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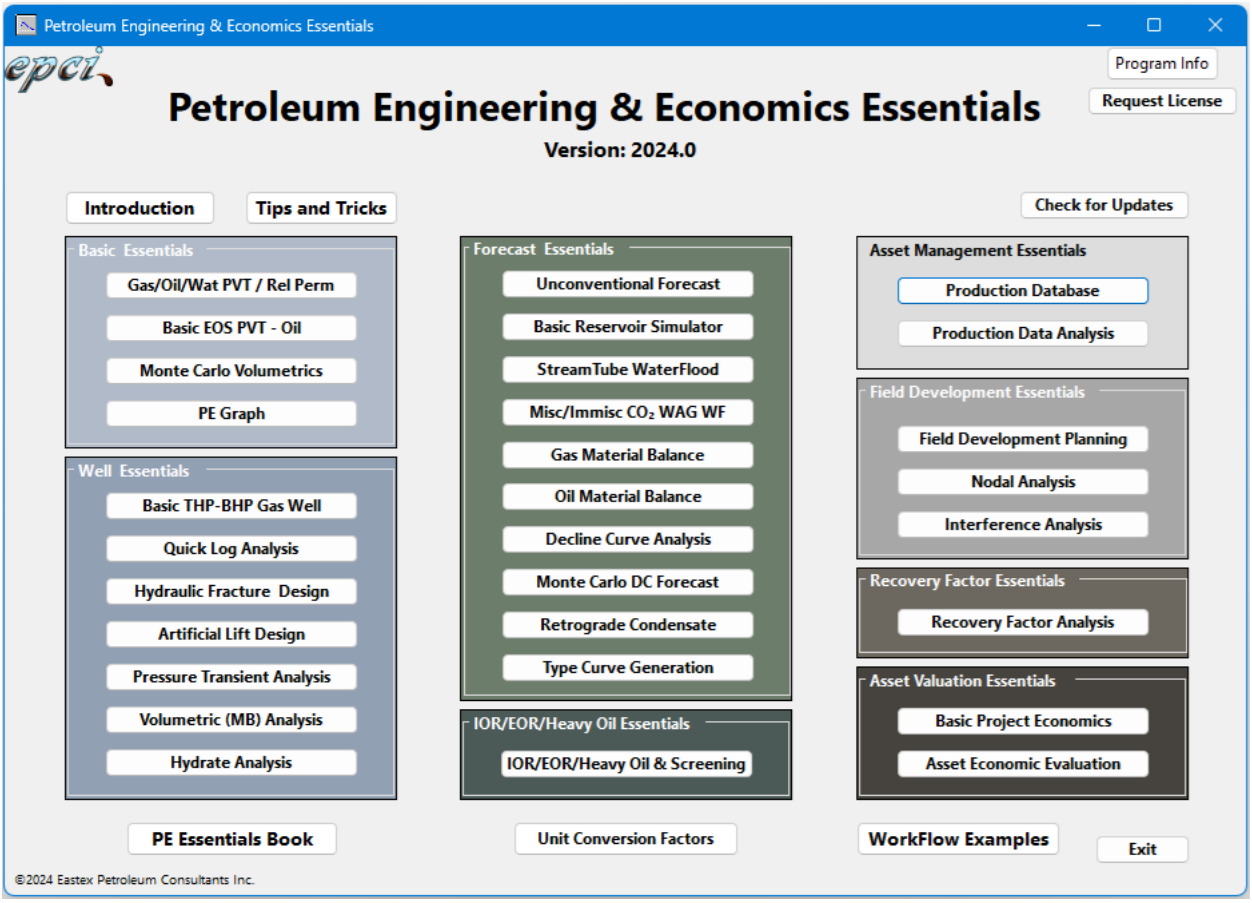
PE^2 Essentials Update Notes – Version 2024.0

The PE^2 Essentials software version 2024.0 was released January 2, 2024.



The 2024.0 version includes the following modifications/updates to the 2023.1 release.

- General
  - Clarified the model naming for each tool (refer to Tips and Tricks)
  - Clarified how to import non-PE Essentials CSV files into PE Graph (refer to Tips and Tricks)
  - Include the steps to import data into the Production Database tool in the Tips and Tricks document

- Production Database Tool
  - All time data is now entered using dates

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- Production Data Analysis Tool
    - Fixed a bug that could cause duplicate well names to be saved
    - Enabled log-log plots and straight lines to be added to the curves in Interpret-PDA
    - Fixed a bug in the PVT routine that would not allow flipping back to correlations after importing a PVT model

- Nodal Analysis Tool
    - NOTE – although Gas Lift Analysis is part of the Nodal Analysis Tool, it has not been enabled at this time pending additional QC
    - Added the option to choose either the Shiu & Beggs (1980) or Sagar, Doty & Schmidt (1991) correlation for wellbore flowing temperature for flowing and injection wells
    - The IPR or the wellbore temperature can now be plotted on the Reservoir tab
    - Added the capability to import PVT models
    - Added the capability of using other correlations for calculating PVT parameters and to match the saturated oil parameters to actual conditions
    - Fixed a bug that could occur when changing wellbore correlations for gas wells
    - Made input unit for THP-to-BHP conversions consistent with the main program
    - Updated the metric Tubing Data Table
    - Changed the IPR routine for gas wells so that the c-factor can be calculated based on reservoir parameters rather than a welltest

- Asset Economics Analysis Tool
    - Fixed a bug that could cause issues in the NPV values listed for the other discount values
    - Updated the DCA import routine to import newer DCA models
    - Changed CSV file output to present mbbls rather than bopd for oil

- PE Graph Tool
    - Added the option to plot all curves as points rather than lines

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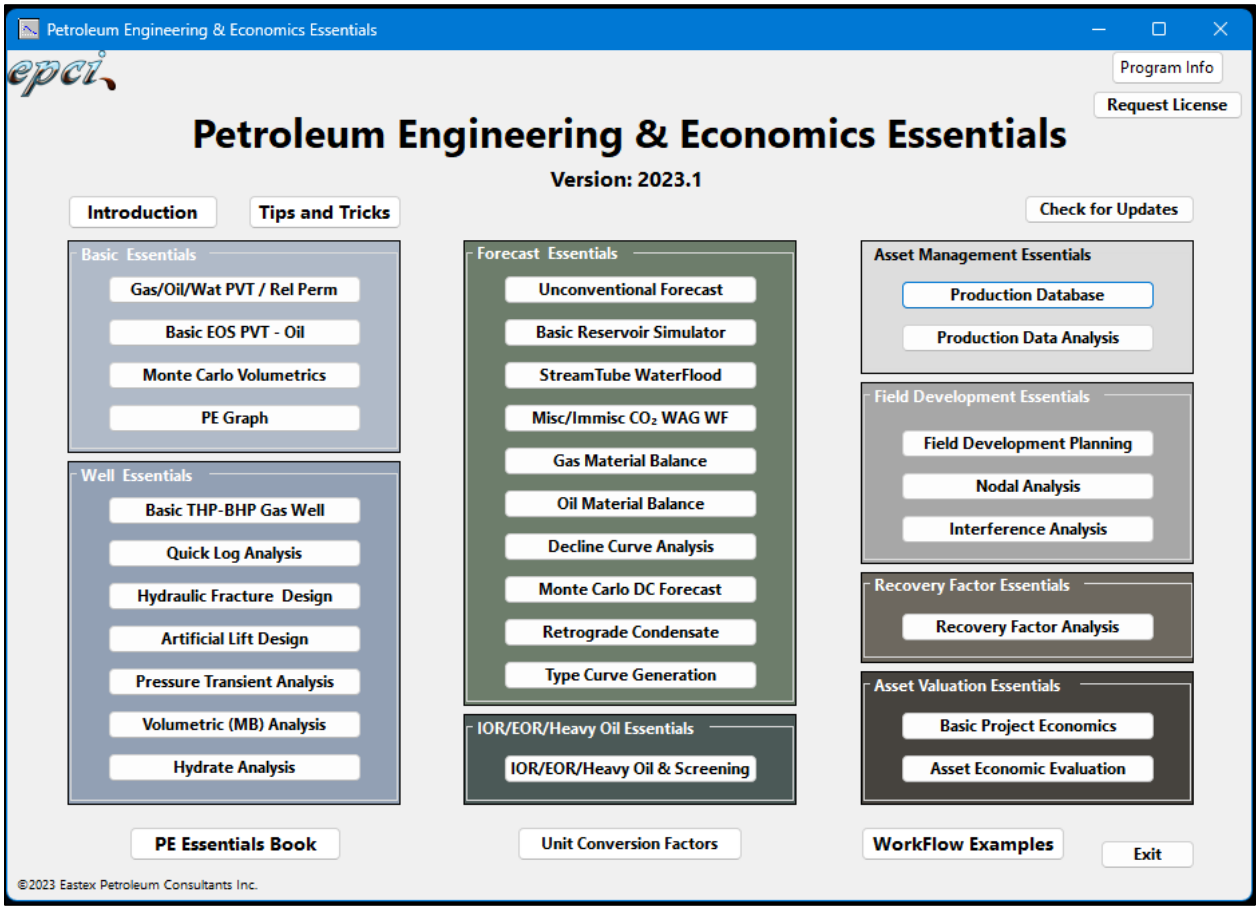
PE^2 Essentials Update Notes – Version 2023.1

