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The Society gratefully acknowledges  
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And special thanks to The American Institute of Mining, Metallurgical,  
and Petroleum Engineers (AIME) for their contribution to the program.

# Acknowledgment

- **Aera Energy LLC**
  - **Providing time for these lectures**
  - **Supporting innovation efforts**

# Innovation in the Oil Field – YOU can do it!

**Phiroze Patel**

**Aera Energy LLC**

# SPE Values

*From the SPE.org website:*

- Excellence
- Integrity
- Professionalism
- Life-long Learning
- Diversity
- Volunteerism
- **Innovation**
- Social Responsibility

# Innovation in the Oil Field – YOU can do it!

## Outline

- **Contrasting systems: Innovation and “business”**
- **Need for communication tools**
  - **Strategy, process, database, measures, goals**
  - **Example: The 4 rules of Innovation!**
- **Portfolio fit**
- **Lessons learned: adapting to YOUR situation**

## Many Upstream Oil Production Companies Are Naturally Conservative

- Huge capital exposure
- Huge environmental exposure
- Two products with a ready market
  - Oil and natural gas
- No end-product marketing creativity



***Keep the machine running with no foul-ups!***

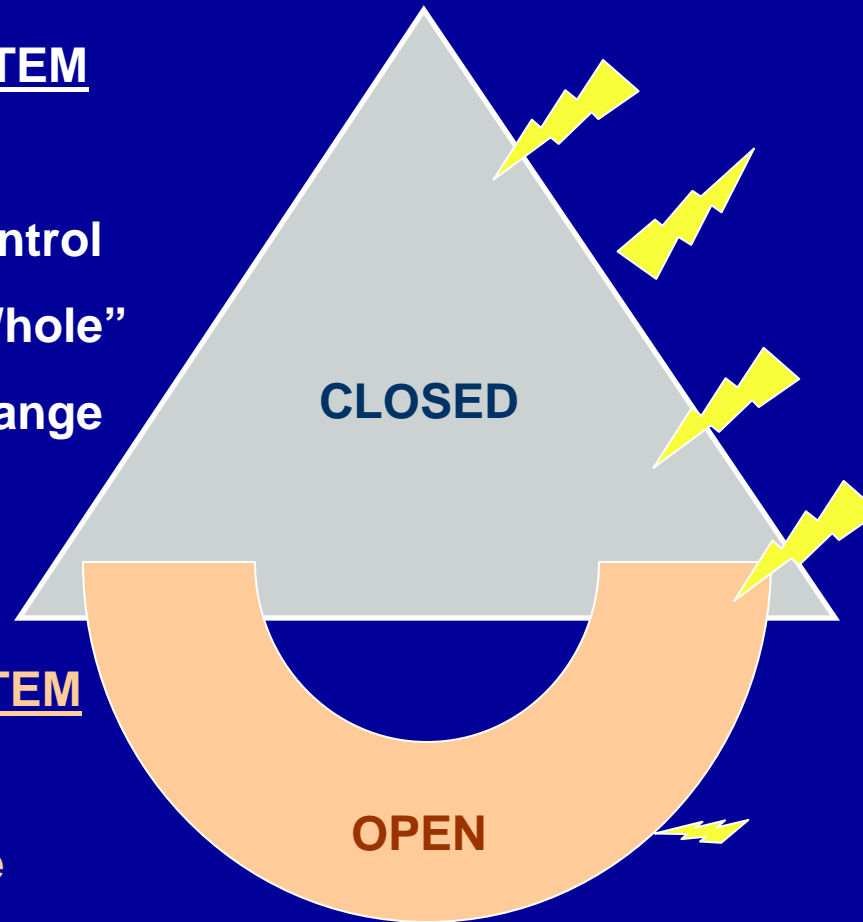
# Systems Thinking – How Innovation Fits in a Typical Oil Company

## CLOSED SYSTEM

- Stability
- Hierarchical control
- “Good of the Whole”
- Doesn’t like change

## OPEN SYSTEM

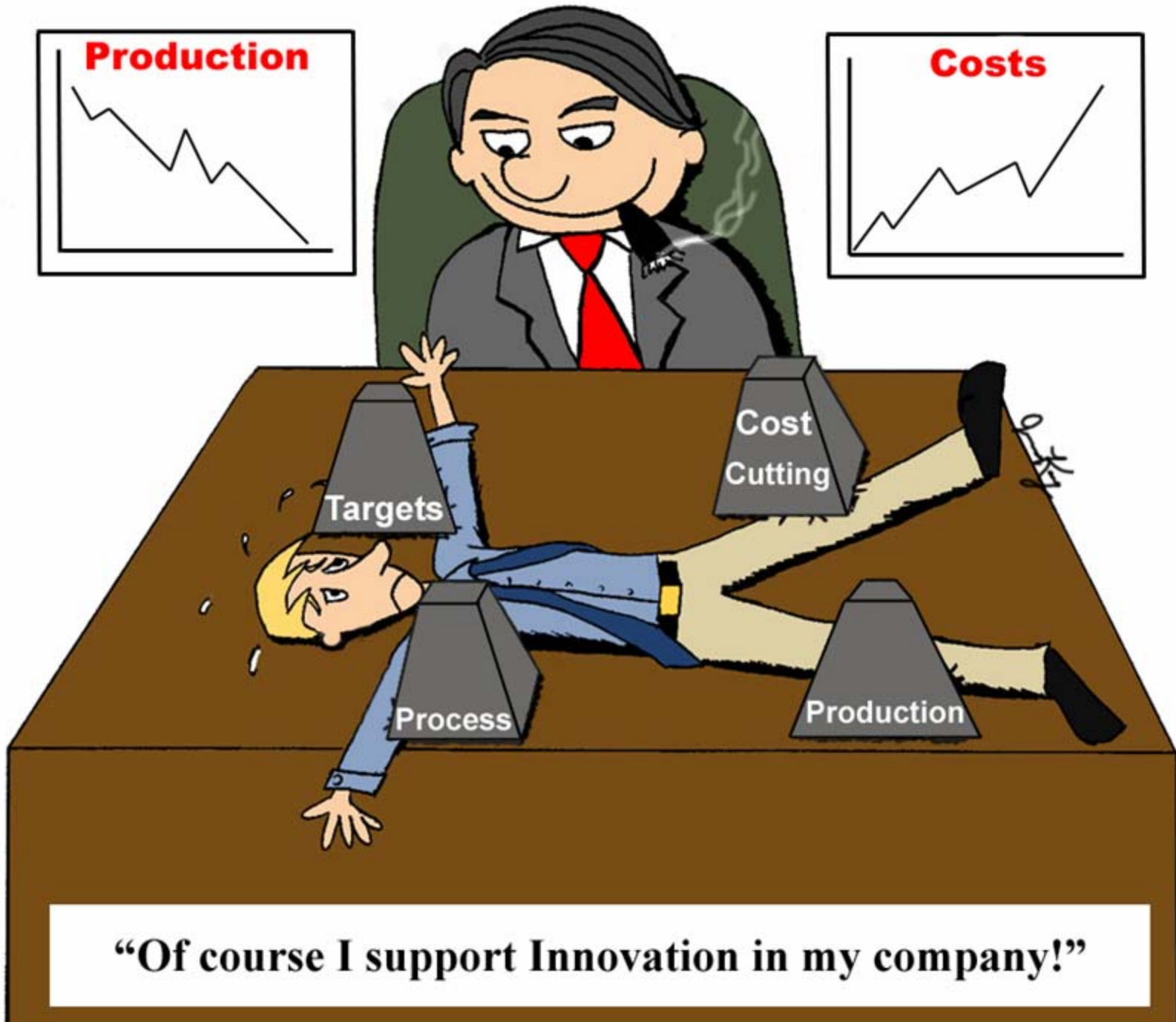
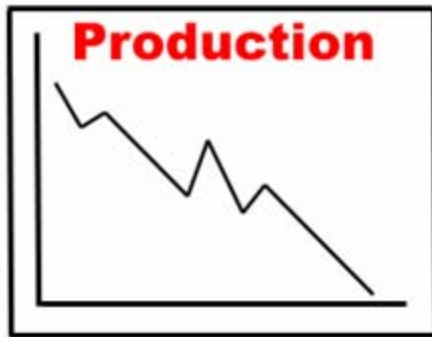
- Participatory
- Collaborative
- Balances Whole and Individual
- 7 • Process tyranny



