IRENA
International Renewable Energy Agency

IRENA

FlexTool

TRAINING FOR ASEAN

SESSION 1: Introducing and installing FlexTool

Introducing the FlexTool

License and development

IRENA FlexTool

1. FlexTool license

- IRENA FlexTool is a free software
- Redistribute or modify under GNU Lesser General Public License

2. Ongoing development

- The main branch is actively developed by IRENA and VTT Technical Research Centre of Finland
- New versions will be announced on irena.org

3. Future developments

- New features are developed according to user needs and wishes
- Any suggestions/comments can be submitted to Flextool@irena.org

Versions of the FlexTool

IRENA FlexTool

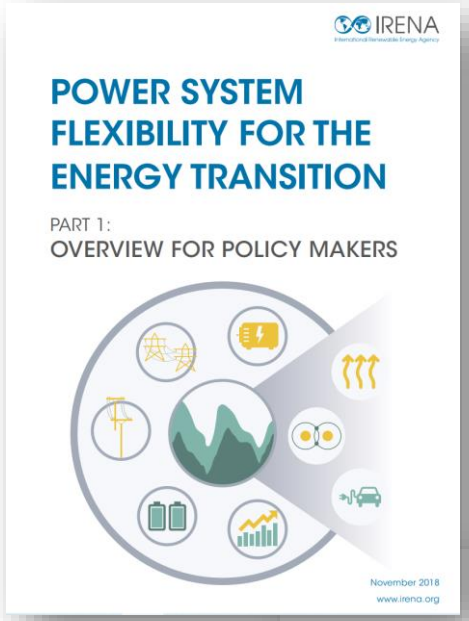
1. **First public version (November 2018)**

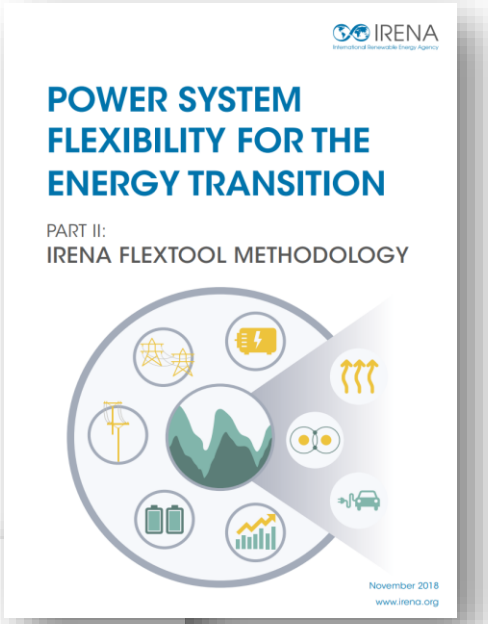
2. **Version 1.2 (April 2019)**
   - New features were added for multinode models and improved result printing

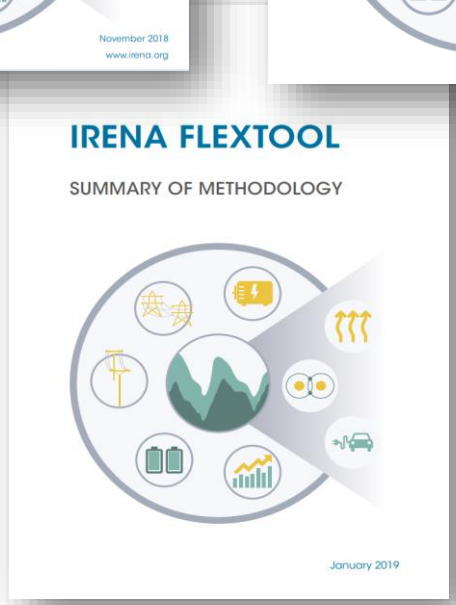
3. **Version 2.0 (April 2020)**
   - Added units with multiple outputs (*e.g.,* CHP units), better unit specific constraints (*e.g.,* minimum and maximum generation, fixed generation, etc.)
   - Further improvements in results printing

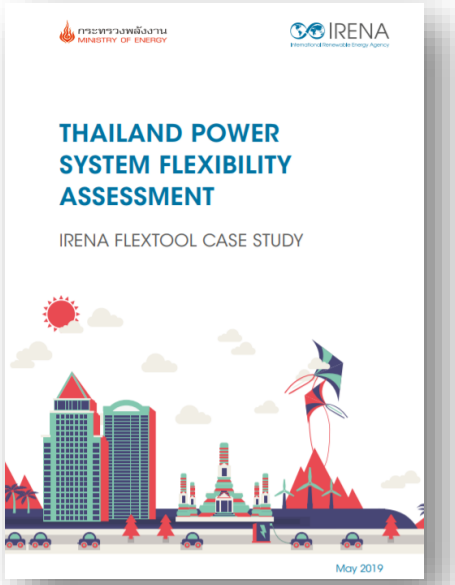
Support documents

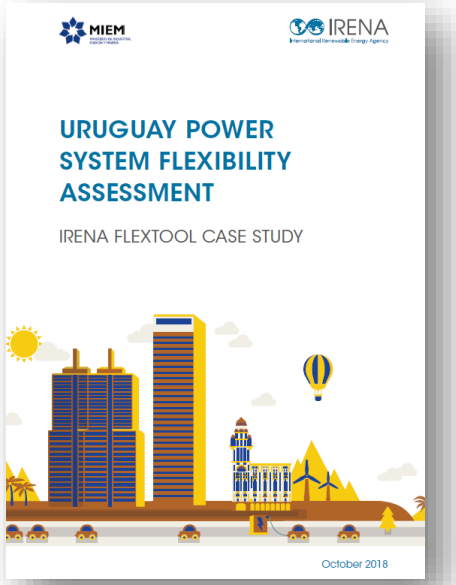
IRENA FlexTool

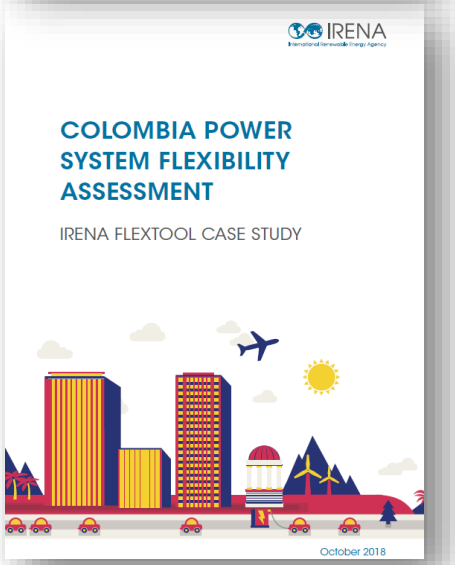


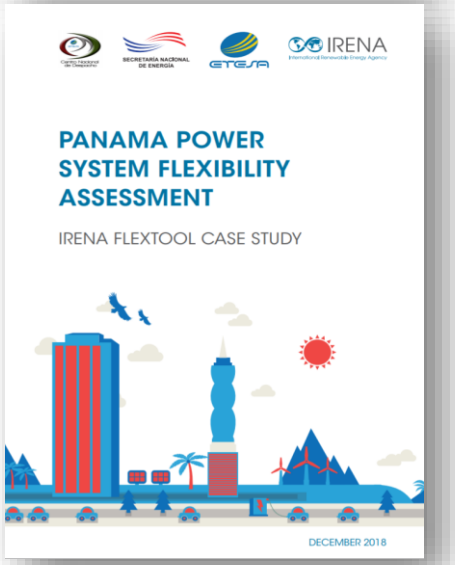












Main files (1-3)

