Challenges of Asset Evaluation

Through Different Stages of Field Life

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May 2009

Objective

- Shed some light on the broad meaning of asset evaluation and its uncertainty as related to technical and commercial aspects

Presentation Outline

- Introduction
  (Asset evaluation and uncertainty)
- Uncertainty in the exploration phase
- Uncertainty in the production phase
- Decisions at late stages
- Conclusions

Introduction

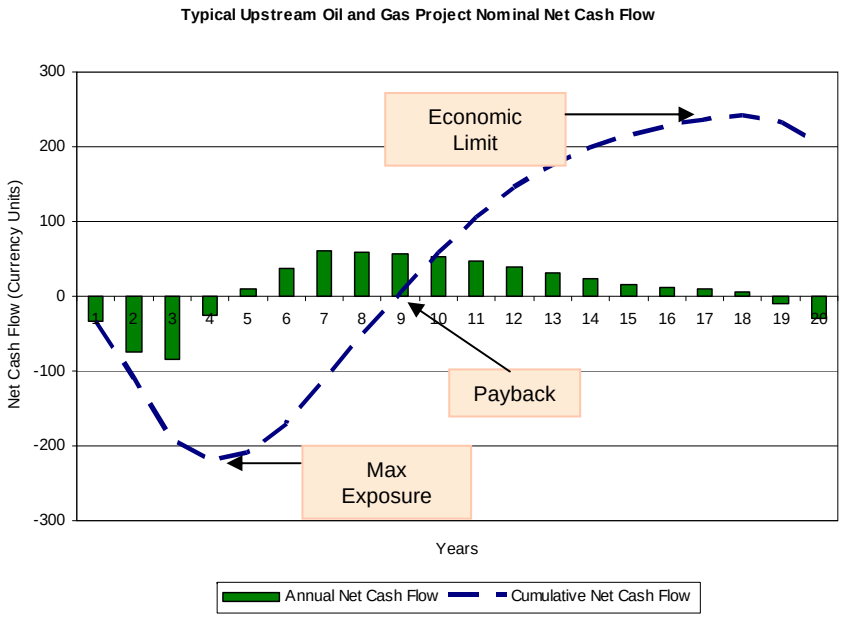
- Petroleum projects (investments) depend on:
  - Available reserves
  - Cost of exploitation
  - Revenue (petroleum price)

- Evaluating oil and gas projects requires the following to be considered:
  - The project is an investment (decisions should be commercially viable)
  - The established market you need to target complicates the evaluation (supply and demand)
  - In the mining industry technical uncertainties are at the centre of the evaluation study

Introduction (cont.)

