Technology Modeling In EIA's New Oil & Gas Model

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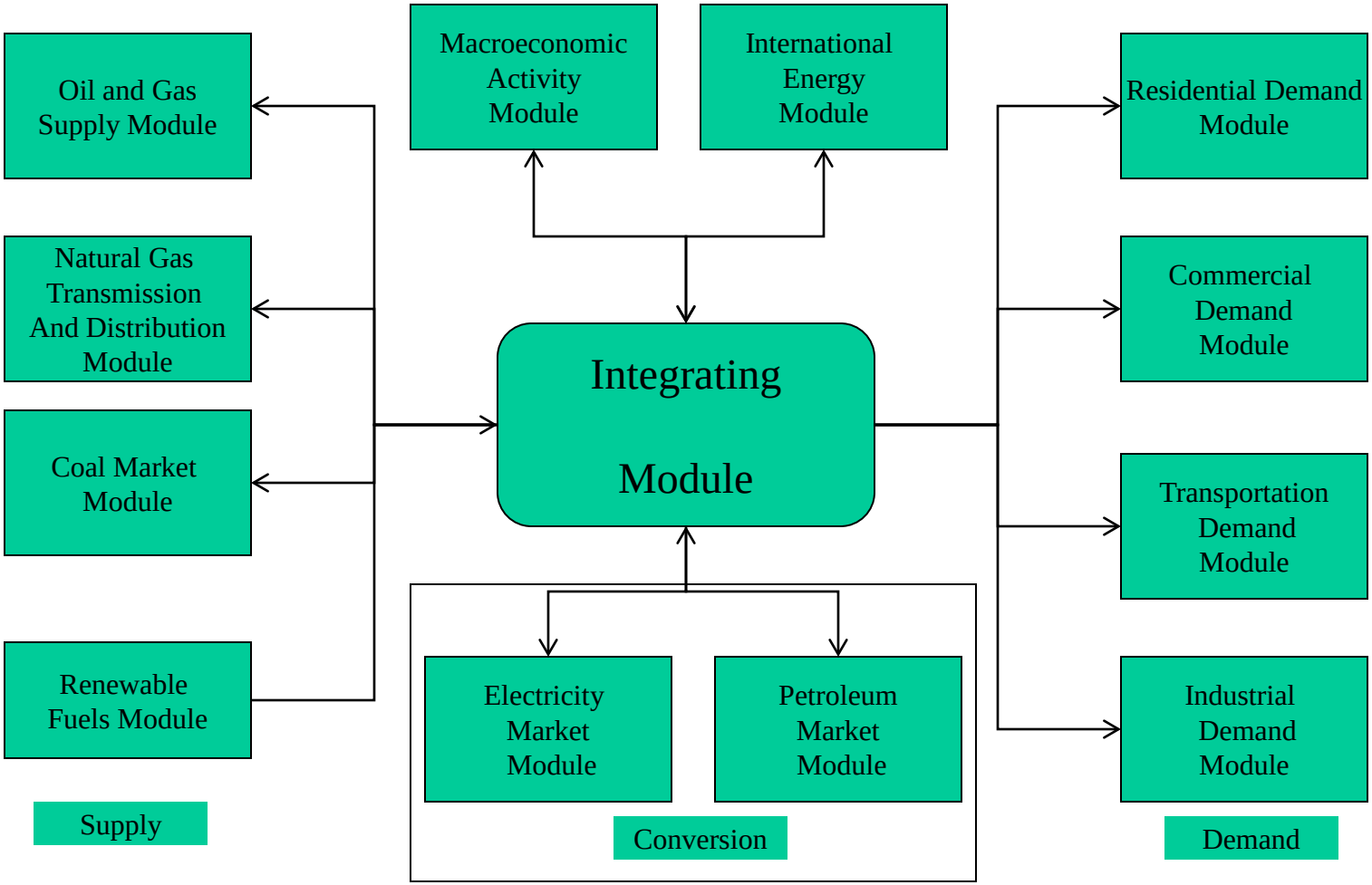
AGENDA

- Scope of EIA's NEMS Model
- Overview of Onshore Lower 48 Oil & Gas Model
- Technology Modeling in OLOGSS
- Effects of R & D Improvements
- Summary

