Type Curve Analysis for Landmen

Introduction

Course Objectives

- Provide an understanding of what type curves are used for and why they are used
- Understand the key parameters in type curves and how they impact NPV
- Understand how type curves are created
- How have type curves evolved with industry completion optimization
- Using type curves – key issues
Course Modules

- Introduction
- What are type curves
- Why use type curves
- Key parameters in type curves
- Multi-segment type curve shape
- Work flow to create type curves
- Binning wells
- Type curve parameter impact on NPV
- Adjusting for well length
- Evolution of type curves as completion optimized
- Using type curves

Data Access

- All required production data is available in the public domain
- Type curves can be generated from public data – if completion specifics are required this is usually not available publically
- Vintaging the sample well data sets may be required to address completion optimization
Public Domain Data

- Typically all land, drilling, completion, production and facilities technical data is available from provincial and national energy regulators
- Data accessed through commercial vendors (IHS, AccuMap, Mosaic, ValNavigator), industry associations (CAPP) and web based services
- Well location, formation tops, drilling depths and completion history
- Log and core data
- Reservoir data
- Well tests
- Well Production

Reliability of Type Curves

- Type curves are estimates based on limited production history and predictions of future performance
- There is always uncertainty in type curves
- A type curve for a given play is only as reliable as the quality of the data and the skill of the evaluator
  
  - Garbage In = Garbage Out!
What are type curves?

What’s a Type Curve?

• An idealized well, usually an average result

• Can be accurate

• Widely used for unconventional oil and gas plays

• Not a new technique: used for decades!

• Powerful and useful: all should know how to use!
What’s Old is New: Type Curves

- Type curve must have a foundation. Examples:
  - Performance of analogous pools and wells
    - Reserves life index
    - Decline profile
  - Volumetric calculations
  - Normalized well production
  - Computer simulations
  - Combination of the above

Basis for Type Curves

Normalizing Well Production

- Setting well performance to a common variable, usually start date
- Can normalize to other variables. Examples, a fraction or percentage of:
  - Maximum rate
  - Maximum recovery
  - Gas or oil in place
- On graph to right, normalized production shows common trends

Some Things to Consider

- When preparing type curves:
  - Geology
  - Permeability
  - Well type: horizontal
  - Drilling and completion techniques
  - Number and size of fracs
  - Frac design, eg “slickwater”
- And this is only the beginning.
Life Gets Complicated

• When preparing type curves, typically have more, rather than fewer type curves as time passes.

• Why: mostly geology. Recognize layers, units.
• Completion optimization: ongoing
• Examples:
  • Montney gas in NW AB, NE BC:
    • 3 layers. 6 areas. 17 curves
    • Number and design of fracs optimized
  • Pembina Cardium: 3 areas, 63 curves and counting

Type Curve Analysis for Landmen

Why use type curves?
Why use type curves?

- On new plays often the most reliable technique to estimate expected well performance if sufficient analagous wells exist
- Can be accurate if based on sizeable well sample
- Based on actual well performance vs. volumetrics
- Best representation of well performance and EUR expectations for multi-stage frac unconventional plays

Evolution of Type Well Curves

Increase horizontal well drilling with no production history or analogies. NEEDED A WAY TO FORECAST WELLS

- Original forecast generated from radial flow model or simulator, vertical well results other reservoir analogies
- Over time, had some analogies to use. Still need more time to confirm the “tail”
- Type Well Curves summarize average well performance decline profile to permit effective forecasting and reserve estimation for evaluations
- Better than volumetric’s as it is difficult to define net pay, varying porosity/permeability, Sw and Area
- Better than Energy Balance due to volumetric issues as well as seldom get Rsi, Pi, PVT, defined sweep efficiency, rel. perm changing GOR, drive mechanism
Application of Type Curves

• Can use type curves for:
  
• Waterfloods
  
• Thermal projects: SAGD, CSS
  
• Individual Wells
  
• Multi stage frac unconventional plays

Heavy Oil Waterflood Type Curve

From type curve profile can estimate:
  
Primary, secondary, incremental recovery
Time to fill-up
Duration of waterflood plateau
Type Curve for SAGD Well Pair