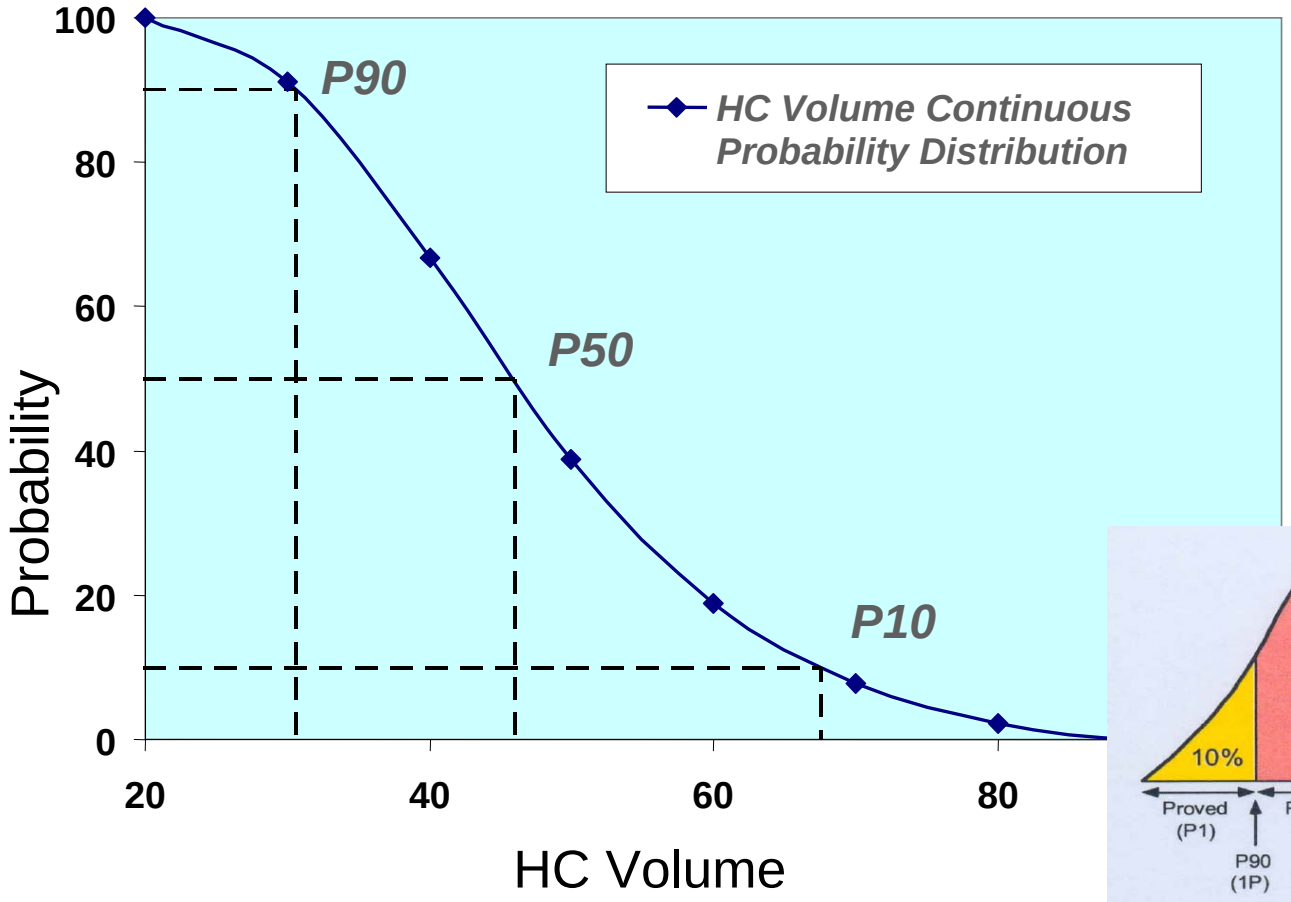
- What is asset evaluation?
  - Understanding the reservoir characteristics
  - Knowing the return on your investment if you decide to develop
  - Including uncertainties in your study

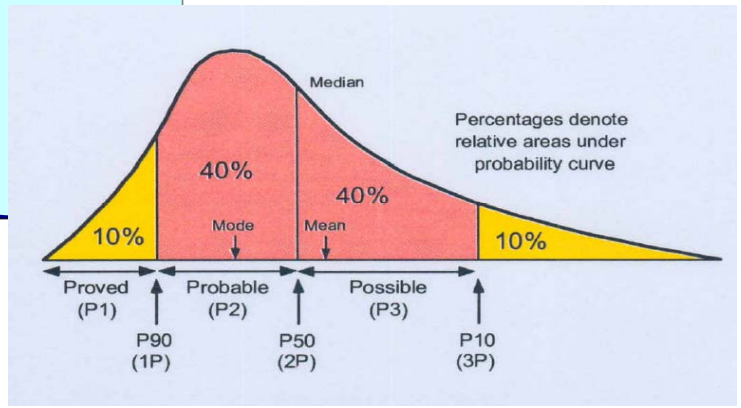
- What is it mainly used for?
  - Buying or selling acreages
  - Annual reporting of the fields value
  - Supporting development decisions



Introduction (cont.)

