have a local license key. Then click on the corresponding 'Edit...' button right of the entry field.

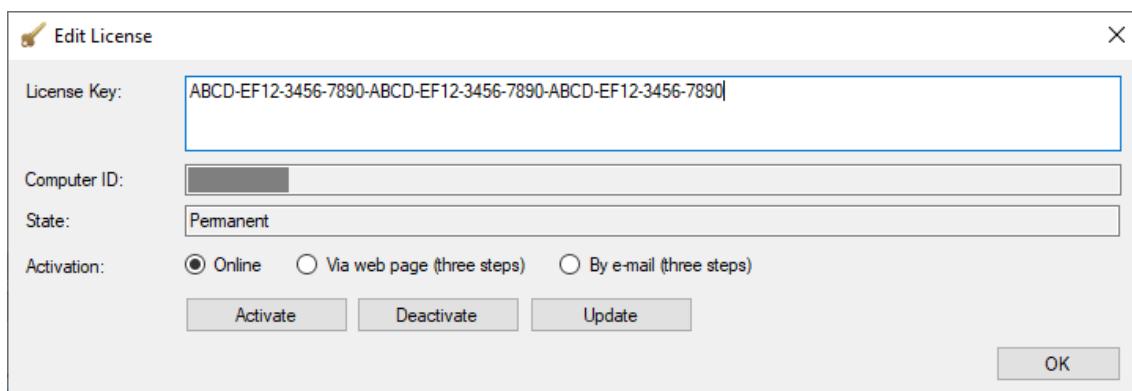


Figure 3: Entering and activating the license key

Enter the license key you have received when purchasing the software and authenticate the license key online by clicking on 'Activate'. An internet connection is required, and the process should take only a few seconds.

There are three options to activate your license:

- **Online:** This is the fastest way to activate a license and should be used if you are connected to the Internet and if the security setting of your network connection allows communication with a server over the Internet. License data will be transferred encrypted to our license management server. The server will send the activated license back to your computer within seconds.
- **Via Web Page:** This is a 3-step process. It can be used if e!Sankey is behind a firewall that prohibits the online activation as described above. You will have to create a license info file ('eSankeyLicenseInfo.lic') using the button "1. Save License Info". This file has to be uploaded to our authentication web page using the link offered. In return you will be provided a processed license info file that you can download to your computer. Finally, this 'AuthenticatedLicense.lic' file has to be imported using the button "3. Import License Info".
- **By E-mail:** This is also a 3-step process, similar to the above: You will create a license info file ('eSankeyLicenseInfo.lic') that you can send to us by e-mail. You will receive an authentication license info file from us in return by e-mail too. This .lic file then has to be imported. Allow up to two work days for manual processing.

Should you have upgraded from e!Sankey basic to e!Sankey pro, or from a temporary license to an indefinite license, or have extended the number of users (multi-seat license) you will be asked upon completion of the extension license purchase to just update your license. In this case your existing license will be updated on our activation server and all you need to do is click on 'Update' in the 'Enter/Edit License' dialog.

License Transfer/Deactivation: In case you have obtained a new computer, or you decide to continue to use e!Sankey on a different computer from the computer where you originally installed it, the license needs to be transferred. To transfer (move) a license of the software to another computer, proceed as follows:

- In the existing e!Sankey installation, run e!Sankey a last time: From the 'Help' menu choose 'Enter/Edit License...' to open the licensing dialog.
- Click on 'Deactivate' in this dialog. The license will be removed.

- On the new computer: Use the installation file and install the latest version of the software (see above). Enter the license key in the license dialog. Click on 'Activate' or use one of the two other options to activate the license

If a deactivation of the license is not possible any more (e.g. because your computer has been stolen, the hard disk has crashed, etc.), please contact support@e-sankey.com to deactivate the license. Should you have lost your license key information, please also contact support@e-sankey.com to retrieve it.

Updates

When new versions of e!Sankey are released, a notification in the bottom right panel on the start page will indicate the availability of an update. Click on the link shown to access a web page where you can download the new version.

You can also use the command 'Check for Updates...' from the Help menu, to find out whether an update is available.

Please note that both, the automatic update notifier, as well as 'Check for Updates...' feature might not work, if you don't have access to the Internet, or if security settings of your firewall prohibit communication with the update server. In this case, please check the community board for announcements regularly, and contact ifu Hamburg GmbH for a new version to be sent.

The update notification service can be deactivated in the Options dialog accessible via the Edit menu.

Support

The help system (Menu Help > Help Topics, or press F1 on the keyboard) is always the first option when you have a question on the software. It describes the functions available, but also contains hints on the use of e!Sankey, and on setting up a Sankey diagram.

For technical support issues the e!Sankey help desk can be reached by e-mail at support@e-sankey.com

In your support request please indicate the exact version number (see About dialog) of e!Sankey you are using, and the operating system of your computer. Please try to be as specific as possible when explaining the technical problem that occurred.

In some cases, our help desk will ask you to submit log files from your computer, which can help us identify the issue. The log files can be found at the following default location (localized operating systems might have different folder names): C:\Users\[USER]\AppData\Roaming\Ifu Hamburg GmbH, Germany\!Sankey\5\log. Quick access to the log file location is available in the Menu Help > About e!Sankey dialog.

The log file is called "general.txt" and should be submitted with your technical support inquiry to our help desk. It can be viewed with a simple text editor.

A community bulletin board is available at <http://forum.e-sankey.com>. It contains useful tips and tricks, and also has a FAQ (frequently asked questions) section. You can browse the posts of other users of e!Sankey and discuss with them.

Uninstalling

To uninstall e!Sankey from your computer, remove the software via the Control Panel > Add/Remove Programs.



Make sure to deactivate the license (see above section 'License Transfer/Deactivation'), so that you can use the key for an installation on another machine.

In the deinstallation wizard on one of the first pages you can opt to deactivate the license.

3 General Functions of e!Sankey

Screen Layout and Windows Handling

The main working area of the e!Sankey application has several panels and areas. In the default layout, they look more or less like this:

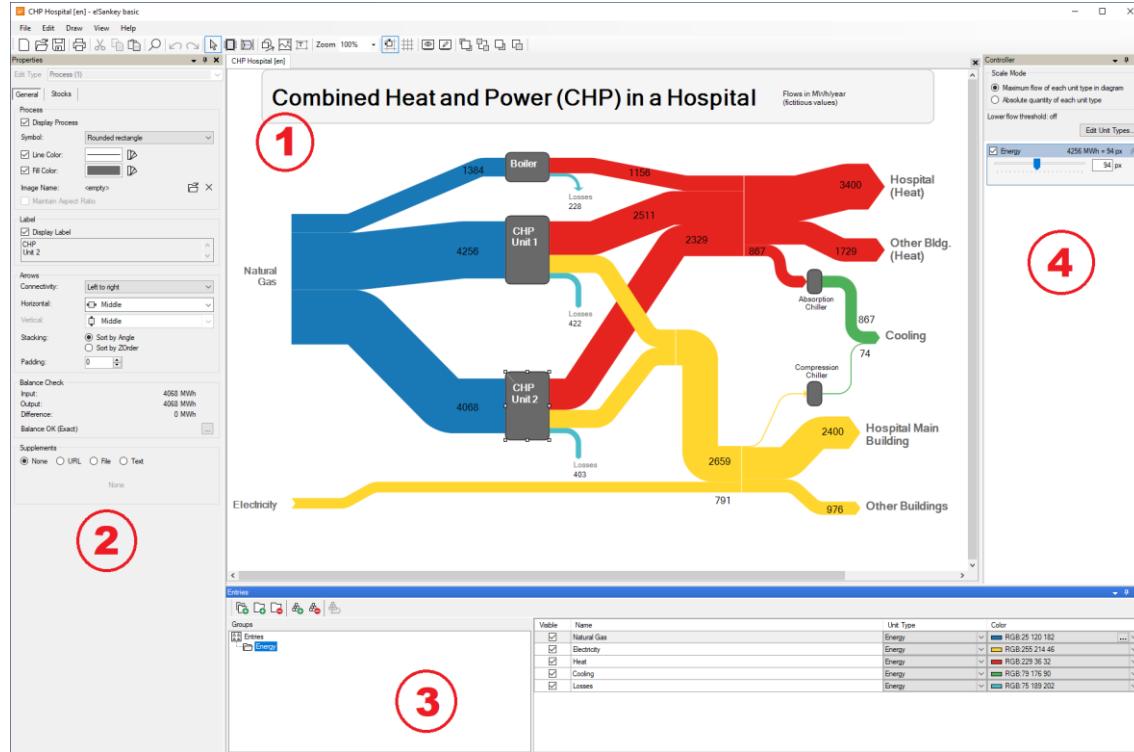


Figure 4: e!Sankey default screen layout, window panes are numbered

The main window panes are:

- **Editor (Drawing Area):** this is where the Sankey diagrams are drawn, several diagrams can be opened at once **(1)**
- **Properties:** allows to edit the properties of the network element marked in the drawing area **(2)**
- **Entries:** list of material, energy, or the like that are used as flows in the arrows of the Sankey diagram **(3)**
- **Controller:** allows to scale the flows in the diagram separately for each unit type **(4)**

The latter three window panes can be hidden and shown using the 'Show' buttons in the toolbar at the top. Window panes can be adapted and arranged, so that the user can customize the screen layout to his/her individual requirements and working style.

Moving Windows: You can move a window pane wherever you want it by clicking the blue title bar and dragging the window where you want it.

Floating Windows: If you drop the window pane at a random location in the program window, it becomes a 'floating' window.

Docking Windows: Docking a window means to attach it to the edge of the program window. This allows you to reposition the various tool windows such as the 'Entries', the 'Properties' or the 'Controller' to dock against different

application edges. To do this, move the floating window pane by clicking in the title bar of the window pane, drag it to the edge where you want to dock it, and drop it onto one of the blue arrows that appears near the edges of the program window. To be able to dock a window, make sure the dockable Windows command is activated in the 'View' menu.



Figure 5: Docking icons (center, dock left, dock top, dock right, dock bottom)

Hide Window Panes: To hide window panes completely, unmark the respective entry in the View menu. To make a hidden pane visible again, set the tick mark in front of the menu entry.

Auto Hiding Windows / Tabbed Windows: In the top-right corner of every window pane, you will see a small button that looks like a pin. If you click this button, the window pane is hidden (or "pinned" to the edge of the program window). However, you can still see the title of the window pane along the edge of the program window. When hovering the mouse over the title, the window pane temporarily displays again until you move the mouse off the window pane. Click the button again to "un-pin" the window pane.

Presentation Mode: If you wish to show the Sankey diagram in full screen without any elements of the application (no windows, no toolbars), switch to the presentation mode by clicking on the button "Presentation Mode" in the toolbar above the editor (or using F12). The diagram will be zoomed to the largest possible size and is not editable. This is ideal for presentations.

To end the presentation mode, use the 'ESC' key, or click on the button in the dropdown toolbar that appears, when you hover the mouse in the middle of the top edge of the screen (12'o clock position on the monitor).

Design Mode: Similar to the above presentation mode, switch to the so-called design mode by clicking on the button "Design Mode" in the toolbar above the editor (or using SHIFT+F12). This will only show the editor area in a maximum size, and all other windows hidden. The menu bar, the toolbar and the context menu remain accessible. This is useful to continue editing the Sankey diagram, but not have other windows reducing the available editor size.

To end the design mode, click again on the 'Design Mode' button in the toolbar.

Reset Panes: To reset the window panes to the default setting (Properties and Overview docked on the left, Entries docked at the bottom, and Controller docked at the right) just select the Reset command from the View menu.

User Interface Language: The user interface language of e!Sankey can be switched to English, German, French, Spanish, Portuguese and Chinese

(Simplified). Access the 'Options' dialog via the 'Edit' menu. On the 'General' tab choose the new language. A restart of the application is required for the change to take effect.

New Sankey Diagram

To create a new Sankey diagram file, click on the button "New Document" in the toolbar. Alternatively select the command "New" from the 'File' menu or use the shortcut 'CTRL+N'. The new diagram file will open with the default diagram template which has some presets regarding unit types, units, entries as well as layout and options of arrows and process symbols.

Another direct access to a new Sankey diagram is from the Start page in e!Sankey. The 'New Diagram' section at the top of the left column lists some of the available templates. The first template in the list (in bold font) is the default template. Click on one of the templates listed in the 'New Diagram' section on the start page.



Read more about templates and how to set a default template in chapter 10

Open Sankey Diagram

To open an existing Sankey diagram file, click on the button "Open Document" in the toolbar. Alternatively select the command "Open..." from the 'File' menu or use the shortcut 'CTRL+O'.

The Sankey diagram files have the file extension '.sankey'. They can be stored on a (local, network, removable) drive on your computer, or in a cloud storage space.

In the 'Open File' dialog in the "Locations" list on the left side you will find local folders previously used, and any cloud storage provider you may have connected in this session.

Currently we support the following cloud storage providers: SharePoint (Microsoft), OneDrive for Business (Microsoft), OneDrive (Microsoft), Dropbox and Google Drive.

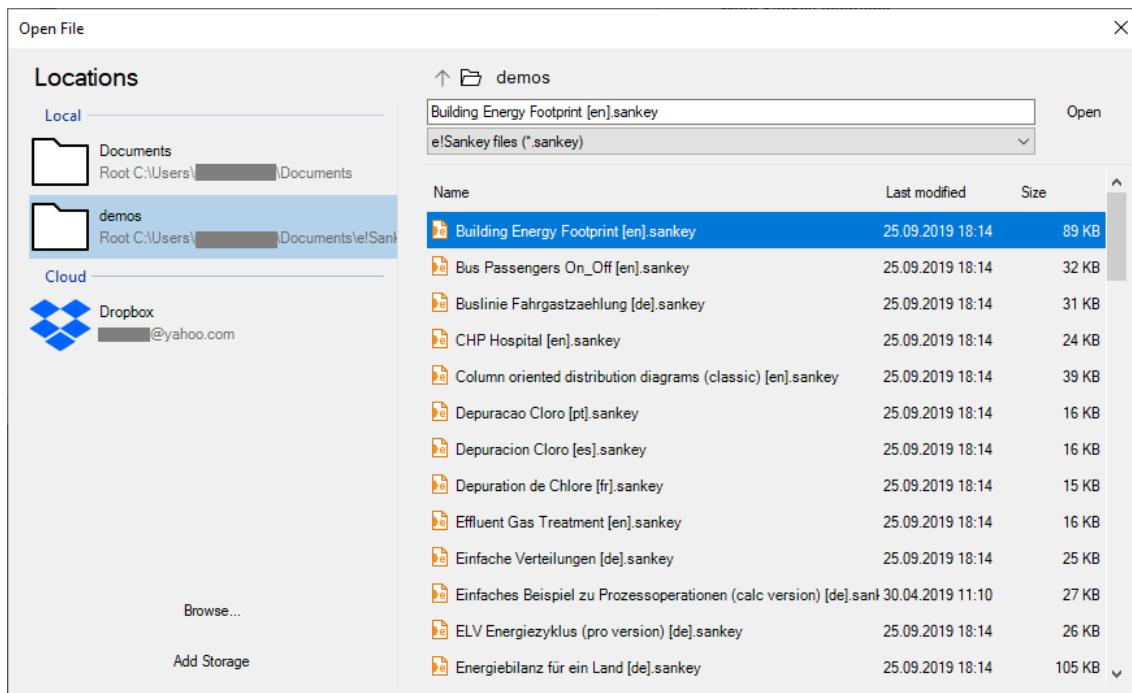


Figure 6: Open File from a local drive or a cloud storage

To add a new local folder or a cloud storage provider, please click on "Add Storage". Adding a cloud storage provider will require that you login and connect to an account you have with one of the providers.

Once you are connected, browse for a .sankey file to open it. The storage location will be shown in the locations list when you use the open dialog the next time. You can disconnect and remove locations from the list using the "Remove" command in the context menu.



For locally stored files you may prefer to use the classic Windows standard dialog for browsing and opening a file directly. Use the button 'Browse...' to open it.

If you do not use cloud storages at all, and wish to work with the "classic" Windows file open dialog, you can remove the check mark for the option "Open and save file with cloud storage support" on the 'General' page of the 'Options' dialog.

Should you wish to open a Sankey diagram file you have previously worked on you can pick it from the list of recently used files. Find this list under "Recent Files" in the 'File' menu, or in the 'Recently Used' section in the left column on the start page.

Save Sankey Diagram

Save a Sankey diagram via the Menu 'File' using the "Save As..." command. In the 'Save As' dialog enter a name for the diagram file. The diagram file will be stored with the file extension '.sankey'.

To save on your local hard disk or a network drive, choose "Browse..." to open the default 'Save As' dialog and browse for the location (folder) where you wish to save the file. Alternatively add a favorite local storage folder by

clicking on button "Add Storage" and selecting a 'Local' drive (e.g. c:\My Documents).

To save the file to a cloud storage, you need to add the cloud storage provider of your choice using the button "Add Storage" and logging in with your credentials.

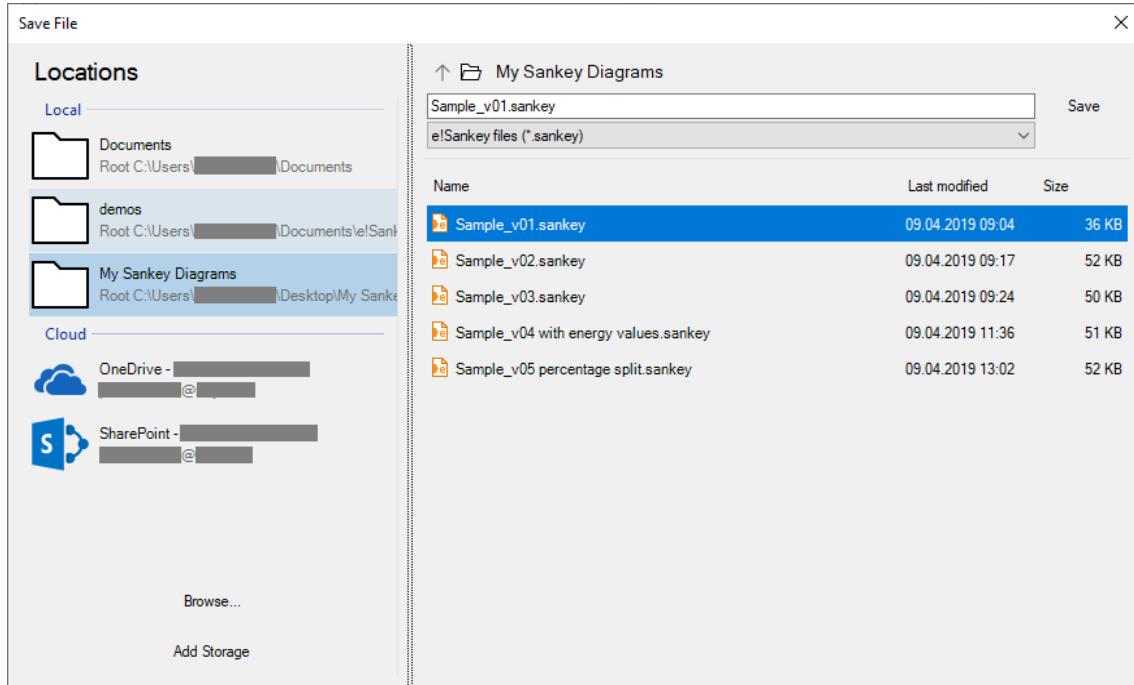


Figure 7: Save to a Local Drive or to a Cloud Storage



If connection to a cloud storage is lost (e.g. because you are offline), the cloud storage spaces are shown in grey. Click on the greyed entries on the left to reconnect.

To actively disconnect from a cloud storage, choose "Remove" from the context menu of the entry in the list of locations on the left side.



Should you not use cloud storages at all, and wish to work with the "classic" Windows file save dialog, you can remove the check mark for the option "Open and save file with cloud storage support" on the 'General' page of the 'Options' dialog.

Search

In larger Sankey diagrams it can be helpful to browse for a specific process (node) or arrow.

Use the button "Search" in the editor toolbar to open a search field in the top right corner of the editor area. Alternatively, the search field can be called using the "Search" command from the 'Edit' menu or with the keyboard shortcut 'CTRL+F'.

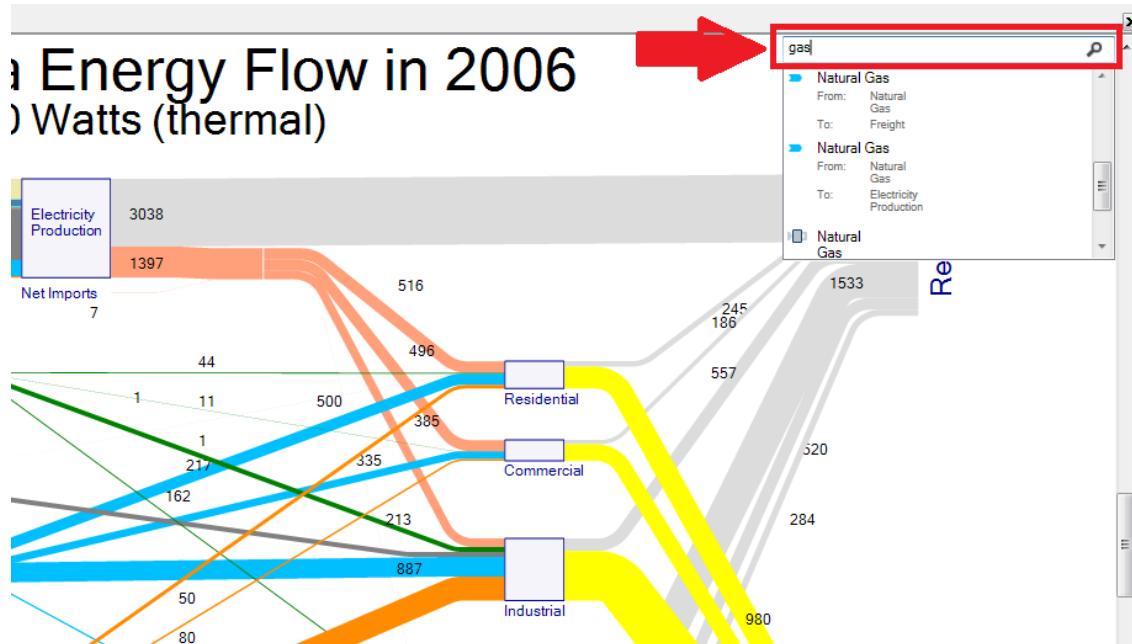


Figure 8: The search feature in the top right corner of the Sankey diagram editor area

In the search field type a text string, then hit the 'RETURN' key to start the search. The hit list will show arrows that contain a flow entry with the text string, as well as process names, where the text string is part of the process label. Also, you will find text elements that match the search criteria.

Skip through the dropdown list that contains the matching elements and select one entry (arrow, process, text element), to bring this element into focus and select it in the editor.

You can use the "Search Next" command from the 'Edit' menu or the keyboard shortcut 'F3' to jump to the next diagram element from the search results.

Undo/Redo

e!Sankey has an Undo and Redo functionality for almost all actions performed by the user in the course of a work session with the software.

Undo: To undo (revert) an action that has been done in the software, click on the button 'Undo' in the main toolbar or use the menu entry 'Undo' in the Edit menu. The hint of the button and the menu entry show the last action performed that will be undone. Alternatively use the keyboard shortcut CTRL-Z.

Several multiple actions can be reverted (undone) by repeating this action.

Redo: To redo (revert undo) an action that has been undone, click on the button 'Redo' or use the menu entry 'Redo' in the 'Edit' menu. The bubble hint of the button and the menu entry show the last action performed that has been undone and that will be reverted. Alternatively use the keyboard shortcut 'CTRL-Y'.

Options

There are a number of option settings for working with e!Sankey.



Note that some of the options might not be available as shown, if the system administrator of your company has decided that they should not be modified by you as the end user.

Open the options dialog from the 'Edit' menu. There are three pages: "General", "Diagram" and (if you are using the 'pro' or the 'calc' version of e!Sankey) "Extended".

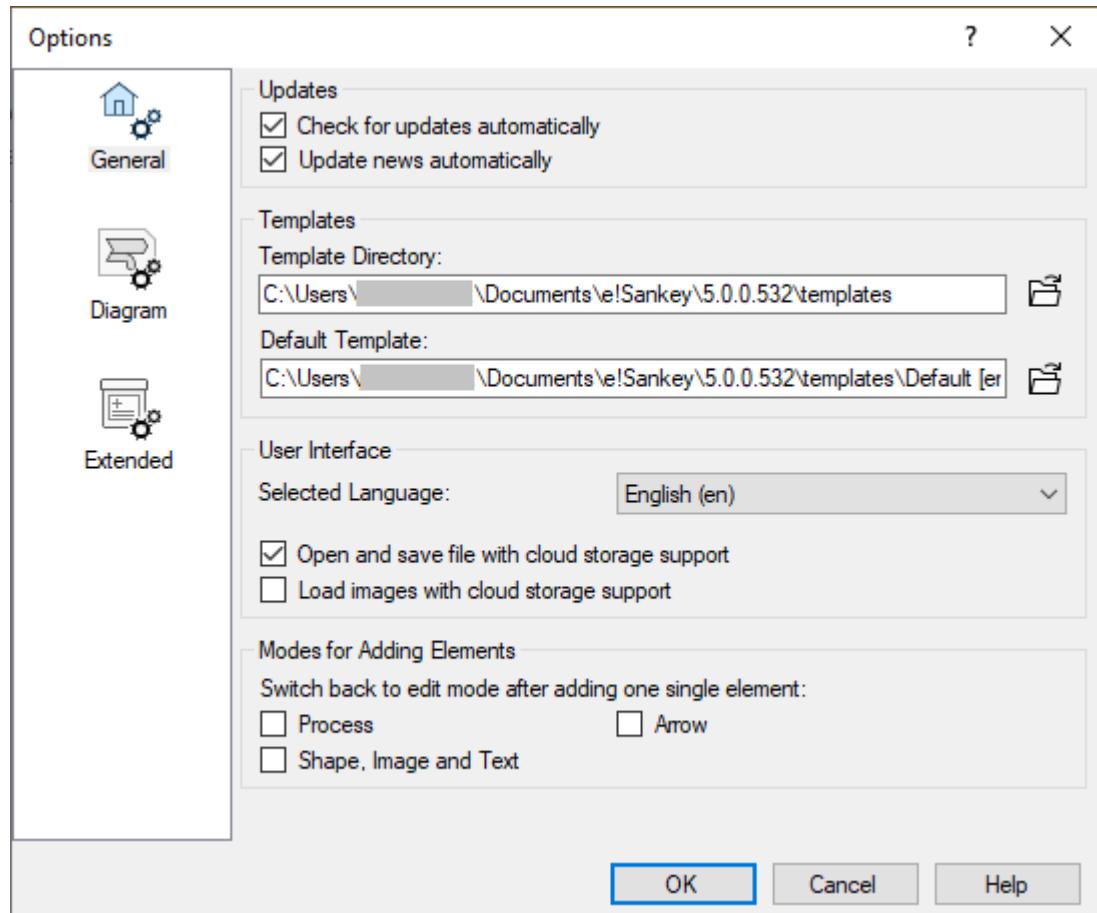


Figure 9: Options dialog, 'General' page

General Options: On the "General" options page, a number of settings can be made that determine the behavior of the application.

- **Updates:** Determine whether e!Sankey has permission to search for updates and to update the news on the start page. For further information on updates, see above in chapter 2.
 - **Templates:** Set the directory path where template files (.santem) are located ("Template Directory"). You can define the path to your preferred Sankey diagram template in the "Default Template" field.
 - **User Interface:** Choose the language of the graphical user interface from the dropdown list. A restart of the application is required for the change of GUI language to take effect.
- Use the option "Open and save file with cloud storage support" to switch between the classic Windows open/save dialog and a modern one with support for opening and saving files to cloud storages. If you leave the option 'Load images with cloud storage support' unchecked, image files will be opened with the classic Windows open file dialog, in order to allow the preview of images stored on your hard disk.

- **Modes for Adding Elements** : By default, adding a new process or drawing an arrow in the diagram can be done repeatedly when selecting the insert mode. Users who prefer to insert only one single element after activating the insert mode can use these options for process, arrow and/or shape/image/text.

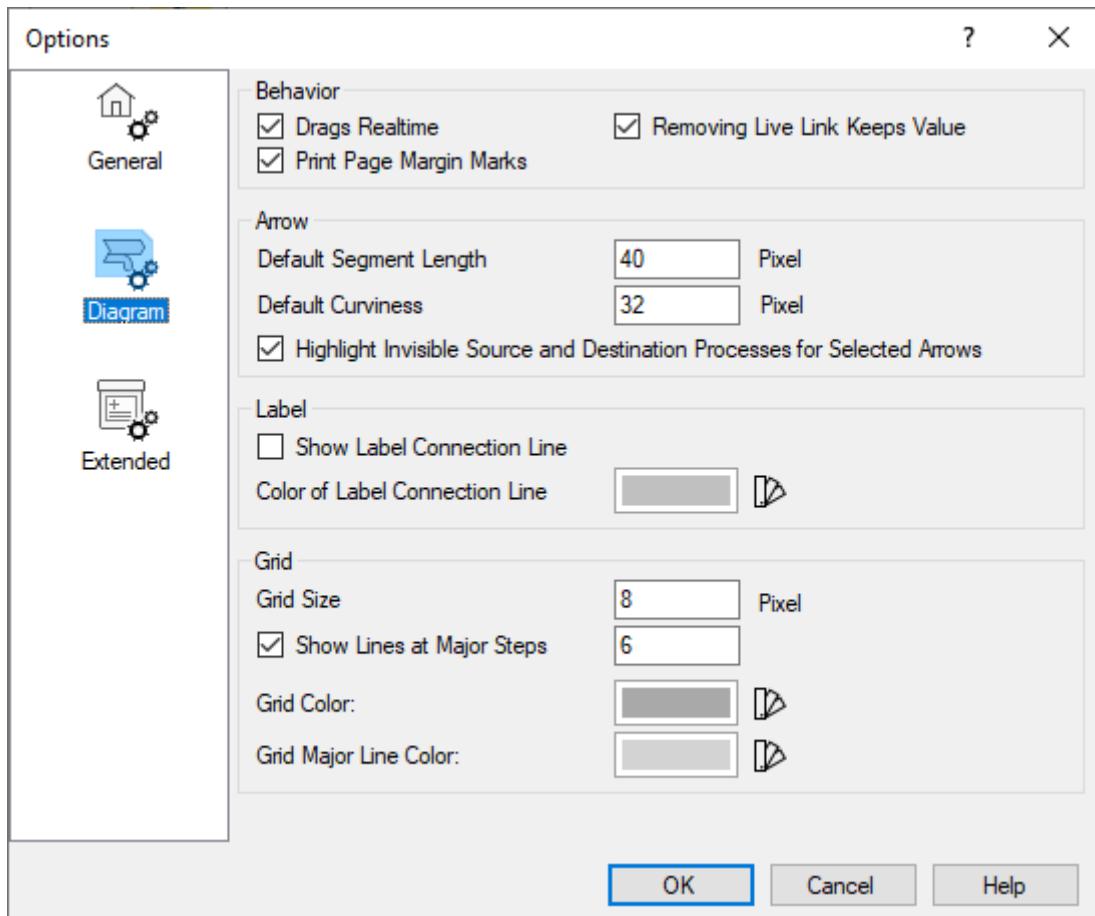


Figure 10: Options dialog, 'Diagram' page

Diagram: On the "Diagram" options page settings for the diagram editor and the layout of the diagram can be made.

- **Behavior:** Some options for the behavior of e!Sankey, such as page margins on printouts.
- **Arrow:** You can change the default segment lengths of the first/last arrow segment (from the process symbol to the yellow arrow point) and the default curviness (softness of a rounded arrow bend) of arrows.
When checking "Highlight Invisible Source and Destination Processes for Selected Arrows" it is easier to see processes that are hidden when selecting the arrows attached to them. See below in chapter 6 in the section on "Hidden Processes".
- **Label:** When setting the option "Show Label Connection Line", a line will be shown from the flow content label to the arrow. The color of the line can be defined using the color dialog. See below in chapter 5 in the section on Flow Content Labels.
- **Grid:** The default grid size is "8". Set the grid size in the entry field. The option "Show Lines at Major Steps" will display additional helper lines in the grid to facilitate alignment of elements. The default value

is "6", i.e. a horizontal and vertical line is shown every $6 \times 8 = 48$ pixels. Set the grid color according to your taste.

