



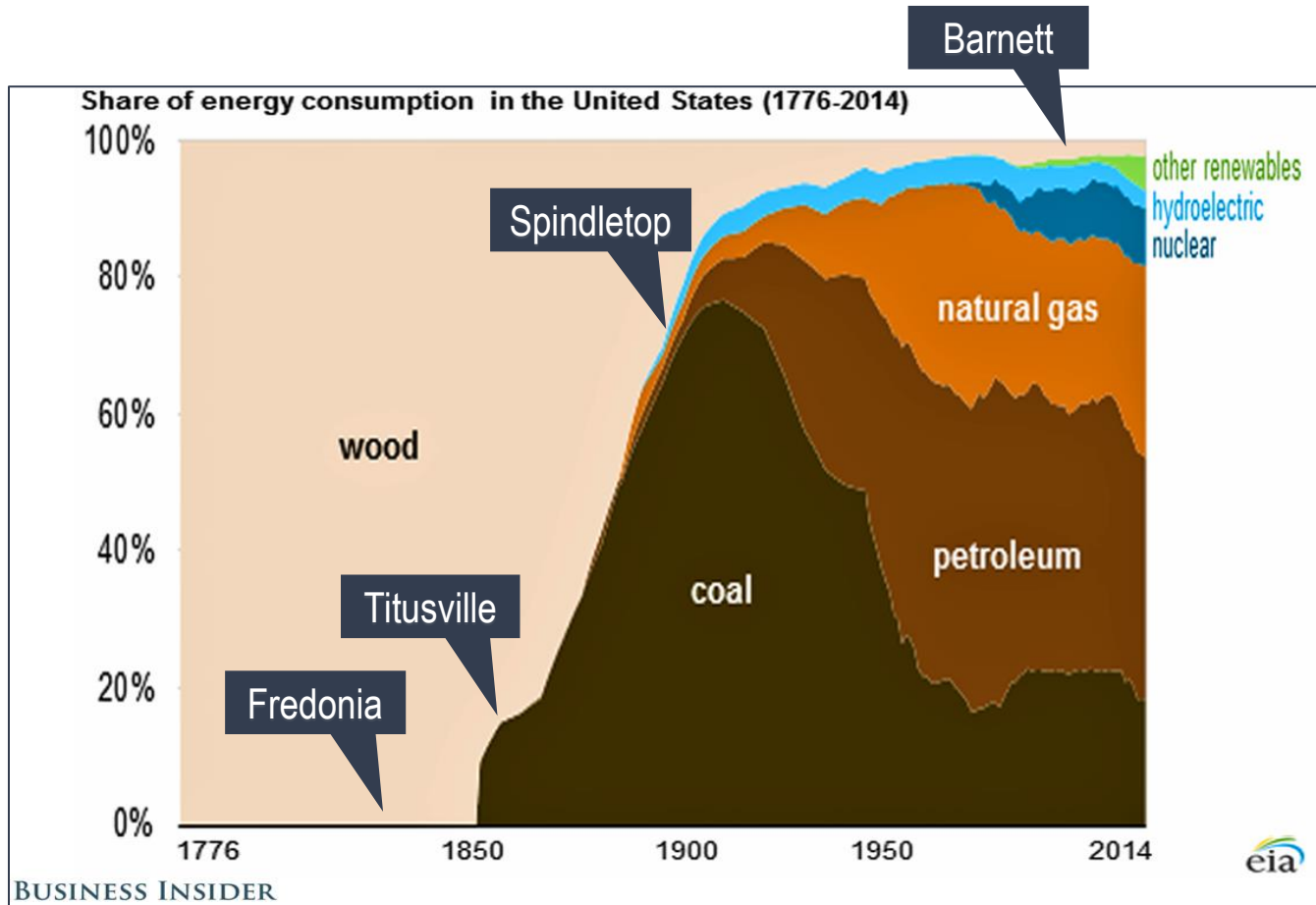
# Mountaineering – Making the Traverse to the Market Summit

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Gas Technology Institute

AICHE Natural Gas Utilization Workshop: Overcoming Hurdles of Technology Implementation  
November 1-3, 2016  
Morgantown, WV