Continuous Probability Distribution

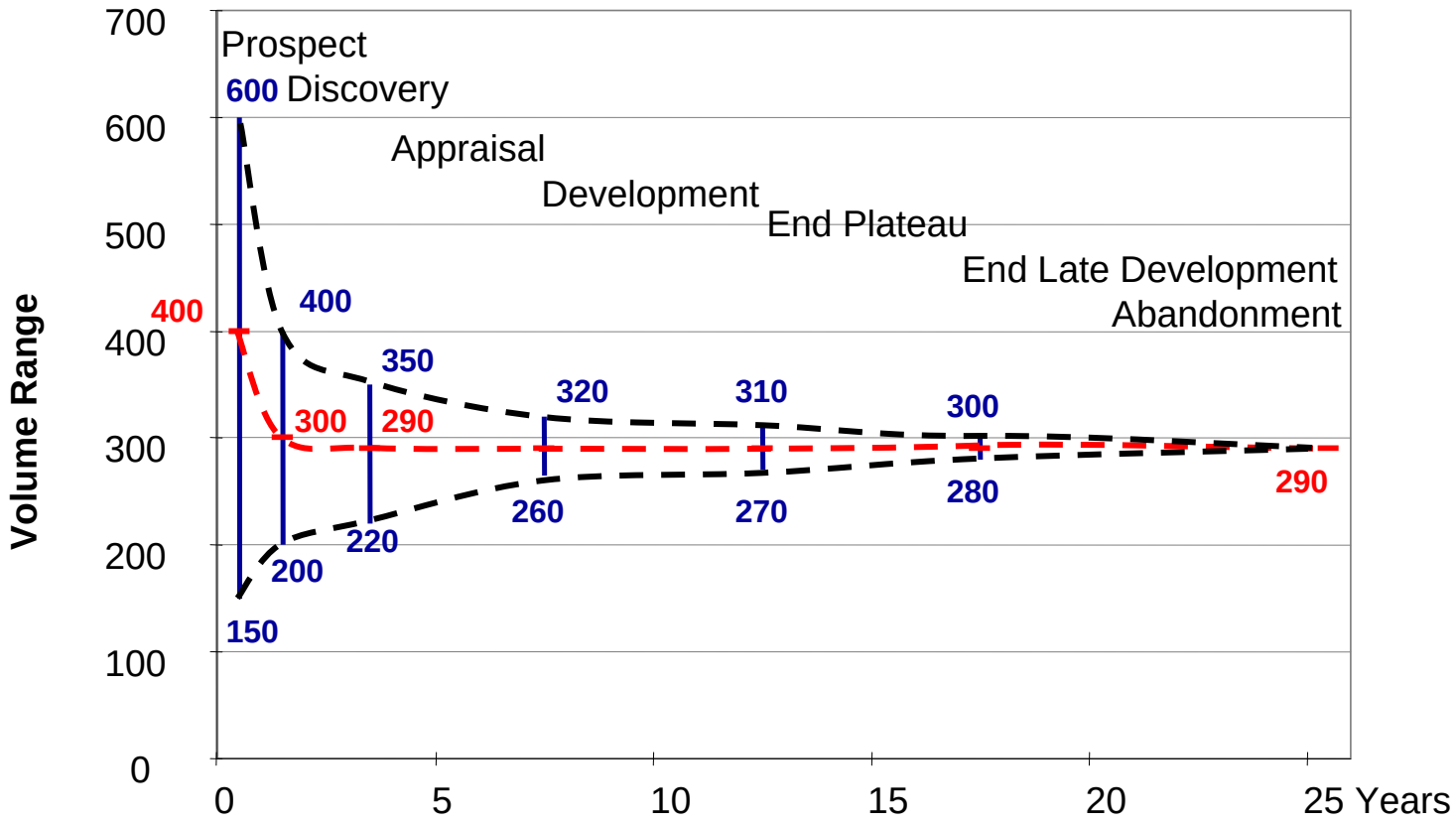




Introduction (cont.)

Technical Uncertainty in Theory

Field Life



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Technical Uncertainty in Theory