## RANDOM SYSTEM

- Exploratory
- Informal structure
- Rapid Innovation
- Anarchy

*After William Isaacs, “Dialogue”*



**“Of course I support Innovation in my company!”**



## To Sustain Innovation You Must:

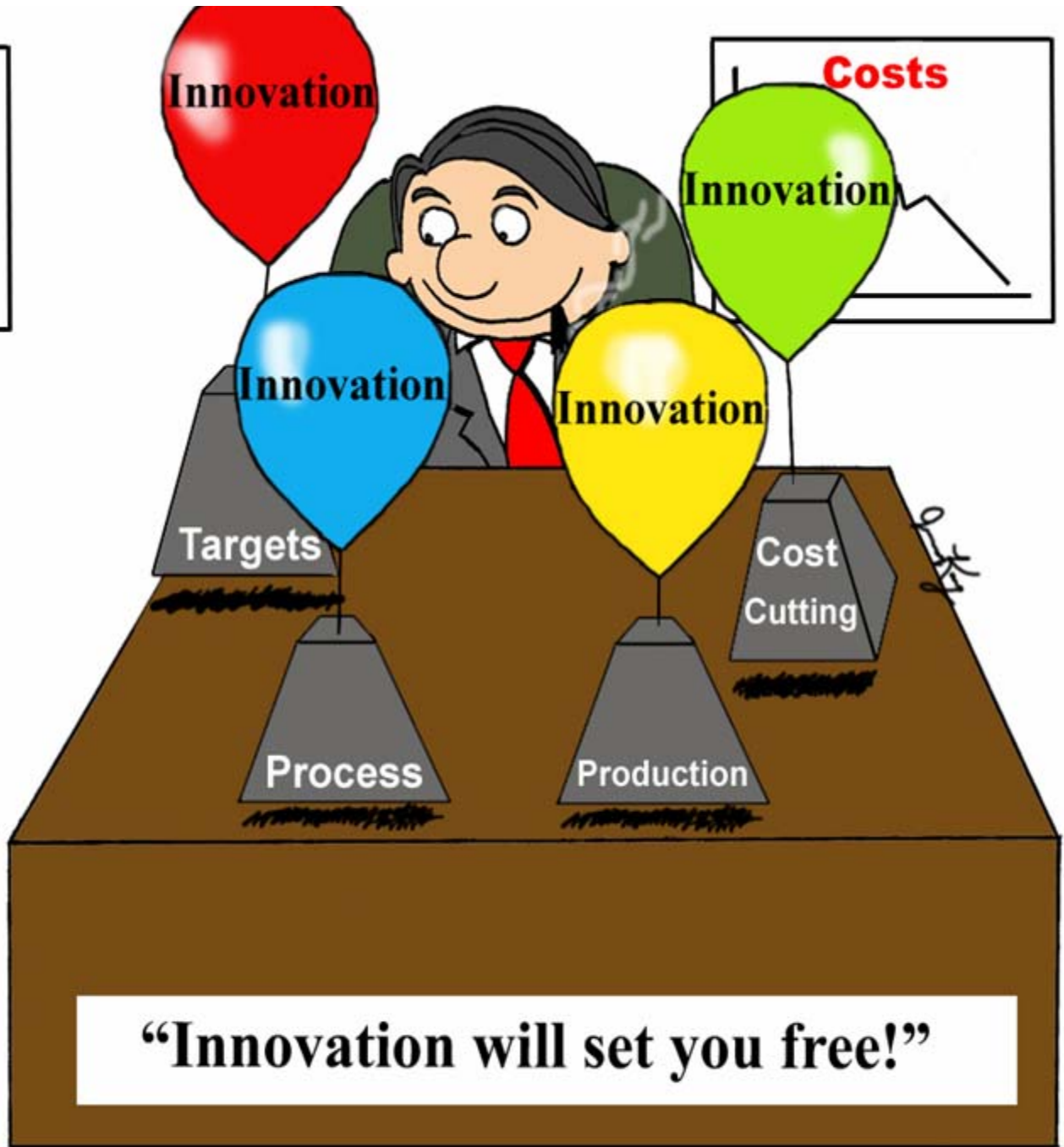
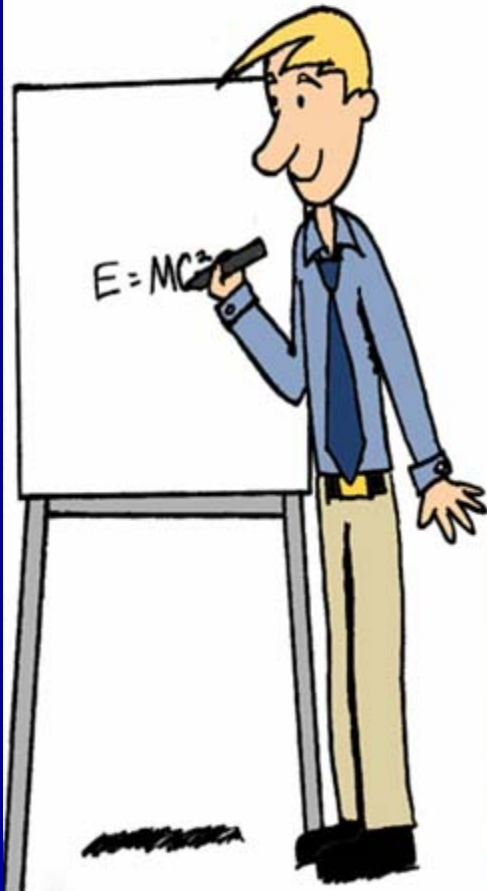
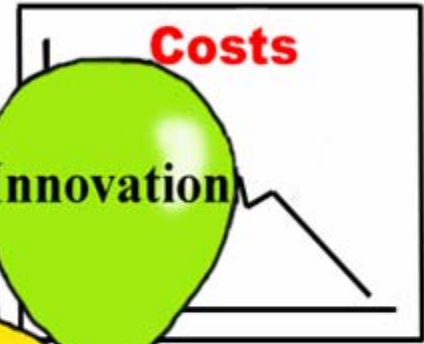
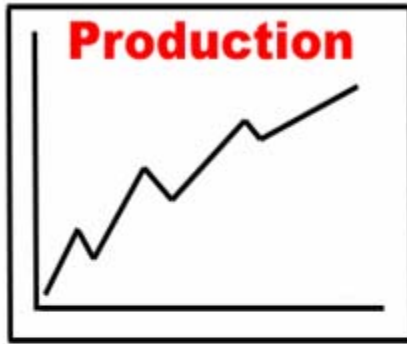
- Recognize System differences
- Satisfy needs of the dominant System