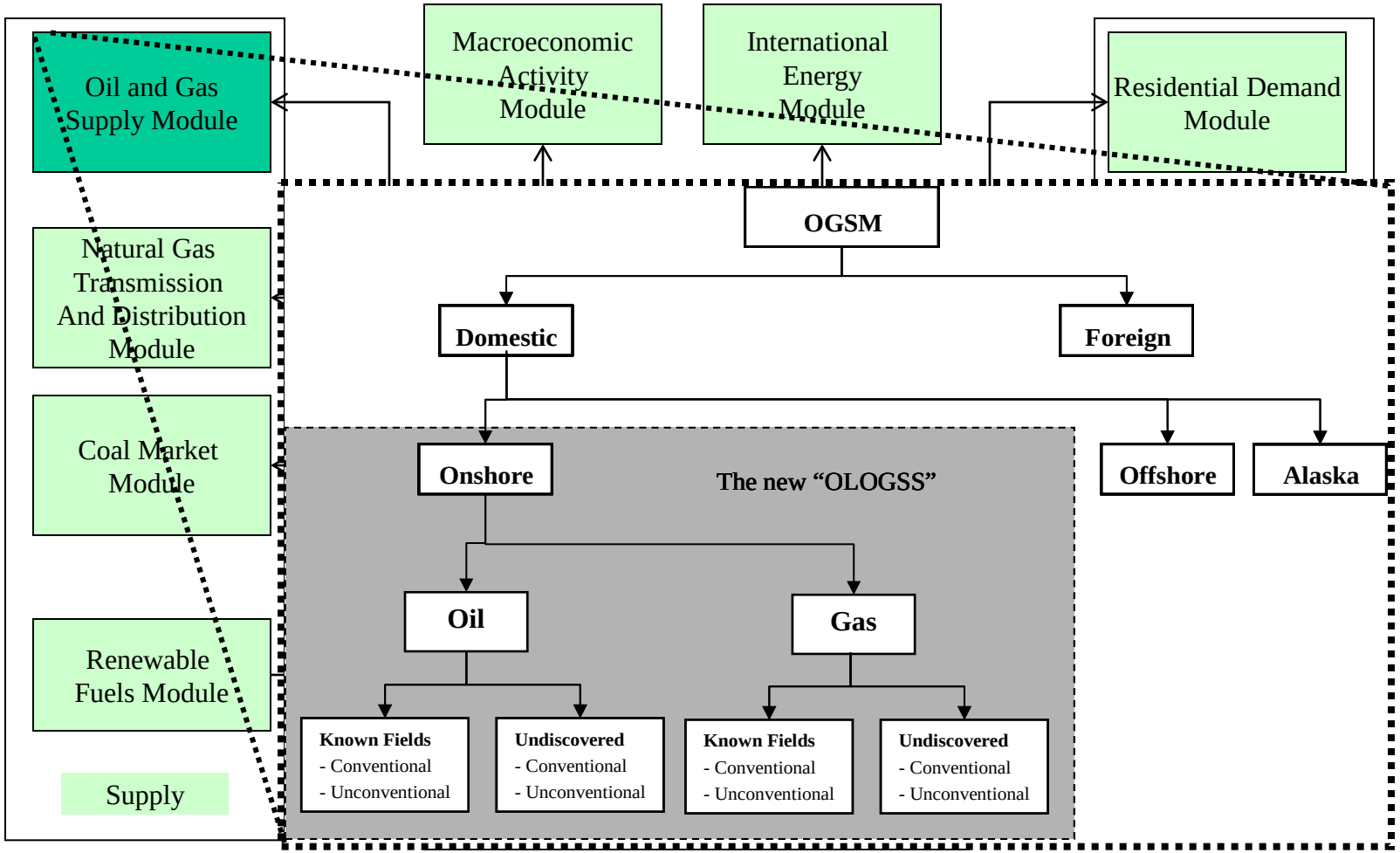
EIA NEMS Model



Analytical Capabilities of NEMS

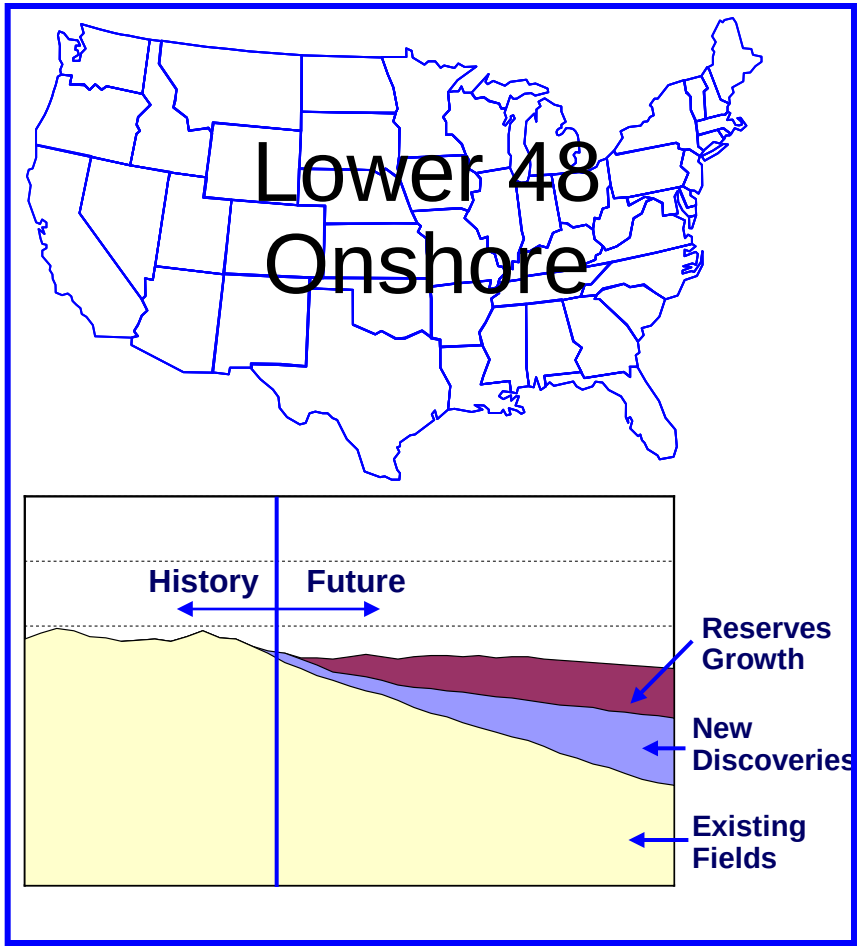
- Impacts On The Production And Price Of Crude Oil And Natural Gas Resulting From Improvements In Explorations And Production Technologies.
- Responses Of The Energy And Economic Systems To Changes In World Market Conditions As A Result Of Changing Levels Of Foreign Production And Demand In The Developing Countries.
- Impacts Of New Technologies On Consumption And Production Patterns And Emissions.
- Impacts Of Existing And Proposed Energy Tax Policies On The U.S Economy And Energy Systems.
- Effects Of Specific Policies, Such As Standards Or Renewable Tax Credits, On Energy Consumption.
- Impacts Of Energy Prices, Energy Consumption, Electricity Generation In Response To Carbon Mitigation Policies Such As Carbon Fees, Limits On Carbon Emissions, Or Permit Trading Systems.

New Onshore Lower 48 Oil & Gas Model (OLOGSS)

