ProMax®

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Experience the Difference

ProMax is built on over 40 years of continual research and development efforts. Our team of development engineers has consistently found innovative ways to model processes so that the end results accurately reflect the actual operating conditions of gas processing, refining and chemical facilities. We take pride in the fact that the focus of our development efforts has been strongly influenced by the needs of our clients. Members of our development team work directly with clients on specific process issues, attend training seminars and help resolve technical support issues on a regular basis. This helps ensure that the people who develop ProMax are in tune with the people who are using ProMax to simulate their facilities.

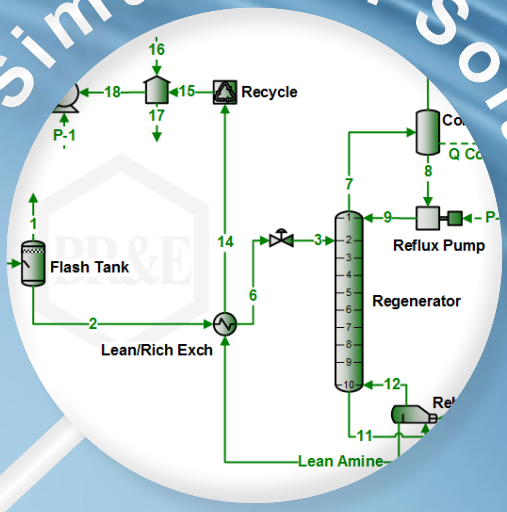
BR&E is committed to supporting our software with a level of service that is unmatched in our industry. Our passion as a company is for our engineers to work side by side with our clients. We find great satisfaction in working with our customers to help devise design alternatives or resolve process issues. For many of our clients, our technical support team has become an invaluable resource not only because of their knowledge of ProMax but also because of their extensive experience and expertise with specific processes.

The technological merits of ProMax, the high level of service that accompanies ProMax, and the endurance of BR&E combine to create a unique resource. If you are in search of a process simulation software package that meets and exceeds your expectations, I firmly believe you will be delighted with ProMax. It is one thing to read about all the features that make ProMax different; it is another thing altogether to ***experience the difference.***

Jerry A. Bullin

Process Solutions

Simulation Software



ProMax®

Service & Support

The ProMax® Promise

Some Applications of ProMax

Oil & Gas Processing

- NGL Recovery & Fractionation
- Cryogenic Processing
- Dew Point Plants
- Nitrogen Rejection
- Helium Recovery
- LNG Processing
- Refrigeration Systems
- Pipeline Systems
- Hydrate / Solid CO_2 / Water Ice Formation, Prediction & Inhibition
- Emissions Calculations & Reporting

Refining

- Oil Characterization & Speciation
- Atmospheric Towers
- Vacuum Towers
- FCC Fractionation
- Fixed Bed Catalytic Crackers
- Hydrotreating Reactors
- Isomerization Reactors
- General Reactors
- Gas Plant Operations
- Treating Plants
- Stabilizers

Treating

- Glycol Dehydration
- Hydrate Inhibition
- Gas & Liquid Sweetening
- Sour Water Stripping
- CO_2 Capture, Compression, & Sequestration
- Sulfur Recovery / Tail Gas Cleanup

Detailed Design

- Exchanger Rating / Sizing including Brazed Aluminum
- Vessel Sizing
- Relief Valve Sizing
- Line Sizing
- Column Sizing / Hydraulics
- Exchanger Performance with Active Rating
- Pipeline Network Simulation
- Custom Designed Applications

"We take pride in the fact that the focus of our development efforts is, and will continue to be, strongly influenced by the needs of our clients."

Jerry Bullin
President

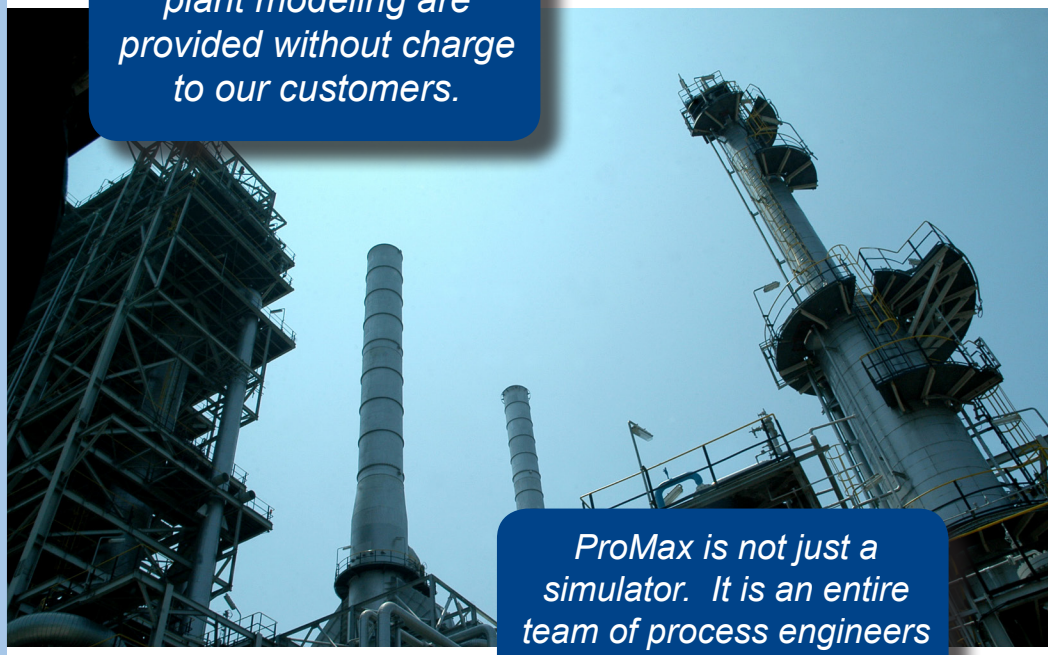
Thousands of clients in over 40 countries use ProMax to meet their process simulation needs.

Technical Support

Experienced chemical engineers are readily available to assist clients with questions regarding simulation issues and general process topics. We take pride in providing effective solutions for our clients in a timely manner.

Access technical articles and tutorials online at bre.com.

Technical support and plant modeling are provided without charge to our customers.



ProMax is not just a simulator. It is an entire team of process engineers ready to assist our clients at a moment's notice.

Initial Plant Models

To demonstrate our commitment to service, BR&E's technical support team will provide initial plant models for clients in operating companies.

"I have been using ProMax for several years to design gas processing and treating plants. BR&E provides unparalleled technical support and assistance. They have been extremely receptive to my requests for improvements to the program and have delivered rapid results. ProMax is an essential tool that I use on a daily basis and it is with great pleasure that I recommend the software."

