

Issues Impacting Methodology for Quantitative Assessments of Oil Shale

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How can the experience from 30+ years of USGS oil and gas assessments help oil shale assessors to avoid some of the major pitfalls?

Problem

Deposit Variability

- Oil shale deposits vary greatly in:
 - Amount of data available
 - Quality of data
- It's like dealing with apples and oranges.
- We need a context in which we can treat them all as fruit.

Questions

Most Important Point in This Talk:

What is the question?

What are the questions?

- Who is asking the question?
 - Who are our users?
 - What do the users need?
- Which of those questions can I reasonably answer, given the data I have?

The “Normal” Routine

- Many assessors start from the other end of the process:
 - What data do I have?
 - What can I do with it?
 - How can I keep doing what I’ ve done for years, which is comfortable?

Relevance of Questions

- How useful is a particular estimate to the users?
- Are crustal abundance estimates useful?
- For which questions are in-place estimates appropriate and for which are recoverable estimates appropriate?

Questions Imply Some Scale

- World scale
 - How much resource in the world?
- Deposit scale
 - How much resource in a specific deposit?
- Time scale
 - How much resource could be relevant to supply in the next 30 years? (5 years?, 100 years?)

Questions Imply Boundaries

- Resource volume
 - What is the smallest deposit considered?
- Yield of oil per ton of oil shale
 - What is the leanest oil shale considered?
- Thickness of shale
 - What is the thinnest oil shale considered?

Questions Imply Technology Assumptions

- Volume estimates of oil are dependent on the technology used for extraction.
- Technology can involve boundaries.
 - What is the maximum thickness of overburden for oil shale developed by strip mining?

Questions Imply Definitions

What should be included
as “oil shale?”

Tomato

Is a tomato a fruit or a vegetable?

Tomato

- Botanically, it's a fruit. (So are green beans, eggplants, cucumbers, and corn kernels!)
- In 1893, the U.S. Supreme Court declared that for purposes of import duties, the tomato should be classified as a vegetable.
 - Based on linguistic custom and culinary use

The definitions you use depend
on the question you ask.

The definitions
(scale, boundaries, technology
assumptions)
you use depend on the question
you ask.

Categories

Not every ton of oil shale is “equal.”

