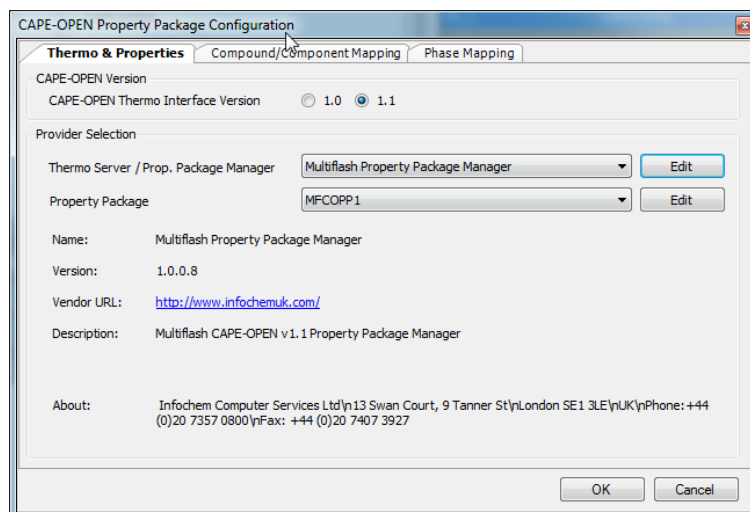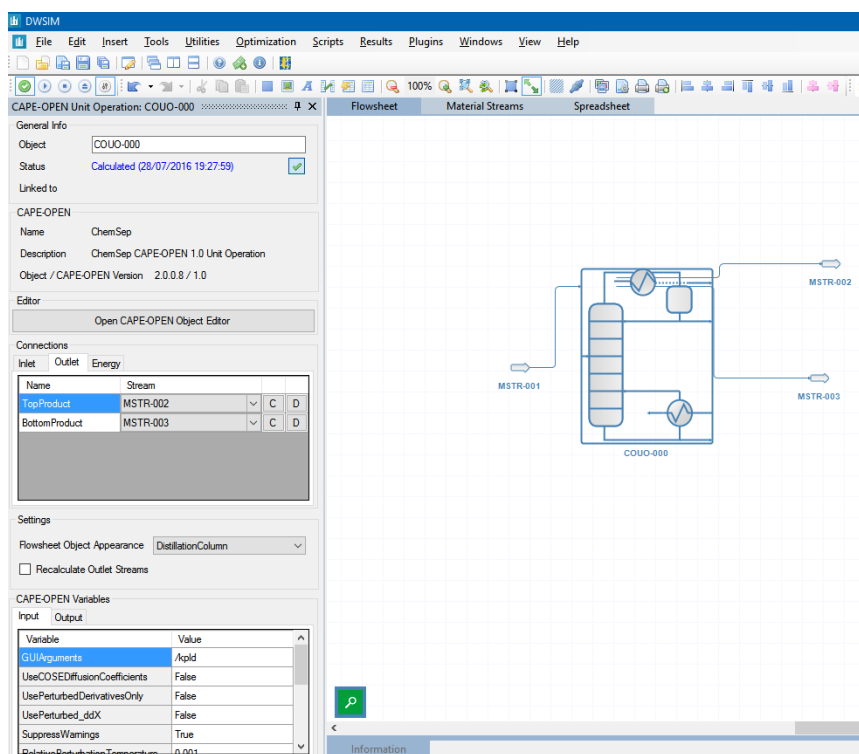# DWSIM 4
CAPE-OPEN Features Quick Guide

1. Introduction

DWSIM 4 features a number of CAPE-OPEN features, including:

- *Property Packages (Thermo Specs 1.0 and 1.1):* It is possible to use external CAPE-OPEN thermodynamic equilibrium and property calculators as Property Packages in DWSIM. Integration is done transparently and the user only has to map PP's components and phases to internal DWSIM ones.

- *Unit Operations:* CAPE-OPEN Unit Operations can be added to DWSIM flowsheets and connected to/from energy and material streams just as normal DWSIM Unit Operations. DWSIM also implements the CAPE-OPEN Reaction interfaces so you can use your CO Reactor together with DWSIM and manage your reactions using the Reactions Manager as usual.