### INNOVATION STRATEGY AND PROCESS

- Manage new idea inflow
  - What to pursue; when to stop
  - What not to pursue
- Measures, goals
- Portfolio fit
- Provide documentation



*Keep it simple*

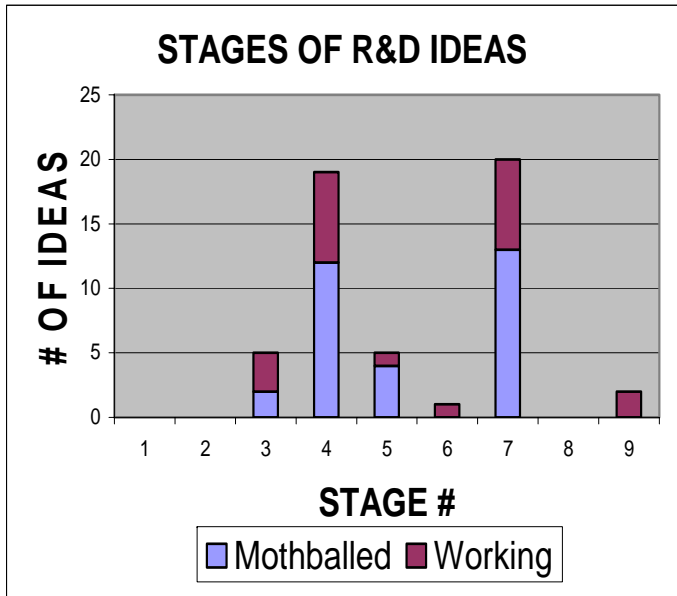
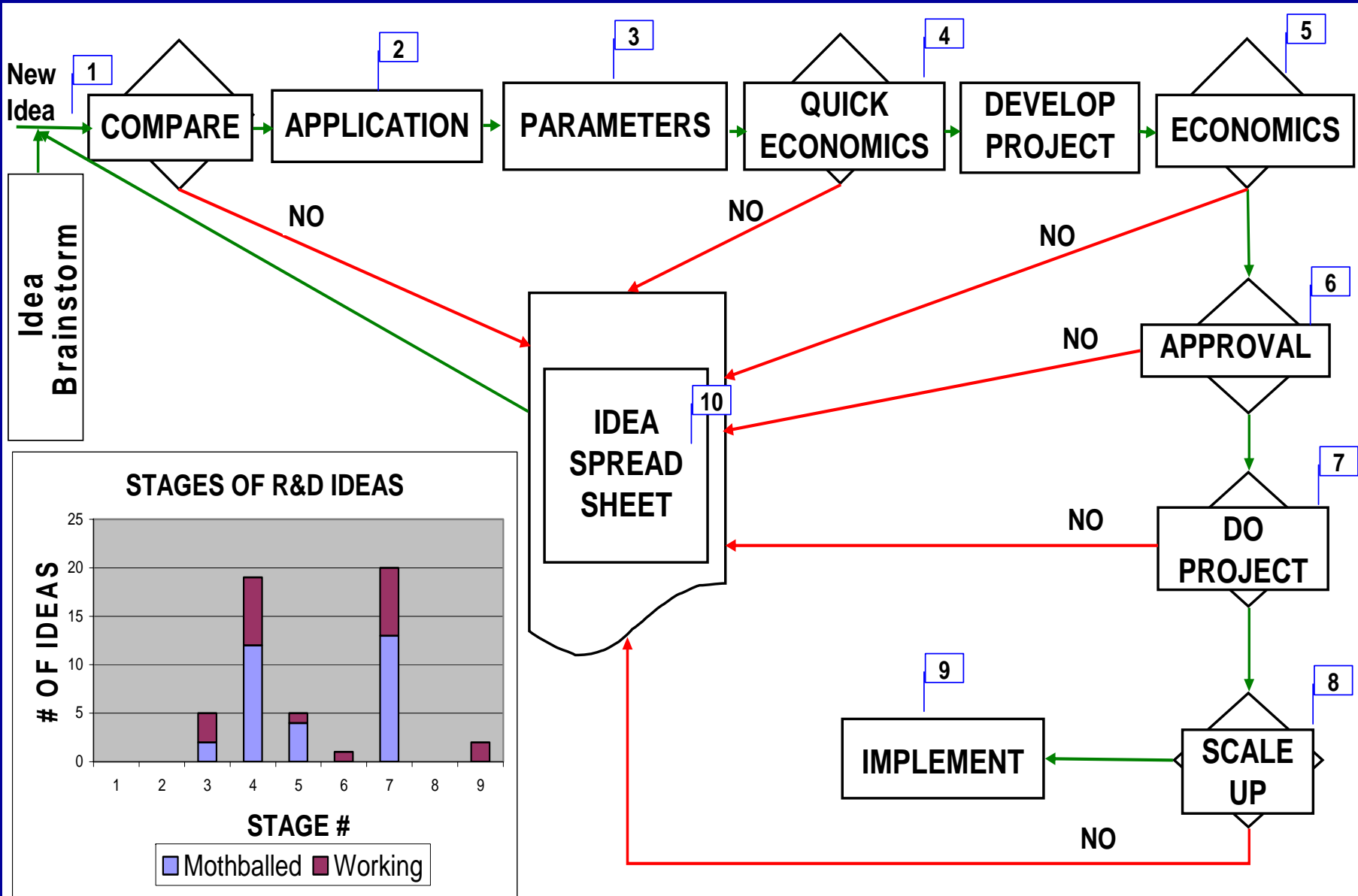


