Minerals Management Service

Resource Evaluation Process

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Outline

- Data and Information Available to MMS for Resource Evaluation
- Overview of Methodology
- Current Estimates
- Update/Revision Schedule

Resource Evaluation

- Are Oil and/or Gas Accumulations Present
- If They are Present, How Large are They
- How Much is Economically Recoverable

Data and Information Available to MMS for Resource Evaluation

- Public Data Sources
  - Literature
  - USGS, State Agencies
  - Purchase of well logs and seismic data (includes state and foreign i.e. Canada, and Mexico)
- Proprietary Data Sources
  - Pre-lease
  - Post-lease

Data and Information Available to MMS for Resource Evaluation contd.

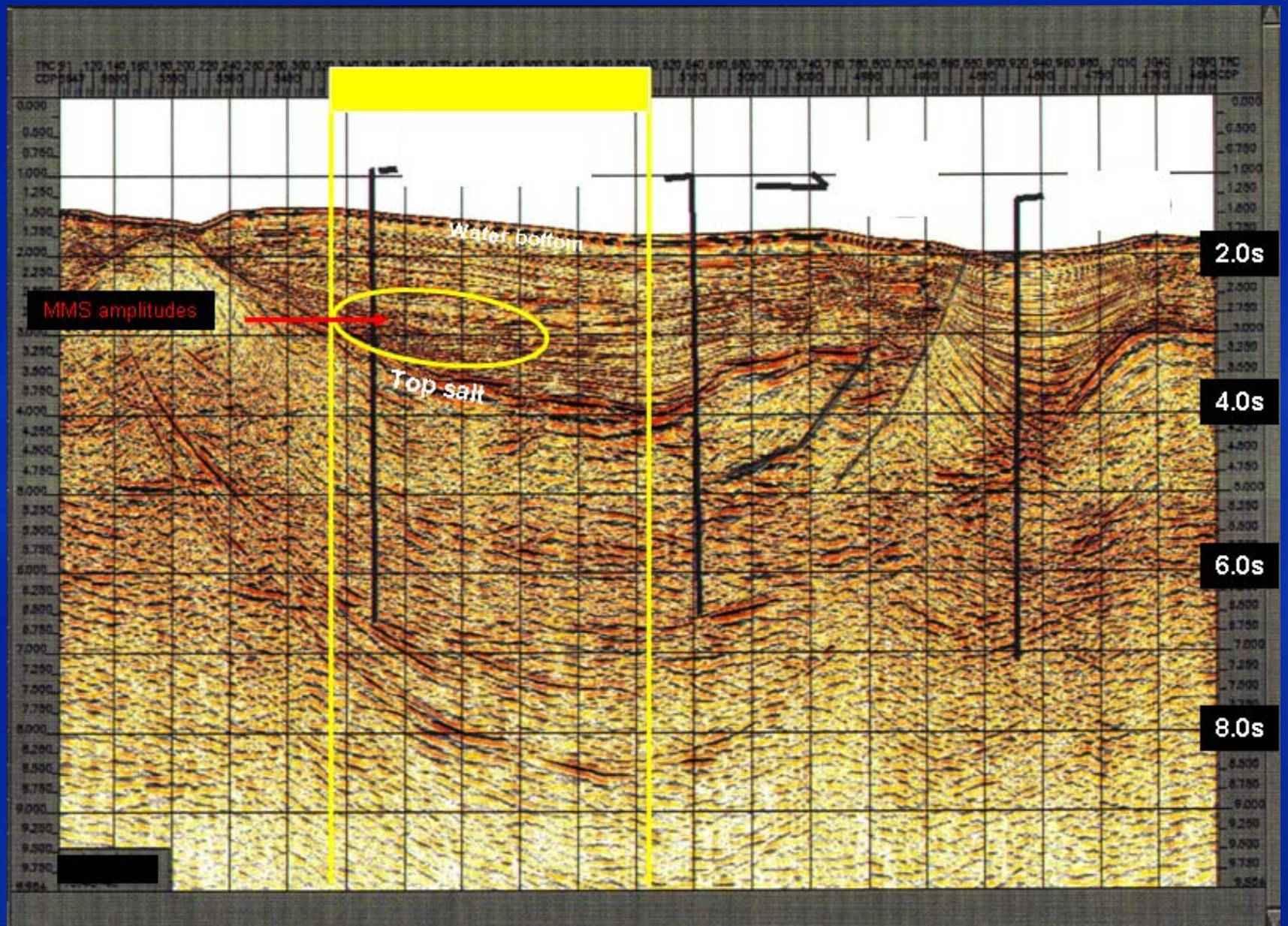
- Pre-Lease Data
  - Industry gathering of data (mostly seismic) is a normal part of the pre-lease process.
- Acquired Through MMS Permit
  - Available for MMS Inspection
  - Available to MMS for cost of reproduction
  - Used for Lease Sales and all other evaluations
  - Types of data
  - Technological advances in data

Data and Information Available to MMS for Resource Evaluation contd.

