



## PROSIMPLUS APPLICATION EXAMPLE

# LOAD & EXPORT OF DATA BETWEEN PROSIMPLUS AND EXCEL BY SCRIPTING

### EXAMPLE PURPOSE

This example illustrates the possibility to link ProSimPlus to Excel: ProSimPlus loads parameters from an Excel file and exports simulation results to the same Excel file.

ACCESS	<input checked="" type="checkbox"/> Free-Internet	<input type="checkbox"/> Restricted to ProSim clients	<input type="checkbox"/> Restricted	<input type="checkbox"/> Confidential
--------	---	---	-------------------------------------	---------------------------------------

CORRESPONDING PROSIMPLUS FILE	PSPS_E20_EN - Script Load & Export Excel.pmp3
CORRESPONDING EXCEL FILE	PSPS_E20_EN - data.xls

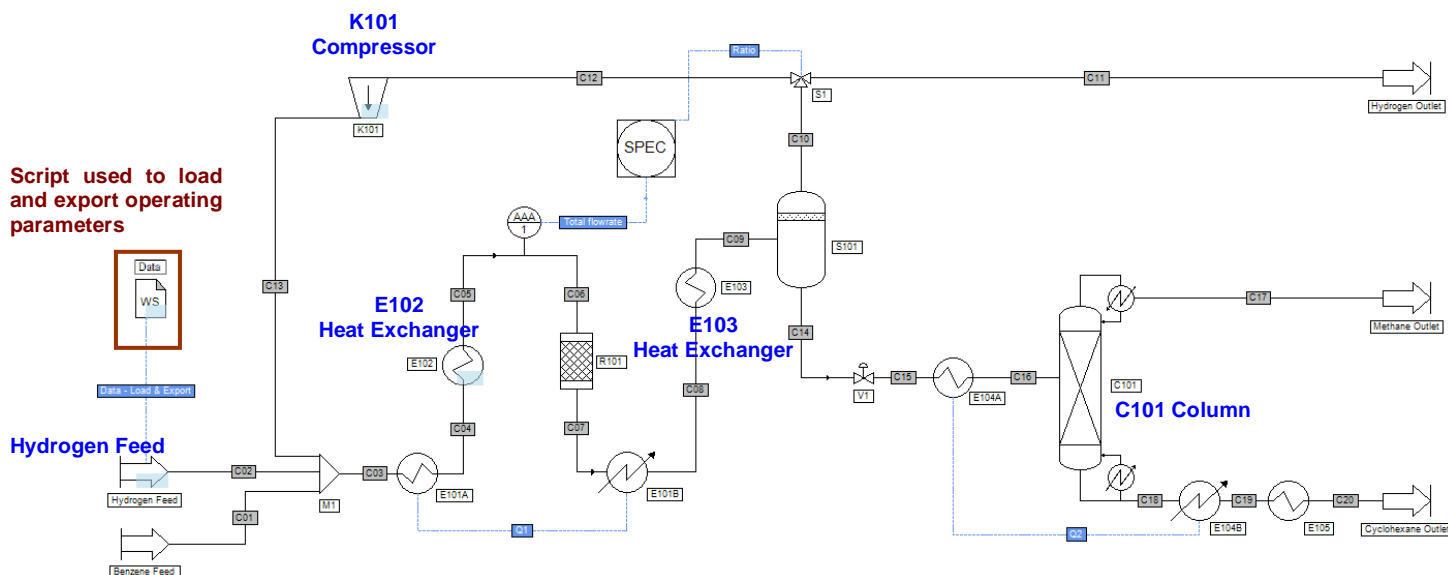
*Reader is reminded that this use case is only an example and should not be used for other purposes. Although this example is based on actual case it may not be considered as typical nor are the data used always the most accurate available. ProSim shall have no responsibility or liability for damages arising out of or related to the use of the results of calculations based on this example.*

