Educational Institute for Equipment and Process Design

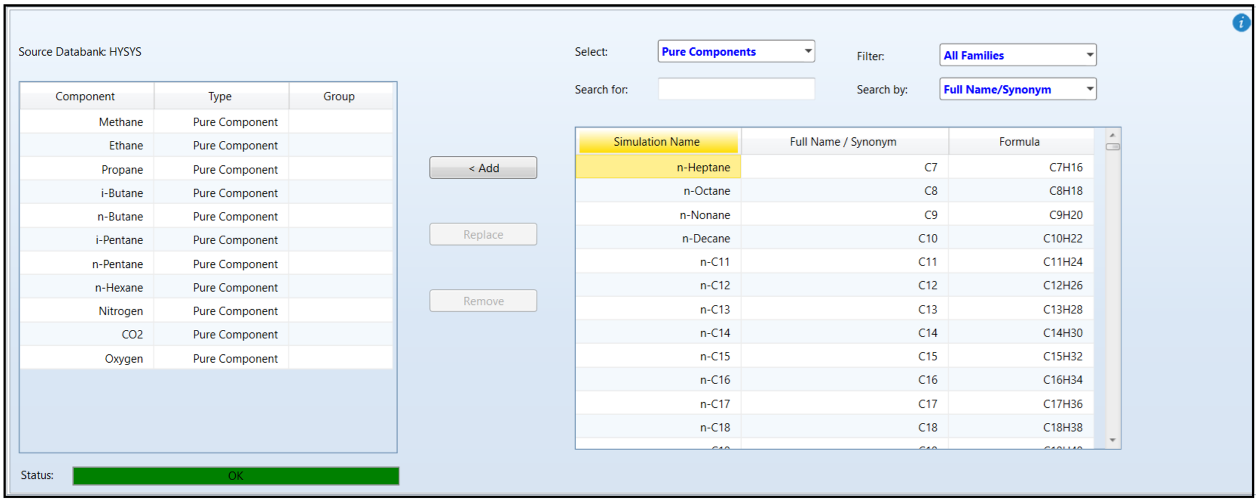
Turbine Simulation

Example: In a gas let-down station, a turbine is installed to reduce the HP-NG pressure to 3 bar, aiming to produce electricity. Here is the HP-NG info at the turbine suction:

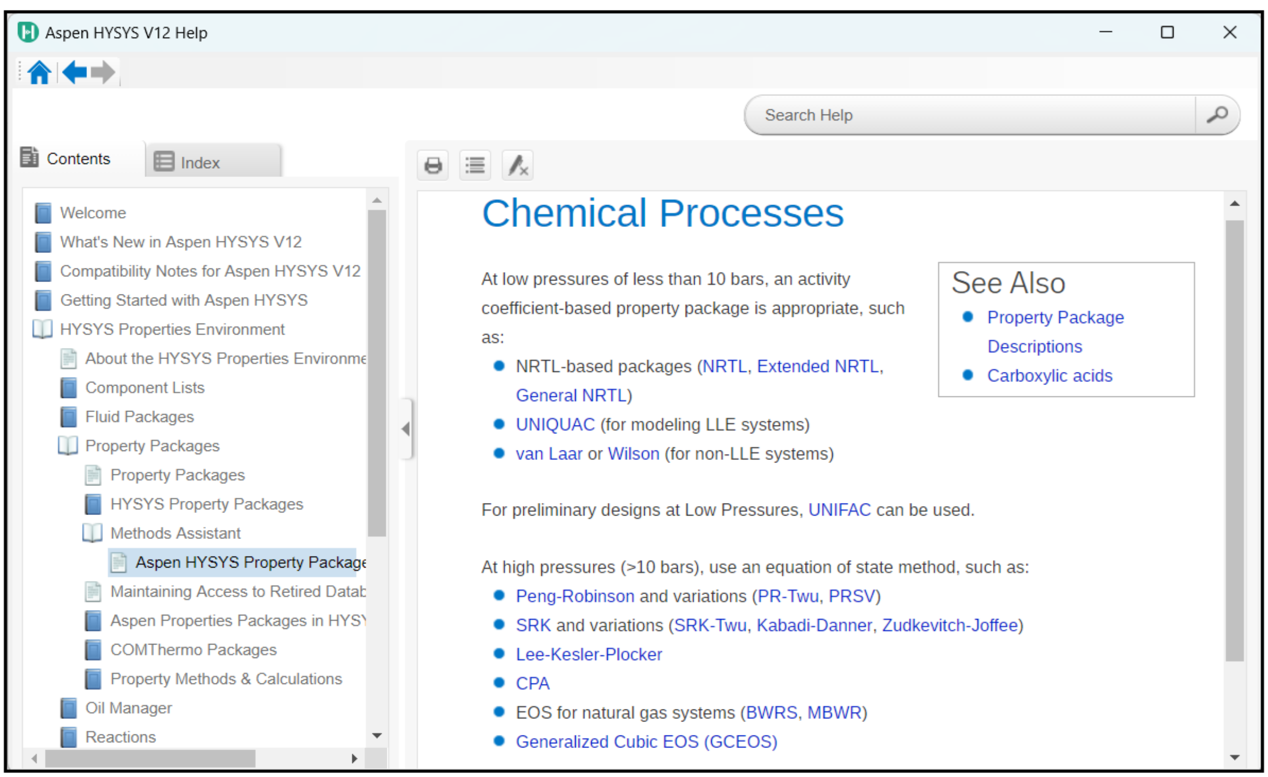
Stream Name	HP-NG
Temperature	25C
Pressure	40barg
Mass Flow	10000 kg/hr.
Component	Composition-Mole%
Methane	95.2
Ethane	2.5
Propane	0.2
Iso-Butane	0.03
Normal-Butane	0.03
Iso-Pentane	0.01
Normal-Pentane	0.01
Hexanes	0.01
Nitrogen	1.3
Carbon Dioxide	0.7
Oxygen	0.02

