Why, What, and How of Industry/Government Partnership

August 22, 2002

John Rogers, Project Manager
Gas Supply Projects Division

Fossil Energy: America’s Energy Foundation

1999
96.1 Quads

Fossil fuels provide 85% of energy (67% of electricity)

2020
127.0 Quads

By 2020, reliance on fossil fuels could grow to 90%

Source: AEO 2001, Table A1

Strategic Center for Natural Gas
America’s Energy Future

- By 2020 Important Energy Efficiency Gains will be realized
- The U.S. will still need to increase energy supply by 30 quads
- Oil and gas will supply 24 quads or 80%
- Under Clear Skies Initiative 80% of all new power capacity will be derived from natural gas

Natural Gas Supply and Deliverability

*Era of “Cheap” Gas May Be Over*

- Supply cushion since mid-1980’s eroded
  - US supply flat past 5 years
  - 2-3%/year demand growth
  - Spot market prices up 4-fold over past year
- T&D infrastructure stressed
  - Need $120-150 billion investment to expand system
- Supply concerns
  - Rapid decline for new wells
  - Smaller field in GOM
  - Imports of Canadian gas/LNG up from 4% in mid-1980s to 15%
- Projected 60% demand growth to 2020
U.S. Federal Lands Contain Large Potential for Raw Energy Sources

- 40% gas production
- 30% oil production
- Over 50% of the remaining resources are located under Federal Lands, onshore and offshore

Government Lands Often “Environmentally Sensitive”

©1995 National Wilderness Institute
National Energy Policy

- Increasing America’s domestic energy supplies
- Protecting America’s environment
- Ensuring a comprehensive delivery system
- Enhancing national energy security

Intense and Concerted Effort

- Find
- Drill
- Produce
Strategy

- Future Energy Resources
  - Long-term 10-20 year future energy benefit
  - Fundamental research
  - Long-term environmental goals
  - Huge potential payoff
  - Constituents: universities, energy companies, National Labs

Advanced Technologies Will Play A Crucial Role to Achieve these Energy Policy Goals
Today’s Technology Development Environment

Energy companies redistribute resources:

– Away from broad-based, long-term research
– Toward specific areas of short term opportunity

Result: abandonment of traditional R&D

National Issue: Under Investment In Energy Research

- Private-sector R&D off sharply
  – Investment by oil & gas producers down > 50% since 1992
  – Much antidotal evidence that remaining “research” mostly near-term
  – Independents have not had significant research
  – Service companies not sufficiently capitalized to do research

- Public-sector R&D off sharply
  – GTI’s (formerly GRI) funding disappearing
  – DOE’s energy supply budget is insufficient

Cheap energy over past century a result of technological advancements
Government Role in R&D

- **Why Government Funds R&D**
  - Fulfill a Federal mission
  - Help economy/society correct a market failure

- **Why Government Does Not Fund R&D**
  - Increase profitability
  - Reduce unit price

- **Why Market Fails**
  - R&D benefits do not accrue to sponsor

- **Why Energy R&D**
  - Environmental protection
  - Human health protection
  - Economic well being
  - Energy security

Technology Reducing Environmental Impact

*Natural Gas & Oil Supply*

- Fewer wells to add same level of reserves
- Lower drilling waste volume
- Lower produced water volumes
- Smaller footprints
- Greater protection of unique and sensitive environments
- Reduced air pollutants and greenhouse gas emissions
National Energy Technology Laboratory

- One of DOE’s 17 national labs
- Government owned/operated
- Sites in:
  - West Virginia, Pennsylvania, Oklahoma, and Alaska
- More than 1,100 federal and support contractor employees
- FY 02 budget of $770 million
- Primary focus is managing external Fossil Energy R&D
NPTO Program Areas

Gas E&P Program Mission

Develop technologies to help ensure an abundant, economical, domestic supply of natural gas with minimal environmental impact

30 - 35 TCF Demand by 2020
**NETL's FY 2002 Natural Gas Budget**

* $137 Million

- **Exploration & Production**: $21M
- **Gas Turbines**: $19M
- **Hydrates**: $10M
- **Stationary Fuel Cells**: $54M
- **Buildings (EE Programs)**: $23M
- **Infrastructure**: $10M