FlexTool involves three main files:

1. flexTool.xlsm file (MS Excel)
2. Input-data files (MS Excel)
3. Result files (MS Excel)

Users must be Excel-enabled:

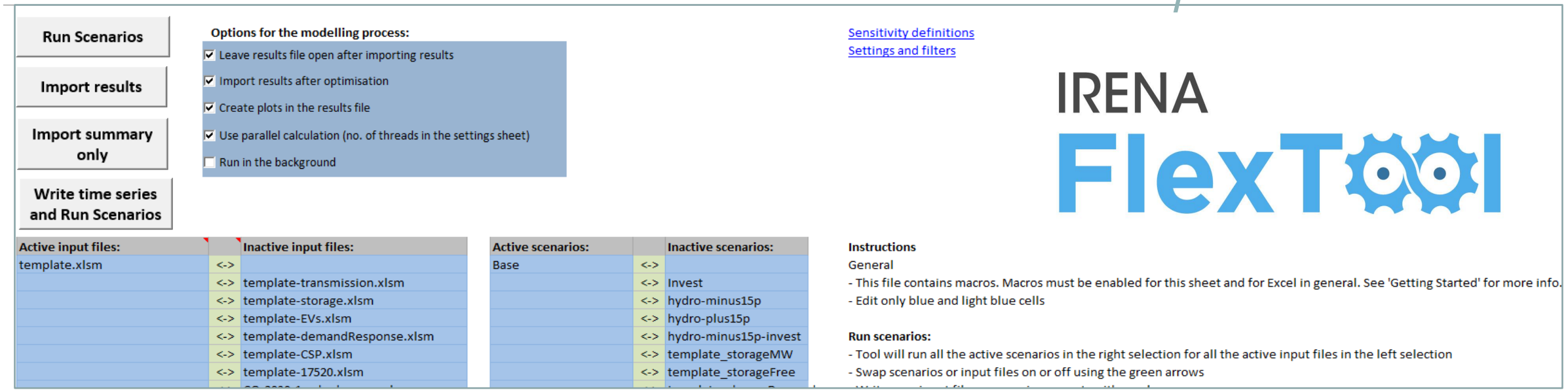
Main files: (1) User interface

IRENA FlexTool

1. flexTool.xlsm (MS Excel)

- Main user interface:
  - Select used model and scenarios,
  - Run the model,
  - Print selected results

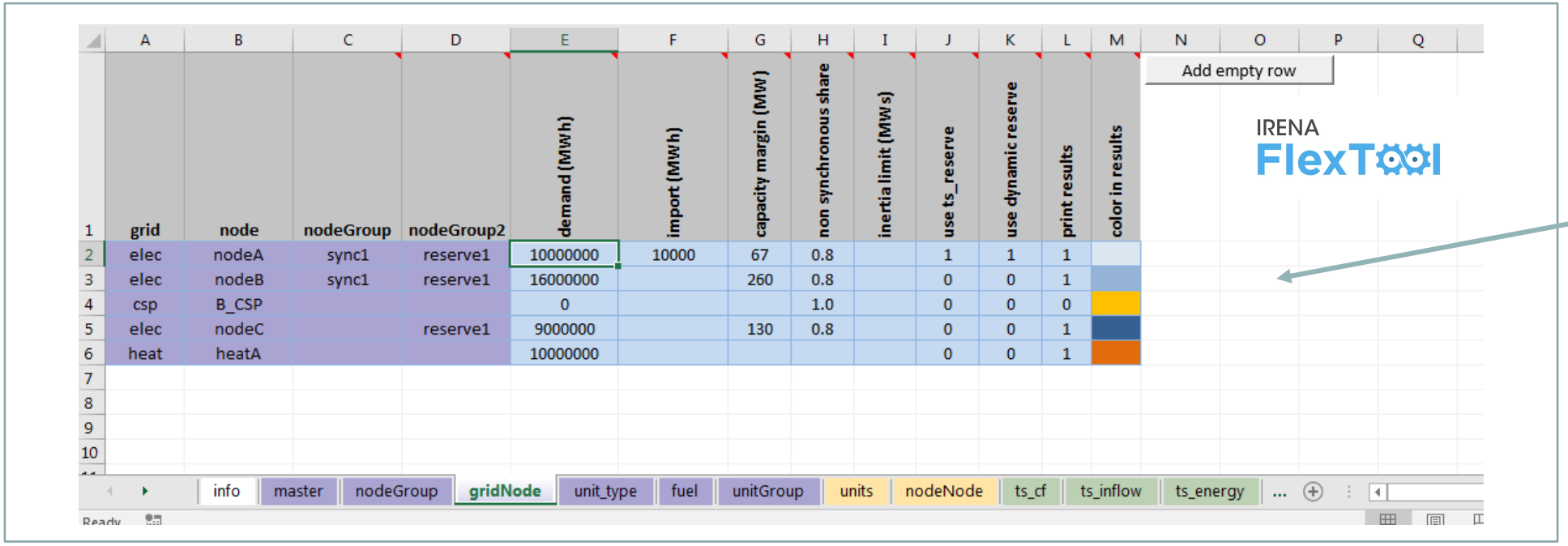
Screenshot: flexTool.xlsm



Main files: (2) Data input

2. Input-data files (MS Excel)

- Input data files define the model version
- flexTool.xlsm is the same for all countries, input data is unique
- Every model year needs its own input data file (*e.g.*, Thailand 2019, Thailand 2030)



	A	B	C	D	E	F	G	H	I	J	K	L	M
1	grid	node	nodeGroup	nodeGroup2	demand (MWh)	import (MWh)	capacity margin (MW)	non synchronous share	inertia limit (MWs)	use ts_reserve	use dynamic reserve	print results	color in results
2	elec	nodeA	sync1	reserve1	10000000	10000	67	0.8		1	1	1	
3	elec	nodeB	sync1	reserve1	16000000		260	0.8		0	0	1	
4	csp	B_CSP			0			1.0		0	0	0	
5	elec	nodeC		reserve1	9000000		130	0.8		0	0	1	
6	heat	heatA			10000000					0	0	1	
7													
8													
9													
10													

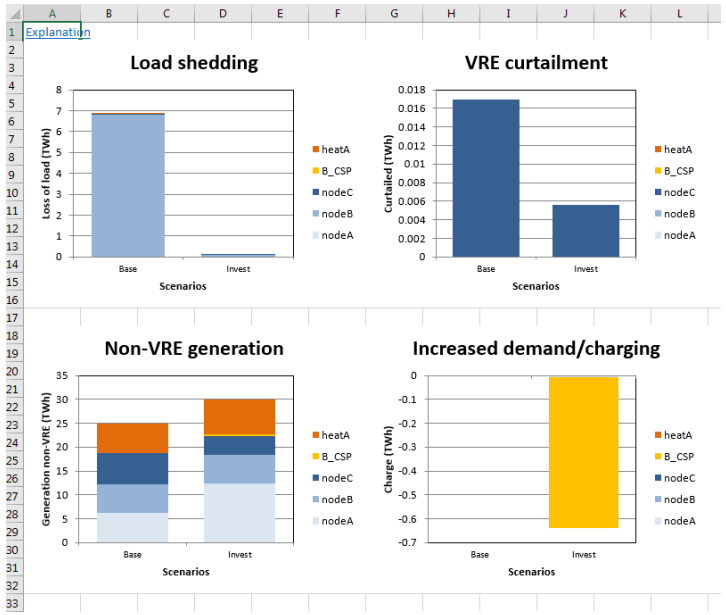
Screenshot of the input data file

Main files: (3) FlexTool results

3. Result files (MS Excel)

- Results show in large amounts, from summaries to more detailed ones
- User has the possibility to show only one scenario or to compare results from multiple scenarios