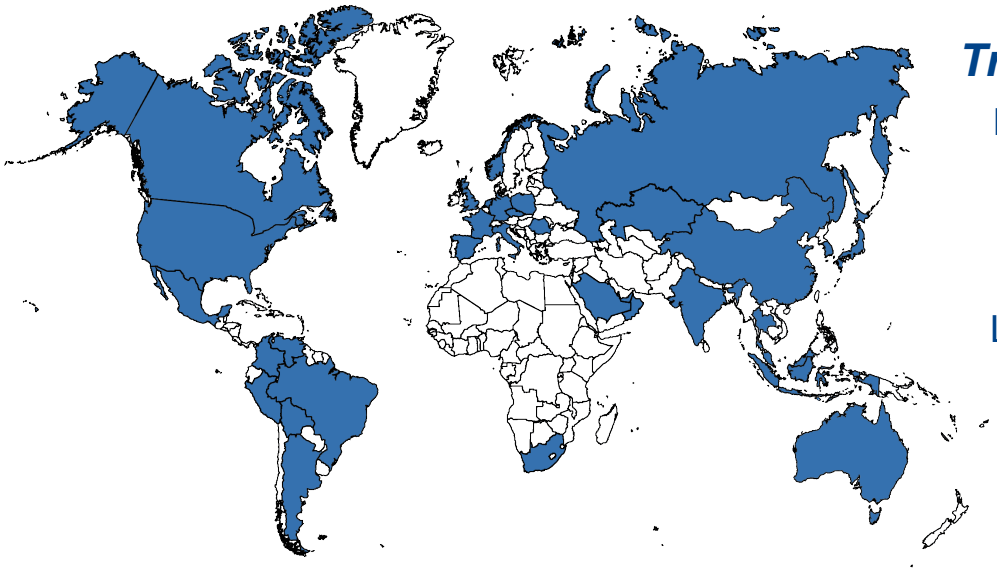
Adam R. Baxter, P.E.

Training sessions around the world

- Our team of process engineers instruct introductory and advanced classes.
- BR&E provides approximately 100 training sessions across 6 continents every year.
- Participants model real process scenarios in an interactive environment.
- Sessions are designed to meet the individual needs of the attendees. Each session is centered on a specific process area and/or skill level.

BR&E provides millions of dollars worth of training each year at no additional cost to our customers.

Register online at bre.com



Training sessions include:

Level 1:

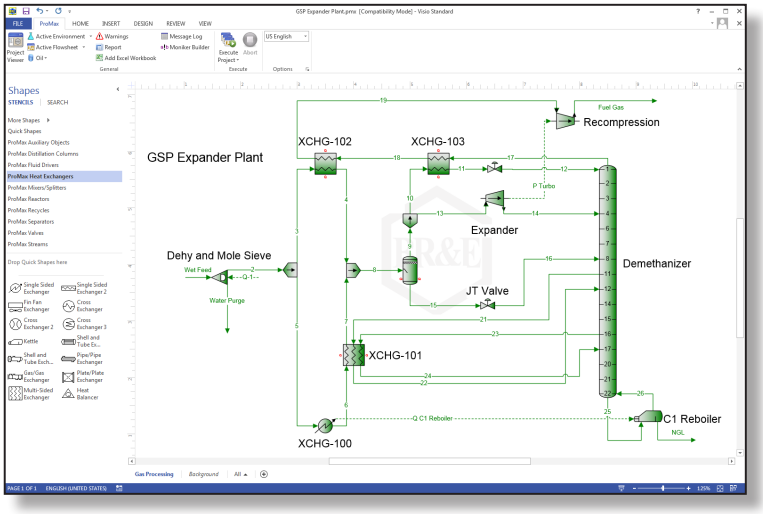
- Air Emissions
- Oil & Gas Focus
- Refinery Focus

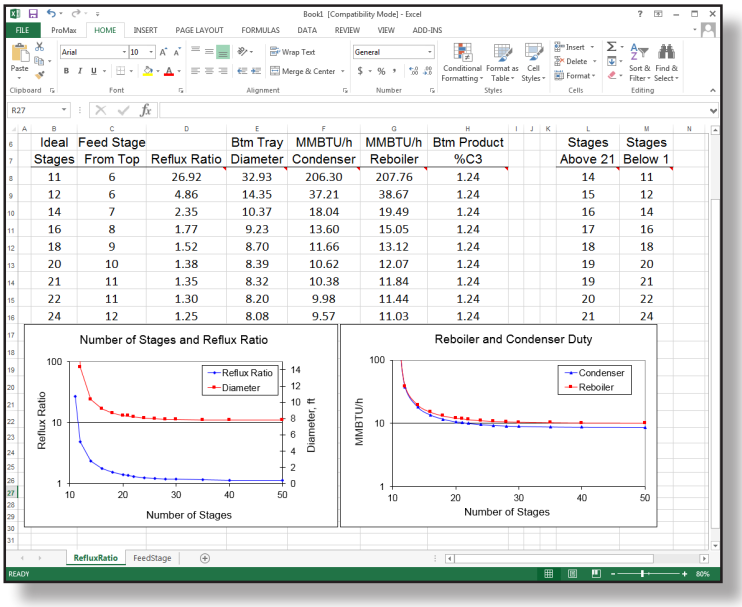
Level 2:

- Gas Processing
- Sour Gas Processing
- Extending Capabilities with VBA
- LNG
- Equipment Rating and Sizing
- AutoKinetic™ Reactors
- Ammonia Production
- Refining

Graphical User Interface

- Quickly set up and edit flowsheets in Microsoft Visio®
- Create clean, customizable drawings and PFDs
- Share values between flowsheets, increasing accuracy and efficiency
- Utilize multiple flowsheets in any simulation



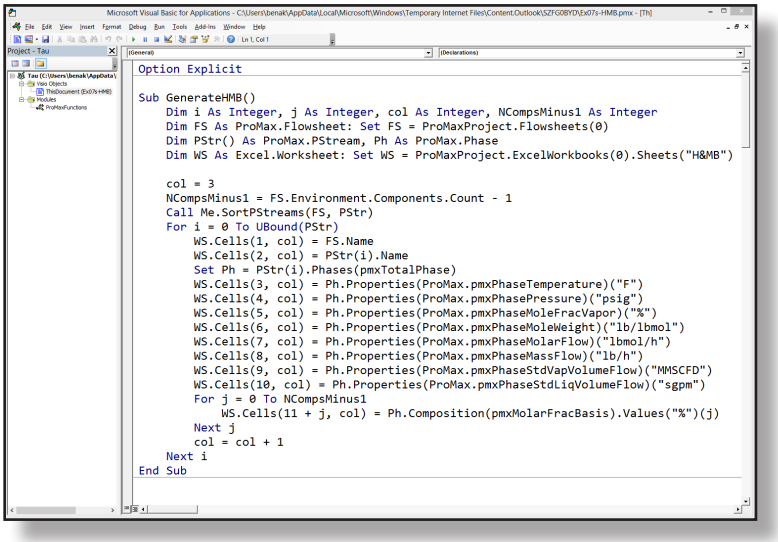


Excel® Compatibility

- Create custom reports
- Generate user defined data sheets
- Perform calculations in Excel while referencing ProMax values
- Use the Excel Solver to optimize process variables

Extensibility

- Access ProMax objects from external programs using ProMax's object-oriented "open architecture"
- Simulate facilities based on real-time data
- Automate Excel workbooks
- Utilize CAPE-OPEN
  - Thermo v1.0 and v1.1 plug compliant
  - Unit Operation v1.0 socket compliant/ thermo v1.0
  - Unit Operation v1.0 socket compliant/ thermo v1.1