The PE^2 Essentials software version 2023.1 was released March 31, 2023.



The 2023.1 version includes the following modifications/updates to the 2023.0 release.

- General
  - Enhanced CSV input routines for all tools to include generic CSV file imports as well as PE Essentials generate CSV files
  - Made CSV imports more user informative
  - Simplified the link to Excel for importing data

- PVT Tool
  - Added the Kartoatmodjo & Schmidt model – this model may yield better viscosity estimates for low-API oil
  - Incorporated multiple relative permeability models:
    - Corey

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    - Generalized Corey
    - Honarpour
    - Included description of Stone I and II and Baker three phase relative permeability models in the documentation
  - Added the option to generate gas-water, oil-water and gas-oil relative permeabilities (pseudo permeability) from production data

- Decline Curve Analysis Tool
  - Added the capability to export the forecast parameters to a CSV file from the 'DCA(Arps) Forecast' tab

- PE Graph Tool
  - RSM input option now includes general data input but can only be for a single entity (Field or a single group or well)
  - Incorporated options to set the import date format to allow a more universal date format

- Interference Tool
  - Incorporate options to set the import date format to allow a more universal date format

- Database Tool
  - Added the option to import all data through generic CSV files – including appending data and reloading the data
  - Fixed a bug that caused the Excel file to remain hidden if a crash occurred during data import

- Nodal Analysis Tool
  - Fixed an issue with calculating tubing pressures for water wells and water injection wells

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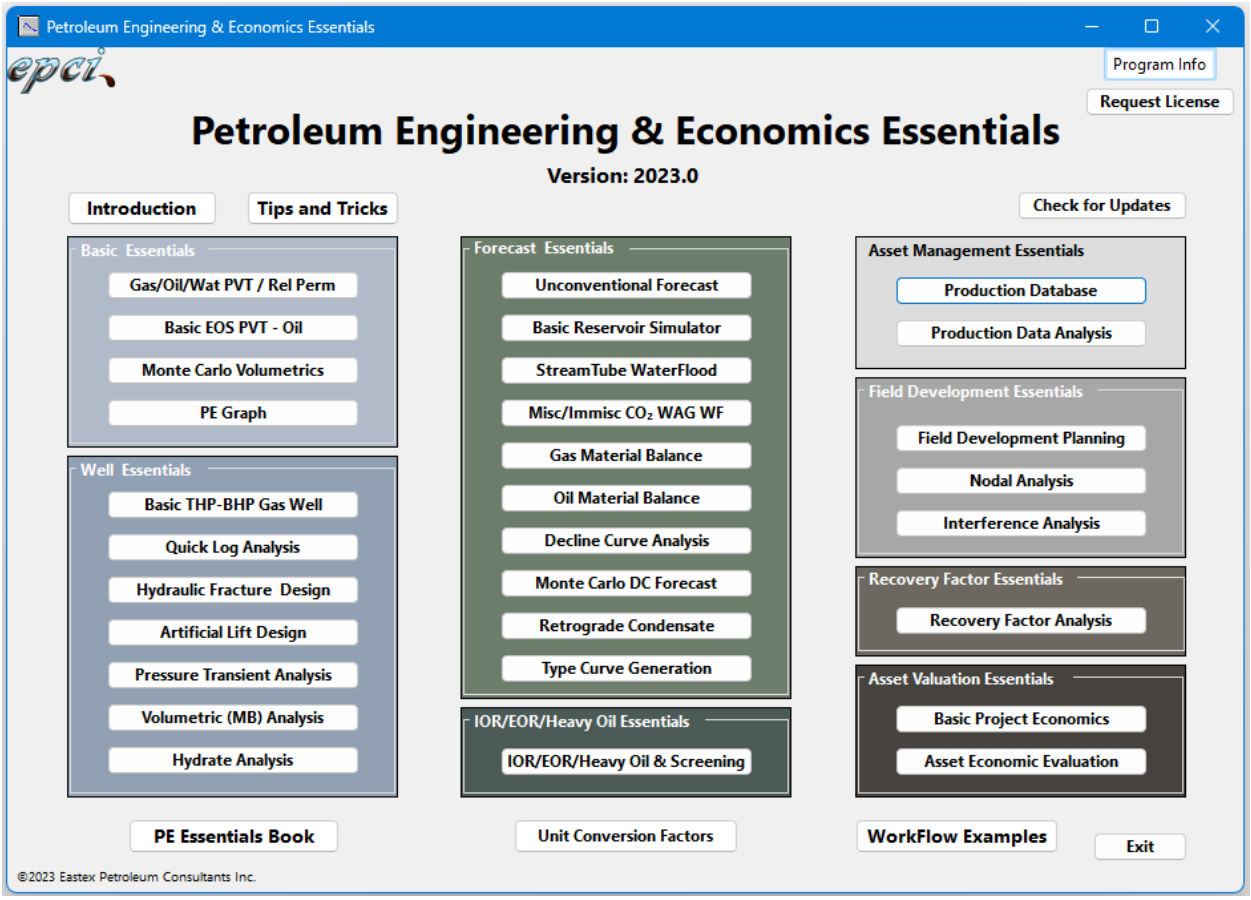
PE^2 Essentials Update Notes – Version 2023.0

The PE^2 Essentials software version 2023.0 was released January 1, 2023.



The 2023 version includes the following modifications/updates to the 2022.0 release.

- General
  - Modified the layout of the start-up screen to include the Tips document
  - A new document titled "Tips, Tricks, Techniques and Work Arounds for the PE Essentials tools" has been added to the tools. This document presents some of the user techniques that have been used with the tools
  - All identified bugs have been corrected
  - Where appropriate, the tool documents have been updated to the 2023 version
  - Incorporated a new licensing system that is more user friendly

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- Asset Economic Evaluation Tool
    - The tool now allows the user to specify the discount factors to be used for Corporate NPV analysis
    - The sensitivity parameters are now automatically calculated every time the model is run so a separate sensitivity run is not required
    - The Excel file for the Corporate Analysis Results now includes gross and net volumes and net (realized) oil and gas prices

- Decline Curve Analysis Tool
    - Added the capability to export the history data, the monthly forecast, and the annual forecast to a CSV file from the 'DCA(Arps) Forecast' tab

- Interference Analysis Tool
    - Updated the document for this tool to describe and demonstrate the validity of the production interference analysis technique

- Production Database
    - Added the option to enter large data sets from a csv file - this significantly speeds up the data loading

- Type Curve Generation Tool
    - When outputting the Arps parameter to a csv file, it now includes the probabilistic distribution of each parameter