## TABLE OF CONTENTS

<b>1. PROCESS FLOWSHEET</b>	<b>3</b>
<b>2. LOAD &amp; EXPORT</b>	<b>4</b>
2.1. Excel file	4
2.2. Scripts	5
2.2.1. "Data" Windows Script Module	6
2.2.2. Hydrogen Feed	8
2.2.3. K101 Compressor	8
2.2.4. E102 Heat Exchanger	8
<b>3. RESULTS</b>	<b>9</b>
3.1. ProSimPlus simulation file	9
3.1.1. Hydrogen Feed	9
3.1.2. E102 and E103 Heat Exchangers	10
3.1.3. K101 Compressor	10
3.1.4. C101 Column	11
3.2. Excel file	12

# 1. PROCESS FLOWSHEET

The process flowsheet is based on the Cyclohexane Plant flowsheet (refer to the ProSimPlus example "PSPS\_E02\_EN - Cyclohexane Plant.pmp3" for a complete description of the process).



The parameters to be loaded and exported are presented hereafter.

To be loaded	To be exported
<b>Hydrogen Feed:</b> Temperature, pressure and partial molar flowrates	<b>E102 Heat Exchanger:</b> Heat duty required to reach the fixed outlet temperature
<b>E102 Heat Exchanger:</b> Outlet temperature and pressure drop	<b>E103 Heat Exchanger:</b> Heat duty required to reach the fixed outlet temperature
<b>K101 Compressor:</b> Exhaust pressure	<b>C101 Column:</b> Condenser and reboiler heat duties

## 2. LOAD & EXPORT

### 2.1. Excel file

The parameters used by the ProSimPlus simulation file are described in the sheet named "Data" and presented below.

	A	B	C	D	E	F
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						

<b>Process Feed</b>		
⇒	<b>Hydrogen Feed</b>	
	<b>Temperature</b>	311 K
	<b>Pressure</b>	37,735 atm
	<b>Partial molar flowrates</b>	
	Hydrogen	1383,33 kmol/h
	Methane	39,13 kmol/h
	Benzene	0 kmol/h
	Cyclohexane	0 kmol/h

<b>Modules</b>		
⇒	<b>E102: Heat Exchanger</b>	
	<b>Outlet temperature</b>	422 K
	<b>Pressure drop</b>	0,34 atm
⇒	<b>K101: Compressor</b>	
	<b>Exhaust pressure</b>	34 atm

Data		Results	+
PRÊT			

Remark: the data to be loaded must be in ProSim Units. The full ProSim unit system can be found in



ProSimPlus in the “Unit sytem” menu :

The simulation results are exported to the following sheet, named “Results”:

	A	B	C	D	E	F
1						
2						
3		<b>Modules</b>				
4						
5	⇒	<b>E102: Heat Exchanger</b>				
6						
7			<i>Heat duty</i>			kcal/h
8						
9	⇒	<b>E103: Heat Exchanger</b>				
10						
11			<i>Heat duty</i>			kcal/h
12						
13	⇒	<b>C101: Column</b>				
14						
15			<i>Condenser duty</i>			kcal/h
16			<i>Reboiler duty</i>			kcal/h
17						
18						

## 2.2. Scripts

A Windows Script Module named “Data” is used to load the data of operating parameters from Excel. Other modules (Hydrogen Feed, E101 and E102 Heat Exchangers...) use then these parameters during calculations.

At the end of the simulation, the Windows Script Module is able to export results to Excel.