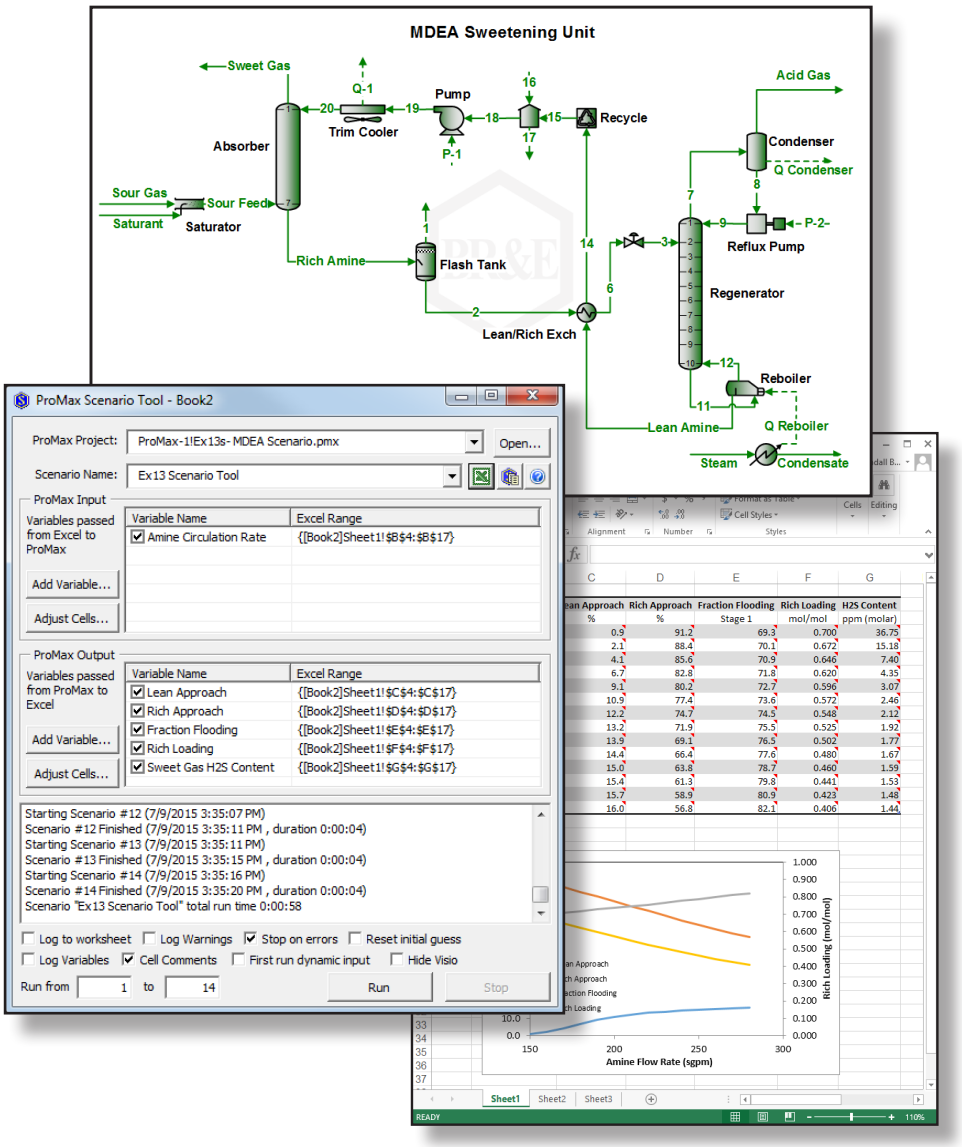
```
Option Explicit

Sub GenerateHMB()
    Dim i As Integer, j As Integer, col As Integer, NCompsMinus1 As Integer
    Dim FS As ProMax.Flowsheet: Set FS = ProMaxProject.Flowsheets(0)
    Dim PStr() As ProMax.PStream, Ph As ProMax.Phase
    Dim WS As Excel.Worksheet: Set WS = ProMaxProject.ExcelWorkbooks(0).Sheets("H&MB")

    col = 3
    NCompsMinus1 = FS.Environment.Components.Count - 1
    Call Me.SortPStreams(FS, PStr)
    For i = 0 To UBound(PStr)
        WS.Cells(1, col) = FS.Name
        WS.Cells(2, col) = PStr(i).Name
        Set Ph = PStr(i).Phases(pmxTotalPhase)
        WS.Cells(3, col) = Ph.Properties(ProMax.pmxPhaseTemperature)("F")
        WS.Cells(4, col) = Ph.Properties(ProMax.pmxPhasePressure)("psig")
        WS.Cells(5, col) = Ph.Properties(ProMax.pmxPhaseMoleFracVapor)("%")
        WS.Cells(6, col) = Ph.Properties(ProMax.pmxPhaseMoleWeight)("lb/lbmol")
        WS.Cells(7, col) = Ph.Properties(ProMax.pmxPhaseMolarFlow)("lbmol/h")
        WS.Cells(8, col) = Ph.Properties(ProMax.pmxPhaseMassFlow)("lb/h")
        WS.Cells(9, col) = Ph.Properties(ProMax.pmxPhaseStdVapVolumeFlow)("MMSCFD")
        WS.Cells(10, col) = Ph.Properties(ProMax.pmxPhaseStdLiqVolumeFlow)("sgpm")
        For j = 0 To NCompsMinus1
            WS.Cells(11 + j, col) = Ph.Composition(pmxMolarFracBasis).Values("%")(j)
        Next j
        col = col + 1
    Next i
End Sub
```

Scenario Tool™

The ProMax Scenario Tool is an add-in for Excel that facilitates the solving of ProMax projects over a range of conditions. The Scenario Tool may be used in any simulation or plant to perform a parametric study by systematically varying selected parameters to determine optimum operating conditions.



"I have used ProMax for several years and really enjoy BR&E's software and incredible customer support. Recently, I needed a process simulation of a complex facility (amine, dehy, cryo, stabilization) we planned to build. I needed the ability to accurately simulate off-design situations such as alternate gas sources and varying inlet flow rates to assure the design was employing adequately-sized equipment. The engineers at BR&E are really good at this sort of work, so I called just to see how much they would charge to model this facility according to my requirements. I was delightfully surprised to learn that they do this for free for their operating company clients. My BR&E salesman prepared the model in a very reasonable amount of time and answered all of my questions about the simulation."

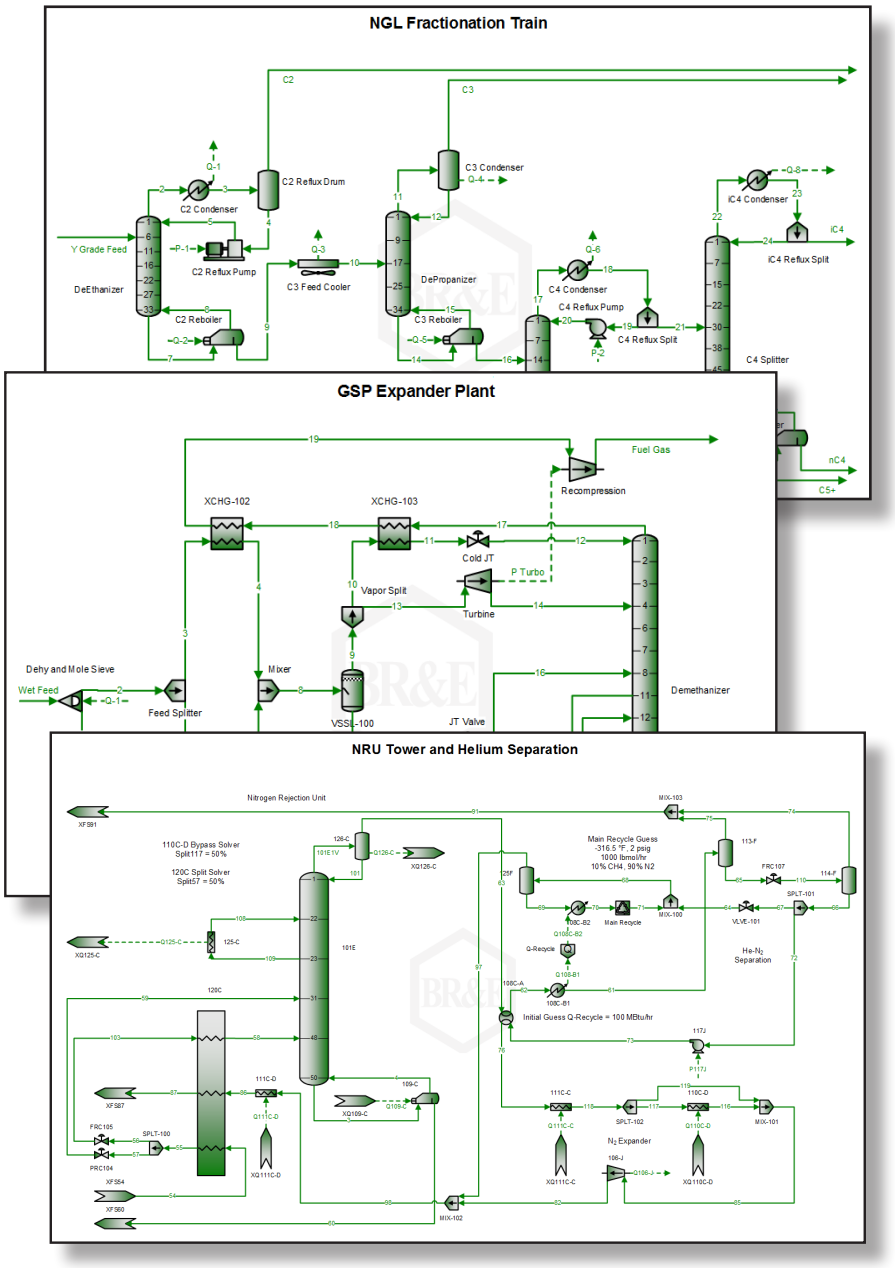
Raymond E. Penderson, P. E.
Senior Engineer
Atlas Pipeline Mid-Continent, LLC
Tulsa, Oklahoma

