



FienX Toolkit v3.2

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Below, **FCL** is short for **Fien Consulting Ltd** (or **LLC**).

Delivery

Any utility system model developed by FCL in Microsoft Excel will rely on the add-in and the add-in will check for itself whether it is dealing with a model derived from the FienX_Template workbook.

A single perpetual FULL license for the Toolkit is delivered with any FCL-built model.

The Toolkit can also be purchased without further services attached. Please, see *Licensing* below and visit FienConsulting.com.

Set-up & Start-up

Installation

NOTE: This add-in is designed for Microsoft Windows and will not work on other operating systems.

Make sure you have downloaded the installation package compatible with your version of Excel: 32-bit or 64-bit.

The installation package and all installed components are “code signed” for your security.

The FienX Toolkit’s main executable is a “XLL” file. After installation, it can be opened (loaded) – like any other Excel workbook – directly from Excel’s File / Open menu, or simply by double-clicking on its icon or on a desktop shortcut. It will snugly nestle into Excel and present its own ribbonbar menu, titled “Fien Consult”.

We recommend you put any workbooks created with the Toolkit in a so-called *Trusted Location* (see below), so that any required macros will not be blocked.

The licensed Toolkit functionality can ONLY be used with workbooks that are derived from the FienX_Template workbook, which can be accessed through the add-in.

This help document can be accessed from the Toolkit ribbon menu in Excel, or downloaded separately from www.FienConsulting.com

Excel Options Settings

The template workbook, and any model derived from it, contains macros and therefore requires that you:

- Store it in a “Trusted Location”
- Or...
- in Excel’s “Trust Center”, enable
 - access to macros
 - use of ActiveX components

It is also important to allow access to the VBA project object model.

For more detail, see the chapter at the end of this document.

Licensing & Security

The Toolkit comes in three license types (tiers): LITE, FULL and PRO. All are “node-locked” – i.e., tied to a single device – and perpetual, but each has different functionality restrictions. See the website for more details.

The splash screen (“About” panel) of the Toolkit will state your licence type.

The 14-day trial license is for the **PRO** functionality and therefore also gives access to the advanced task-specific template workbooks.

A license can be transferred to a different device up to 5 times. For this, first “Deactivate” the license and then re-activate it on the other device. The access to this functionality can be found under “Tools + Options” (on the Toolkit ribbon) and then “Licensing”.

Once activated, a licence needs to be verified every 90 days. This is a very simple and quick procedure, via the relevant button (see below).

Features

Loading the add-in will create a new menu ribbon in Excel, entitled “Fien Consult”. In broad terms, this ribbon offers the following features

Open Templates

This lets you create different workbook templates. Only two of these templates are available for all licence types:

FienX_Template: for general “free-hand” modelling

FienX_Trending: a macro-free workbook for collecting process data in a structured manner

The remaining templates require a **PRO** licence. See names and descriptions for the various workbooks available. Each workbook contains instructions for its use, but it is assumed that you have some familiarity with the concepts involved.

All templates, apart from the “Trending” tool, contain macro code, as described under Security.

As soon as you create a new workbook from its template, you will be asked to save it in its own location and with a new name.

Check Workbook

Determines whether the currently active workbook is derived from a FienX template file.

Tools + Options

Requires an active workbook. The pop-up window contains three sub-tabs:

1. **Calc. Settings** gives short-cut access to a few important Excel settings, but also:

Clear calc logs on F9

This erases the Calc. Log (see below), each time you press F9 to recalculate the workbook.

Warn on Save when VBA is “Unprotected”

Uncheck this option in models that are not meant to have protected macro code, to avoid repetitive warnings.

2. **Tools** several handy features for manipulating your workbook:

Find external links

Useful tool for finding cells that contain links to other workbooks.

Strip macros from workbook

This lets you generate a “neutralised” copy of the workbook, in preparation for sharing it with people who may not have the FienX add-in or who are not supposed to see your calculations.

- All macros will be removed (by saving the workbook as an XLSX file)
- Sheets of your choosing will be converted to “Values Only”.
- Hidden sheets will become “Very Hidden”.

Protect / Unlock sheets (ONLY with PRO licence)

This is meant for those who develop complex workbooks and want to *automatically* lock or hide certain sheets to prevent accidental corruption by either themselves or other users. After a workbook has been protected, the same button can also be used to Unlock/Unhide all sheets configured under this feature.