	A	B	C	D	E
1	Update sheets window	template_groups	template_groups_v4		
2		Base	Invest		
3	Optimal objective	6.97E+10	2306494547		
4	Iterations	1557	988		
5	Time (s)	1.402	1.032		
6					
7	Total cost obj. function (M CUR)	69583.86596	2231.355963		
8	Time in use in years	0.053424658	0.053424658		
9					
10	Emissions				
11	CO2 (Mt)	6.61487	8.70964		
12					
13	General results	elec	elec		
14	VRE share (% of annual demand)	29.7	34.01		
15	Loss of load (% of demand)	19.6	0.3842		
16	Insufficient reserves (% of reserve demand)	0	0		
17	Insufficient inertia (% of inertia demand)	0	0		



Screenshots of the results file

Install and test the FlexTool

Steps to install IRENA FlexTool

IRENA FlexTool can be installed and run in just **five steps**:

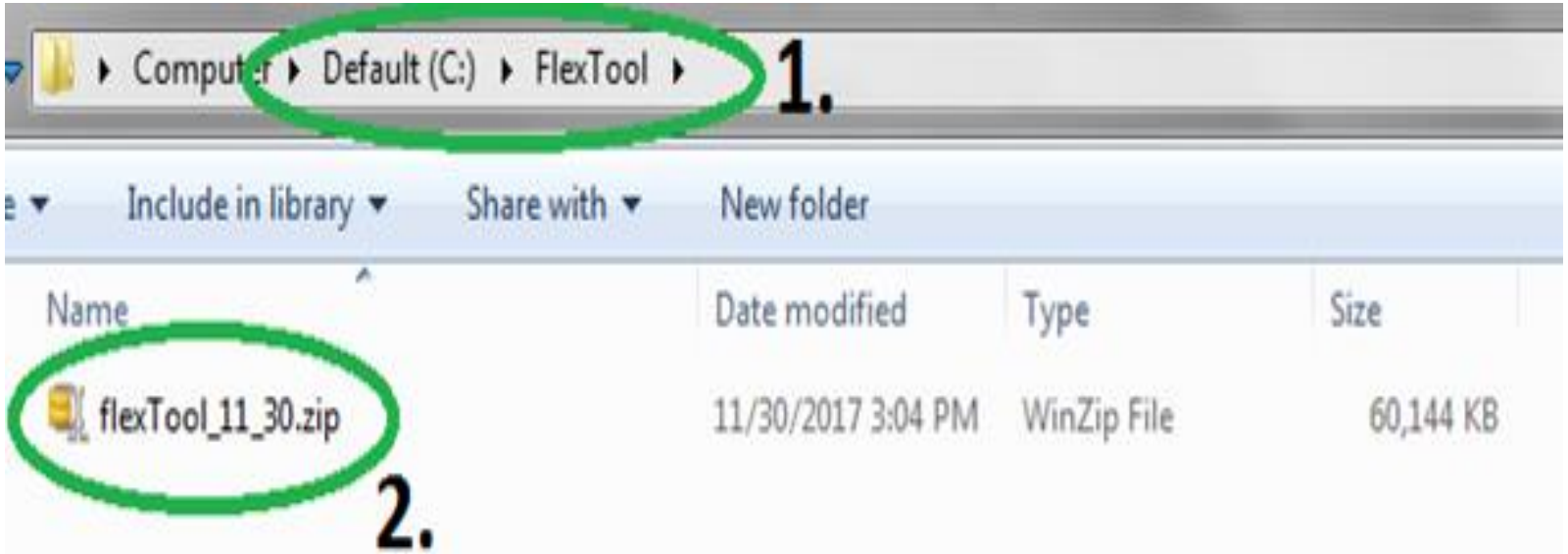
1. Create folders and copy files
2. Enable macros in flexTool.xlsm Excel file
3. Run existing demo model
4. Introduction to results file
5. Batch run – Running both dispatch and investment modes

Create folders and copy files, 1/2

IRENA FlexTool

1. **Create a folder for FlexTool** (*e.g.,* c:\FlexTool)
   - Install folder is called **root folder**

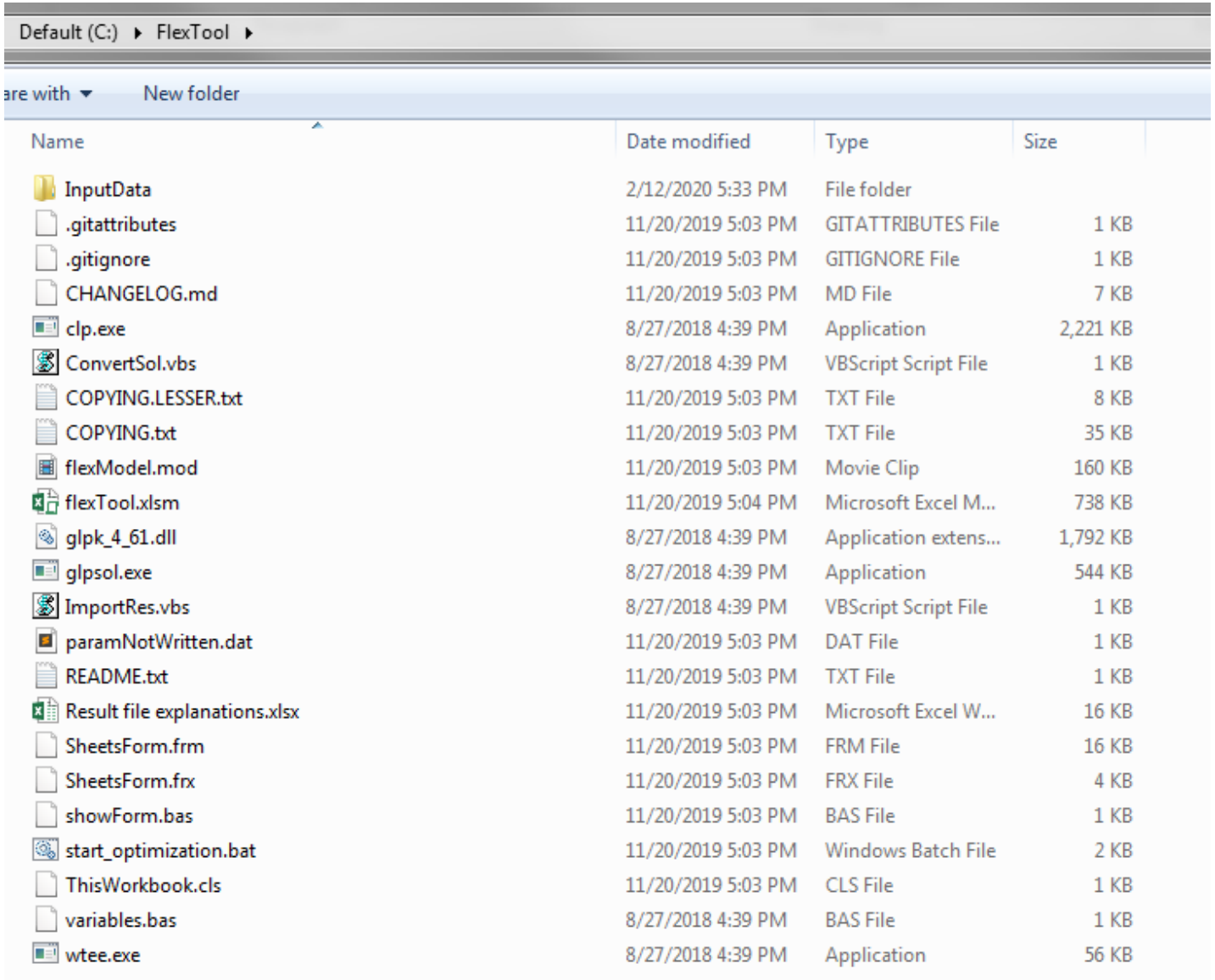
2. **Copy zipped FlexTool install package to the new folder**
   - File is named as flexTool_YYYY_MM_DD.zip (*e.g.,* FlexTool_2019_11_03.zip)
   - Check from file name which version (date) of the tool you are installing



