Rock Mechanics / Geomechanics from an Energy Perspective

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First, a few words about ARMA

What is ARMA – Professional Association

What is the ARMA Mission –

To be the recognized representation of multi-disciplinary rock mechanics advancements and applications, to serve its Members and the Public.

How does ARMA Accomplish this –

• ARMA will encourage individuals and accept Members who share a common interest in rock mechanics

• ARMA will be the technical leader in rock mechanics via sponsored symposia, publications, workshops, training courses, other means

• ARMA will provide recognition of its Members for individual accomplishments, expertise in rock mechanics, and public benefit

• ARMA will offer advisory expertise to help Government, Academia, Industry, and the Public
Rock Mechanics / Geomechanics from an Energy Perspective

- Begin by making some comments about “Energy”
- Share some perspectives I have from the last energy crisis—related to rock mechanics / geomechanics
- Draw some Conclusions
What about Energy

World commodity / largest commodity next to currency trading

What are the problems?

1. Large amount of carbon being put into the atmosphere
2. Energy, just as nearly any business, cycles from excess to scarcity
3. Because some have [current] energy sources and some do not, this leads to a great “shifting of wealth”
4. Someday we will run out of oil, gas, and coal—firstly, cheap oil
What can we learn from the last Energy Crisis—1970’s

Looked at:
- Oil, Gas, and Coal Production
- Geothermal Energy Recovery
- Energy Storage—gas, oil, and exotic storage concepts
- Hydro-Electric & Pumped Hydro Storage
- Began Coal-Bed Methane Recovery
- Heavy oil Recovery and Enhanced Oil Recovery
- Oil Shale, Methane Hydrates were ‘Discovered’, Insitu Combustion of Coal

Learned:
First and foremost—rock mechanics / geomechanics was a key to technology advancements related to energy
Some perspectives I have from the last energy crisis—related to rock mechanics / geomechanics
Oil & Gas Recovery

1. Drilling

2. Tight Gas Shales

from Stosur 2004
Geothermal Energy Recovery

1. Hydrothermal Systems

2. Enhanced Geothermal Systems
Nuclear Waste Storage

1. Political/Social Problem

2. Geo-Technical Issues are key to a solution
Energy Storage

1. Natural gas storage

2. Compressed air storage
   / Hot Water Storage /
   Pumped Hydro Storage
Carbon Sequestering

1. Large power plant emits 1-3 million tons / year (during life of power plant, may be 1-2 billion barrels of CO₂)

2. That CO₂ must go somewhere ??? And, it must stay fixed
“Far-Out” Technologies for Energy Recovery

1. Oil Shale
2. Methane Hydrates
Global Observations

What has happened since 1970’s Energy Crisis,

- Oil & Gas – Great Advancements (downhole motors, PDC bits, horizontal drilling, micro-seismic)
- Coal Mining – Advancements (longwall, methane drainage, modeling, roof control, deeper mining)
- Geothermal – Hydrothermal has been exploited; little progress on dry rock
- Nuclear Waste Storage – WIPP Site in operation; commercial storage site ??
- Compressed Air & Hot Water Energy Storage—No Applications
- Low Head Hydro—Couple of Applications; no significant impact
- Oil Shale—Still “close” by some estimates ??
- Tar Sands—Heavy Oil of Alberta is being exploited
- Deep Water Oil & Gas—much activity; big impact
- Coal Bed Methane—big impact; about 8% of US gas supply
- Methane Hydrates—being considered at present ??
- Insitu Combustion/Conversion of Coal—no applications; being considered
Conclusions Regarding Rock Mechanics / Geomechanics

- A very ‘key player’ in energy resource recovery
- Advancements have been made, much the result of computers
- Rock Mechanics/Geomechanics is viewed as a significant business opportunity
Finally ----

Although Rock Mechanics/ Geomechanics continues to be key for energy, it is “hard” – mechanics means ‘math and physics’; will “it” rise to the occasion and provide breakthroughs needed ???

Rock Mechanics/ Geomechanics offers strong job/ career opportunities

‘Forefront’ is getting rock fabric/ texture into our analysis

In a Global sense, the World will have to put more $ into energy recovery—taking away from food, housing, clothing, education, medical care, other things

How priorities work out will be important; of concern is how will education fare ???
and remember,

perception without facts can be disastrous and knowledge without wisdom can be dangerous