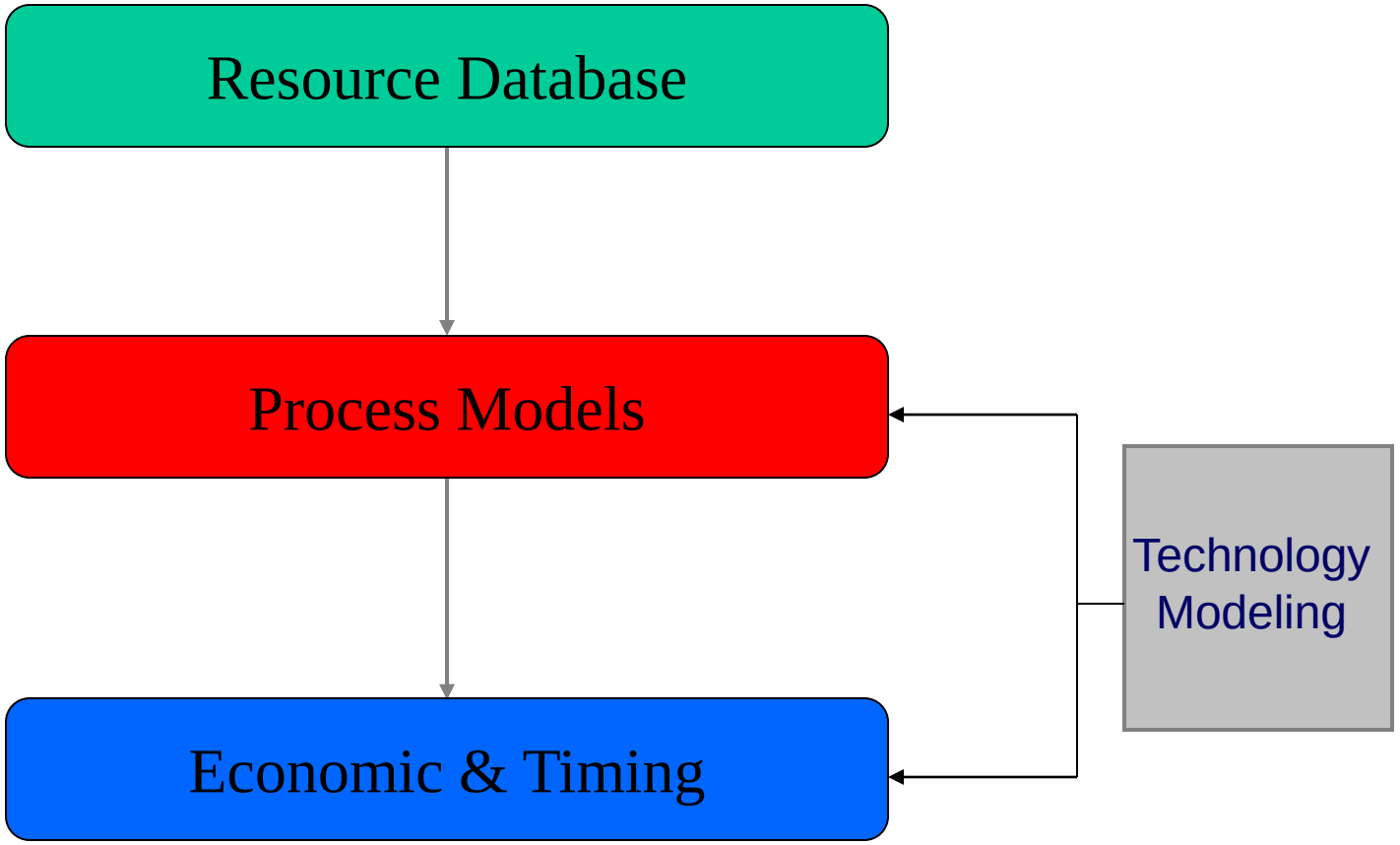


Capabilities of OLOGSS

- Model Entire Oil & Gas Resource in Lower 48 States
  - Conventional
  - Unconventional
    - Tight Sand
    - Oil Shale
    - Continuous Formations, etc
- Ability to Model
  - Technology Change / Improvements
  - Land Access Issues
  - Legislative Policy Issues (Royalty Relief, Tax Credits, etc)



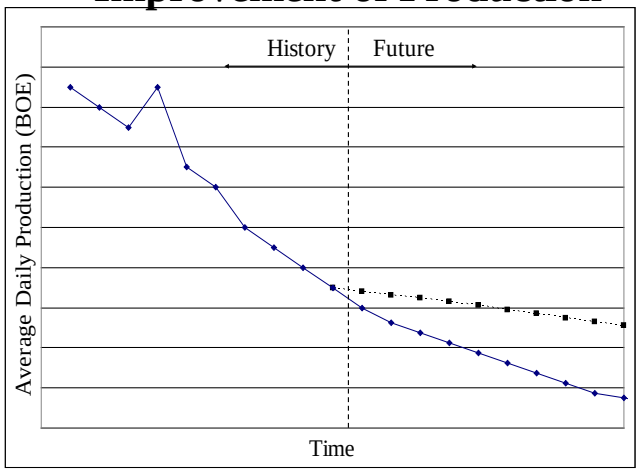
Overview Of System Logic



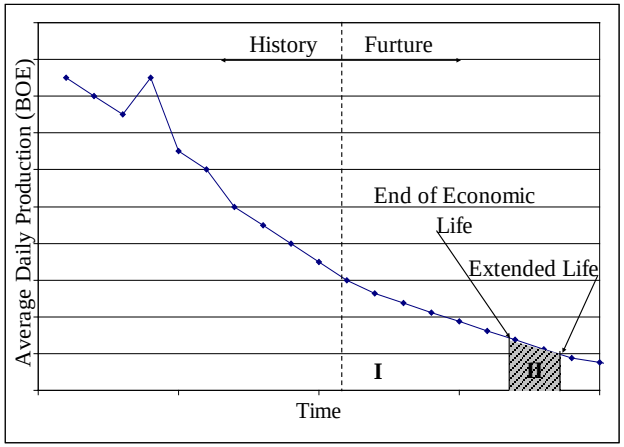
Effect of Technology Advances

- Three Major Effects:
- Effect on Overall Production Profile of the Resource
- Effect on Economics of the Resource
- Combination of Both