Create folders and copy files, 2/2

IRENA FlexTool

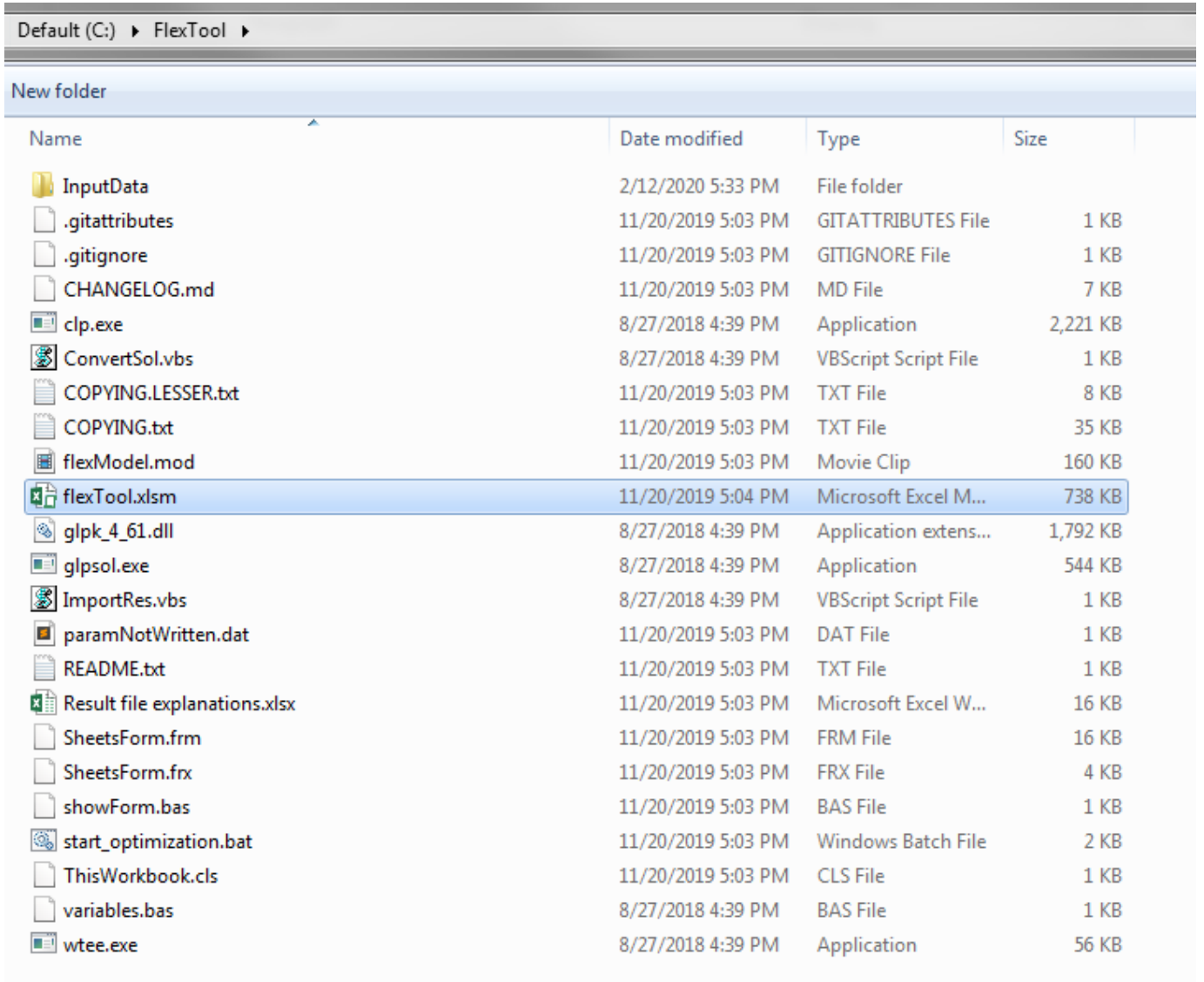
3. Unzip files to root folder



Enable macros, 1/3

IRENA FlexTool

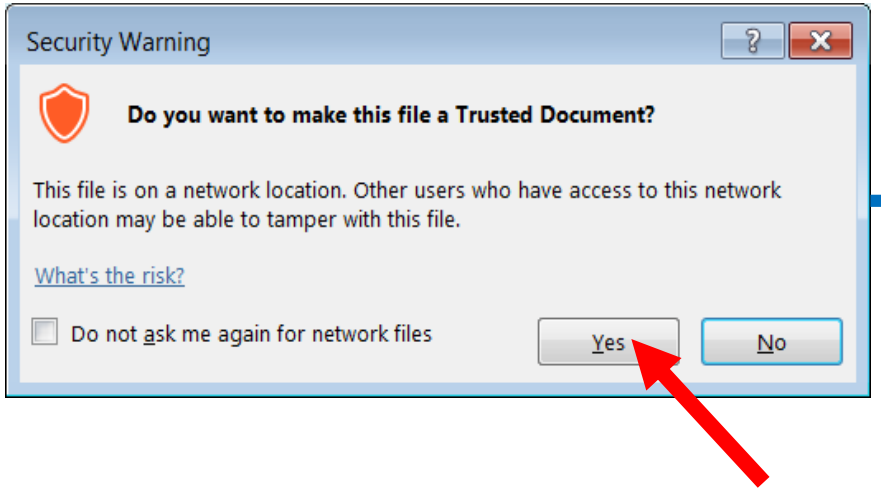
1. Run flexTool.xlsm from root folder



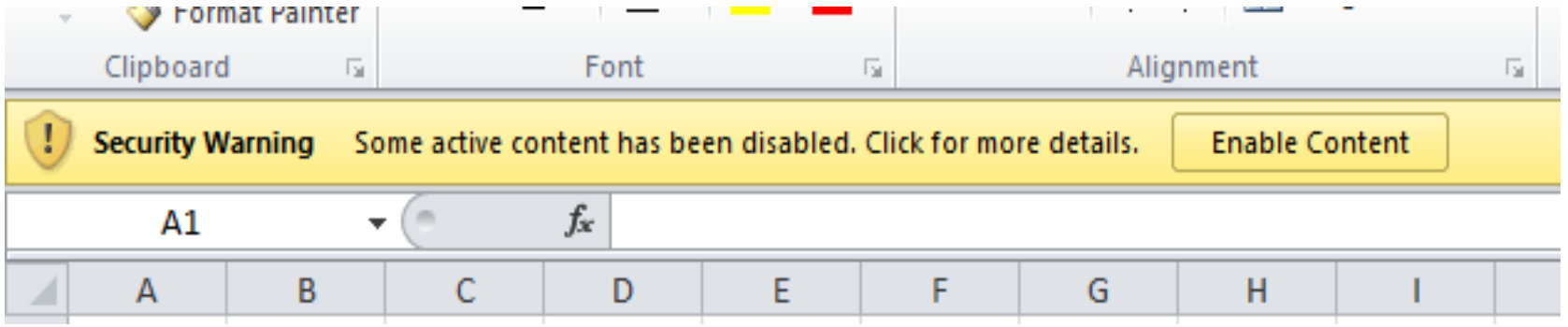
Enable macros, 2/3

IRENA FlexTool

2. Click "Yes" or "Enable Content"



OR



Enable macros, 3/3

IRENA FlexTool