**“Innovation will set you free!”**

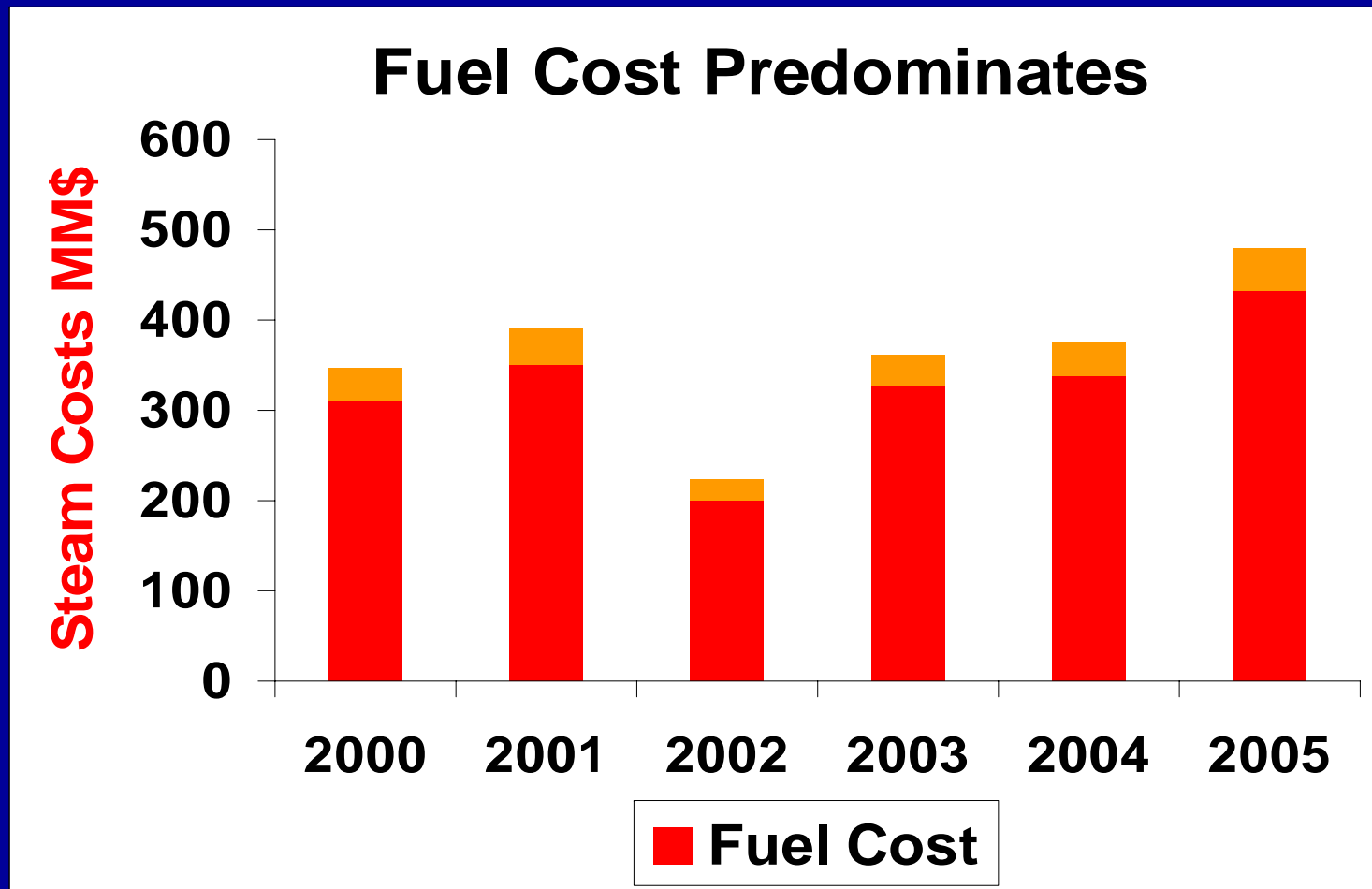
## One Innovation Strategy

- **Rapidly funnel many ideas into a few large, implementable projects**
- **Focus on breakthroughs rather than continuous improvement**
- **Extensive externalization**
- **Implement pilots as required to establish viability**
- **Minimize traditional research due to long lead time**