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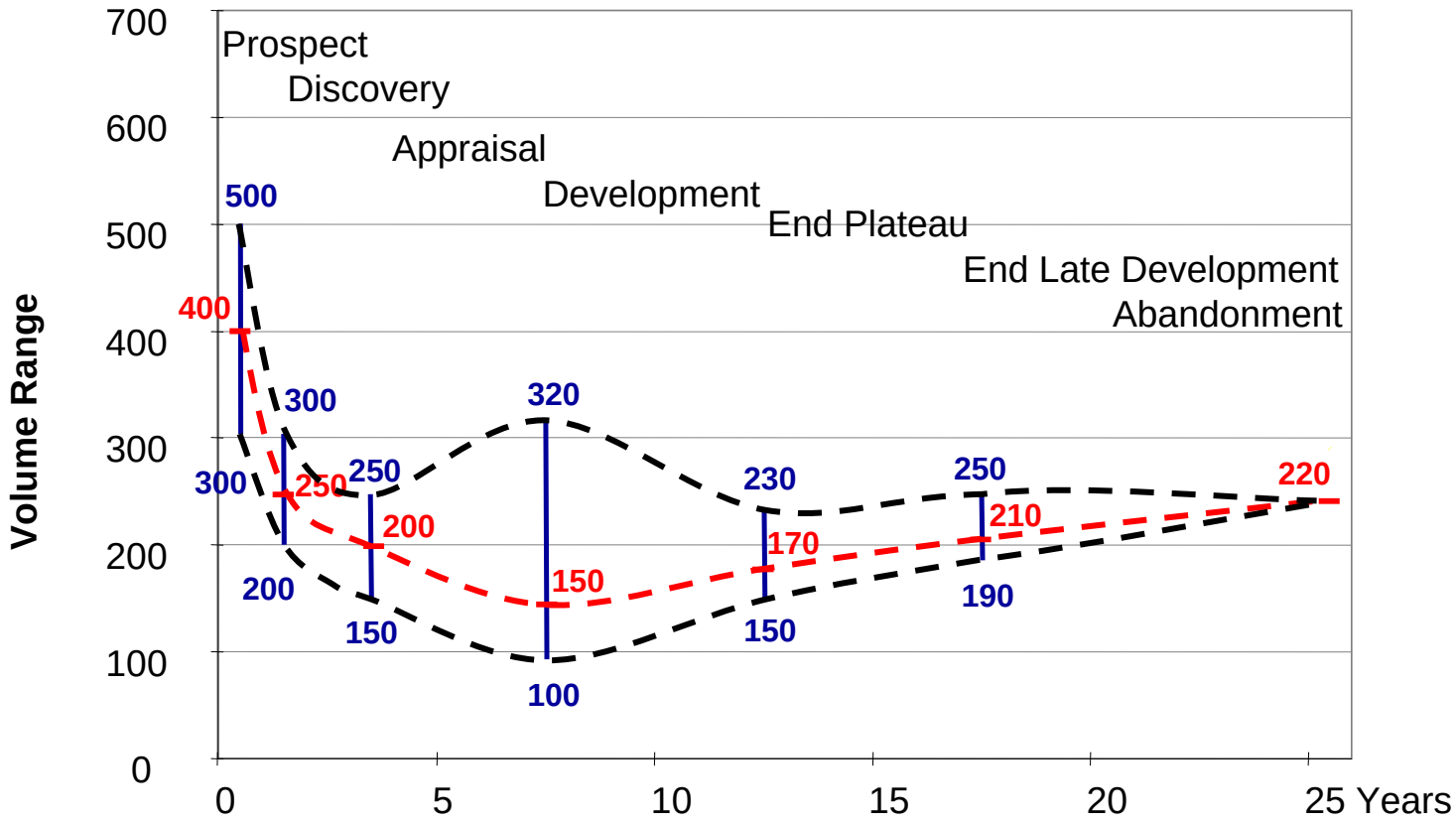


Uncertainty in the Exploration Phase

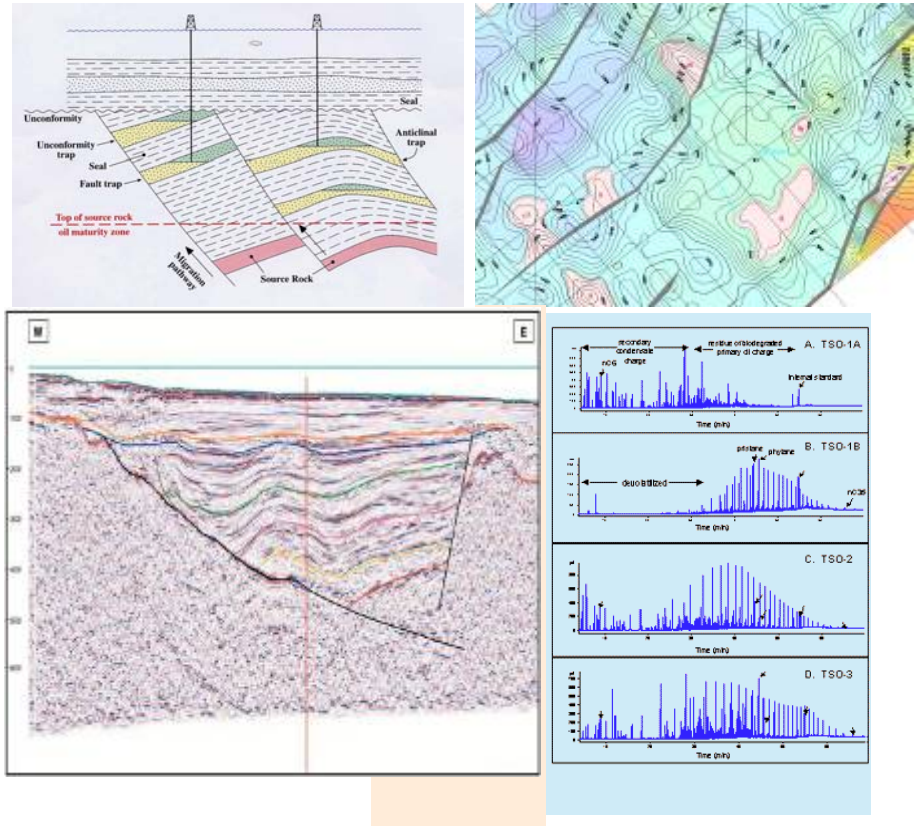
- The asset evaluation focuses on:
  - Reservoir rock volume and fluid contacts
  - Type of fluid
  - Petroleum initially in place