# Innovations Find Resources

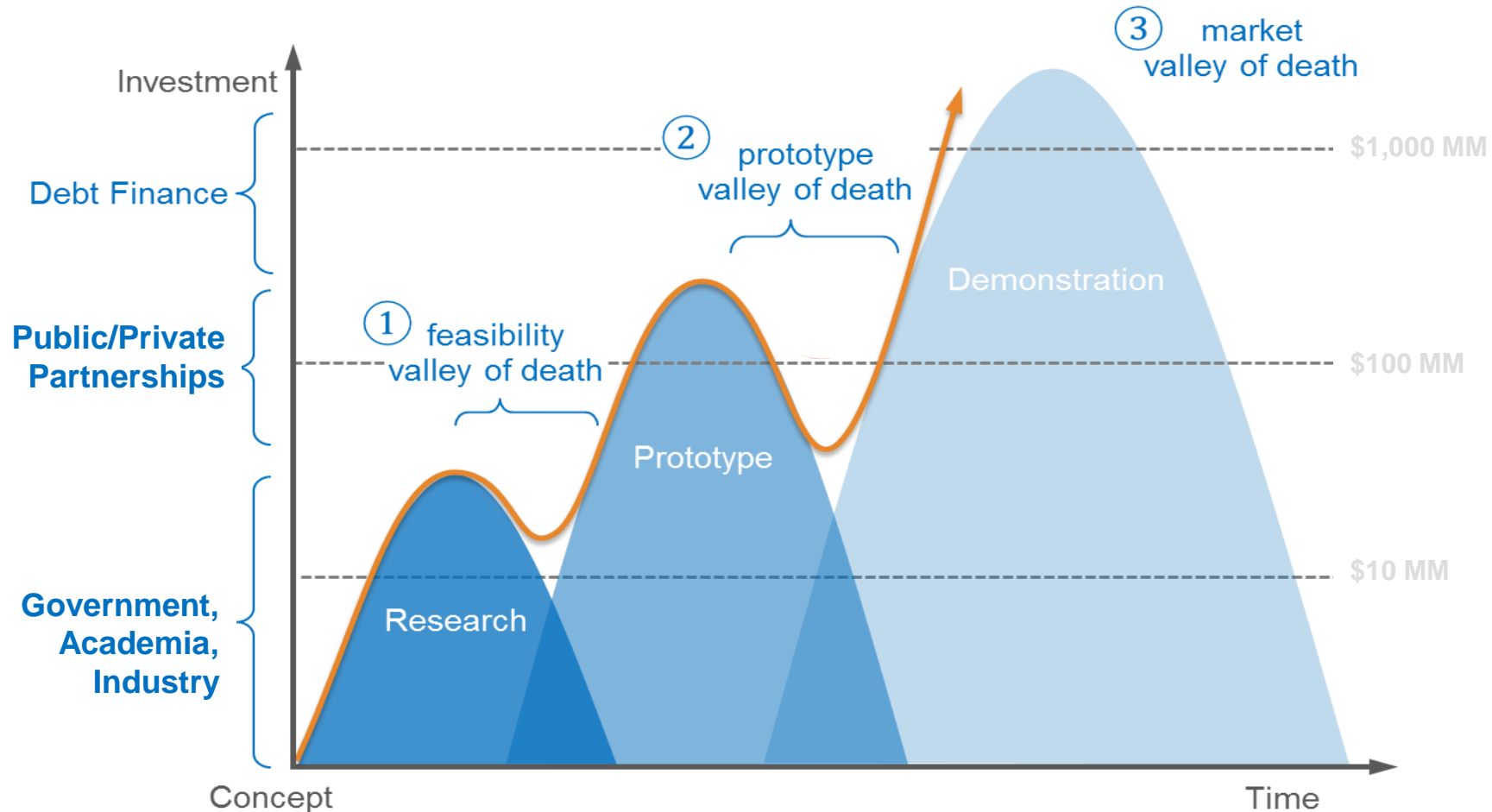


Economic interest drives discovery and innovation. Technology is developed to supply market opportunities.

Technology, in the hands of small-stake entrepreneurs, has succeeded in supplying energy resources.

Who will innovate to turn our abundant raw resources into valued products?