Once configured on the fnx_Settings sheet, specified sheets will automatically be hidden or locked when the file is closed. Via this button, those sheets can then be easily unlocked and accessed again by someone with a PRO licence and the password.

H/D Serial Nr (ONLY with PRO licence)

By adding your H/D identification number to the little table on the fnx_Settings sheet, your computer will automatically be recognised as having Admin rights when the workbook is opened. This will unhide/unlock all sheets configured under the auto-protect feature.

For added protection, this feature is not implemented for task-specific template workbooks.

3. **Licensing** functionality needed to administer your Toolkit licence:

Purchase

This will transfer you to the relevant web page. Internet access required.

Activate

Use this to activate a purchased licence code, once you have received this by email.

De-activate

Use this to de-activate a licence on the current device, in preparation for re-activation on another device. This is allowed up to five times for any licence.

Verify

Once activated, a licence needs to be verified every 90 days. This is a quick and simple procedure, via this button.

Show Calc. Log

Displays the log of UnitOp function calls and any resulting error messages. This can be helpful for debugging complex models.

UnitOp Models

Gives access to all “equipment models” via a drop-down menu. **This functionality is not available with a LITE licence.**

Combustion Models

Creates a standard table for entering fuel specifications and for doing certain standard calculations for fuel properties and combustion emissions. It also sets up the template for firing efficiency calculations. **This functionality is not available with a LITE licence.**

There are separate models for:

Gaseous Fuels

Takes a full gas composition for calculation of heating value and combustion emissions.

Liquid Fuels

Expects more approximate measures of WatsonK, API and Sulphur mass-fraction, to estimate heating value and combustion products. If you know the heating value or emissions factors for a fuel already, then use that information.

Solid Fuels (or any hydrocarbon fuel, if necessary)

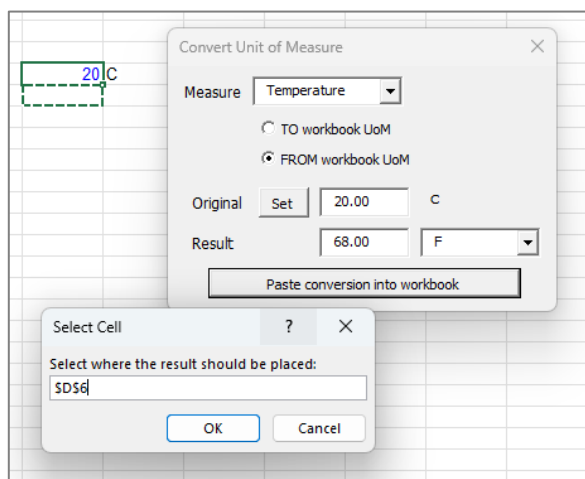
Uses only weight-fractions of Carbon, Hydrogen and Sulphur to calculate emissions. Lower Heating Value must be specified explicitly

The lower part of the table – used for combustion calcs and thermal performance – can be copied separately, for modelling multiple equipments that use the same fuel.

Units of Measure Conversion

This tool helps you create a worksheet formula to convert a value to or from the “workbook” units.

The workbook units of measure (UoM) are selected on the fnx_Settings sheet. If you need to display a value also in another unit of measure, then use this tool to create a formula that takes the original value and the conversion factors available in fnx_Settings to find the converted value.



Note that this uses only UoMs that have been defined in the `fnx_Settings` sheet. You can add to these definitions, as described in Units of Measure handling.

When pasting the result into the workbook, TWO cells will be used: one for the converted value and one for the associated UoM label.

NOTE: This feature only works in workbooks derived from the “general modelling” template.

Trends Table

This can be used in any Excel workbook but requires access to the “VBA project object model” under Excel’s Trust settings. It creates a new worksheet with carefully designed lay-out for collecting, filtering and trending process data. The columns can be easily copied for trending additional parameters. Also, multiple sheets may be created

At the top of the sheet you can specify the limits, etc. for validating and filtering the raw data. It is up to the user to configure how to pull in the historical data from a specific data source.

The Trends Table sheet implements the FienX “FilterValue” function. For this, macro code is added to the workbook, which means **it will have to be saved as a macro-enabled “XLSM” file**. Note that this functionality does not require a FienX workbook.