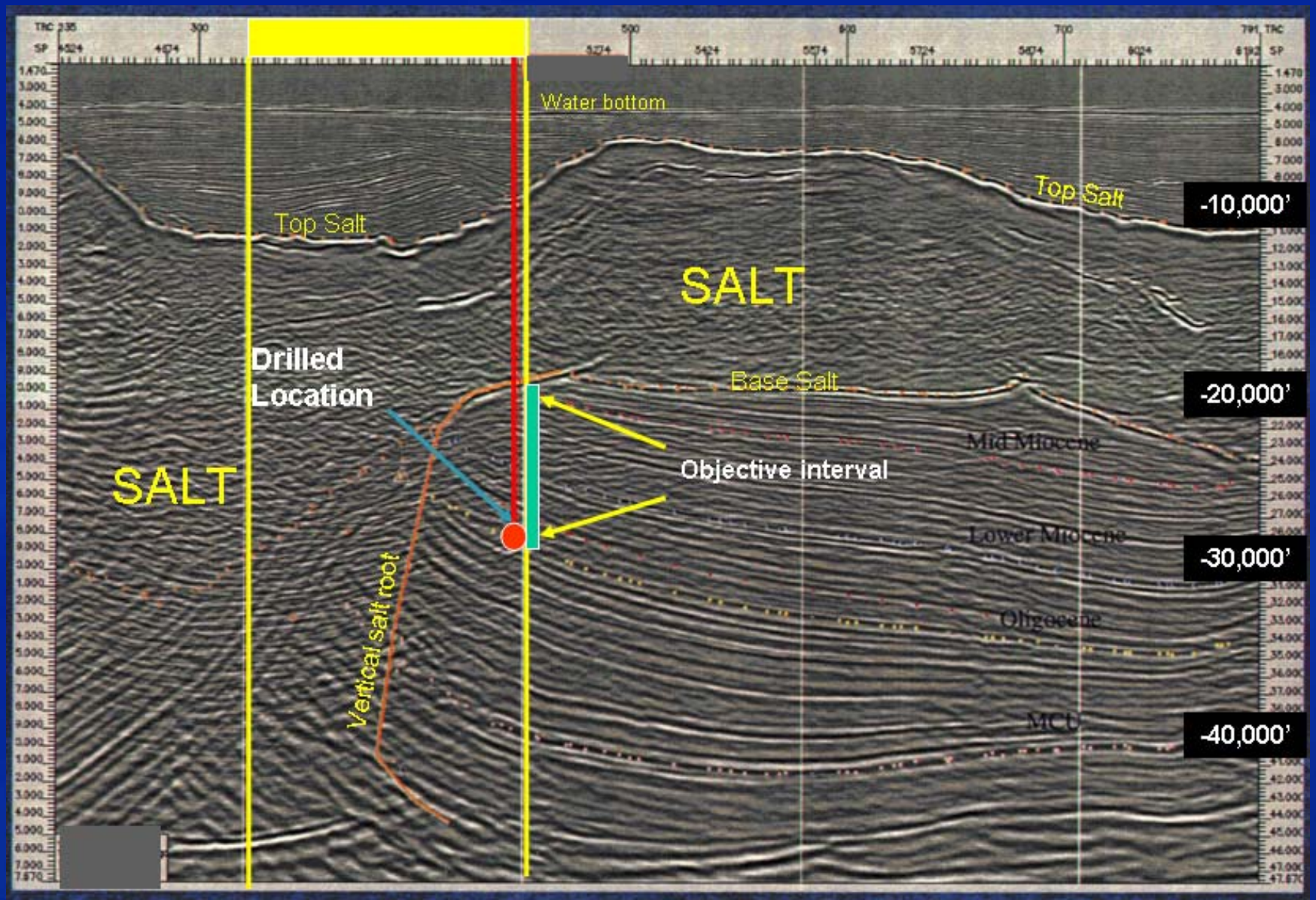
- What we can tell with this data
- Data is made available to the public after proscribed time period

- Post-Lease Data
  - Acquired through lease agreement
  - Consists of all data from wells, all production and injection data, seismic data shot on-lease
- G&G Data Budget
  - Mostly pre-lease seismic data purchased
  - ~ $1 million / year, mostly for GOMR

1990's Seismic Data



2000's Seismic Data



Resource Classification Nomenclature

- Resources
  - Concentrations of naturally occurring liquid or gaseous hydrocarbon that conceivably can be discovered.
  - Undiscovered Resources
    - Hydrocarbons estimated on the basis of geologic knowledge and theory to exist outside of known accumulations.
  - Discovered Resources
    - Hydrocarbons whose location and quantity are known or estimated from specific geologic evidence.

Resource Classification Nomenclature contd.

- Play (or Geologic Play)
  - A play is a group of geologically related hydrocarbon accumulations that share a common history of hydrocarbon generation, accumulation, and entrapment.