How to simulate:

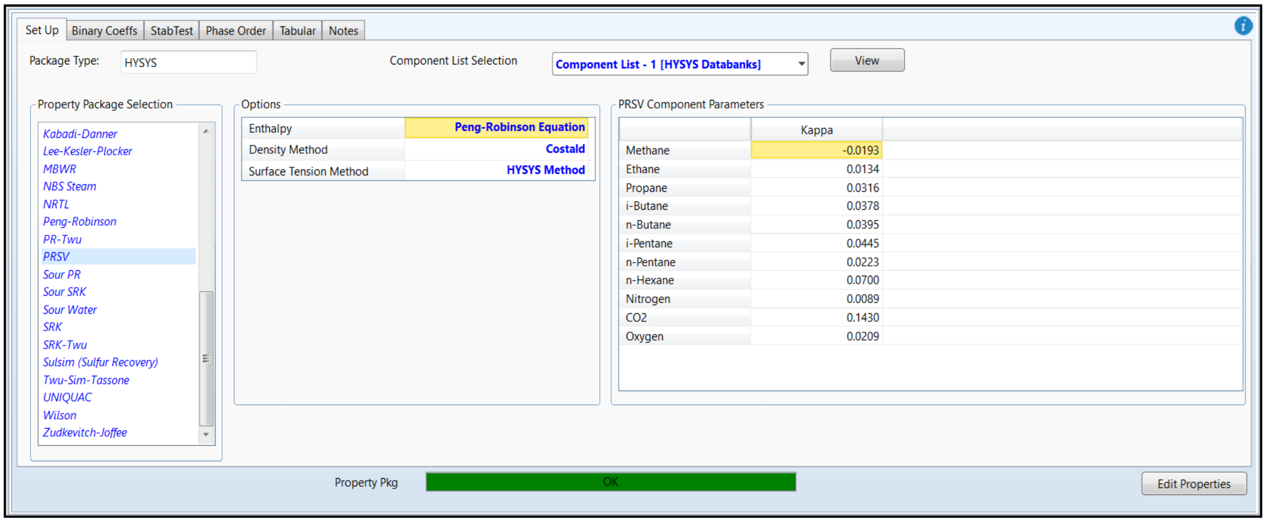
1.Select the aforementioned components in component list