3. In flexTool.xlsm

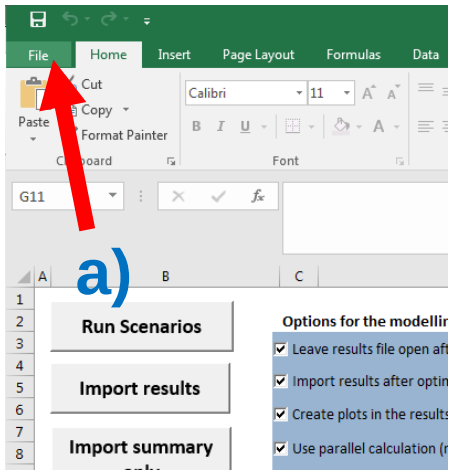
a) Click "File", then

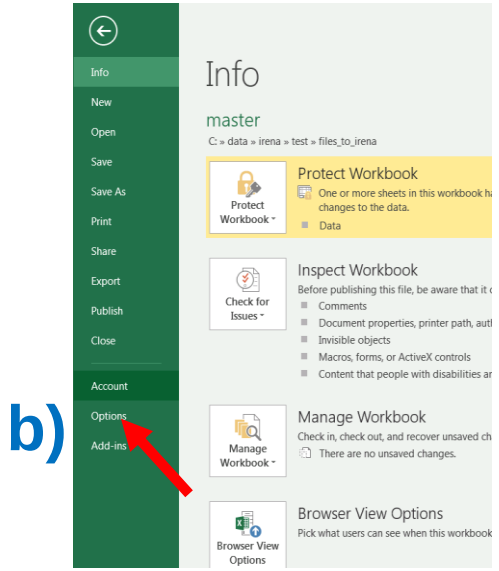
b) "Options",

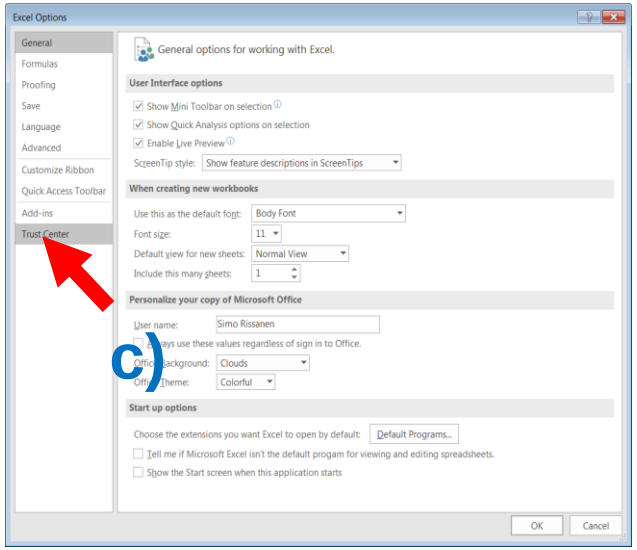
c) "Trust Center",

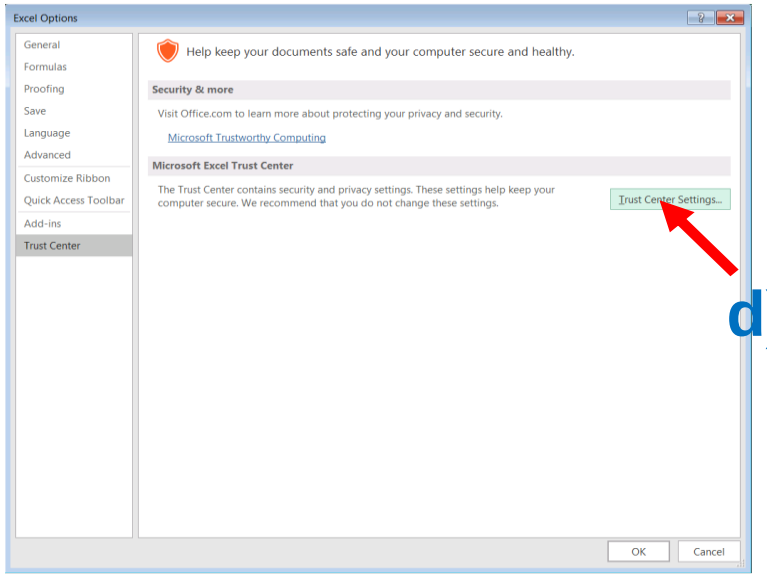
d) "Trust Center settings",

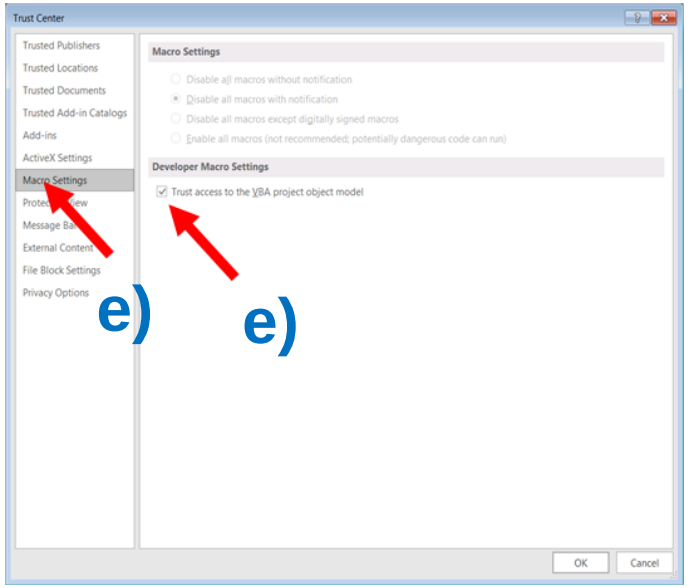
e) "Macro settings" and make sure that "Trust access to the VBA project object model" is checked