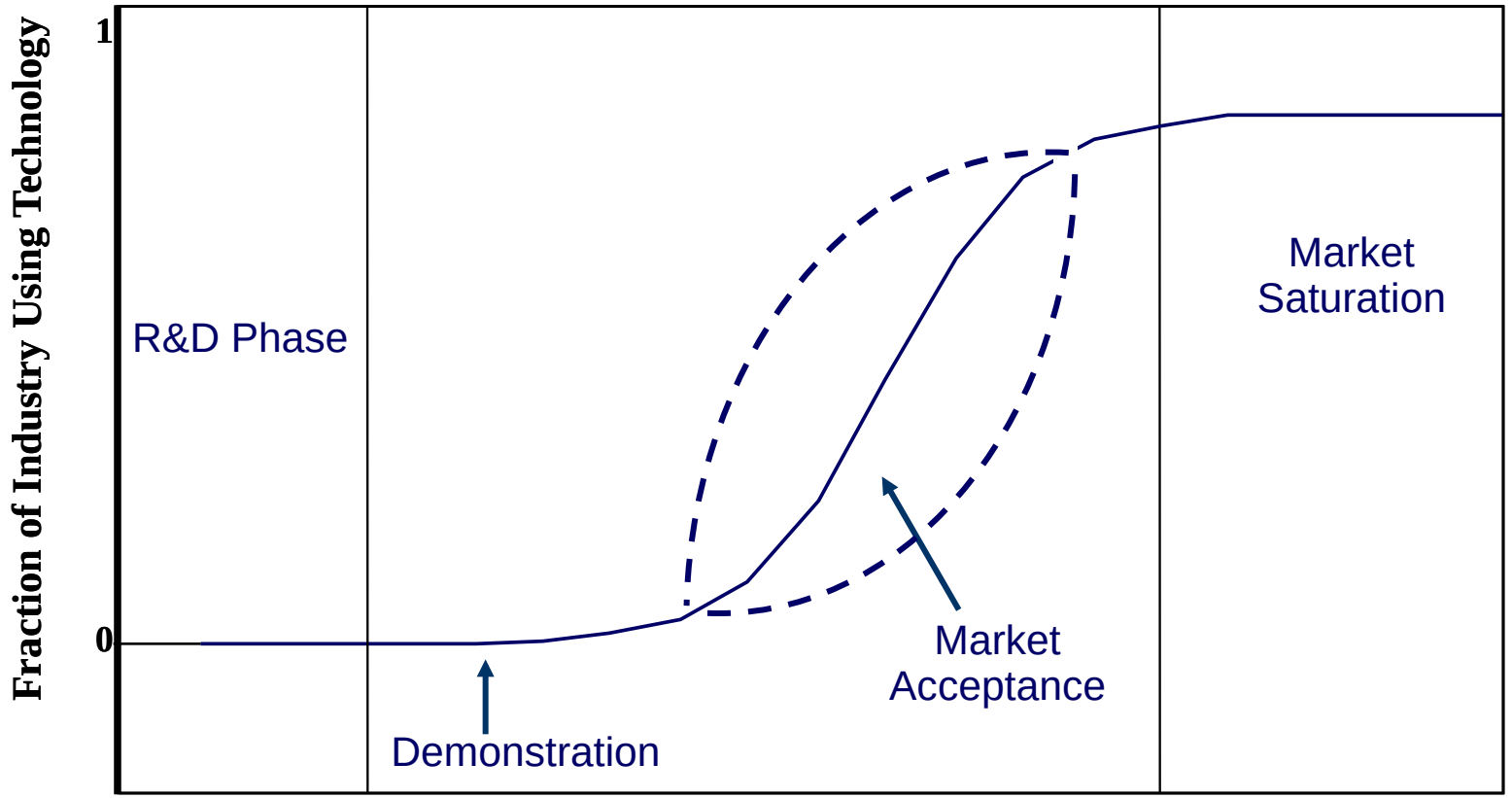
Improvement of Production



Improvement of Project Economics



Three Phases of Technology Development:



Possibilities of Phase Outcomes

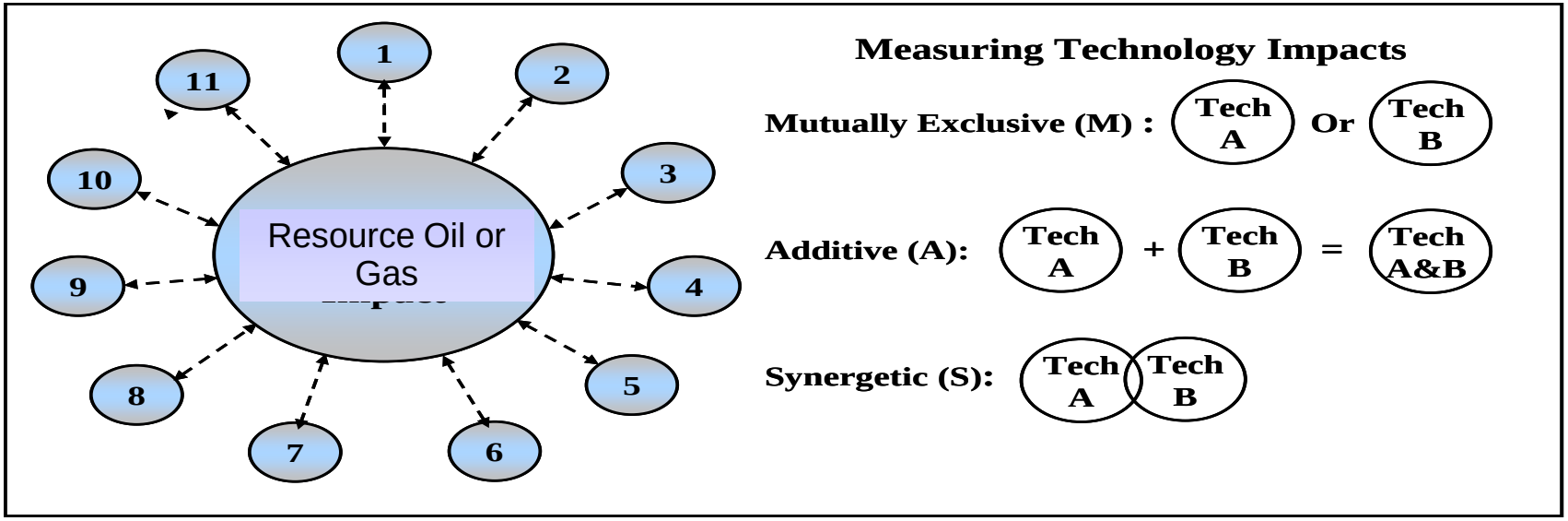
- RD & D Phase (Outcome)
- -Technology May be a Success
- -Technology May be Unsuccessful
- - Performance May be a fraction of Targeted Goals