  - Well deliverability
  - Recovery factor
  - Un-risked and risked resources (chance of success)

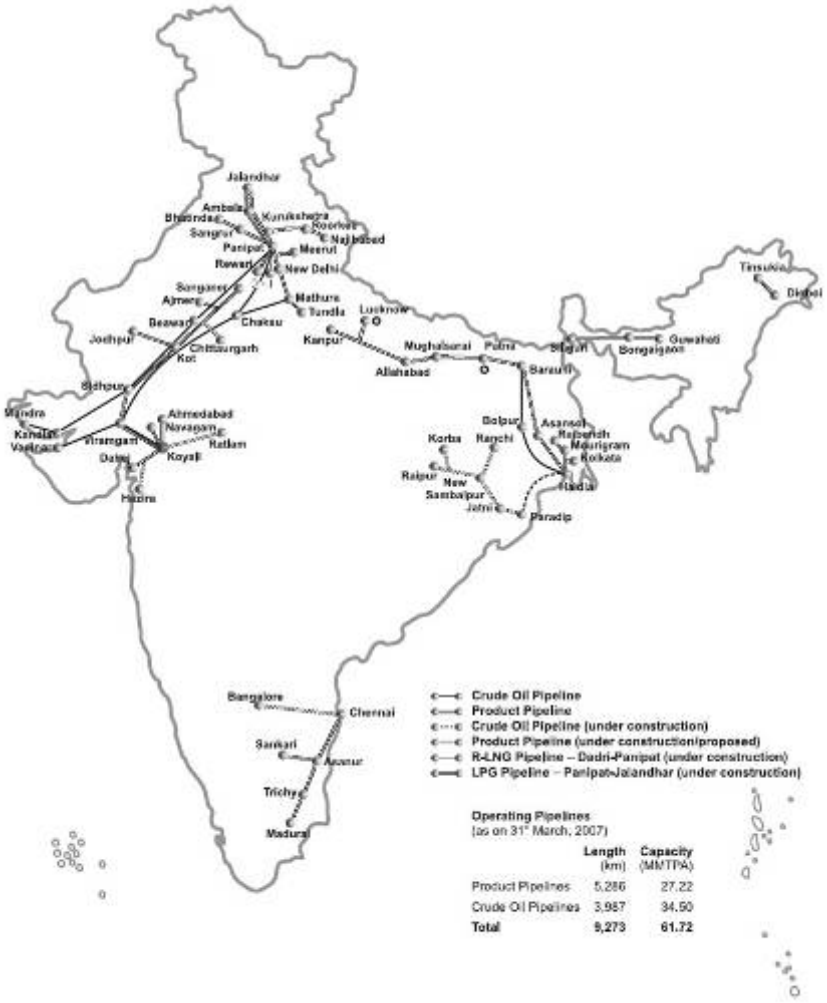
  - Existing infrastructure
  - Cost of developing in that area
  - Cost of production and product price

Uncertainty in the Exploration Phase (cont.)

- Geological concerns:
- Reservoir rock volume and fluid contacts
  - Seismic maps
  - Formations to target
- Likely HC characteristics
  - Gas or oil
  - Contaminants H2S, CO2…
  - SG, viscosity…
- Geological chance of success (influences exploration evaluation)
  - Source rock
  - Reservoir
  - Migration
  - Reservoir seal and timing



Uncertainty in the Exploration Phase (cont.)