Run existing demo model, 1/4

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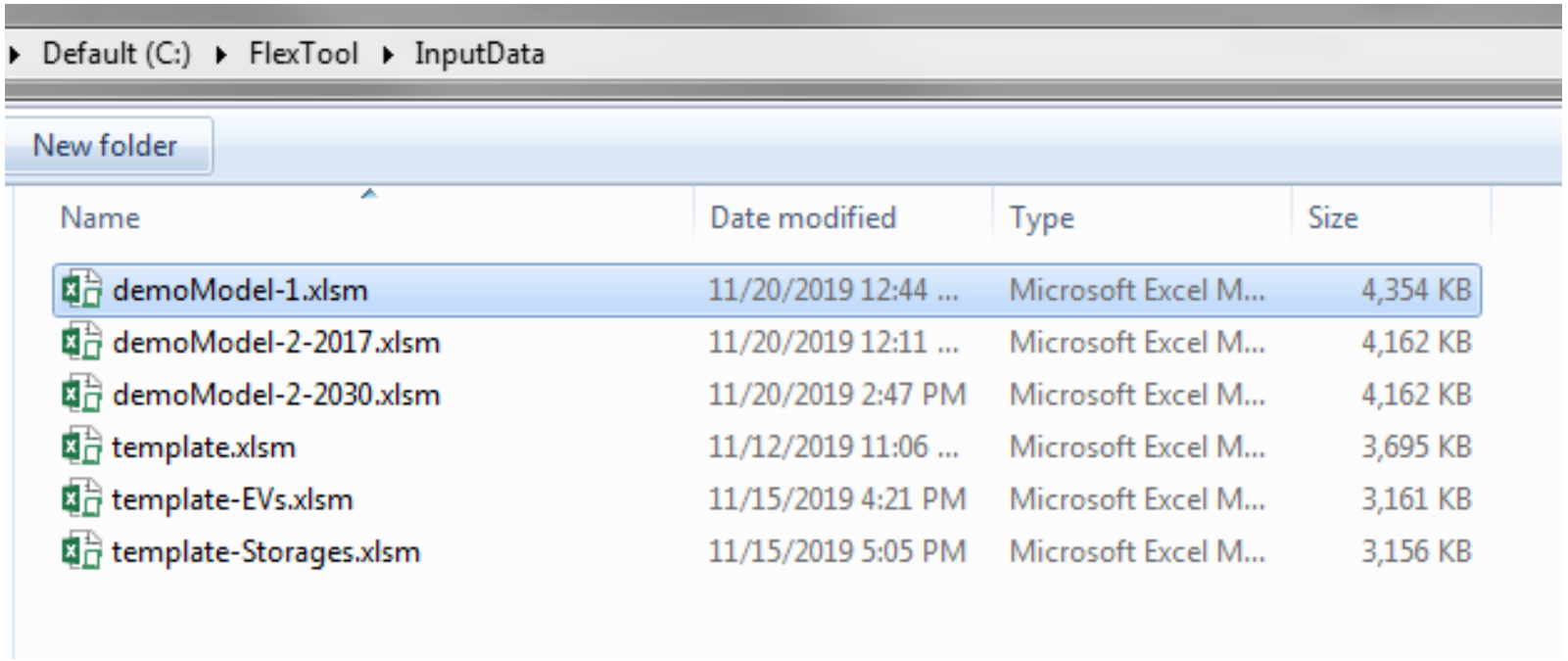
1. **Check from 'InputData' subfolder which files are included in the installation package.**
   a) Template file is the default model and basis to create new models
   b) Template_xxx are additional examples on how to model specific technologies
   c) In addition, your installation package might contain other input data files (*e.g.,* demo models or input data for your own country)



Run existing demo model, 2/4

IRENA FlexTool

2. Open flexTool.xlsm

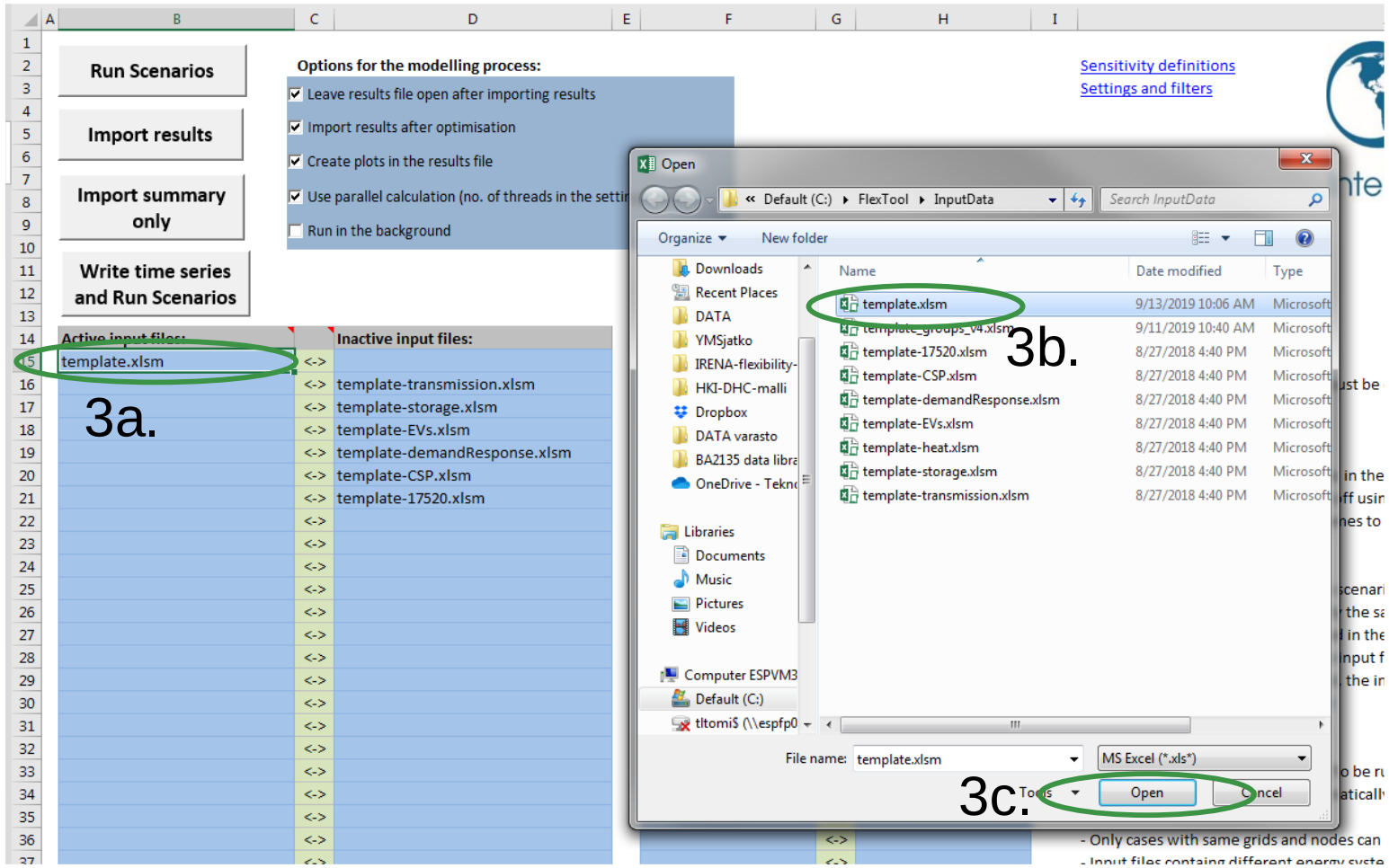
a) Check from previous chapter that macros are enabled from two places