- Basic EOS PVT – Oil Tool
    - Now saves the recombination data with the model

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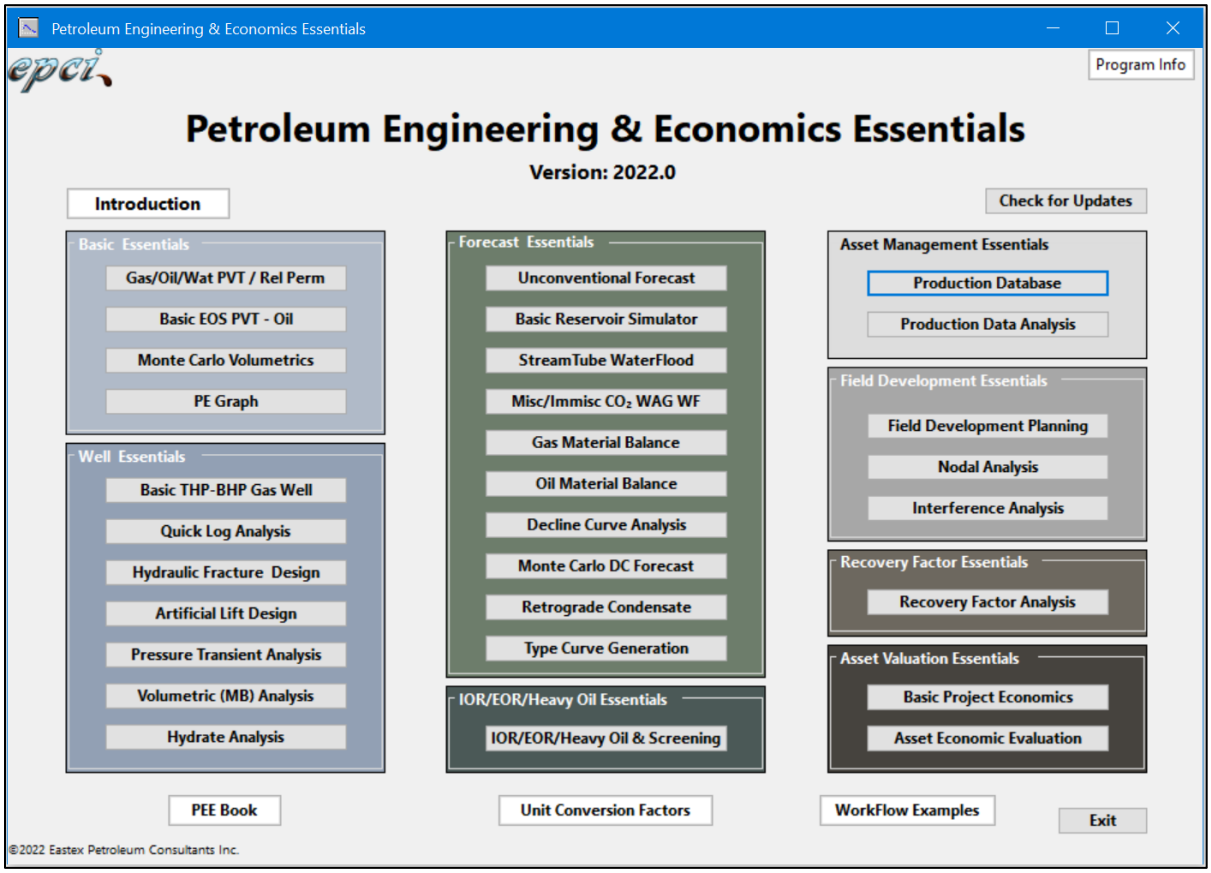
PE^2 Essentials Update Notes – Version 2022.0

The PE^2 Essentials software version 2022.0 was released January 3, 2022.



The 2022 version includes the following modifications/updates to the 2021.05 release.

- General
  - Modified the layout of the start-up screen for new tools
  - The Introduction section in the PE Essentials book has been expanded and includes information on the different databases used by the tools
  - Where appropriate, the tool documents have been updated to the 2022 version
  - The Workflow Examples have been updated
  - Four new tools have been added to this update: Interference Analysis Tool; Retrograde Condensate Forecast Tool; INTERPRET-PDA WF Tool and Type Curve Generation Tool
  - A screen capture capability is added to all tools that will create a png file of the tool screen
  - All tools now include the option of entering any character in well names

- Type Curve Generation Tool **NEW**
  - The tool can be used to generate a number of type curves from historical data, DCA forecast data and DCA analysis parameters
  - Type curves include: average curve; P90/P50/P10 type curves from historical data; P90/P50/P10 type curves from DCA forecasted data; and, P90/P50/P10 type curves generated from probabilistic analysis of Arps parameters (Qi, Di and b)
  - A "project-based" forecast can then be generated using any combination, and number, of type curves

- Interference Analysis Tool **NEW**
  - A production data interference analysis tool has been added that can be used to investigate well-to-well interference/communication from the production data
  - Permeability calculations from the interference time is also presented

- Retrograde Condensate Forecast Tool **NEW**
  - The tool will generate the reservoir depletion performance and a production forecast for a retrograde condensate gas reservoir
  - Two forecast options are available: using a correlation; or using compositional information (CVD) from PVT analysis
  - A tool is also included that will estimate reservoir fluid parameters (specific gravity, maximum retrograde volume, C7+ volume and dew point pressure based on historical condensate/gas production
  - A separator (flash) test tool is included to evaluate reservoir fluid characteristics as well as determine optimum well operating parameters
  - A gas/liquid recombination tool is included to recombine separator fluids

- Production Database Tool
  - Added the capability to smooth the complete well data for one or more wells using 3-point, 7-point or 11-point averaging
  - Corrected an issue when trying to set a data point to zero in the 'Edit Table Data' routine
  - Added an option to export well summaries: start date, well name, cum oil, cum gas, cum water, end date, production time

- Gas Material Balance Tool
  - Added the option to export the gas production forecast to a CSV file
  - Fixed an issue with pressure reporting
  - Included the B_g factor in the stored/exported model

- Oil Material Balance Tool
  - Changed input/output units to mbbls/10^3 m^3 instead of mmbbls/$10^6 m^3$

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- Production Data Analysis Tool
  - Added the **NEW** INTERPRET-PDA WF tool for waterflood performance analysis and EUR estimates
  - The PDA tool can smooth/average production data streams (oil-gas-water-pressure) from multiple wells with a user-specified averaging interval
  - Included an option to retain the unaveraged cumulative volumes or to recalculate the volumes based on the averaged values
  - Converting a Gas MBal forecast to a PDA well now includes BHP
  - Exporting a Gas MB model to a CSV file now includes all the model info
  - Corrected issues with exporting the model for the Basic Reservoir Simulator

- Volumetric (MB) Analysis Tool
  - Updated the Gas MB model import to include water drive
  - Corrected the time heading for the CSV output file
  - Added large end-points to interpretation line

- PE Graph Tool
  - Corrected the Text Font dropdown to indicate the program's startup font

- Gas/Oil/Wat PVT / Rel Perm Tool
  - Dew point pressure can now be calculated using three different models or from the average of all models
  - Changed the Pc, Tc calculations for the C7+ component to the Riazi and Daubert correlation

- Basic EOS PVT – Oil Tool
  - Changed the Pc, Tc calculations for the C7+ component to the Riazi and Daubert correlation`
  - Changed the omega calculation for the C7+ component to the Edmister correlation

- Decline Curve Analysis Tool
  - Corrected an issue with entering the "User" option for forecasts
  - Added diagnostic plots to the DCA tool – linear flow, BDF
  - Added sliders to the DCA tab to assist with refining the Arps DCA interpretation – allows refining the Q_i, decline and b-factors for the Arps analysis model

- Basic Project Economics Tool and Asset Economic Evaluation Tool
  - Corrected an issue with importing forecast data from the DCA database

- IOR/EOR/Heavy Oil & Screening Tool
  - The IOR/EOR Screening and EOR/Heavy Oil Tools have been combined into one tool