Can estimate production profile, recovery

Fraction of Maximum Oil Rate

Fraction of Original Oil in Place Recovered

Steam Oil Ratio, Bbl/Bbl

Oil Rate

Monthly SOR

Cumulative Steam Oil Ratio

Heavy Oil Well Type Curve Example

<table>
<thead>
<tr>
<th>Seal, Average Calendar Daily Oil vs Cumulative Oil</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of produced wells</td>
</tr>
<tr>
<td>Avg drainage area</td>
</tr>
<tr>
<td>Avg pay</td>
</tr>
<tr>
<td>Avg S_o</td>
</tr>
<tr>
<td>Avg S_i</td>
</tr>
<tr>
<td>Oil Viscosity [cp]</td>
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<tr>
<td>Avg Recov. RF</td>
</tr>
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</table>

Cumulative Oil (Mbdt)

Average Calendar Daily Oil (MMbdt)
Production Used for Type Curve

Example: Kaybob South, Alberta

Variety of type curves modelling performance of number of treatments

ERCB ST 98-2011
Tying Type Curve to Production

All the Montney horizontal wells in a township in northwest Alberta. The thick line is the average of all the wells’ production.

Time-Cum Display For Review

Cum Gas Production MMcf

Months on Production

- 2 bcf
- 3 bcf
- 4 bcf
- 6 bcf
- 8 bcf
Estimate Recovery from Type Curve

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<tr>
<th>Month Since First Prod</th>
<th>Cum Gas Prod, MMcf</th>
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<td>6</td>
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<td>36</td>
<td>1020</td>
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</table>

What’s your answer?

Undrilled Locations

- Type curves used extensively to estimate future production forecasts from individual wells in resource plays
- Used to generate development plan to attain specified facility capacity levels
- Used to determine ultimate recovery potential (reserves + resources) for a specific acreage position in a play
- Type well represents the expected average well – represents the best estimate or 2P or 2C volume and value
Type Curve Analysis for Landmen

**Key parameters in type curves**

Three Key Parameters

- Initial production rate
- EUR – ultimate recoverable volume
- Curve shape – big impact on NPV10
Initial Production rate

- Strongly influenced by completion technique
- Improvements in the initial rate have been seen in most plays as completion technique is optimized
- Geology always a big factor

EUR

- Ultimate recoverable reserves dependent on
  - Geology
  - Completion technique
  - Well length
- Expect significant variability within a given play
- Typically significant uncertainty in EUR due to limited production history
Curve shape

- Big impact on NPV10
- Often gets the least focus of the three parameters but has huge influence on value
- Typically three segments in most multi-frac stimulated wells – usually modeled as two segments for simplicity
- First segment – hypermonic linear flow reflects flow from the fracture network
- Second segment – exponential or hyperbolic reflects flow from the rock matrix
- Start of second segment is called time to boundary dominated flow (Tbd)

Curve shape - Multi-stage frac

- Initial decline rate
- Time to boundary dominated flow i.e. length of first segment - linear flow from fracs
- First segment n value (expect 2.0 for linear flow)
- Second segment n value
- Imposition of minimum decline rate for second segment
Curve shape – waterflood

- Reservoir fill up time period
- Peak rate
- Length of plateau period
- Decline trend post plateau – decline rate and n value

Curve shape – SAGD Thermal

- Time to reach plateau rate
- Peak rate expectation
- Plateau rate time period
- Post plateau decline rate
- SOR and CSOR expectations – will drive economics
Issues in Type Curve Creation

- recognizing well flow regimes
- Profiles in early time:
  - how steep,
  - How long
- Long term performance
- updating

Checking Type Curves

- Remember: type curves are an idealization or a model
- Must test model against well performance
- Will have models with a range of performance
- Next slide show verifications of type curves.
- Must continually update type curves as additional performance data is available
Verifying a Gas Type Curve

Important to check type curves and incorporate production, other information.