To support the “FilterValue” function, another sheet is also created, called “NmdRngs” (Named Ranges). This can be re-used for other purposes, wherever the FilterValue function is needed.

The “Binary Text” table on the NmdRngs sheet is used to translate textual status information to a binary value (1 or 0). Add more rows to this little table depending on how many strings are used to indicate equipment status in your historian.

Units of Measure handling

At the start of any modelling task or use of one of the PRO templates, it is crucial to first specify the units of measure (UoM) you will apply.

To avoid unnecessary clutter, the Toolkit contains only the most practical property and equipment calculations for real-world operational applications. For the same reason, it also includes only the required units of measure that apply to those calculations. However, for those required properties, you have great flexibility in handling the units of measure.

The standard `fnx_Settings` sheet enables the selection of a UoM for each relevant property and also allows the definition of alternative units, when necessary. As usual, the cells with blue font can be modified. After completing your selection via the drop-down lists, press the Update button to register it in the system.

DO NOT MODIFY the layout of this page.					
	Update		check	1.0	
Pressure	bar_g	0.1000	0.1000	1 bar_g =	0.200 MPa
Temperature	C	1.0000	273.1500	1 C =	274.150 °K
Enthalpy	kJ/kg	1.0000	0.0000	1 kJ/kg =	1.000 kJ/kg
Mass Flow	t/h	0.3	0.0000	1 t/h =	0.3 kg/s
Power	kW	1.0	0.0000	1 kW =	1.0 kW
Heat Duty	GJ/hr	277.8	0.0000	1 GJ/hr =	277.8 kW
Distance	m	1.0000	0.0000	1 m =	1.000 m
Density	kg/l	1000.00	0.0000	1 kg/l =	1000.000 kg/m3
Not used in any FienX functions:					
Volume Flow	m3/s	1000.0000	0.0000	1 m3/s =	1000.000 l/s
Water Flow	l/s	1.0000	0.0000	1 l/s =	1.000 l/s
Air Flow	m3/s	1000.0000	0.0000	1 m3/s =	1000.000 l/s

If the sheet does not already offer the UoM you require, then simply replace one of the default UoMs with the new one: specify the “title” in the yellow cell and then enter the “Factor” and “Offset” needed to convert **FROM** your new UoM **TO** the internal UoM. The relevant internal UoM is indicated at the top of each table. For temperature (see below), the internal UoM is Kelvin. To convert FROM Celsius (C) TO Kelvin (K), a value is multiplied by 1.0 and then incremented by 273.15. All other UoMs are handled in the same manner. The “check” field in the screenshot above can be used to test the conversion for any property.

Temperature		to Kelvin	
from...		Factor	Offset
K		1.0000	0.0000
C		1.0000	273.1500
F		0.5556	255.3722
R		0.5556	0.0000

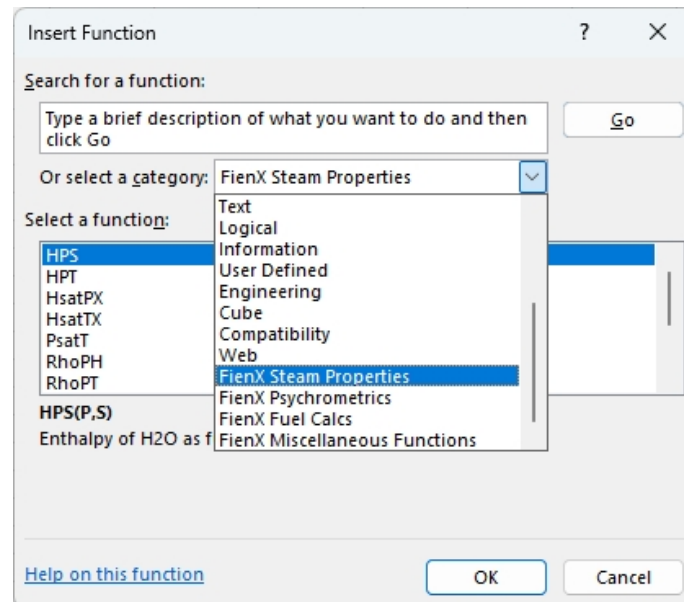
NOTE:

- Active UoMs can be shown in your workbook by typing “=uomT” (for temperature), “=uomH” (for enthalpy), etc. These will be automatically updated when a new UoM is selected.
- Beware: changing a UoM does **not** modify any manually entered values
- The units for volumetric flow (e.g., water or air) can be used for your own purposes but are not used by the Toolkit functionality.
- Do not modify the lay-out of this standard sheet, to avoid corruption.