Overview of Methodology

- Assessment of hydrocarbon resources is a statistical analysis of geologic and geophysical data
  - Geological/geophysical analysis of area of interest
  - Play definition and analysis
  - Resource Assessment
- Results are estimates of undiscovered technically recoverable resources of the identified geologic plays

Overview of Methodology contd.

- These results are subject to a separate economic and engineering analysis to estimate the undiscovered economically recoverable resources for the assessment area.

Geological / Geophysical Analysis

- Identifies areas of hydrocarbon potential
- Ascertains the areal and stratigraphic extent of potential petroleum source rocks, reservoir rocks, and traps within these areas
  - Published and Proprietary reports and information compiled
  - Exploratory well and seismic reflection profiles identify potential reservoirs, reservoir rock properties, potential traps

Play Definition

- Involves the identification, delineation, and qualitative description of a body of rocks that potentially contains geologically related hydrocarbon accumulations
- A group of hydrocarbon accumulations within a properly defined play can be considered as a single entity for statistical evaluation

Play Map

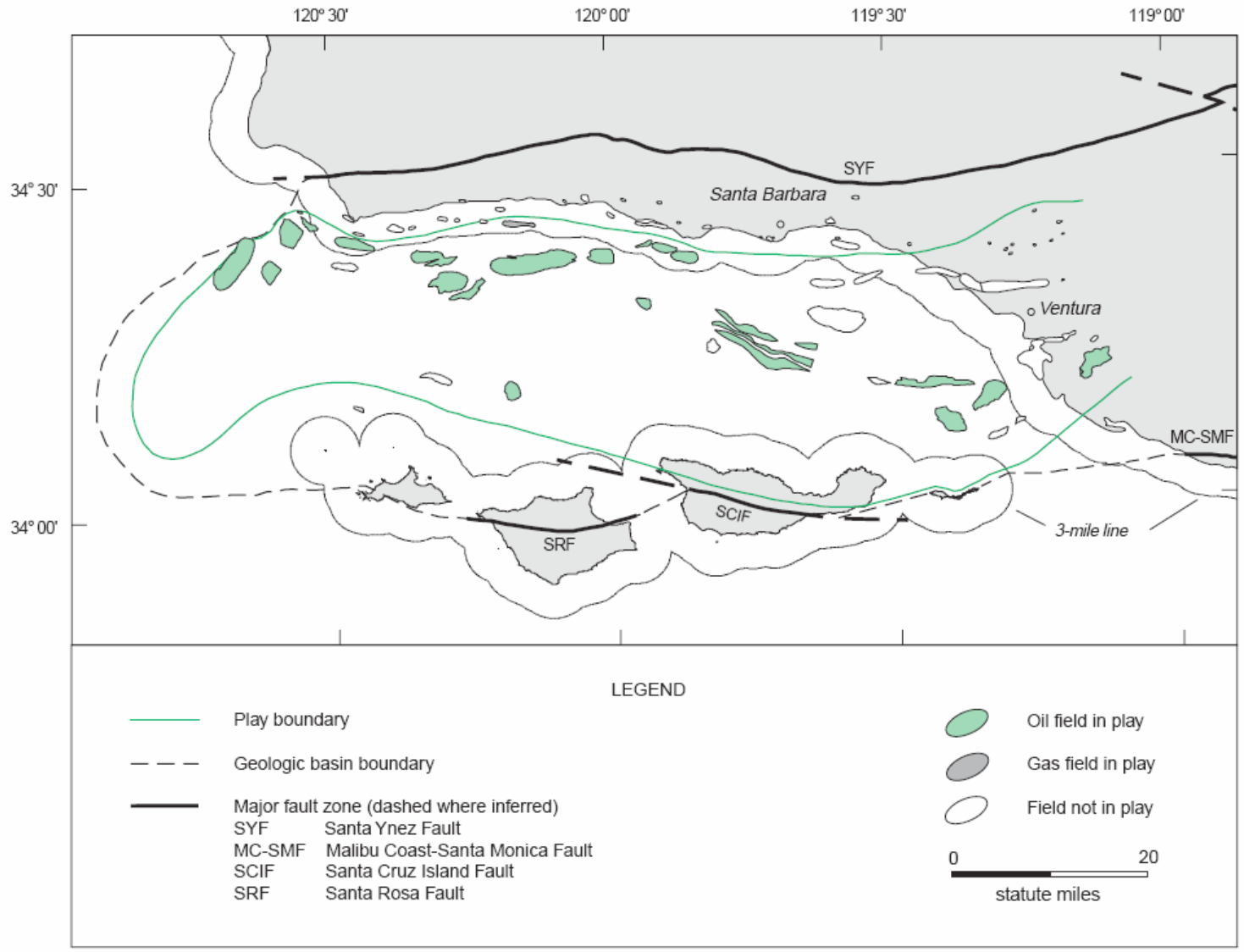


Figure 77. *Map of the Monterey Fractured play, Santa Barbara-Ventura basin showing select fields.*