# Innovator's Tough Traverse

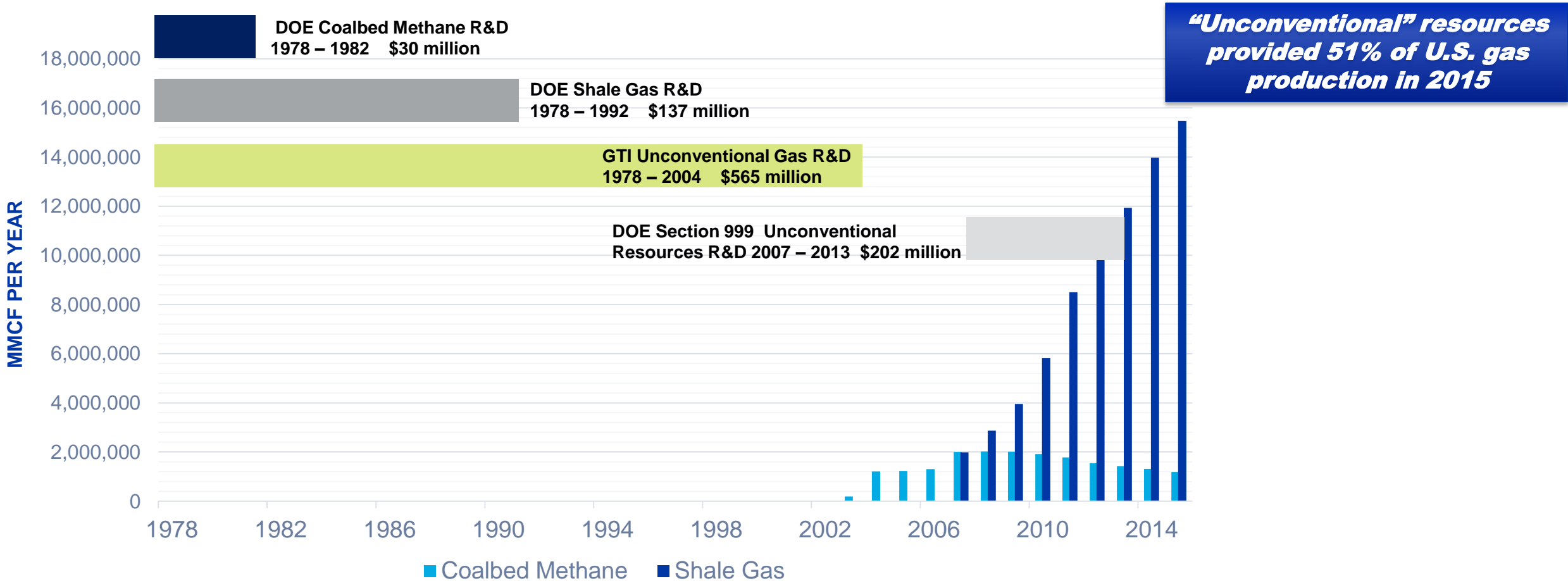


This is not a solo expedition - accept help.

Pursue non-incremental innovations.

Don't skip a step.