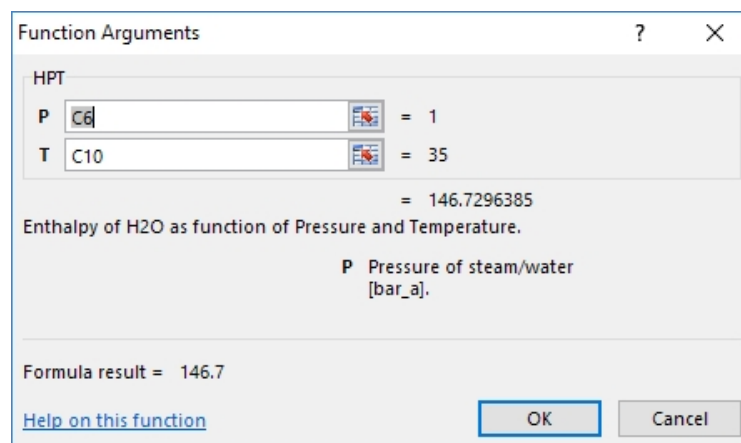
Adding a Calculation

General

When you have opened a FienX workbook, you can use the regular Excel Function Wizard (see image below), to explore and access the ToolKit functions.



Selecting a function presents the standard Function Arguments dialogue, containing various bits of helpful text, including the units of measure expected in the current workbook.

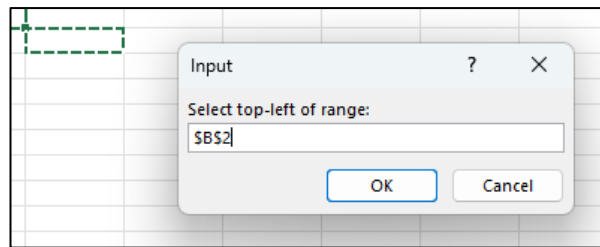


Of course, once you are sufficiently familiar with the functions you need, you can also just start typing them directly into a cell.

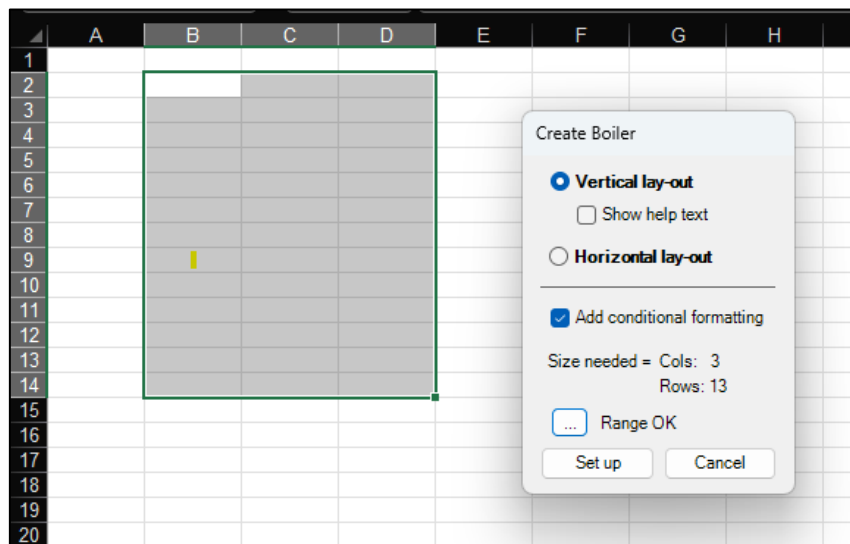
To add Unit Operations (UnitOps) or Combustion models, you must go via the FienX Toolkit menu in the ribbon bar.