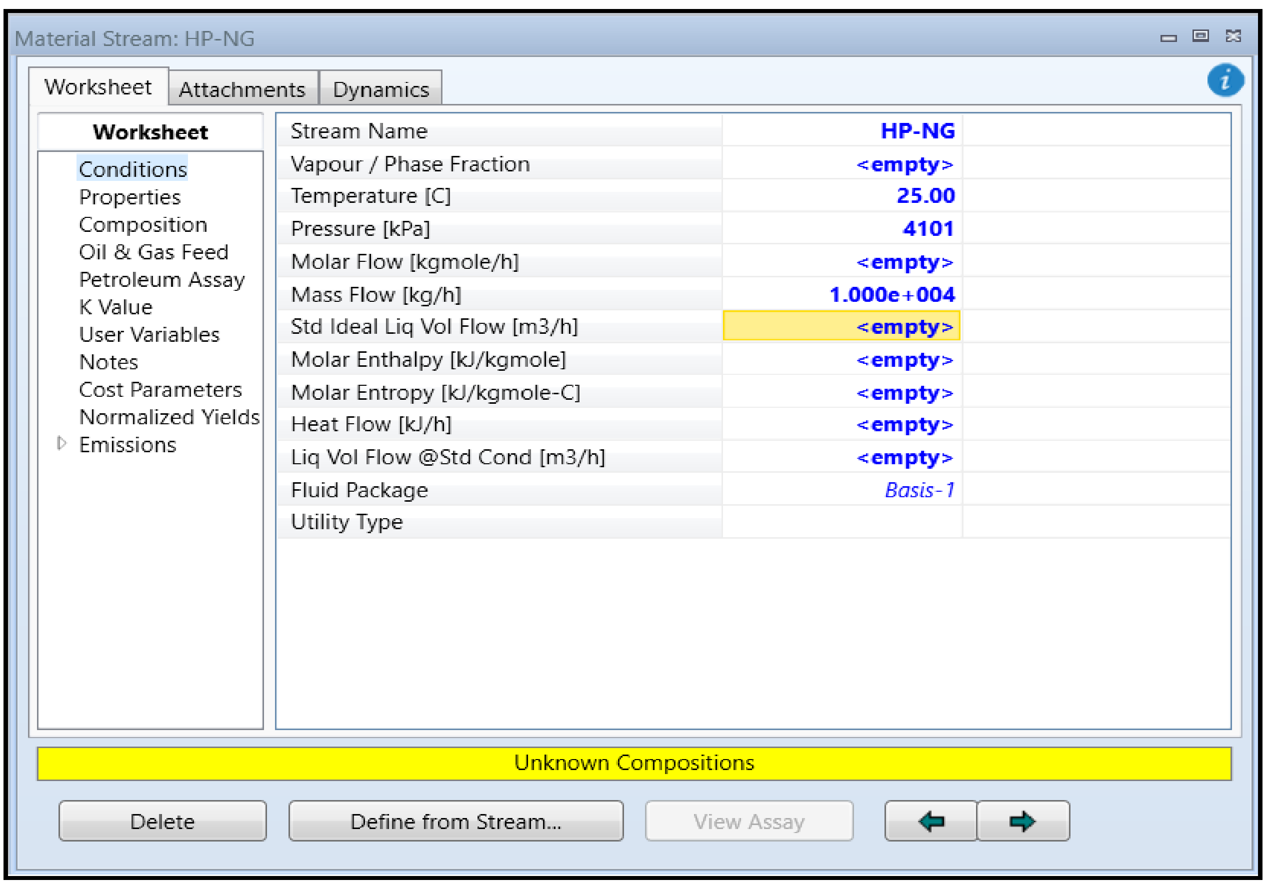
2.Select PRSV as Fluid Package. To help you better understand how to use Method Assistance, for this example we use such tool as follows:

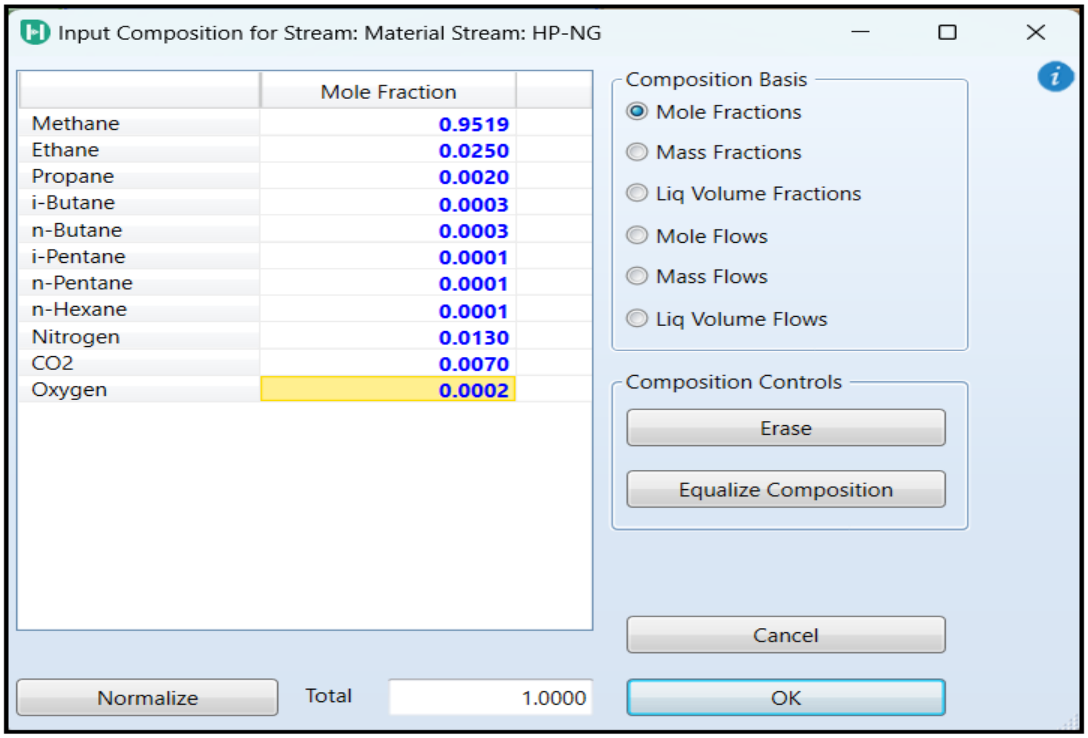


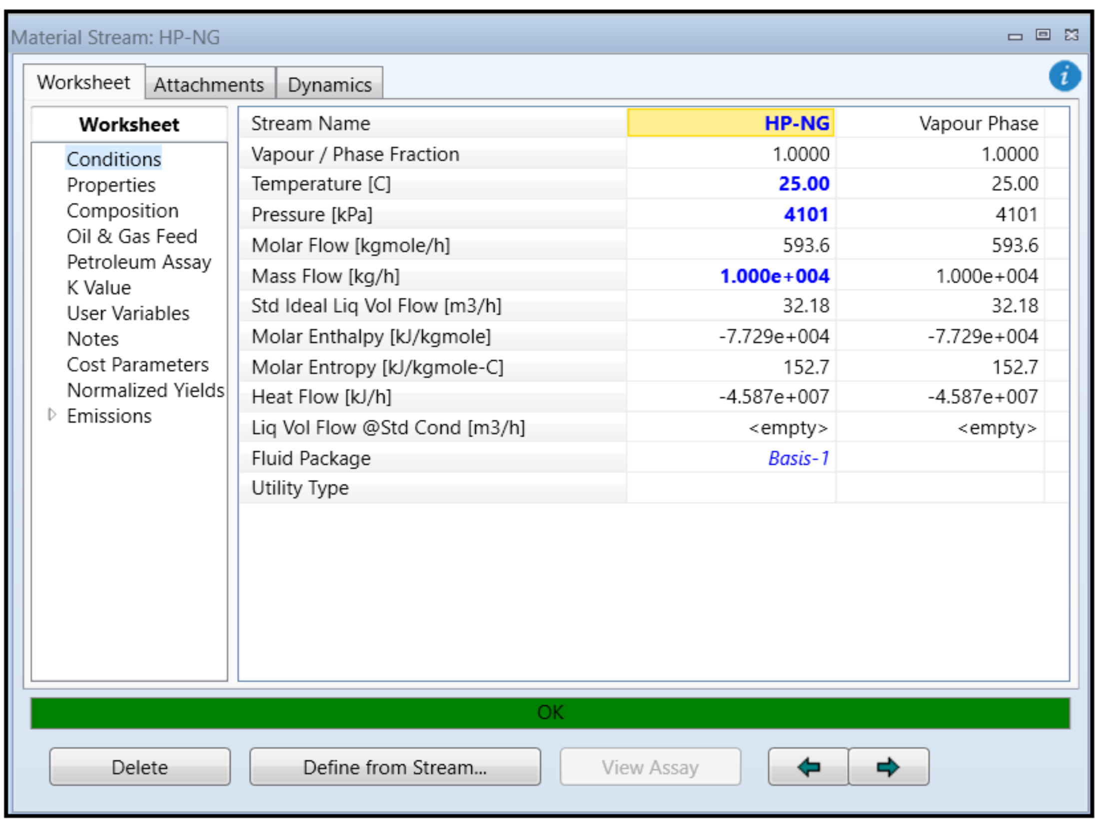
Since the stream pressure is more than 10 bar, a Peng-Robinson variant like PRSV is selected.