Type Curve Analysis for Landmen

Why a multi segment curve shape?
Schematic of fracture

Fracture schematic

Bi-wing/Simple  Dendritic/Off-Balance/Complex  Fracture Network
Flow regimes – vertical vs. hz multi stage frac

Radial Flow → Boundary Dominated Flow  Linear Flow → Radial Flow → BDF

Multi stage frac nomenclature

homogeneous completion
Evolution of Type Well Curves - Shape

ABCs of Reservoir and Well Dynamics: Controlling Factors

- Completion
- Near wellbore permeability
- Pressure support
- Drive mechanism
- Far field permeability

Decline rate is steep: ~90% in first year, generally caused by:
- Transient effects
- Pressure depletion
- Increasing gas saturation
Secondary recovery will become critical to maintain a higher plateau oil rate
- Lack of drive energy
Considerations

- Analysis of early time flow
- Look for the “2” but...
- Know that other factors can impact the profile
  - Not flowing at constant BH conditions
  - Relative permeability effects
- A valid decline curve can have $b < 2$
- Includes both reservoir and man-made effects

Second Segment Generation

There s.b. three segments to properly forecast wells but time consuming. Sproule uses two segments (some competitors use one). The second segment is developed utilizing the following information and experience:

- In house simulation and sensitivities
- Decline nature of more mature Hz producing from similar reservoirs
- Studying decline behavior of vertical wells
- Reviewing results of applying realistic declines & “n” to second segment
- Determining how “n” is changing during linear/transition flow
- Resource studies – volumetrics → reasonable recovery factors

This process is updated every year with new production to verify assumptions
Type Curve Workflow Objective

Define a methodology to analyze production history and create type curves for plays with both small/large numbers of wells

Data Preparation

- Define your area of interest based on common reservoir characteristics (Twp, Sec, Rge) and compile a list of oil (or gas) wells in that area.
  - You can find the wells using any software of your choice (e.g., PetroDesk, AccuMap, GeoScout, etc.)
  - Example of search criteria’s are:
    • Geographic field name (ex. Pembina)
    • Geologic formation (ex. Cardium)
    • Zone Deviation (ex. Horizontal)
    • Fluid type (ex. Oil (or Gas))
      - Within Oil wells, add a filter for GOR since wells with GORs >10,000 scf/bbl must be excluded from the oil type curves (based on AER). The High GOR wells will be converted to gas in the database to create gas type curves instead.
    • On Stream Date (to filter out any relevant technological changes)
Binning Wells

• Creating bins for wells based on geologic and well completion considerations

Binning Wells

• Includes but not limited to:
  • Geological layer
  • Well length, number of stages
  • Date of first production (vintage)
    – Completion technique – Plug & perf, open-hole packers, cemented multi-port
    – Fracture size and fluid
  • Well location and spacing
  • Operational Practices
  • Operator
Data Preparation

• Example - South Pembina area (see map below), Cardium zone

Data Preparation

• For the purpose of this exercise, we use the North Montney field (see map below)
Data Preparation

- Reservoir characteristics and well production performance can vary greatly within the Montney formation.
- A crucial step in Montney type curve development is determining which geological layer each well is drilled in.
- There are many ways to "slice" the Montney rock package into separate geological layers for type curve creation.
  - One way is to use the defining log characteristics (ex. gamma signature, porosity). This is Sproule's preferred method.
  - Some operators divide up the Montney according to their development plan, based on where they are targeting to land their horizontal wells (ex. into 50 m intervals regardless of log characteristics).

Data Preparation

- Import the list of wells and latest updated production history into your database
- Review the data for anomalous well results with obvious completion issues, high shut in periods, rate restrictions or other issues – remove wells that are not representative
- Remove wells with very limited production history
- Establish how far outside the acreage position of interest to include offset well results
- QC the data using rate vs. time plots
Linear Flow Analysis

- Select the wells with the most representative production behavior for log-log q vs. t (linear flow) analysis.
  - Older wells will provide a better picture of the productivity of the play (assuming same completion technology and operational practices).
  - High on-time will provide better results for N (b-value) calculation.
  - No operational issues (no kinks in production or prolonged shut-in periods, etc.)
  - The number of wells determined to be statistically significant is highly dependant on the type of play, the quality of available data and experience of the evaluator.

Montney Type Curves

- Log-log q vs t examples
Montney Type Curves

- Log-log q vs t examples

![Log Log Rate Time Plot](image)

- Slope: 0.5117
- N: 1.95
- Producing months: 30

Over 4 years of production and no distinguishable slope change is evident
Montney Type Curves

- Linear Flow Analysis Result

- Investigation into the initial flow trends of the wells in the field with the most production history as previously demonstrated in the log-log q vs t graphs will provide a range of N values for that field.
- Plotting these N-values on a probability distribution graph will provide a guideline for what N can be expected when declining each well and developing the type curve.
- Some N values will have to be disregarded if a well profile is erratic or scattered.
- The distribution of N values below from a representative sample set indicate that an N of 2.0 for the North Montney field is a reasonable approximation.