Extended: On the "Extended" options page – available only in the 'pro' and 'calc' versions of e!Sankey - users preparing template files that are fed with data from an external data source using the e!Sankey Software Development Kit (SDK) can adjust the settings and reference a key lookup list.

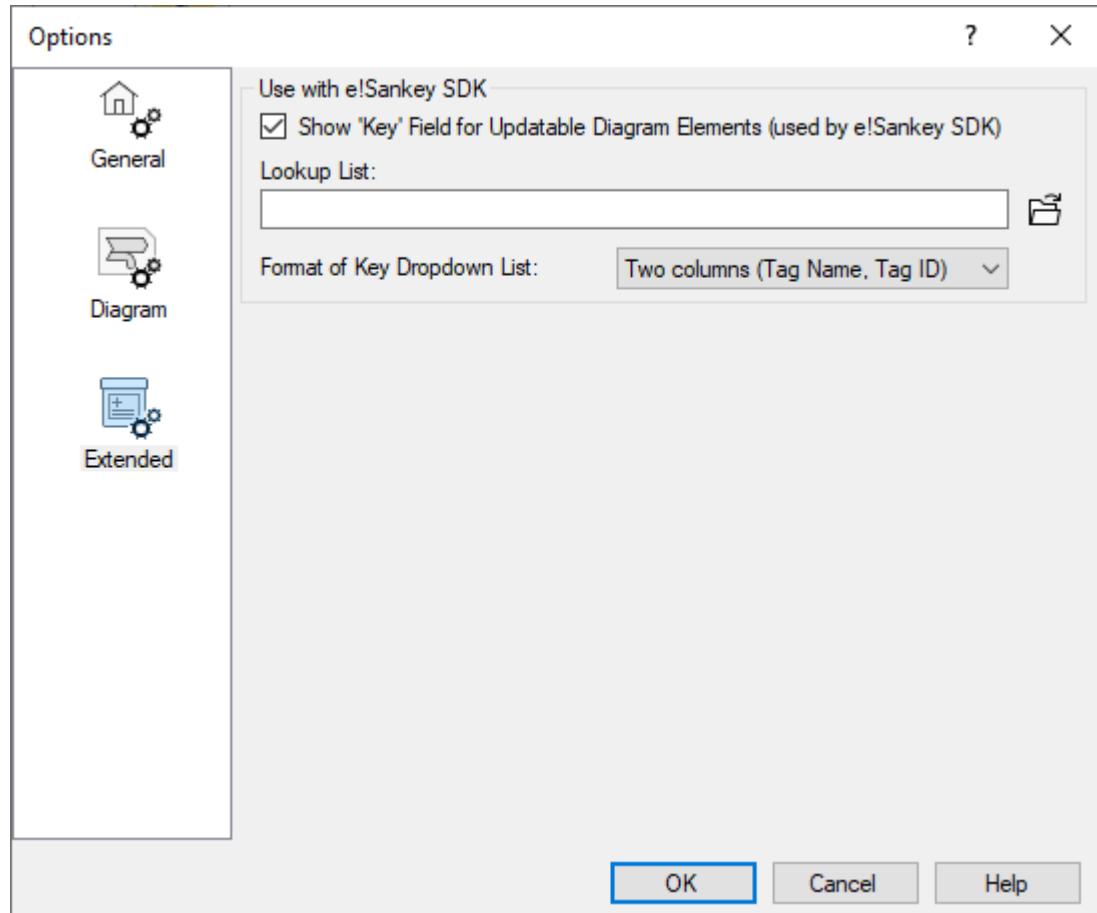


Figure 11: Options dialog, 'Extended' page

- Use with SDK: Should you plan to reference elements of the diagram and automatically update a Sankey diagram with data from an external source using the e!Sankey Development Kit (SDK) you will use the option "Show Key Field". Setting a check mark will add a "Key" column in the flows table, the stocks table and for text labels, more details in chapter 15).
The users of the e!Sankey SDK will find a description of the use of the key field in the SDK documentation.
- Lookup List Path: If you are using a key list in CSV format (e.g. exported from your energy management software), you can set the path to this lookup list here. This will help you enter the keys based on the list of available IDs in your data source.
- Format Dropdown List: Set the format how keys are presented in the dropdown list of the "Key" field". Either one column (just the ID), or two columns (name/description and ID).

4 Getting Started

Creating a Diagram File

To create a new diagram file, click on the button "New Document" in the toolbar. Alternatively select "New" from the 'File' menu and choose one of the predefined templates. Or, click on one of the templates listed in the 'Templates' section on the start page.

Templates have entries, units, preference settings and color pallets predefined. You can learn more about templates in chapter 10.

To save a diagram file, click on the 'Save Document' button in the toolbar, or choose 'Save As...' from the file menu. You will be asked to enter a name. e!Sankey diagram files have the file suffix ".sankey".

Three Basic Steps: Drawing Processes and Arrows, Entering Flows

In this section you will learn how to draw Sankey diagrams in e!Sankey. Sankey diagrams consist of processes (also referred to as "nodes") and arrow lines between the processes. Flows are entered in the flows with their quantities and represented with the arrow width proportional to the magnitude of the flow.

Even if the process boxes are not visible (hidden) in the diagram, they must first be drawn, in order to be able to connect an arrow to them.

1 - Draw Process: To draw a process, click on the button 'Process' in the toolbar, then click in the drawing area where you wish to place the process (node).

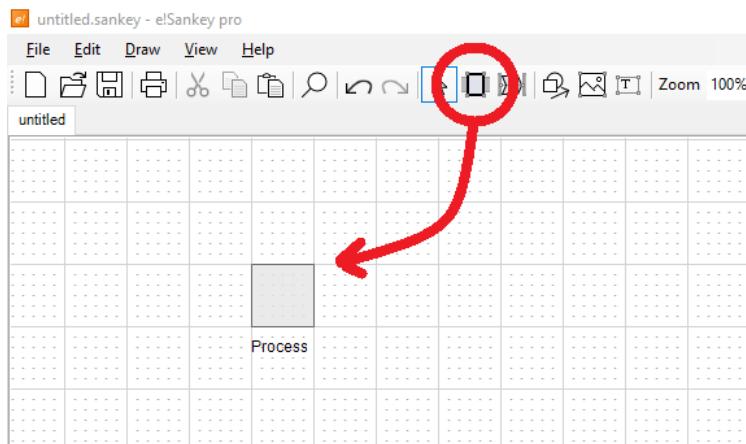


Figure 12: Selecting the Process button and positioning a process symbol in the editor

You can continue to insert processes when in the insert mode until you choose another command (or hit 'ESC' or click the right mouse button to end the insert mode).

After setting two or more processes, you can connect these process nodes with arrows, as follows:

2 - Draw Arrow: Move the cursor to the centre of the process symbol (start node). The process will become filled gray and the cursor symbol turns into a hand. Click with the left mouse button, keep it pressed, then drag to the other process (destination node). When over the centre of the process symbol, this square will be filled gray too. The mouse button can be released now. The arrow will snap to the process. It will also connect to the process, if you only drag it very close to the destination process - almost like a magnet.

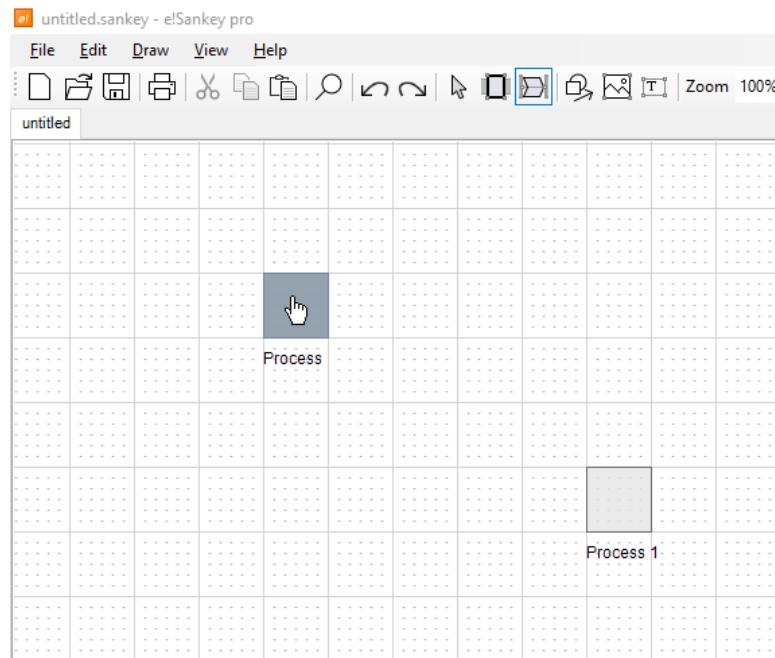


Figure 13: Two processes are linked with an arrow. In the insert arrow mode a process will be shown filled when the mouse cursor is hovered over it. Press the mouse-button...

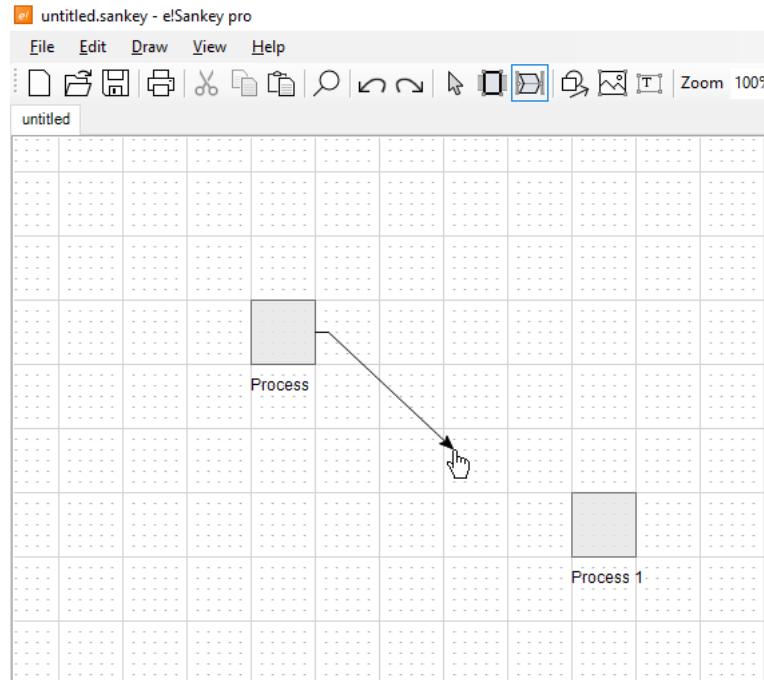


Figure 14: ...keep it pressed and drag towards the destination process...

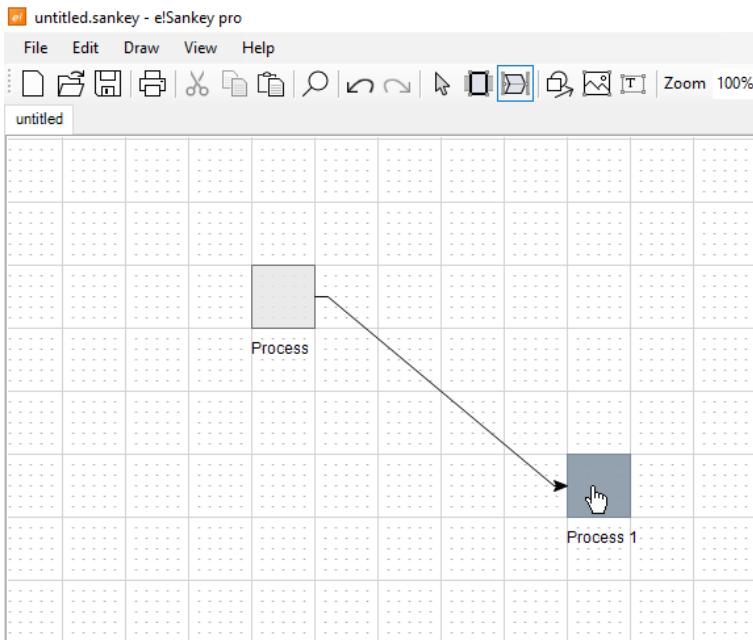


Figure 15: ...the destination process will be shown filled when the mouse cursor is moved over it. This signals that the arrow will snap to that process. Release the mouse button.

The arrow at that stage is empty. This is indicated with the hint "<No Flows>". The arrow shows two yellow marker points and two red points where it connects to the processes. You will learn more how to use these points later.

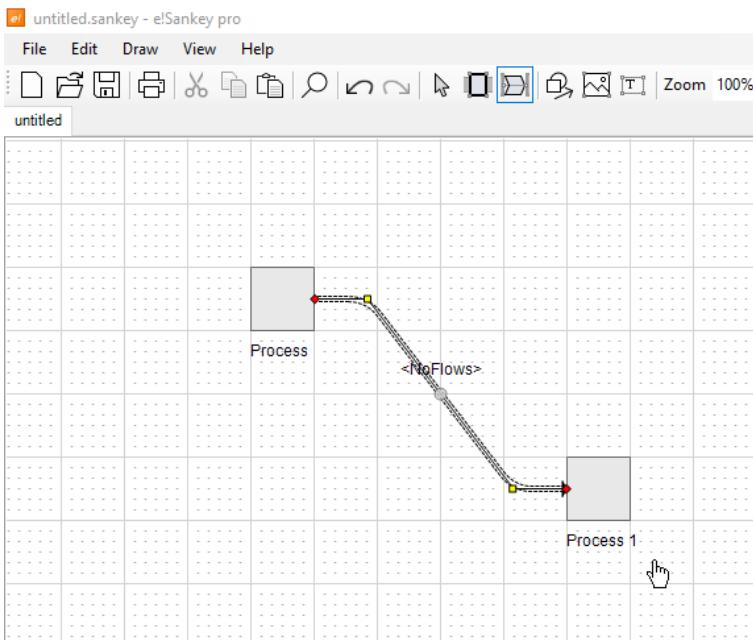


Figure 16: An arrow has been drawn, but it contains no flows at this stage.

Finally, you have to define what flows along the arrows from one process to the next. This can be material, products, heat or any other form of energy, persons, money ... These items can be defined in the 'Entries' window.

3 - Enter Flow in Arrow: If there are no pre-defined sample items in the 'Entries' window, create one by clicking on the button "Add Entry". Drag the entry "Entry 1" onto the arrow. The Arrow Property dialog will come to front, and the entry will appear in the flow list. You can directly enter a quantity in the "Quantity" column of the flow entry. When you click return, the arrow line between the two processes is shown at a width, representing the quantity.

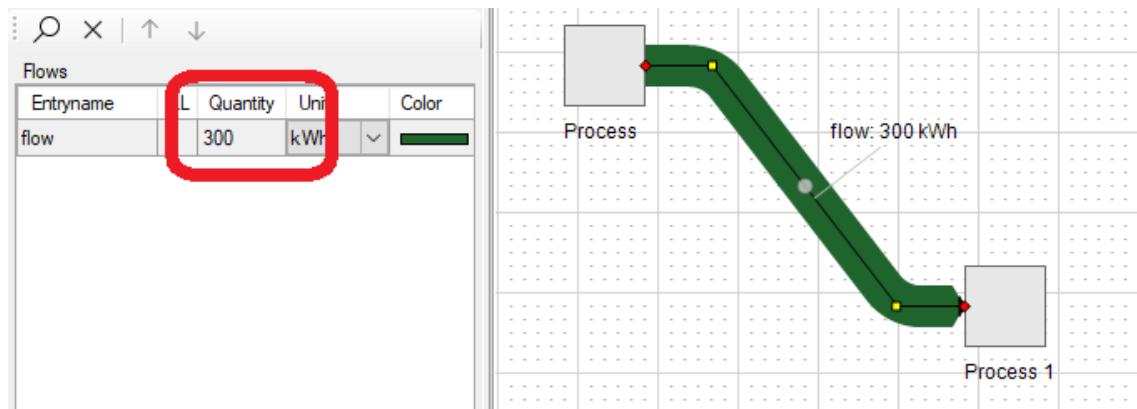


Figure 17: Entering a quantity value for the entry that has been dragged onto the arrow

These three steps are essentially what you need to know to create a Sankey diagram.

In the next chapters, you will learn how to use the many option settings and individual properties of the diagram elements, to improve the layout and design of your Sankey diagram.

5 Arrows

Arrows are the most important elements in a Sankey diagram. They always run between two process symbols and are directed from a source (starting node) to a target (destination node). Arrows can take up flows from the Entries list. The quantities of the flows are represented by the width of the arrow.

Several flows can run in one arrow (multi-flow arrow).

Arrows are drawn in the Sankey diagram between two processes by choosing the button "Arrow/Draw Arrow Between Processes" in the toolbar, then clicking on a process in the diagram, keeping the left mouse button pressed, and dragging to another process.

The insert mode is turned on and allows repeated drawing of arrows until you return to the edit mode with a right mouse click or choose another element from the toolbar. An alternative single arrow insert mode can be activated in the Options > General dialog.



An advanced arrow drawing mode exists for advanced users: Rather than setting two processes and drawing an arrow between these, you can just click on an empty space in the editor and drag to another position in the editor. Processes will be added at the beginning and end of the new arrow.

Flows Table

Flows on an arrow are shown in the 'Flows' table in the bottom section of the arrow properties dialog when the arrow is marked. As has been described above in chapter 4 the flows can be directly inserted into an arrow by dragging&dropping entries directly onto this table. Alternatively, the flow will also be shown in this table when an entry is dragged&dropped onto an arrow in the editor drawing area.

The 'Quantity' column is used to enter or modify the flow quantity (that is used to determine the width of the Sankey arrow)

Flows					
Entryname	LL	Quantity	Unit	Key	Color
Sample Entry 1		100	kg		
Sample Entry 2		300	kg		
Sample Entry 3		85	kg		

Figure 18: Arrow Properties, Flows Table

For multi flow arrows (i.e. arrows that have more than one flow) the sort order can be adapted using the 'Move Up' / 'Move Down' buttons.



Insert several selected entries into one arrow by drag&drop. To insert one or more entries into several arrows, use the 'Insert Entry into Arrow(s)' button in the Entries window.

A flow can be removed from an arrow by selecting it and then clicking on the button 'Delete Flow'.



Values for flows listed in this table can be fed from an Excel worksheet via the Live Link (versions e!Sankey pro and e!Sankey calc only). In this case a symbol is shown in the column "LL". Further hints on the Live Link to Microsoft Excel can be found in chapter 11



Users preparing Sankey diagram template files for use with the e!Sankey SDK (automation of Sankey diagram creation) see an additional column 'Key' in this table. Further hints on the 'Key' field in chapter 15

Delete Arrow: Arrows can be deleted by selecting them and clicking on the DEL key or selecting the command "Delete" from the context menu. Note that all flows made on an arrow will be deleted along with the arrow.

Mind that by removing processes to which arrows are connected, these arrows will also be deleted, since the arrow loses its connection at the head or the tail.

Arrow Properties

Click on an arrow to mark it, and the arrow properties dialog will be shown in the property pane.

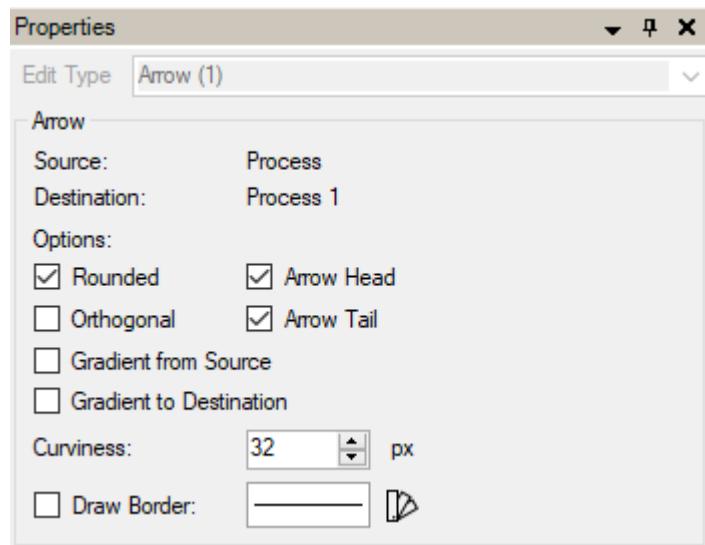


Figure 19: Arrow Properties

The 'Edit Type' dropdown list at the top of the Properties dialog allows editing the properties of several selected element of this type. The number in brackets indicates the number of elements selected and affected by the changes. In the image above, only one arrow is marked in the Sankey diagram.

Arrow Style

Arrows can be shown with different layout options. Check the possibilities in the property dialog. Below are just some of the options for arrow appearance.

The options 'Arrow Head' and 'Arrow Tail' can be used to individually turn on or off the base (tail) or the head of each arrow.

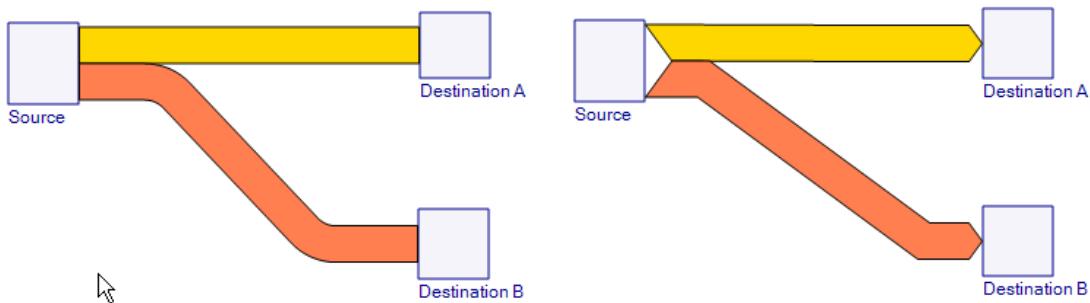


Figure 20: No arrow head/tail on the arrow (left), arrow head/tail option turned on (right)

The shape of the arrow head can be adapted and can look differently. For example, an explicit arrow spike can be added.

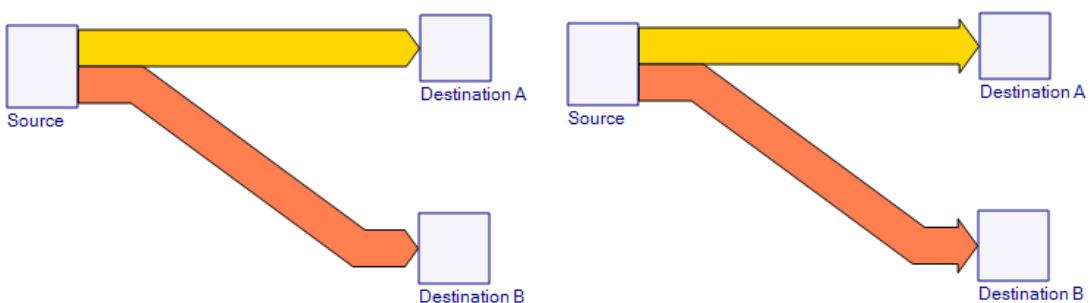


Figure 21: No explicit arrow spike at head of the arrow (left), spiked arrow heads (right)

The options for the arrow spike, arrow spike angle, arrow spike base width etc. are set in the document options. To view the document options, click on an empty area in the Sankey diagram to bring up the document properties.



See section on 'Arrow Spikes' below for more details.

The option 'Rounded' will lead to arrows that are drawn with rounded bends. Curviness is the measure for the radius of an arrow bend. The default setting is 30° degrees.

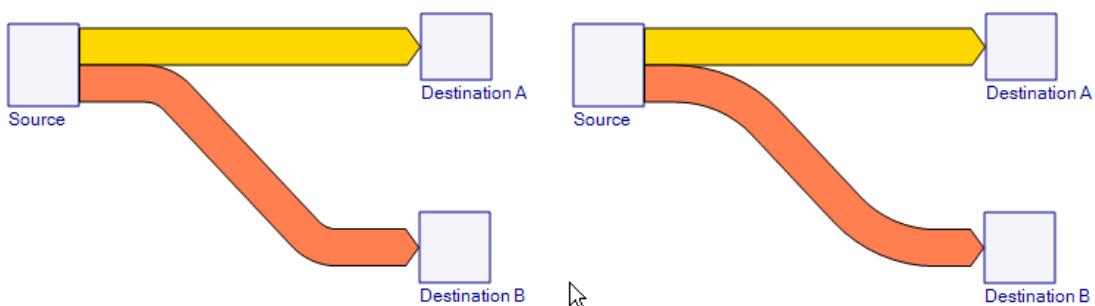


Figure 22: Option 'Rounded', normal curviness (left), high curviness value '90' (right)

In some cases orthogonal arrow routing might be preferable. You can set the option 'Orthogonal' in the arrow properties to produce arrows that always bend at 90°. This is achieved by adding two additional waypoints on the arrow. To switch back from an orthogonal arrow routing to a normal arrow routing, uncheck the option and additionally remove the waypoints (grey marker points) on the arrow.

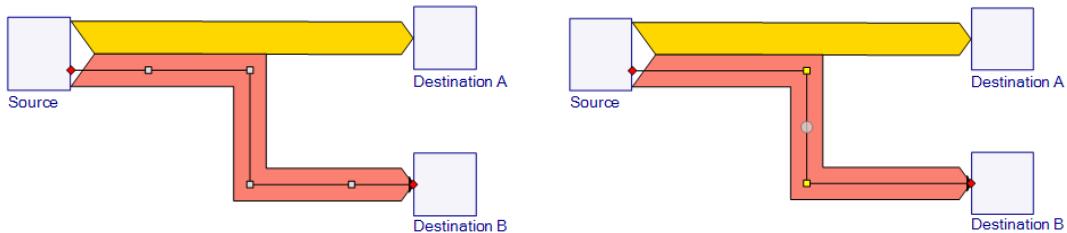


Figure 23: Option 'Orthogonal' has added two additional grey waypoints (left), the same effect can be achieved by dragging the yellow points of the first arrow segment manually so that they are in one vertical line (right)



Instead of using the 'Orthogonal' option for arrow routing, the same effect can also be achieved by dragging the yellow arrow points, that force a horizontal/vertical first segment away from the process, so that the middle arrow segment bends at 90°



Read more about the grey and yellow arrow waypoints below.

Use 'Draw Border' to determine, whether an arrow should have a border line. Click on "Select Color" to set the border line color, width and style.

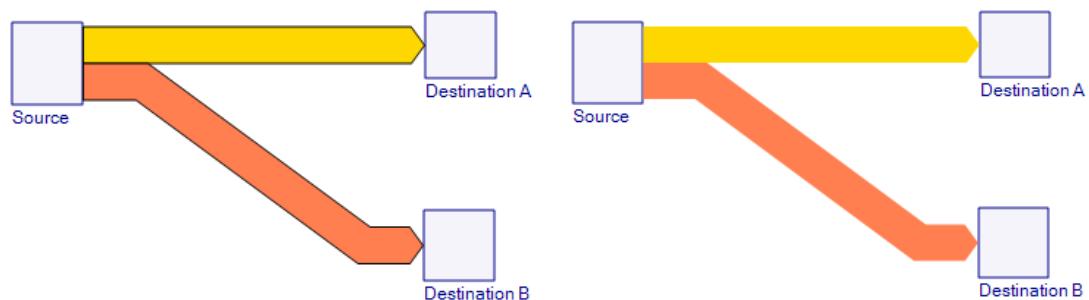


Figure 24: Showing border line (left), option 'Draw Border' turned off (right)

These are just some of the possibilities you have for changing the arrow routing and appearance. Settings are made for arrows individually or by using multiple edit for selected arrows.



Use 'Set As Default' from the context menu of the arrow to remember the settings for the next arrows you will be drawing in the diagram.

Arrow Labels

The options in the "Label" section of the arrow properties allow showing or hiding flow labels.

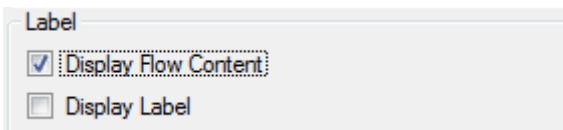


Figure 25: For each arrow an automatically created flow content label is shown. It can be hidden. An additional a comment label for free text can be displayed

There are two different labels available for each arrow:

The flow content label is created automatically when a flow and a flow quantity is entered into the arrow. By default, it is turned on (visible). Remove the check mark in front of the "Display Flow Content" option to hide this label. The label is made up from the entry name, quantity and unit.

 The flow content label and its appearance can be customized. The elements to be shown in the flow content label can be turned on and off individually. the label can be rotated and fixed to the arrow segment. Read more about these label options below.

The arrow comment label is an additional optional label, where free text can be entered by the user.

Color Gradient on Arrow: Using the options "Gradient from Source" and/or "Gradient to Destination" it is possible to override the default color setting for a Sankey arrow, as defined in the "Entries" window for a material (see below). As a result, the arrow will feature a color gradient from one color to another. The start color is defined by the color of the process and has to be set individually for each process in the Process Properties.



Figure 26: Stacked arrow with color gradients (source and destination processes are hidden)

Arrow Spikes: In some cases, it might be useful to emphasize very thin Sankey arrows, by showing an arrow spike at the head.

This is a setting for the whole diagram, so it can be found in the property panel for the diagram, which appears when clicking on an empty area in the

editor. In the "Document Options" pane at the bottom, the following options are available:

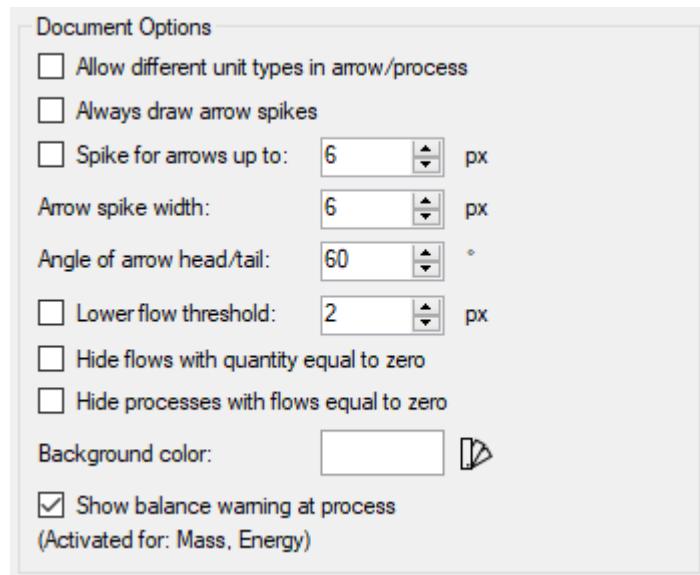


Figure 27: Document options in Diagram Properties dialog

Set the option "Always draw arrow spikes" in order to have all arrows, independent of the arrow width showing a spike. Alternatively use "Spike for arrows up to:" and only thin arrows which have a width up to the chosen value will get a spike.

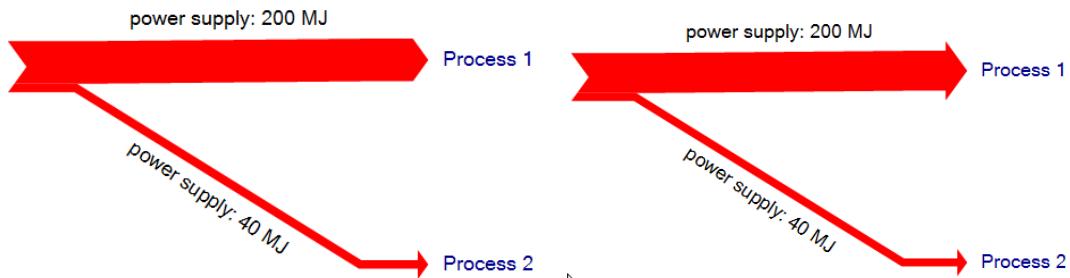


Figure 28: This option can be used when arrows of the diagram don't show spikes to give only a spike to thinner arrows (left). Alternatively, the option "Always draw arrow spikes" will produce spikes even for wider arrows (right).

