The Interactive Innovation Process

- **Invention**
  - Discovery Science
  - Use-Inspired Research
  - Proof-of-Concept

- **Translation**
  - Prototypes
  - Semi-Works
  - Pilot Plants

- **Adoption**
  - Initial Deployment
  - Test Marketing
  - Pioneer Plants

- **Diffusion**
  - Widespread Adoption
  - Improved Technology Process

**Learning by Doing**

**Learning by Using**

*Demonstration and Commercialization are Both an Outcome and Driver of the Innovation Process*
Unconventional Natural Gas: Integrated Government-Industry Innovation Process

**Graph Details:**
- **x-axis:** Year (1975 to 2009)
- **y-axis 1:** Annual Program Budget (in 1999 Dollars)
- **y-axis 2:** Annual Shale Gas Production (Tcf)
- **Value of Tax Credits ($/Mcf)**

**Key Information:**
- **Federal Funding:** Steady over 16 years
- **GRI Funding:** Steady over 16 years
- **Time limited tax credit**
  - Gas produced after tax credit
  - Gas produced under tax credit

**Source:** MIT Future of Natural Gas Study
Additional Ideas for Design Principles

• Market Risk/Policy Risk
  – Clinch river, synthetic fuels, Kemper had both
  – More flexible financial instruments needed

• Greater Funding Certainty
  – Full funding; multi-year funding; dedicated revenue streams

• Separate Organization/Management Framework
  – Project management commonality more important than fuel type

• Project Management
  – DOE Order 413.3b (independent costs estimates; design before construct; comprehensive risk assessment)

• Exit Strategies

• Follow-on Support
  – Loan program; time-limited tax incentives; purchase commitments