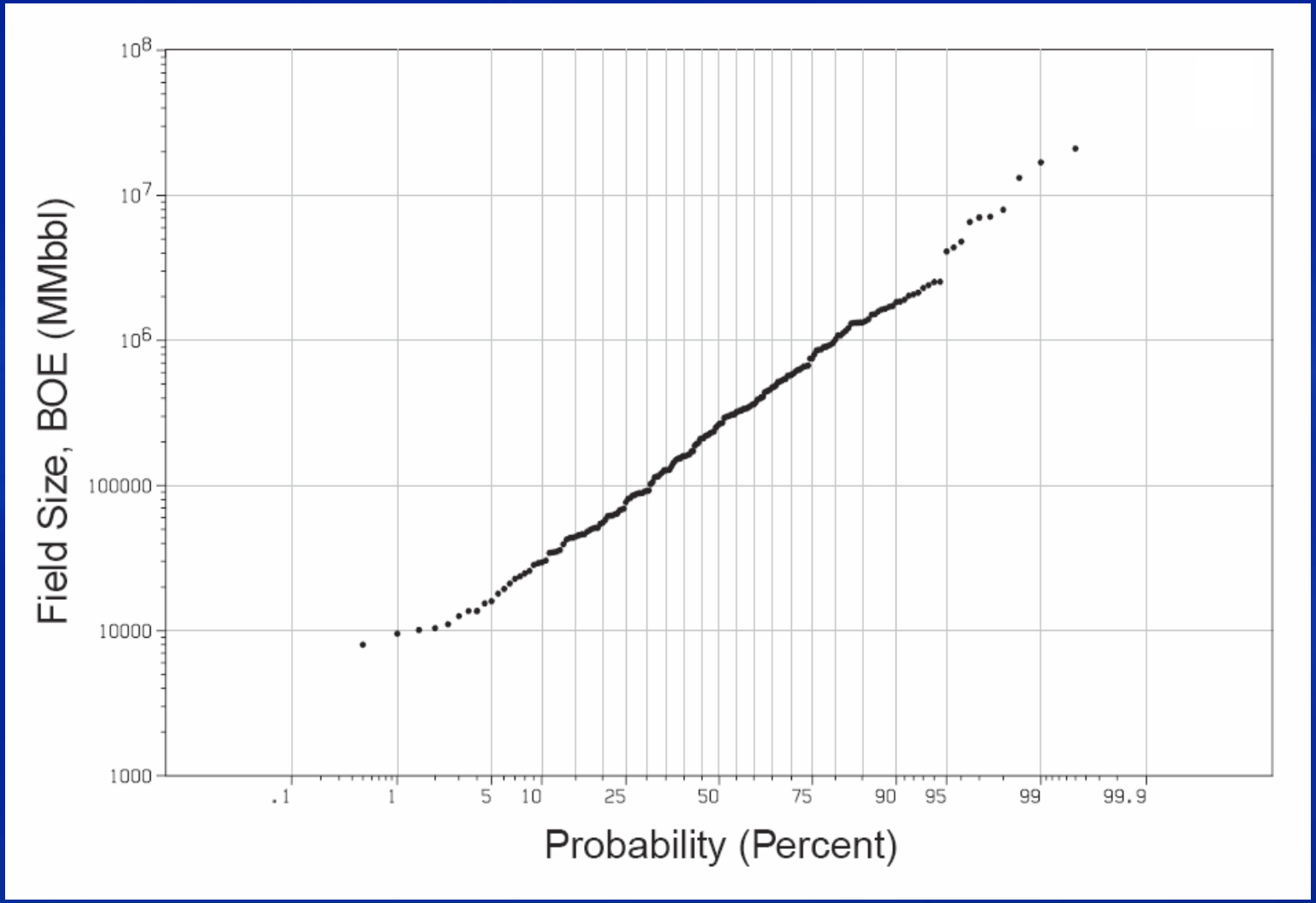
Play Analysis

- Quantitative description of parameters relating to the volumetric hydrocarbon potential of the play
- Expressed in the form of probability distributions which reflect our uncertainty about the specific value
- Taken together these parameters describe the volumetric resource potential of the play assuming the play actually contains hydrocarbons

Play Analysis contd.