### 2.2.1. "Data" Windows Script Module

The script (used to load and export parameters) is presented below.

```
' Return the path of the folder containing the specified file (without the "\" delimiter)
```

```
Function ExtractFilePath(Filename)
```

```
Set fileSystem = CreateObject("Scripting.FileSystemObject")
Set file = fileSystem.GetFile(Filename)
ExtractFilePath = fileSystem.GetParentFoldername(file) & "\"
Set file = Nothing
Set fileSystem = Nothing
```

```
End Function
```

**File path extraction**

```
Dim Excel, Workbook
```

```
Sub OnSimulationStart()
```

```
' Excel: Application creation
```

```
Set Excel = CreateObject("Excel.Application")
```

```
' Data file: Opening
```

```
Set Workbook = Excel.Workbooks.Open(ExtractFilePath(Project.Filename) & _
"PSPS_E20_EN - data.xls")
```

```
End Sub
```

**Start of simulation:**

- Excel Object creation
- Excel File opening

```
' Data load
```

```
Function OnCalculation()
```

```
With Module
```

```
' --> Hydrogen Feed
```

```
.parameter(1) = Workbook.WorkSheets("Data").Range("E7") ' Temperature
```

```
.parameter(2) = Workbook.WorkSheets("Data").Range("E8") ' Pressure
```

```
For i = 1 to Project.Compounds.Count
```

```
.parameter(2+i) = Workbook.WorkSheets("Data").Range("E" & 10+i) ' Partial Flowrates
```

```
Next
```

```
' --> E102: Heat Exchanger
```

```
Project.UserValues("E102_T") = Workbook.WorkSheets("Data").Range("E21") ' Temperature
```

```
Project.UserValues("E102_DP") = Workbook.WorkSheets("Data").Range("E22") ' Pressure drop
```

```
' --> K101: Compressor
```

```
.parameter(12) = Workbook.WorkSheets("Data").Range("E26") ' Exhaust Pressure
```

```
End With
```

```
OnCalculation = True
```

```
End Function
```

**Module Calculation:**

- Data loading

```
' Data export
```

```
Sub OnSimulationEnd()
```

```
' --> E102: Heat duty
```

```
Workbook.WorkSheets("Results").Range("E7") = Project.modules("E102").HeatDuty
```

```
' --> E103: Heat duty
```

```
Workbook.WorkSheets("Results").Range("E11") = Project.modules("E103").HeatDuty
```

```
' --> C101: Condenser (Qc) and reboiler (Qb) duties
```

```
Workbook.WorkSheets("Results").Range("E15") = Project.modules("C101").Qc
```

```
Workbook.WorkSheets("Results").Range("E16") = Project.modules("C101").Qb
```

```
' Data File: Save and close
```

```
Workbook.Save
```

```
Workbook.Close
```

```
Set Workbook = Nothing
```

```
' Excel: Exit
```

```
Excel.quit
```

```
' Excel: Application release
```

```
Set Excel = Nothing
```

```
End Sub
```