- *Flowsheet Monitoring Objects:* DWSIM support CAPE-OPEN plugins, 'aka' Flowsheet Monitoring Objects, such as the WAR Add-in created by William Barrett, USEPA:
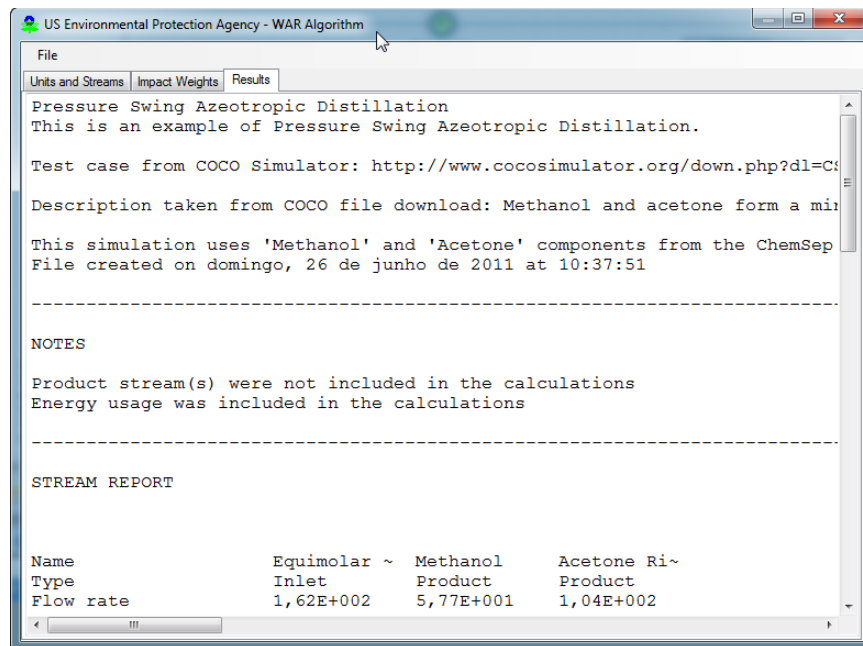

CAPE-OPEN Property Packages, CAPE-OPEN Unit Operations, DWSIM Property Packages and DWSIM Unit Operations can work together on any combination. For example, you can use a DWSIM PP as the thermo provider for a CAPE-OPEN Unit Operation just as you can use a CAPE-OPEN PP as the thermo provider for a DWSIM Unit Operation.