- In addition plays are assigned success probabilities (risk) based on discovery status and subjective evaluation of the components necessary for success (source, reservoir, and trapping)
- Risk (success) vs. Probability
  - Play Risk
  - Prospect Risk

Field Size Distribution



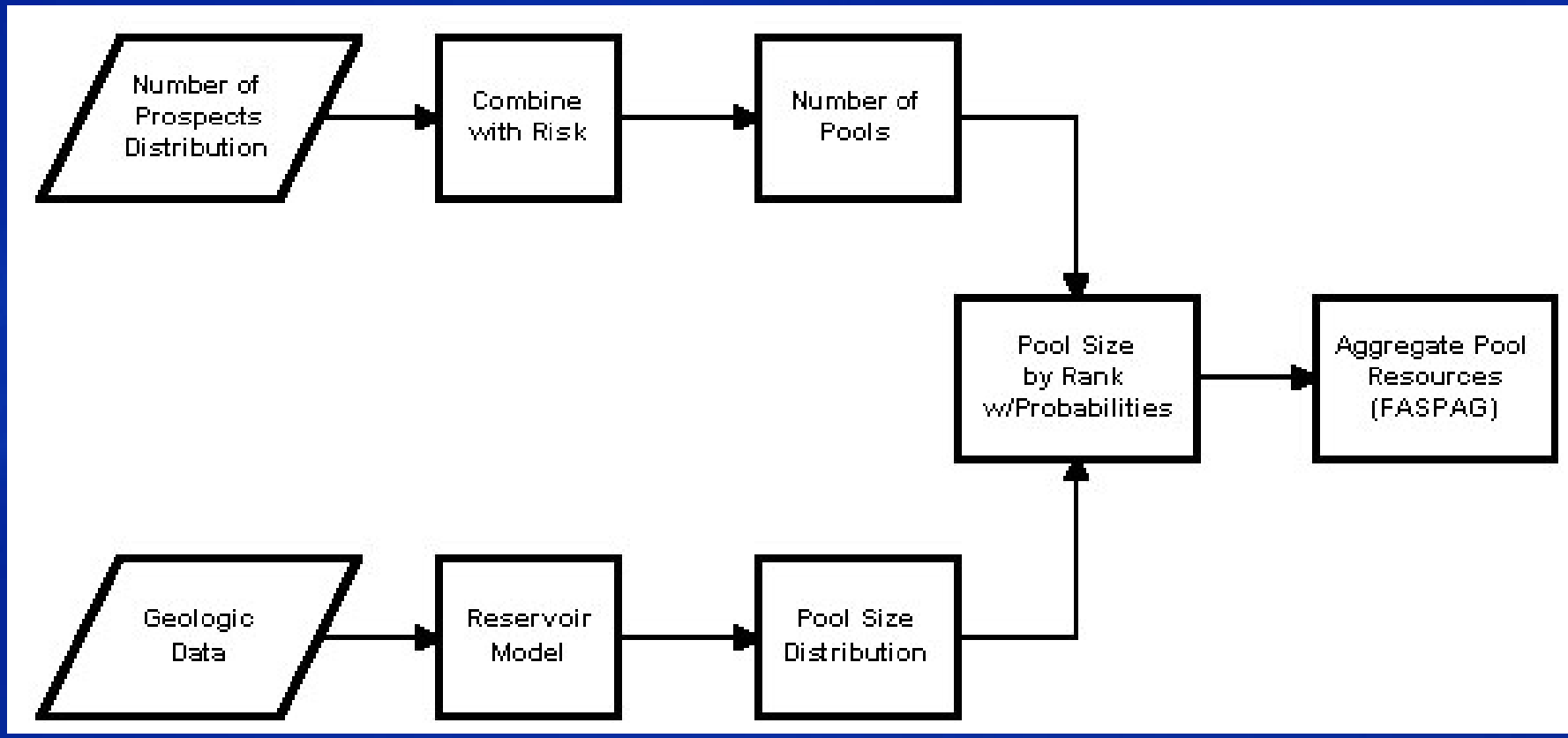
Resource Assessment

- Based on the geological information developed in the Geology and Play Analyses described above
  - Both Technically and Economically Recoverable resource estimates are generated
  - Uncertainty is handled through Probabilistic Methods
  - Uses computer model and based on assumption that within a properly designed play the size distribution of the entire population of accumulations (both discovered and undiscovered) will be lognormal