**End of simulation:**

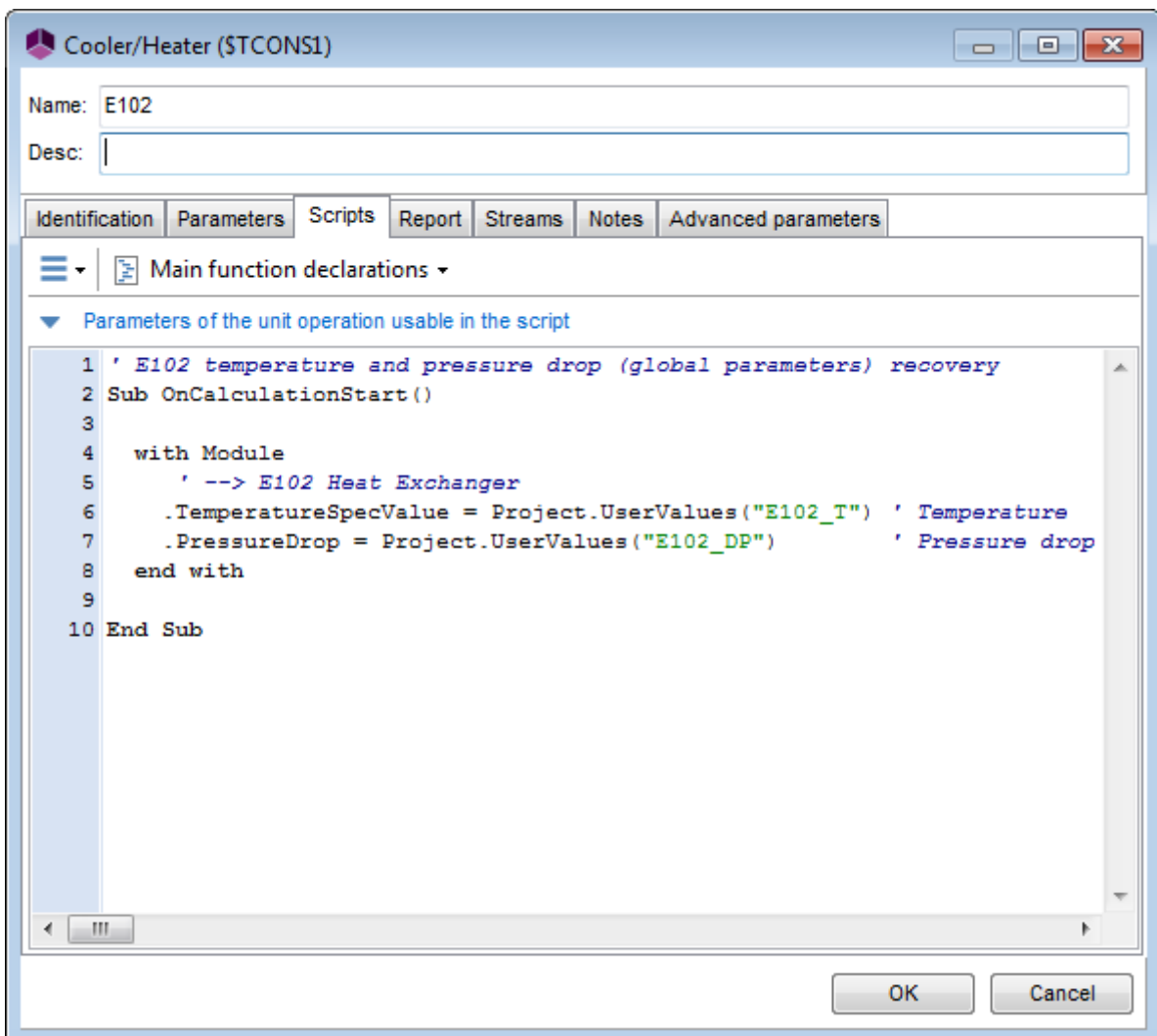
- Data exporting
- Excel file: Save and close
- Excel Object: Release

Remark: ProSimPlus user must specify the right Excel File location.

In this example: "ExtractFilePath(Project.FileName) & "PSPS\_E19\_EN - data.xls"" means that the Excel file "PSPS\_E19\_EN - data.xls" is in the same directory as the simulation file. Of course, this location can be modified.

EXX (XX between 7 and 26 in this example) are the Excel cell addresses of the working parameters (for importation or exportation).

To access the "Script" tab of a module, open the corresponding module definition window and select the "Script" tab as presented below for the "E102" module:



For further information about scripting in ProSimPlus, please refer to the "Windows script" help accessible by pressing "F1" in the script module definition window.

### 2.2.2. Hydrogen Feed

The script used in the “Hydrogen Feed” module is presented hereafter.