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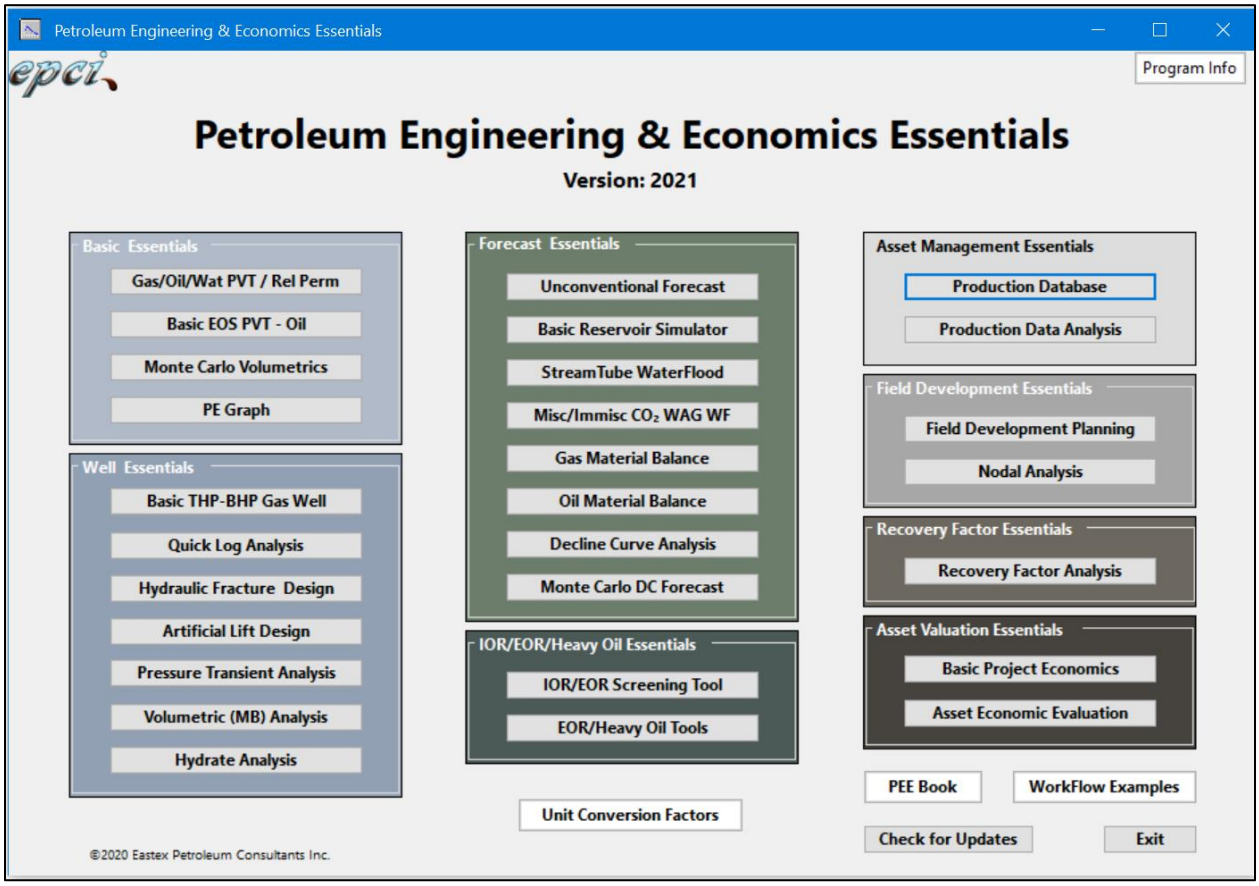
PE^2 Essentials Update Notes – Version 2021.0

The PE^2 Essentials software version 2021.0 was released in December 2020.



The 2021 version includes the following modifications/updates to the 2020.1 release.

- General
  - Modified the layout of the start-up screen
  - All tools include the capability of saving a screen capture to a file
  - All tools have exception handling routines to capture most program crashes
  - The PE Essentials book has been updated for the 2021 release
  - The Basic THP-BHP Oil Well tool has been removed (use the Nodal Tool)
  - All known bugs have been corrected
  - The tool documents have been updated to the 2021 version
  - The Workflow Examples have been updated
  - New tools have been added to this update: Hydrate Analysis tool, PE Graph, INTERPRET-PDA and INTERPRET-PDA WI

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- Hydrate Analysis Tool **NEW**
    - A Hydrate Analysis tool has been added to this version of the tools
    - For quick analysis of hydrate temperature, numerous Specific Gravity based models and options are included
    - The more accurate Composition based model should be used as appropriate
    - The tool includes the capability to estimate inhibitor volumes required to prevent hydrates in wells/pipelines.

- PE Graph Tool **NEW**
    - PE Graph is a new plotting tool for use with PE Essentials CSV and RSM format files
    - The PE Graph includes the capability to modify plot properties
    - Plots can be saved to a png file or can be printed
    - PE Graph includes a tool to review the contents of a CSV/RSM file before the data is loaded into the tool for plotting
    - The PE Graph workspace can be saved and reloaded

- PVT Tool
    - Added CGR calculation routines
    - Calculated CGR can be matched to a known value (0 for dry gas)
    - The tool can now export dry or wet gas PVT tables for simulator use

- EOS PVT Tool
    - Added the option to generate and export a PVTO black oil PVT table

- Oil Material Balance Tool and Gas Material Balance Tool
    - Corrected an issue with importing history data

- Decline Curve Analysis Tool
    - A new technique to estimate initial decline and b-factor for a hyperbolic decline using a '1/D vs Time' plot has been added to the DCA tool
    - Automatic linear regression for DCA has been re-implemented
    - The NormDCA tool is now accessed from the main menu to further show that it is not part of the main DCA/eDCA routines
    - The NormDCA forecast can now be saved to the PE Tools database
    - The DCA document has been significantly updated

- Field Development Planning Tool
    - Added the capability for viewing and exporting the statistical parameters generated for the wells

- Comprehensive Asset Evaluation Tool
    - Improved the input of parameters by incorporating 'tabbing' or using arrow keys to move around the input tables

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- Basic Reservoir Simulator Tool
    - Corrected issues with the export of industry-standard simulator data files
    - The generated industry-standard simulator data file includes the output RSM format that results in a file that can be input to the PE Graph tool

- Nodal Analysis Tool
    - Improved the input of parameters by incorporating 'tabbing' or using arrow keys to move around the input tables
    - Added capability to calculate and plot the wellbore gradient to assist with pressure matching
    - Added the capability to import well THP/CHP pressure data from the PE Tools dBase, convert the pressures to BHP, and update the database with the calculated BHP pressures

- Production Database Tool
    - Updated the database – older versions will be automatically upgraded to the 2021 format (NOTE: the updated database cannot be read by older versions of the Production Database tool)
    - Added the capability to import injection well data
    - All exported CSV files are now saved to a common 'PE Essentials 2021\CSV Output Files' directory to simplify input to the PE Graph tool

- Production Data Analysis Tool
    - PDA tool can now import injection well data from the Production Database
    - Added the INTERPRET-PDA tool to add straight line trends to the plotted production data
    - Added the INTERPRET-PDA WI tool which can perform Hall plot analysis of water injection well data
    - All exported CSV files are now saved to a common 'PE Essentials 2021\CSV Output Files' directory to simplify input to the PE Graph tool
    - To calculate a simple BHP, can import a well model from either a 'Basic THP-BHP' or a Nodal tool gas/oil well model
    - Can manually import and/or modify wellbore parameters for the THP/CHP to BHP conversion
    - Corrected issues with the export of industry-standard simulator data files
    - The generated industry-standard simulator data file includes the output RSM format that results in a file that can be input to the PE Graph tool
    - Multi-well simulator schedule include files can be generated