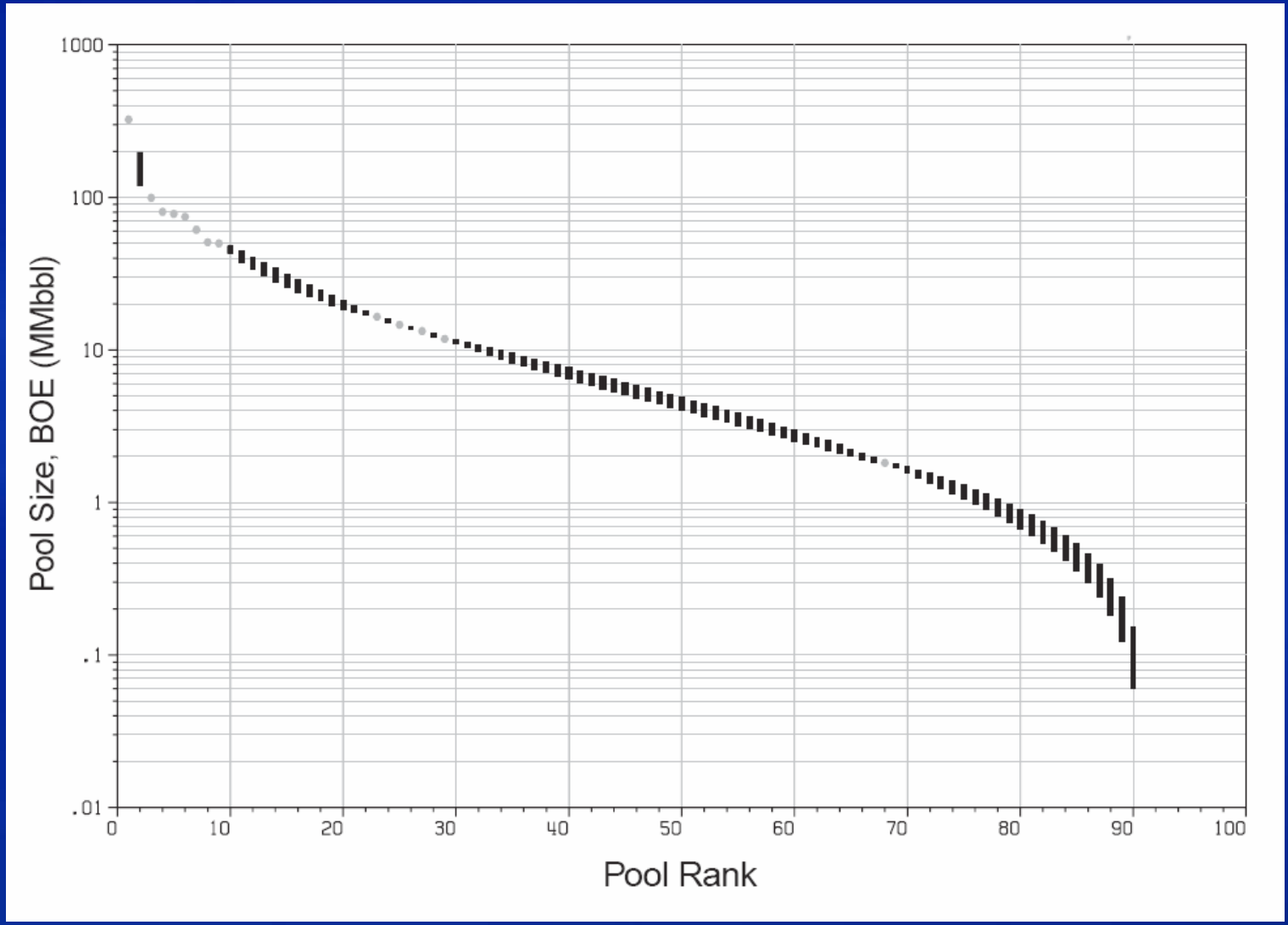
Resource Assessment contd.

- GRASP Model (*Geologic Resource ASessment Program*)
  - Estimates the size and number of undiscovered accumulations in a play
  - Calculates resources as a probability distribution
  - Plays without sufficient discoveries can be incorporated using analog field information
  - Repeatable results

GRASP Model - flowchart



Pool Rank Plot



Aggregation

- As a final step (for both technically and economically recoverable resources) the plays or assessment areas are statistically aggregated to higher levels, such as basin, planning area, region and nation