Transition Decline

- Figuring out the transition decline of HZ wells i.e. the point at which wells transition from linear flow to boundary dominated flow (BDF).
Transition Decline

- Transition from Linear Flow to BDF

  - Review the long term producers to identify transition to BDF.
  - To use the log-log q vs. t analysis to determine the time it takes for a well to hit BDF, a well must typically produce in the BDF flow regime for up to a year before it can be seen that a well has a hit a boundary.
  - Identify the “time to BDF” and use the corresponding “transition decline rate” to set transition from first segment to second segment of Arp’s curve.
  - Use of the transition decline rate is preferred in a database that will continue to be used and updated year after year.
  - In the absence of long term data in any specific field, the whole play is used as an analogy to determine the transition decline rate.
  - If limited data on the specific play then may need to assume time to BDF from history of similar (analogous) plays

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Transition Decline

- Montney Type Curves

  - To use the log-log q vs. t analysis to determine the time it takes for a well to hit BDF, a well must produce in this flow regime for up to a year before it can be determined that a well has a hit a boundary.
  - The oldest wells in the North Montney field are just barely getting to this point in their life.
  - There is indication from some of the longest producing wells in North Montney that 4 years is a reasonable assumption.
  - Some of the oldest wells in the entire unconventional Montney play are in the Dawson area, and have been on production for 6 years and not yet seen a boundary.
Creating Type Curves

• Creating the average Horizontal well type curve. This type well is representative of the *average* production profile of the entire set of wells.

• Using the n value from the linear flow analysis and the Tbd flow or transition decline rate as a guide complete decline analysis for each well in the data set so that a best estimate forecast is placed on every well.

• Adjust the decline parameters as required to get a best fit curve fit to the history for each well.

• Goal is to put a best estimate two segment decline production forecast on each well in the data set.
Creating Type Curves

- The “average” type well
  - Normalize the data to peak rate or to initial production date

- Match the average curve with a forecast.
  - This is the start of an iterative process so do not expect a perfect match immediately.
  - Use the parameters from the linear flow analysis and from other analysis completed on the play as a starting point.
  - It is a good idea (where possible) to vary only the $Q_i$ and $D_i$ to get a good fit rather than change multiple parameters.
Performance Binning

- Binning wells for the target field based on various productivity variables. The most appropriate binning variable is dependant on the type of play and whether or not issues such as well loading, on-time fluctuations etc. are common in the early life of the well(s).

Cardium Type Curves – The whole spectrum

- Creating a range of type curves for the defined field to capture all low, average and high productivity wells.
Cardium Type Curves

- **Range of Type Curves**

- Once all wells are in their bins, create a type well for each bin and repeat the iterative procedure used before (for the average type well) to determine the variances in each bin.
  - Start with the \( N_1 \) values determined before and vary the \( Q_i \) and \( D_{1i} \) between different bins.
  - The differences in the declines \( (D_{1i}) \) used for the best fit forecast in these bins will indicate the range of initial declines to be used from the lowest tiers to the highest ones.
  - Note that high productivity bins usually have steeper declines than low productivity bins.
Cardium Type Curves

- Range of Type Curves
- Bin 2:

Cardium Type Curves

- Range of Type Curves
- Bin 3 (average bin):
Cardium Type Curves

- Range of Type Curves
- Bin 4:

![Cardium Type Curves Bin 4](image)

Cardium Type Curves

- Range of Type Curves
- Bin 5 (highest bin):

![Cardium Type Curves Bin 5](image)
Cardium Type Curves

- Range of Type Curves
- The number of tiers (type curves) required for any particular area is based on your estimation of its lowest and highest EUR.
  - As per Sproule practice for reserves reporting for Cardium wells, as you drop tiers, there is a 20% reduction in EUR.
    - Tier 1 EUR (1P value) = 0.80 x Tier 2 EUR (2P value).