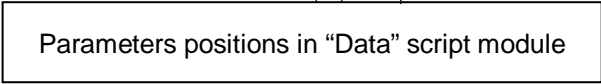
```
' Temperature, pressure and partial molar flowrates recovery from the "Data" script module
Sub OnCalculationStart()

  With Module
    '--> Hydrogen Feed
    .OutputStreamTemperatureSpecValue = Project.Modules("Data").parameter(1) ' Temperature
    .OutputStreamPressureSpecValue   = Project.Modules("Data").parameter(2) ' Pressure

    For i = 1 to Project.Compounds.Count
      .OutputStreamCompositionSpecValues(i) = Project.Modules("Data").parameter(2+i) ' Partial molar
    flowrates
    Next

  End With

End Sub
```



### 2.2.3. K101 Compressor

The script used in the “K101” module is presented hereafter.

```
' Exhaust pressure recovery from the "Data" script module
Sub OnCalculationStart()

  '--> K101 Compressor
  Module.SpecificationValue = Project.Modules("Data").parameter(12) ' Exhaust pressure

End Sub
```

### 2.2.4. E102 Heat Exchanger

The script used in the “E102” module is presented hereafter.

```
' E102 temperature and pressure drop (global parameters) recovery
Sub OnCalculationStart()

  With Module
    '--> E102 Heat Exchanger
    .TemperatureSpecValue = Project.UserValues("E102_T") ' Temperature
    .PressureDrop = Project.UserValues("E102_DP") ' Pressure drop
  End With

End Sub
```

*Remark:* global parameters (Project.UserValues) can be defined (in this case, they are defined in the “Data” module) and then used in all of the modules (like here in the “E102” module).