Chances of Success

- Implementation Phase
- -Effective or Not Effective
- -Lack of Understanding
- -Lack of Access to Technology

Market Acceptance

Impacts of Multiple Technologies



Example:

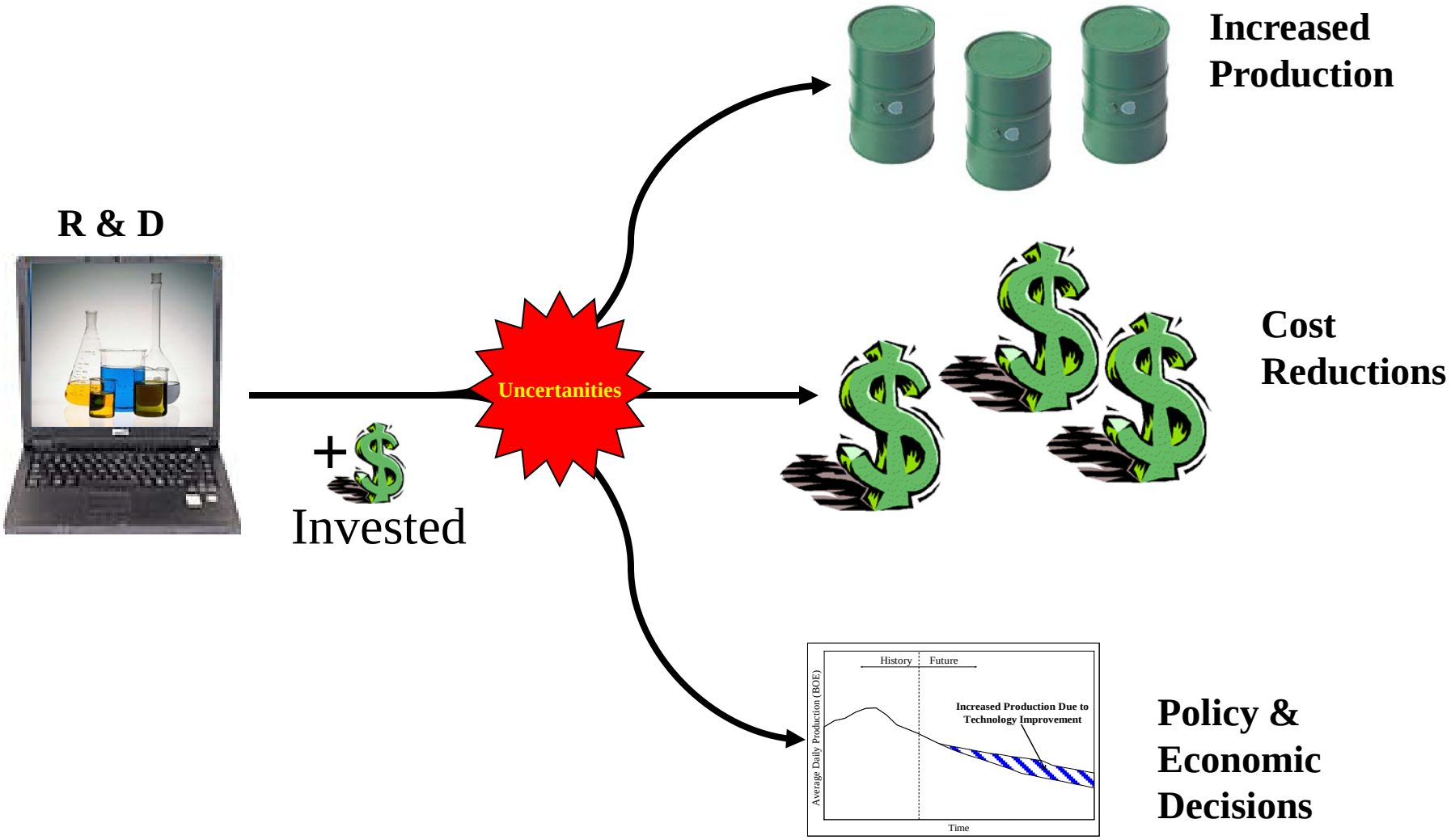
- Reservoir Characteristics Help Improve Production by 15%
- Drilling Bit Improvements Help Reduce Drilling Cost by 10%

These Technologies are Mutually Exclusive, Additive, and/or Synergetic

Why We Are Here

- To Identify Technologies/ Technology Groups
- Discuss Possible Outcomes of Such Technologies
- Suggest Target Improvement
- Market Acceptance & Possibility of Success