---

**Gas Exploration & Production Program Goals**

- **Recover more from existing fields** (Near-Term)
  - Effective Technology Transfer
  - Locate by-passed zones in conventional reservoirs
  - Enhance stripper well production
- **Exploit marginal/unconventional resources** (Mid-Term)
  - Reduce drilling cost
  - Improve success rates in finding gas in tight sands
  - Increase recovery efficiency
- **Encourage E&P of frontier resources** (Long-Term)
  - Deep (>20,000 feet) gas
  - Methane Hydrates
Drilling, Completion & Stimulation Objectives

- **Faster**
  - New bit technology & slim hole
  - Drilling Systems to destroy rock faster
- **Deeper**
  - High temperature & pressure
  - Develop smarter drilling systems
  - Increase penetration rates in hard rock
- **Cheaper**
  - Reduce cost of drilling in shale, low-perm, & deep water
  - Develop cheaper horizontal & multilateral wells
- **Cleaner**
  - Develop cost-effective, environmentally friendly drilling technologies to increase access to federal lands using a small footprint

Gas E&P Program Highlights

- **Deep Horizontal Well**
  - Intersected 400 open fractures at 15,000'
  - Produced over 6.4 bcf in three years
  - Encountered significant water
  - CD available

- **Water Identification Studies**
  - ARI conceptual water flow models for GGRB & WRB
  - IDT 3-D basin model for WRB
  - Overpressure zones, sweet spots, & gas water content
Gas E&P Program Highlights

- **Microwave Processing** - binding cutters to bits
  - Penn State University/Dennis Tool Co.
  - Dramatically longer-lasting bits
  - Applications to various other industries

- **Advanced Composite Drill Pipe**
  - ACPT
  - Half the weight of steel pipe, extend the capacity of current rigs and allow high speed data communication

- **Intellipipe**
  - Novatek/Grant Prideco
  - Steel drill pipe with high speed data communication capability

---

Gas E&P Developing Highlights

- **High-pressure jet assisted drilling system**
  - Integration for faster drilling of hard rock
  - Shallow and deep testing

- **Mud Hammer Optimization**
- **Downhole Mixing Technology**
  - Lower Horsepower Reduced cost 50%
  - Allows real time control
  - Licensed to Halliburton
  - SPE 77676 at 2002 SPE ATC

- **Ultra-lightweight cement**

- **Laser Drilling and Completion Research**
  - Long Term
Deep Trek Program

- **Purpose**
  - Develop drilling and completion technologies for very deep drilling (>20,000')

- **Status**
  - Roadmap workshop March 2001
  - Budget established in 2002
  - Solicitation issued February 2002
    - Round 1 complete
    - Round 2 proposals due November 2002

Partnerships Leverage Scarce R&D Funds

- **Research Partners**
- **Industry**
- **Government**
Partnership Approach

- Careful Planning with Significant Industry Input
  - Technology roadmaps; advisory committees; consortiums; merit reviews.
- Cost-shared R&D conducted with partners
  - Industry; federal agencies; National labs; universities.
- Modest budget
  - Approximately $30 Million/year
- Technology transfer
  - Successful field demonstrations; PTTC; Web Site; workshops; Gas TIPS.

Options for Industry Participation

- Advisory Committees
  - Hydrates program
- Roadmapping
  - Infrastructure, hydrates, and many others
- Cooperative Agreements
  - Joint industry projects, individual firms, etc.
- Consortiums
  - Advanced turbines, carbon products, SWC
- National laboratory partnership
  - NGOTP, hydrates, ultra-clean fuels
Competitive merit-based Solicitations

- **BBFA Broad Based Financial Assistance**
  - Broad technical applications in a specific program area
  - Several Times per year
- **Targeted Solicitation (example Deep Trek)**
  - Focused technical applications in a specific area
  - Example: Deep Trek
- **SBIR Small Business Innovative Research**

Proposals Need To Address

- Industry involvement
- Performance indicators
- Phases go/no-go decision points (Off ramps)
- Technological risk
- Clear public benefit
- Dollar value of public benefits
- Project Management
NETL Typical Scoring Criteria
Applied R&D Proposals

- Criteria are Clearly stated in the Solicitation
- Generally four Criteria
  - Scientific and Technical Merit
  - Technical Approach
  - Technical and Management Capabilities
  - Commercialization Potential and Benefits of Proposed technology to the U.S.
- Critical that all of the stated criteria be addressed

Technology Enables Both Affordable Energy for Economic Development and Environmental Protection
NETL Oil & Gas E&P Points of Contact

Strategic Center for Natural Gas

Brad Tomer
(304) 285-4692
brad.tomer@netl.doe.gov

National Petroleum Technology Office
Roy Long
(918) 699-2017
roy.long@npto.doe.gov