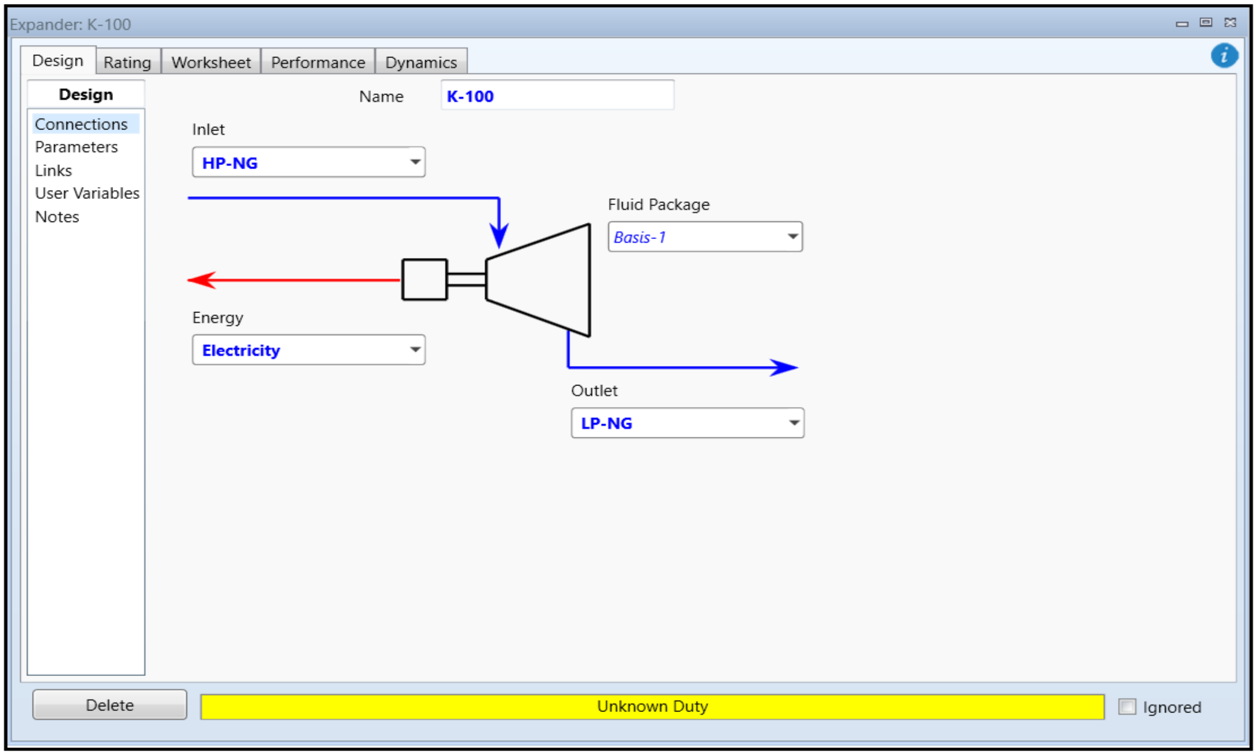
3.Enter Simulation Environment and define HP-NG stream like below:

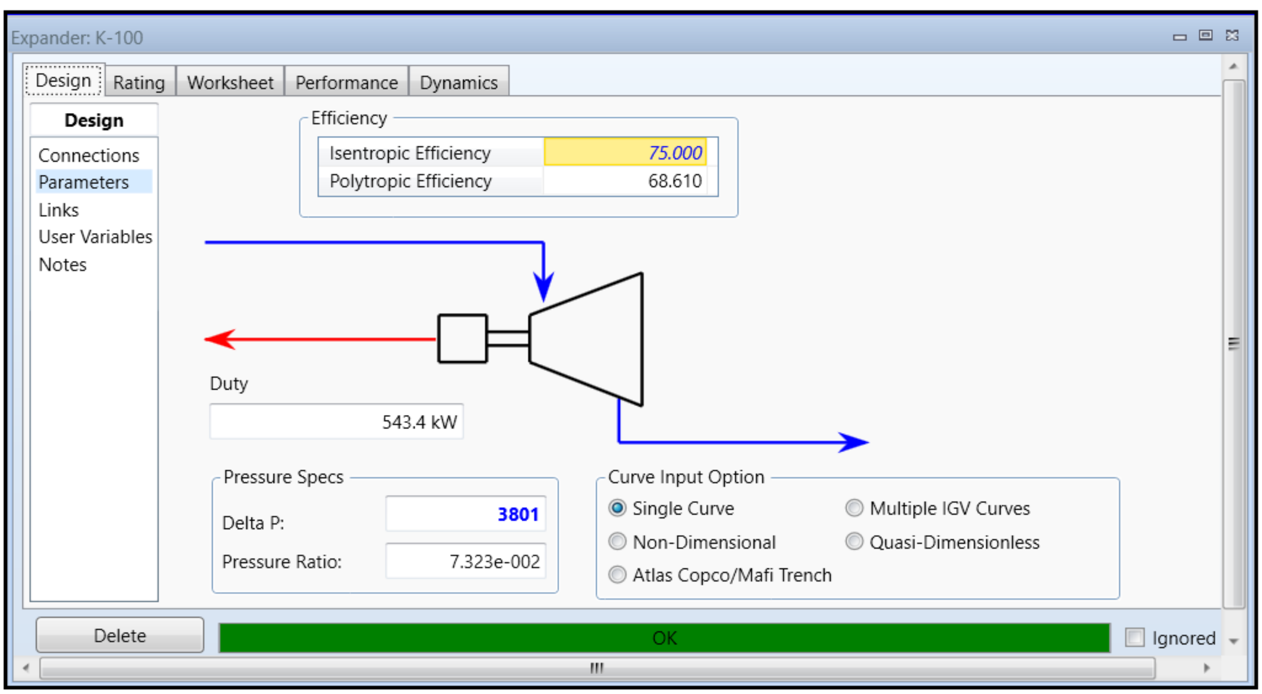



Input Composition for Stream: Material Stream: HP-NG
Mole Fraction
Methane 0.9519
Ethane 0.0250
Propane 0.0020
i-Butane 0.0003
n-Butane 0.0003
i-Pentane 0.0001
n-Pentane 0.0001
n-Hexane 0.0001
Nitrogen 0.0130
CO2 0.0070
Oxygen 0.0002
Composition Basis
Mole Fractions
Mass Fractions
Liq Volume Fractions
Mole Flows
Mass Flows
Liq Volume Flows
Composition Controls
Erase
Equalize Composition
Cancel
Normalize
Total 1.0000
OK


Material Stream: HP-NG
Worksheet
Attachments
Dynamics
Worksheet
Conditions
Properties
Composition
Oil & Gas Feed
Petroleum Assay
K Value
User Variables
Notes
Cost Parameters
Normalized Yields
Emissions
Stream Name HP-NG Vapour Phase
Vapour / Phase Fraction 1.0000 1.0000
Temperature [C] 25.00 25.00
Pressure [kPa] 4101 4101
Molar Flow [kgmole/h] 593.6 593.6
Mass Flow [kg/h] 1.000e+004 1.000e+004
Std Ideal Liq Vol Flow [m3/h] 32.18 32.18
Molar Enthalpy [kJ/kgmole] -7.729e+004 -7.729e+004
Molar Entropy [kJ/kgmole-C] 152.7 152.7
Heat Flow [kJ/h] -4.587e+007 -4.587e+007
Liq Vol Flow @Std Cond [m3/h] <empty> <empty>
Fluid Package Basis-1
Utility Type
OK
Delete
Define from Stream...
View Assay

4.Select turbine from Model Pallete/Pressure Change and put it in the flowsheet. Then, select HP-NG as the inlet stream and define LP-NG as the outlet stream. Finally specify a name like Electricity for the energy.





5.Based on the result, the power produced is 543.4 kW.

6.By checking the Worksheet table or Performance table, more info could be gained.