Adding UnitOps via the FienX Toolkit menu

When you decide to add a UnitOp via the FienX menu, you will first be asked where to place the calculation:



The ToolKit then presents the following window:



The radio buttons determine whether data entry and results will all be in either a single column or a single row. The vertical lay-out allows some additional help text to be shown. The horizontal lay-out is sometimes preferred for creating tables of multiple equipments of the same type.

Conditional formatting will automatically show “hard-coded” values or text in a blue font and formula results in the default (normally black) font. This is useful for spotting where user entries were made.

The range selector is for choosing the top-left cell of where the model is to be created. You can see how many rows and columns are needed for the chosen lay-out.

Press “Set up” to complete the process.

Adding Combustion Models via the FienX Toolkit menu

When adding a combustion model, you will also be asked where to place it and warned if the necessary space is not entirely empty. If accepted, the fuel table and burner model will then be automatically inserted starting at the selected top-left cell.

The PRO template workbooks

Steam Pricing

When evaluating the benefits of reducing steam consumption, increasing steam generation from waste heat, or improving condensate recovery in your system, it is important to know the true marginal value of that steam and/or condensate. Using design values, or values that include asset depreciation or annual maintenance costs, for example, is not appropriate. This workbook gives good estimates of the real prices for:

- steam (at multiple pressure levels and for various "use types")
- condensate (at multiple pressure levels)
- boiler feed water (BFW; after deaeration and pressurisation)

Note that these are "marginal" prices, i.e. representing the cost of one additional ton of steam/condensate/BFW produced or saved.

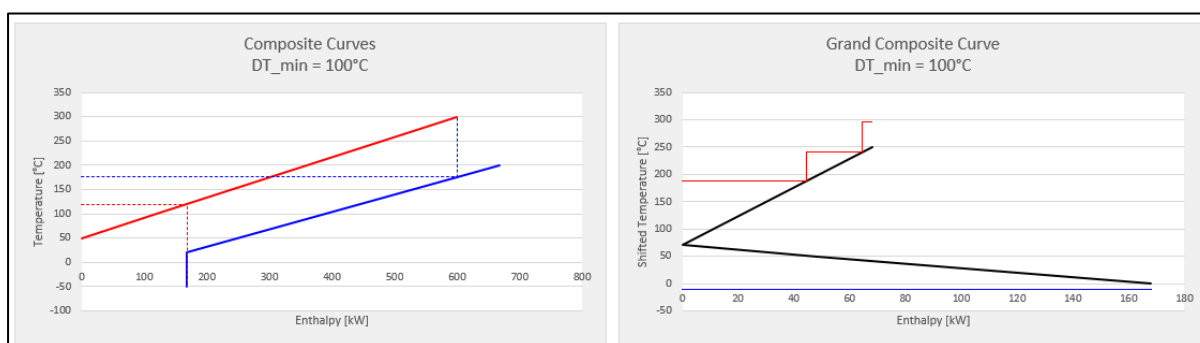
The workbook also generates values for the FEVs needed in the Pinch Analysis template.

See the "Instructions" sheet in the workbook for further info.

Pinch Analysis

This tool will do a basic Pinch Analysis for heating and cooling targets, for any number of process streams and any number of hot and/or cold utilities. It uses some inputs (FEVs) from the "Steam Pricing" workbook.

Familiarity with Pinch principles is assumed. Instructions for use are provided in the workbook.