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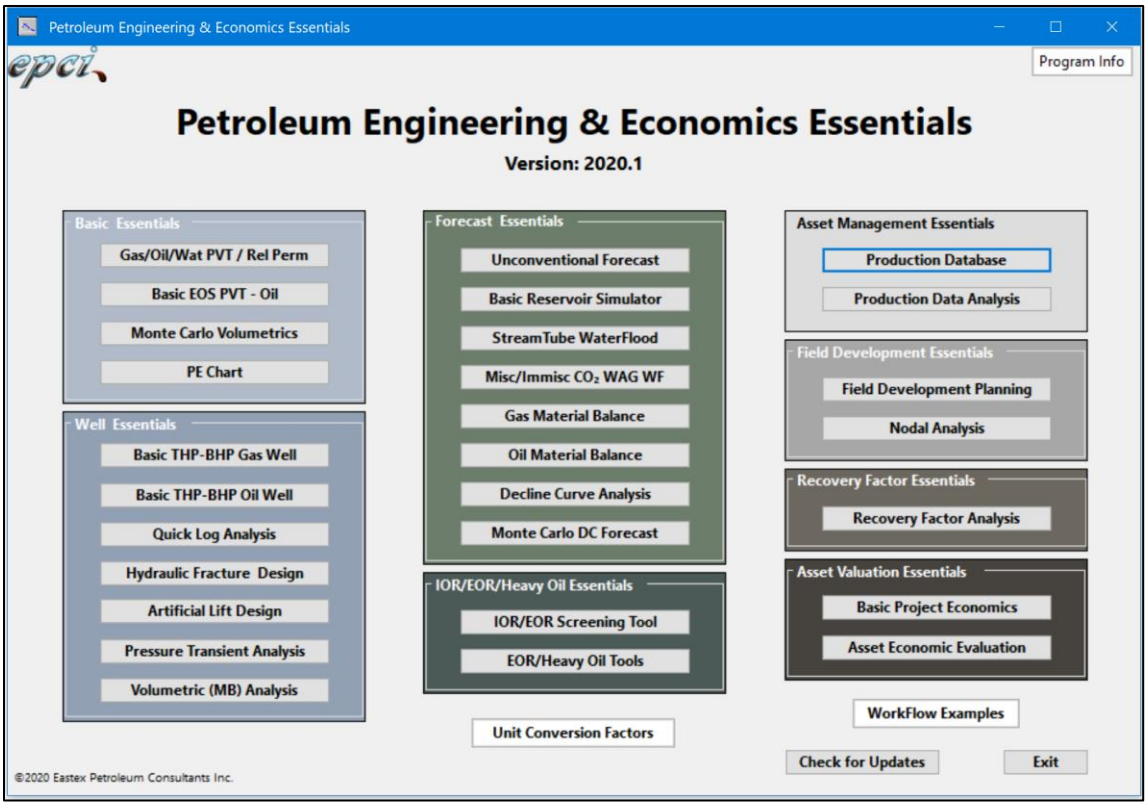
PE^2 Essentials Update Notes – Version 2020.1

The PE^2 Essentials software version 2020.1 was released in January 2020. This update continues the full integration of the tools and includes the addition of a new tool.



The 2020.1 version includes the following modifications/updates to the 2019.2 release.

- General
  - Modified the layout of the start-up screen
  - General bug fixes and GUI upgrades
  - PE^2 Essentials network version upgraded to version 2020.1
  - The tools are free for everyone to use, without the requirement to request a license, until the end of March 2020

- Nodal Analysis Tool **NEW**
  - The Nodal Analysis tool has been added to this version of the tools
  - The tool is a system analysis tool that includes modeling of the reservoir, wellbore, and surface pipeline and can include gas lift, ESP and compressors

- Six wellbore pressure drop correlations, which includes a mechanistic model, and one pipeline correlation are included in the tool
- The tool can pre-process tubing curves and generate simulator VFP tables
- VFP tables include model description
- The tool can read THP/CHP pressure data from wells in the PE Tools database and convert them to BHP
- The tool includes information tables for tubing, casing and pipelines
- The example PE Tools database includes numerous examples for use in the Nodal Analysis tool

- Decline Curve Analysis Tool
  - This update includes a major upgrade of the DCA tool
  - eDCA is now considered the primary analysis technique
  - eDCA model forecasts can now be exported for comparison purposes
  - All eDCA models generate equivalent Arps parameters which are used as the basis for in-depth oil/gas/water forecasting
  - Additional flexibility has been added to the forecasting parameters
  - A new technique called Normalized DCA has been added to the tool
  - The NormDCA technique allows a DCA analysis and production forecast to be performed on choked wells that have THP, CHP or BHP data available
  - Equivalent Arps parameters can be generated for the NormDCA forecast

- THP-BHP Gas and Oil Tools
  - Removed the option to export VFP tables since this is now included in the Nodal Analysis tool

- Production Data Analysis Tool
  - Fixed a minor issue with the tabular data format that occurred after the data had been edited
  - Minor changes to the GUI
  - Added support for the new NormDCA technique

- PVT Tool
  - Fixed an issue with the exporting of the simulator PVT and rel perm tables
  - Added model description to the simulator PVT tables

- Comprehensive Asset Evaluation Tool
  - CAPE has been rebranded as the “Comprehensive Asset Economic Performance Evaluation” tool to describe its purpose more fully

- Production Database Tool
  - Added counter to indicate the row being read from the Excel file

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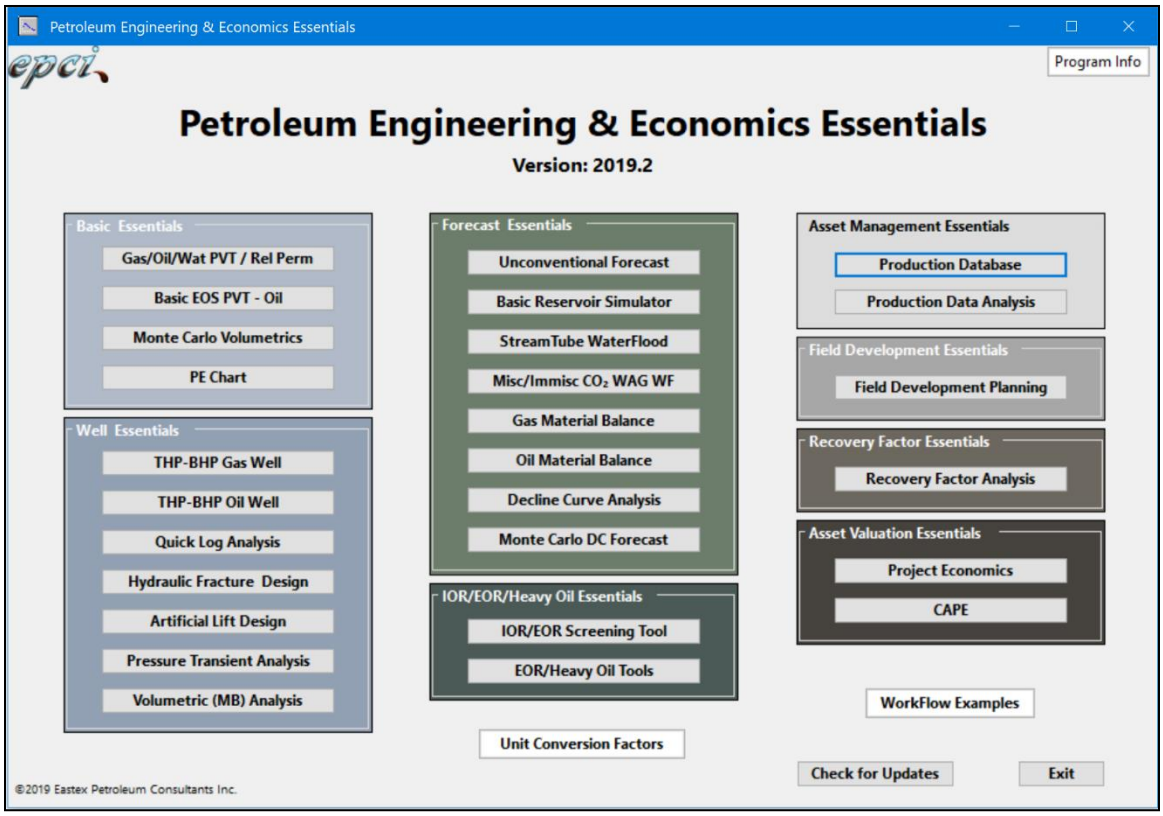
PE^2 Essentials Update Notes – Version 2019.2

The PE^2 Essentials software version 2019.2 was released in June 2019. The 2019.2 version represents the first step in the full integration of all the tools.