Hydrocarbon Recovery and Fractionation

ProMax can be used to model virtually any NGL, LNG, or LPG recovery and fractionation process or nitrogen rejection unit (NRU). Capable of modeling an entire processing facility and associated support systems in a single project, ProMax is a comprehensive simulation resource utilized worldwide.

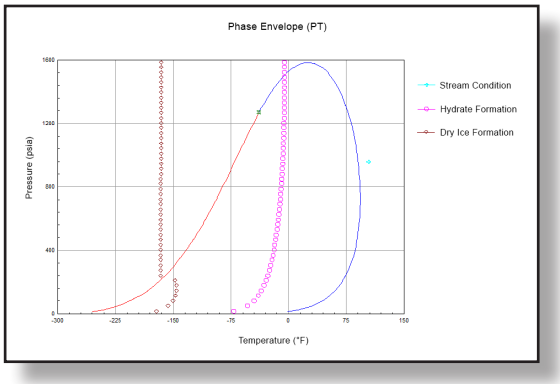
- NGL and LPG fractionation trains
- Turboexpander plants
- GSP and RSV plants
- JT plants
- Nitrogen rejection units
- Helium recovery units
- Dew point control plants
- Refrigeration plants
- Pipeline and gathering systems
- Plant utility systems

- Explore Rate-Based or ideal stage column approaches
- Perform parametric studies and economic analyses
- Predict exchanger performance with in-line rating
- Maximize desired products and process economics



Glycol Dehydration & Hydrate Prediction/Inhibition

ProMax is renowned for its accuracy in predicting the performance of both glycol dehydration and hydrate suppression systems.

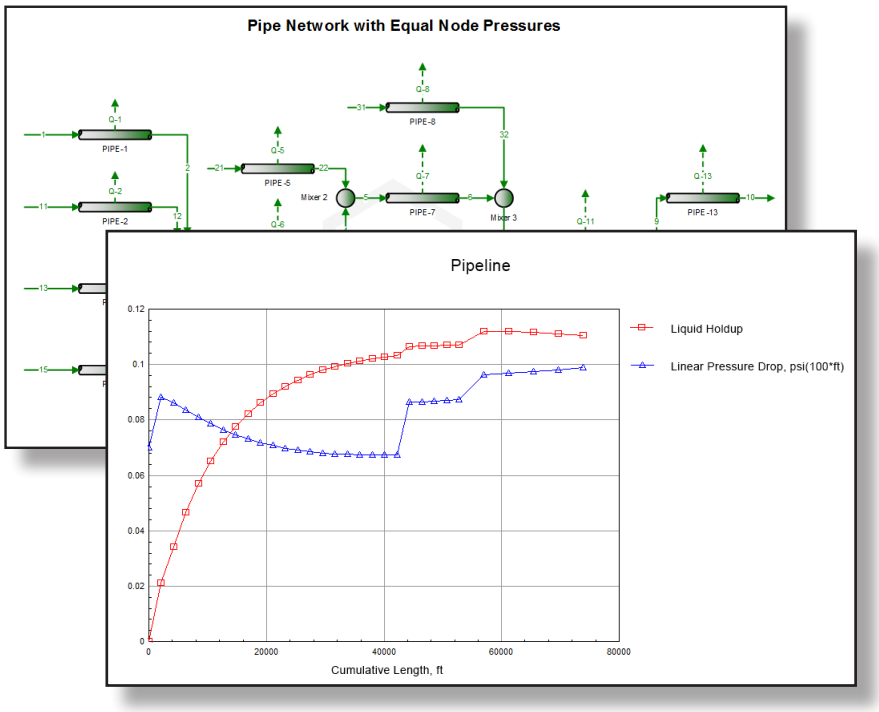


- Calculate hydrate, ice, and solid CO_2 formation temperatures
- Calculate hydrate inhibitor requirements
- Optimize glycol flow rate
- Plot hydrate, ice, and solid CO_2 curves on phase diagrams

- Perform dehydration simulations using TEG, DEG, or Methanol
- Model injection systems using Methanol or EG
- Accurately predict BTEX and VOC emissions
- Accurately model Methanol distribution in three phase systems

Pipelines and Gathering Systems

Pipelines and pipeline networks for above ground, buried, and subsea conditions may be simulated, including known or calculated heat losses to the environment.



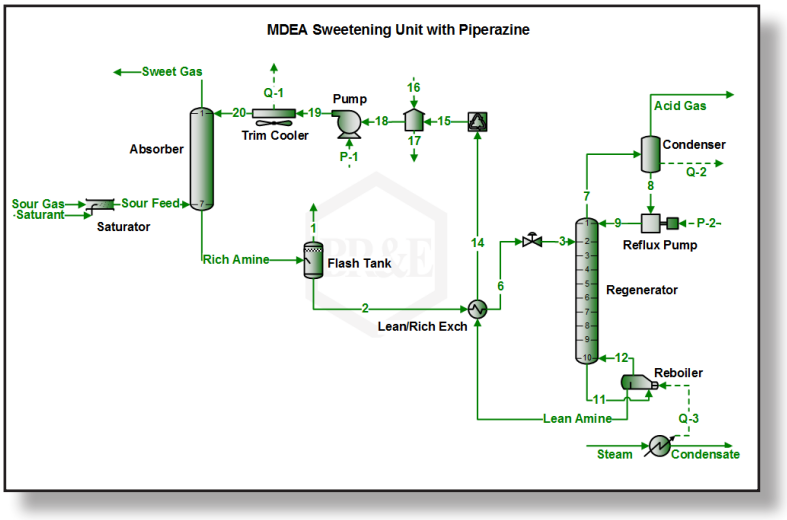
- Model horizontal, vertical, and inclined pipelines
- Predict locations of drip condensate
- Predict liquid holdup and volumes from pigging operations
- Optimize compressor discharge pressures to balance system nodes
- Monitor cricondentherm, heating values, and other parameters throughout pipeline networks
- Predict solids formation in a pipeline