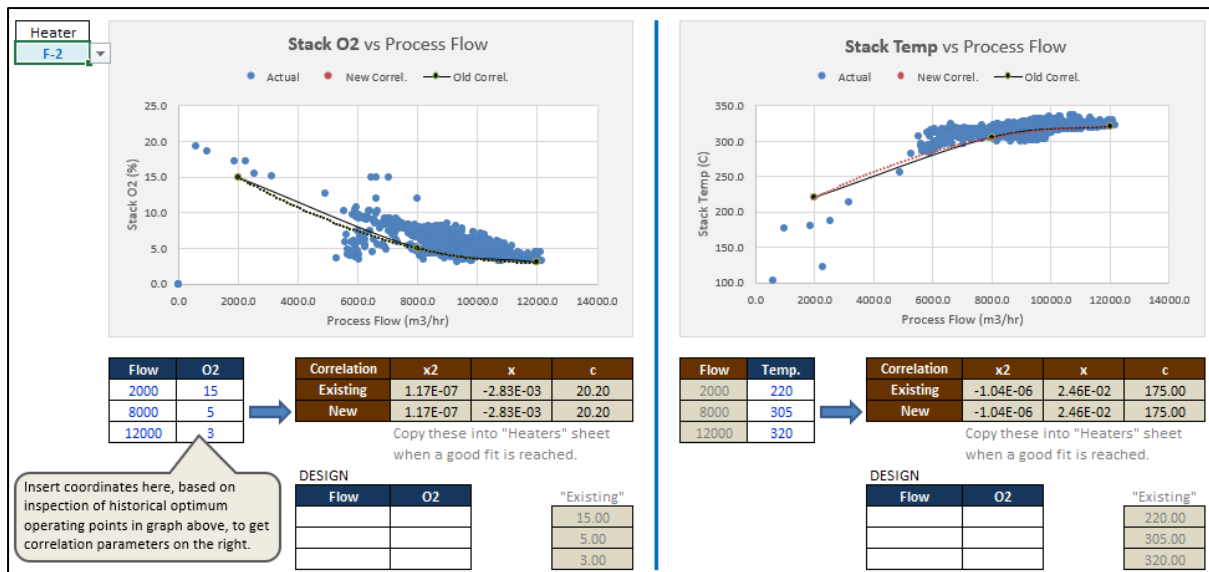


Fired-Heater Analysis

This workbook offers trending and analysis of the emissions and efficiency of fuel-fired heaters, like boilers and furnaces. It allows specification of gaseous, liquid and solid fuels.

The workbook contains substantial SAMPLE DATA, which can all be replaced/deleted.

The "Guide" sheet explains how to use this tool.



Cooling Tower Evaluation

Use this template to evaluate the design or performance of a generic cooling tower.

- Enter data for DESIGN case and CURRENT case, to evaluate any deterioration in performance (KaV/L).
- Use "Rating" to evaluate how the cooling water temperature changes with changing operating and/or ambient conditions.

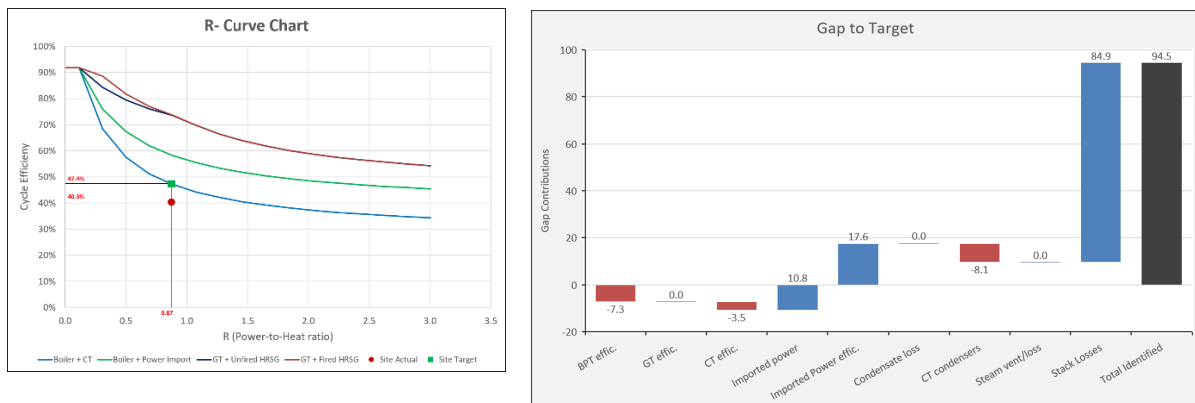
The optional input of a measured make-up flow can help to verify (reconcile) the overall data set.

Further instructions for use are available in the workbook.

R-curve Gap Analysis

This workbook contains relatively advanced calculations for analysing the overall cycle efficiency of co-generation (or Combined Heat & Power - CHP) systems. It also performs an automatic gap analysis between "target" and "actual" performance. Some familiarity with the concepts involved is highly recommended.

Further instructions are included in the workbook.