The 2019.2 version includes the following updates to the 2019.1 release.

- General
  - Modified the layout of the start-up screen
  - Added the capability of checking the website for updates to the tools
  - General bug fixes and GUI upgrades to the 2019.2 version
  - PE^2 Essentials now includes a network version of the tools for corporate license management
  - All tools have been updated to read/write to the PE Tools Database
  - All tools include a "mini-book" that present background theories and use of the tool
  - The main book is still available on the EPCI website but will not be updated to new versions of the tools

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- Database Tool
    - The Database tool manages all the raw production data in the PE Production Database
    - Includes the capability to export the data to a csv file for importing into a spreadsheet or plotting using PE Chart
    - A backup can be generated of the database

- PDA Tool
    - The PDA tool builds and manages the PE Tools Database which is the repository for all models, input/output and forecasts for the tools
    - The PE Tools database integrates all the tools by storing all the input model files
    - The PDA tool imports production data from the PE Essentials Database
    - Forecasts stored in the database can be converted to an equivalent well for use in other tools, for example, the DCA tool
    - All PE^2 Essentials tools can read and write to the PE Tools database
    - A backup can be generated of the database

- PVT Tool
    - This update includes a major upgrade of the PVT tool
    - Added the option to generate pseudo oil components as well as pseudo gas components
    - Added numerous oil property correlations that can be chosen to generate the PVT properties
    - Added the capability to tune the oil properties generated by the correlations to lab measured properties
    - Generating PVT tables for the different fluids is much more informative

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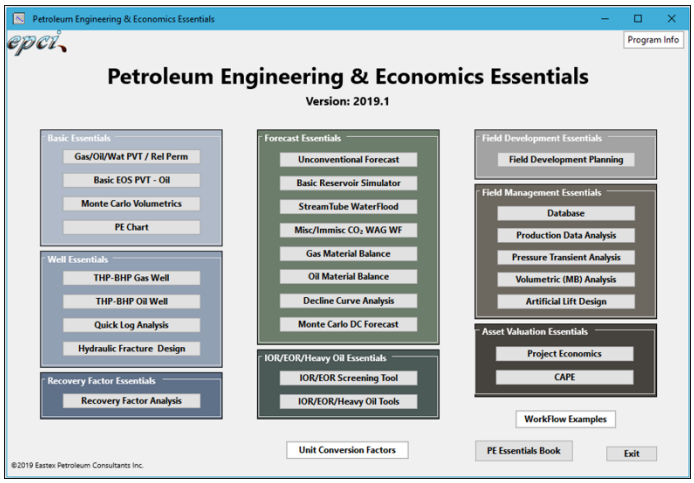
PE^2 Essentials Update Notes – Version 2019.1

The PE^2 Essentials software version 2019.1 was released on January 2, 2019. This update is a major update of the tools.



The 2019.1 version includes the following updates to the 2018.4 release.

- General
  - Updated the start-up screen to the 2019.1 version: Petroleum Engineering & Economics Essentials
  - General bug fixes
  - Update of the Book to the 2019.1 version

- Recovery Factor Tool
  - An Artificial Neural Network (ANN) oil recovery factor model has been added to the tool (ref. World Oil, March 2009)
  - The ANN model has been trained using data from onshore and offshore oil fields
  - Once trained the ANN model was tested against a different data set from onshore and offshore oil fields
  - The ANN RF includes separate models for sandstone and carbonate reservoirs
  - The PE^2 Essentials book describes the ANN model and the steps used to train the model

- Database Tool
  - The ability to sum production data from multiple wells has been added to the Database tool
  - The summed data can be saved in the database for use in the other tools

- Monte Carlo Volumetric Tool
    - The gas model and the oil model are incorporated into the main tool and can be accessed without re-starting the tool
    - Corrected a minor issue with the random distribution calculation for the recovery factor in the oil model
    - Added the option to use a triangular distribution for the input values

- Monte Carlo Decline Forecast Tool
    - The gas model and the oil model are incorporated into the main tool and can be accessed without re-starting the tool
    - The tool can now access the DCA database so a previously analyzed well can be brought into the tool for probabilistic decline curve forecasting
    - Importing a well from the DCA database will populate the Monte Carlo parameters with the Arps parameters and will import the historical data for that well
    - The water cut, oil cut, GOR and WOR for an oil well are forecasted based on the DCA database parameters and presented in a table and is included in the exported forecast files
    - The WOR and CGR for a gas well are forecasted based on the DCA database parameters and presented in a table and and is included in the exported forecast files
    - After importing a well from the DCA database, the Monte Carlo model for that well can be saved to a separate file for future use

- Oil Material Balance Tool
    - The option of using either the Hall (1953) or the Newman (1973) correlation for rock compressibility was added to the tool

- Gas Material Balance Tool
    - The option of using either the Hall (1953) or the Newman (1973) correlation for rock compressibility was added to the tool
    - An aquifer has been included to facilitate gas/water history matching of the reservoir performance
    - Cannot use the multi-tank model with an aquifer and the aquifer model cannot be used to forecast well production (future update)

- CAPE
    - Modified the results Export screen for ease of use
    - Corrected a printing error on the reporting of the year
    - Added a generic Service Contract to the Fiscal Regime options
    - Added the option to apply start of year, mid-year or year-end discounting
    - Added “Purchase Options” to the tool. This will allow the economics of an acquisition for a given equity position to be evaluated.

- PVT Tool
  - Added gas-water relative permeability curve generation
  - Added option to export PVT and relative permeability data to a simulator input format (Eclipse/OPM).

- THP-BHP Gas and Oil Tools
  - Added a document file presenting a general table of tubing and casing data that can be accessed on the main screen
  - Added option to export VFP tables to a simulator input format (Eclipse/OPM).

- Pressure Transient Analysis Tool
  - No longer have to choose oil or gas to start the tool, loading a gas test or oil test will automatically setup the model for the fluid

- DCA/eDCA Tool
  - Corrected an issue when the Excel data import went past the data
  - Added a diagnostic plot for the LeBlanc-Okouma Power Law (LOPL), eDCA model that can be used to identify the onset of boundary dominated flow (BDF) after performing an LOPL model fit
  - Fixed a plotting issue with cum-based oil eDCA

- PDA Tool
  - Corrected plotting of ratios for oil/gas on the data validation page
  - Added option to generate curves for P90, P50 and P10 production wells based on selected wells
  - Added a warning whenever a previously averaged well or a P90/P50/P10 well is included in subsequent well calculations
  - Added option to plot well count

- Basic Reservoir Simulator Tool
  - BOAST III data file export option has been removed
  - Added the capability to export a data deck in an industry standard format. This data deck can be read by Eclipse-compatible simulators, for example, the OPM Flow simulator (www.opm-project.org).

- Log Analysis Tool
  - Added a pressure gradient (RFT/MDT) analysis tool

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PE Essentials Update Notes – Version 2018.4

The PE Essentials software version 2018.4 is an incremental update for 2018 and was released in August, 2018. This update is a minor update pending the 2019 release. The 2018.4 version includes the following updates to the 2018.3 release.

- General
    - Updated the start-up screen to the 2018.4 version
    - A new tool has been added –Database
    - The PDA tool reads/imports data from the Database for editing and export to the other tools
    - General bug removal
    - Update of the Book to the 2018.4 version
    - Modification of the "PE Essentials Extra" DCA files to PE Database files

- Decline Curve Analysis Tool
    - The eDCA can now transfer the Arps parameters to the main tool without exiting the eDCA tool
    - The tool has been enhanced to allow importing of up to 1000 wells and 20,000 production data points per well/asset

- Production Data Analysis Tool
    - The PDA tool can import data from the Database and export the production data to other PE Essentials tools

- Database Tool
    - The Database tool is used to enter the production data into a common database
    - The database can be read by the PDA tool for editing and export of the production data to the other PE Essentials tools
    - The tool includes a flexible multi-well plotting tool

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PE Essentials Update Notes – Version 2018.3

The PE Essentials software version 2018.3 is the final planned major update for 2018 and was released in May, 2018. The 2018.3 version includes the following updates to the 2018.2 release.