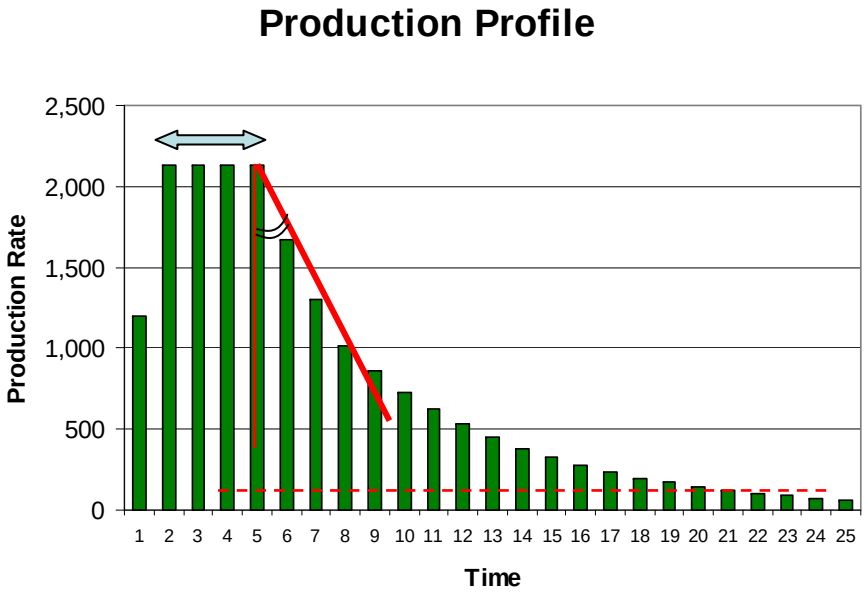
Costing and developing concerns:

- Existing infrastructure
  - Suitable refineries
  - Extra capacity in nearby pipelines
  - Ports and market
- Cost of developing in the area
  - Deep water, far desert
  - Reservoir fluid contaminants
  - Availability of workforce, technology…

Uncertainty in the Exploration Phase (cont.)

Reservoir engineering concerns:

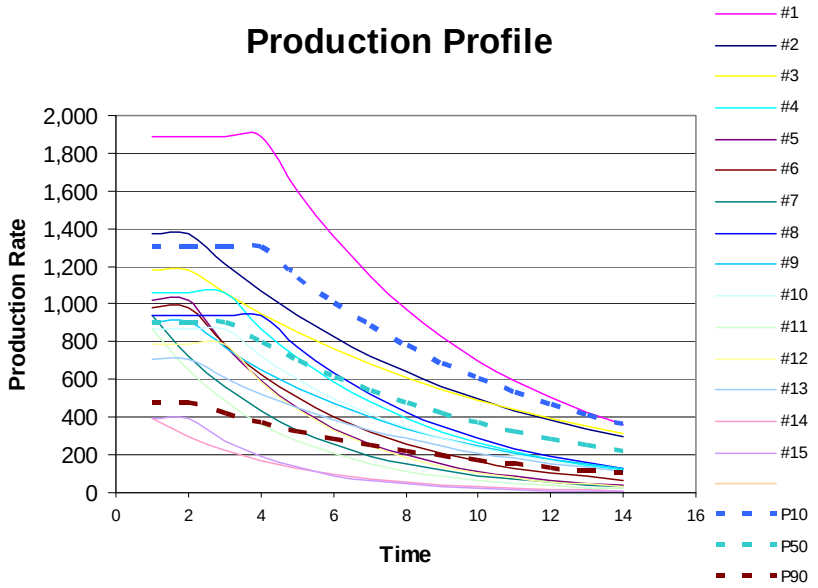
- Recovery factor
  - Fluid type
  - Recovery strategy
  - Analogues
  - Facilities
- Well deliverability
  - Well rate
  - Plateau length
  - Decline rate
  - Cut off, licence expiry
  - Difference between high, mid and low cases
  - **Real** data from analogue fields



Uncertainty of the Exploration Phase (cont.)