# A Simple but Workable Innovation Process



# Example Project – Make Cheaper Steam

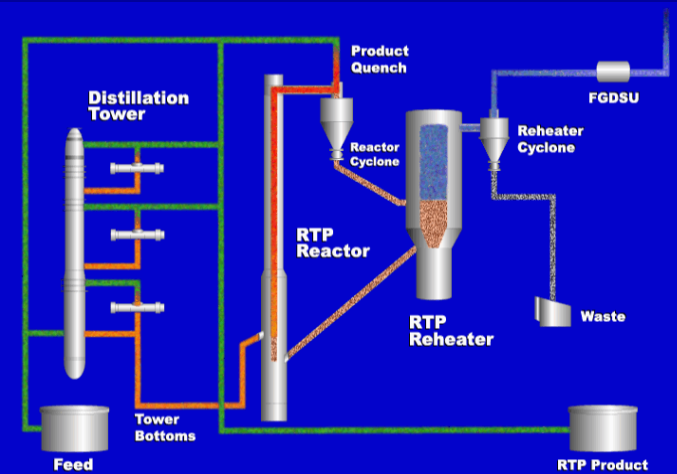


 *Use alternative fuel*

# Ways to Use Alternative Fuel



**1999  
Cogenerating  
Electricity**



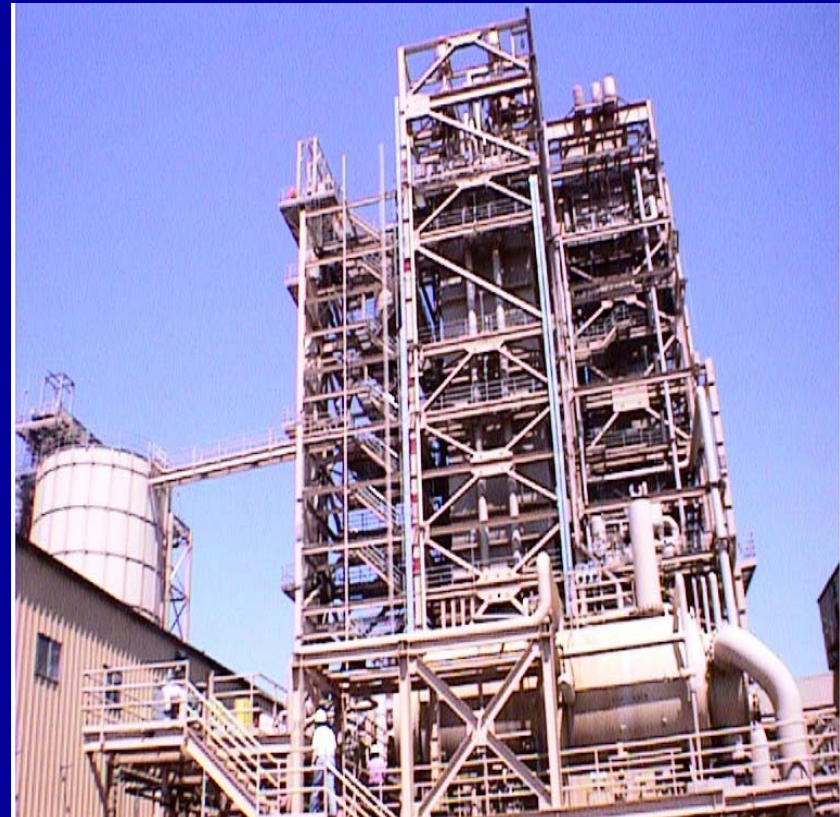
**2003  
Cogenerating  
Upgraded Oil**



**2006  
Burning  
Waste**

# Burning Alternative Fuels

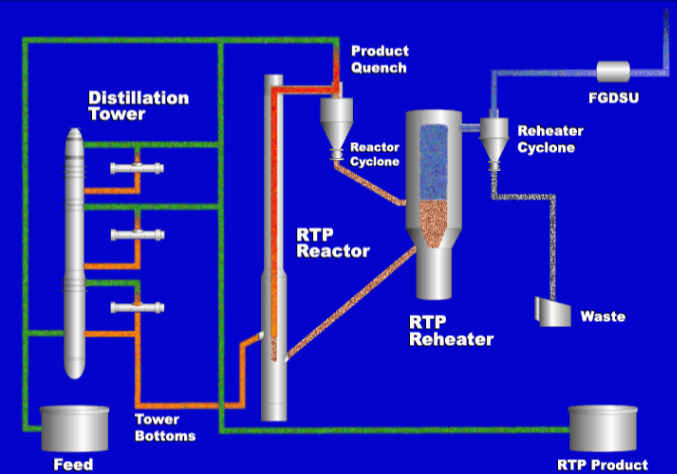
- **Fluidized Bed Combustor**
  - Tires
  - Manure
  - Coke, coal
- **Novel process**
- **Make residuum**
- **Cogens**