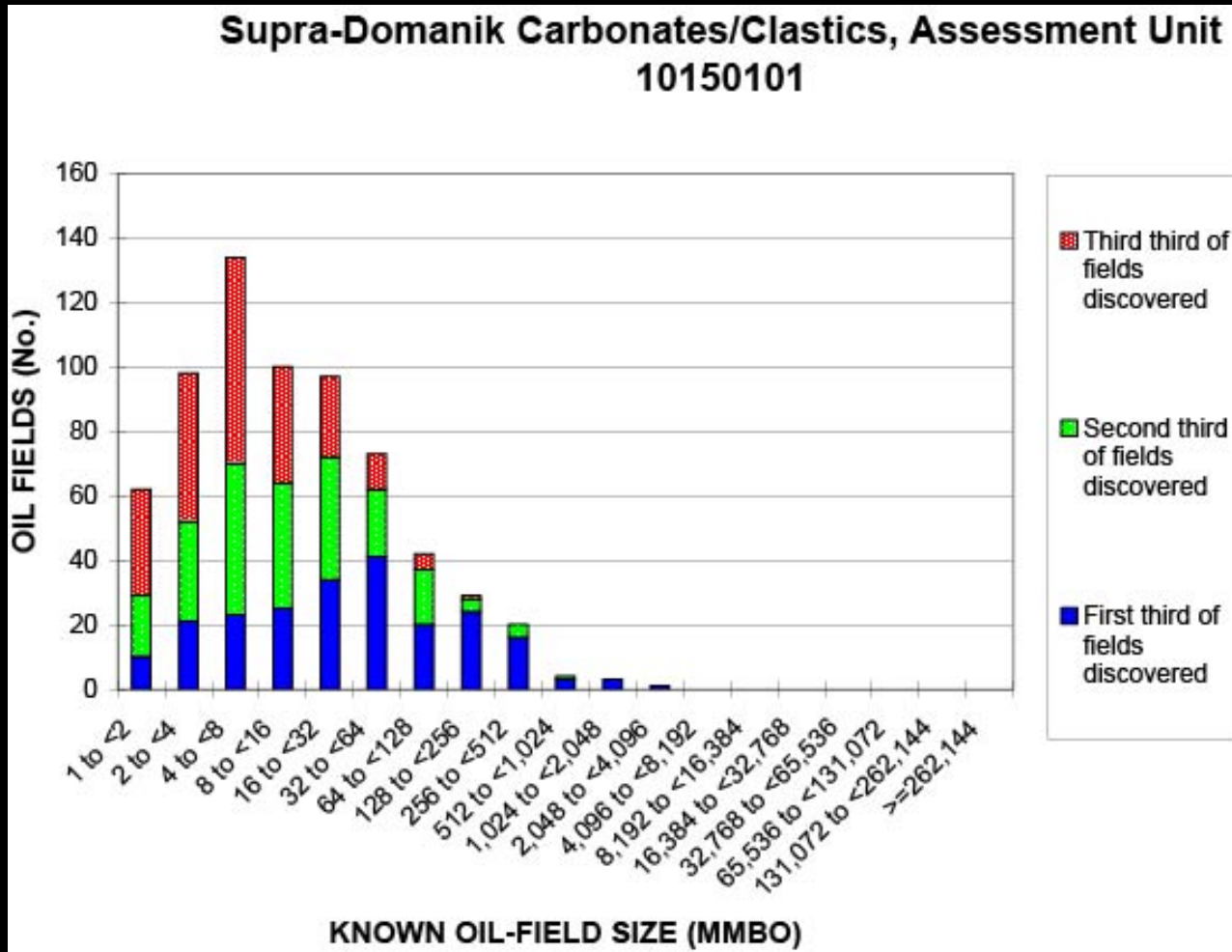
Types of Categories

- Discovered versus undiscovered
- Quality
 - Yield of oil per ton of oil shale
- Producibility
- Cost
- Distinct classes versus a continuous range

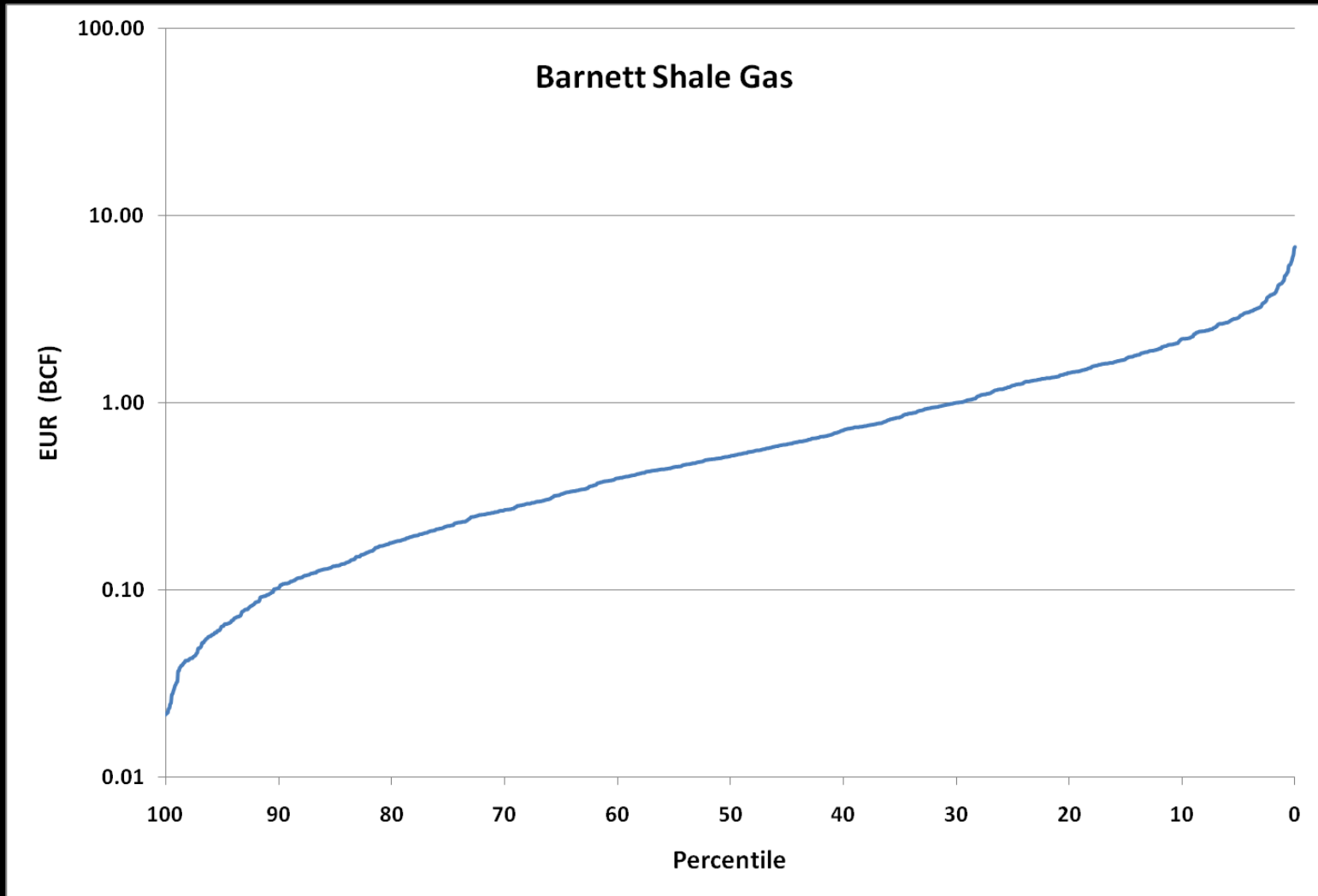
Erecting categories allows one to answer several questions.