Acid Gas Removal

- Model MEA, DEA, TEA, DGA®, MDEA, DIPA, or any blend of amines
- Predict performance with additives such as piperazine or strong acids
- Model the Sulfinol®* Process
  *Shell Sulfinol Licensors and Licensees
- Use Ideal Stage kinetic or Rate-Based kinetic approaches
- Predict hydrocarbon/BTEX and mercaptan solubility in amines
- Optimize amine type, amine flow rate, and reboiler duty
- Size columns with trays, random packing, structured packing, or any combination
- Model caustic treating systems for mercaptan or Acid Gas removal
- Model physical solvents such as DEPG, NMP, methanol, and propylene carbonate for Acid Gas Removal
- Model Potassium Carbonate processes with or without promoters

Model virtually any process flow or configuration including:

- Multiple absorbers and regenerators
- Vapor and liquid treating
- Split flow processes
- Static mixers



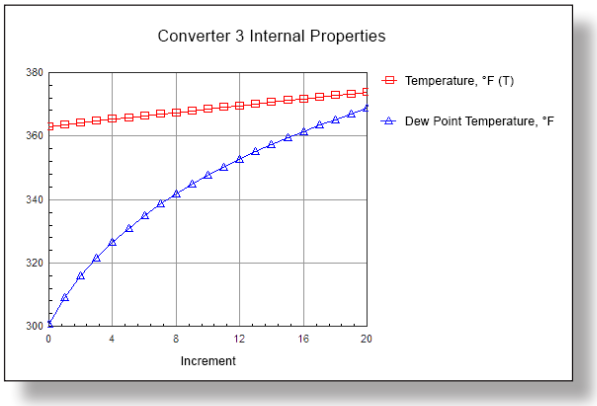
"Besides being a vital tool to determine and evaluate different gas treating processes, ProMax offers a great deal of technical support with very short response times and comprehensive follow up. In DYPROTEC we use [ProMax] for dew-point control analyses, dehydration, and naphtha stabilization to evaluate the feasibility of projects. Additionally, ProMax allows us to verify the operating conditions and the efficiency of processes already installed, so we can offer outstanding support to our clients. We are very happy with the software, service and support that ProMax brings to our company."

Adriana Cano Andrade
Sr. Process Engineer
DYPROTEC, Colombia

Sulfur Recovery/Tail Gas Cleanup

ProMax contains a complete suite of reactor models allowing the user to easily create an accurate model of sulfur recovery unit operations. Model almost any Claus Unit configuration including acid gas bypass, hot gas bypass, enhanced oxygen, catalytic burners, and more. A theoretical approach with empirical modifications allows the user to model real world behavior, whether for the Claus process itself or a variety of other Claus/Tail Gas technologies:

- Selectox/Recycle Selectox®
- COPE™
- Ultra®
- Sulfreen®
- SCOT®
- SUPERCLAUS®
- MODOP®
- CBA®
- EUROCLAUS®



Sour Water Stripping

Model virtually any flow configuration of a sour water stripping facility with ProMax. Users have access to BR&E's proprietary electrolytic property package, enabling them to create models that accurately predict operating conditions.

- Model refluxed/non-refluxed systems
  - partial condenser
  - pump around system
- Model various stripping options
  - kettle reboiler
  - thermosiphon
  - steam injection
  - fuel gas injection
- Simulate acid or caustic addition for enhanced stripping or pH control
- Model two-column systems for separate NH_3 and H_2S products

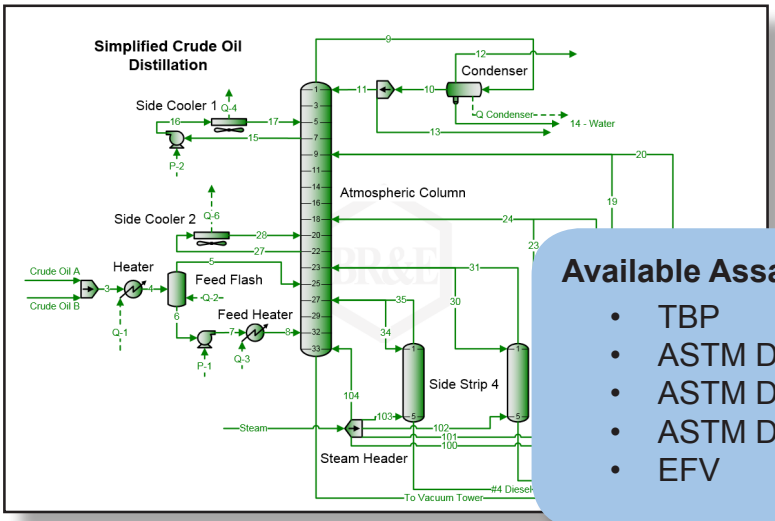
"The level of knowledge BR&E has, especially about sour gas processes, is only surpassed by their willingness to share it with engineers to improve their operations. I whole-heartedly recommend any company or engineer with the opportunity to use ProMax to do so. You will be impressed with the level of service and support you will receive, not to mention the precision ProMax provides."

Ismail Alami
Supervisor
Saudi Aramco
Dhahran,
Saudi Arabia

Oil and Refining

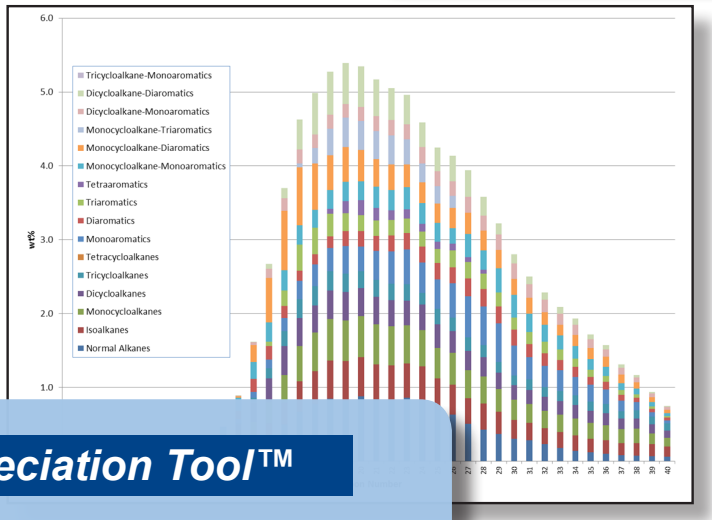
- Model atmospheric and vacuum towers
- Simulate product fractionators such as FCC and coker main fractionators
- Streamline the prediction of yield estimates for processes such as Reforming, Isomerization, and Hydrocracking
- Investigate crude preheat network performance and monitor fouling
- Study the impact of changing crude slates on downstream processing and treating
- Evaluate crude oil blends to maximize profitability

Use ProMax to characterize single or multi-component oils and blends for use in common refining applications through pseudo-components. Alternatively, using the oil speciation tool, pure components and compound species can be used to describe crude oils.



Available Assay Types:

- TBP
- ASTM D86
- ASTM D1160
- ASTM D2887/SD
- EFV



Oil Speciation Tool™

A must-have tool to determine the composition of an oil fraction sample in terms of pure components from assay data such as API gravity, boiling curve, and sulfur content.