# Ways to Use Alternative Fuel



**1999  
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# Technology Transfer Between Industries



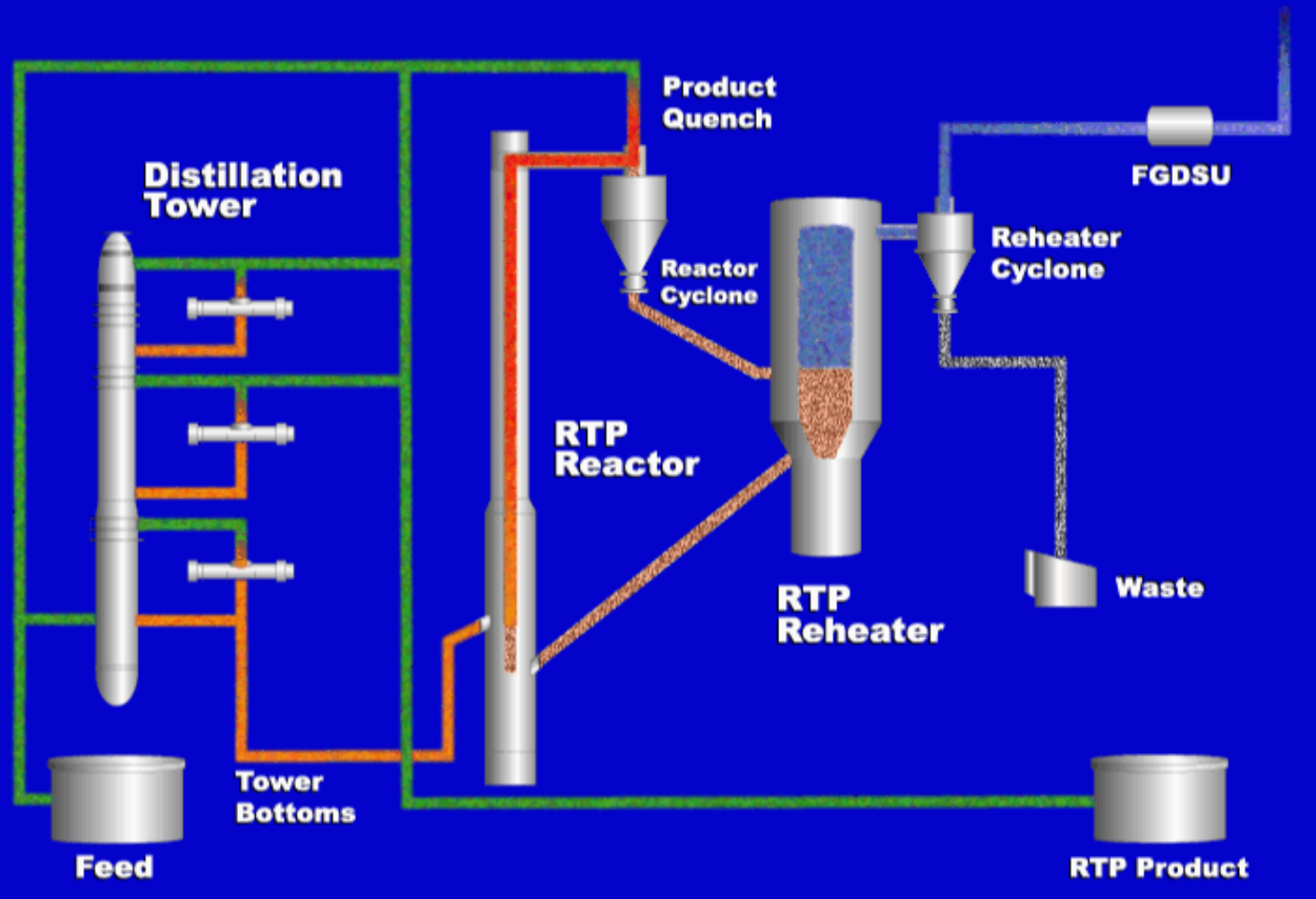
***Food Industry***



***Petroleum Industry***

*Courtesy Ivanhoe Energy*

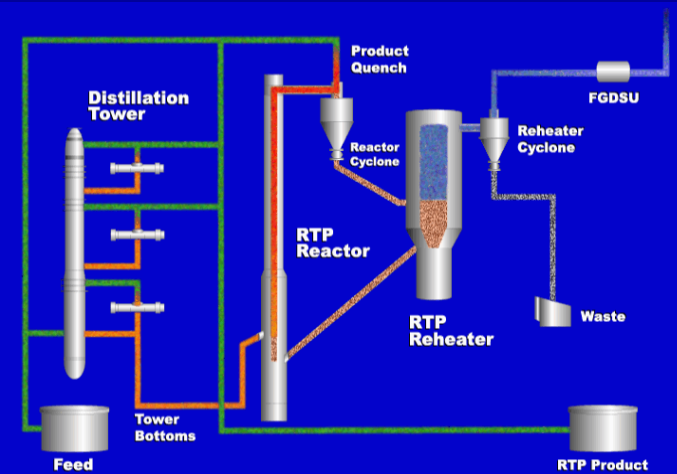
# Rapid Thermal Processing (RTP™) Heat Recovery for Steam



# Ways to Use Alternative Fuel



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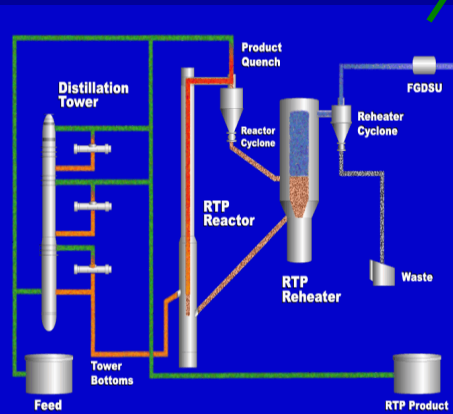
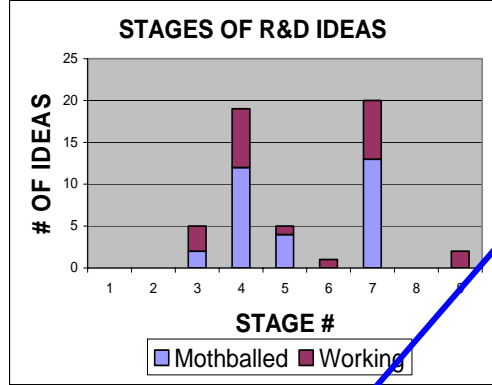
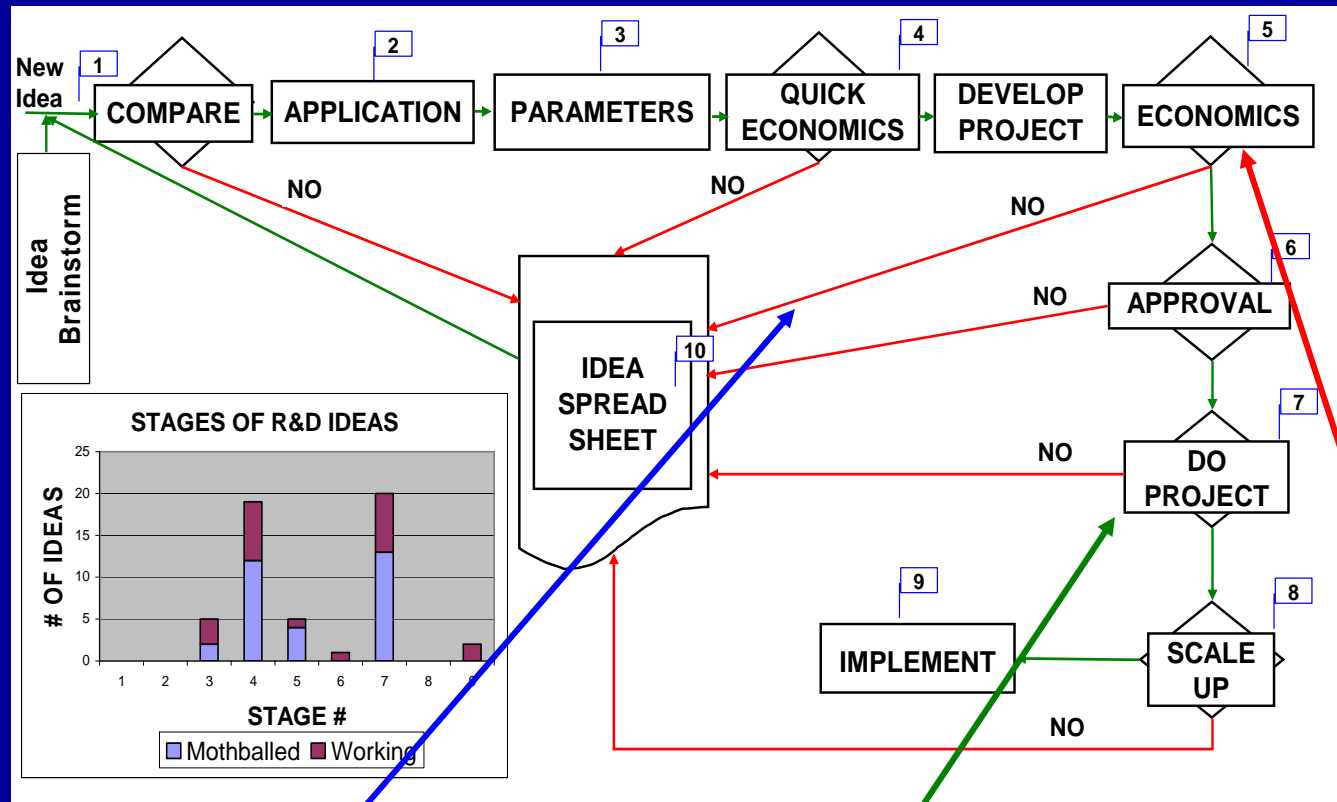
# Latest Process to Make Cheaper Steam