- How much of the volume is in any particular subset?
- How much resource is there given certain technologic assumptions?
- How much resource is there at a given cost per barrel of production?

Field-Size Distribution



EUR Distribution



Probability

Problem

How to deal with estimates of
very different entities

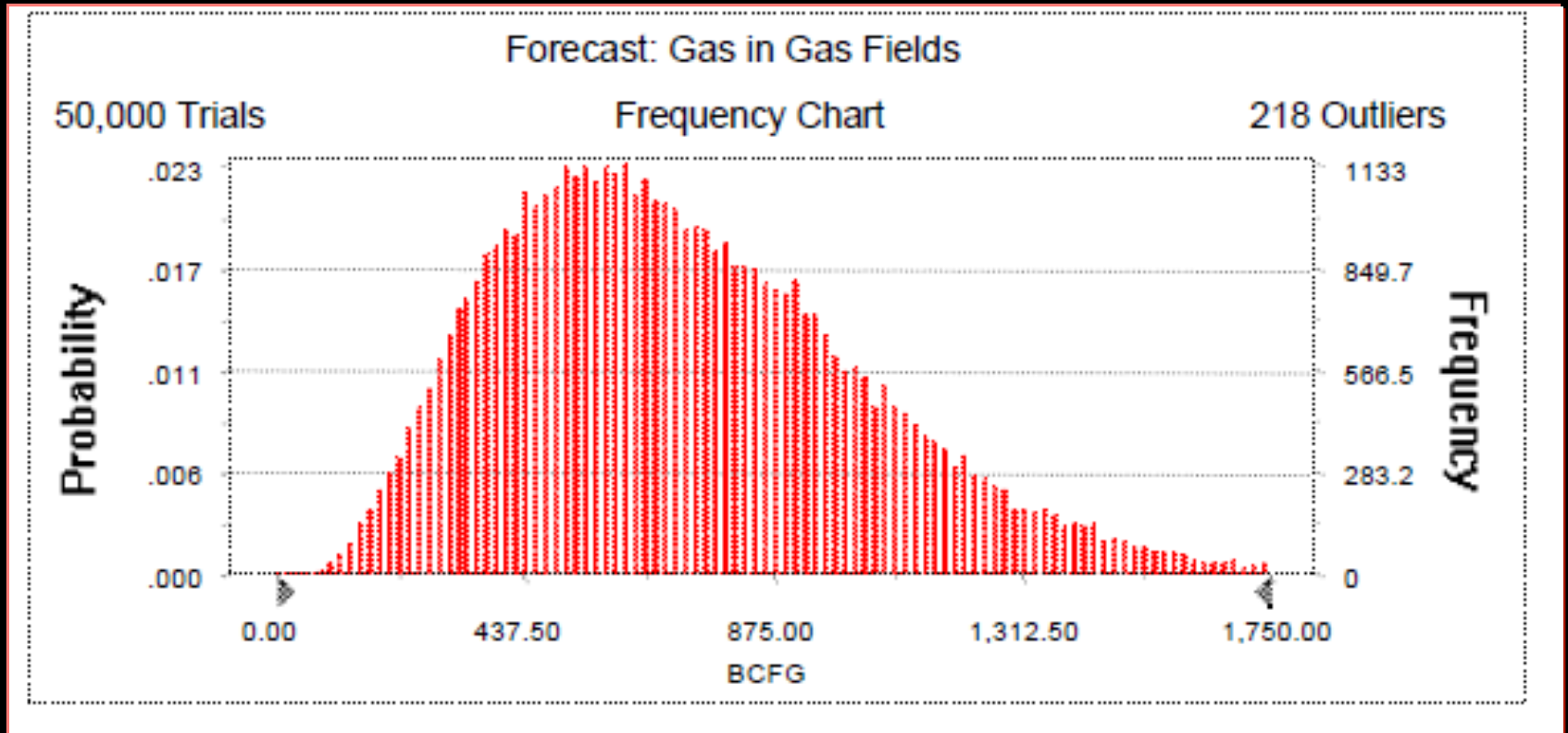