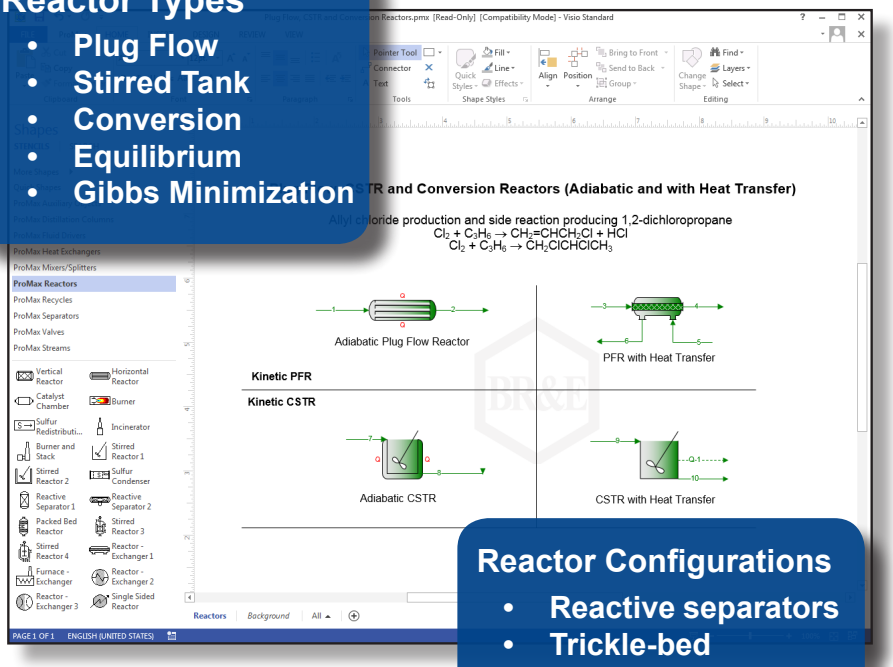
Reactors

ProMax has 2100+ pure components for modeling chemical processes and offers a powerful, yet flexible set of reactors. User defined reaction sets containing either single or multiple simultaneous reactions can be created to give the user precise control over stoichiometry, equilibrium conditions, reaction rates, and much more.

- Fully customizable reactor configurations and geometries
- Built-in support for flow and mixing regimes
- Built-in support for transport phenomena and multiphase kinetics
- Rigorous models for binary particle beds
- Rate-Based reactor modeling
- Reactive Distillation columns

Reactor Types

- **Plug Flow**
- **Stirred Tank**
- **Conversion**
- **Equilibrium**
- **Gibbs Minimization**



Reactor Configurations

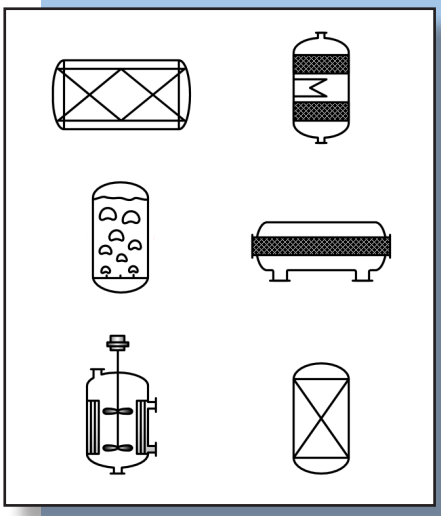
- **Reactive separators**
- **Trickle-bed**
- **With heat transfer & exchanger rating**
- **With or without interphase mass transfer**