- General
  - Updated the start-up screen to the 2018.3 version
  - A new tool has been added – Companies & Assets Performance Evaluation (CAPE)
  - General update of all the tool GUI's
  - The Price List for an Individual or Student License can now be downloaded from the eastexpetroleum.com site

- Decline Curve Analysis Tool
  - The eDCA tool is now part of the base DCA tool and includes the LOPL model, published in the March issue of World Oil
  - Added the capability to copy the eDCA Arps parameters to the main database without exiting the eDCA screen
  - The tool has been enhanced to allow importing of up to 10,000 production data points per well/asset

- Economics Tool
  - Corrected a bug in the oil/gas price import routine when importing from Excel
  - Corrected a bug in the ongoing project costs calculation
  - Added the capability to import multi-well history/production data from a DCA database file
  - The Corporate Economics tool is now part of the base Economics tool
  - Removed the simple PSC model from the Corporate economics tool (a full-featured PSC model is available in CAPE)

- Production Data Analysis Tool
  - The PDA tool can export files for import into the other PE Essentials tools including export of a multi-well DCA database file

- CAPE Tool
  - Companies & Assets Performance Evaluation (CAPE) is a full-featured economics package
  - All aspects of the economics model can be varied on a yearly basis
  - Full access to the economic calculations are available in an Excel file which can be generated by CAPE – the Excel file includes comparative plots
  - Two fiscal models are available – Taxes & Royalties; and PSC

- Currency can be specified for the economics analysis but oil/gas prices are imported in US$
- CAPE can use the built-in currencies or a user currency can be entered
- CAPE can import production data from any PE Essentials tools or it can be imported from Excel
- CAPE can import multi-wells/assets from a DCA database file and includes the option of delaying the start-up of the DCA asset
- CAPE includes the option to run sensitivities on specified parameters
- CAPE can save single asset models or a multi-asset database
- The multi-asset database can be password locked for read-only access to ensure a secure audit trail

- Documentation
  - The documentation has been updated to the current version of the tools
  - Additional sections and examples were added for the 2018.3 version

- Free Trial Period
  - A 2-week free trial period is being implemented for the 2018.3 version
  - A Demo Authorization Code will be generated by sending the serial number and a request to PEEssentials@eastexpetroleum.com

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PE Essentials Update Notes – Version 2018.2

The PE Essentials software version 2018.2 is a major update to the software and was released in March, 2018. The 2018.2 version includes the following updates to the 2018.1 release.

- General
  - Updated the start-up screen to the 2018.2 version
  - A new Essentials section has been added – Asset Valuation Essentials
  - All tools have access to the relevant section of the book through the "Info" button on the menu of each tool
  - General clean-up of all the GUI's

- THP-BHP Oil Well Tool
  - The capability to load a table of THP/CHP values for conversion to BHP was added to the tool

- Unconventional Forecast Tool
  - Fixed a bug in the numerical model for well spacings less than 700 feet

- Basic Reservoir Simulator Tool
  - Added the option to export the well schedule to a csv file to allow modifications to the schedule and re-importing of the modified schedule

- Decline Curve Analysis Tool
  - Added an optional tool to the main DCA tool called eDCA (enhanced DCA) which includes DCA models

- eDCA Tool
  - This is a new tool that includes six different decline curve models: Arps; Stretched Exponential; Duong; Logistic Growth; Power Law Exponential; and LeBlanc-Okouma Power Law (LOPL)
  - LOPL is a new decline curve model published in the March issue of World Oil
  - Production data can be fitted to any decline model and equivalent Arps parameters can be generated for use in the main DCA tool

- Production Data Analysis Tool
  - This is a new tool that performs general analysis of the production data, including rate-time analysis in the form of flowing material balance and includes an analytical simulator
  - The production data can be edited to remove spikes in the data set
  - There is a built-in routine to convert THP/CHP to BHP

- If multi-wells are imported into the database, it is possible to generate an averaged well profile from selected wells
- There is an extensive plot capability to assist with flow regime identification
- For a gas well, flowing material balance analysis includes the option to simultaneously match flowing P/Z and flowing PI
- For an oil well, flowing material balance analysis includes the option to perform the analysis using oil pseudo pressure to more rigorously model changing fluid parameters
- Flowing material balance analysis, as well as the analytical simulator, requires import of an appropriate generic material balance model which is generated with the Oil Material Balance Tool
- The analytical simulator uses the method of images to model the production pressures and includes the following reservoir configurations: infinite homogeneous; faulted; parallel faults (linear channel); perpendicular faults; constant pressure boundary; parallel no-flow and constant pressure boundaries; linear net pay variation; finite radial; and radial composite.
- The PDA tool includes the option to build well models for use in the Unconventional Forecast tool and the Basic Reservoir Simulator tool

- Project Economics
  - The Project Economics tool has been moved to the new Asset Valuation Essentials section

- Documentation
  - The documentation has been updated to the current version of the tools.
  - Additional sections and examples were added for the 2018.2 version.

- Free Trial Period
  - The 1-month free trial period is being maintained for the 2018.2 Version. A Demo Authorization Code will be generated by sending the serial number and a request to PEEssentials@eastexpetroleum.com.

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PE Essentials Update Notes – Version 2018.1

The PE Essentials software version 2018.1 is a major update to the software and was released in December, 2017. The 2018.1 version includes the following updates to the 2017.4 release.

- General
    - Update of the GUI for all tools.
    - Allowed commas in information boxes.
    - Included the information box data in the save/export file names.
    - Incorporated date input option for Excel file imports.
    - Where appropriate added the capability to save imported Excel data to a csv file for future importing.
    - A new Essentials section has been added – Field Management Essentials

- Quick Log Analysis Tool
    - Corrected a bug that occurred when data for 6 zones was entered.

- Hydraulic Fracture Design Tool
    - The option to enter flowing pressure was added to the tool. This allows the user to generate a stabilized potential rate for the fractured well at any flowing pressure.

- Oil Material Balance Tool
    - An oil material balance analysis tool has been added to the Forecast Essentials section.
    - This tool includes three aquifer models: the Schilthuis Steady State Aquifer Model; the Fetkovich Finite Aquifer Model; and the Van Everdingen and Hurst Unsteady State Infinite Aquifer Model.
    - The tool also includes a Depletion Drive Option for volumetric undersaturated oil reservoirs

- Decline Curve Analysis Tool
    - Corrected a bug that caused issues when a rate of 0 was entered for the final history point.
    - Allowed a forecast to be generated for shut-in wells.

- Project Economics Tool
    - A bug was corrected that allowed discounting to be applied from year 0. The default discount year is now year 1 (the first year of production).
    - A Corporate Economics module has been added to the tool. This module will generate corporate before- and after-tax cash flows for the project.

- Three fiscal regimes are included in the Corporate Economics module: basic cost recovery; taxes and royalties; and production sharing contracts.
- Basic cost recovery includes a cost recovery uplift that is used to model penalty wells where the operator can recover additional capital when wells are dilled on penalty.
- An option to include over-riding royalty can be used to model a non-participating partner.
- Working interest before and after capital payout can be varied.
- All fiscal regimes include capital depreciation for tax purposes.

- Field Development Planning Tool
  - Added the capability to import a "User.csv" file.
  - The tool can now import the forecast files from the following tools: Waterflood; CO_2 Miscible/Immiscible Waterflood; Unconventional; Basic Simulator; Gas Material Balance; and Monte Carlo DC.

- Pressure Transient Analysis Tool
  - The Pressure Transient Analysis Tool includes a Horner-based build-up analysis module and an analytical test simulator.
  - The build-up analysis module includes a Horner analysis plot as well as a log-log pressure/derivative diagnostic plot.
  - All gas analysis routines are performed using pseudo pressure.
  - The analytical test simulator can use the build-up analysis results or user supplied input data.
  - The test simulator uses the method of images to model the test and can model the following reservoir configurations: infinite homogeneous; faulted; parallel faults (linear channel); perpendicular faults; constant pressure boundary; parallel no-flow and constant pressure boundaries; linear net pay variation; finite radial; and radial composite.