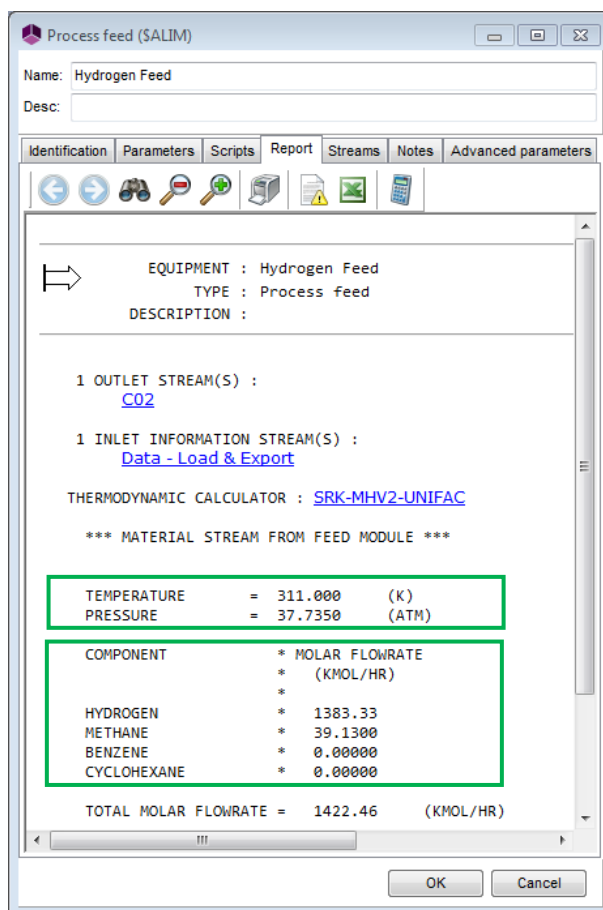


## 3. RESULTS

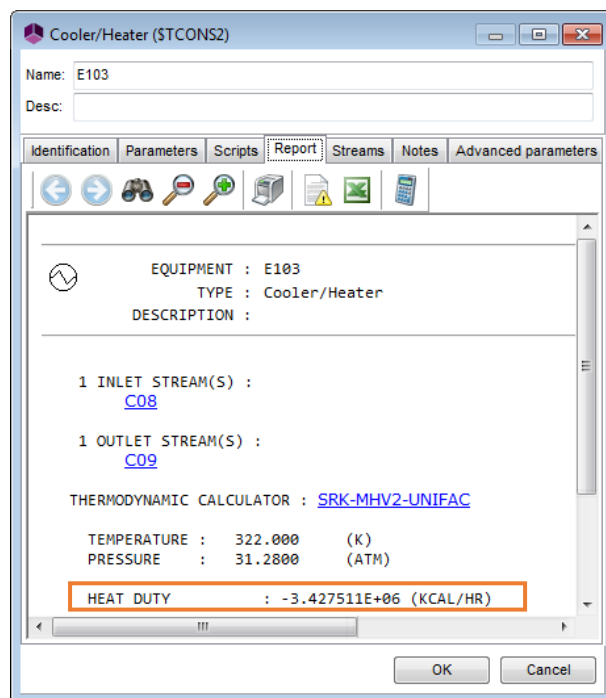
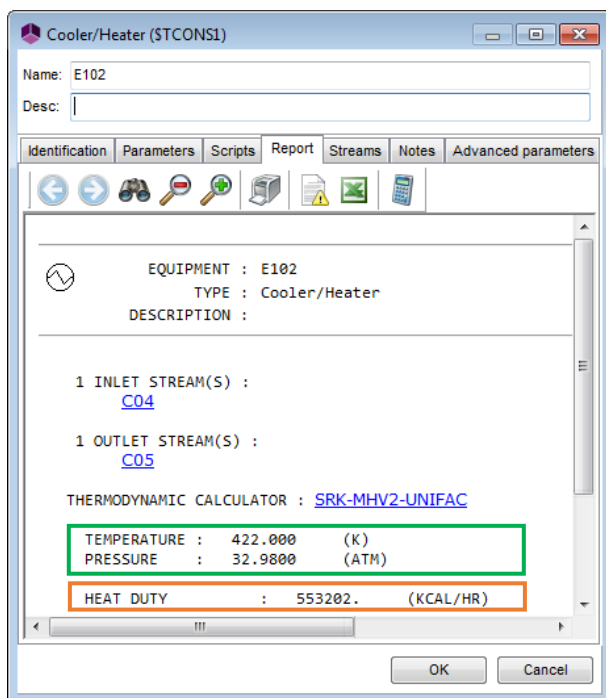
### 3.1. ProSimPlus simulation file

At the end of the simulation, the user can see in the “Report” tab of the different modules the imported data (boxed in green in this document) and the results (boxed in orange in this document) that have been exported to the Excel file.