You can use the "Arrow spike width setting" to determine the width of the base of the spikes. Use this option with caution, as a wide base over-emphasizes smaller arrows.

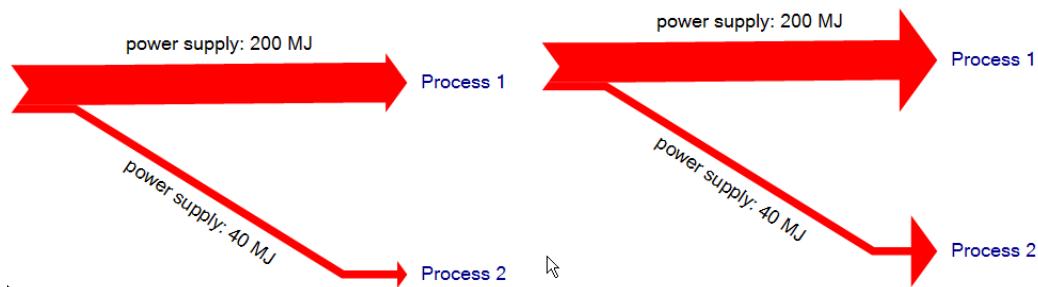


Figure 29: Arrow spikes with a normal base (left) and a wide spike base (right, not recommended)

Use the "Angle of arrow head/tail" to set the spike angle.

Please note that the flow values remain unchanged. Just by changing the arrow head (spike) settings, the impression the Sankey diagram conveys is quite different.

Flow Labels

Flow content labels are created automatically when inserting a flow into an arrow and entering its quantity. They are placed at a default position near the middle of the arrow route. The arrow label can be dragged around and positioned where it fits best.

Click on a flow content label and the properties dialog will be shown in the property pane. The entry in the 'Edit Type' dropdown list shows the number of flow content labels that are selected and that will be affected by property changes.

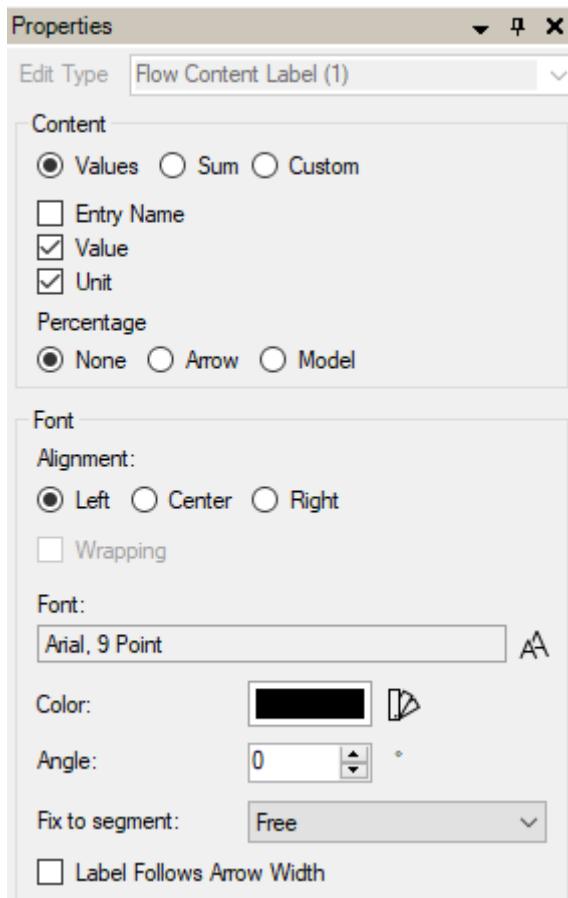


Figure 30: Flow Content Label Properties

The default display option for the arrow label is set to "Values", so that the flow quantities are shown. "Sum" refers to multi flow arrows (several flows in one arrow) and forces the sum of the flows with the same unit type to be displayed.

Flow content labels are composed of the flow name, the quantity and the unit. They are made up automatically and therefore cannot be edited directly. Name, quantity and unit can be turned on and off individually. Use the tick mark in front of the item in the "Content" section.

The 'Alignment' and 'Font Style' of the flow content label can be edited in the "Font" pane.



Note: To hide a flow content label entirely, remove the check mark in front of the "Display Flow Label" option in the arrow (!) property dialog.

Show Percentage in Flow Labels: Since e!Sankey is a visualization tool and thus does not have any calculation functionality to calculate flow quantities (see comment on last page for more information), there is a feature that allows to determine the percentage of a flow within a multi flow arrow, or the percentage of its quantity in relation to the largest quantity of a flow of the same unit type in the whole diagram.

In the Flow Content Label property panel, set the 'Percentage' option to "Arrow" to show the percentage contributions of each flow in a multi flow arrow.



Figure 31: Percentages of the flow in a multi flow (option "Arrow")

Use the setting "Model" in the 'Percentage' option to show the percentage contributions of each flow of the same unit type in regard to the largest flow in the model.

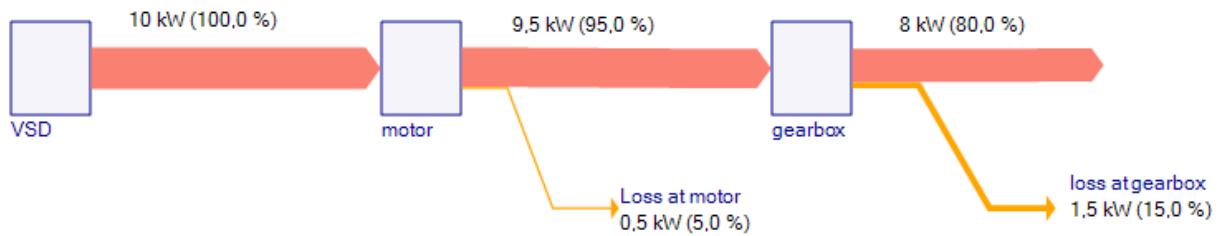


Figure 32: Percentages in the arrow labels (for "Model")



A third 'Percentage' option (percentage of output from a process or input into a process per unit type) is available using keywords in a custom defined flow label. See hereafter.

Custom Flow Labels: In addition to the automatically created flow labels, users may choose to create custom flow labels using format strings. Custom flow labels offer a variety of possibilities to individually adapt the way the flow labels are displayed (e.g. labels on multiple lines or characters interjected).

To modify one or more selected flow content labels switch to the option "Custom" in the properties dialog of the flow label.

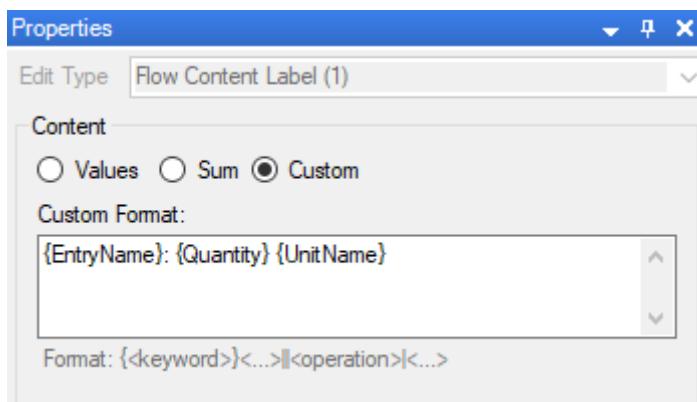


Figure 33: Flow Content Label Properties, custom format string

In the "Custom Format" field enter a format string using the keywords in curly brackets (braces). After the keywords enter a double pipe "||" followed by one or more operations. When using several operations, they must be separated with a pipe "|". Do not use line breaks unless intended.

When typing an opening curly bracket "{" a selection list drops down and allows choosing a keyword. When typing a double pipe "||" or a pipe ("|") a selection list drops down from which an operation can be chosen.

Keywords:

{EntryName}	displays entry name
{GroupName}	displays group name of entry
{NewLine}	creates a line feed
{PercentArrow}	shows percentage value of flow quantities of the same unit type in the respective arrow (multi-flow arrows)
{PercentModel}	shows percentage value of flow quantity in relation to the largest flow quantity of this unit type
{PercentProcessDestination}	shows percentage value of flow quantity of the overall flow quantity of this unit type at the process located at the destination of the arrow
{PercentProcessSource}	shows percentage value of flow quantity of the overall flow quantity of this unit type at the process located at the beginning of the arrow
{Quantity}	displays flow quantity
{UnitName}	displays unit name
{UnitTypeName}	displays unit type name

Operations:

groupByUnitType	For multi flow entries the entries are summed up per unit type, and the number of items given instead of a list of entry names. Note that flows of
-----------------	--

	different unit types in one arrow are possible only when the option "Allow Different Unit Types in Arrow" is set in the document options panel of the diagram properties
replace("text1", "text2")	text1 in the first quotation marks is replaced by text2 e.g. in the entry name
setEllipsis("chars")	Use this to replace the default ellipsis ("...") used for truncated entry names by the string in quotation marks
setMaximumEntryNameLength(20)	Cuts the entry name after the number of characters indicated in brackets. The last three characters of a truncated entry name is replaced by an ellipsis (...).
setPercentageDecimals(1)	Sets the number of decimal places for percentage values calculated with one of the above percent keywords. If not used, the default number format will be valid for percentage values.
setPostfix("text")	The text in quotation marks is set after the actual flow content label. Instead of a text string also use one or more key words: {BasicUnitName} {CountEntries} {CountUnitTypes} {NewLine} {SumBasicUnit}
setPrefix("text")	The text in quotation marks is set before the actual flow content label. Instead of a text string also use one or more key words: {BasicUnitName} {CountEntries} {CountUnitTypes} {NewLine} {SumBasicUnit}
setSeparator("text")	The character or text in quotation marks is used to separate the entry names in multi flow arrows (by default a line break is used).

For the keywords {Quantity} and {Percent...} the suffix ":format" (for example ":0.00") can be used to force a specific number format for the value. You can use any of the number format strings listed in the table on page 70.

Examples:

- {EntryName} from group {GroupName} creates a flow label such as "cadmium from group heavy metals" or "mercury from group heavy metals" (2 keywords with an interjected text string using the name of the entry group)
- {EntryName} {UnitTypeName}: {Quantity} {UnitName} || groupByUnitType creates a flow label for a multi flow that would

look similar to this:

2 Entries Mass: 1200 kg

3 Entries Energy: 4000 MJ

- `{PercentProcessDestination} || setPercentageDecimals(0)` will check what contribution the flow has to the overall input to the process at the end of the arrow (destination) and display the value in percent without decimals i.e. as integer values. Note that all flows have to be of the same unit type (e.g. "Energy", see figure below).

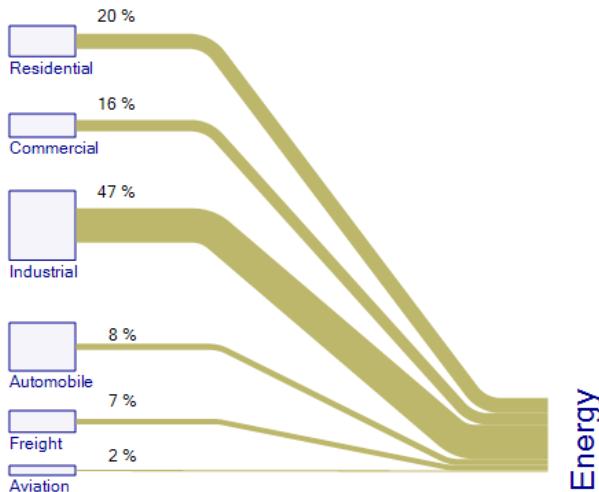


Figure 34: Contributions to an overall consumption using the custom flow label format string keyword `{PercentProcessDestination}`



Keywords are also used in the custom balance label, that allows presenting balance check numbers as a text label. For a list of keywords and operations for this specific label, please see below in 'Balance Check' section in chapter 6.

Flow Comment: Additionally to the flow content label, created automatically, an arrow comment label can be created, where free text can be entered, e.g. for comments etc.

Flow Labels for Arrows with Multiple Flows: Multi flow arrows are arrows that contain more than one flow entry. For multi flow arrows, the arrow label can be switched from individual "Values" to the "Sum" of all flows. If the flows are all in one group and have the same unit type, then the name of the group will be displayed along with the sum value. If flows are located in different entry groups, then the word "Sum" will be shown instead.

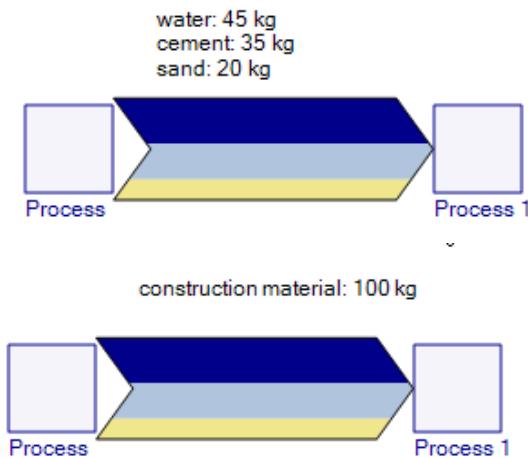


Figure 35: Multi flow with detailed arrow label and with "Sum" arrow label

The sort order in Multi Flow arrows can be adapted using the 'Move Up' / 'Move Down' buttons in the flows table in the bottom part of the arrow properties dialog.



Use 'Set As Default' from the context menu of the file to remember the settings for the next arrows labels.

Rotate Flow Label Both arrow labels as well as arrow comment labels can be rotated, e.g. to be able to place the label parallel to an arrow route.

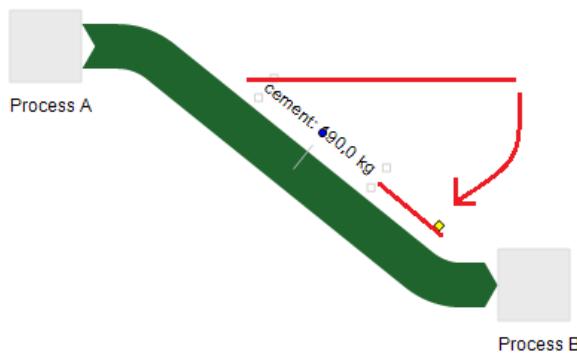


Figure 36: The Flow Label can be rotated around an axis by dragging the yellow point.

You can use the yellow point to rotate the label around the blue turning point or enter an angle degree in the "Angle" field. The label is freely rotatable only in the "Free" setting of the "Fix to Segment" option.

The label can be fixed to an arrow segment, so that it follows with its angle to a changing arrow segment orientation. By that, when dragging a process and the connected arrow follows the node, the label will stay fixed to it.

Use the dropdown list "Fix to Segment" in the properties dialog to choose an orientation of the flow content label in relation to the arrow segment. The default is "Free", so that the flow content label stays with the middle segment of the arrow but does not change its angle when the arrow angle changes.

Use "Forward" to lock the angle to the segment. "Backward" might be meaningful when the arrow label is overhead (upside down).

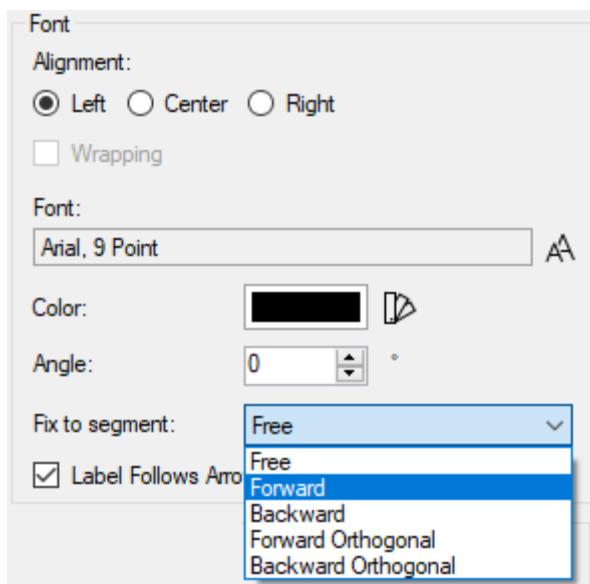


Figure 37: Fixing the flow content label to the arrow segment in a given orientation

Flow Label Follows Arrow Width: If the final width of an arrow cannot be determined beforehand, and there might be a risk that a change in the arrow width will happen (either by changing the scale for the unit type, or by an update flow quantity via a Live Link into an Excel worksheet) it is recommended to let the flow content label follow the arrow width, by activating the option "Label Follows Arrow Width". The position of the label will then be fixed in relation to the arrow border and adjust automatically, should the arrow width change.

Arrow Routing and Waypoints

The routing of an arrow between two process nodes is done automatically. The arrow line has certain arrow points that determine the route. Further points can be added. These points become visible when the arrow is clicked. Additionally, the connectivity behavior at the process can be set, which also influences the arrow routing.

The yellow points (lug points or hook points) are created by default at the end of the first segment after at a horizontal or vertical offset from the process node, and at the beginning of the last segment of an arrow that is linked to the process node. These yellow points can only be moved horizontally or vertically, depending on the orientation of the base segment or head segment of the arrow to the process node. They cannot be removed.

The red points are shown at the head and at the foot (tail) of the arrow where it connects to the process. These points can be used to disconnect the arrow from the process and reconnect it to another process.

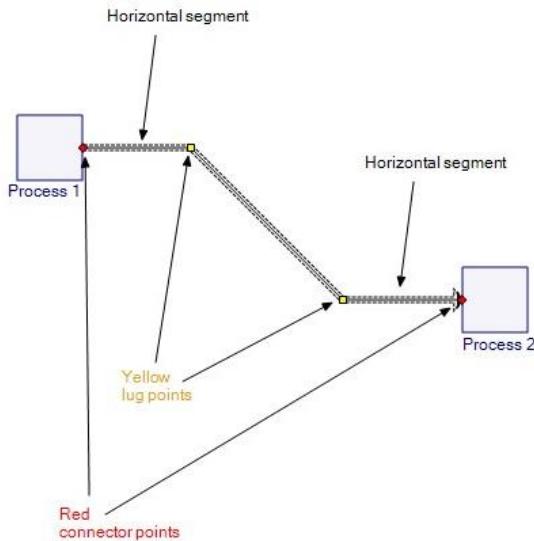


Figure 38: Yellow lug points and red connector points

On the arrow segment between the yellow points any number of grey bending points (routing waypoints) can be added. These grey points can be moved in the X- and Y-direction and can be used to give an arrow routing that suits the requirements best.

To add a waypoint or bending point on an arrow segment, drag the grey large round marker point that is temporarily shown in the middle of a segment when the arrow is marked. Alternatively, choose 'Add Point' from the context menu of the arrow. Drag the grey point to the desired place. Note that grey arrow waypoints cannot be inserted on the first and last (horizontal or vertical) segment, where the arrow connects to the process.



It is better to have less waypoints on an arrow than more. When a connected process is dragged to a new position, only the waypoints on the arrow remain fixed, and only the first connected segment follows.

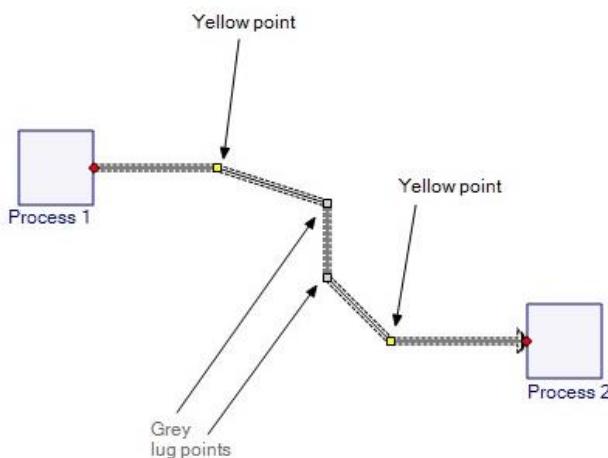


Figure 39: Grey bending points on the arrow segment between the yellow lug points.

To remove a waypoint on an arrow, use the command "Delete Point" from the context menu of the arrow.

To remove all waypoints on an arrow, use the command "Delete All Points" from the context menu of the arrow. The arrow will then be drawn with a straight middle segment between the yellow lug points again.



To delete the waypoints on multiple arrows, mark the arrows while keeping the CTRL key pressed and select the command "Delete All Points" from the context menu (while still holding the CTRL key pressed). This is a quick way to set the default routing to a number (or all) arrows again.

Connectivity: The way an arrow connects to a process node depends on the connectivity setting in the process property dialog. The default setting is "Free", i.e. the connection direction is not restricted to a certain mode but will be determined automatically depending on the angle of an imaginary line between process nodes. Thus, the arrow offset will 'jump' to the other side of a process node when you move the process connected to it on the other end of the arrow to another position, where this imaginary line is above or below a 45° angle.

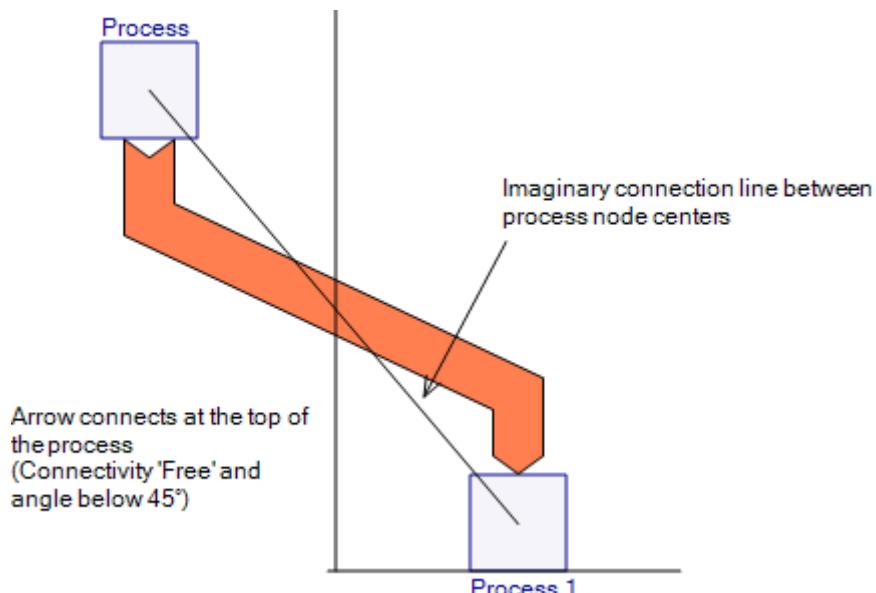


Figure 40: Automatic routing and connectivity depends on the angle between the imaginary connection line between the process symbol centre and a vertical line. Arrow connects at top.

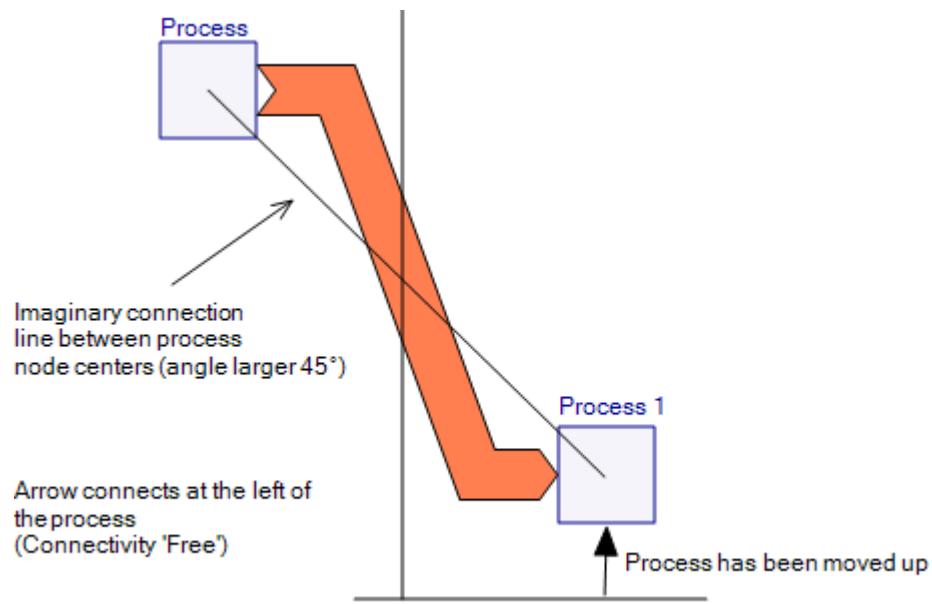


Figure 41: The angle between the imaginary connection line between the process symbol centres and a vertical line exceeds 45° the arrow connection "flips" to the side.

If you want to force the arrow to connect to a specific side of a process, set the connectivity in the process property dialog to one of the following options: Left-To-Right, Right-to Left, Top-To-Bottom, Bottom-To-Top. The automatic connection direction as shown above will be overruled.

Read more about how arrows connect to a process in the chapter 6 on processes, section on process options.

Z-Order: In stacked arrows (arrow sections where several arrows join to form one arrow head, or, one common arrow base), the automatic algorithm using the angle of the imaginary line between the process centres might lead to a wrong sorting order in the stacked arrow segment.

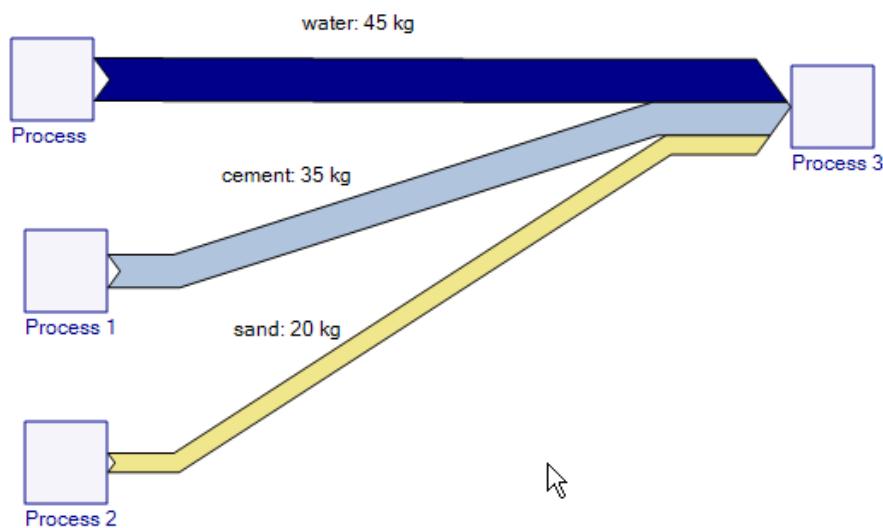


Figure 42: Process 2 (light sand color) is at the bottom

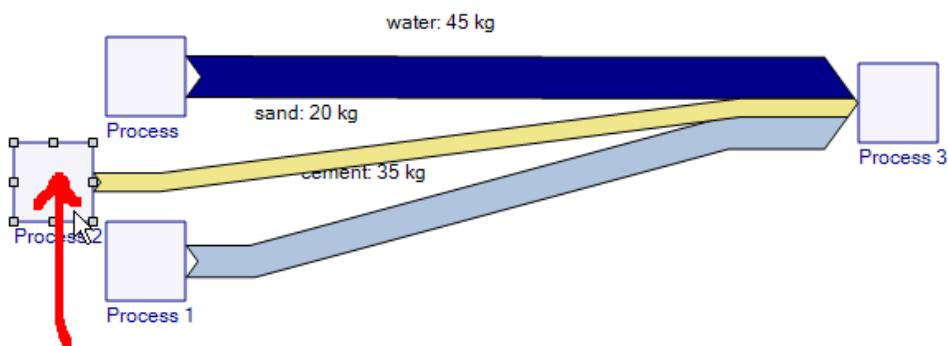


Figure 43: Process 2 (light sand color) is moved up to the middle...

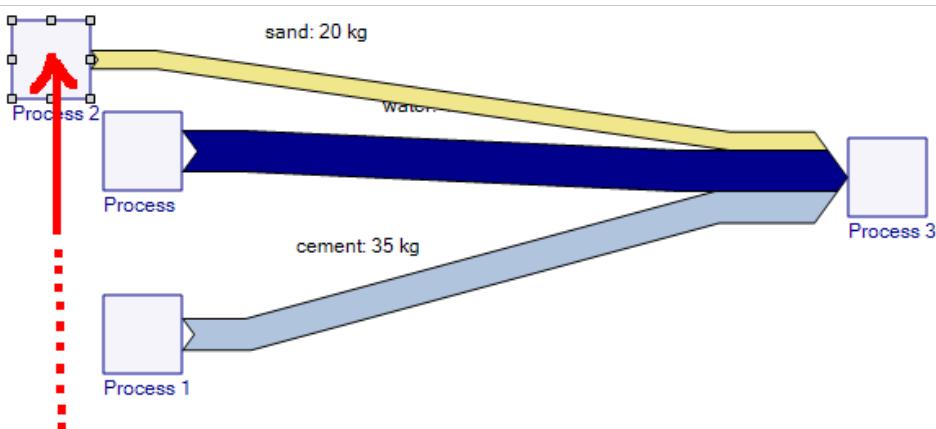


Figure 44: ... then to the top the order in the stacked arrow segment is sorted accordingly (option "Sort by Angle")

In case such automatic sorting is undesired, click on the process where the stacked arrow segment connects (here: Process 3) and switch to "By Z-Order" in the Stacking option. In this case the automatic stacking by angle will be superseded.

The Z-Order of arrows (the layer on the drawing area) can be influenced by defining the element layer with the command 'Bring Forward' or 'Send Backward' from the context menu of an arrow. Using 'Bring to Front' brings the selected arrow all the way to the front, while 'Send to Back' sends it to the last layer of the diagram. With this option, the arrow which is in the front (topmost layer) will be the first arrow to connect to the process, while the one that is on the last layer is the one that connects at the bottom of the process.

Z-Order for Crossing Arrows: For crossing arrow lines, the Z-Order setting can be used to determine which of the arrows runs on top of the other. Click on the arrow that is supposed to be on the top layer and select "Bring to Front" from the context menu. Alternatively, click on the arrow underneath and choose "Send Backward" (repeat several times, if necessary, arrow will be moved backward one layer each time).



The commands for changing the element layer 'Bring Forward', 'Send Backward', 'Bring to Front' and 'Send to Back' are also available in the main toolbar.

Note: Z (in addition to X- and Y-axis) is the axis orthogonal to the drawing area.

In the figure on the left the blue arrow is in front, the pink arrow is in the back. In the same diagram on the right the blue arrow is send backward, the pink arrow is now on the top layer.

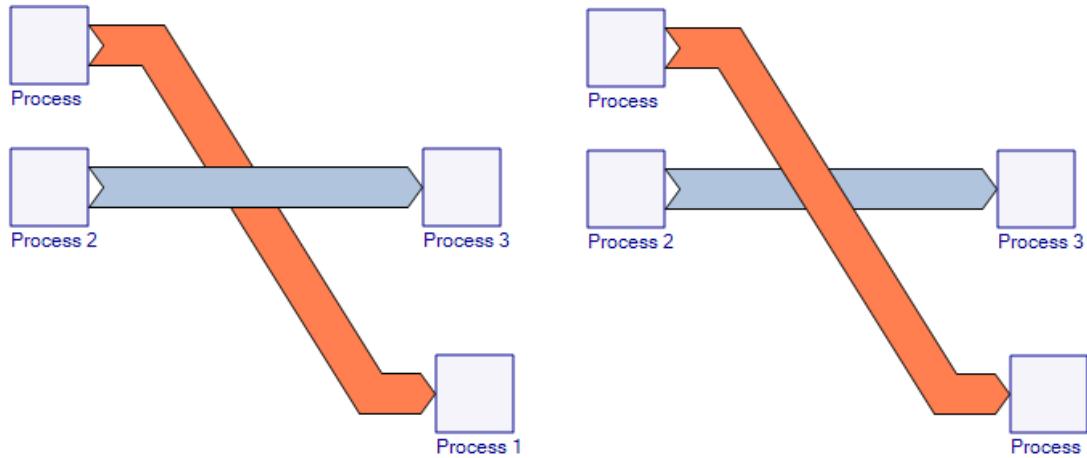


Figure 45: Z-Order determines the order of superimposition, which is important especially for crossing arrows

Supplements for Arrows



The supplements feature is available in e!Sankey pro and calc versions only.