Type Curve Seminar

Considerations for binning wells
Considerations for binning wells

• Includes but not limited to:
  • Date of first production (vintage)
  • Geology – reservoir quality
  • Geological layer
  • Fracture size and fluid
  • Completion technique
  • Well location and spacing
  • Operational Practices
  • Operator

Added Considerations for oil wells

• Includes but not limited to:
  - GOR
  • Regional performance variations
  - Regional geology variations
  - Well length
  • Fracture size and fluid
  - Completion technique
  - Well location and spacing
  • Operational Practices
  • Operator
Additional issues for gas wells

- Includes but not limited to:
  - Liquid yield
  - Regional variation in geology
  - Regional variation in performance
  - Geological layer
  - Well length
  - Fracture size and fluid
  - Completion technique
  - Well location and spacing
  - Operational Practices
  - Operator

Regional performance variation binning

- Identify clear variation in well performance
  - EUR
  - Initial rate
  - Curve shape
- Can identify need to split into areas from statistical plot of EUR and qi – should be log normal distribution
- Separate into specific regional areas that have different performance results
- Bin and set type curves by regional area – results in specific type curves by regional area
Performance binning

- Identify clear variation in well performance
  - EUR
  - Initial rate
  - Curve shape
- Can identify need to split into areas from statistical plot of EUR and qi – should be log normal distribution
- Separate into specific regional areas that have different performance results
- Bin and set type curves by regional area – results in specific type curves by regional area

Type Curve Analysis for Landmen

*Impact of parameters on NPV*
Key Factors Impacting Economics

- Type curve parameters – Qi, EUR, curve shape
- Liquid yield for gas plays
- GOR and NGL for oil plays
- Product prices
- Capex for DCCTI
- Royalty incentives – AB = HONWRR for oil and NWRR + Deep gas for gas; BC = Tier 1 and Tier 2 incentives for gas
- Opex
- Surface loss

Montney Type Curve Sensitivity

- Economic Indicators

<table>
<thead>
<tr>
<th>Economic Results</th>
<th>Type Well</th>
<th>Economic Results</th>
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<tbody>
<tr>
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<td>NPV10 ($M)</td>
<td>PVR 10</td>
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<td>Base Case</td>
<td>1,705.2</td>
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<td>Case 1 - EUR</td>
<td>1,868.5</td>
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<td></td>
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<td>Case 2 (Qi)</td>
<td>6,000</td>
<td>99.95</td>
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<td></td>
<td>2.00</td>
<td>5.00</td>
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<tr>
<td>Case 3 (Curve Shape-single segment)</td>
<td>5,500</td>
<td>99.83</td>
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</table>
Montney Type Curve Sensitivity

- Tornado Chart

Case 1: The effect of EUR on NPV10 was explored by changing the N on the second segment of the decline curve. The low case is represented by an N2=0, the best case is N2=0.3 and the high case is N2=0.5.

Case 2: The effect of Qi on NPV10 was explored by using Qi for the low case is 5,000 Mcfd, Qi for the best case is 5,500 Mcfd and the Qi for the high case is 6,000 Mcfd

Case 3: The effect of curve shape on NPV10 was explored by using single segment decline curves for the low and high cases, with N=2 and N=0.5, respectively. The best case is represented by a typical two-segment trend, where the N transitions from 2 to 0.5 after five years.

Montney Type Curve Sensitivity Case Study

- Overview

The following case study will highlight the differences in NPV10 that can result when different methods for creating type curves is used, and how too much reliance on software can skew results. Two cases will be presented:

- Lower Montney Auto
  This case represents the resulting type curve if the software scaling function is used for all individual well declines without any additional user input

- Lower Montney Decline
  This case represents the resulting type curve if all individual well declines are created by the user, and only using the software to calculate the average type well

All economic inputs required to calculate NPV10 are constant for both cases, and are presented on the next slide.
### Montney Type Curve Sensitivity Case Study

#### Economic Assumptions

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<th>Price Offset</th>
<th>Royalties</th>
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<tbody>
<tr>
<td>S4L 150831 Esc.</td>
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<td>Owner: Crown</td>
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</table>

- Gas ($/Mcf): 15.00
- C3 ($/bbl): 15.00
- C4 ($/bbl): 15.00
- C5+ ($/bbl): 11.00