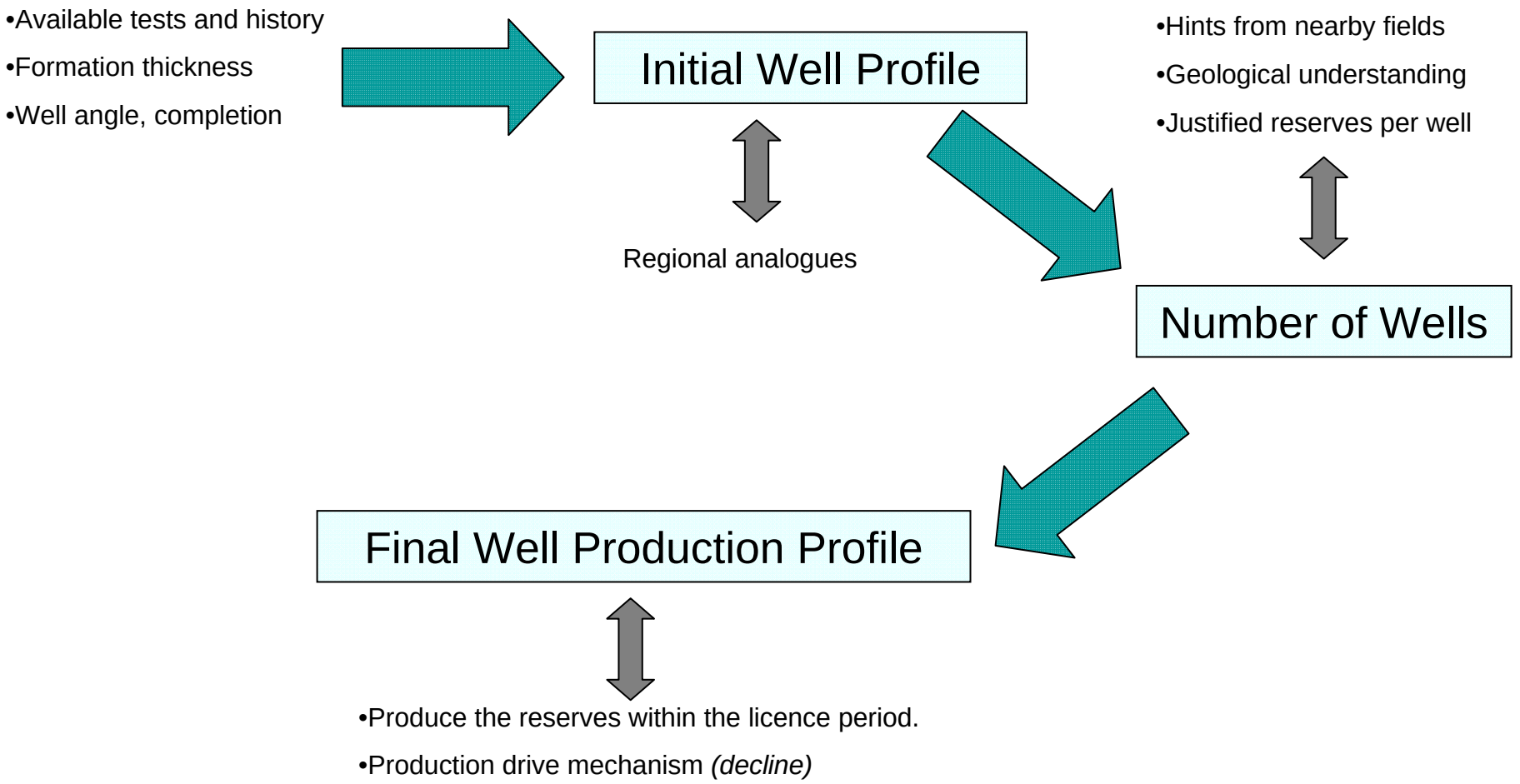
Well deliverability:

- Real data helps to indentify the variance in exploration prospectivity
- Variations in volume from P90 up to P10
  - F, H, N/G
    (Increase well productivity)
  - Area
    (Increase number of wells)



Uncertainty in the Exploration Phase (cont.)