Technology Development Path



Technology Groups

A. Reservoir Characterization/Management

B. Drilling/Completion

C. Stimulation/ Fracturing

D. Specific Processes

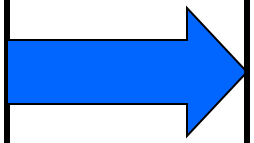
A: Reservoir Characterization / Management

APPLICABLE RESOURCES

CONVENTIONAL		UNCONVENTIONAL	
OIL	GAS	OIL	GAS

R & D FOCUS

- Seismic 4D
- Geological Modeling
- Logging Tools
- Downhole Sensors
- Reservoir Simulators
- Project Management



POSSIBLE OUTCOMES

- Decrease Dry Hole rate
- Increase Resource Recovery
- Optimize Productivity
- Define Reservoir Heterogeneity
- Increase Resource Accessibility
- Optimize Well Planning & Construction
- Reduce Operating Cost

A: Reservoir Characterization / Management Targets

** % of Total Operating Cost

R & D Focus	Possible Outcomes	Target (%)	Market Acceptance	Probability Of Success %	Cost to Apply Technology (%) **
• Seismic 4D	- Reduce Dry Hole Rate - Increase Resource Recovery	- 20 + 5-10	50-70	60-80	10
• Geological Modeling	- Define Reservoir Heterogeneity - Optimize Productivity	Qualitative + 4-6	60-80	80-90	2-4
• Logging Tools	- Define Reservoir Heterogeneity - Increase Resource Accessibility	Qualitative + 4-6	80-90	60-80	4-6
• Downhole Sensors	- Reduce Real Time and Cost - Optimize Productivity	- 6-8 + 4-7	50-60	50-70	6-8
• Reservoir Simulators	- Increases Resource Accessibility - Reduces Real-Time and Cost	+ 4-6 - 2-5	75-80	80-90	3-4
• Project Management	- Optimize Well Planning & Constructions	Qualitative	80-90	80-90	2-4

B: Drilling/ Completion

APPLICABLE RESOURCES

CONVENTIONAL		UNCONVENTIONAL	
OIL	GAS	OIL	GAS

R & D FOCUS

- Down Hole Seismic
- Drilling Cutters
- Drilling Fluids
- Down hole Logging While Drilling
- Advance Completion Techniques

POSSIBLE OUTCOMES

- Reduce Near Well bore Damage
- Increase Drilling Efficiency
- Increase Rate Of Penetration
- Improves Hole Quality and Reduce Rig Time
- Increase Multiple Zone Completion
- Reduce Economic & Technical Risk

B: Drilling/Completion Targets

** % of Total Operating Cost

R & D Focus	Possible Outcomes	Target (%)	Market Acceptance (%)	Probability Of Success	Cost to Apply Technology (%) **
• Down Hole Seismic	- Increase Accuracy of Formation Evaluation - Increase Resource Development	Qualitative “	50-70	65	7-9
• Drilling Cutters	- Increase Rate Of Penetration - Decrease Rig Time	+ 4-6 - 5-7	50-60	70	2-4
• Drilling Fluids	- Increase Drilling Efficiency - Reduce Drilling Cost	+ 4-7 - 6-8	50-70	55	2-4
• Down hole Logging While Drilling	- Stability in Pay Zone - Increase Drilling Efficiency	Qualitative “			
• Advanced Completion Techniques	- Multiply Zone Completions - Reduce Near WellBore Damage				

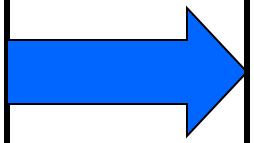
C: Stimulation/Fracturing

APPLICABLE RESOURCES

CONVENTIONAL		UNCONVENTIONAL	
OIL	GAS	OIL	GAS

R & D FOCUS

- Remote Sensors
- Natural Fracture Detection
- Advanced Stimulation Techniques
- Hydraulic Fracturing Techniques
- Well Bore Flow Modeling



POSSIBLE OUTCOMES

- Increase Resource Recovery
- Increase Target Efficiency
- Optimize Field Development
- Reduce Stimulation Cost
- Reduce Overall Cost
- Increase Production Rates, and Reduce Well Cleanup Times.

C: Stimulation / Fracturing Targets

** % of Total Operating Cost

R & D Focus	Possible Outcomes	Target (%)	Market Acceptance (%)	Probability Of Success (%)	Cost to Apply Technology (%) **
• Micro Hole Fracture Techniques	- Increase Resource Recovery - Increase Production Rates	+ 4-7 + 5-7	60	65	5-8
• Borehole Imaging	- Increase Target Efficiency - Reduce Stimulation Time	+ 2-3 - 6-8	55	60	5-6
• Advanced Stimulation Techniques	- Increase Target Efficiency - Increase Production Rates & Reduce Well Cleanup Times - Reduce Skin	+ 6-9 + 6-8 - 10	60	68	4-5
• Hydraulic Fracturing Monitors	- Increase Production Rates & Reduce Well Cleanup Times	+ 5-6	65	65	3-6
•Well Bore Flow Modeling	- Define Types Of Stimulation Required	Qualitative	62	60	2-4