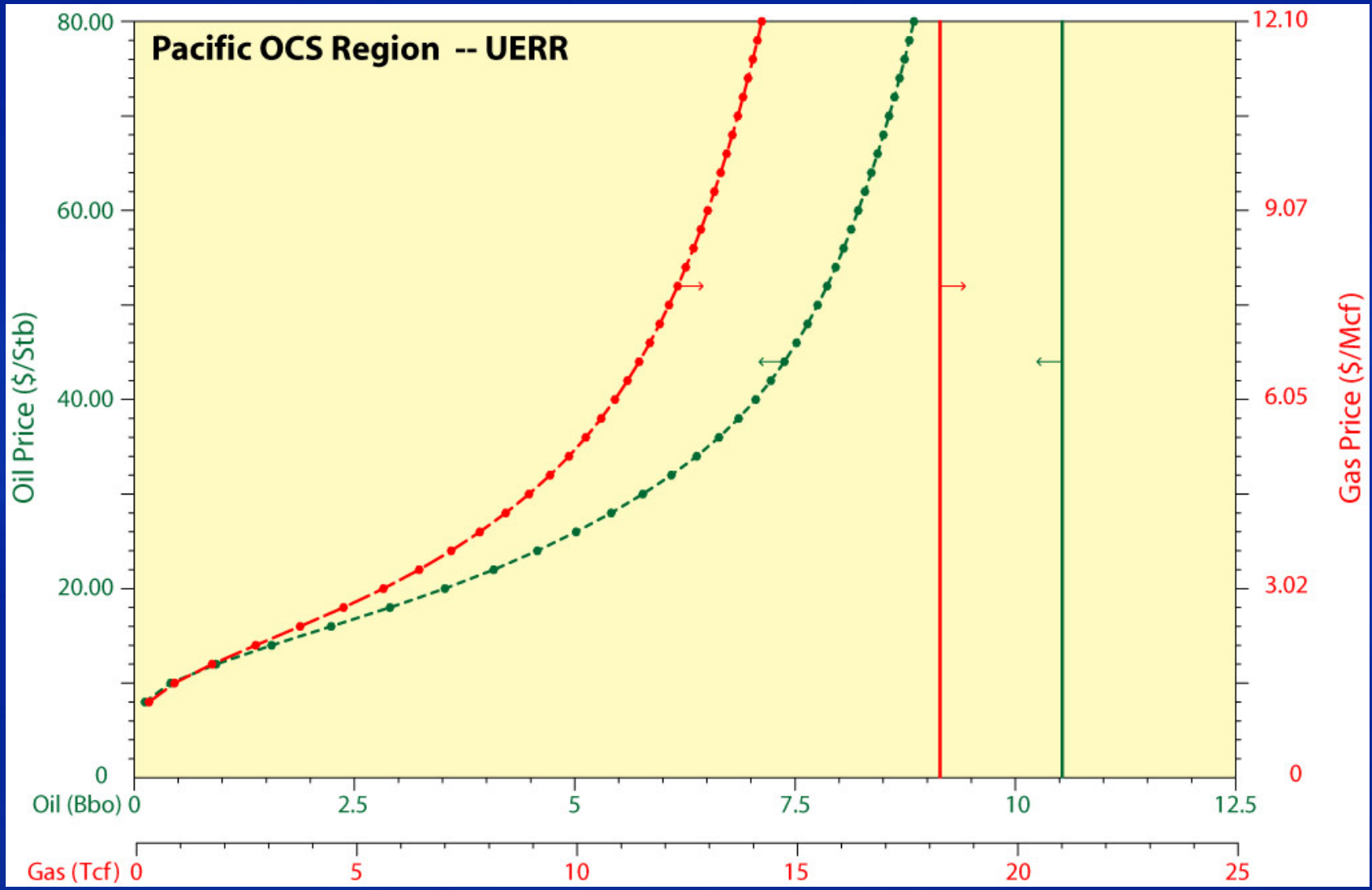
Economic Analysis

- Follows aggregation to the assessment area level
- Estimates portion of resources that could be profitably extracted over a range of commodity prices at the current level of technology
- Probabilistic based discount-cash flow model that simulates exploration, development, production, and delivery of the field resources in each assessment area

Economic Analysis contd.

- Uncertainties in oil and gas prices is handled by developing continuous series of estimates over a wide range of prices – expressed as price-supply curve
- Economic values are also aggregated to higher levels
- Costs can be adjusted relative to oil and gas prices

Price-Supply Curve



MMS Securing Ocean Energy & Economic Value For America

Assessment of Undiscovered Technically Recoverable Oil and Gas Resources of the Nation's Outer Continental Shelf, 2006

Using a play-based assessment methodology, the Minerals Management Service estimated a mean of 85.9 billion barrels of undiscovered recoverable oil and a mean of 419.9 trillion cubic feet of undiscovered recoverable natural gas in the Federal Outer Continental Shelf of the United States.

Figure 1. Federal OCS Areas of the United States.

Introduction

This report summarizes the results of the Minerals Management Service (MMS) 2006 assessment of the technically recoverable oil and gas resources for the U.S. Outer Continental Shelf (OCS) (see figure 1). The OCS comprises the portion of the submerged seabed whose mineral estate is subject to Federal jurisdiction. The 2006 assessment represents a comprehensive appraisal that considered relevant data and information available as of January 1, 2003, incorporated advances in petroleum exploration and development technologies, and employed new methods of resource assessment.

This assessment provides estimates of the undiscovered, technically and economically recoverable oil and natural gas resources located outside of known oil and gas fields on the OCS. It considers recent geophysical, geological, technological, and economic information and utilizes a probabilistic play-based approach to estimate the undiscovered technically recoverable resources (UTRR) of oil and gas for individual plays. This methodology is suitable for both conceptual plays where there is little or no specific information available, and for developed plays where there are discovered oil and gas fields and considerable information is available. After estimation, individual play results are aggregated to larger areas such as basins and regions. Estimates of the quantities of historical production, reserves, and future reserves appreciation are presented to provide a frame of reference for analyzing the estimates of UTRR.

More detailed information about the geology, assessment methodology, and economics will be published in separate regional assessment reports.