Schematic well count and rates judgements:

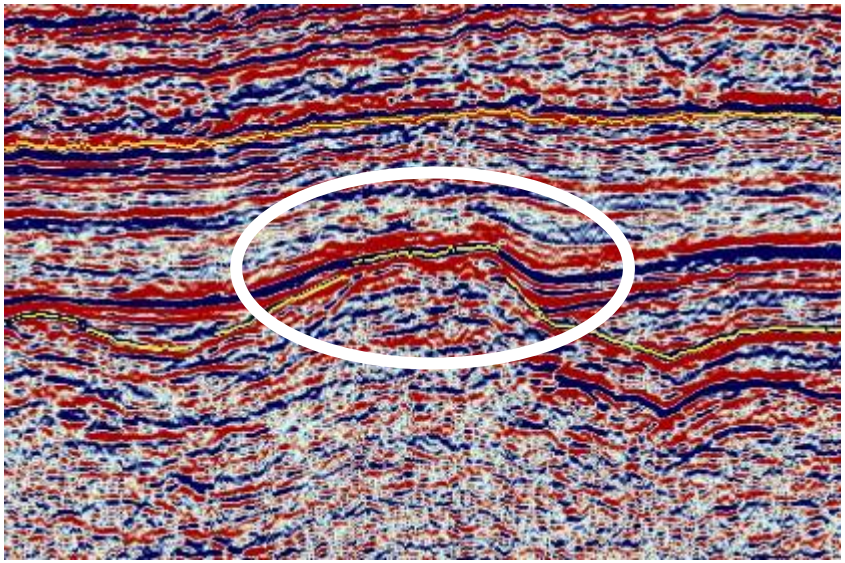


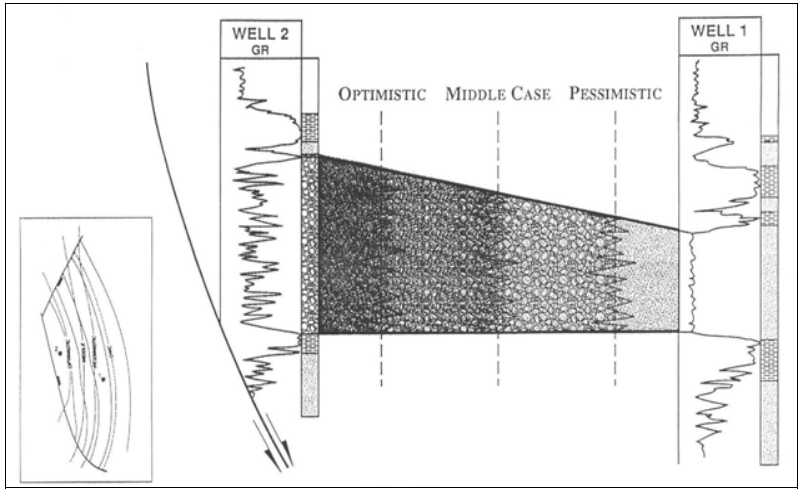
Uncertainty in the Production Phase

Asset evaluation in the production phase:

- Production geoscience
- Reservoir management
- Production operation

Uncertainty in the Production Phase (cont.)





- The production geoscience concerns:
  - Facies distribution and its properties F, K…
  - Shape of structure
  - Faults, compartmentalisation, fractures…
  - Fluid contacts
  - 3D, 4D seismic

Uncertainty in the Production Phase (cont.)

- The reservoir management concerns:
  - Well performance
  - Reservoir pressure communication, fluid composition
  - Predicting the decline and water breakthrough
  - Assessing the drive mechanism
  - Reservoir response to different enhancements
  - Identifying un-swept area, new well locations

- The production operations concerns:
  - Commissioning the facilities (delay or underperforming)
  - Upgrading the existing facilities to maximise production

Uncertainty in the Late Phase

The technical challenges:

- Technical uncertainty is limited
  - A lot of data from the reservoir is available
  - Reservoir performance is recorded
  - Most of the facilities are in place and running
  - Further reservoir utilisation through EOR, CO2, changing depletion strategy,..

The commercial challenges:

- Commercial challenges run high
  - Decommissioning liabilities are expensive (decision not date), HC price
  - Situation became more fragile (little reserves to spread costs)
  - Challenge to reduce operational costs (keep production economic)
  - Old facilities and HSE
  - Possibility to extend the PSC licence
  - Strategic decisions (selling the field, change of exploitation strategy,..)
  - Offering services for another company (using the existing facilities)

Conclusions

- Uncertainty is due to both the technical and the investment nature of the petroleum projects (dynamic nature)
- The level of uncertainty is very high in the pre-discovery stage
- Although more is revealed about the reservoir as the field matures, the commercial challenges might increase at the late stages of project life

Thank You