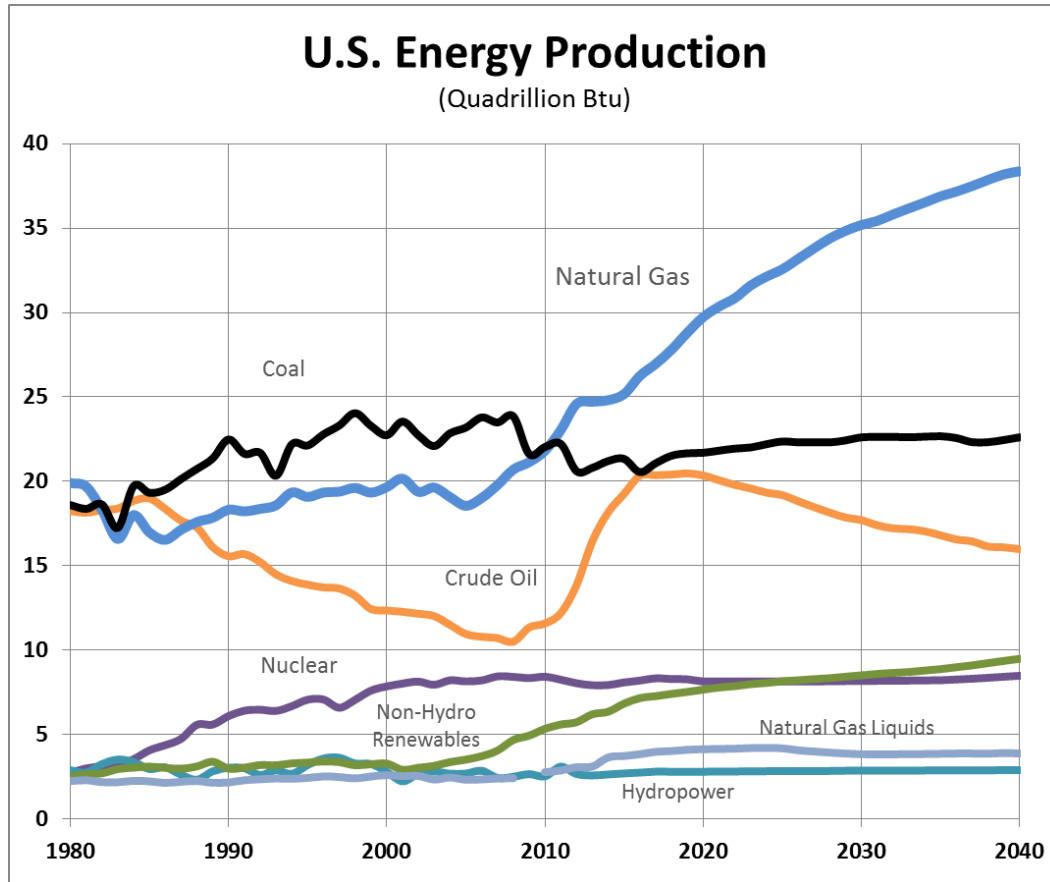
# Tapping Unconventional Gas



Sources: GTI, EIA, DOE, RPSEA

# “New Technology” Fundamentally Transformed U.S. Energy Market in 2008

*Supply Driving Prices Driving Demand*

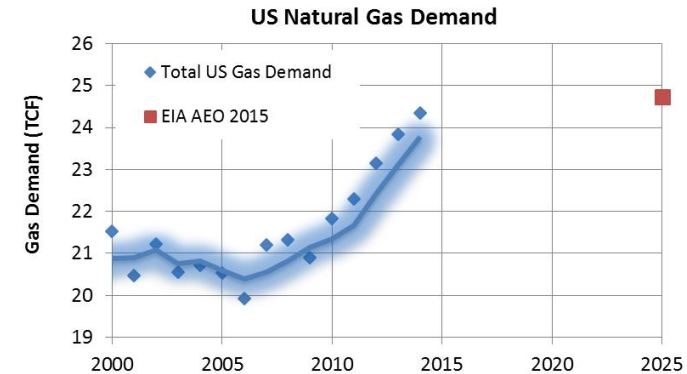


Expanding natural gas supplies *saved consumers about \$75 billion in 2014* compared to 2008 prices...

Prices (\$/MMBtu)	Residential	Commercial	Industrial	Power Generation
2008 Prices	13.16	11.58	9.14	8.77
2014 Prices	10.97	8.90	5.53	5.19
% Reduction	17%	23%	39%	41%
<b>Savings (\$, billion)</b>	<b>\$11.1</b>	<b>\$9.25</b>	<b>\$26.8</b>	<b>\$29.2</b>

*... and is still stimulating demand.*

More macro-economic benefits will be realized.



Source: DOE-EIA

# What Do We Do With This Abundant Supply?

- 1) Invest in commodity export capacity
  - a) Few \$Big projects
  - b) Cost advantage persists in Middle East
  - c) Emerging competition – Australia, FLNG
- 2) Energy incumbents invest in conversion
  - a) Few \$Big projects
  - b) Long approvals
  - c) Proven (old) technologies
- 3) Technical and business innovators invest in conversion
  - a) Smaller  $\phi$ capacity project size
  - b) Innovative (new) technologies critical to competitiveness





# Business as Usual: Huge Capital Risk



few capital sources ~ deployment barrier  
low technology risk ~ innovation barrier