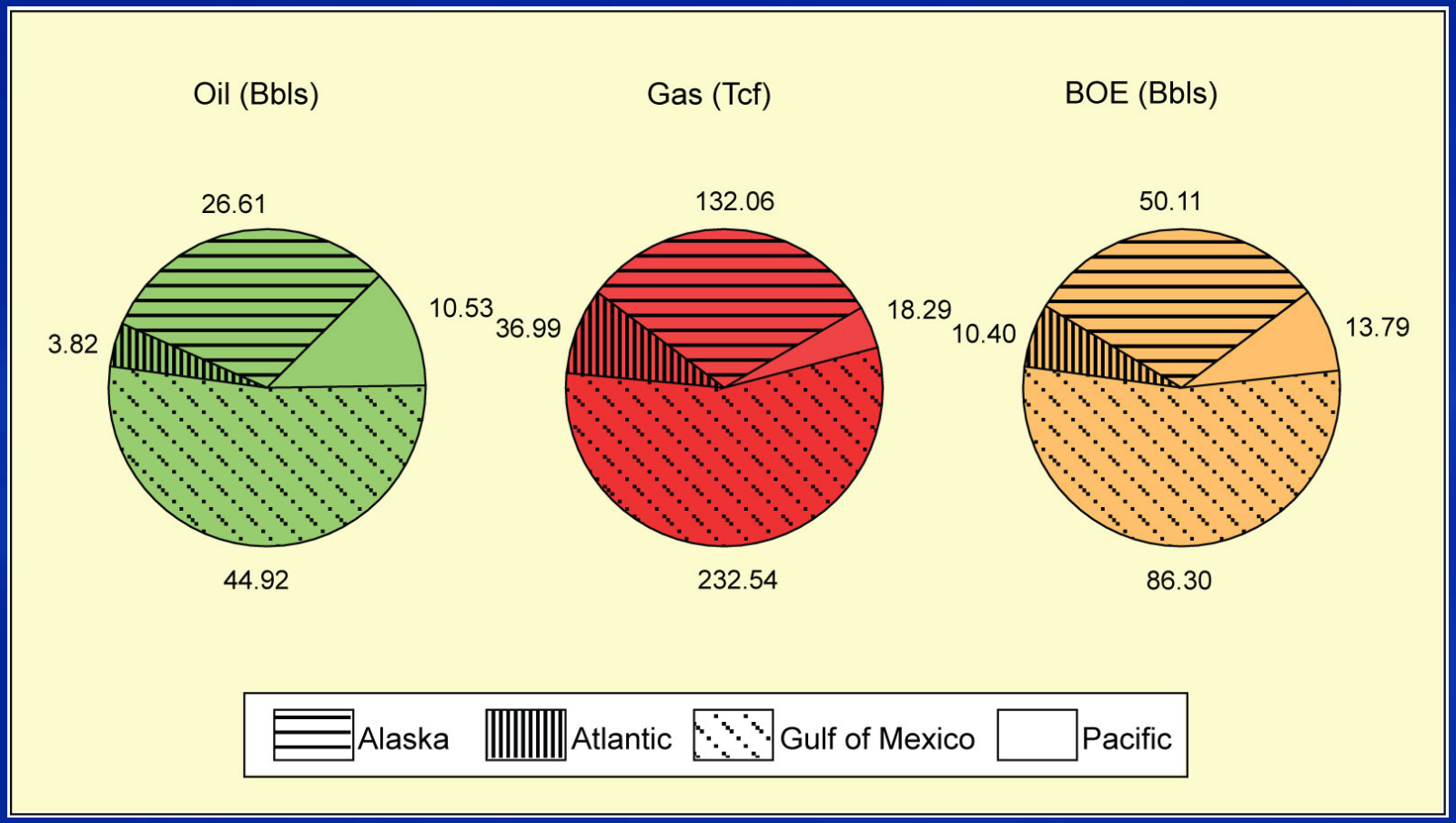
Commodities Assessed

The petroleum commodities assessed in this inventory are crude oil, natural gas liquids (condensate), and natural gas that exist in conventional reservoirs and are producible with conventional recovery techniques. Crude oil and condensate are reported jointly as oil; associated and nonassociated gas are reported as gas. Oil volumes are reported as stock tank barrels and gas as standard cubic feet. Oil-equivalent gas is a volume of gas (associated and/or nonassociated) expressed in terms of its energy equivalence to oil (i.e., 5,620 cubic feet of gas per barrel of oil) and is reported in barrels. The combined volume of oil and oil-equivalent gas resources is referred to as barrel of oil-equivalent (BOE) and is reported in barrels.

This assessment does not include potentially large quantities of hydrocarbon resources that could be recovered from known and future fields by enhanced recovery techniques, gas in

http://www.mms.gov/revaldiv/RedNatAssessment.htm

2006 UTRR



Undiscovered Technically Recoverable Resources by Type and Region

Update/Revision Schedules

- Timing for Major Assessments are Driven by 5-Year Program Schedule
  - New resource assessment will guide initial 5-Year program planning
  - Updates will be done mid-program or as needed