Explore

Fundamental details of reactor performance for design and debottlenecking

Discover

Accurate analyses of reactor operations to achieve optimized operating targets



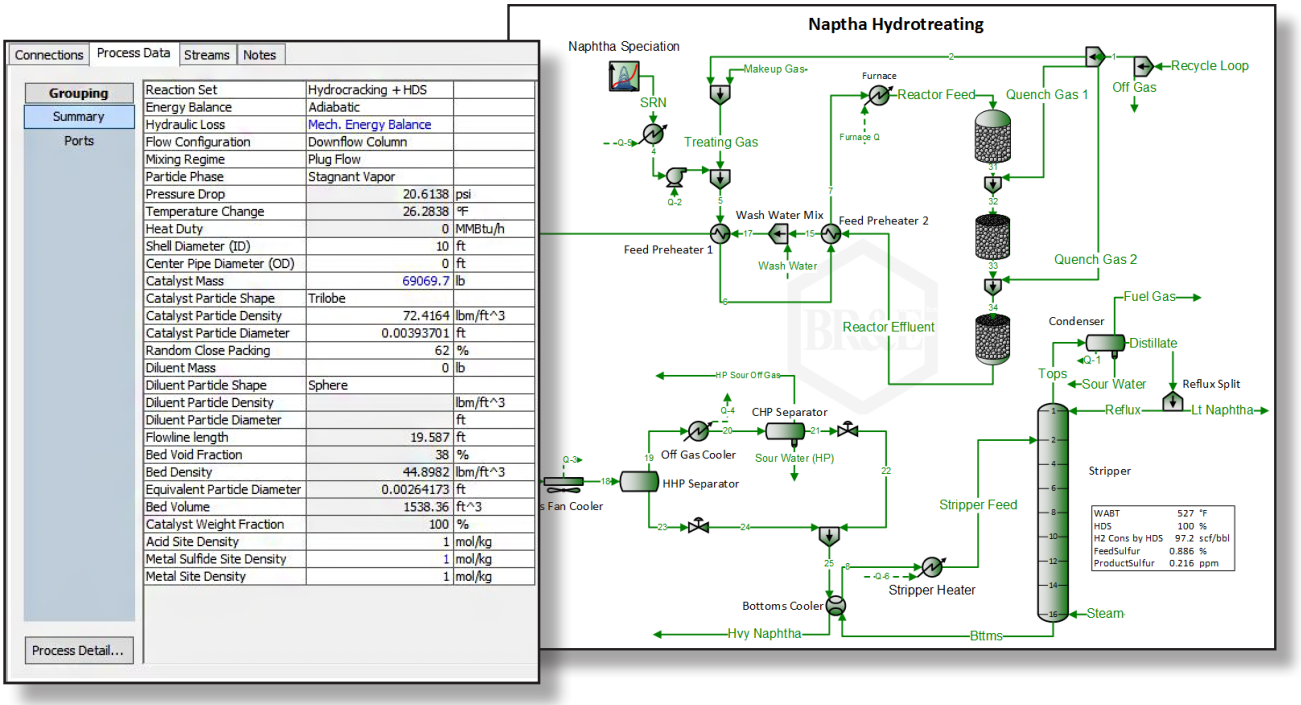
Improve

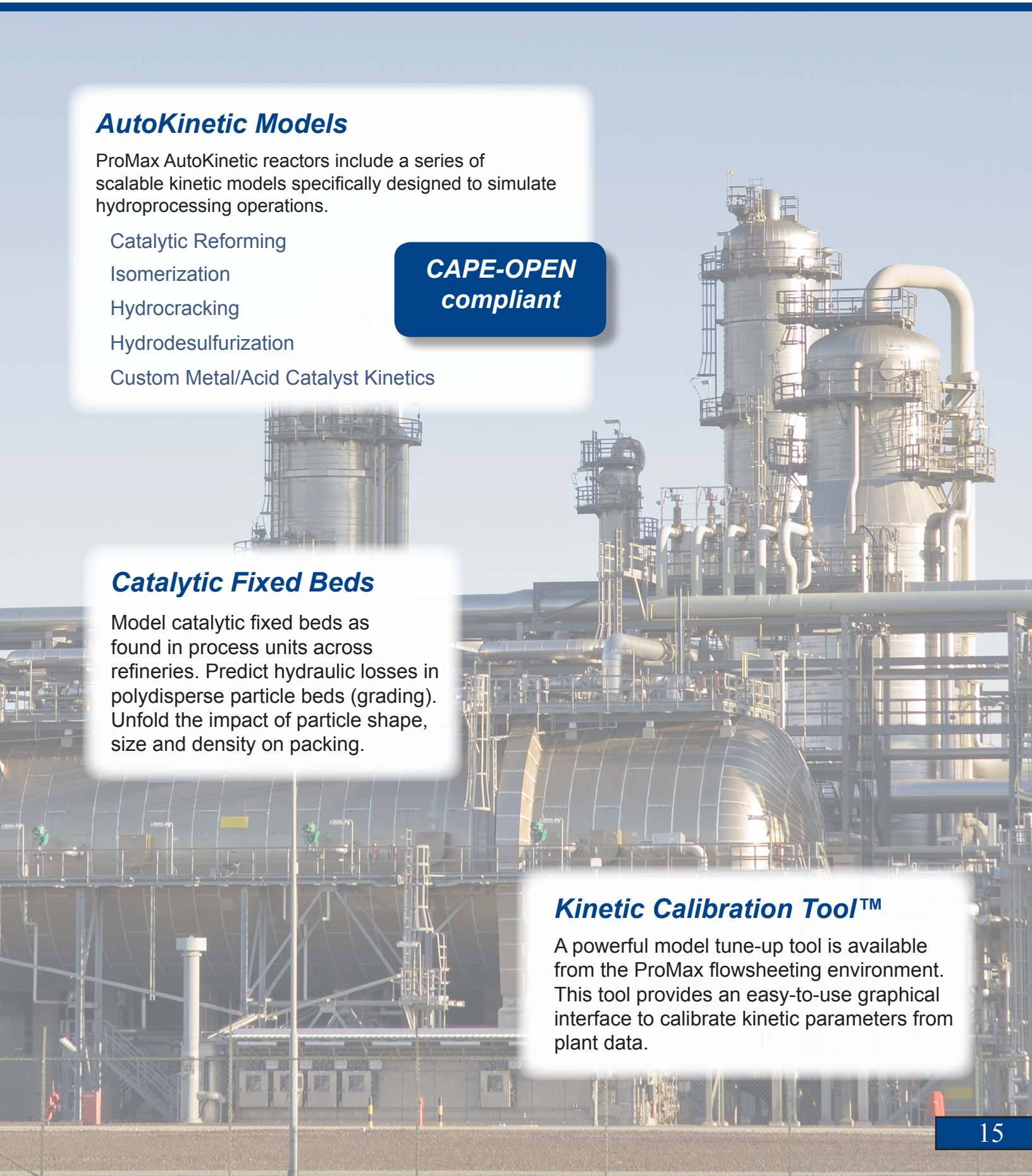
Yield estimations to support capital projects, feedstock selection, and plant-wide optimization

AutoKinetic™ Reactors

ProMax AutoKinetic reactors provide a suite of rigorous reactor models to simulate refining and other hydrocarbon reactor processes. Among other benefits, these models can accurately predict reactor operations to achieve optimized operating targets and provide fundamental details on reactor performance for design and debottlenecking.

- Computer-generated reaction sets from chemistry fundamentals
- Customizable reaction sets based on user's selection of species in simulation environment
- Simplified workflow that removes the burden of introducing user specified reactions, rate expressions, or kinetic parameters
- Open access to model kinetic parameters
- Easy-to-use Oil Speciation capabilities to convert assay data into a mixture of compound and pure species
- Intuitive model calibration with user-supplied data
- Flexible multi-bed reactor configuration with seamless integration of heat/quench operations
- Powerful graphical tools for performance analysis
- CAPE-OPEN Process Modeling Component (PMC)





AutoKinetic Models

ProMax AutoKinetic reactors include a series of scalable kinetic models specifically designed to simulate hydroprocessing operations.

- Catalytic Reforming
- Isomerization
- Hydrocracking
- Hydrodesulfurization
- Custom Metal/Acid Catalyst Kinetics

CAPE-OPEN compliant

Catalytic Fixed Beds

Model catalytic fixed beds as found in process units across refineries. Predict hydraulic losses in polydisperse particle beds (grading). Unfold the impact of particle shape, size and density on packing.

Kinetic Calibration Tool™

A powerful model tune-up tool is available from the ProMax flowsheeting environment. This tool provides an easy-to-use graphical interface to calibrate kinetic parameters from plant data.

Environmental Solutions

Calculate:

- Working, breathing, and loading losses following AP-42
- Flash emissions
- Process emissions

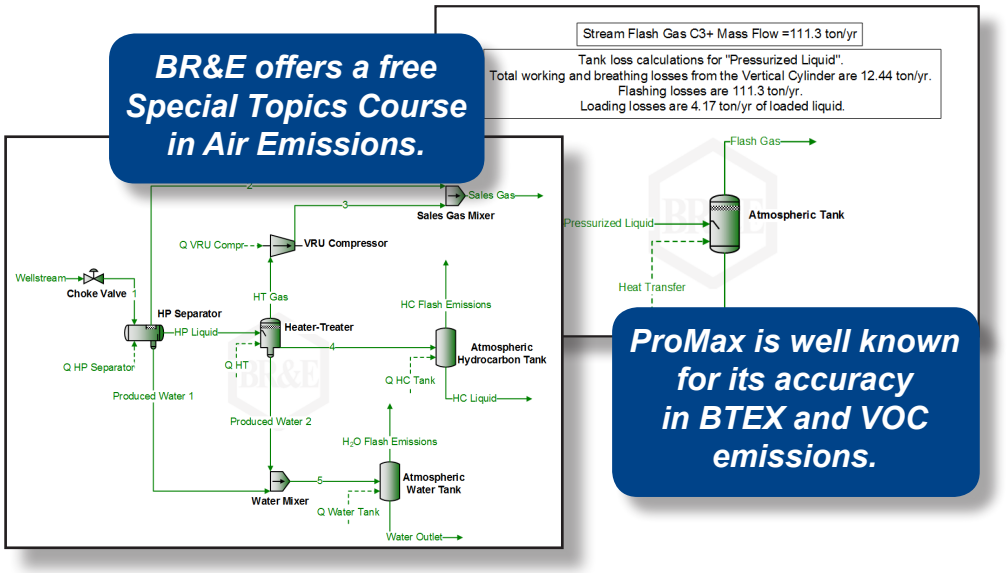
Model:

- Condensate, oil, and produced water tanks
- Well sites
- Flares
- Amine, glycol, and other processing units
- Thermal oxidizers

Improve:

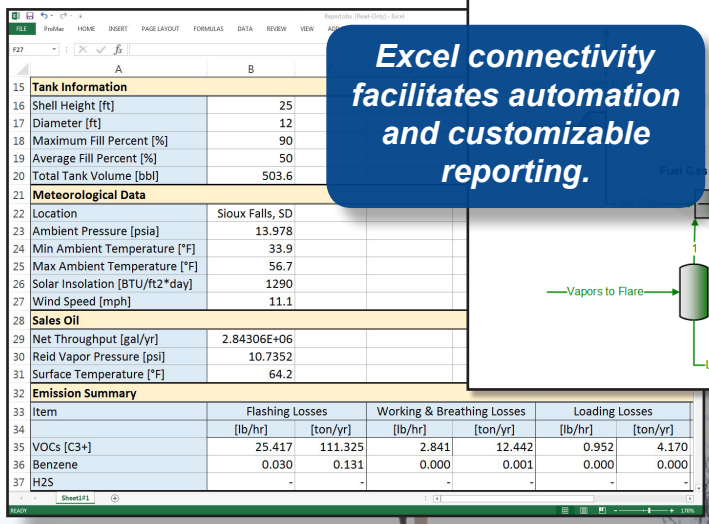
- Operations by studying the impact of process configuration and operating variables on emissions rates
- Economy by exploring potential options to reduce emissions
- Productivity by avoiding PSD reviews
- Efficiency by generating reports for hundreds of wells quickly using the Scenario Tool™

BR&E offers a free Special Topics Course in Air Emissions.