3. Open 'sensitivity scenarios' sheet.

a) Click the first 'active input files' blue cell

b) Choose 'template' input file from the pop-up window

c) open the input file



Run existing demo model, 3/4

IRENA FlexTool

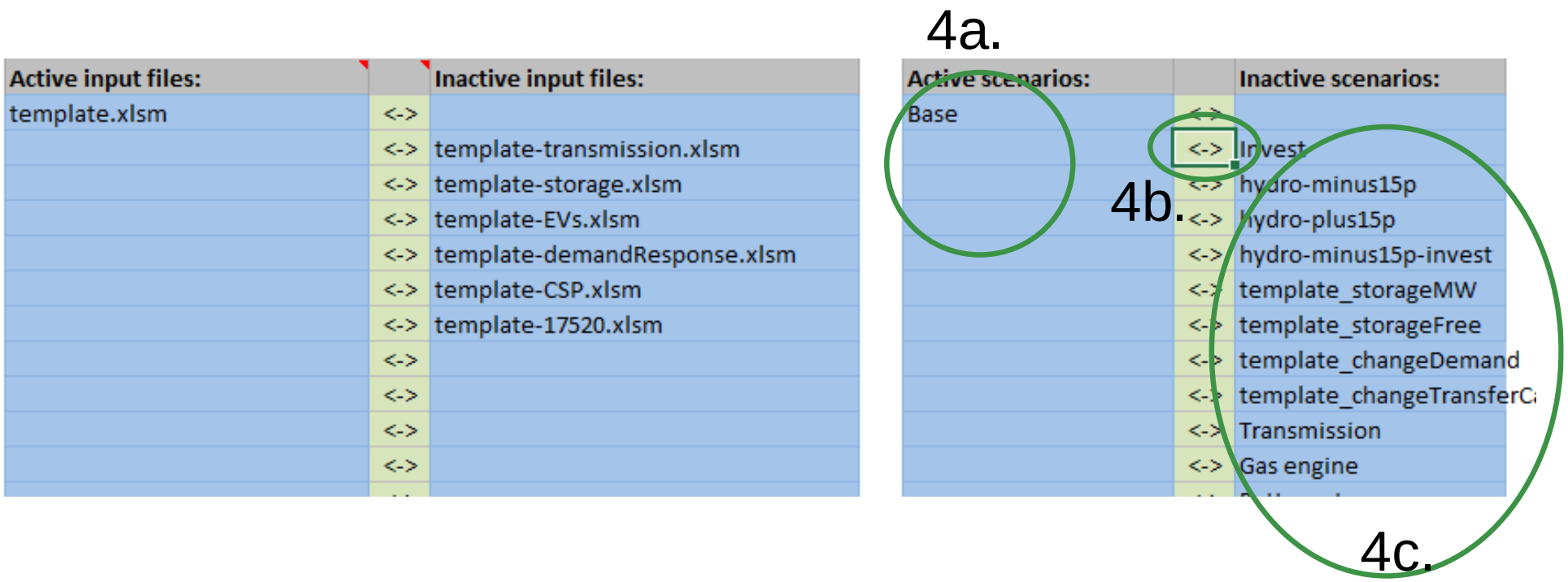
4. Select active scenarios

a) Check that only 'Base' is selected

b) You can activate (list on left) or deactivate (list on right) scenarios with green arrows

c) The list of inactive scenarios can be long, model does not run them unless activated

d) You will later learn how to create your own scenarios



Run existing demo model, 4/4

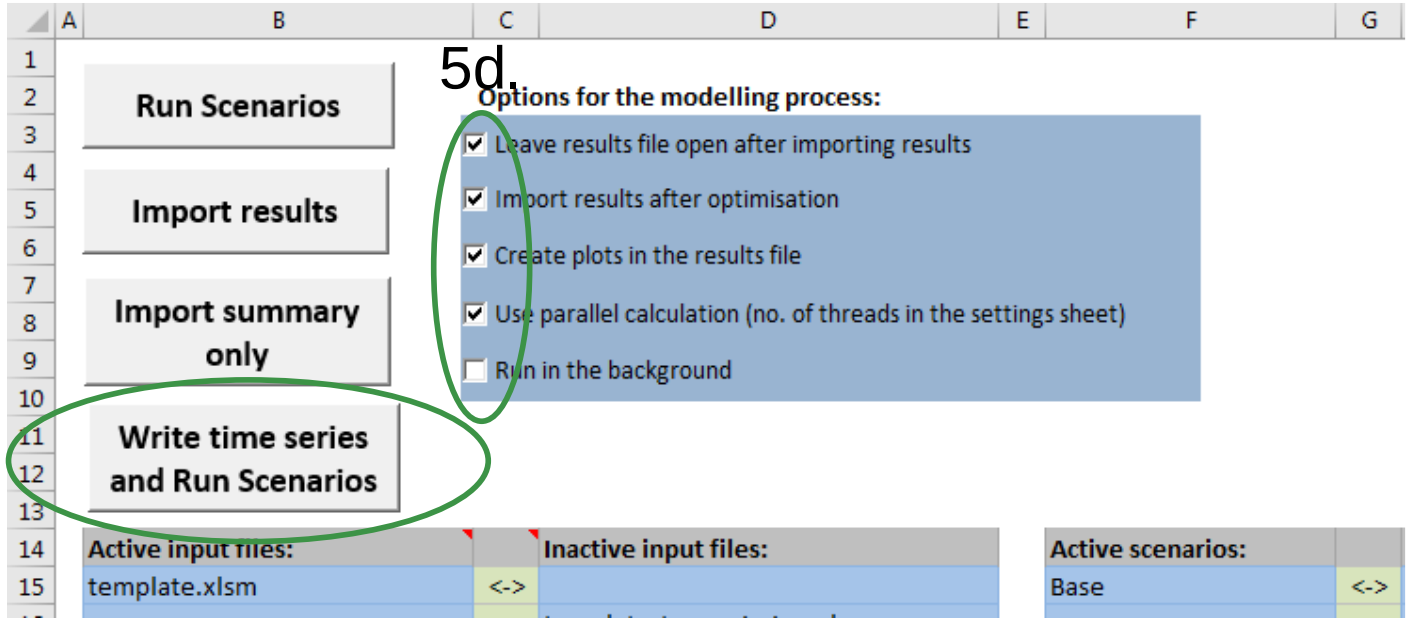
5. Run demo model

a) Click ‘Write time series and Run Scenarios’

b) Close the input file before running the model. The Flextool warns you if the input file is open.