To link additional information to arrows, it is possible to define media files or other supplements. These can be called in the editor by opening the context menu of an arrow and choosing the command "Open Supplement". Alternatively, select an arrow and hit the keyboard shortcut F6.

The following supplements can be linked behind an arrow:

- URL (web address, local file)
- File (any file on the hard disk, e.g. a video, a PDF, or another .sankey file)
- Text (text, optionally with simple common markdown formatting)

Links to files are defined in the "Supplement" panel of the arrow properties. One supplement per element is possible.

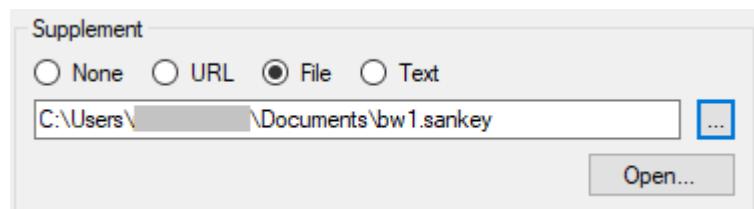


Figure 46: Setting a supplement. Here, another e!Sankey file on the hard disk is called

The default setting for supplement type is "None" when no file is linked.

To open a web page, choose the supplement type "URL" and enter the full path in the field below. Hit the button "Open..." to test the link.

To set a file as supplement, choose the type "File" and type the file path in the field below. You can use the button "Browse" to search for the file on your hard disk. The file will open with application defined for the respective file type. For example, a PDF file will open in the installed PDF viewer application. You can check with the button "Open..." to see if the supplement file path is properly set.

Using file type "Text" will display a text entry field. In this text box either type simple text or use Common Markdown⁵ to apply some formatting to the text output. The text will show in a popup window when the arrow's supplement is called.



If supplements are set for arrows, the link will also be included in the SVG graphic file export. The feature to call media files or other supplements can then also be used from the exported image file. See chapter 13 on SVG for more details.

⁵ For details please visit <https://commonmark.org/help/>

6 Processes

Processes (or nodes) are set in the Sankey diagram by choosing the button "Process/Add Process to Diagram" in the toolbar and then clicking at a position somewhere in the drawing area.

The insert mode is turned on and allows repeated insertion of process until you return to the edit mode with a right mouse click or choosing another element from the toolbar. An alternative single process insert mode can be activated in the Options > General dialog.

Processes have to be set at the beginning (foot) and the end (head) of each Sankey arrow. They may be turned invisible (hidden), but still they do have to exist. Click on an arrow to mark it, and the hidden process symbol can be seen.

Delete Process: Processes can be deleted by selecting them and clicking on the DEL key or selecting the command "Delete" from the context menu. Note that all arrows connected to a process will also be deleted along with the process, since the arrow loses its connection at the head or the tail.

You might want to consider hiding the process (see below) rather than deleting it.

Options for Processes

When marking a process symbol in the diagram, the properties pane will show the process property dialog.

The entry in the 'Edit Type' dropdown list shows the number of processes selected that will be affected by the property changes.

The option 'Display Process' allows hiding the process symbol (remove tick mark). The option 'Display Label' allows hiding the label of the process (remove tick mark).

By default, a process (node) is shown as a square symbol or rectangle. Alternatively, you can set the shape of the process to be displayed as a rounded rectangle, or ellipse/circle.



Mind that the look of the process symbol is defined in the diagram template (see chapter 10 of this user manual). So, if you wish to always use rounded rectangles or circles as process symbols, you can just define this and store it as your preferred template (default diagram template).

The 'Line Color' and 'Fill Color' of the process symbol can be adapted individually. Click on the color field or the button next to it to call the color selection dialog.

The "Arrows" section in the process property dialog relates to the way that arrows are connected to the process. The connectivity and stacking settings are explained above in chapter 5 on arrows in the section on 'Z order'.

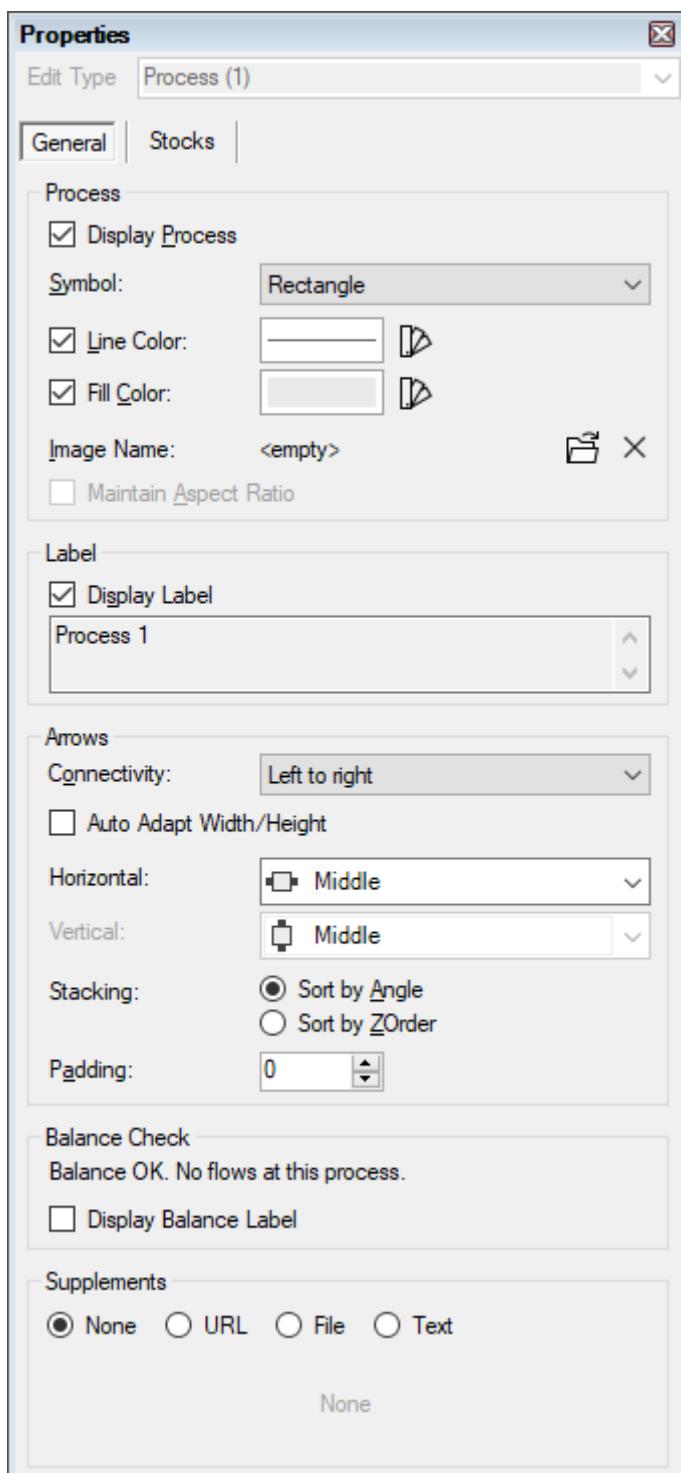


Figure 47: Process Properties

Balance Check: This feature will let you verify whether inputs and outputs at a process are balanced for the selected unit type. Enable this feature in the document options (the properties dialog with the document options is visible, when you click on an empty area in the diagram, i.e. when no explicit element is marked), if you want to perform a balance check at processes.

 Balance check must be enabled for the unit type in the 'Edit Unit Type' dialog before it can be used. Read more in chapter 9.

To do a balance check for the unit type for which this has been enabled, set the flag "Show balance warning at process" in the document options. A red marker will be shown on the process.

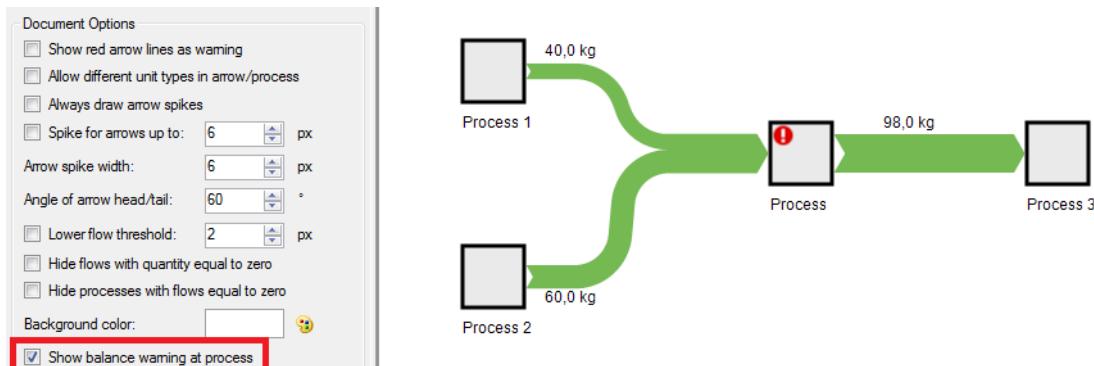


Figure 48: Option "Show balance warning at process" is turned on. A red warning marker is shown because input and output of the process don't match.

Hover the mouse pointer over the exclamation mark in the process to get more information. Additionally, when selecting the process, details will be shown in the process properties dialog in the 'Balance Check' panel.

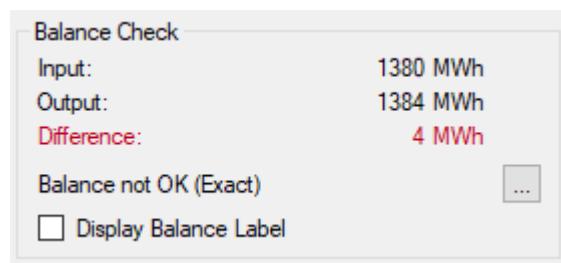


Figure 49: Balance check details at process, selectively per unit type

The configuration of the balance check (i.e. whether the sum of inputs and the sum of outputs for each unit type must match exactly, or whether a tolerance is permitted) can be set in the 'Balance Check Configuration' which can be called from this panel.



The 'Balance Check Configuration' is explained in detail in chapter 9.

Balance Label: Checking the option "Display Balance Label" creates a special text label for the process, that can be used to display the information from the balance check (e.g. sum input side, sum output side, difference input/output) in the editor next to the process.

The balance label can be enabled and edited for one or for several processes at the same time.

In the default setup, the balance label is made up from three lines (Input, Output, Difference) for each activated unit type with balance check. The balance label will be placed directly below the process.

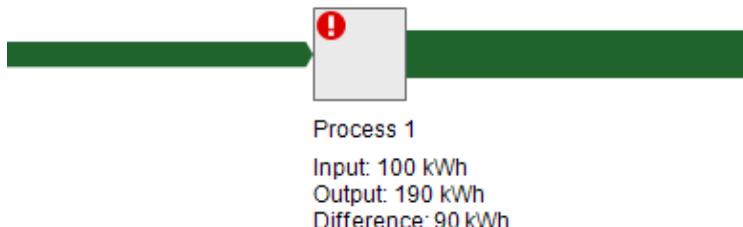


Figure 50: Default balance label at process, showing balance check values

There are many options to adapt the balance label, and to produce an adapted balance label. To do this, you have to switch to the option "Custom" in the properties dialog of the balance label.

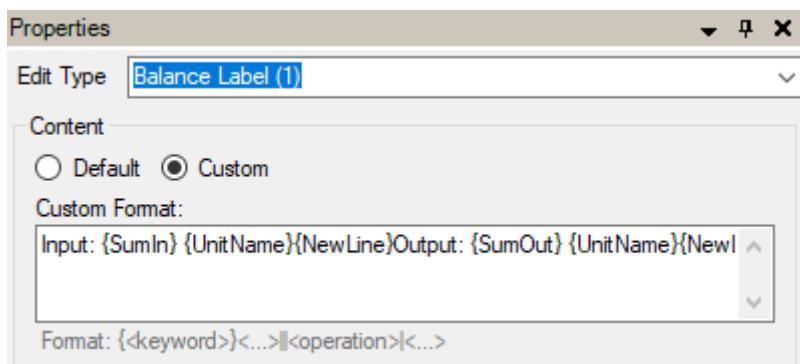


Figure 51: Balance Label Properties, custom format string

In the "Custom Format" field enter a format string using keywords in curly brackets (braces). After the keywords optionally enter a double pipe "||" followed by one or more operations. When using several operations, they must be separated with a pipe "|". Do not use line breaks within the string section for operations.

When typing an opening curly bracket "{" a selection list drops down and allows choosing a keyword. When typing a double pipe "||" or a pipe ("|") a selection list drops down from which an operation can be chosen.



Use of keywords for custom balance labels is similar to the custom arrow labels (explained above in chapter 5), but the available keywords are partly different.

Keywords:

{SumIn}	displays the sum value of all flows of the unit type on the input side of the process (same as in the balance check)
{SumOut}	displays the sum value of all flows of the unit type on the output side of the process (same as in the balance check)
{NewLine}	creates a line feed
{DiffAbs}	shows difference between the sums on the input and output sides per unit type as an absolute value

{DiffSumInMinusSumOut}	shows difference between the sum on the input side minus sum on the output side. Value can be positive or negative.
{DiffSumOutMinusSumIn}	shows difference between the sum on the output side minus sum on the input side. Value can be positive or negative.
{BalanceState}	shows balance state ("Balance OK" or "Balance not OK") as text. This text can be replaced with another string through the <code>replace</code> operation (see below).
{DiffUnitName}	displays the unit name for the difference value <code>{DiffAbs}</code> or <code>{DiffSumInMinusSumOut}</code> or <code>{DiffSumOutMinusSumIn}</code> . Note that for relative tolerance setting the unit name is "%"
{UnitName}	displays unit name for input or output value
{UnitTypeName}	displays unit type name (for the which the balance check is performed)

Operations:

balanceWarningColor("AAEEFF")	Colors the label in a font color specified by the hex value in brackets, if the balance warning is triggered. This color supersedes the default color set for the balance label in the properties
negativeColor("AAEEFF")	Colors the label in a font color specified by the hex value in the bracket, if the balance difference results in a negative value. This color supersedes the default color set for the balance label
replace("text1", "text2")	"text1" is replaced by "text2". Use this, for example to replace the default text "Balance not OK" yielded from the <code>{BalanceState}</code> keyword by another text. Use this also for translation into other languages.
setPostfix("text")	The text in quotation marks is set after the actual flow content label. Instead of a text string you can also use one or more key words: <code>{BasicUnitName}</code> <code>{CountEntries}</code> <code>{CountUnitTypes}</code> <code>{NewLine}</code> <code>{SumBasicUnit}</code>
setPrefix("text")	The text in quotation marks is set before the actual flow content label. Instead of a text string also use one or more key words:

	{BasicUnitName} {CountEntries} {CountUnitTypes} {NewLine} {SumBasicUnit}
setSeparator("text")	The character or text in quotation marks is used to separate the entry names in multi flow arrows (by default a line break is used).
showBalanceStrategyValues	Shows a dash "-" instead of a "0" in case there are no arrows with input or output flows at the process.
showOnlyForBalanceWarning	If the balance check does not trigger any balance warning, the whole balance label will be hidden.

Examples:

- Difference {DiffSumInMinusSumOut}
This balance label will show the difference of the sum of input flows minus the sum of output flows of one unit type. If output is larger than input, the difference is shown as negative.
- Difference
{DiffSumOutMinusSumIn}{DiffUnitName} || negativeColor("#D00020")
This custom balance label will show the balance difference if the sum of output flows is larger than the sum of input flows, but will show the value in red font color, should it be negative.
- {BalanceState} || balanceWarningColor("#D00020") | replace("BalanceOk", "OK") | replace("BalanceNotOk", "Warning!{NewLine}This process not balanced")
No absolute values for balance difference is shown in the custom balance label. Instead a text "Warning. This process is not balanced" will be shown in red color, if there is a difference, and the text "OK", if the balance warning is not triggered.

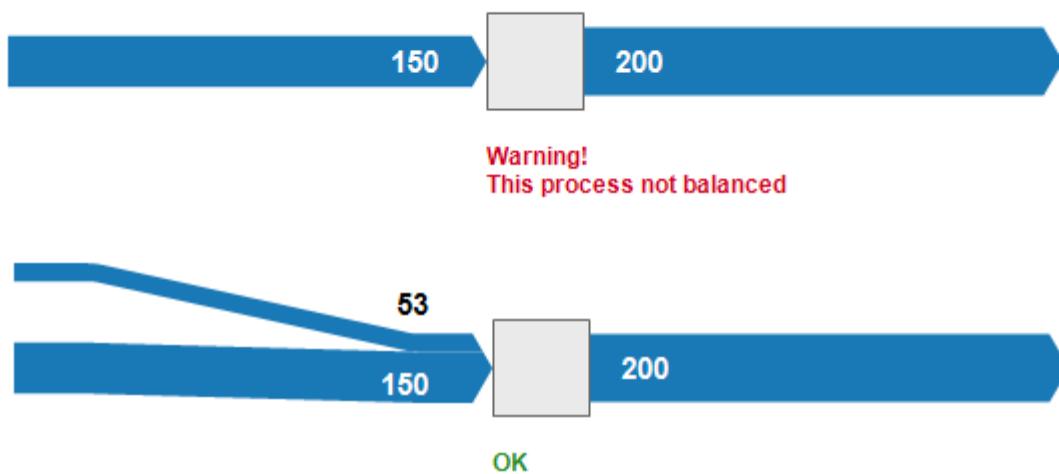


Figure 52: With an absolute tolerance set to "10", the process check at the top throws a text warning in red, while it returns "OK" in the example at the bottom (custom label keywords see third example above)

Using Images and Icons for Processes

The color of the process symbol border line and filling can be set individually. Instead of the default process symbol, you can also set an icon or image.

This feature is especially helpful, when you prepare your diagram for presentation, and want to create even more appealing Sankey diagrams.

Use the "Select Image" button in the process properties to load a graphics file instead of the default square or rectangle node symbol. The following file formats are supported: BMP, GIF, JPG, PNG, ICO, TIF, EXIF, EMF, WMF, UMF.

Set the option "Maintain Aspect Ratio" to keep the original image aspect ratio, even when the process shape is resized. To remove an image and return to the default process symbol, use the "Delete Image" button.

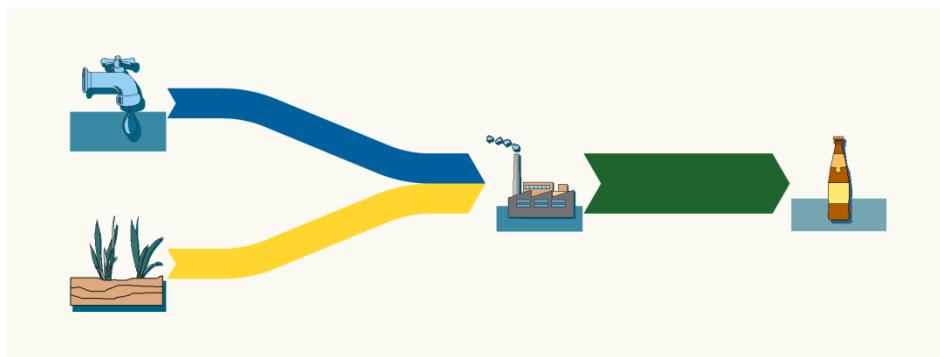


Figure 53: Sankey diagram section using cliparts as overlay for process symbols

A clipart library (icon library) licensed from a third party with approximately 100 PNG graphics files are included in e!Sankey and can be used to supply icons in process symbols. The default path to these libraries is "C:\Users\<USER>\Documents\<VERSION>\clipart\".



To preview the cliparts, the classic Windows open file dialog with image preview should be used. Make sure you have the option "Load images with cloud storage support" turned off in the 'User Interface' panel of the 'General' page in the 'Options' dialog.

There are many clipart images and icon files available on the WWW, that can be used free of charge (sometimes requiring source attribution).

Hidden Processes

If you prefer not to see the process box, it is possible to hide it by unchecking the 'Display Process' option in the process property dialog. The accompanying process label can be hidden separately, using the 'Display Label' option.

Often Sankey diagrams look better without the process symbols. Nevertheless, to draw the arrows, and to move the arrow head around, it is required to first draw the process symbols and then hide it.

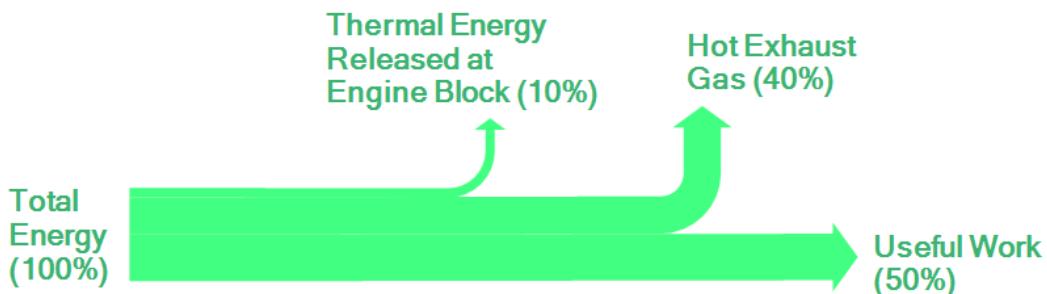


Figure 54: This simple Sankey diagram has four process symbols that are hidden

The process symbols will be shown transparently when the arrow that connects to them is marked. This allows dragging the process, if required. Process can also be hidden in the process list of the diagram properties dialog (click on empty area in the editor to bring up the diagram properties).

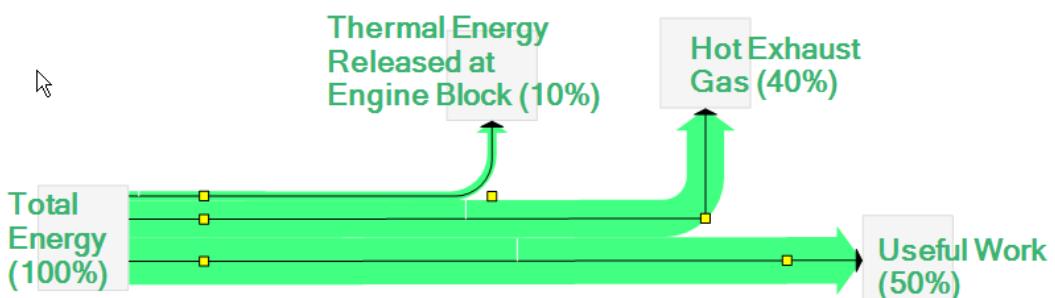


Figure 55: The same Sankey diagram, the process symbols are visible in transparent color when the arrows are marked

There is also a conditional visibility for processes, depending on whether the flows connected to a process have the flow quantity zero. This feature allows the hiding of arrows and connected processes in Sankey diagrams where there are (temporarily) no active flows. It is useful in connection to flow quantities fed from an Excel spreadsheet with the Live Link (see chapter 11)

Use the options "Hide processes with flows equal to zero" in the document options (in conjunction with the option "Hide flows with quantity equal to zero") to hide parts of a Sankey diagram where there are only zero flows.

Connectivity

The way an arrow connects to a process node depends on the connectivity setting in the process property dialog. The default setting is "Free", i.e. the connection direction is not restricted to one specific side at which the arrow has to dock.

If you want to force the arrow to connect to a specific side of a process, set the connectivity in the process property dialog to one of the following options: Left-to-Right, Right-to-Left, Top-to-Bottom, Bottom-to-Top. The automatic connection direction as shown above will be overruled.



Read more about how arrows connect to a process in the chapter 5 on arrows, section on connectivity.

Mode of Connecting: By default, the arrow connects with its center line (visible when you select the arrow) in the center of one of the sides in the

process. This docking point will be maintained, even when the process symbol's size is changed.

If you prefer the arrows to rather be connected with their lower border at the bottom or their upper border at the top, then choose 'Bottom' or 'Top' in the dropdown list for horizontally connecting arrows (arrow docking at a process from the left or from the right).

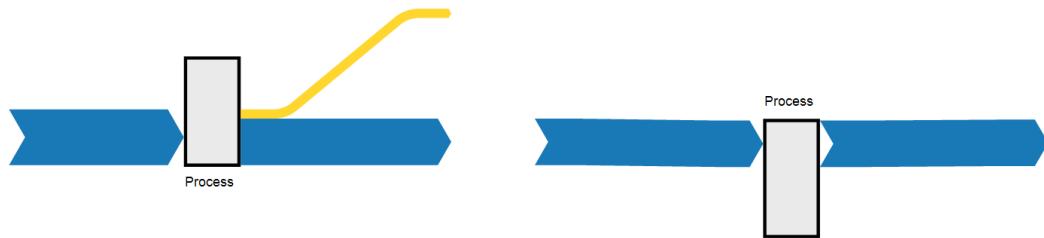


Figure 56: Arrow connectivity horizontal/bottom and horizontal/top

In the same way, if you want to force the arrows to connect with their left border aligned with the left side of a process or with their right border aligned with the right side of a process, then choose 'Left' or 'Right' in the dropdown list for vertically connecting arrows (arrow docking at a process from the top or from the bottom).



Figure 57: Arrow connectivity vertical/left



Use the connectivity settings horizontal/bottom, horizontal/top, vertical/left, vertical/right in conjunction with the alignment of processes and the command 'Adapt Process Size' ('Height to Arrow' and 'Width to Arrow', see below) to achieve the best results.

Changing Process Size and Shape

When inserting a process by clicking in the drawing area, the process is shown as a square (48 x 48 px). The size can be changed by dragging the marker points that are shown when the process is selected.

To adapt process symbols of different size and shape all to the same process size, mark the processes that require adaptation, then go to one process that

has the correct size and shape (and can serve as the role model for the others). From the context menu of this process symbol choose "Set Size to this Element".

Also, the process height or width can automatically be adapted depending of the arrows connected to it. To do so, choose the command 'Adapt Process Size' from the context menu of the process. In the cascading menu select 'Height to Arrow', 'Width to Arrow', or 'Height/Width to Arrow'.



Figure 58: Default process size ('Process') and automatically adapted process height ('Process 1')

Auto Adapt Width/Height: should you wish to always set the process height (or width) so that the size changes when the width of the attached arrows changes, then you can activate the option "Auto Adapt Width/Height". Note that this option is only available if the connectivity is different from "Free".



"Auto Adapt Width/Height" is a great feature to control the size of the processes, in particular, if the arrow width cannot be determined beforehand, e.g. because the flow quantity values are fed via Live Link from an Excel Sheet.

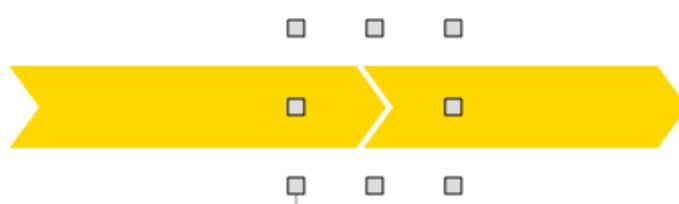
For obvious reasons it is only available for connectivity setting "Left-to-Right", "Right-to-Left", "Top-to-Bottom" and "Bottom-to-Top". If arrows connect from all sides (connectivity "Free") the option is greyed out.

Also mind that, should the arrow width become very small, the process height/width may become too small.

Padding for Processes: By default the arrows connect exactly at the border line of a process. This looks OK in many cases and works especially well when you remove arrow head and tail.

With a process icon instead of the default square symbol, however, the connecting arrow sometimes seemed to be "glued" to the icon too closely. The padding option for processes in this case can be set to a positive value, increasing the distance of the arrow connect by adding an invisible padding area.

The padding value can also be negative, so that the arrow head and tail connection underruns the default border line of the process.



Figures 59: Padding at process, negative value, process itself is hidden

Aligning Processes

To align a number of process elements, mark these elements, then go to the process node to which the other elements shall be aligned. Open the context menu and choose "Align to this Element". From the cascading menu select one of the alignment modes.

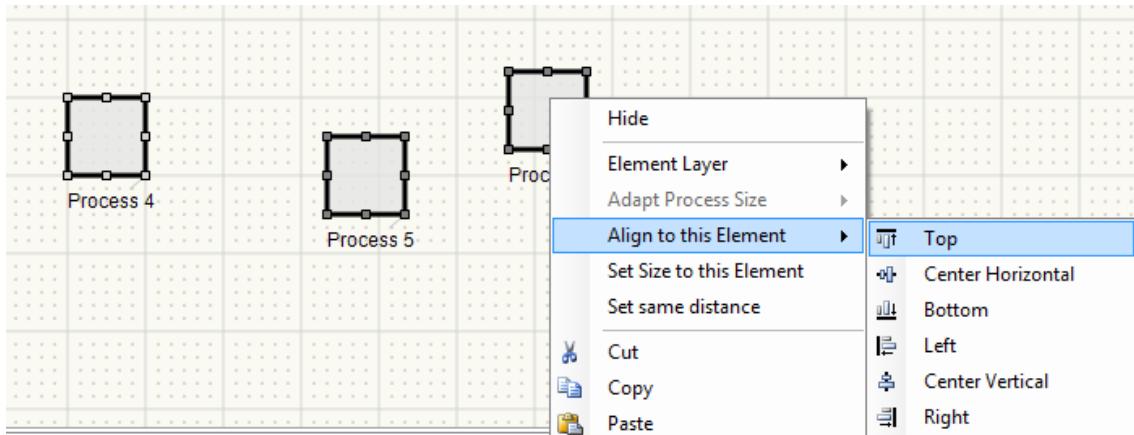


Figure 60: Aligning three processes to the top (using the right process as orientation)

In addition to the alignment in one line, it is sometimes necessary to distribute a number of process elements evenly at the same distance.

To set several processes at a same distance from each other, mark these process elements, then open the context menu and choose "Set at Same Distance".



Did the alignment or equidistant setting go wrong because you accidentally chose the wrong alignment side or the processes ended up clumped together? Just use 'Undo' (CTRL+Z) to revert the action.

Supplements for Processes



The supplements feature is available in e!Sankey pro and calc versions only.

To link additional information to processes, it is possible to define media files or other supplements. These can be called in the editor by opening the context menu of a process and choosing the command "Open Supplement". Alternatively, a process can be marked and the keyboard shortcut F6 can be hit.

The following supplements can be linked behind a process:

- URL (web address)
- File (any file on the hard disk, other Sankey files)
- Text (text with simple common markdown formatting)

Links to files are defined in the "Supplement" panel of the process properties. One supplement per element is possible.

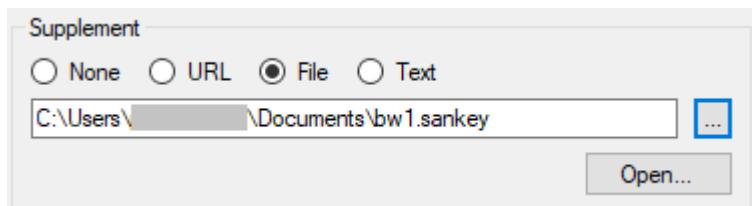


Figure 61: Setting a supplement. Here another e!Sankey file on the hard disk is called

The default setting for supplement type is "None" when no file is linked.

To open a web page, choose the supplement type "URL" and enter the full path in the field below. Hit the button "Open..." to test the link.

To set a file as supplement, choose the type "File" and type the file path in the field below. You can use the button "Browse" to search for the file on your hard disk. The file will open with application defined for the respective file type.



If the linked file is not found defined in the path, then e!Sankey will additionally go looking for it in the local directory where the calling Sankey diagram file is located. By this, it is easy to just send the .sankey file that has linked files along with all the supplements to another user, who just has to make sure all files are located in one folder, so that the call of supplements works.

Using file type "Text" will display a text entry field. In this text box either type simple text or use Common Markdown to apply some formatting to the text output. For details please visit <https://commonmark.org/help/>. The text will show in a popup window when the process's supplement is called.