ProMax is well known for its accuracy in BTEX and VOC emissions.

Excel connectivity facilitates automation and customizable reporting.



	A	B
15	**Tank Information**	
16	Shell Height [ft]	25
17	Diameter [ft]	12
18	Maximum Fill Percent [%]	90
19	Average Fill Percent [%]	50
20	Total Tank Volume [bbl]	503.6
21	**Meteorological Data**	
22	Location	Sioux Falls, SD
23	Ambient Pressure [psia]	13.978
24	Min Ambient Temperature [°F]	33.9
25	Max Ambient Temperature [°F]	56.7
26	Solar Insolation [BTU/ft2*day]	1290
27	Wind Speed [mph]	11.1
28	**Sales Oil**	
29	Net Throughput [gal/yr]	2.84306E+06
30	Reid Vapor Pressure [psi]	10.7352
31	Surface Temperature [°F]	64.2
32	**Emission Summary**	

33	Item	Flashing Losses		Working & Breathing Losses		Loading Losses	
34		[lb/hr]	[ton/yr]	[lb/hr]	[ton/yr]	[lb/hr]	[ton/yr]
35	VOCs [C3+]	25.417	111.325	2.841	12.442	0.952	4.170
36	Benzene	0.030	0.131	0.000	0.001	0.000	0.000
37	H2S	-	-	-	-	-	-

Equipment Rating and Sizing

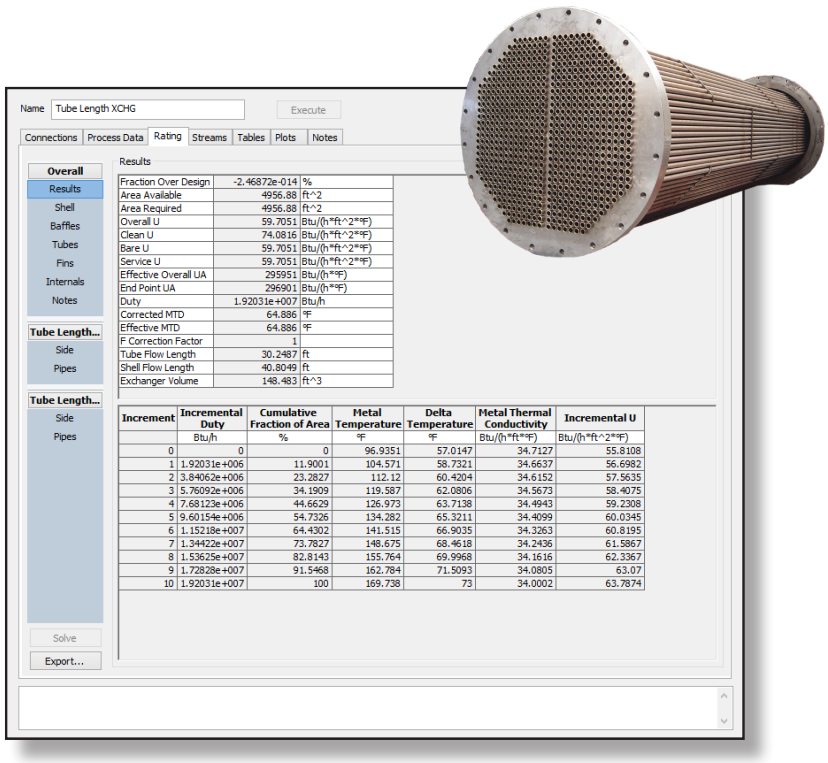
Separators

ProMax is capable of sizing both horizontal and vertical separation vessels for either two or three phase flow configurations including liquid/liquid sizing.

Rate-Based and Ideal Stage Columns

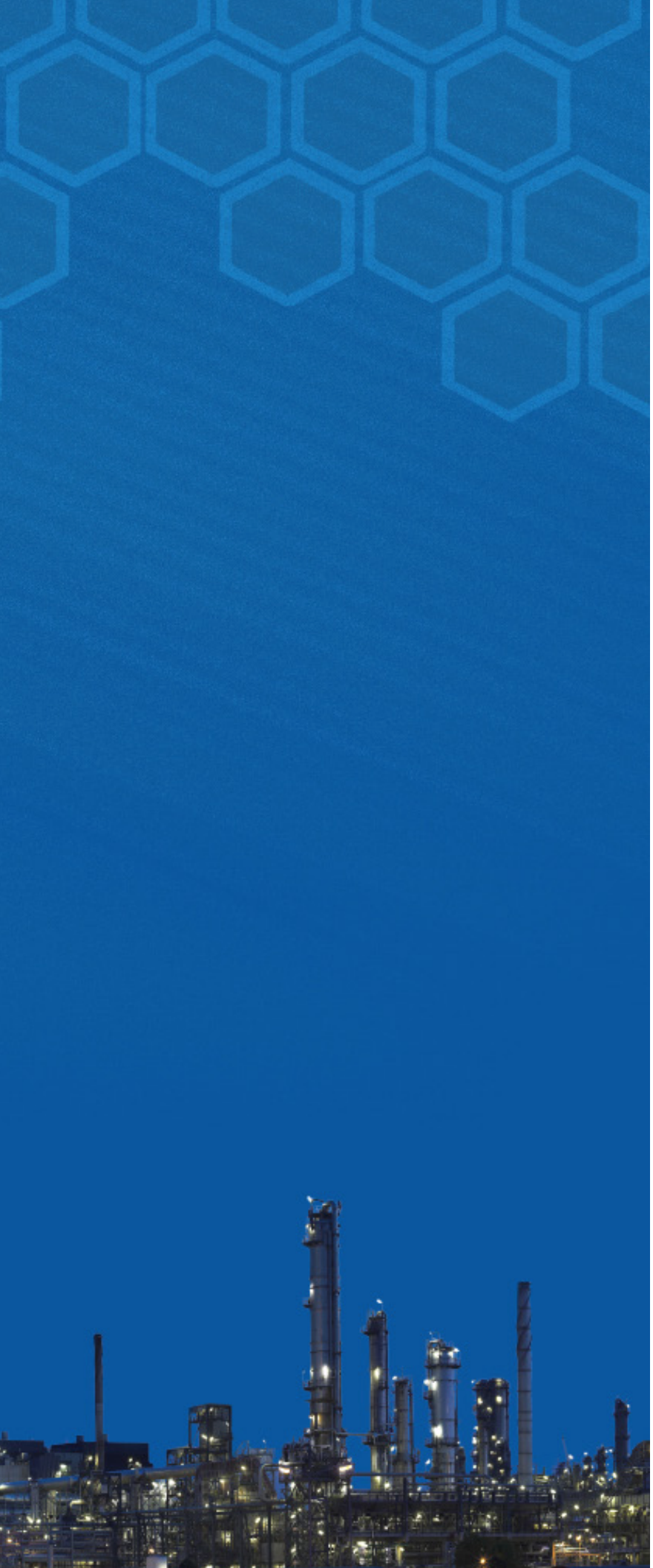
Column hydraulics for trays, random packing, structured packing, or any combination of these may be investigated in ProMax. Detailed stage data is presented on both a phase and component basis. ProMax automatically displays component recoveries for every product stream, allowing the user to easily maintain column performance.

- Vessels
- Column Hydraulics
- Heat Exchangers
- Control Valves
- Line Sizing
- Relief Valves



Exchangers

- Rate and/or size shell and tube, plate-frame, fin fan, double pipe, and brazed aluminum plate fin exchangers
- Choose from over 70 heat transfer fluids
- Generate TEMA datasheets
- Calculate complete exchanger details



ProMax®

Process Simulation Software

by

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