- Production Surveillance Tool
  - The Production Surveillance Tool can be used to monitor production trends.
  - Numerous production parameters, including surface pressure can be plotted versus time or cumulative production. There is also an option to plot the production data versus various superposition time functions.
  - Three user defined variables can also be imported.
  - An option to plot $\Delta P/q$ using either THP or CHP is included in the plotting options.
  - The tool can export the data in a format for importing into the following tools: Gas Material Balance (history); Oil Material Balance (history); Project Economics (user file); Field Development Planning (type curve); THP-BHP Gas Well; THP-BHP Oil Well; Unconventional Forecast (history matching); Basic Reservoir Simulator (history - future option); Decline

Curve Analysis (well import); Monte Carlo DC Forecast (DCA History file).

- Volumetric (Material Balance) Analysis Tool
  - The Volumetric (MB) Analysis tool can be used as a surveillance tool to monitor trends in cumulative production and reservoir pressure over time.
  - The tool can also be used for material balance analysis to determine initial gas or oil in place. The results can be used in the Oil Material Balance tool to determine ultimate recovery.
  - For gas reservoirs, the conventional P/Z plot can be used and for oil reservoirs a number of plots are generated based on whether the reservoir is a depletion drive, gas drive or water drive reservoir. A plot of the drive indices can be used to assist with the material balance analysis.
  - Reservoir performance generated by the Oil Material Balance tool can be imported into the tool for matching the history data and confirming the MB analysis.

- Artificial Lift Design Tool
  - The Artificial Lift Design tool can be used to design the following artificial lift systems: sucker rod pumps; plunger lift; jet pump; and electrical submersible pumps.
  - A number of historical pump catalogues have been included for reference purposes.

- Documentation
  - The documentation has been updated to the current version of the tools.
  - Additional sections and examples were added for 2018.

- Free Trial Period
  - The 1-month free trial period is being maintained for the 2018 Version of PE Essentials. A Demo Authorization Code will be generated by sending the serial number and a request to PEEssentials@eastexpetroleum.com.

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PE Essentials Update Notes – Version 2017.4

The PE Essentials software version 2017.4 was released on July 16, 2017 and includes the following updates to the 2017.3 release.

- General
  - Minor bug corrections.

- Field Development Planning Tool
  - An "anomaly" in the routines to display metric terms was corrected.
  - Corrected an issue with IPR calculations at minimum FBHP.
  - Corrected an issue with saving type curve GOR data when saving the model.

- Documentation
  - The documentation has been updated to the current version of the tools.
  - General edit corrections.

- Free Trial Period
  - A new free trial period system has been implemented. Rather than an automatic 2 week free trial, a Demo Authorization Code will be generated for a 1-month free trial period by sending the serial number and a request to PEEssentials@eastexpetroleum.com.
  - Every time an update is released, a new 1-month demo can be requested.

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PE Essentials Update Notes – Version 2017.3

The PE Essentials software version 2017.3 was released on June 12, 2017 and includes the following updates to the 2017.2 release.

- Gas/Oil/Water PVT / Rel Perm
  - The hydrocarbon parameters used in this tool (Table 2.1-1 in the book) were updated to the GPA 2017 parameters – GPA Midstream Standard 2145-16, Table of Physical Properties for Hydrocarbons and Other Compounds of Interest to the Natural Gas and Natural Gas Liquids Industries, 2017.
  - Corrected an issue with capillary pressure calculations.

- Basic EOS PVT - Oil
  - The hydrocarbon parameters used in this tool (Table 2.2-1 in the book) were updated to the GPA 2017 parameters – GPA Midstream Standard 2145-16, Table of Physical Properties for Hydrocarbons and Other Compounds of Interest to the Natural Gas and Natural Gas Liquids Industries, 2017.

- Basic Reservoir Simulator
  - A problem with how the fault parameters were calculated was corrected.
  - The "Quick Plot" routines were significantly improved to allow QC'ing of the input grid and visualization of the dynamic grid results.
  - Added "Run Info" which is used to uniquely identify model run files.

- General
  - Minor bug corrections.

- Documentation
  - The documentation has been updated to the current version of the tools.
  - An example has been added to the Appendix that uses the Basic Reservoir Simulator to compare a horizontal gas well to the same horizontal gas well with the inclusion of 7 hydraulic fractures.

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PE Essentials Update Notes – Version 2017.2

The PE Essentials software version 2017.2 was released on May 15, 2017 and includes the following updates to the 2017.1 release.

- Field Development Planning Tool
  - The Field Development Planning tool includes well/pad planning, BHP/THP prediction, rig scheduling, facility constraints, facility uptime, and can incorporate statistical/probabilistic variations of the parameters used for the production profiles. A normalized well type curve is the basic building block for the forecasting routines in the PE Essentials Development Planning tool.
  - The type curve data can be imported from an Excel spreadsheet or from forecast files generated by other PE Essentials tools.
  - If there is more than one well or pad in the development scenario, random variations in each well's productivity can be implemented through the use of 'Statistical Parameters'.
  - If well flowing pressures are required, reservoir, wellbore and PVT parameters need to be entered. Most of the parameters required to calculate pressure can be imported from a PE Essentials THP-BHP file.
  - The results generated by the Field Development Planning tool can be directly imported into the PE Essentials Scoping Economics tool to fully evaluate the development scenario.

- THP-BHP Oil Well Tool
  - A single point THP-BHP conversion option has been added to enable calibration of the oil well pressure drop correlation.

- Scoping Economics Tool
  - Forecasts generated by the Field Development Planning tool can be imported into the Scoping Economics tool.

- General
  - Graphics routines included in some of the tools have been enhanced.
  - Minor bug corrections.

- Documentation
  - The documentation has been updated to the current version of the tools.
  - An example has been added to the document comparing pad drilling to sequential well drilling.

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PE Essentials Update Notes – Version 2017.1

The PE Essentials software version 2017.1 was released on March 2, 2017 and includes the following updates to the 2017 release.

- The 2017.1 release is the first commercial release of the tools. This release includes a 30 day free trial period.

- Gas/Oil/Water PVT and Rel Perm Tool
    - Gas Compositions are now generated based on a Gaussian distribution. Different components for the C2+ components will be generated every time the 'Generate Gas Components' button is clicked.

- THP-BHP Gas Well Tool
    - THP data for conversion to BHP can now be imported from an Excel spreadsheet.

- Unconventional Forecast Tool
    - Gas Compositions are now generated based on a Gaussian distribution. Different components for the C2+ components will be generated every time the 'Generate Gas Components' button is clicked.
    - The numerical model is run as a multithreaded process. This allows the user to stop the simulation at any time during the run.
    - Historical data for the History Match Tool can be imported from an excel spreadsheet.

- Basic Reservoir Simulator Tool
    - A simulation schedule can be entered to allow open/shut of completion zones and modification of well operating parameters.
    - The schedule can be imported from an Excel spreadsheet to allow historical operating parameters to be input into the simulator for history matching purposes.
    - LSORx and LSORz solution options are available to better handle horizontal wells and grid geometry.
    - A stabilized IMPES solution has been implemented to enable modeling of rapidly changing grid block conditions.
    - The simulator is run as a multithreaded process. This allows the user to stop the simulation at any time during the run.
    - The frequency of updating the information table during a run can be specified.

- Low Perm Material Balance Tool

- Historical data can be imported from an excel spreadsheet.

- Decline Curve Analysis Tool
  - Production data can be imported from an excel spreadsheet.

- Scoping Economics Tool
  - Oil/gas price history/forecasts can be imported from an Excel spreadsheet.
  - An excel file containing historical oil and gas prices from January 1974 is included with the tools. The Excel file also includes a price forecast (2017+) as well.
  - The year to start discounting can be set to allow full cycle (look back) economic analysis.
  - User production forecasts can be imported from an Excel spreadsheet.
  - Forecasts generated by the Low Perm Material Balance Tool can be imported into the Economics tool.

- Documentation
  - The documentation has been updated to the current version of the tools.
  - Additional examples have been added to the document including an economic evaluation of the uplift resulting from a horizontal hydraulically fractured well.