Economic Calcs

This is not a “FienX-enabled” workbook, so cannot be used for modelling of utility systems. Instead, it helps to calculate:

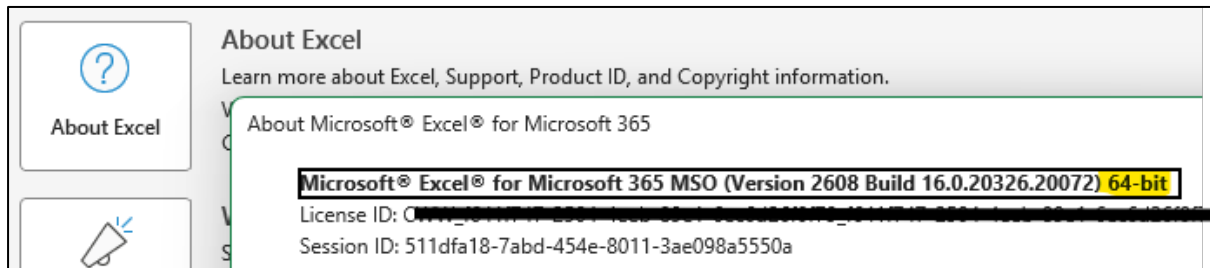
1. the NPV of an intended (utilities) cost-saving project. Depreciation schedules can be modified as necessary.
2. the maximum capital expenditure to achieve an acceptable IRR for a specified annual cost reduction from cost saving programmes.

This template is not available for TRIAL licences.

Installation Instructions

Compatibility

Make sure you download the correct version of the add-in to be compatible with your version of Excel: 32-bit or 64-bit.



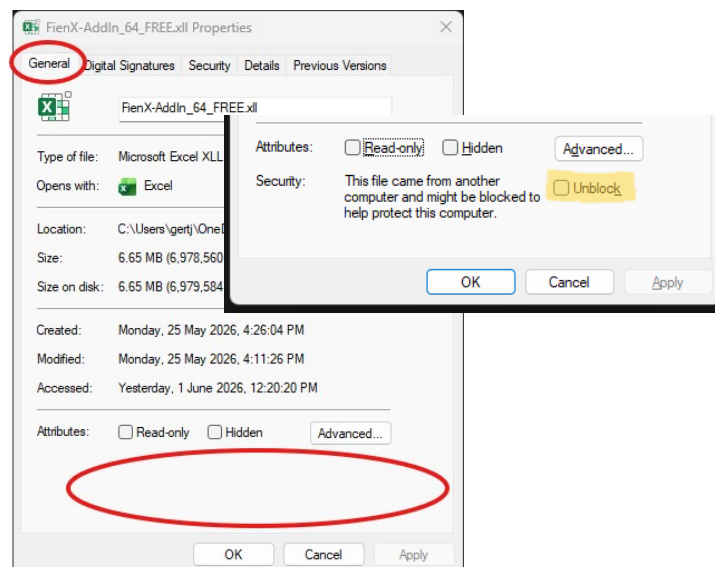
First-time Use

1. Close Excel completely
2. Double-click on the installed XLL file, to...
 - a) Start Excel
 - b) Load the Toolkit

You may find it helpful to create a shortcut to the XLL file on your desktop.

Resolve XLL “blocked”

If the .XLL file is “blocked” on first use, right-click the file name in Windows Explorer, to access “File Properties”. Then, on the “General” tab, select “Unblock” to remove the block.

