



Rethinking an Industry Recommended Practice: *Lessons being Learned from Monograph 5 (Type Well Profiles)*

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Committee Members

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Introduction - SPEE Monographs

SPEE Monograph 3, "Guidelines for the Practical Evaluation of Undeveloped Reserves in Resource Plays"

- ▶ Published 2010
- ▶ Set forth methods for determining proved areas within a resource play, along with methods for estimating per-well reserves for undeveloped locations within those proved areas

SPEE Monograph 4, "Estimating Ultimate Recovery of Developed Wells in Low-Permeability Reservoirs"

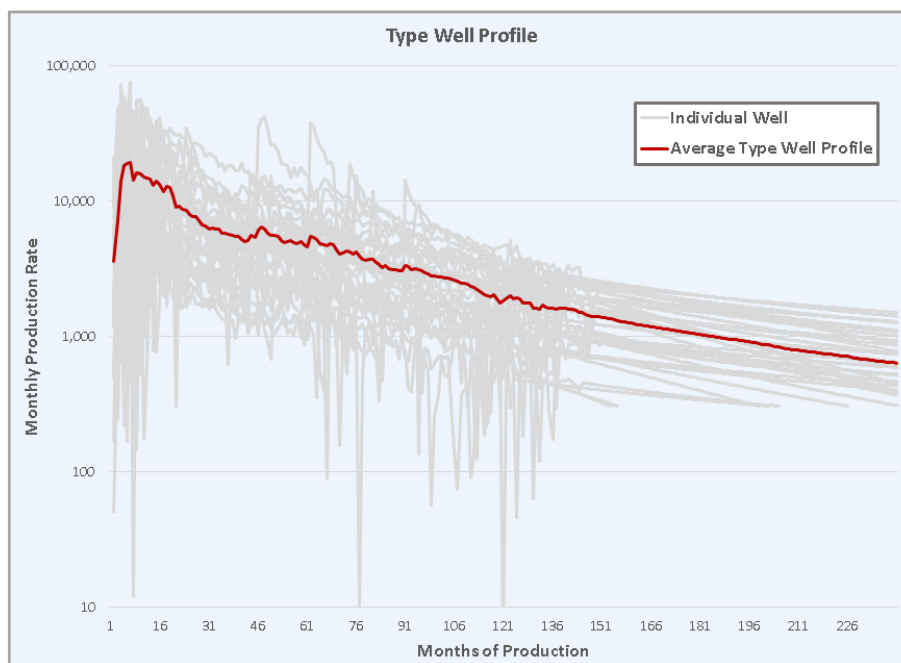
- ▶ Published 2016
- ▶ Presented and discussed several different methods of forecasting on a by-well basis

SPEE Monograph 5, "A Practical Guide to Type Well Profiles"

- ▶ Published 20?? - Work in progress
- ▶ A recommended practices guideline for the evaluation engineer to perform type well analysis, as well as, a guideline for assessing the reliability of type well profiles

Type Well Profiles (TWP)

- ▶ Estimated production profile for a typical well in a reservoir of interest
- ▶ Utilization of historical well performance from analogous wells



Finding the Right Tool in the Toolbox

*The purpose of this monograph is to be a **recommended practices guideline** for the evaluation engineer to perform type well analysis, focusing first on public or easily obtained data, and then **enhancing the reliability** by supplementing detailed or proprietary data as necessary. The monographs gives **due consideration to the “fit for purpose”** confidence level to be achieved. Secondly, this monograph serves as a guideline for **assessing the reliability** of type well profiles.*