- Use waste wood as fuel
  - Ample supply in area
  - Current disposal problems
- Burner from dryer technology
  - Similar to existing steam generators
  - Tested and used widely



*Courtesy ONIX*

# Using the Process to Communicate



# Learnings from the Example

## THE 4 RULES OF INNOVATION

- **Reduce time spent: quick analyses**
- **Align with decision makers**
- **Be persistent**
- **The simpler the better!**

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# Portfolio Fit

Rock Rubbleization

Solvent Injection

Seismic Stimulation

Backpressure Reduction

Cheap Steam  
Repair kinked wells  
BCX Corrosion Control

Pure Research

Pure Development

## REAL RESULTS

Upper dogleg: 314 ft (96 m)

Lower dogleg: 636 ft (194 m)



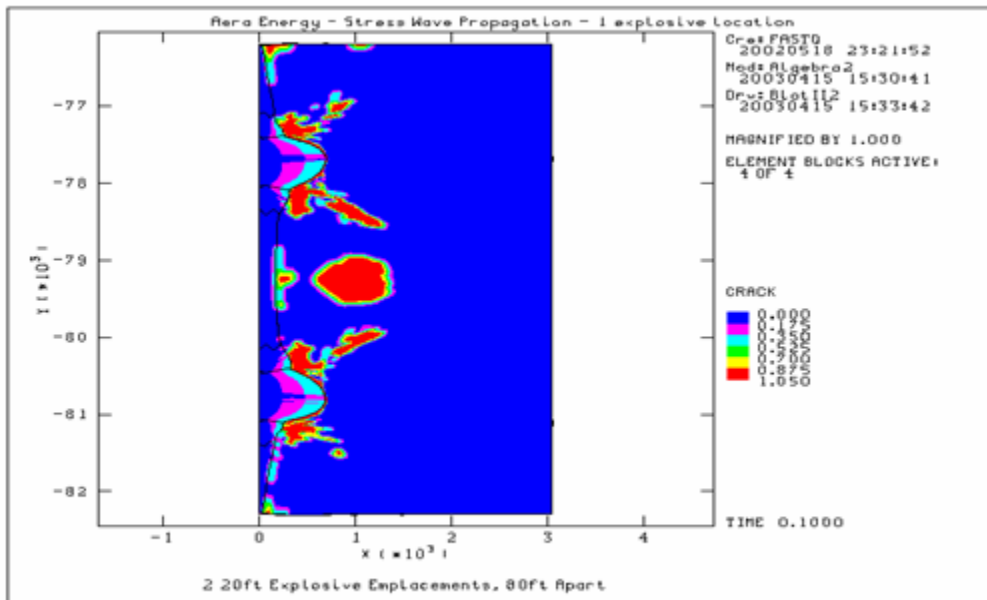
Courtesy Weatherford

## What fits one portfolio...

- Basic research done
- Tested
- Engineering thought through
- Competent vendor

## ... and what does not.

- Research stage
- No physical, tangible results
- Needs all engineering done
- No vendor



## What we wouldn't have tried:

- **Steam generation without natural gas**
- **“Solvent” with steam injection**
- **Water treatment**
- **Extracting iodine from produced water**
- **Bio-competitive exclusion technology**
- **Pressure pulse well stimulation**
- **Fixing kinked wells**
- **Pumping kinked wells**
- **Steam zone delineation method**