- Price Offset: Gas ($/Mcf) = -0.60

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<th>CAPEX</th>
<th>OPEX</th>
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<tr>
<td>Complete (M$)</td>
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<tr>
<td>Equip/Tie-in (M$)</td>
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<th>Liquid Yields</th>
<th>Surface Loss (%)</th>
<th>Heating Value (BTU/scf)</th>
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<td>4.0</td>
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<td>C4 Yield (bbl/MMcf)</td>
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<td>C5+ Yield (bbl/MMcf)</td>
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<td>Condensate (bbl/MMcf)</td>
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<table>
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<tr>
<th>Decline Parameters Economic Results</th>
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<td>Lower Montney Auto</td>
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<td>5,500</td>
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<td>Lower Montney Decline</td>
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<td>Lower Montney Decline</td>
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Type Curve Analysis for Landmen

Adjusting for completion optimization

Should reflect latest completion

- Completions continually evolving on most plays
- Should reflect current optimized completion for future locations
- Often limited production history from latest completion technique
- Often subjective assessment of impact from latest advancements in completion technique
Adjusting for well length

• Best approach is to plot actual qi and forecast EUR from wells with varied lengths

• Typically see large variance in well results which often makes direct assessment of relationship of EUR and Qi to well length highly subjective

• Can also use reservoir simulation tools to assess expected relative impact

• Impact of completion parameter changes – play specific

Vintaging wells

• Bin wells by year or time period to assess impact of completion changes

• Vintaging facilitates assessment of what group of wells is representative of current completion techniques

• Need to be cautious about reducing sample set size to too low a number of wells if vintaging to narrow time periods

• Most operators change multiple completion variables at the same time so difficult to assess impact of individual variable changes
Type Curve Analysis for Landmen

Using type curves?

Waterflood projects

- Quality of analog is critical – spacing, well development type, reservoir parameters (permeability, thickness, viscosity etc)
- Geology is critical to establishing what analog is appropriate
- Need sufficient history to establish key parameters
- Need to normalize the pool specific type curve to time zero and to pore volumes of water injected
- Type curve from geological equivalent analog pool used to establish time to fill up, recovery factor, peak rate, incremental recovery
Thermal projects

- Quality of analog is critical
- Geology is critical to establishing what analog is appropriate
- Need sufficient history to establish key parameters
- Need to normalize the geology specific type curve to a specific well length and reservoir thickness
- Type curve from geological equivalent analog used to establish curve shape, EUR, recovery factor, peak rate, CSOR for new project development

Multi-stage frac plays

- Used to establish rate forecast for producing wells
- Rate forecast for locations based on specific type curve for layer, regional area and completion
- Future development potential based on application of type curve(s) over entire developable acreage position
- Basis of value projections for unconventional play full field development
- Type curve will drive reserve and resource volume estimates
**Undrilled Locations**

- Type curves used extensively to estimate future production forecasts from individual wells in resource plays
- Used to generate development plan to attain specified facility capacity levels
- Used to determine ultimate recovery potential (reserves + resources) for a specific acreage position in a play
- Type well represents the expected average well – represents the best estimate or 2P or 2C volume and value

**Regionally specific type curves**

- Tendency to use a single type curve to represent a play can be misleading
- Not good enough to have a position in a play – key is where are you in the play
  - Regional variations in productivity
  - Liquid yield drives economics
  - Can be wide variations in EUR over short distances
- As each play evolves the number of type curves increases to capture variation in well results
Application Methodology

- **Producing wells** are not assigned direct type curves. Instead, the general parameters of that area (expected N and transition decline) are used in conjunction with the actual production profile in order to estimate reserves for a horizontal producer.
  - The decline rate of the well will determine whether or not it is in the linear or BDF portion of its producing life. Accordingly, either a double or single segment forecast will be applied with greater weight placed on the more recent trend.

- **Locations** will be booked based on average EUR of analogous wells, also taking applicable geological information into account. The type curve tier closest in match to this avg EUR is used with all the accompanying parameters of that tier.

- In either case, it is important to **use your engineering judgment** to determine how to best apply the type curve and its parameters to the well in question.

Miss uses of type curves

- Lump all wells together without recognizing variation in regional performance
- Oversimplify curve shape to a single segment harmonic or hyperbolic decline trend
- Assume full incremental reserves for downspacing
- Assume high certainty in expectations too early in field development
- Average typical well type curve (best estimate) represents P+P case not the proved case
- Build type curve from performance of a rate restricted or declining surface pressure operation
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Presentation Copies Available

- Presentation will be posted on a FTP site
- Contact Mikhaila at mikhaila.molloy@sproule.com to receive access to FTP site to download Type Curve presentation