2. Using external components

2.1. Property Packages

To use external CAPE-OPEN Property Packages to DWSIM, add a Property Package of the "CAPE-OPEN" type to the flowsheet:
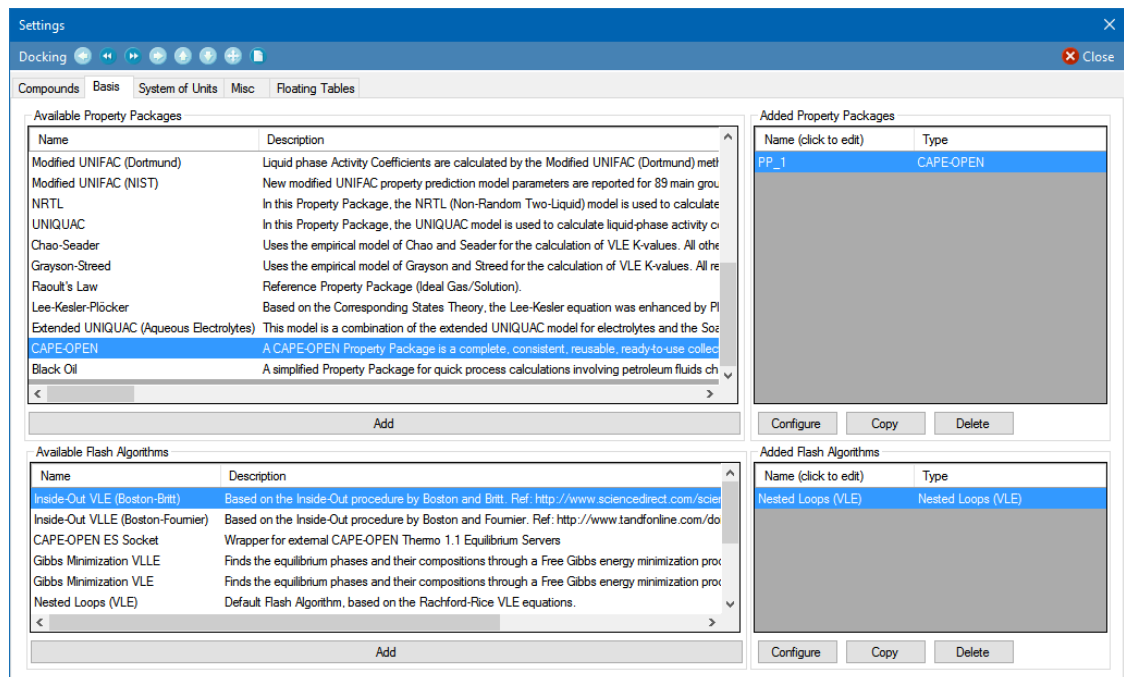
After that, click on "Configure" to setup your property package. On the window that appears, select a Thermo Server or Property Package Manager, depending on the CAPE version you chose. After selecting the server, a list of available Property Packages for that server should be available for selection on the PP combo box:
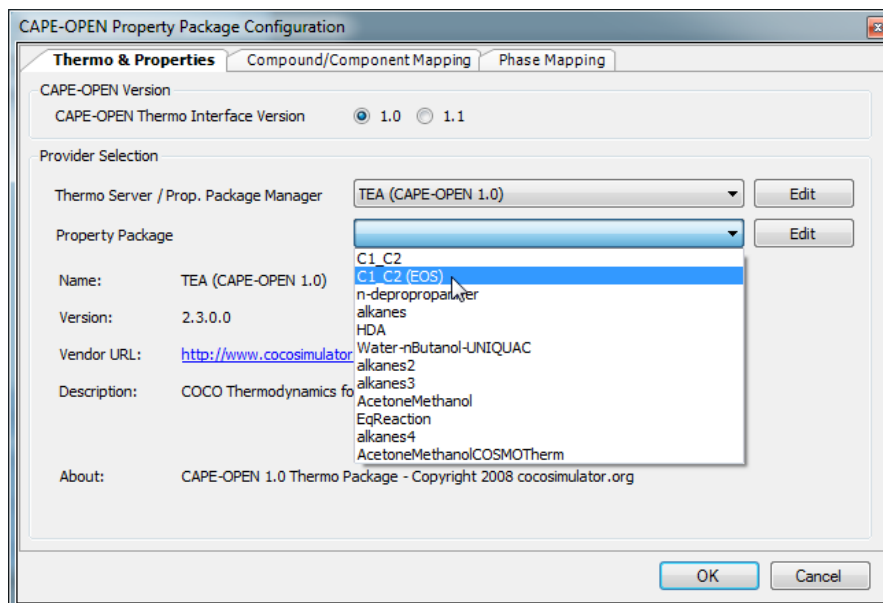
After selecting your Property Package, you can edit it by clicking on the "Edit" button. If the package was just selected or you've done changes to its compounds or phases, you MUST map compounds and phases to DWSIM equivalents on the "Compound/Component Mapping" and "Phase Mapping" tabs:
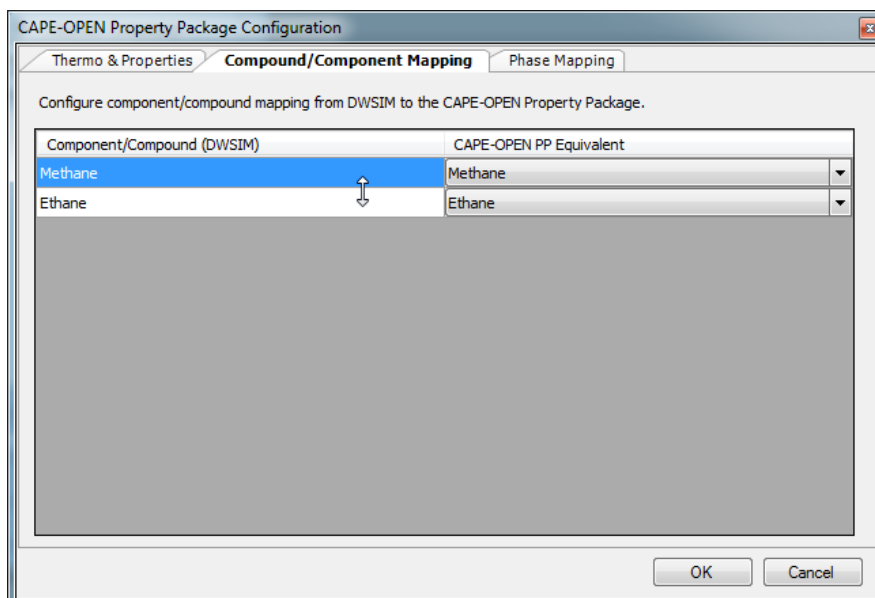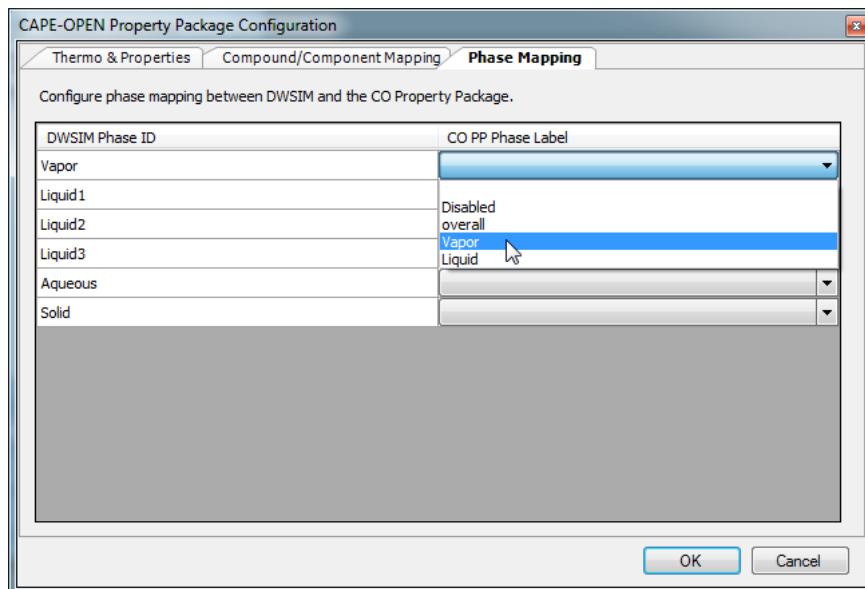
IMPORTANT:

- If your PP lists "Overall" or "Mixture" as a phase, you should not associate it with any of DWSIM phases.
- If a DWSIM phase doesn't exists in the PP, select "Disable" as its label - DO NOT leave it blank!
- DWSIM and the CAPE-OPEN PP should have exactly the same number of compounds, even if some of them aren't used by DWSIM or by the PP.

After the compound and phase mapping steps, click "OK" and you're ready to go.

2.2.   Unit Operations

To add CAPE-OPEN Unit Operations to DWSIM flowsheets, drag and drop the "CAPE-OPEN Unit Operation icon to the flowsheet. A selection window will appear where you should choose which Operation will be added:
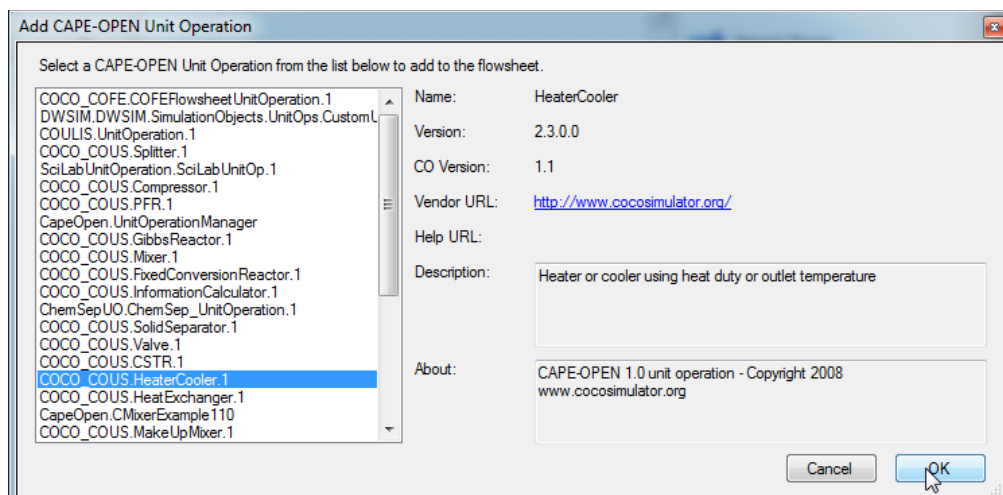
After the Unit is added, it works the same way as a DWSIM Unit Operation. You can edit its connections to Material and Energy Streams, parameters and access its 'Edit' window through the object editor:
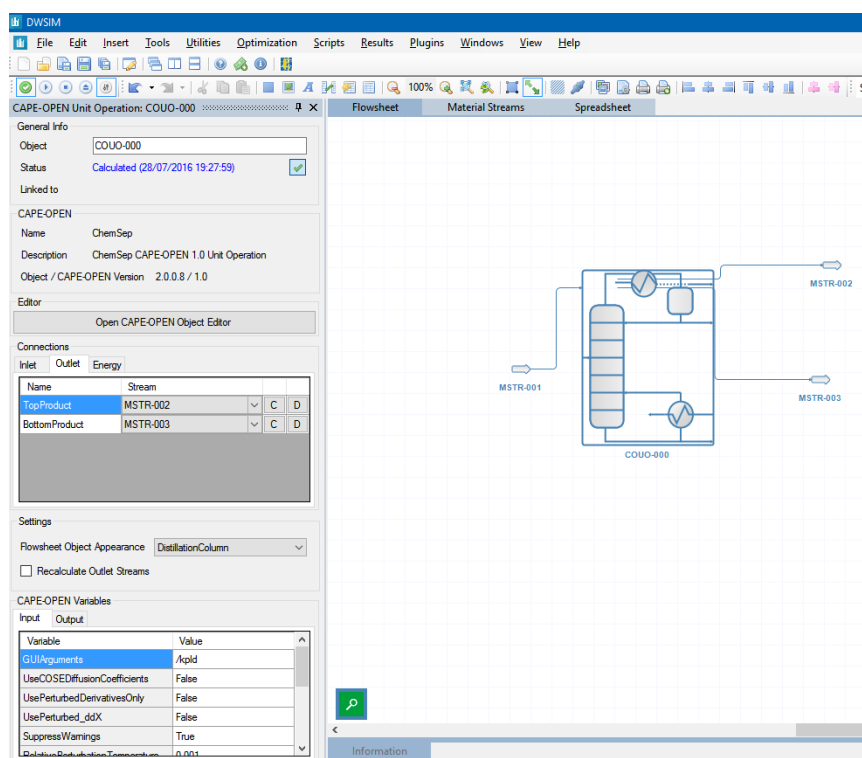
IMPORTANT: The "Property Package" setting for the CAPE-OPEN Unit Operation has no effect. It accesses the property packages linked to Material Streams to do calculations. It is recommended that all streams connected to a CAPE-OPEN UO have the same associated Property Package to ensure consistence of the results.

2.3. Flowsheet Monitoring Objects

CAPE-OPEN Add-ins are accessed through the "Plugins" menu item just as normal DWSIM Plugins:

3. Other features

3.1. Using DWSIM as a CAPE-OPEN Property Package Manager (Thermo 1.1)
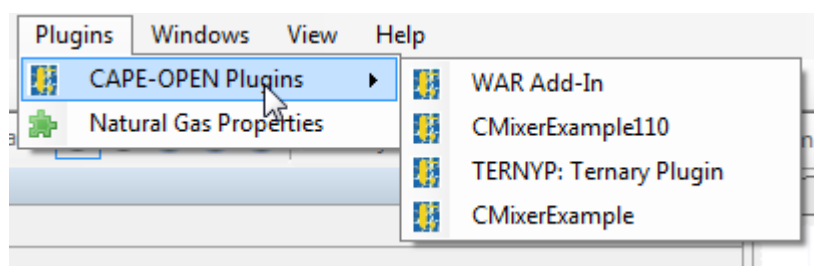
If you registered DWSIM types during the installation process, DWSIM will expose its Property Packages to CAPE-OPEN compliant simulators through Thermo 1.1 Interfaces (if your simulator is only Thermo 1.0 compliant, DWSIM Thermo Server will not be shown). The configuration window allows you to add/remove compounds, configure flash settings, set the GUI language and edit model parameters and BIPs. You can download an example of DWSIM Property Packages used as property and equilibrium calculators in COCO/COFE on SourceForge.
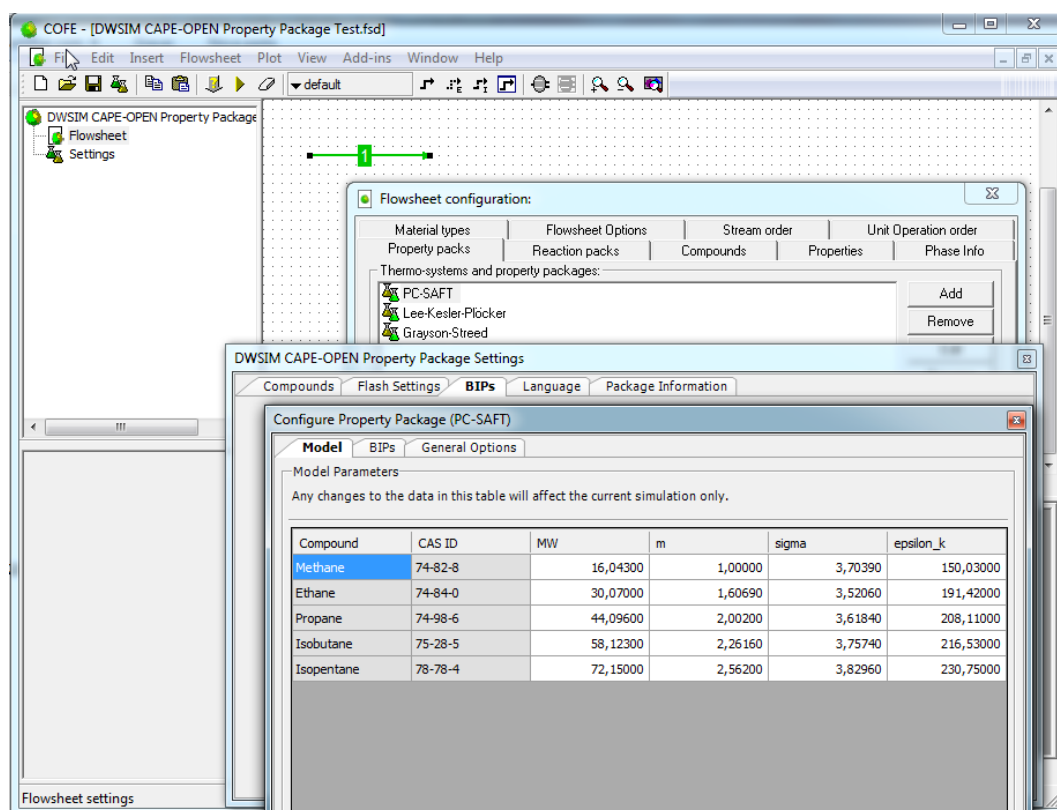
3.2. Using the Script Unit Operation in CAPE-OPEN compliant simulators

If you registered DWSIM types during the installation process, the Custom Unit Operation will be exposed to CAPE-OPEN compliant simulators as "IronPython/IronRuby Script Unit Operation". You can download an example of the Script UO being used to model a simple membrane separation process in COCO/COFE on SourceForge.

COFE - [IronPython Script Membrane Unit.fsd]

File Edit Insert Flowsheet Plot View Add-ins Window Help

IronPython Script Membrane Unit.fsd
  Flowsheet
  Settings

Script Editor (IronPython)

Script | Includes

Courier New | 10

```
1   # Simple Membrane Unit Operation
2   # Calculates the Permeate stream mole fractions and total mole flow
3   #
4   # The script solves the following equation for each component:
5   #
6   # Qi = PCi * A / L * Nu * (Pxi1 - Pxi2) / ln(Pxi1 / Pxi2)
7   #
8   # Qi          Permeate Molar flow for component i
9   # PCi         Permeability for component i
10  # A           Area per unit
11  # L           Unit length
12  # Nu          Total number of units
13  # Pxi1        Partial pressure of component i in feed
14  # Pxi2        Partial pressure of component i in permeate
15  #
16  # An iterative method is used to solve for the output partial pressures such
17  # that mass is conserved over the unit.
18
19  # This script gets and sets properties using the CAPE-OPEN Interfaces implemen
20  # Material Object. You can find more details about them by reading the CAPE-OP
21  # Interface Reference Documents available at http://www.colan.org/index-3.html
22
23  # Version History
24  # [06/21/11] initial release, using Thermo 1.0 Interfaces
25
26  import clr
27  import math
28  from DWSIM import *        # DWSIM namespace is imported automatically by the
```

Ready