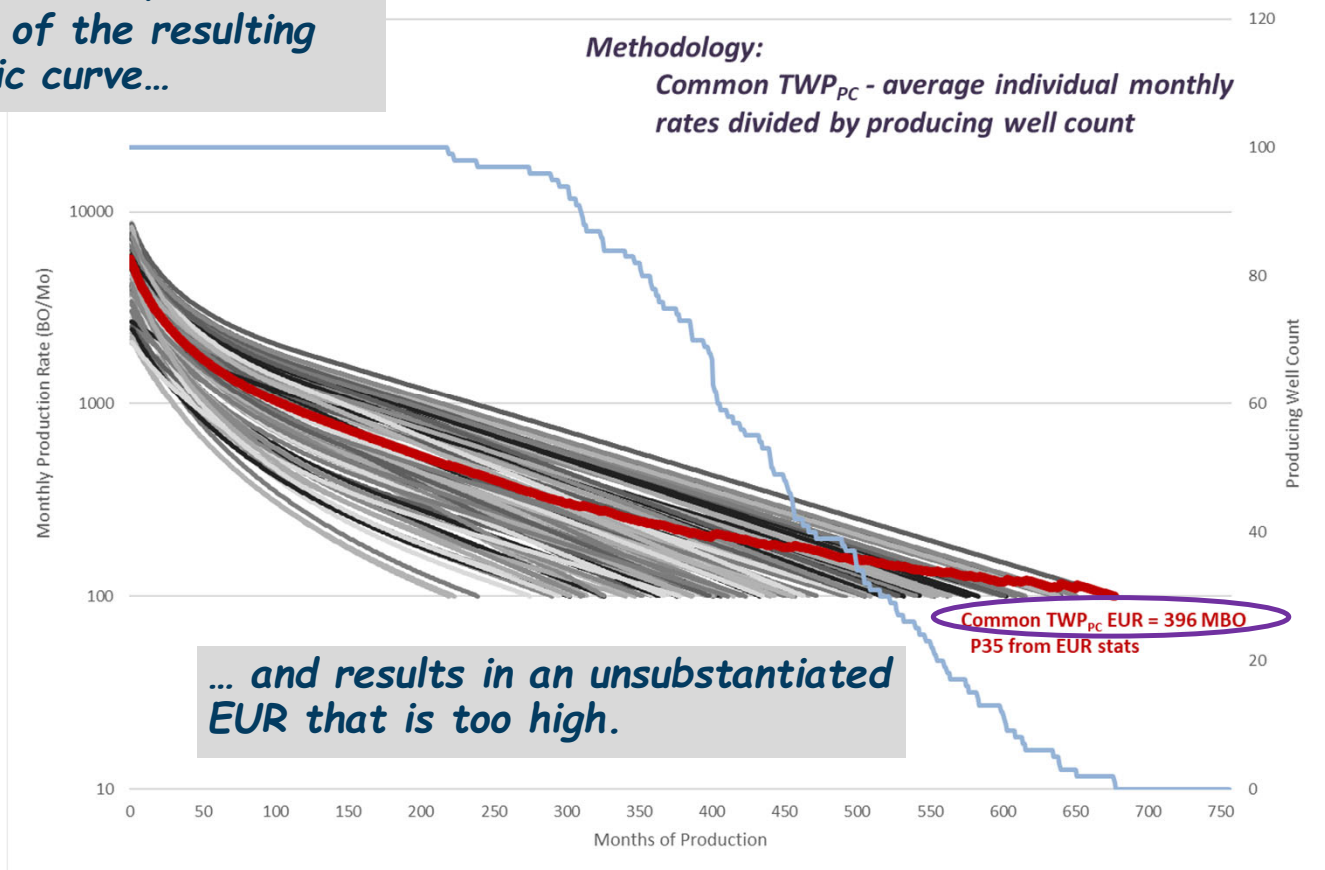
One Common Approach

Common TWP_{PC} for a sample of hyperbolic declines will often result in over curvature of the resulting average hyperbolic curve...

Hyperbolic Declines (100 wells)
Synthetically generated - "History + Forecast"

Methodology:

Common TWP_{PC} - average individual monthly rates divided by producing well count



EUR Stats:

P90 = 188 MBO
P50 = 332 MBO
Mean = 365 MBO
P10 = 585 MBO
P10/P90 Ratio = 3.11

Simple Adjustment to the Common Approach

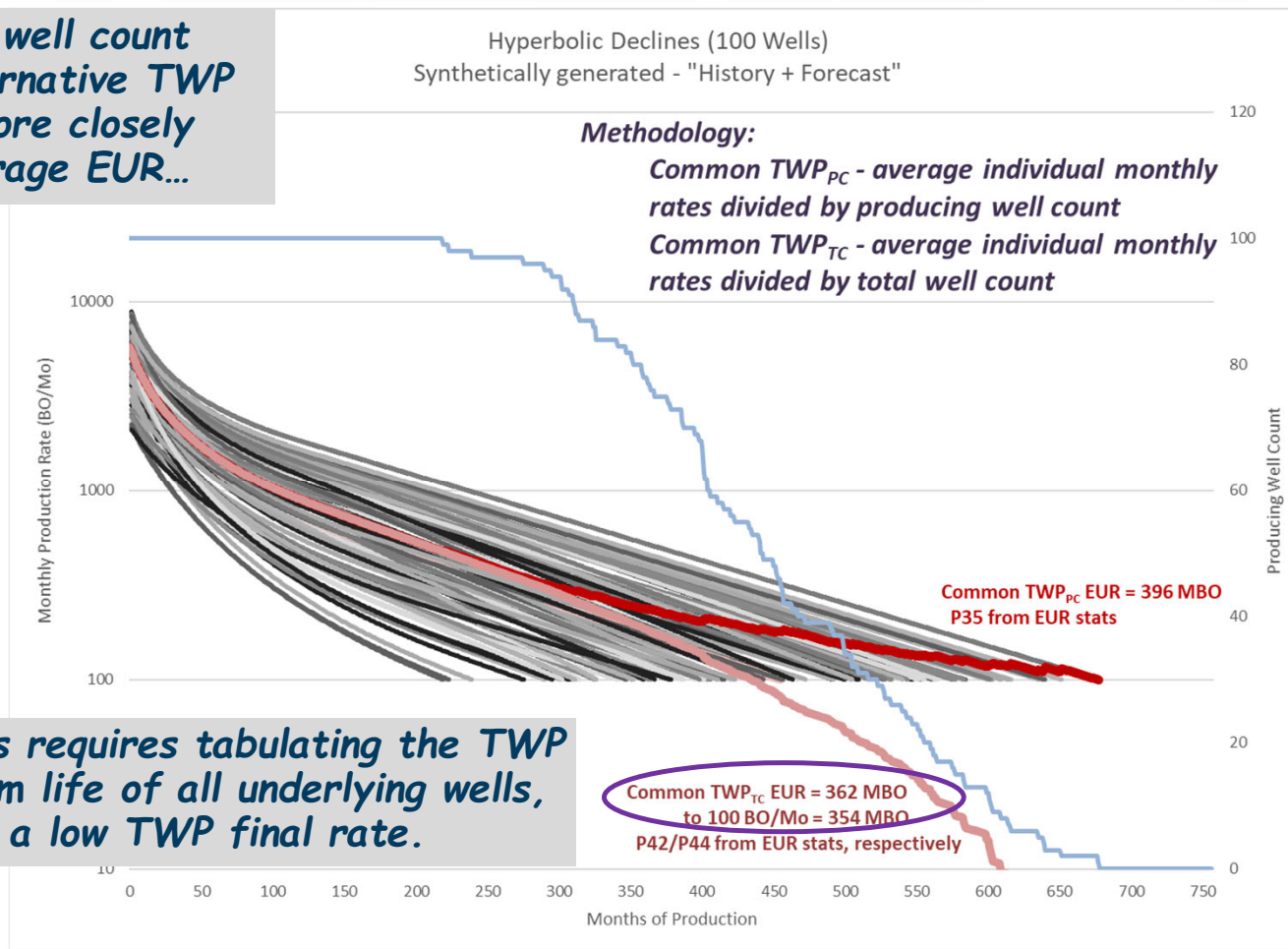
Using a constant well count results in an alternative TWP (TWP_{TC}) which more closely matches the average EUR...

Hyperbolic Declines (100 Wells)
Synthetically generated - "History + Forecast"

Methodology:

Common TWP_{PC} - average individual monthly rates divided by producing well count

Common TWP_{TC} - average individual monthly rates divided by total well count



EUR Stats:

- P90 = 188 MBO
- P50 = 332 MBO
- Mean = 365 MBO
- P10 = 585 MBO
- P10/P90 Ratio = 3.11

... although this requires tabulating the TWP to the maximum life of all underlying wells, which leads to a low TWP final rate.