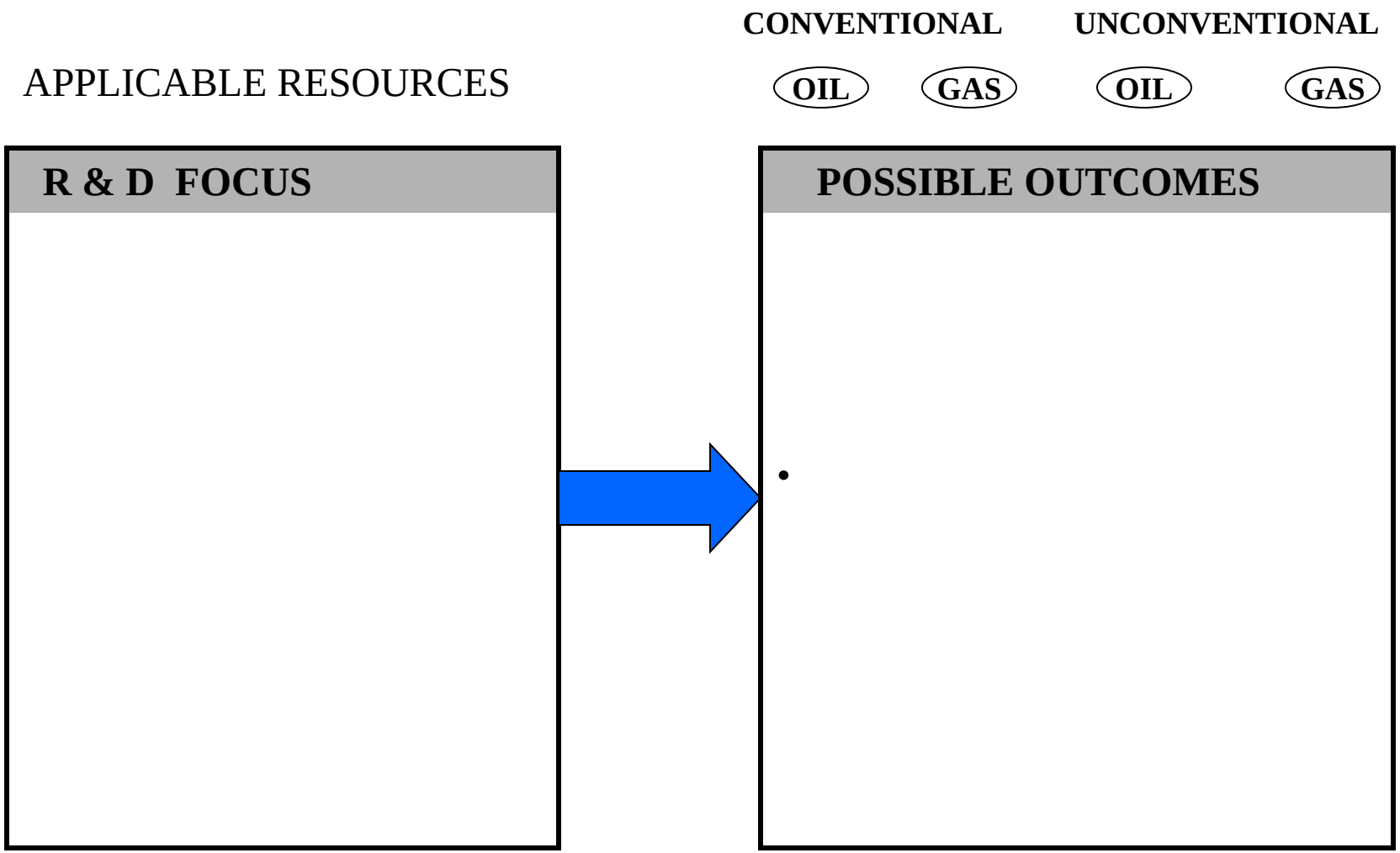
Specific Processes

- CO2 EOR
  - Increase Injection Rate ---> By How Much?
  - Volume of CO2 Injected
    - 0.4 HCPV – Normally Used
    - Is 1.0 HCPV or Higher – A new industry practice?
  - Use of Industrial CO_2
    - How soon do you think capture technologies can be commercialized
      - EIA assumes 4- 8 years depending on source of emission.
    - How much is the operator willing to pay for CO_2delivered at well head?

Summary

- All target improvements will be calculated in the process and timing models.
- Variables will be defined to address such target improvements.
- EIA expects to complete this model by June/July 2008
  - Testing and final results by September 2008
- EIA will present preliminary results to this committee in August 2008 for comments and suggestions.

Other Technologies Not Considered



Targets for Other Technologies

** % of Total Operating Cost

R & D Focus	Possible Outcomes	Target (%)	Market Acceptance (%)	Probability Of Success (%)	Cost to Apply Technology (%) **