If supplements are set for processes, the link will also be included in the SVG graphic file export. The feature to call media files or other supplements can then also be used from the exported image file. See chapter 13 on SVG for more details.

Stocks: "Stocks" are a feature of e!Sankey pro and e!Sankey calc. This feature allows painting stubs to represent stock increase or stock decrease, or balance differences at processes.

Stocks are managed on the second tab of the Process Properties. If you wish to set stocks increase, stocks decrease or balance differences at processes, switch to the second tab page.

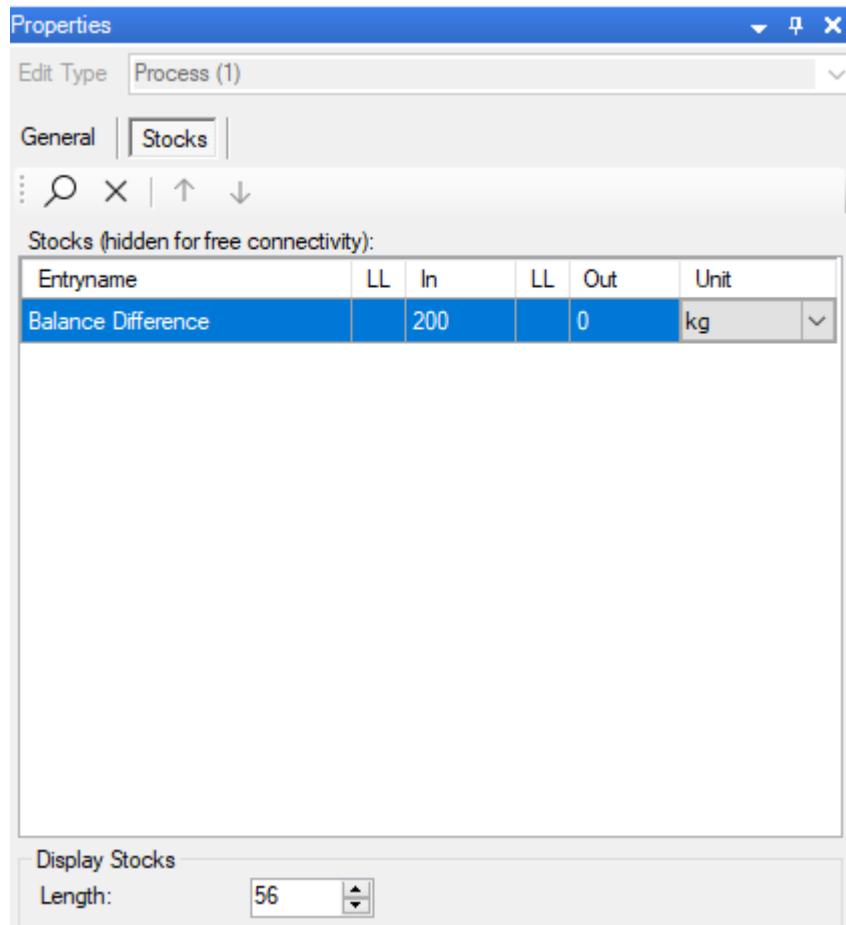


Figure 62: Stock changes on the input side and on the output side of a process

To visualize a stock increase or a stock decrease simply drag an entry from the Entries window onto a process symbol. Alternatively add the entry in the "Stocks" table on the second page of the process properties. Then enter a quantity for the entry in the column "In" and/or "Out".

The order of stocks in the table can be adapted using the 'Move Up' / 'Move Down' buttons.

An entry can be removed from the stocks table by selecting it and then clicking on the button 'Delete Stock'.



Values listed in this table for stocks on the input and output side can be fed from an Excel worksheet via the Live Link (versions e!Sankey pro and e!Sankey calc only). In this case a symbol is shown in the column "LL". Further hints on the Live Link to Microsoft Excel can be found in chapter 11



Users preparing Sankey diagram template files for use with the e!Sankey SDK (automation of Sankey diagram creation) can see an additional column 'Key' in this table. Further hints on the 'Key' field in chapter 15

Stocks are only shown if the 'Connectivity' setting is not set to "Free" (read more on connectivity in section 5).

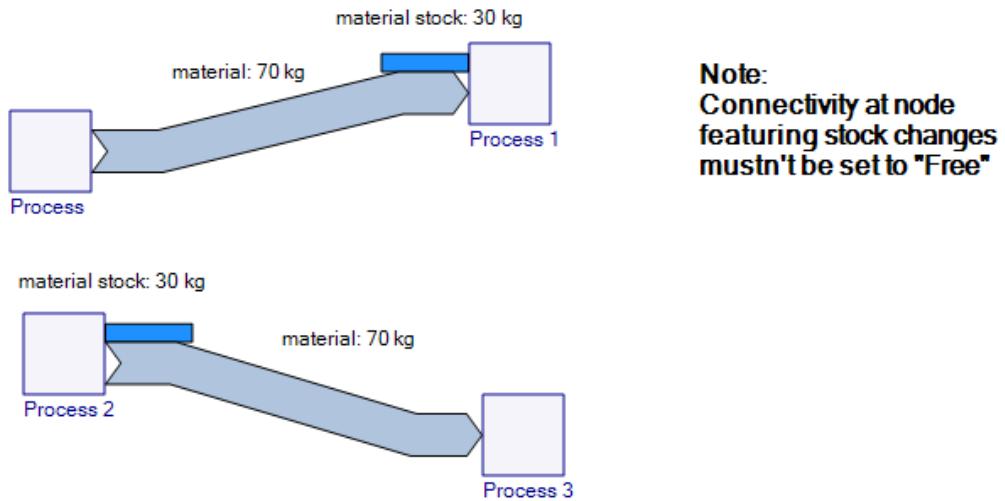


Figure 63: Stock changes on the input side and on the output side of a process

7 Additional Diagram Elements

Graphical Shapes

Additional graphical elements are available to improve a Sankey diagram layout. These are: rectangle (not the process symbol!), rounded rectangle, ellipse, and line (not the Sankey arrow line!). These items are available in the 'Shapes' menu in the toolbar.

The insert mode for graphical shapes elements is turned on and allows repeated drawing of the selected shape until you return to the edit mode with a right mouse click or choose another element from the toolbar. An alternative single shape element insert mode can be activated in the 'Options' dialog on the 'General' page.

The rectangle, if set to transparent can be used to draw a frame around certain sections of the diagram for additional graphical structuring or grouping.

Simple non-Sankey arrows, lines and boxes can be used to add comments in a diagram, as shown in the figure below.

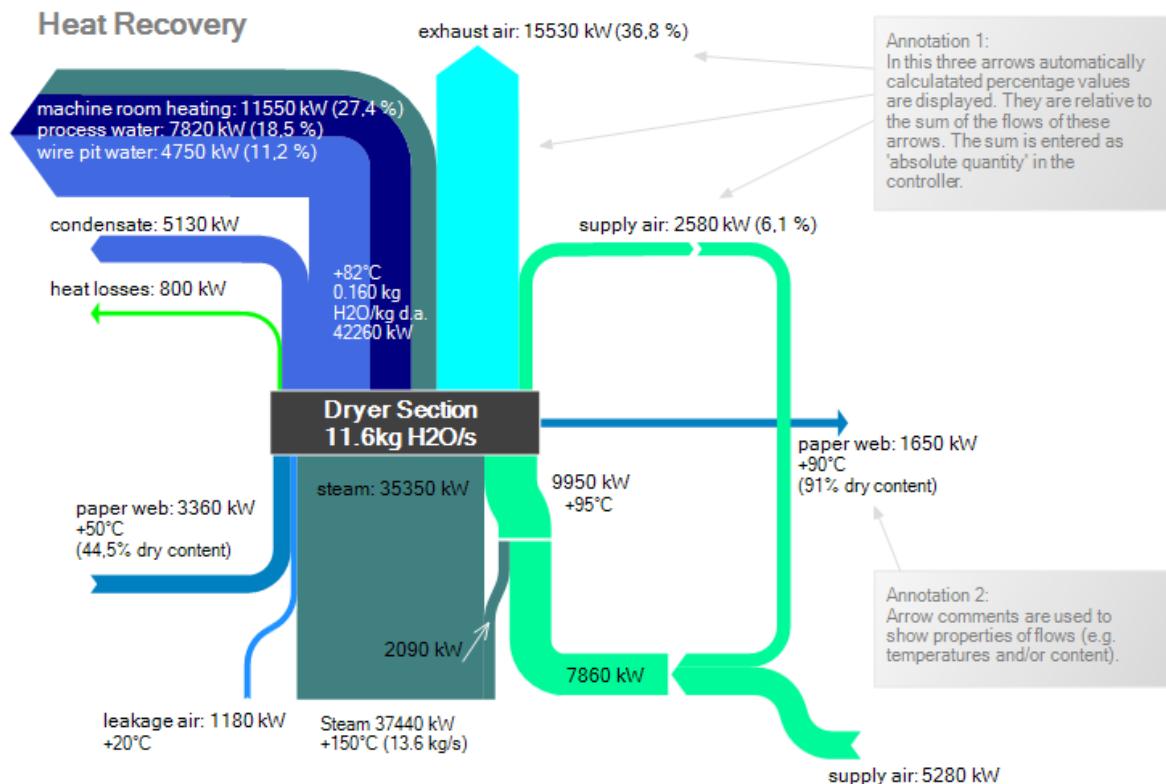


Figure 64: Use of boxes with fill color and pointer arrows for additional comments

Text Element

To add additional text to a Sankey diagram, select the "Add Text" button from the editor toolbar. Alternatively choose the command "Text" from the 'Draw' menu. Then click at the position in the editor where the text element should be placed.

The insert mode for text elements is turned on and allows repeated drawing of these elements until you return to the edit mode with a right mouse click or choose another element from the toolbar. An alternative single text element insert mode can be activated in the Options > General dialog.

The 'Text' property dialog can be used to replace the default text. You can also directly click the text element to edit the text (inline editing).



If you have text copied to the clipboard, the 'Paste' command from the context menu of the diagram will create a text element and add the text at the cursor position.

Alignment, font, font size, font color can also be edited in the text properties for one or more selected text element.

Text labels can be rotated either by dragging the yellow point, or by entering an angle value in the properties.



Text labels can be linked to an external source using Live Links (pro version only). Read chapter 11 for more information.

Image Element

Image elements (photo, clipart, logo, button) may be used to graphically enhance the Sankey diagram. For example, a company logo can be displayed near the actual Sankey diagram in the editor area.

Image elements can also be used as background for the Sankey diagram. This allows e.g. adding a map, a drawing of the shop floor, a technical drawing etc. in the background of the Sankey diagram.

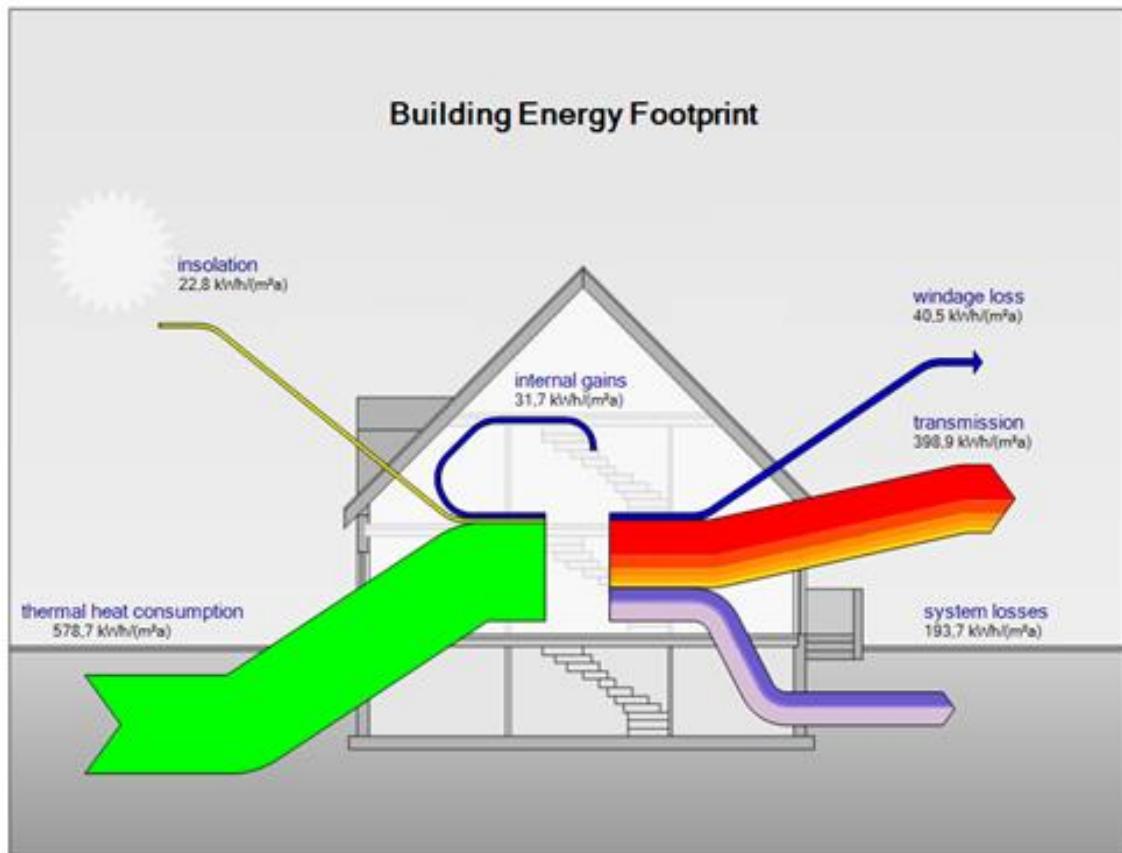


Figure 65: Background image in a Sankey diagram

To add an image, choose "Image" from the 'Draw' menu. Then draw a frame with the dimensions the image shall have in the editor area. In the properties dialog of the image element, click on "Open Image File" to select a graphics file. The following file formats are supported: BMP, GIF, JPG, PNG, ICO, TIF, EXIF, EMF, WMF, UMF.

Change the element layer using the commands from the context menu or the corresponding buttons in the toolbar. Typically, the image element will be behind the Sankey diagram ("Send to Back").

The image element can be resized using the marker points. Marker points are not visible, if the option "Original Size" is turned on.

You can set a tick mark in front of the option "Maintain Aspect Ratio" to ensure that the image is not distorted by changing width/height proportions. Use the option "Original Size" to reset the image size after the size or shape has been modified.

"Lock Position" can be used to fix an image at its present position and to avoid that it is selected or moved accidentally

Image transparency can be set in the "Transparency" field. Reduced transparency might produce a good effect for background images.

To remove the image element, mark it and press "DEL" or use "Delete" from the context menu.

Supplements for Shapes, Texts, Images



The supplements feature is available in e!Sankey pro and calc versions only.

Just like for arrows and processes it is possible to link additional information to graphical shapes, text elements and images using supplements. These can be called in the editor by opening the context menu of the element and choosing the command "Open Supplement". Alternatively, the respective shape, text element or image can be selected and the keyboard shortcut F6 can be hit.

Links to files are defined in the "Supplement" panel of the element properties. One supplement per element is possible.

To open a web page, choose the supplement type "URL" and enter the full path in the field below. Hit the button "Open..." to test the link.

To set a file as supplement, choose the type "File" and type the file path in the field below. You can use the button "Browse" to search for the file on your hard disk. The file will open with application defined for the respective file type. For example, a PDF file will open in the installed PDF viewer application. You can check with the button "Open..." to see if the supplement file path is properly set.

Using file type "Text" will display a text entry field. In this text box either type simple text or use Common Markdown to apply some formatting to the text output. The text will show in a popup window when the supplement of the shape, text element or image is called.



Figure 66: An image file is used to invite the viewer of the Sankey diagram to open a supplement: rectangle shaped button and icon for a link on the WWW.



Using links to other files or to an URL on the web, or to another Sankey diagram file (.sankey) is a useful feature in connection with the SVG export. If you activate the option for supplements, the exported SVG diagram file will also contain the links. Should the SVG file be viewed in a browser, the links are clickable.

See chapter 13 for more details on the SVG diagram export.

Legend

To identify the flows (streams) in a Sankey diagram by their color, in addition to any flow labels that might be visible next to the Sankey arrow, a legend can be added in the diagram.

Add a legend element by clicking on "Show Legend" in the 'Draw' menu.

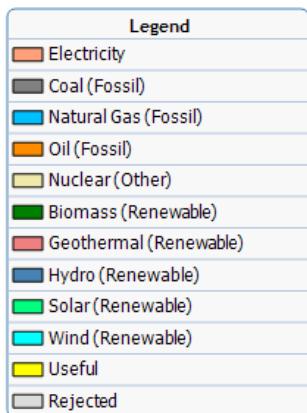


Figure 67: Legend for a Sankey diagram, sorted by groups with some custom sorting

The legend can be dragged to the most appropriate position and adapted using the legend property dialog. In this property dialog, there are two pages of properties. Click on "Graphical" to adapt lines, background color, font, and other graphical items of the legend.



You can remove (rather than hide) the legend by deleting it. The legend can be produced anew, by selecting on "Show Legend" in the 'Draw' menu.

In the panel "Entries" choose whether you wish to show only the "Name of Entry" in the legend, or if you wish to add the basic unit name, the unit type or the group name in brackets behind the legend entry.

The color box for an entry can show a frame line around it ("Show Border of Color Box").

On the page "Content" you can set options for sorting and display of legend entries. Sorting of the entries in the legend by default is alphabetically. You can also sort "Alphabetically Group Name, Entry Name" or switch to "Custom". For custom sorting use the list below and mark specific entries, then shift them up or down using the two arrow buttons.

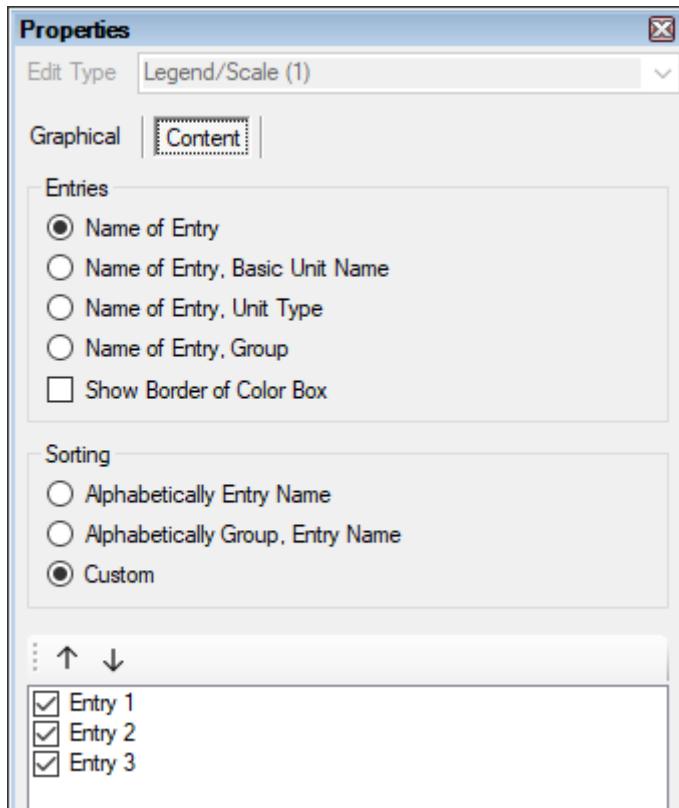


Figure 68: Legend properties, page 'Content'

Use the "DEL" key or the command "Delete" from the context menu to remove the legend again. It can be shown again any time by calling "Show Legend" from the 'Draw' menu.

Scale

When individual flow quantities are not shown on each arrow, a scale can be displayed in the diagram. The scale will present three representative arrow magnitudes for each unit type.

To show the scale element, choose "Show Scale" from the 'Draw' menu.

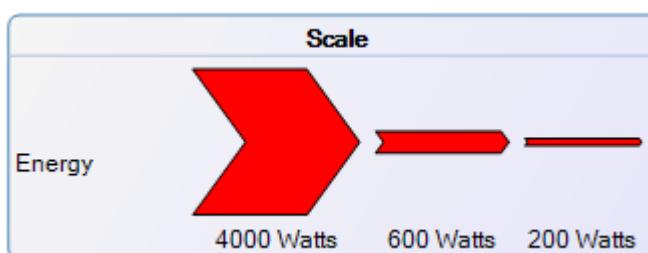


Figure 69: Scale

The properties of this graphical element can be edited in the properties dialog when the element is marked.

To remove the scale element, mark it and press "DEL" or use "Delete" from the context menu.

Useful Hints for Drawing Sankey Diagrams

Copy & Paste: 'Copy & Paste' can be used to copy diagram sections. You can copy diagram sections between different diagram files (Hint: open several files in tabbed editor areas), but mind that the flows in the copied file might have different unit types and colors in the other diagram file. There is no automatic unit conversion. Scaling might be required after copying and pasting between diagrams.

Multiple Element Editing: To mark several elements of the diagram, drag a marking frame around them with the mouse button pressed. Mark the whole diagram with all elements using CTRL+A. Move the selected elements of the diagram with the mouse or the cursor keys or edit several element properties at once. For editing the properties of multiple elements, choose the element type from the dropdown list 'Edit Type'.

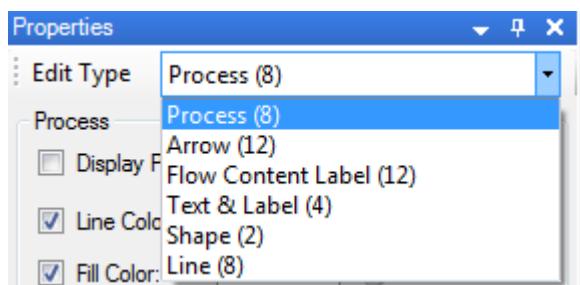


Figure 70: Multiple element editing in properties dialog



To select all elements of a specific type for joint editing, you can mark one of the elements (e.g. an arrow) first, then use CTRL+A. The respective element is then already been set in the "Edit Type" dropdown list. Property settings will be applied to all elements.

Set as Default: Alternatively use 'Set As Default' from the context menu of an element (e.g. arrow, process, ...) and mark the settings of the current element as the preferred one for this element type. When inserting a new element of this type the settings will be used. This requires however, that you have a vision of how the arrows and processes should look like at an early stage of designing your diagram.

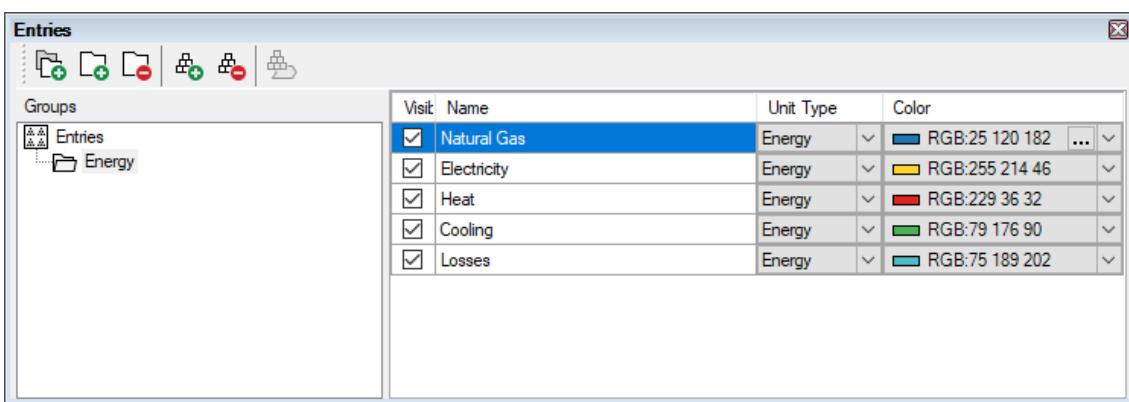
Use of Grid: To properly align process elements, it is helpful to turn on the grid. Process elements will snap to the grid if the "Snap to Grid" button is also active. Both buttons can be found in the editor toolbar. Options for the grid can be set in the 'Options' dialog, such as the distance of grid points and additional grid helper lines. By default, the grid distance is 6 px.

8 Entries

For each diagram, the items used as flows in the arrows have to be defined in the 'Entries' list. This list is located at the bottom of the screen by default.

Create a new entry by clicking on the 'Add Entry' button in the 'Entries' window. Alternatively, use the keyboard shortcut CTRL+E to create a new entry in the current folder. Replace the default "New Entry" placeholder with the actual name and select the unit type (for unit types see below in chapter 9) of this entry.

A color will be assigned automatically, but you can choose any other color from the color set defined for the unit type, by selecting it from the dropdown list. Any other color can be chosen by clicking on the button with the three points (for more information see color management dialog below).



The screenshot shows the 'Entries' dialog window. On the left, there's a tree view labeled 'Groups' with 'Entries' and 'Energy' selected. The main area is a table with columns: 'Visit' (checkbox), 'Name', 'Unit Type', and 'Color'. The table contains five rows:

Visit	Name	Unit Type	Color
<input checked="" type="checkbox"/>	Natural Gas	Energy	RGB:25 120 182
<input checked="" type="checkbox"/>	Electricity	Energy	RGB:255 214 46
<input checked="" type="checkbox"/>	Heat	Energy	RGB:229 36 32
<input checked="" type="checkbox"/>	Cooling	Energy	RGB:79 176 90
<input checked="" type="checkbox"/>	Losses	Energy	RGB:75 189 202

Figure 71: Entries dialog

The 'Entries' list can be grouped in folders. Groups help to structure extensive lists of materials, substances, energies etc.

A new group on the same level can be created by clicking on the button "Add New Group". Use "Add New Group" to create a folder within the currently selected entries folder. Folder symbols can be moved within the hierarchical structure on the left side of the "Entries" window using drag&drop. A selected folder can be deleted using the button "Delete Folder". Mind that entries within the folder will also be deleted (after an additional request for confirmation) even if they are already used as a flow in the Sankey diagram.

Adding Entries in an Arrow: As described above in the "First Steps" section, the entries from the entries list are added to an arrow in a Sankey diagram and a quantity is stated.

Adding a flow to an arrow from the Entries window can be done in three different ways:

- Drag one or more entries directly onto the arrow in the Sankey diagram
- Mark the arrow in the diagram, so that the arrow properties dialog comes to front. Then drag one or more entries onto the 'Flows' table in the arrow properties dialog
- Select one or more arrows in the Sankey diagram, so that the arrow properties dialog comes to front. Then select one or more entries in the 'Entries' window and click on the button 'Insert Entry in Arrow'

The name of the entry is displayed in the arrow content label next to an arrow when the entry has been used to define a flow and a quantity has been entered.

Changing a name of a material, a unit, or a color will result in an updating of the flow everywhere in the diagram wherever it is used.

Hide all Flows of an Entry: By default flows for all entries are visible. To hide all flows of a specific entry in the Sankey diagram, you can temporarily remove the checkmark in the 'Visible' column in front of the entry name. This feature allows showing only certain flows in the Sankey diagram.

Note that for avoidance of confusion, the settings for hidden flows are not stored. When you save a Sankey diagram file and reopen it again, all flows will be displayed.

A similar feature exists in the 'Controller' window, where all flows that belong to a certain unit type can be hidden by removing the check mark in front of the scaling panel of the unit type.

Hide Zero Flows Individual flows can be set to hidden, if their flow quantity is zero. This feature allows the hiding of arrows and connected processes in Sankey diagrams where there are (temporarily) no active flows. It is useful in connection to flow quantities fed from an Excel spreadsheet with the Live Link (see chapter 11)

Use the option "Hide flows with quantity equal to zero" in the document options (in conjunction with the option "Hide processes with flows equal to zero") to hide parts of a Sankey diagram where there are only zero flows.

Delete Entry: Deleting an entry from the entries list will lead to a removal of all flows of this entry in the Sankey arrow. You will be asked to confirm this action. The command 'Delete Unused Entries' from the context menu of the 'Entries' window can be used to remove entries that are not used as flows in the diagram.



When saving a diagram as template, the Entries list will be part of the template. Therefore, you can create a model Entries list that you wish to use in different of your diagrams and save it as a template file (.santem). New diagrams created using this template will feature the pre-defined entries list, including the colors and unit settings.

Color Management: By default, the color pallet defined for a unit type will be suggested for the entries defined within the unity type (see chapter 9 on unit types). However, individual colors can of course be chosen for any entry.

For choosing individual colors for an entry, click on the button with the ellipsis (...) in the 'Color' column of the 'Entries' window.

The 'Edit Fill Color' dialog will be prompted. This dialog has three tabs. On the "Named Color" tab choose from one of the 256 named colors.

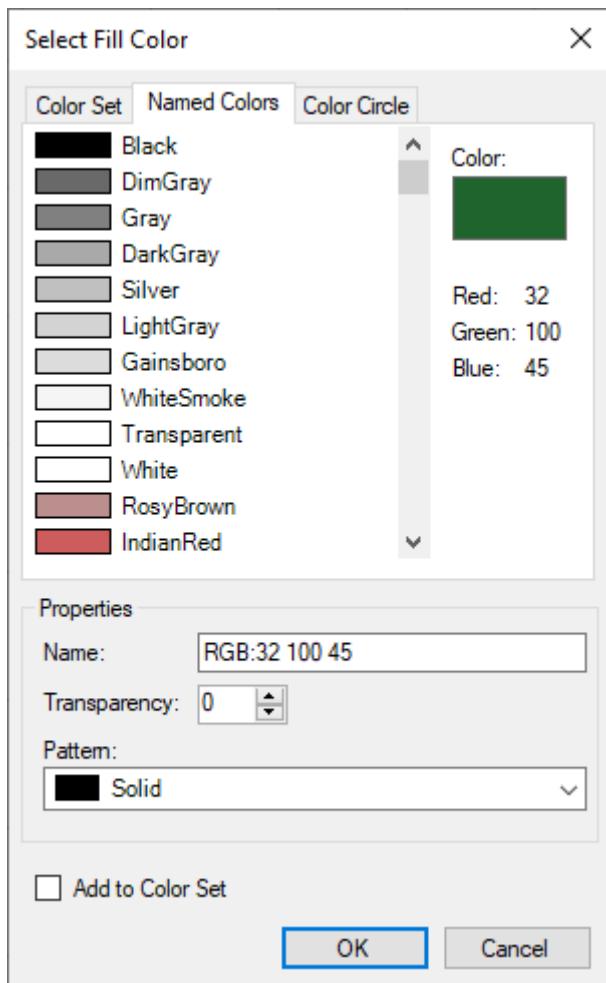


Figure 72: 'Select Fill Color' dialog, 'Named Colors' tab

Alternatively use the color wheel on the "Color Circle" tab to define any other color by its RGB value, or using values for hue, saturation, brightness.

You can create a list of favorite colors (shown on the 'Color Set' tab) that will be populated, when the "Add to Color Set" check box is marked when choosing a color.

Transparency can be set from the dropdown list in the Properties pane.

You can choose a fill pattern for the color from the dropdown list in the Properties pane on the left.