Another Adjustment to the Common Approach

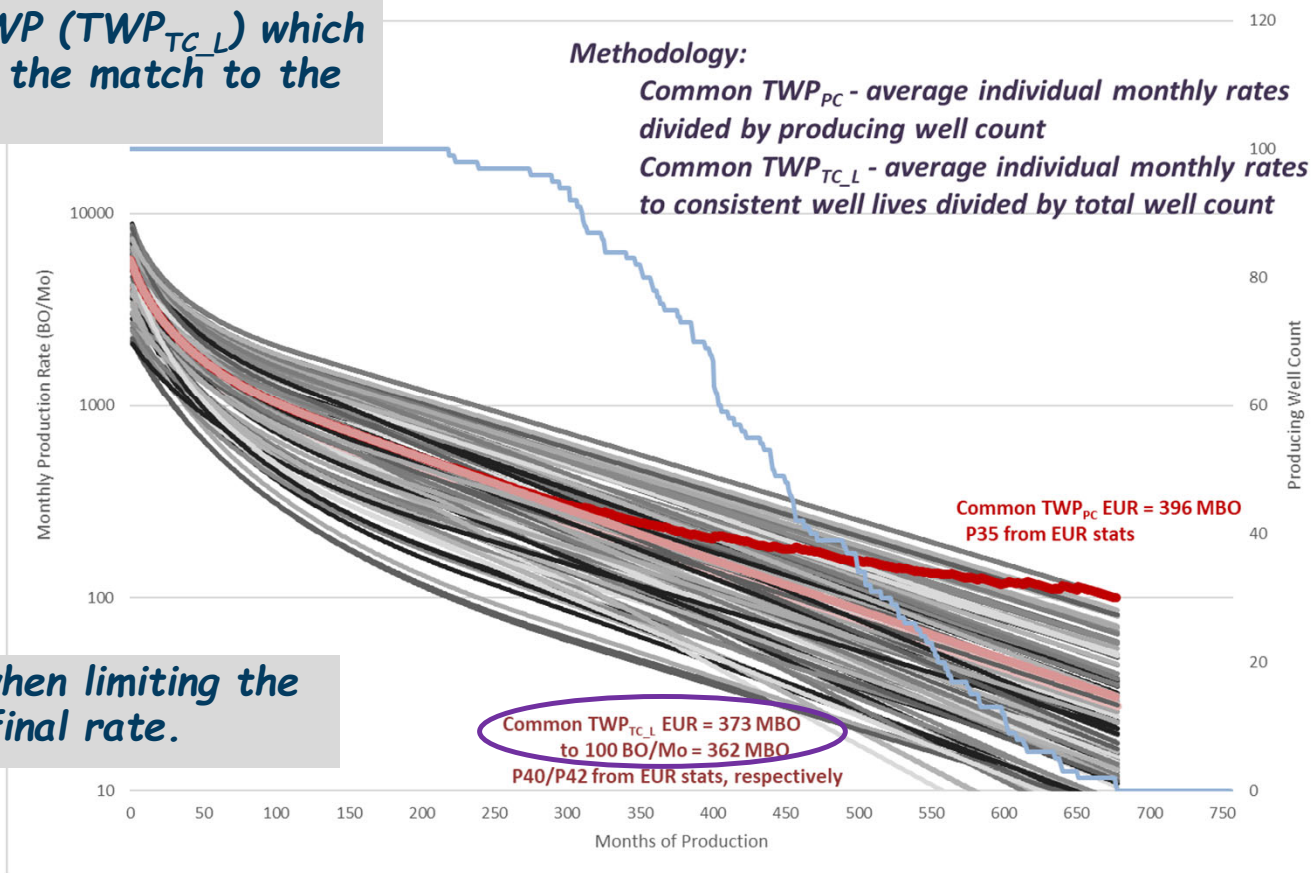
Using a constant well count coupled with consistent well lives results in an alternative TWP ($TWP_{TC,L}$) which further improves the match to the average EUR...

Hyperbolic Declines (100 Wells)
Synthetically generated - "History + Forecast"

Methodology:

Common TWP_{PC} - average individual monthly rates divided by producing well count

Common $TWP_{TC,L}$ - average individual monthly rates to consistent well lives divided by total well count



EUR Stats:

- P90 = 188 MBO
- P50 = 332 MBO
- Mean = 365 MBO
- P10 = 585 MBO
- P10/P90 Ratio = 3.11

... particularly when limiting the resulting TWP final rate.