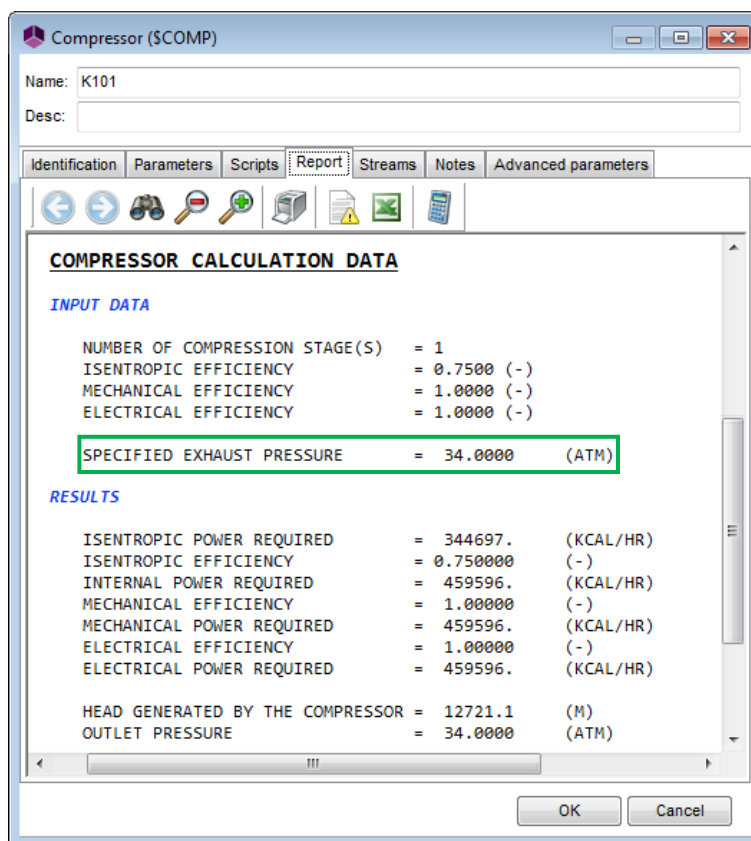
#### 3.1.1. Hydrogen Feed



### 3.1.2. E102 and E103 Heat Exchangers



### 3.1.3. K101 Compressor



### 3.1.4. C101 Column

The screenshot shows a software window titled "Distillation column (\$COLD)". The window has a menu bar with "Identification", "Parameters", "Scripts", "Report", "Streams", "Profiles", "Notes", and "Advanced parameters". The "Report" tab is active. Below the menu bar is a toolbar with various icons. The main area contains a table with the following columns: STAGE, TEMPERATURE (K), (DT), PRESSURE (ATM), LIQUID FLOW (KMOL/HR), and VAPOR FLOW (KMOL/HR). The table lists data for a CONDENSER (stages 1-14) and a REBOILER (stage 15). Below the table, several summary statistics are displayed, including CONDENSER DUTY, OVERHEAD VAPOR PRODUCT, REFLUX RATIO, STAGE = 8, FEED FLOWRATE, VAPOR MOLE FRACTION, REBOILER DUTY, and BOTTOM LIQUID PRODUCT. The window has "OK" and "Cancel" buttons at the bottom right.

STAGE	TEMPERATURE (K)	(DT)	PRESSURE (ATM)	LIQUID FLOW (KMOL/HR)	VAPOR FLOW (KMOL/HR)
<b>CONDENSER :</b>					
1	275.65	158.32	15.600	10.4255	10.4255
2	433.97	16.69	15.626	19.7746	20.8510
3	450.66	2.94	15.653	22.3828	30.2001
4	453.60	0.62	15.679	22.9195	32.8083
5	454.22	0.19	15.706	23.0291	33.3450
6	454.42	0.11	15.732	23.0569	33.4547
7	454.53	0.10	15.759	23.0693	33.4825
8	454.63	25.52	15.785	529.510	33.4948
9	480.15	3.26	15.811	673.911	163.535
10	483.41	0.49	15.838	698.859	307.936
11	483.90	0.16	15.864	702.603	332.885
12	484.06	0.12	15.891	703.723	336.628
13	484.17	0.11	15.917	704.514	337.748
14	484.28	0.11	15.944	705.261	338.539
<b>REBOILER :</b>					
15	484.39	--	15.970	365.975	339.286

**CONDENSER DUTY** = 139841. (KCAL/HR)  
 OVERHEAD VAPOR PRODUCT = 10.4255 (KMOL/HR)  
 REFLUX RATIO = 1.00000  
 STAGE = 8, FEED FLOWRATE = 376.400 (KMOL/HR)  
 VAPOR MOLE FRACTION = 1.361794E-02  
**REBOILER DUTY** = 1.624906E+06 (KCAL/HR)  
 BOTTOM LIQUID PRODUCT = 365.975 (KMOL/HR)

### 3.2. Excel file

The results exported to the Excel file can be seen below.

	A	B	C	D	E	F
1						
2						
3			<b>Modules</b>			
4						
5	⇒		<b>E102: Heat Exchanger</b>			
6						
7			<i>Heat duty</i>		553201,697	kcal/h
8						
9	⇒		<b>E103: Heat Exchanger</b>			
10						
11			<i>Heat duty</i>		-3427510,52	kcal/h
12						
13	⇒		<b>C101: Column</b>			
14						
15			<i>Condenser duty</i>		139840,857	kcal/h
16			<i>Reboiler duty</i>		1624906,47	kcal/h
17						
18						

PRÊT