c) Wait and watch

d) FlexTool automatically imports results file if the option is selected



Introduction to results file

6. Summary of results

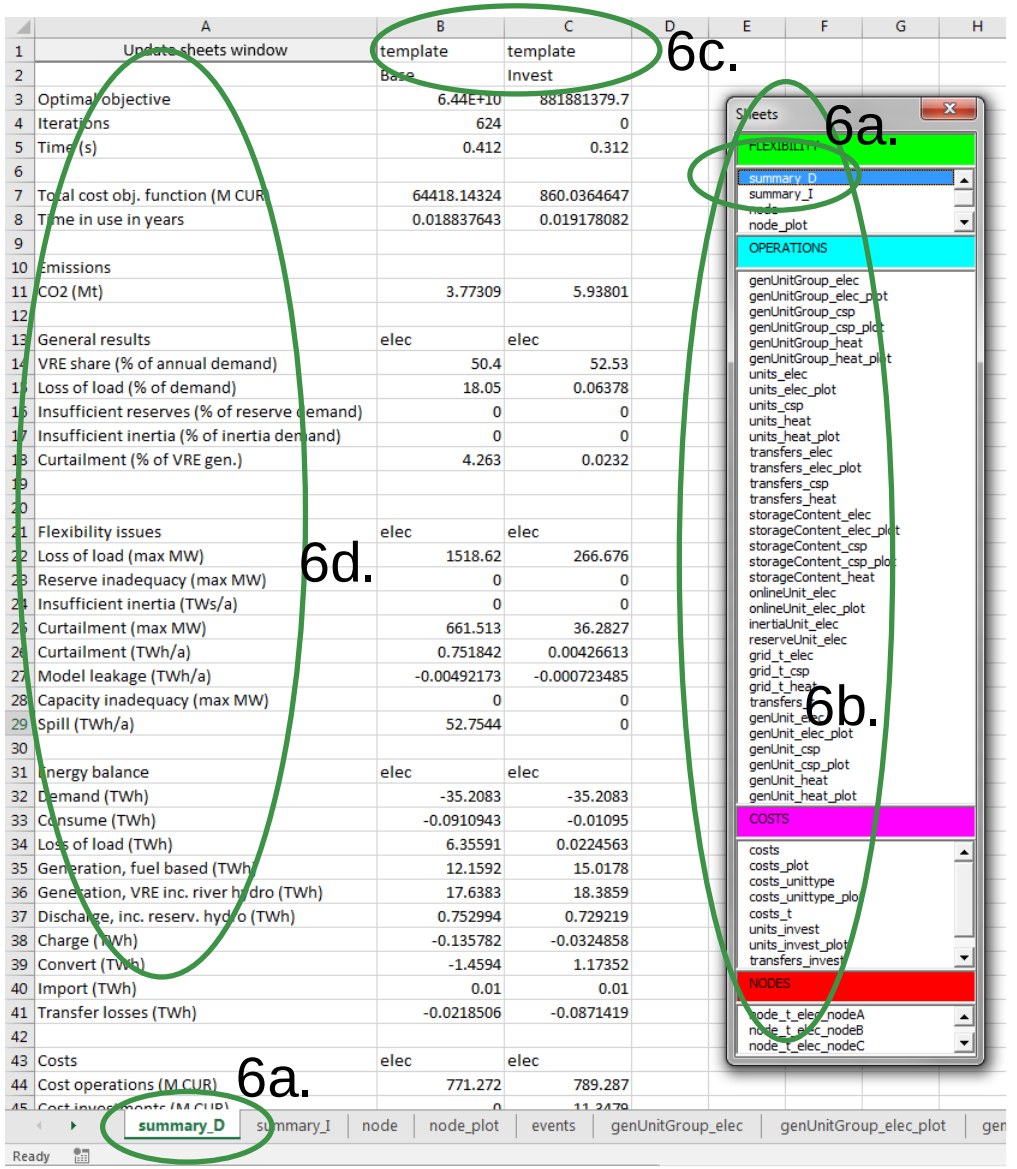
a) Shows most important results

b) Open ‘summary_D’ sheet from results file

c) Use the quick selection to find ‘summary_D’ sheet

d) Run input data files and scenarios are shown at the top

e) Summary result types are list at left side



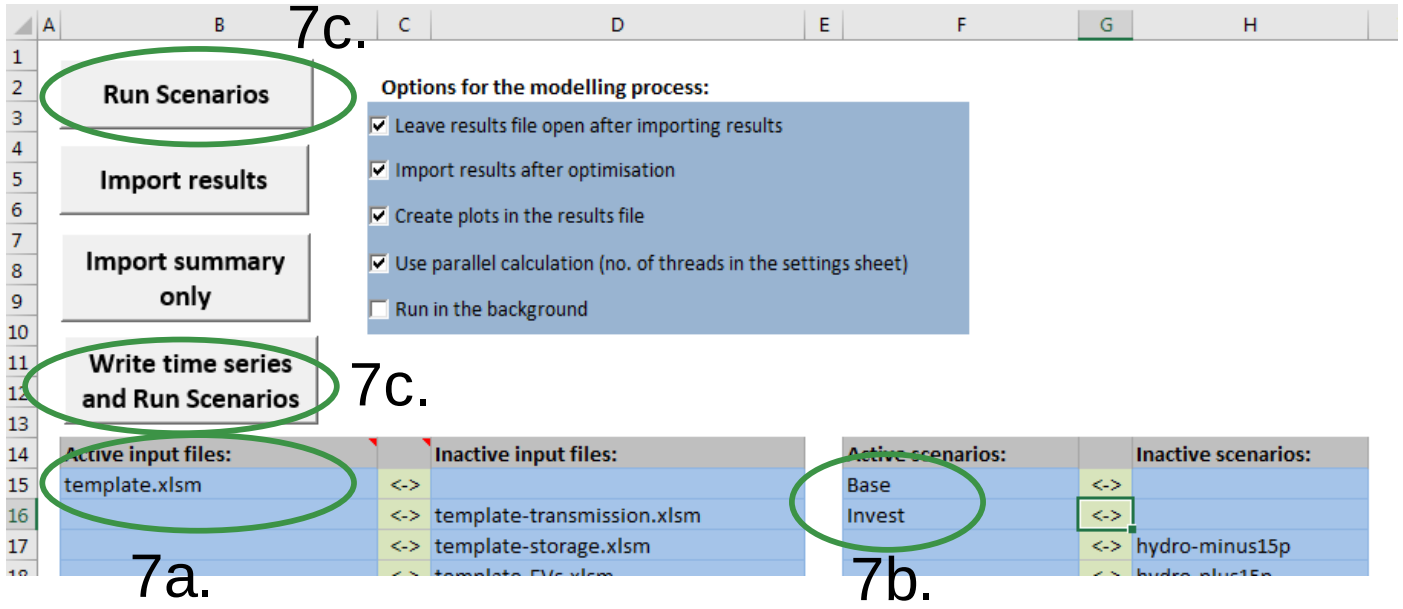
Batch run - Dispatch and Investment

7. It is easy to run many scenarios with FlexTool

a) Select input files

b) Select base and invest scenarios *

c) Click ‘Run Scenarios’ or ‘Write time series and Run Scenarios’ **



FlexTool will run all combinations of selected input files and scenarios (*e.g.,* 3 input files and 5 scenarios means 3x5 = 15 model runs)

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