Workflow Overview

Identify

Purpose
Area of Interest
Data Integration

Validation

QA/QC
Bias Consideration
Uncertainty Analysis



Data Refinement

Data QC &
Diagnostics
Identify Determinants
of Performance
Analog Identification
& Selection

Analysis

Determine TWP
Construction Method
Preparation of TWPs
Application

- ▶ Purpose dependent analysis
- ▶ Identify minimal data necessary for analysis
- ▶ Consider complications
- ▶ Account for practicalities
- ▶ Availability of additional data to enhance reliability of analysis

Identify

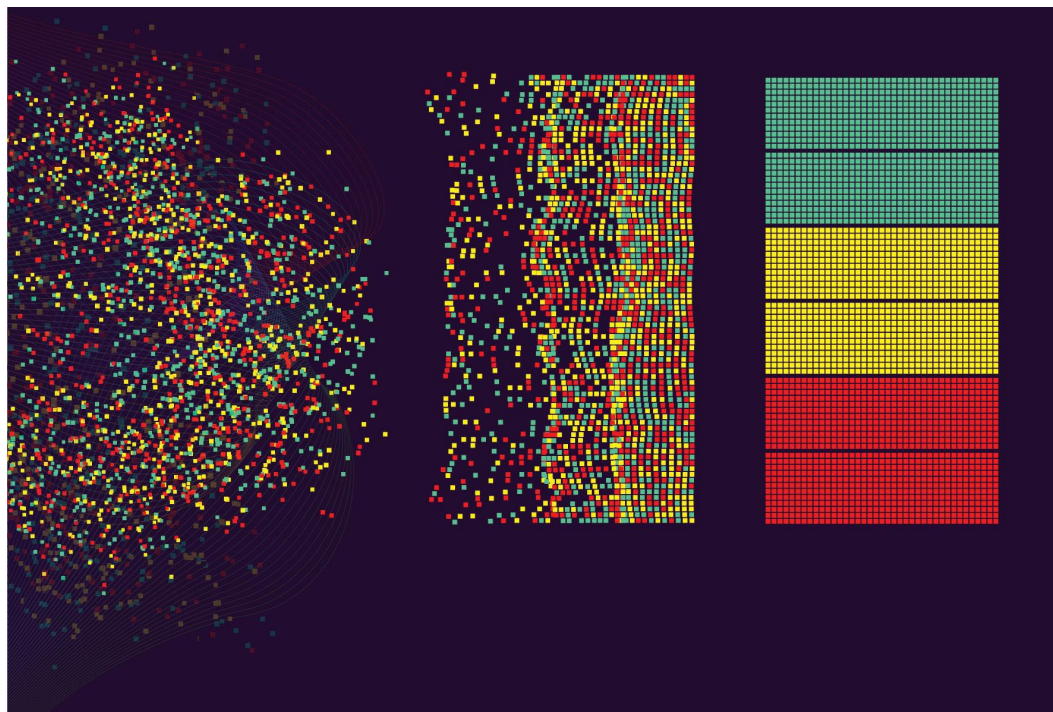


More is Better...Or is it?

Identify

Challenges:

- ▶ Data Storage
- ▶ Data Integration
- ▶ Novel Analysis
- ▶ Complex Analysis



Opportunities:

- ▶ Enhanced Performance Analysis
- ▶ Automation
- ▶ Knowledge is Power



- ▶ Potential for multiple types of data bias to influence the outcome
- ▶ Mitigation may be necessary to eliminate or greatly reduce error associated with bias

Specific Types of Bias

Validation



▶ Selection Bias

▶ Forecast Bias

▶ Normalization Bias

▶ Population Bias

▶ Survivor Bias

- Vintage Bias
- Performance Bias

- ▶ Validate use of appropriate analog set
- ▶ Validate results with diagnostics and hind-casting
- ▶ Characterize the certainty level of data analysis



Key Challenge: How to Integrate new recommended practices into corporate workflows



- ▶ Internal policy and adoption
- ▶ Software limitations



Reinventing the Wheel

- ▶ Too often engineers across an organization reinvent the wheel
- ▶ Ensure standards are met
- ▶ Consistency of technique
- ▶ Flexibility to allow for “fit for purpose”



Thank you!



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<https://SPEE.org>