Shell Pearl GTL Facility, Qatar

# Mega-Project Economics

RAND Study

52 mega-projects

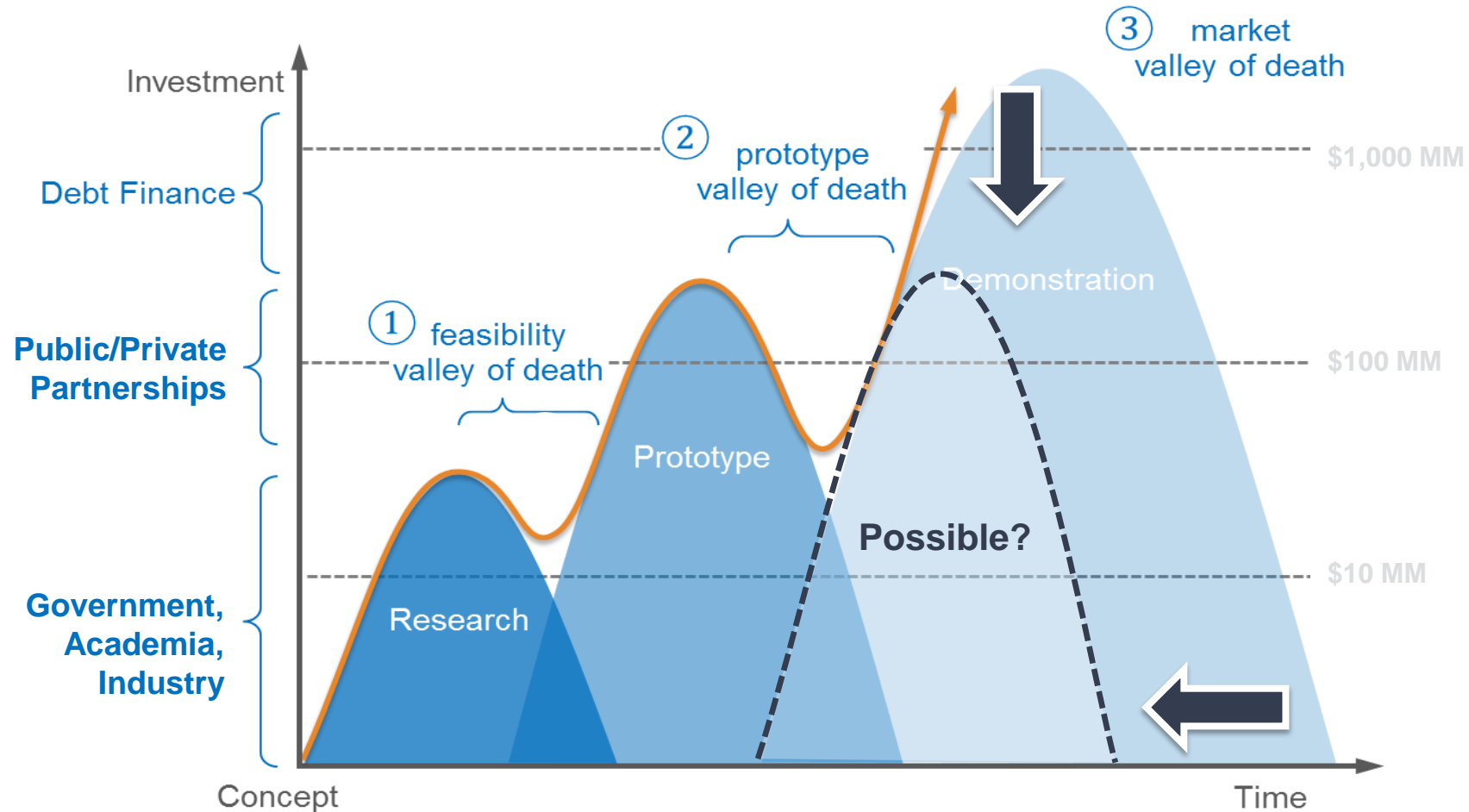
\$0.5B and \$10B (1984 dollars)

**average over budget = 90%**

Source: E.W. Merrow. Understanding the outcomes of megaprojects: a quantitative analysis of very large civilian projects, The RAND Corporation, Santa Monica, CA, 1988.



# Innovation's Tough Traverse



Attack CAPEX and OPEX through process-intensified solutions.