Solution

Put the estimates in a
probabilistic context

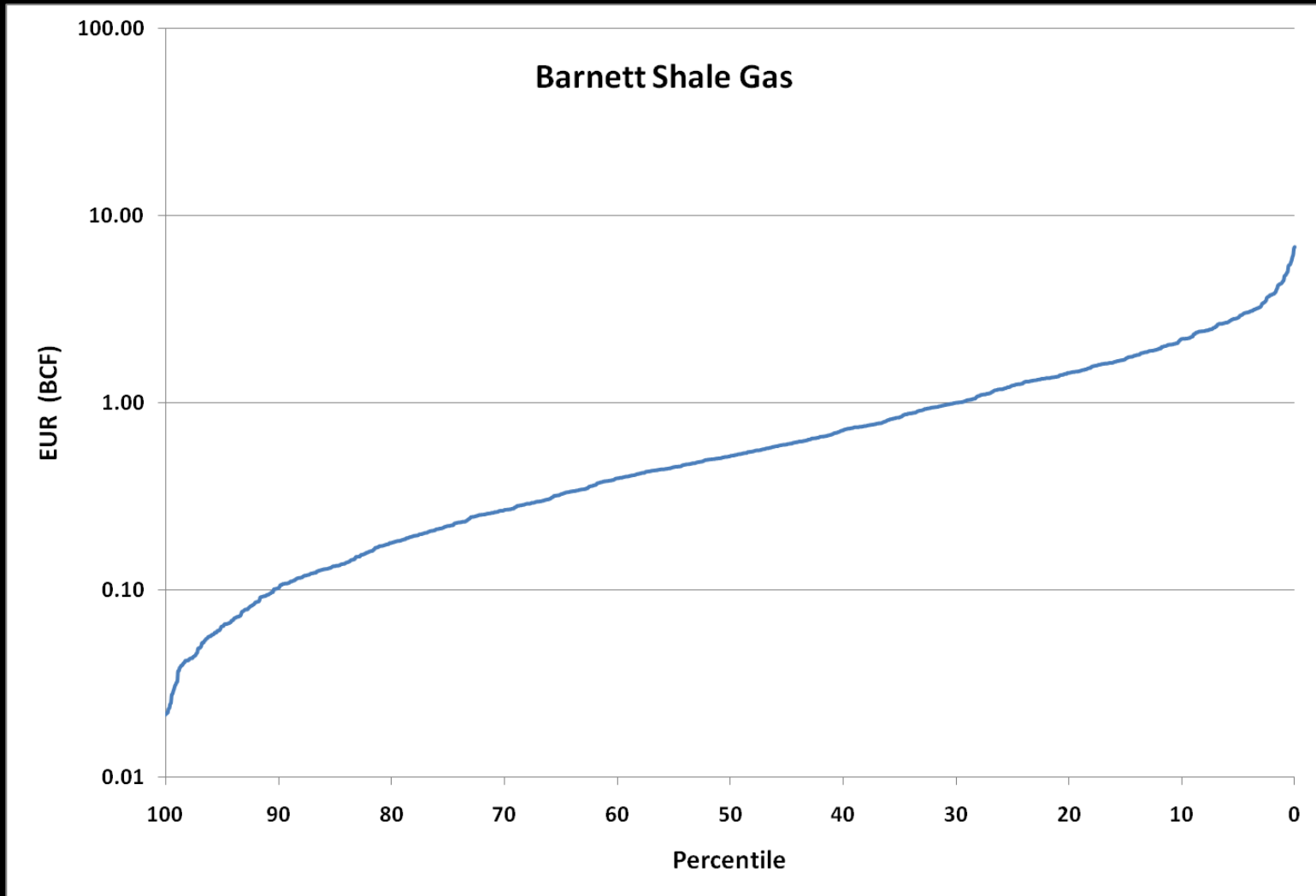
Probabilistic Context

- A more appropriate context to mix:
 - Well-described deposits
 - Poorly-described deposits
 - Undiscovered deposits
- All deposits need not be estimated using the same methodology
 - Different methods for discovered versus undiscovered