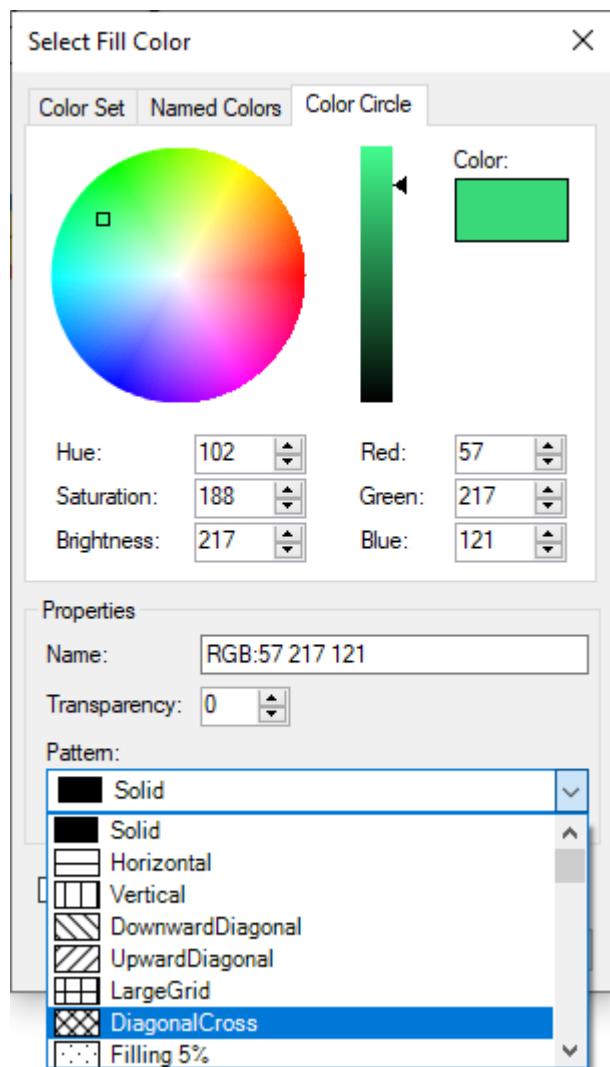


Figure 73: Color Circle tab with pattern drop down list

9 Unit Types

For each material in the Entries dialog, a unit type has to be selected. Unit types are administered in the "Edit Unit Types" dialog accessible using the "Edit Unit Types" button in the 'Controller' window.



Depending on the template you have chosen for opening the Sankey diagram file, several unit types may already be defined and ready for use. If there are no unit types available, it is required to define at least one unit type, before being able to define entries. In most templates shipped in e!Sankey the common unit types "Mass" and(or "Energy" are pre-defined and activated.

The names of the unit types are listed in the "Unit Type" list box at the top. Mark one entry in this list to view the basic unit and the other units available for this unit type in the table in the bottom part of the window.

Name	Coefficient
kg	basic unit
g	0,001 kg = 1 g
t	1000 kg = 1 t
kt	1000000 kg = 1 kt

Figure 74: Edit Unit Types dialog

The list of unit types can be sorted by using the buttons 'Move Up' and 'Move Down' with the arrows below the list. Mark one entry then click on these buttons to change its position in the list. The order of the unit types is decisive for the order of the scaling sliders in the 'Controller' window, and the sorting of the unit types in the dropdown list when defining a new entry (see chapter 8).

Additional unit types can be defined using the button "Add a New Unit Type" with the plus sign. For a new unit type enter a name in the field "Name", define a number format for display of quantities in this unit type and – if you wish to – define a color pallet for this unit type.

The two additional options "Used" and "Balance Check" can be activated for the marked unit type.



Read further down how to define units within a unit type.

Number Format: The field "Display Format" can be used to individually assign a number format to the selected unit type.

All quantities are formatted to match the chosen format. By this, it is – for example – possible to define integer values for "Mass" in tons, and scientific number format for another unit type e.g. additives (in mg).

The codes that can be used in the number format are as follows:

- **0**
The flow value is displayed as an integer number. If it has decimal digits it will be rounded to the next full number.
- **0.00**
The number is shown with exactly two decimal places. The value will be rounded to two decimal places or filled with zeros if there are less. This is the common number format for currencies.
- **0.###**
The number is displayed with three decimal digits. If it has more decimal places it will be rounded to three decimal digits. If it has less than three, filling zeros will not be displayed.
- **0,0**
Use a comma after the first zero to display thousand separators (e.g. five million is shown as '5,000,000'). Please note that the thousand separators from the Windows Regional Settings is used.
- **0,0.00**
The comma after the first zero is used to add thousand separators (see above). The number of decimal places is fixed to two places (see above).
- **e**
The letter 'e' in the number format field is used to display a number in the scientific number format (standard form, exponential notation).
- **0.0;"error";<"0,1"**
A combination of number formatting strings can be used. The one shown above is a combination of three format strings, separated by semicolons (';').
The first section ('0.0') is applied to positive numbers (fixed one decimal place, see above).
The second section (string "error") is used for negative values. Since negative values cannot be displayed in e!Sankey, a specific number format is not applicable. Instead of the negative number the string within the quotation marks is shown.
The third section ('<"0,1"') can be used for null values. If, for example, rounding of very small values would turn the number to

zero, the operator and the string within the quotation marks can be shown (in this example '`<0,1`').

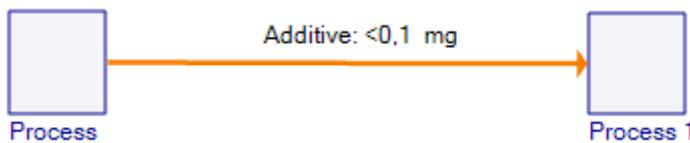


Figure 75: Example for the use of a number format for a Unit Type

Color Set: A color set can be defined for each unit type in the "Color Set" field. If a color set is defined, the color of an entry defined within this unit type will be suggested from this pre-defined color set. Nevertheless, it is always possible to assign individual other colors to an entry, even if this color has not been defined in the color set.

Click on the button "Edit Color Set" to open the color pallet definition dialog. In this dialog colors can be selected and added to the color set for the unit type. Use the button "Add" to amend the color to the list on the right side. Use Replace to overwrite the marked entry in the list with another color. With the arrow buttons you can change the order of the colors within the color set.

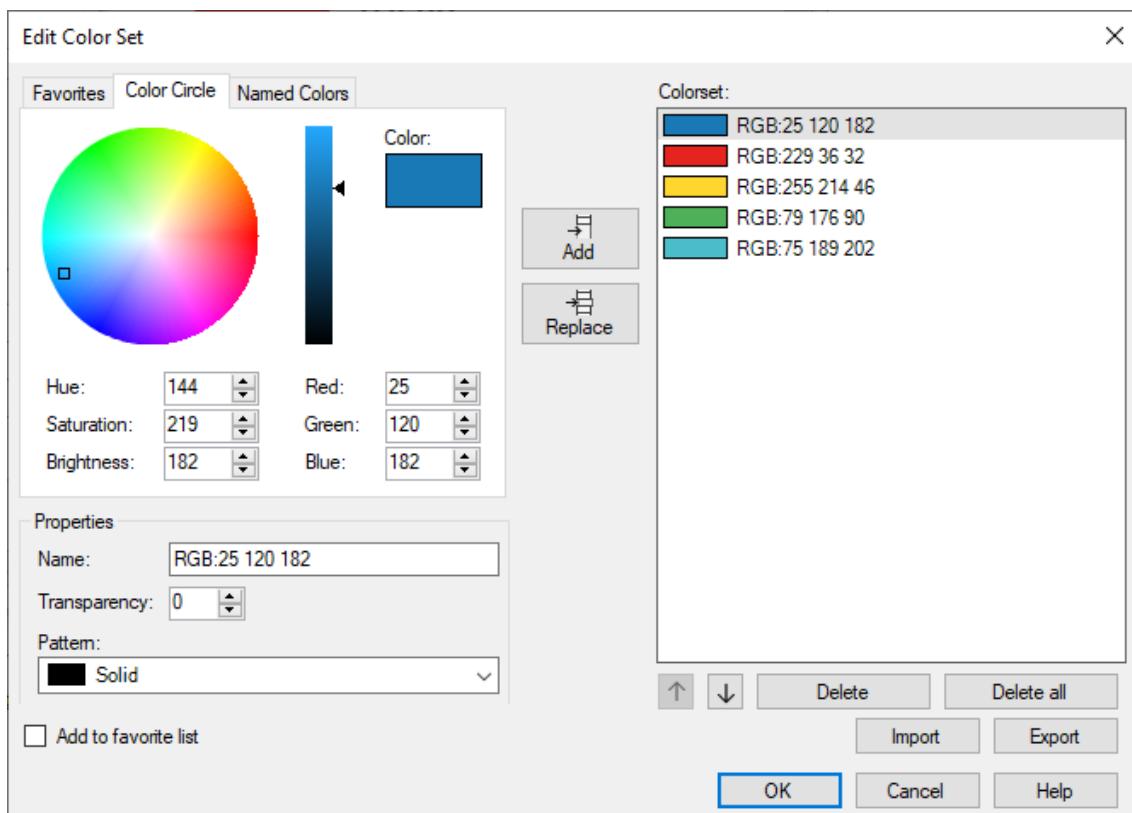


Figure 76: Creating color pallets for unit types

Balance Check: This feature will enable you to verify whether inputs and outputs at a process are balanced for the selected unit type. Enable this feature if you want to perform a balance check at processes.

There are three different modes for the balance check per unit type. Click on the button "Configure Balance Check" in the "Edit Unit Types" window to open the configuration dialog:

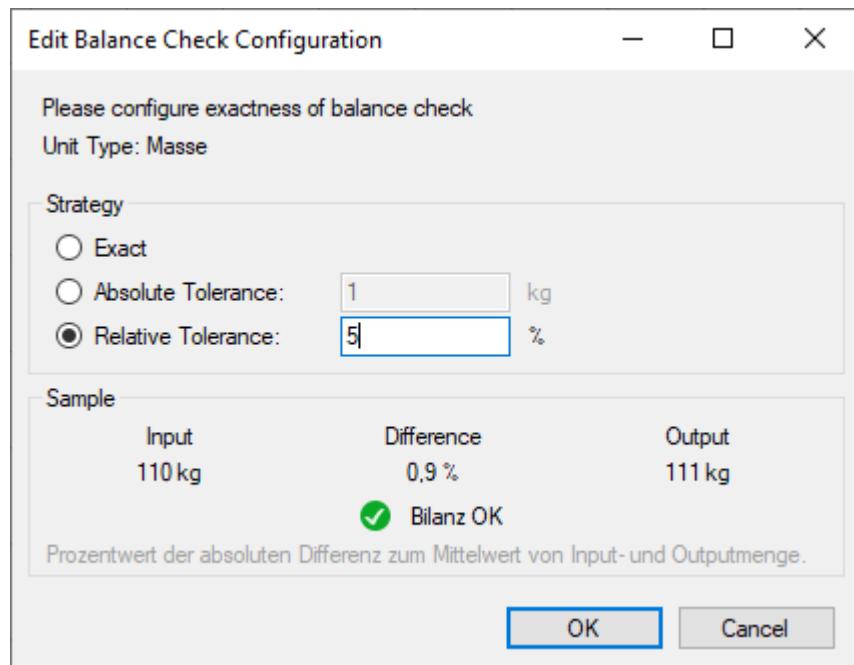


Figure 77: Balance check configuration

Choose one of the settings in the "Strategy" panel:

- **Exact:** input and output flow quantities of each unit type must be identical at a process node, otherwise a balance warning will be triggered. Note that even a very small difference will lead to a warning.
- **Absolute Tolerance:** Enter a value in the basic unit for the unit type until which a difference between input and output flows at a process node does not trigger a balance warning.
- **Relative Tolerance:** Enter a value in percent until which a difference between input and output flows at a process node does not trigger a balance warning. The percentage relates to difference to the mean value of input and output.

The setting currently configured for a unit type is also shown in the "Balance Check" panel in the process properties.



See chapter 6 on processes for settings and visualization of the balance check per unit type. The visual balance warning at the process ("exclamation mark") can be suppressed, even though it is activated for one or more unit types.

Also check the section on balance labels in chapter 6. The values shown in the balance check can be displayed in the Sankey diagram near the process in a customizable format.

Used: Only if the check box "Used" is checked, will the unit type be activated, and entries can be defined using this unit type. If you have a template with many unit types defined, you should only set this flag for unit types that you are actually using for flows. Otherwise you will have many (unused) scaling sliders in the 'Controller' and a long dropdown list of possible unit types to select from when defining a new entry.

Units for a Unit Type: For each unit type defined in the "Edit Unit Types" dialog at least a basic unit must be defined. The basic unit can be "kg" or "ton" for the "Mass" unit type, it can be "kWh" or "PJ" for the unit type

"Energy". If you have defined any other unit type by yourself, please think of a meaningful basic unit. When no other units next to the basic unit are set, then all flows of entries that have this unit type are entered and shown in the basic unit.

Units can be used to enter flow quantities in arrows and stock change quantities (stock increase and stock decrease) in processes. Even though the quantities are entered in another unit, it will be converted to the basic unit for the unit type and the width of Sankey arrow will still be displayed correctly and proportionally.

To change an existing basic unit, just click in the first line of the units table in the "Name" column and edit the unit name there. Mind that changing a basic unit does not convert any flow quantities. The existing quantities will just show the modified basic unit name (e.g. "cbm" instead of "cubic metres").

Additional units with a conversion factor can be defined in the list of units for a unit type. Click on the button "Add Unit" next to the table to create a new entry. Define a name and enter the conversion factor of the unit to the basic unit in the "Coefficient" column. Check the conversion shown upon leaving this field.

Units for Energy	
Name	Coefficient
MJ	basic unit
kJ	0,001 MJ = 1 kJ
kWh	3,6 MJ = 1 kWh
MWh	3600 MJ = 1 MWh
GWh	3600000 MJ = 1 GWh

Figure 78: Examples for units with conversion factor (unit type 'Energy')

To delete a unit entry, mark it and click on the button "Delete Unit" next to the table. Mind that units that are already being used for flows or stocks cannot be deleted.

Scaling: Each unit type can be scaled individually using the sliders shown on the Controller panel. Drag the slider to the left or to the right to adapt the width of the arrows with flows of the respective unit type.

The scale ratio is shown at the top of slider box in relation to a quantity in the basic unit (e.g. 100 kg = 25px for mass). This determines the width of the arrow with flows of the specific unit type.

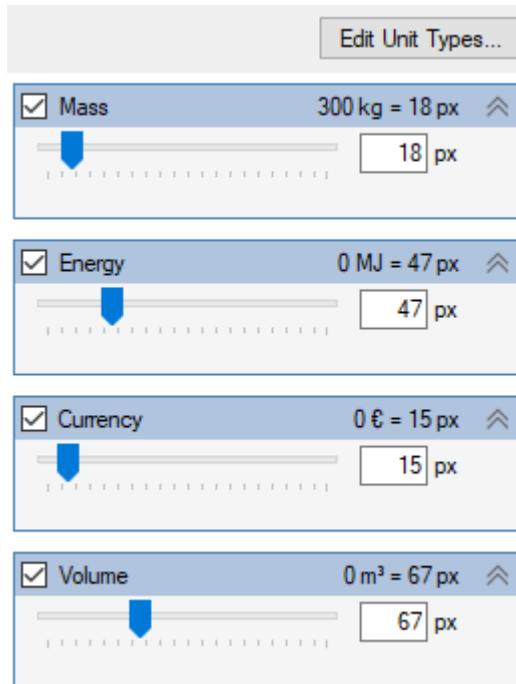


Figure 79: Sliders for scaling arrow widths per unit type



Remove the tick mark in front of a scaling slider, if you don't want to display flows of entries with this unit type in a diagram. This feature will allow you to manage flows of different unit types in one diagram, but selectively display the Sankey diagrams separately for mass, energy, volume streams, etc.

By default, the scaling is done with respect to the "Maximum flow of each unit type" in the diagram.

Alternatively you may want to scale by "Absolute quantity of each unit type". In this case an additional entry field will appear where the absolute quantity can be entered. This quantity corresponds to the scale setting of the slider given in Pixels (px).

If you set the option "Cut Off" values larger than the absolute quantity will not be scaled any more, but the arrow will maintain the width of the absolute quantity, and a transparent checkerboard pattern will be shown to signal that this specific flow is not to scale.

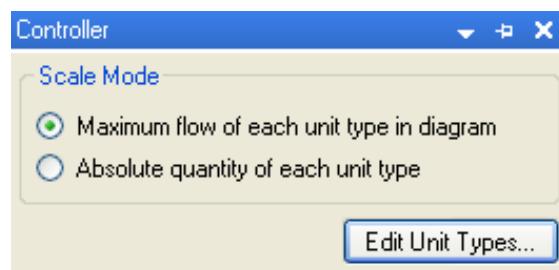


Figure 80: Scale Mode pane

Note that typically flows of different unit type are not found in the same arrow. Thus, when inserting an entry with a different unit type into an arrow, where a flow of a material with another unit type already exists, a warning

will be prompted. You can actively disable that feature, by setting the "Allow different unit types in one arrow" flag in the diagram properties dialog.

10 Templates

e!Sankey allows to save diagrams as template files. Template files can serve as models for creating new diagrams in the same styles. When saving a diagram as a template file, the following items will be included:

- Entries
- Unit Types (with their units, number format and color pallets)
- Process and arrow properties (see 'Set As Default' command)
- Graphical elements (shapes, text elements, legend)
- Options settings

When you create new diagram using a stored template, all of the above will be available.

A diagram template can save you time and ensure that your Sankey diagrams have a certain style. For example, if you typically use a certain unit type, you can preset it along with the units used in the template. If you intend to use the same names and colors for flows (in order to better compare different diagrams) you can pre-define entries in the template. If you want to give the look of process symbols and arrows your specific layout, you can define size, border line, fill color, and font for labels of process symbols. For arrows define options such as rounded bends, arrow head and tail, font size and color of flow content labels, then save them in your preferred diagram template.



To make sure that the look of processes and options for arrows are saved to the template, please select "Set as Default" in the context menu of the process and of the arrow. Then remove the elements you used for defining the templates before saving it (you probably wish to start with an empty diagram).

To store a diagram file as template file, use the 'Save As...' command from the File menu. In the Standard file save dialog choose 'e!Sankey Template (.santem)' from the file type dropdown list.

A "Save as Template" dialog will be prompted. A one line description of the template must be entered that allows identifying the template in the list of templates on the start page.

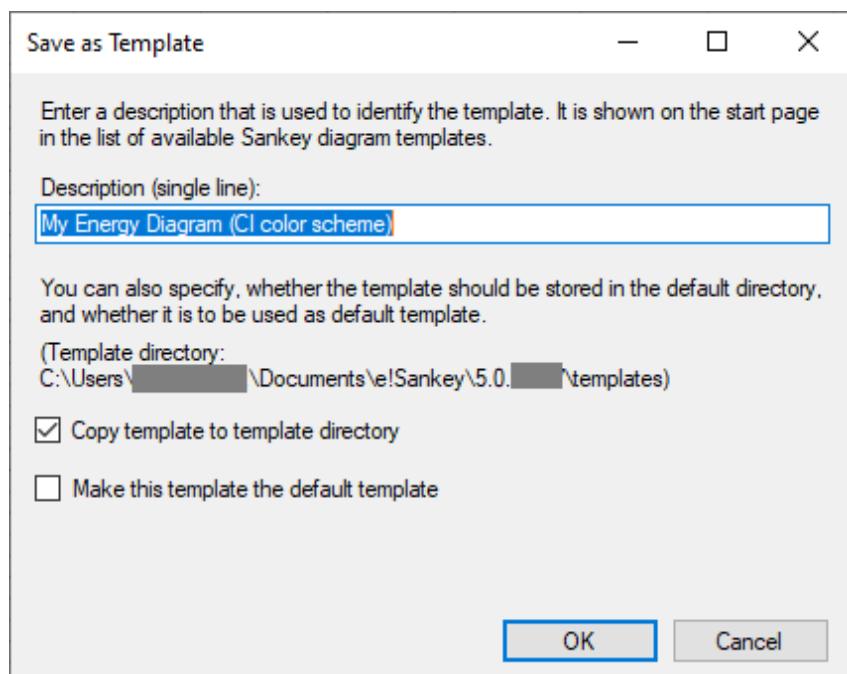


Figure 81: Saving a template file

If the newly created template should be presented on the start page of e!Sankey to use it for creating new Sankey diagrams, you can check the option "Copy template to template directory".

If, in addition the option "Make this template the default template" is checked, this template will appear at the top of the list of available templates in bold font. It will also be set as the template that is used when creating a new Sankey diagram using the "New Diagram" button in the toolbar or opening a new diagram file with the "New Diagram" command from the File menu.

New Diagram

-  Typical Energy Diagram (unit BTU)
-  Diagram with Live Links (pro version)
-  Diagram, simple arrow
-  Diagram, 4 arrows, empty
-  Diagram, material split 4 shares
-  Diagram, 4-way distribution
-  Energy efficiency diagram, losses branchout
-  Diagram

Figure 82: List of templates on the start page with the default template at the top

The default template can be set in the Options dialog on the 'General' page.



The templates in this list in a newly installed e!Sankey version are just samples. If you don't like them, simply create your own diagram templates and set your own preferred template as default.

Using templates: To create a new diagram file using a specific template, either click on the entry in the list in the 'New Diagram' section on the start page.

The template files (.santem files) are typically located in the "Templates" subdirectory of the e!Sankey installation. If you receive template files from someone else, you can just copy them into that folder, and they will appear as a template to choose from in the list.



The default directory where template are stored
(c:\Users\<USER>\Documents\{e!Sankey}\5.0.x.y\templates)
can be defined in the 'Options' dialog on the 'General' page. You
can find more information in chapter 3.

11 Live Link to Excel



The Live Link feature is available in e!Sankey pro and calc versions only.

Using the Live Link requires a desktop version of Excel 2016 or higher⁶ to be installed on your computer.

With this feature a "live" connection from one or more Excel spreadsheets to an e!Sankey diagram can be established. When changes are made in the spreadsheets connected to the e!Sankey diagram file, it can be updated (automatically or manually), so that the arrow widths and the text labels in the diagram reflect the new values.

Live Links to Excel can only be created for existing diagram elements. Drawing new diagram elements with this feature is not possible.

If you have the Excel source file on a drive that is synchronized with a cloud drive (e.g. OneDrive), or if the Excel file is stored in a cloud storage, please see the section 'Live Link to Excel file in Cloud Drive' below.

Live Link for Numeric Values

The Excel Live Link dynamically links the quantity value for a flow in an existing diagram file in e!Sankey with a cell in an Excel spreadsheet. When the user changes the value in the cell of the Excel sheet, the value in the Sankey diagram will be updated automatically and the arrow is redrawn accordingly, so that its magnitude represents the new value.

A Live Link is created by copying a cell value in Excel ('Ctrl-C') and pasting it ('Ctrl-V') in the "Quantity" field in the Arrow properties. To have the properties visible, the arrow must be selected, before the cell content is pasted. A Live Link reference to the cell address in the spreadsheet is set. An icon is shown in the LL column, to indicate the status of the Live Link.

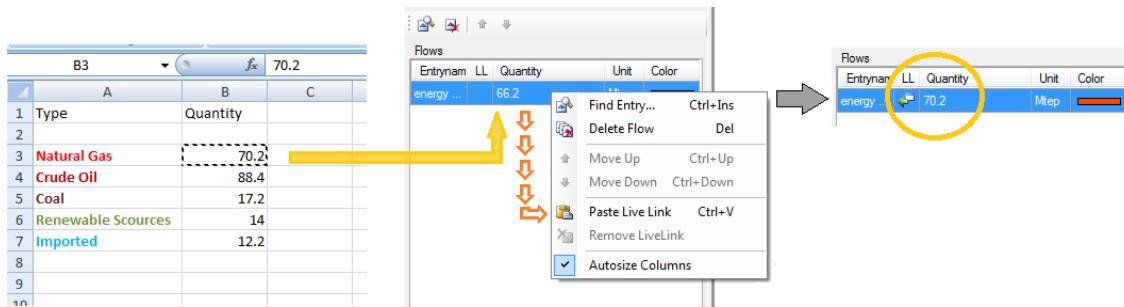


Figure 83: Copy the cell value in Excel. Select the arrow in e!Sankey. On the left side of the screen, paste into the area below "Flows".

Note that there can be multiple Live Links from one e!Sankey diagram into one or more Excel worksheet(s) in one or more Excel file(s). The Excel files can also be located on a shared network drive so that other users can update the values.

⁶ Live Link may technically function with Excel 2010 and Excel 2013 too, but Microsoft has terminated mainstream support for these two versions. We therefore recommend using Excel 2016 or Excel 2019 or Excel Microsoft 365 (desktop app).



Note that the Live Link references to the value of the cell, so that the cell in Excel may also contain a formula or a currency sign (e.g. "1.000 \$").

Updating of Live Links: When a Sankey diagram file that contains Live Links is opened, the user is prompted with a dialog box and asked whether Live Links should be updated.

Live Links can also be updated at any time using the command 'Update Live Links' (menu 'Edit' > command 'Update Live Links...') or by clicking on the 'Update' button in the Edit Live Links dialog. The update works even if the Excel file is closed.

In case you wish to view changes made in Excel directly in the Sankey diagram, you can keep the Excel file open at the same time. In this case make sure you have updated the Live Links as described above at least one time. All changes of values in the cells referenced with a Live Link will cause the Sankey diagram to update immediately.

Editing Live Links: An overview of all Live Links can be seen in the 'Edit Live Links' dialog (menu 'Edit' > command 'Live Links...').

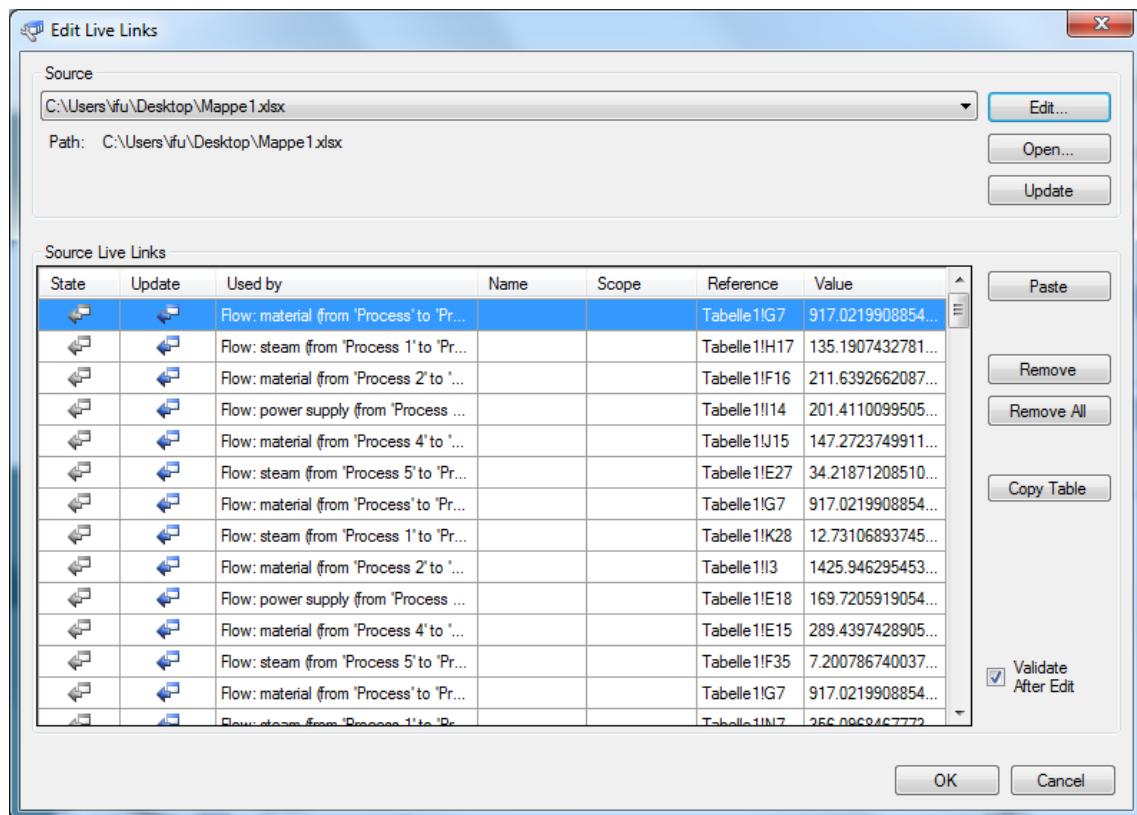


Figure 84: Edit Live Links dialog shows which Live Links have been set

The name of the source Excel file is shown in a selection list in the panel 'Source' at the top. The path to the location of the file is shown below the list. To modify the source Excel file, click on the button "Edit...".

To open the connected Excel file, click on "Open...".

For the Excel file selected in the dropdown list 'Source' above, all existing Live Links are shown in the 'Source Live Links' table below. Each Live Link entry can also be directly edited in this table: A Live Link reference can be pasted directly in one selected line (as an alternative to pasting it into the flow table in the Properties dialog of an arrow as described above).

The table can be copied using the button "Copy Table". It can then be inserted to a Word or Excel document, where it can be printed. Such a list of Live Links can serve to check the completeness or for auditing purposes.

Remove individual Live Links from the table by clicking them in the list and then clicking the button "Remove". Remove all Live Links by clicking the button "Remove All" (make sure you really want to remove all Live Links!).

In case the Live Link is to direct cell address, this address (e.g. "Table1!A15") is shown in the column 'Reference'. Should the reference be into a named cell (see below), this is shown in the columns 'Name' and 'Scope' (i.e. the name of the worksheet).

Live Link for Text String

Additionally, to the Live Link for numerical values, text strings from Excel sheets can also be linked to text elements in the e!Sankey diagram file.

This can be done for Text Labels, Process Labels and Arrow Comment Labels. (Note: Arrow Labels are created automatically from the entry name, the quantity, and the unit. They are not directly editable, thus cannot be updated via an Excel Live Link.)

A Live Link for a text string is created by first copying a cell value in Excel ('CTRL+C'). Then mark the text label, process label or arrow comment field in the diagram to bring up the 'properties' dialog. Use the "Paste Live Link" button below the text field. The Live Link is shown by the active Live Link icon.

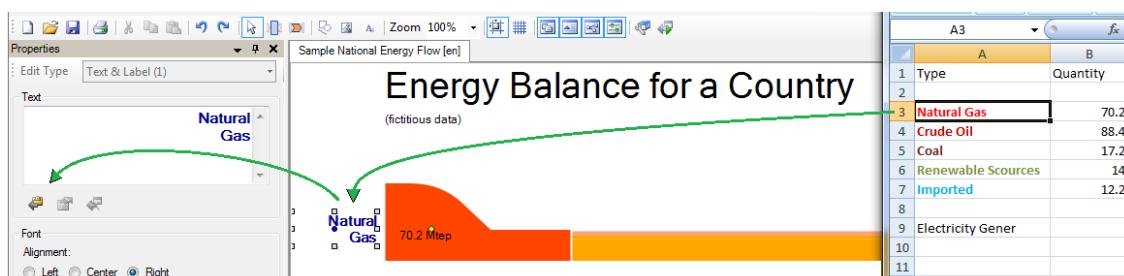


Figure 85: Copy the text from a cell in Excel. Click the existing text label in e!Sankey. In the Properties dialog click on the button "Paste Live Link".



Note: Pasting the content of the clipboard with 'CTRL+V' will just paste the content as normal text but will not set the Live Link! Use the "Paste Live Link" button below the text field instead.

To remove a Live Link reference, click on the button "Remove Live Link" below the text entry field of a text label, process label or arrow comment.

To edit a Live Link for a text string, click on the button "Edit Live Link" below the text entry field.

Using Named Cell Areas in Excel to Maintain Live Links to Cells: When a Live Link is created to a cell in an Excel sheet, the reference is by default made to the cell ID (e.g. "C1"). However, if the spreadsheet layout is changed the location of the cell with the value that is linked to the diagram in e!Sankey might be shifted. This happens, for example, when columns or lines are inserted.

In order to maintain the Live Links even when the location of the original cell, thus its cell ID, changes, it is necessary to work with named cells. Before you create the Live Link as described above, name the cell (in Excel 2003: Menu Insert > Names > Define, in Excel 2007: Menu Formulas > Define Names or context menu of selected cell > Name a Range > New Name). When a Live Link is created, it will use the name of the cell instead of the direct cell address ID. The named cell can be located anywhere in the Excel sheet, even when it is moved. When the value in the named cell is updated, the Live Link will still work even though it might have a different location.

Live Link to Excel file stored in Cloud Drive

If your source file is stored in a cloud storage space (e.g. SharePoint, OneDrive, Dropbox, Google Drive), the handling of the Live Link might differ from the procedure used as described above for locally stored Excel files. This is due to the difference in identifying and addressing the Excel files and to the need for being connected to the cloud account for updating the Live Links. Establishing (=setting up) Live Links and updating Live Links to an Excel workbook stored on a cloud drive is described hereafter:

Setting the Live Link: If the Excel source file is stored locally or on a network drive, then the Live Link for flow values is created with copy (CTRL+C) of the cell and pasted (CTRL+V) on a flow in e!Sankey (see above).