# Importance of Long-Term Support for Shared Test Facilities



5 MW<sub>th</sub> fully integrated and instrumented test bed for gasification, gas processing, and syngas synthesis technologies.

- Accelerates and economizes development programs.
- Gives component providers a place to prove their equipment.
- Enables technology developers to focus on their part of an integrated process.
- Allows standardized performance validation in an industrial setting.
- Integrates scientists, engineers, operators, and technicians.

# Realizing the Potential of Shale Gas

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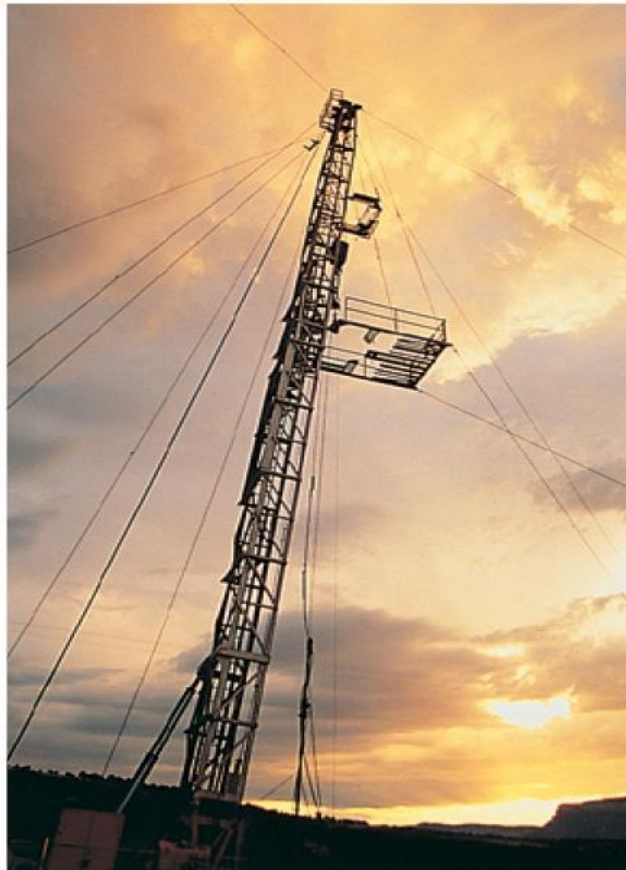
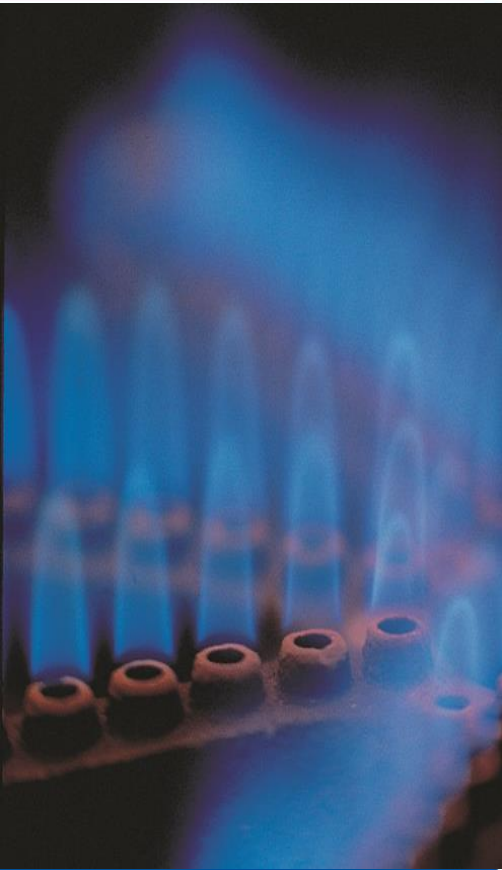
The “Shale Gas Revolution” can support much more than incremental improvements in decades-old processing technology.

The scale of traditional energy conversion solutions is incompatible with technical and financial risks – suppressing innovations.

We look forward to realizing new processes that are optimized for these resources, producing exactly the molecules our economy desires at unprecedented technical and cost efficiency.



# Turning Raw Technology into Practical Solutions



[www.gastechnology.org](http://www.gastechnology.org) | [@gastechnology](https://twitter.com/gastechnology)





The future ain't what it  
used to be. Yogi Berra