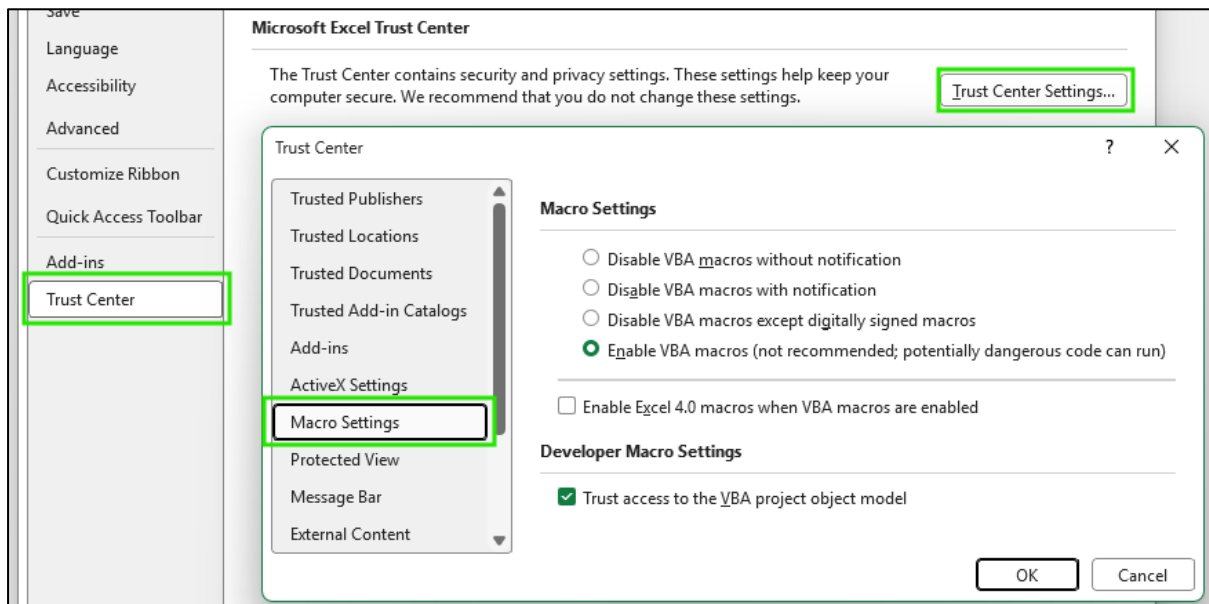


Alternatively, you could declare the installation folder of the XLL (add-in) as a Trusted Location in Excel settings (see below).

Excel Trust Center

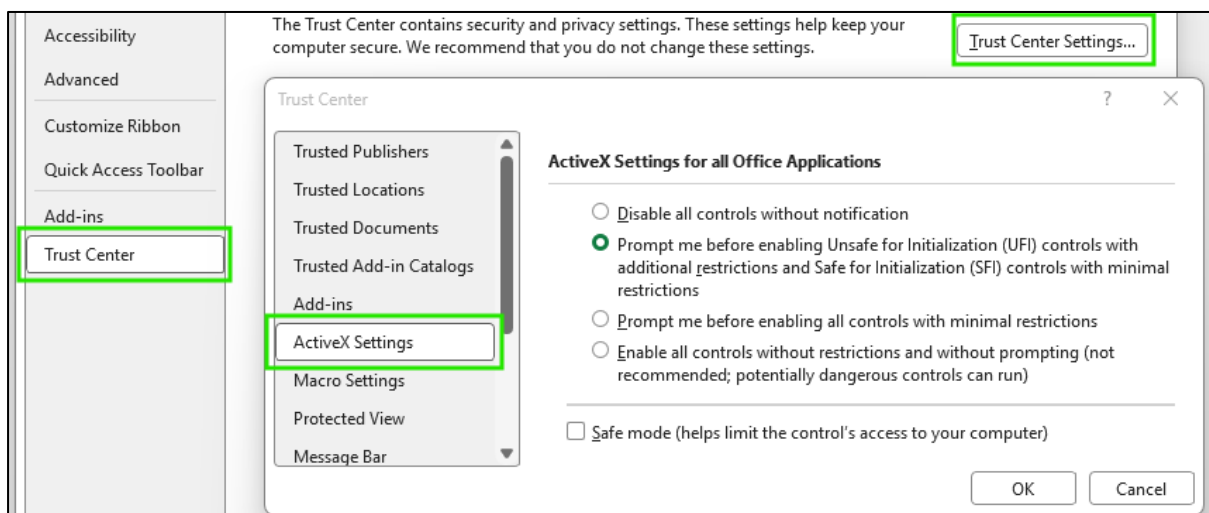
The add-in and the workbook macros must be allowed to run. Under File / Options, go to “Trust Center” and enable

- Access to macros
- Access to the VBA project object model



And/or declare the ToolKit's XLL folder and the folder(s) where you store your FienX workbooks as “Trusted Locations” in the Trust Center.

In latest versions of Excel, the following ActiveX setting may also be needed, especially if the add-in fails to insert unit operations ...



Trusted Locations

Adding files to trusted locations can be very helpful. Microsoft made these available for a good reason. See which standard locations are already available and consider if you could store your FienX model files there or in subfolders.

Note that it is not recommended to move the FienX installation files (XLL) to another location. Instead, consider declaring the installation folder as “trusted”.