The same mechanism can be used for Excel files in the cloud, but you have to observe the following: When opening the Excel worksheet, this must be done in the so-called Excel desktop app (Office 365) and not in the Excel browser app ("Microsoft Office Online"). Consequently, the creation of Live Links cannot be done, if the cloud storage provider opens Excel files in the Excel browser app, such as for example Dropbox.



Setting up the Live Links to an Excel file located in the cloud requires the Excel desktop app. Cloud storages that only open the Excel files in a browser online app cannot be used to establish Live Links.

If you are storing your files in the cloud but are accessing the files through a synchronized cloud folder, then the handling of the Live Link works just the same way as with a file stored on a local hard disk or network drive.

You can create Live Links to an Excel file that is located in the synchronized folder because they sync mechanism handles the addressing of the file.

For some cloud storage accounts to be synchronized an additional app may need to be installed on the computer, e.g. the Dropbox Desktop-App or Google Drive App.

Updating Live Links: e!Sankey will check whether the data has to be updated via the Live Link on opening a file that has Live Links and when the update is manually triggered by the user.

Mind that the Excel tables could have been modified by another user, if you have shared access to them in the cloud.



Updating Live Links to an Excel file located in the cloud requires that you are signed in to your cloud storage account, have a permanent synchronization with your files in the cloud or that you actively trigger the update using the "Update Live Links" command.

12 Process Operations



The Process Operation feature is available in e!Sankey calc only.

You can set the values of flows with data defined in Excel workbooks using Excel Live Links (see chapter 11). Process Operations allow the automatic creation and calculation of flows directly in e!Sankey without the need of external programs. To achieve this simple calculation operations like Sum or Division are defined for a process and a small number of operation parameters have to be specified. Based on this information e!Sankey is now capable to calculate flow values. You can freely mix flows specified manually or via Excel Live Links with flows calculated using process operations.

Process Operations Dialog

To define a Process Operation, double-click on the process or use the context menu (right-click "Process Operations..."). After selecting an operation, closing the dialog with "OK" will trigger an automatic calculation of the diagram.

Currently the dialog offers seven different Process Operations to choose from: "Automatic", "Merge", "Sum", "Difference", "Split", "Transformation" and "Ignore". Selecting a process operation on the left side of the dialog will allow the user to configure the operation on the right.

Process Operations have different sets of parameters. A parameter all share is the direction. The direction can be changed in the top left corner of the dialog by selecting if the inputs or outputs of a process should be calculated. This will change the direction for all operations in the dialog.

After having selected an operation and having set all necessary parameters, closing the dialog with "OK" will trigger an automatic calculation and e!Sankey will calculate new flows in the relevant arrows.



Be aware that when you are working with an existing diagram and using Process Operations, the calculation may delete some flows depending on your configuration. You can always Undo the calculation to restore your previous flows in case of an unwanted change.

For Process Operations to be applicable, certain prerequisites have to be met depending on type and direction. An error message will appear in the dialog if the Process Operation cannot be applied with the current composition of the process and its connected arrows.

Automatic

This is the default behavior for all processes, unless a specific Process Operation has been selected. It can calculate missing flows per entry if all but one connected arrow contains a flow for that entry.

The automatic calculation follows the below rules:

- It is tried to create a balance between input and output flows.
- This compensation takes place per entry. There is no allocation of flows of different entries in the same arrow.
- All arrows without existing flows with the corresponding entry are considered valid targets for calculated flows. Regardless of whether flows for other entries are contained in the particular arrow.
- "Existing" flows are all flows defined manually or generated by the calculation of upstream or downstream processes.
- The automatic calculation requires exactly one candidate arrow for each entry.
- Negative flows cannot be generated.
- The calculation direction is determined automatically. The selection of whether incoming or outgoing flows should be calculated has no effect on the automatic calculation.

Below you will find examples that illustrate the possibilities and constraints of the automatic calculation:

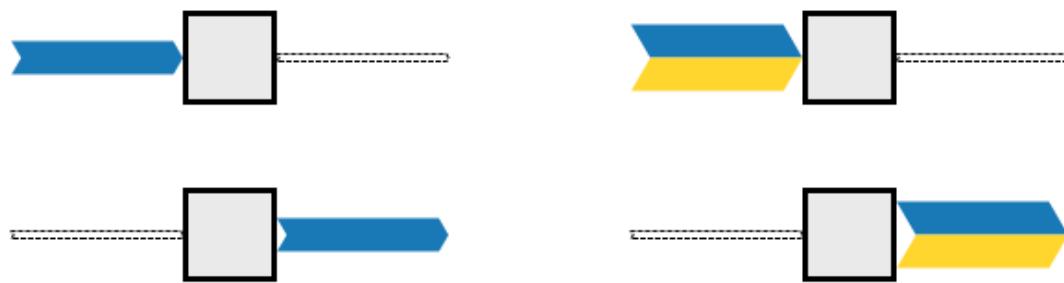


Figure 86: Automatically calculable processes

The processes in the above can all be calculated by the Automatic Process Operation. All of them are connected to exactly one arrow which does not yet have flows for the given entries. The examples on the left will calculate a blue flow in either the empty output (above) or the empty input (below) arrow. Respectively the examples on the right will create two flows, one blue and one yellow.

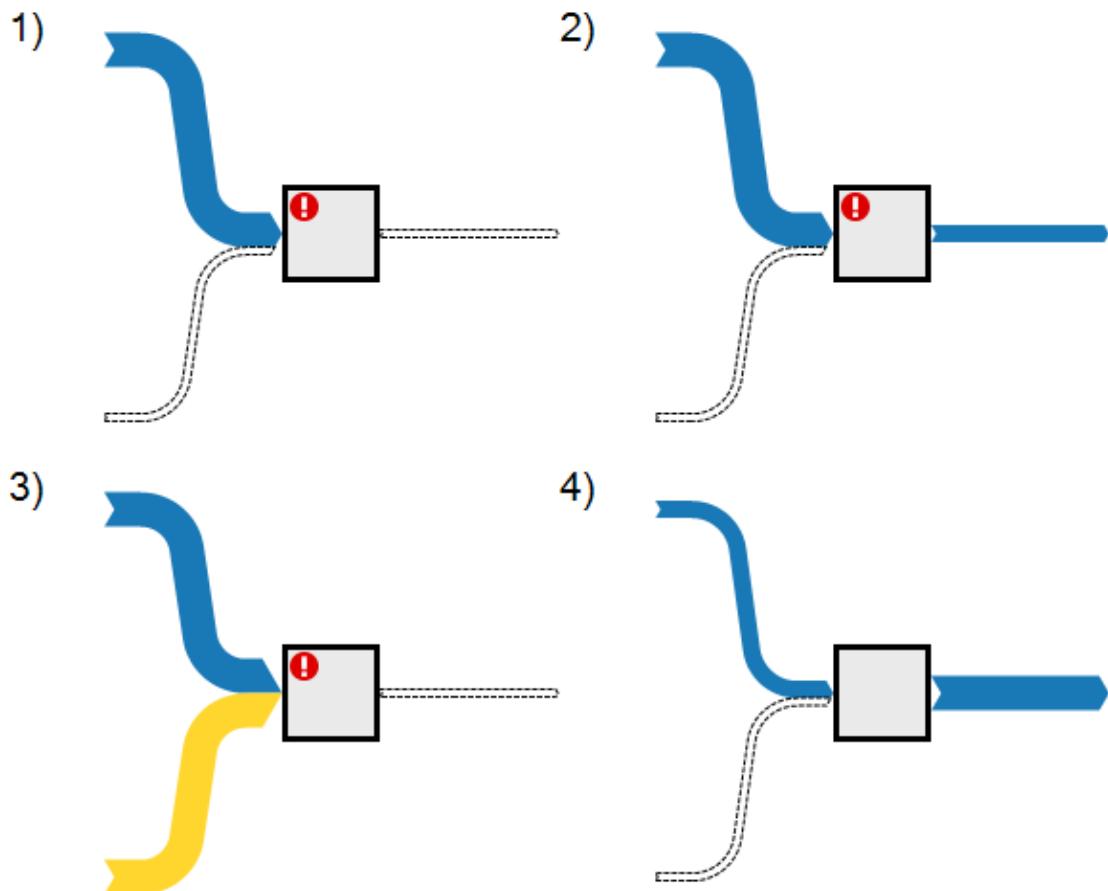


Figure 87: Examples for automatic calculation

Of the four examples shown above only the last one (4) will be able to calculate a flow.

Nr 1) Cannot be calculated because there are two potential targets for the calculated blue flow.

Nr 2) Cannot be calculated even though there is only one potential target. When subtracting the input from the output amount, the calculated flow would be negative.

Nr 3) Even though the second input arrow contains a yellow flow it is considered empty with regards to the blue entry. So, there are two target arrows available for the blue entry.

Nr 4) A flow will be added to the empty input arrow. The amount will be positive when subtracting the input from the output flows.

Merge

The "Merge" Process Operation takes all flows from all incoming or outgoing arrows and passes them to the single output or input arrow, depending on the selected direction. Flows of the same entry will be summed up in a new flow; all other entries will be passed on with their initial values (see Figure 88 below).

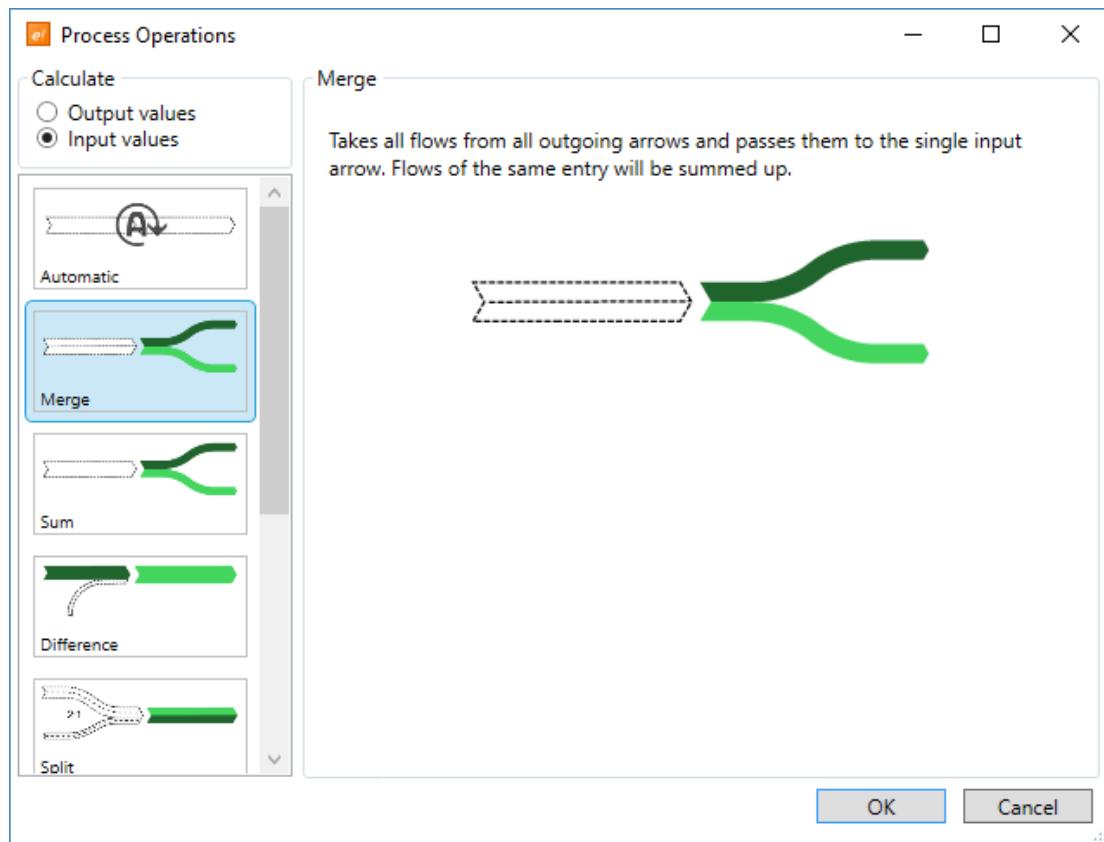


Figure 88: Process Operation "Merge"

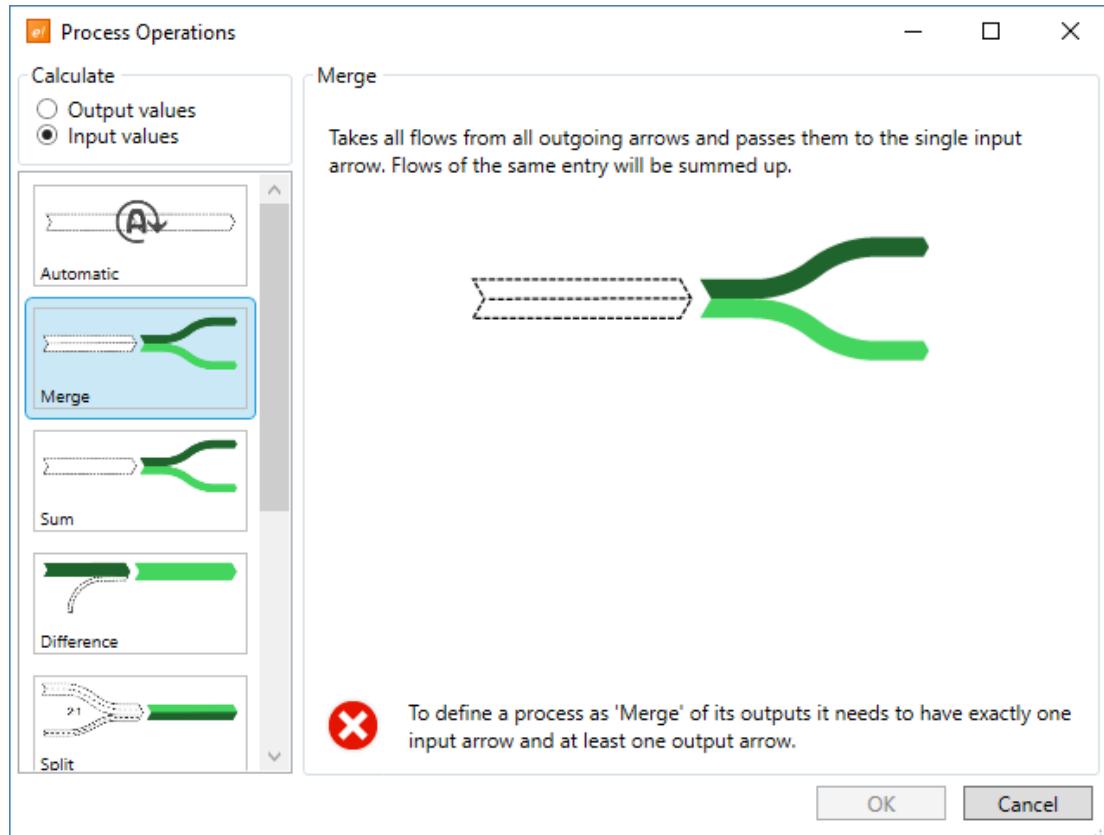


Figure 89: Process Operation "Merge" with errors

To be able to use the "Merge" Process Operation, the chosen process needs to have at least one input arrow and exactly one output arrow for the output direction or at least one output arrow and exactly one input arrow for the input direction. Otherwise an error will be shown in the dialog and the operation cannot be selected. In Figure 89 above, the Process Operation cannot be selected because the prerequisites were not fulfilled.

Sum

The "Sum" Process Operation calculates the sum of all input or output flows and creates a flow of the selected entry at the single outgoing or incoming arrow, depending on the selected direction.

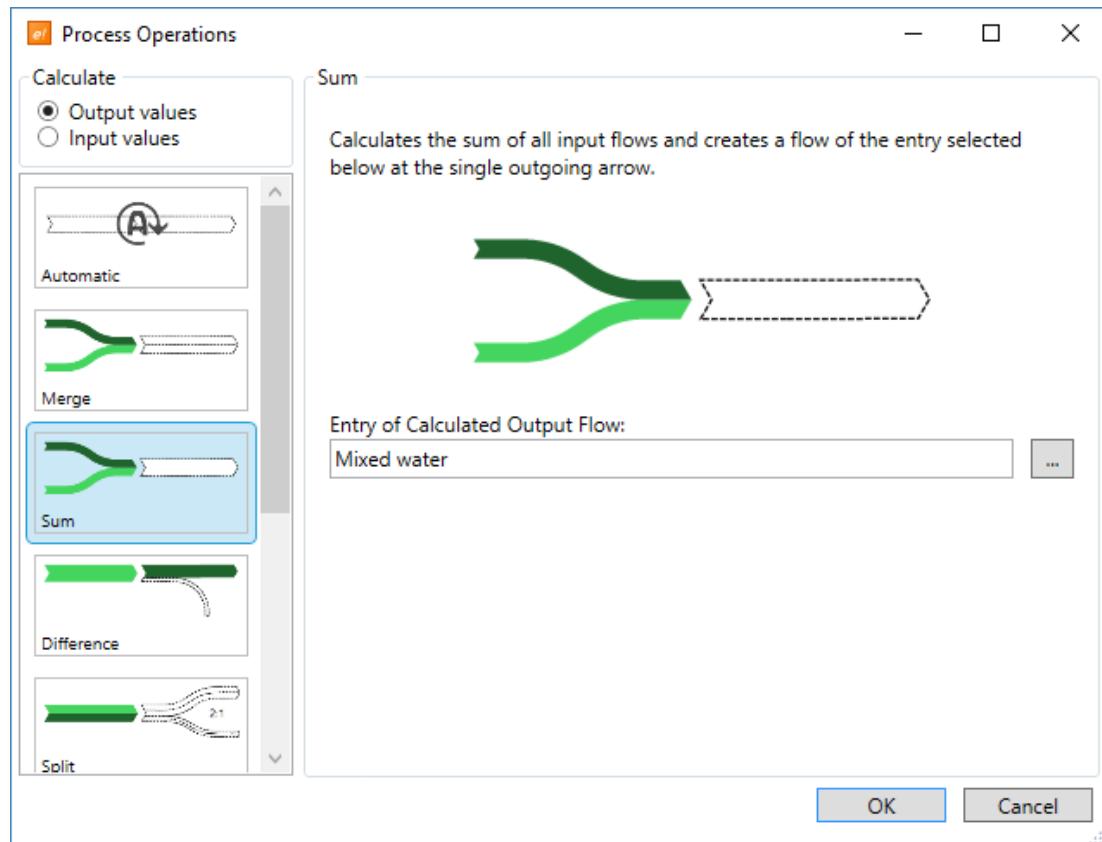


Figure 90: Process Operation "Sum" with direction output

To configure the operation, select an entry from all available entries in your diagram to define the entry for the calculated input or output flow. After a successful calculation, the output or input arrow will contain a single flow of the selected entry with the calculated sum of all incoming or outgoing flows (depending on the chosen direction).

To be able to use the "Sum" Process Operation, the chosen process needs to have at least one input arrow and exactly one output arrow for the output direction or at least one output arrow and exactly one input arrow for the input direction. Otherwise an error message will appear on the dialog and the operation cannot be selected.

Difference

The "Difference" Process Operation calculates the difference of the surrounding flows and creates a flow of the selected entry at the outgoing or

incoming arrow connecting the selected process. Depending on the selected direction, the difference will be calculated as sum of all input flows minus the sum of all output flows for the output direction or, for the calculation of input values, as sum of all output flows minus the sum of all input flows.

After closing the dialog with "OK", e!Sankey will calculate a new flow in the arrow connecting the selected process with the correct difference of the surrounding flows.

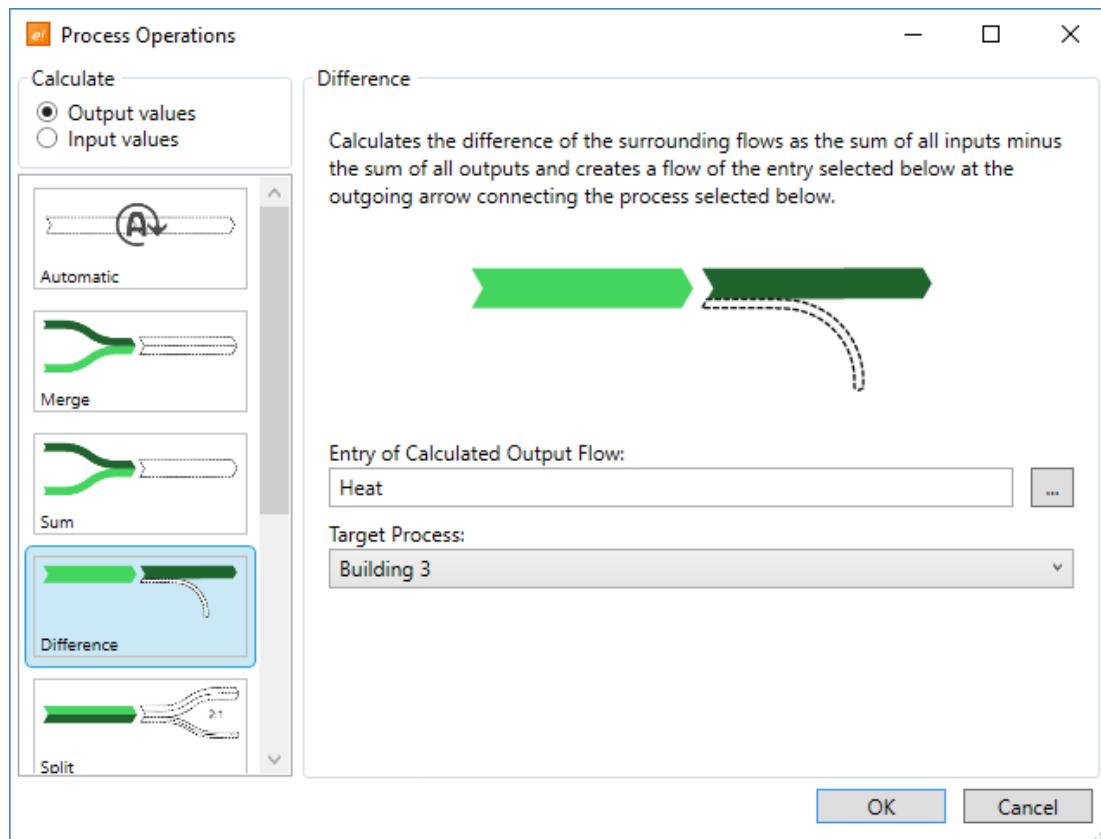


Figure 91: Process Operation "Difference"

To configure the operation, select an entry from all available entries in your diagram to define the entry for the calculated flow. In the drop down box below, you can choose the arrow in which the output/input flow should be created by selecting the corresponding consuming or delivering process (see Figure 91).

To be able to use the "Difference" Process Operation, the chosen process needs to have at least one connected input arrow and at least one connected output arrow. Otherwise, an error message will appear on the dialog and the operation cannot be selected.

Split

This Process Operation works like the "Merge" process operation, but the input or output flows are distributed to a number of outgoing or incoming arrows, whereby the composition of the flows is preserved (see Figure 92).

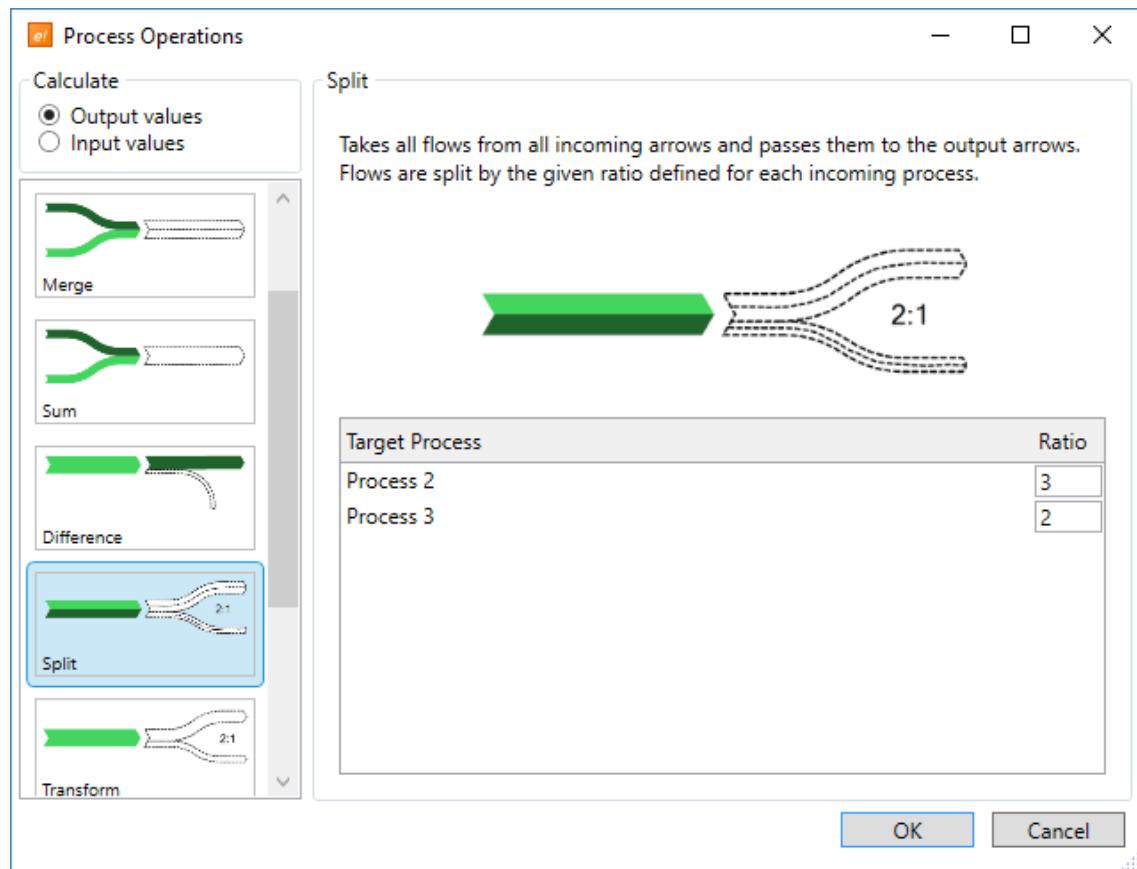


Figure 92: Process Operation "Split"

The proportion per arrow is calculated as follows:

$$\text{proportion (arrow)} = \text{ratio (arrow)} / \text{sum (all ratio values)}$$

For the sake of illustration, see Figure 93 and Figure 94. Here, the incoming flows are distributed to the outgoing arrows in a ratio of 3:2.

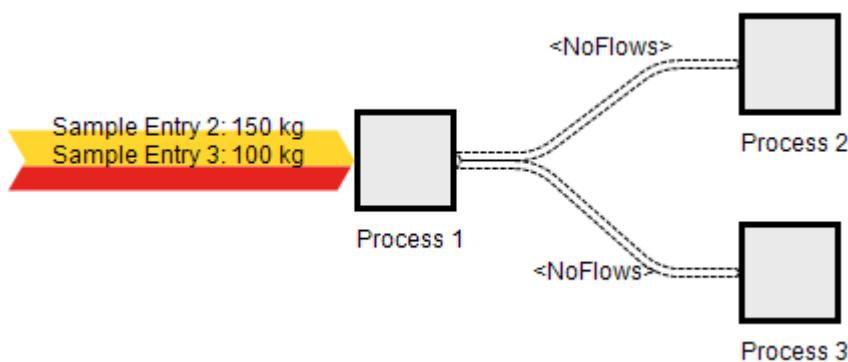


Figure 93: Process Operation "Split" before calculation

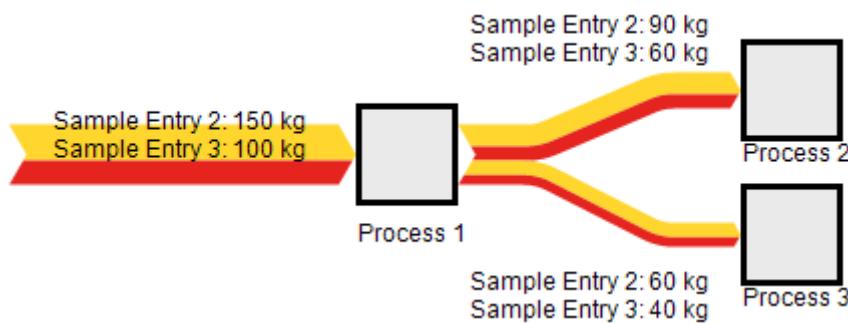


Figure 94: Process Operation "Split" after calculation

To define a process as "Split", it must be connected to at least one input and one output arrow.

Transform

This Process Operation is similar to the "Split" Process Operation. The flows are also split, but instead of being forwarded, a new entry is selected for each incoming or outgoing arrow (see Figure 92: Process Operation "Split").

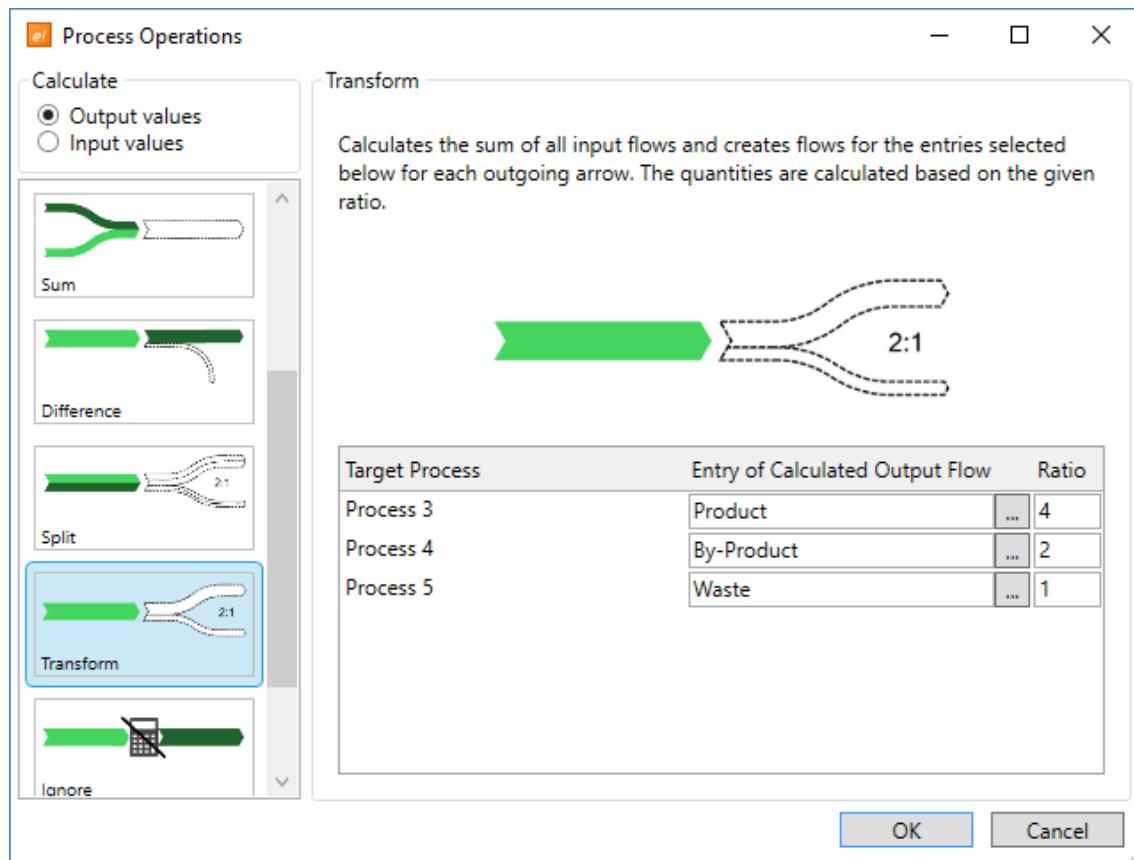


Figure 95: Process Operation "Transform"

For the sake of illustration, see Figure 96 and Figure 97. Here, the incoming flows for the upper arrow are transformed into 4 parts of the entry "Product", 2 parts of the entry "By-Product" for the middle arrow and one part of the entry "Waste" for the lower arrow.