**+ More**

# Lessons Learned

- **Realize organizational “Systems” conflicts and resolve them upfront**

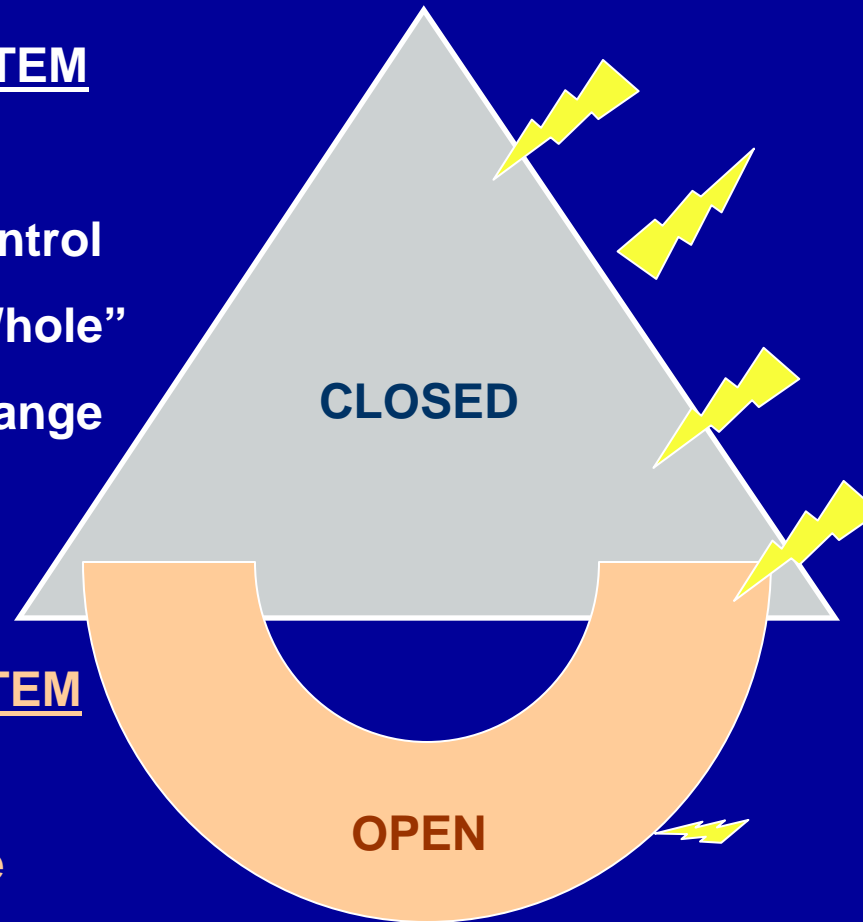
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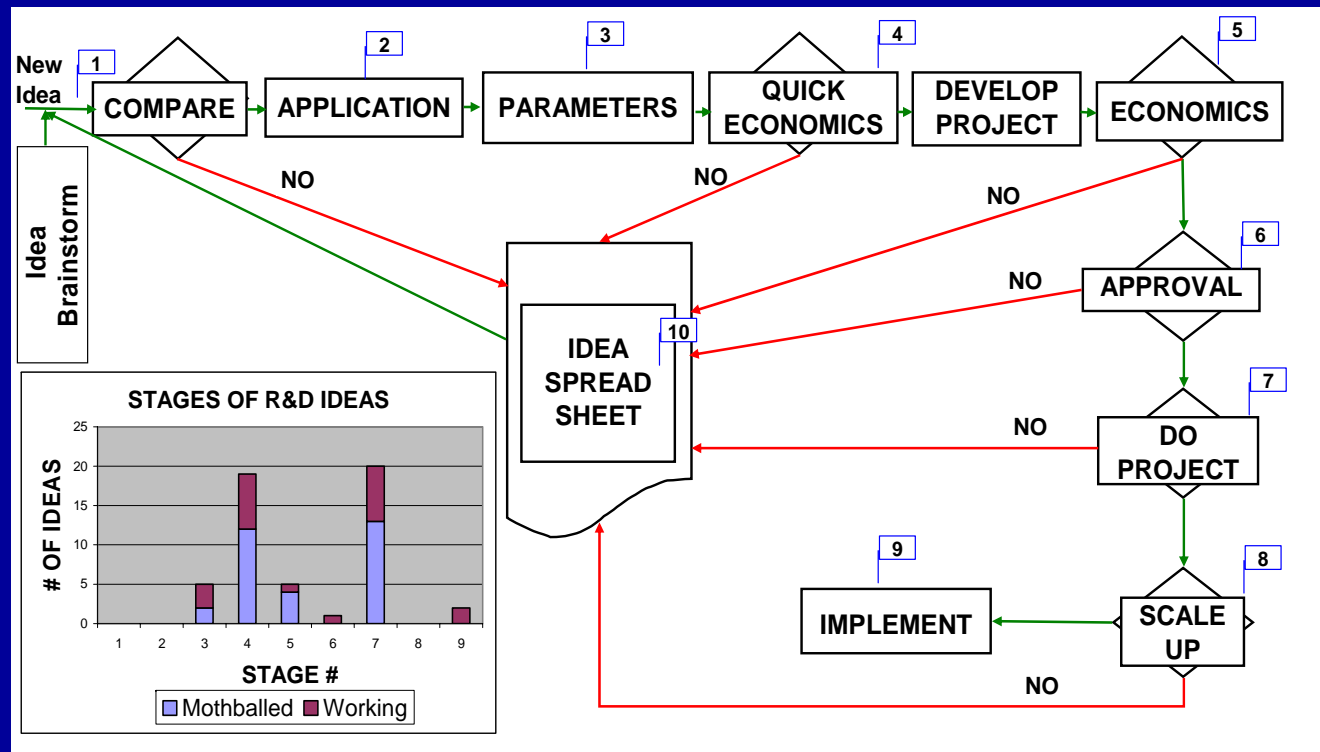
## Lessons Learned

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- Set a strategy, construct a process, and use to develop AND reject projects

# Strategy

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# Process



## Lessons Learned

- Realize organizational “Systems” conflicts and resolve them upfront
- Set a strategy, construct a process, and use to develop AND reject projects
- Analyze (fast!), Align, Persist, Simplify
- YOU can do it! – big or small company



# EXTRAS

## Engage the Organization

- **The “Closed” and “Open” Systems with process, measures ...**
- **Engineers and geologists with “brainstorm”**
  - Opportunity to be heard
  - More ideas are related to “better” idea
  - Help develop their own project
  - Implementation

# “Brainstorm” Session

- Select diverse participants
- Spend time organizing and tabulating

Probability of  
Success\*

***Brainstorm “Needs”***



***Find Solution***

**68.8%**

***1. Brainstorm Solution***

***2. Brainstorm “Needs”***



***Fit “Need” to  
Solution***

**87.5%**

# Example “Brainstorm” Session

- Select diverse participants
- Spend time organizing and tabulating

<u>THEME</u>	<u>TECHNOLOGY OR SOLUTION</u>	<u>NEED</u>
GETTING INFORMATION FROM SMALL SPACES DOWNHOLE	D1. Down hole fiber optics for chemical analysis	CSTL7. Pinpoint water injection, direct to unswept
	D4. Passive seismic	CSTL11. Inexpensively ID production/injection communication
	D6. Technology of Cold <ul style="list-style-type: none"> <li>- Cool</li> <li>- Drill mud while drilling</li> <li>- Use Cold as tracer</li> </ul>	CSTL21. Improved vertical inj conformance
	D7. Glaucoma test – pressure pulse	CSTL26. ID swept zones in reservoir
	D14. Piezoelectric properties of Xtals	CSTL27. Hunt Beach needs better way to get injection profiles
	D15. Technology to put memory sensors on tubing and gather when pull tubing	B2. Reservoir pressure in 3D
		B8. Image fluids in reservoir by zone
		B12. Injection profiles survey capability for doglegged injectors