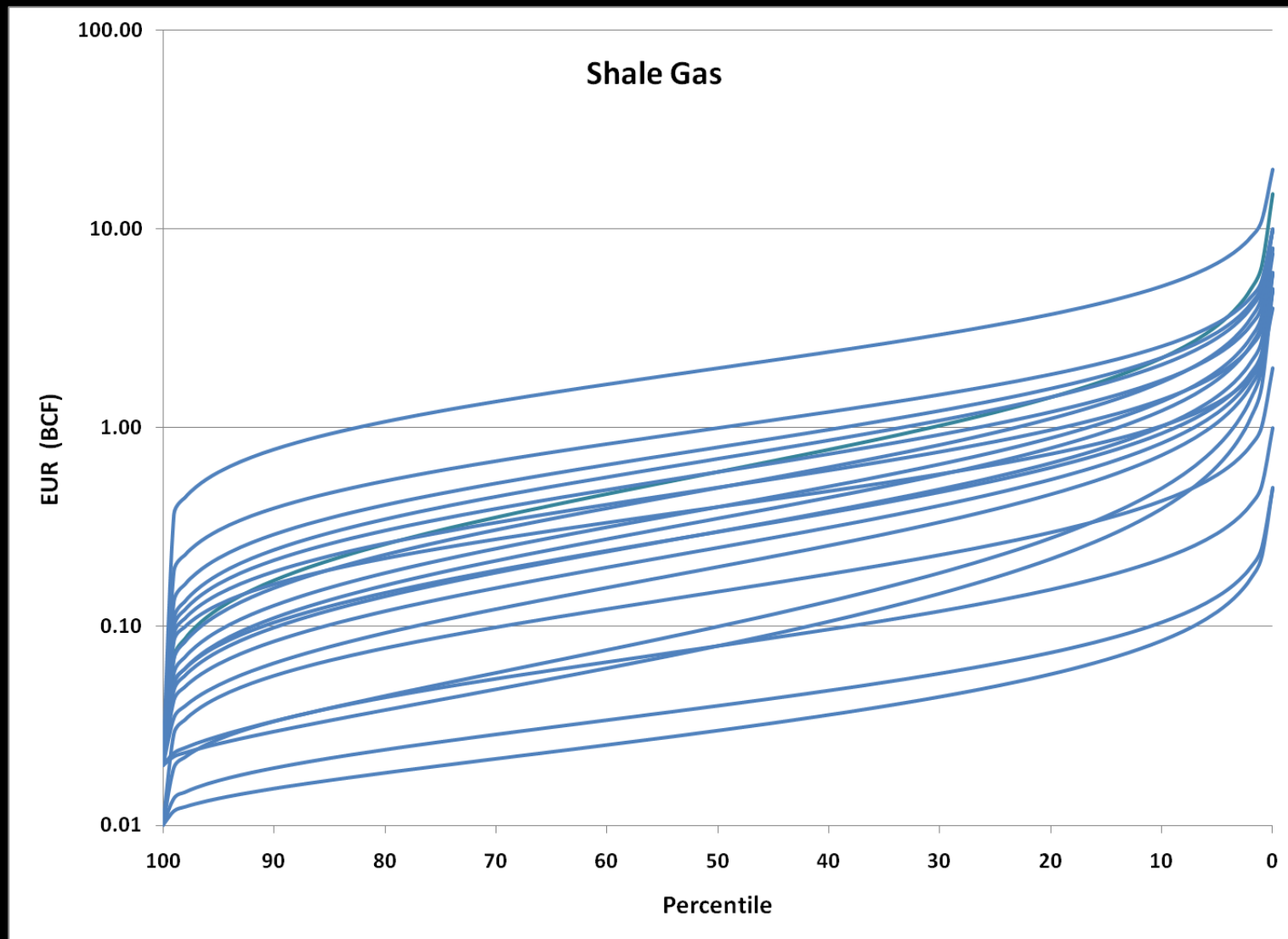
Volume Probability Distribution



EUR Distribution



EUR Cloud



Summary

Most Important Point in This Talk:

What is the question?

Helpful Hints

- Refine the questions that you are trying to answer.
- Use categories to allow you to answer multiple questions.
- Make your definitions fit the questions.
- Put estimates in a probabilistic context.

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