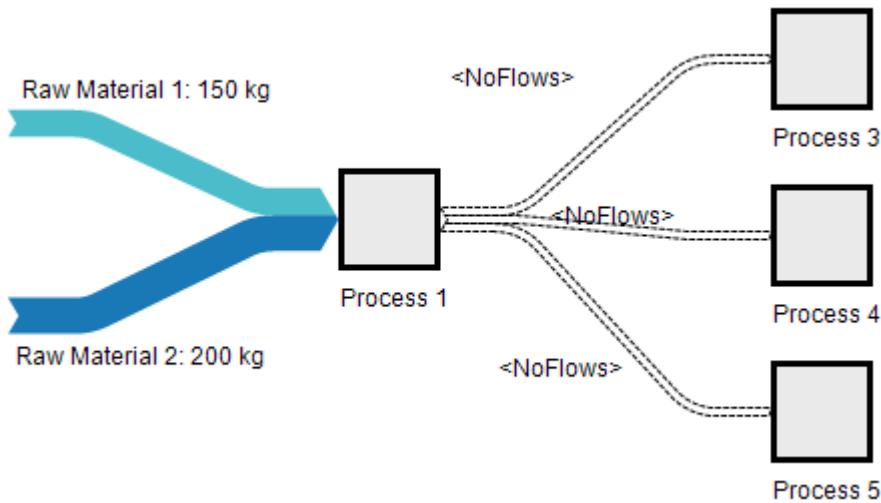


Figure 96: Process Operation "Transformation" example before calculation

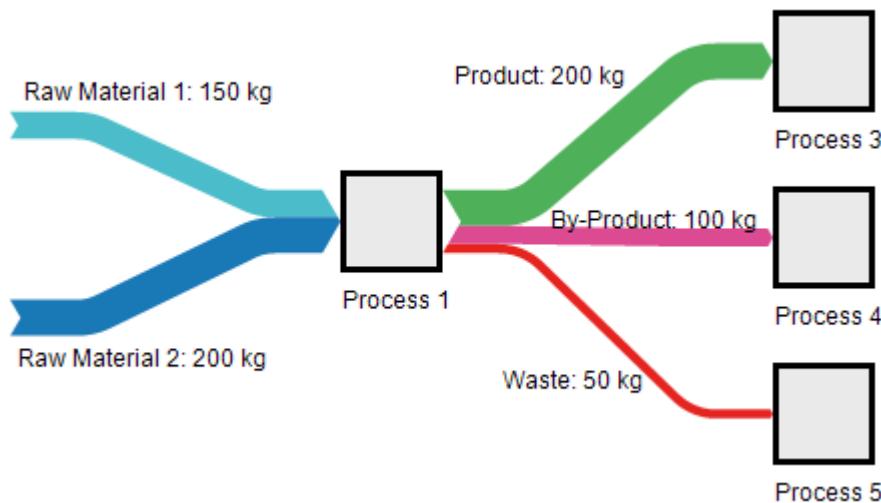


Figure 97: Process Operation "Transformation" example after calculation

To define a process as "Transformation", it must be connected to at least one input and one output arrow.

Ignore

This process will be ignored during calculation and no flows, neither input nor output, will be created or changed by this process.

Note that when setting the process operation to "Ignore", the process is passive, and does not inspect or handle any flows in the adjacent arrows. This is similar to the behavior of the e!Sankey basic or e!Sankey pro version.

Calculation Example

In the diagram in Figure 98, the overall amount of mixed water should be calculated based on the known water sources (company well, rainwater reservoir, public water supply).

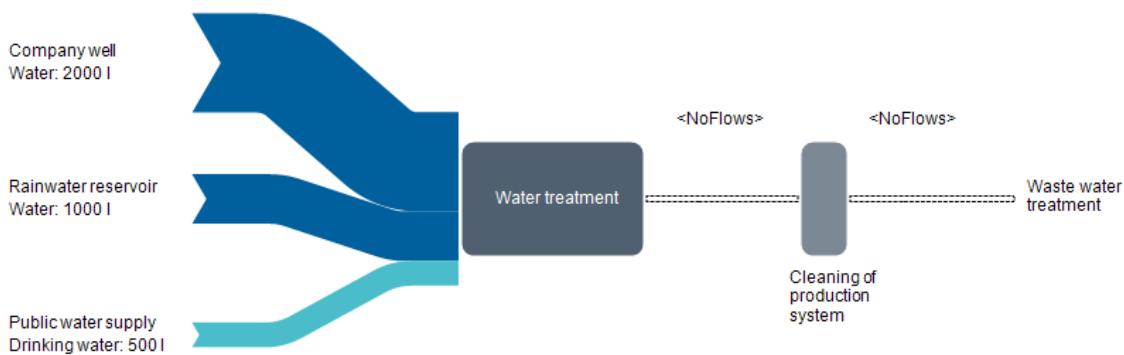


Figure 98: Water usage example diagram before calculation

For this, the process "Water treatment" is selected and the Process Operation dialog is opened. The most suitable Process Operation for this calculation is the "Sum" operation. The entry "Mixed water" is chosen as entry for the resulting output flow.

After a successful calculation, there is a new flow in the arrow leaving the process "Water treatment" with the entry "Mixed water" and the correct sum of 3500 liters (see figure below).

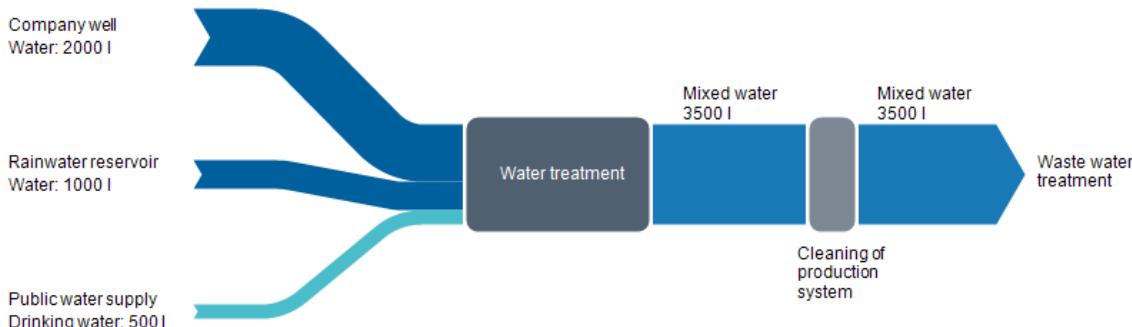


Figure 99: Water usage example diagram after calculation

In the properties window of the arrow we can see a calculation icon in the LL column of the flow, indicating that the flow has been created by the calculation (see figure below).

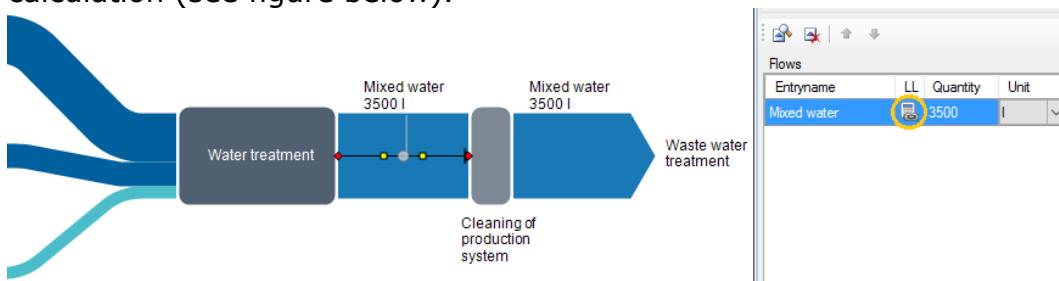


Figure 100: Flow properties show calculation as origin for quantity value

Working with Process Operations

After having defined at least one Process Operation in your diagram, you may want to adjust your diagram, e.g. adding new arrows, flows or updating values manually or via Excel Live Links. The automatic calculation of flows only occurs after having selected a Process Operation. If you want to re-calculate your diagram after having made other changes, select the menu

item "Start" from the "Calculation" menu. Alternatively, you can use the keyboard shortcut "F9" at any time.

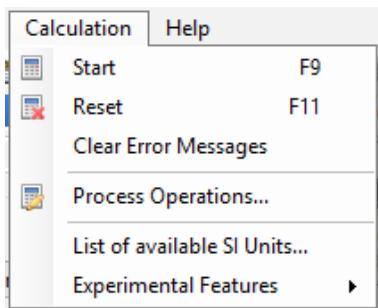


Figure 101: Calculation menu items

Calculation Errors

Each time a calculation is performed, a message indicates if the calculation was successful or not. In case of an unsuccessful calculation, an error message shows how many processes have calculation errors. An exclamation mark indicates the affected processes. Moving your mouse over the icon, a tooltip message will explain in detail where the problem lies and suggests possible solutions.

In case you want to clear the error indicators from the calculation, you can use the menu entry "Clear Error Messages" from the "Calculation" menu. After a new calculation, the error messages and indicators will appear again if the reasons for the errors have not been fixed.

Balance warnings are not affected by this.

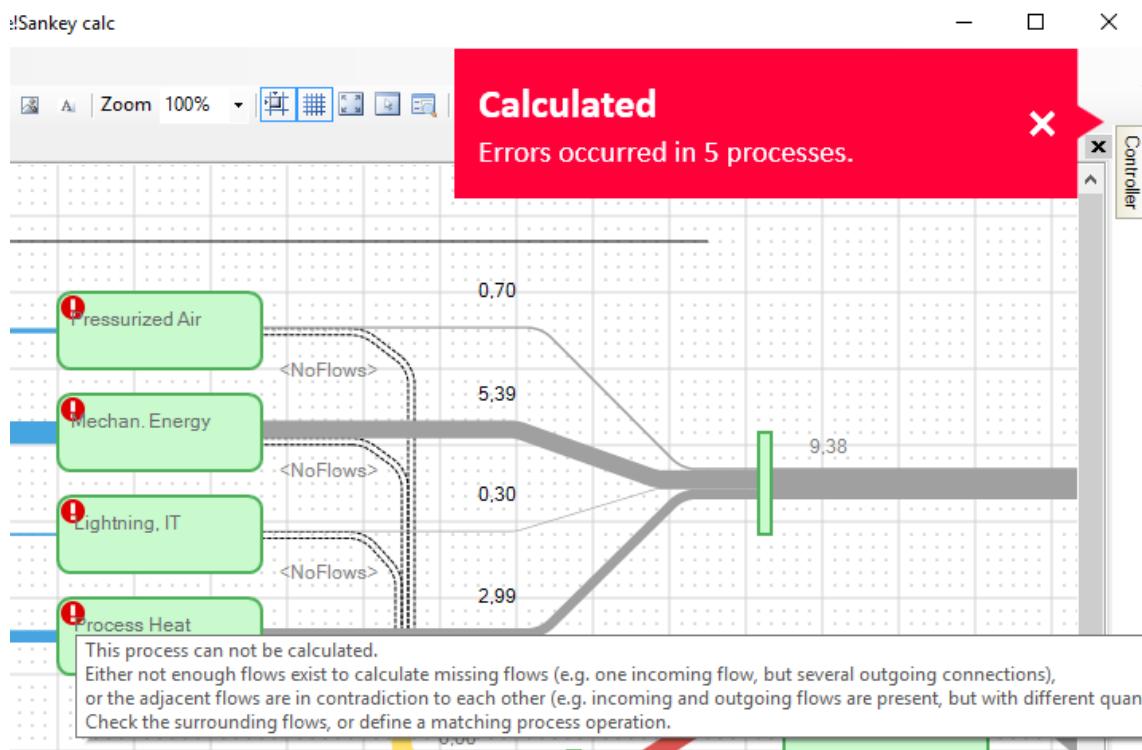


Figure 102: Calculation error message example

Using the menu item "Reset" from the "Calculation" menu, you can delete all flows created by the calculation.

The menu entry "Process Operation..." will open the process operations dialog of the selected process. This corresponds to double clicking on the process.

Calculation and Units of Measurement

To achieve correct results which fulfill expectations, flows that are defined in different units of measurement (e.g. one flow in g and one flow in kg) and which should be offset against one another, have to be converted by the calculation beforehand. At the moment the calculation only works with units of measurement from the International System of Units (SI) and uses the provided conversion factors. You can see a list of currently supported SI units (from the International System of Units) using the menu item "List of available SI units" in the "Calculation" menu.

If you are using units of measurement beyond the supported SI units, you may be alerted by error messages that the calculation did not succeed. On the one hand this can mean the calculation is incomplete and not all processes could be calculated. On the other hand, this can also mean that although processes have been calculated and flows have been created, the result (the amount of the calculated flows) is not valid because of missing conversion factors.

In such cases an error indicator can be found at the affected processes. Please check if you can use a SI unit instead of the used unit of measurement. You can either rename the used unit or create and use a new unit of measurement according to the most suitable SI unit.

13 Exporting and Printing

Save a Sankey diagram file using the 'Save As' command in the file menu, An e!Sankey diagram file has the file extension '.sankey'.

Copy to Clipboard: An alternative way to quickly use the Sankey diagram created in another application is via the Windows Clipboard. It may however not yield the best results in regard to image quality.

To directly copy a Sankey diagram, select all elements (either by pulling a frame around it, or by using CTRL-A), then copy it (with CRTL-C or with the Copy command from the Edit menu). Switch to the other application (Word, Power Point, etc.) and paste the content of the clipboard.

Export as Graphic File

To create an image file from the Sankey diagram you created in e!Sankey, choose the 'Export...' command from the File menu, and select a file type. The following file types are available: PNG, JPG, GIF, BMP, EMF, PDF, SVG.

Note that the graphics file created is typically limited directly by the network elements, i.e. does have a narrow 2 pixel white margin around it.

In order to produce high resolution image export files, the following "Choose Export Quality" dialog will come up. It allows for setting a scaling factor for the export or determine a custom export size.

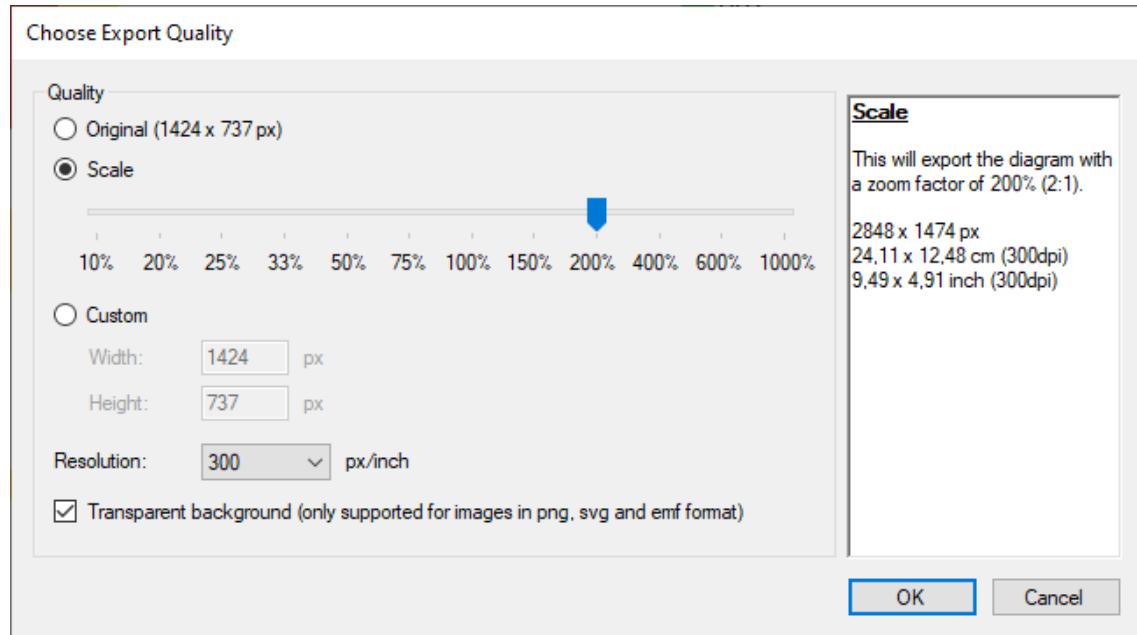


Figure 103: Export Quality dialog

It is recommended to select a large zoom factor (e.g. 400%) before exporting the diagram to a file, and then reduce the size of the image file, in order to obtain the best quality (e.g. in a printout).

EMF (Enhanced Meta File format) is based on the WMF (Windows Meta File format) and an image format used in Windows OS for printing purposes.

PNG typically produces a good quality, especially when setting the scale factor higher.

PDF format can be used by professional printers to embed in printing jobs.

SVG (Scalable Vector Graphics) can be displayed by web browsers that have rendering properties for SVG files. SVG files can also be opened and edited in graphics applications such as Inkscape, Adobe Illustrator or Photoshop CC. Please refer to the application's user manual on how to import SVG files.

 When planning to use the SVG format in a graphics applications rather than in a browser, make sure to not switch on additional options for interactive display of data.

Export as SVG Graphic File with Interactivity



The SVG file format export is available in e!Sankey pro and calc versions only.

SVG (Scalable Vector Graphics) can also be displayed by most web browsers (Chrome, Firefox, Internet Explorer 11, Opera, and Safari) that have rendering properties for SVG files.

The SVG files may have additional data embedded that can be viewed in the browser. This interactive viewing of data in the diagram requires that JavaScript be enabled in the browser.

If you have chosen the SVG file type for export, the 'SVG Export Configuration' dialog will be prompted. It allows setting the options for interactivity and tooltips in the exported SVG diagram file when used in a browser environment.

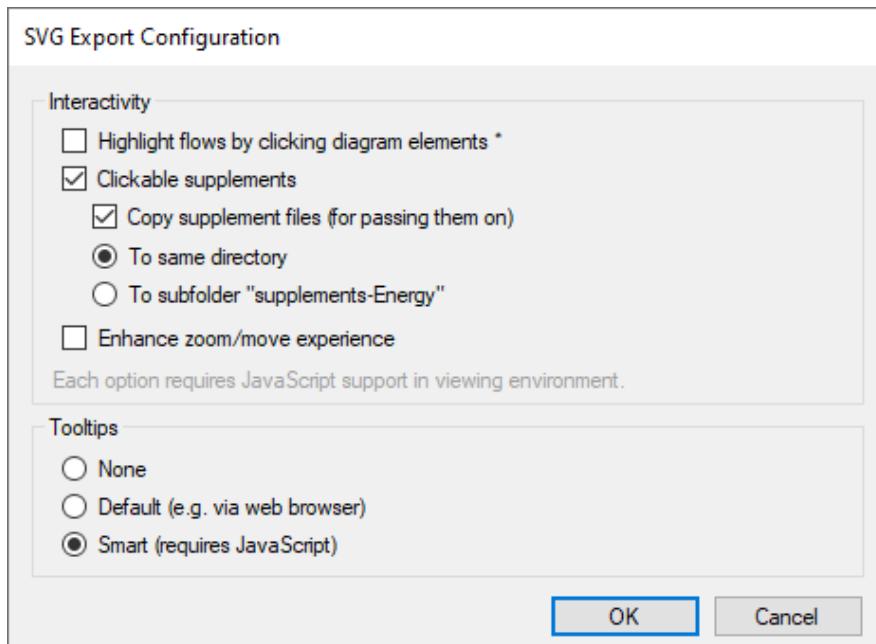


Figure 104: SVG Export Configuration dialog

The SVG file can be opened from a local drive or from a URL. The following interactive actions with the SVG image file are possible in a browser environment. Note that JavaScript must be enabled in the browser for the interactive features to work.

Highlight: Select "Highlight Flows by Clicking Diagram Elements" to be able to focus on arrows or processes with connected arrow in the diagram. By holding the CTRL key pressed and clicking an arrow you can toggle three highlighting modes:

- **CTRL+1st click:** highlights selected arrow (rest of diagram dimmed)
- **CTRL+2nd click:** highlights all arrow that have same flow (rest of diagram dimmed). In stacked arrows, it highlights the other flows in the arrow additionally
- **CTRL+3rd click:** reset, highlight whole diagram again

By holding the STRG key pressed and clicking a process node you can highlighting the node and adjacent arrows:

- **CTRL+1st click:** highlights selected process and all connected arrows on input and output side (rest of diagram dimmed)
- **CTRL+2nd click:** reset, highlight whole diagram again



The highlight & dim effect can in most cases not be printed from the browser. It can be saved as image file in the highlight & dim mode though.

Clickable Supplements: A link can be set behind most of the elements of the Sankey diagram. Select "Clickable Supplements" in the 'SVG Export Configuration' dialog to allow for clicking on elements in the exported SVG diagram file and opening the connected media files or URLs.

Note for supplement file type 'File': If you are using locally stored files (PDF, DOCX, XLSX or .sankey) as supplements rather than web links or files stored in a cloud service, you must ensure that the supplements defined for the elements are available locally where the SVG file is used and that file paths are correct on the target file system. Supplement files are not stored in the SVG file, only their file path.

To support the passing on of SVG files with their linked files, the option "Copy supplement files" has been introduced. A copy of each linked file is saved either to the same folder (option "To same directory") where the .sankey file resides, or to a subfolder (option "To subfolder"). Clickable links will hence still work when the SVG file and the associated files are passed on to another computer.



The link actions are determined in the properties of the element before exporting the diagram as SVG. Read in chapters 5 to 7 of this manual how to set a clickable link for an arrow, process, text label or graphical element.



In the exported SVG diagram file viewed in a browser, clickable elements or areas can be identified by hovering the mouse cursor over the elements.

Zoom & Move: Select "Enhance Zoom/Move Experience" in the 'SVG Export Configuration' dialog to add the possibility to zoom and move in the SVG diagram file when viewed in the browser.

Tooltips: In the panel 'Tooltips' of the 'SVG Export Configuration' dialog select whether you wish to have tooltips available in the exported diagram. These tooltips are shown when in the diagram when viewed in a browser environment and hovering with the mouse cursor over arrows or processes.

- **Arrow Tooltip**

The flow quantity with the color tag, name, quantity, and unit is shown in a tooltip

- **Process Tooltip**

The input/output balance of the process is shown with a list of flows in the connected arrows. If there is a balance difference, this will also be indicated in the last line of the tooltip. For more details on the process balance see chapter 6

Using the option "None" will disable tooltips in the exported SVG diagram. The option "Default" uses the default tooltip style of the browser. The option "Smart" uses styled tooltips but requires JavaScript to be enabled in the browser.



If the tooltips are too small when you view the SVG file in a browser (this can happen in particular if you are using the Edge and Internet Explorer web browser), then please set the scale in the export quality dialog to 200% or 400%. This will increase the size of the tooltip font.



Should you have used image files in .EMF format in your Sankey diagram (e.g. as images in the process symbol) then these images will in some cases not be properly rendered in the exported SVG file. To circumvent this limitation, please use images in another graphics format.

Printing

Printing: The diagram can be printed using 'Print...' from the File menu. A print preview will always be shown. It allows adjusting of the zoom and page setup.

To make most use of the page area, choose the 'Fit to Page Size' in the zoom dropdown list.

There is an option for hiding page margins on the printout in the Options dialog on the Diagram page ("Print Page Margin Marks").

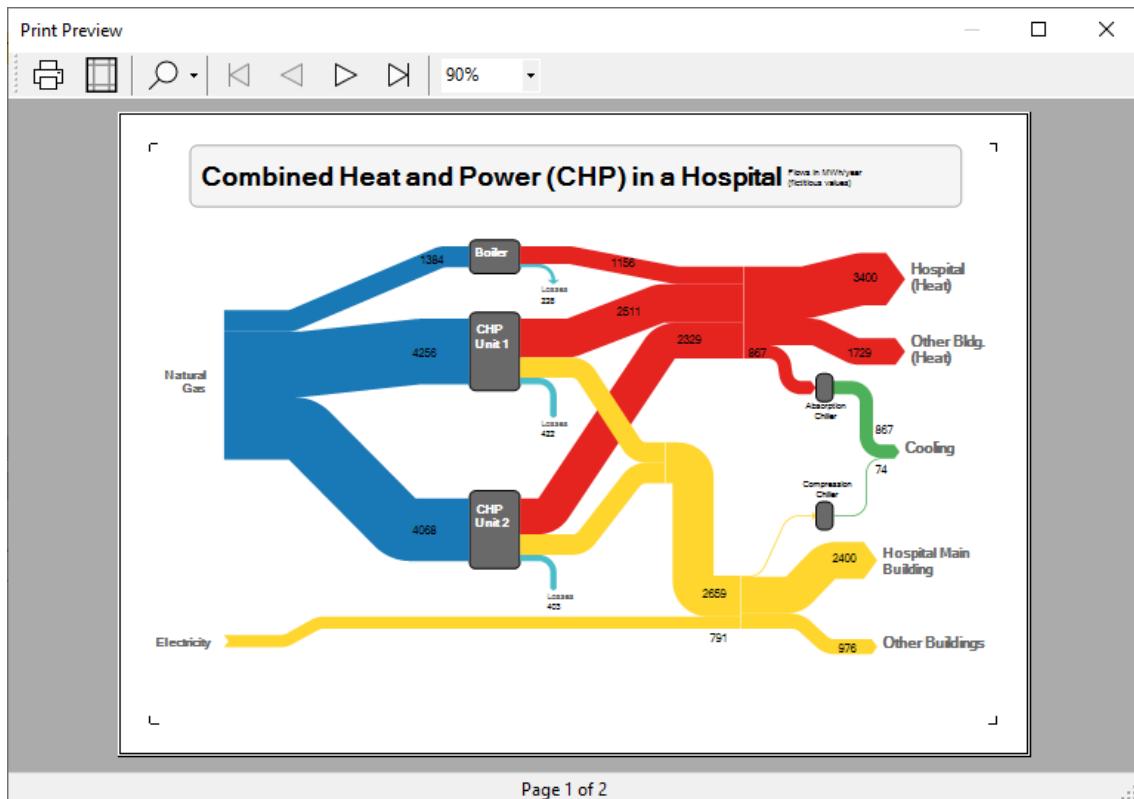


Figure 105: Print Preview dialog

14 Further Hints

GUI language:

You can change the language setting of the user interface (GUI) in the 'Options' dialog. Restarting is required for the language change to take effect. Currently the following languages are supported: English, German, French, Spanish, Portuguese and Chinese (Simplified).

Version Update:

The 'Version' panel on the start page will show you, if the license is up-to-date or if an update version has been made available.

This check for updates can be disabled in the 'Options' dialog. If it is disabled, use 'Check for Updates...' from the Help menu. An internet connection on port 80 is required. If your corporate security policies prohibit this, please check the announcements on <http://www.e-sankey.com/> or in the e!Sankey forum (bulletin board) to find out, if there is a new version.

Updates within the same version level (e!Sankey 5.x to 5.y) are typically free-of-charge. We recommend that you install intermediate version updates as they become available.

Support:

Visit the e!Sankey forum at <http://www.e-sankey.com/smf/index.php> to read hints, get support and discuss with other e!Sankey users.

The support e-mail address is support@e-sankey.com

15 SDK and Integration of Sankey Diagrams

General Information

A software development kit (SDK) version of e!Sankey is available. It allows for automatic updating of Sankey diagrams from a data source, and for setting up Sankey diagrams using XML files.

The e!Sankey SDK can be used to integrate Sankey diagrams into other applications (e.g. energy management software, plant control applications, measurement data databases).

Please contact development@ifu.com should you be interested in a customized solution. Please inquire about licenses at sales@e-sankey.com should you be interested in the SDK package.

Handling Key Fields (for SDK)

If you are using your e!Sankey pro desktop version to prepare Sankey diagrams that are subsequently being used as templates for a solution developed with the e!Sankey software development kit (SDK), then you might need to work with key fields.

Keys are the unique IDs that are used to reference elements of a diagram that are updated with values from an external data source.

The elements that have key fields for unique IDs are

- Flows (for flow quantity) in arrows
- Stocks (stock increase quantity, stock decrease quantity) at processes
- Process labels (process names)
- Text labels

The programmatic addressing of keys is described in the e!Sankey SDK documentation. However, if your task is to set the keys in a Sankey diagram, you need to know the following:

The key column is only available (visible) when the option "Show Key Field" on the 'Extended' page of the options dialog is turned on (see 'Options Dialog' in chapter 3 of this manual). Turn it on to be able to enter keys.

Keys are strings made up from characters and numbers. They must be unique in the diagram (i.e. you cannot use the same key for two different elements). Key names can contain spaces. Keys are case-sensitive, i.e. there is a difference between lowercase and uppercase caption.

The data source typically provides key/value pairs. Check whether a list of keys is available from the data source that will later be used to provide the data for update of the Sankey diagram. Copy the keys from the key/value pair list provided and type them in the "Key" field for the respective element.

Key Overview: When the option "Show Key Field" is set, a "Keys in Diagram" window can be called from the Edit menu. This list will give you an overview which keys have been defined for each element.

Keys in Diagram			
Element	Key	Value	Lookup Entry
Flow: Entry 1 0 kg (from 'Process' to 'Process 1')	a1	0	-
Flow: Entry 2 0 kg (from 'Process' to 'Process 1')	a21	0	-
Flow: Entry 3 0 kg (from 'Process' to 'Process 1')	a17	0	-

3 Keys

Initialize Process Keys Copy to Clipboard Copy with Element Information OK

Figure 106: List of keys in the diagram

Copy the list of keys with their current values to the clipboard using the button 'Copy to Clipboard'. The first two columns are 'key' and 'value'. Following columns are 'lookup list entry', 'type', 'from process', 'to process', 'flow entry'.

If you want to create your own set of keys rather than using pre-existing keys from your data source and typing them in by yourself, use 'Initialize Process Keys'. This will create a key for all process names in the Sankey diagram. Existing keys will not be overwritten. (Note: this feature is not available for keys for flows, stocks, and texts).

Key Lookup: If the administrator of the data source can provide a list of keys, it can be used as a lookup list in your desktop version. This will immensely help you to select the keys and also avoid mistyping the key name.

The lookup list must be a CSV file and can be located either on your computer or anywhere on an accessible network drive. The path to the lookup list CSV must be set in the options dialog on the 'Extended' page.

The format of the CSV file used for lookup should be as follows: There is one entry per line. The file has one or two columns. If there are more columns all columns after column two will be ignored.

- If there is only one column, this has to be a simple list with tag IDs serving as keys.
- If there are two columns, then the first column should be a name or description of the element (string), the second should contain the tag ID. The value in the second column will be used and copied to the "Key" field.

Several delimiters (e.g. ' or ") are allowed, so are the separators (e.g. comma, semicolon, pipe). The algorithm will try to determine the delimiter and separator.



Since spaces are allowed within the values, the space as separator should be avoided, unless you have the values in explicit delimiters (e.g. "value").

If a lookup list is available and has been set in the option, then typing some characters in any of the key fields will automatically bring up a list of hits with keys (IDs or names) that match. You can then select the correct entry from the lookup list.

Entryname	LL	Quantity	Unit	Key	Color
Sample Entry 1		200	kg	B	
				Building_14 (ID: G_MS120A) Building_15 (ID: G_MS122C) Building_15 (ID: F960) Building_14 (ID: Effluent Treatment) Building_14 (ID: Sensor TRA99648) Administration Bldg (ID: S_MS620)	

Figure 107: Using lookup lists to enter keys

The entered characters can be either in the key ID itself or in a description or real name of an equipment or machine the key references.

If you don't wish to use a lookup list, or if no lookup list is configured you can always type the key directly into the key field.

e!Sankey – show the flow / Umberto – know the flow

The software e!Sankey for the visualization of material and energy flows is a side product of the development of the material and energy flow modeling software Umberto. While e!Sankey requires all flows to be known and simply displays these flows in a graphically appealing diagram, its bigger brother 'Umberto' is a fully fledged modeling tool for material and energy flows.

It is used to determine material and energy flows in a process system using process specifications and powerful calculation algorithms. It also allows calculating the costs associated with material and energy flows in the production system, and the environmental impacts. Sankey diagrams are an alternative display option for the modeling results.

Read more about Umberto at <http://www.umberto.de>

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