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Riding the Energy Roller Coaster: Challenges, Innovations & Opportunities

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2012 President SPE Intl.

The Future of Energy!

Outline

Energy Industry Challenges

- Oil Prices
- Energy Demand
- Fossil Fuels
- Renewable Energy

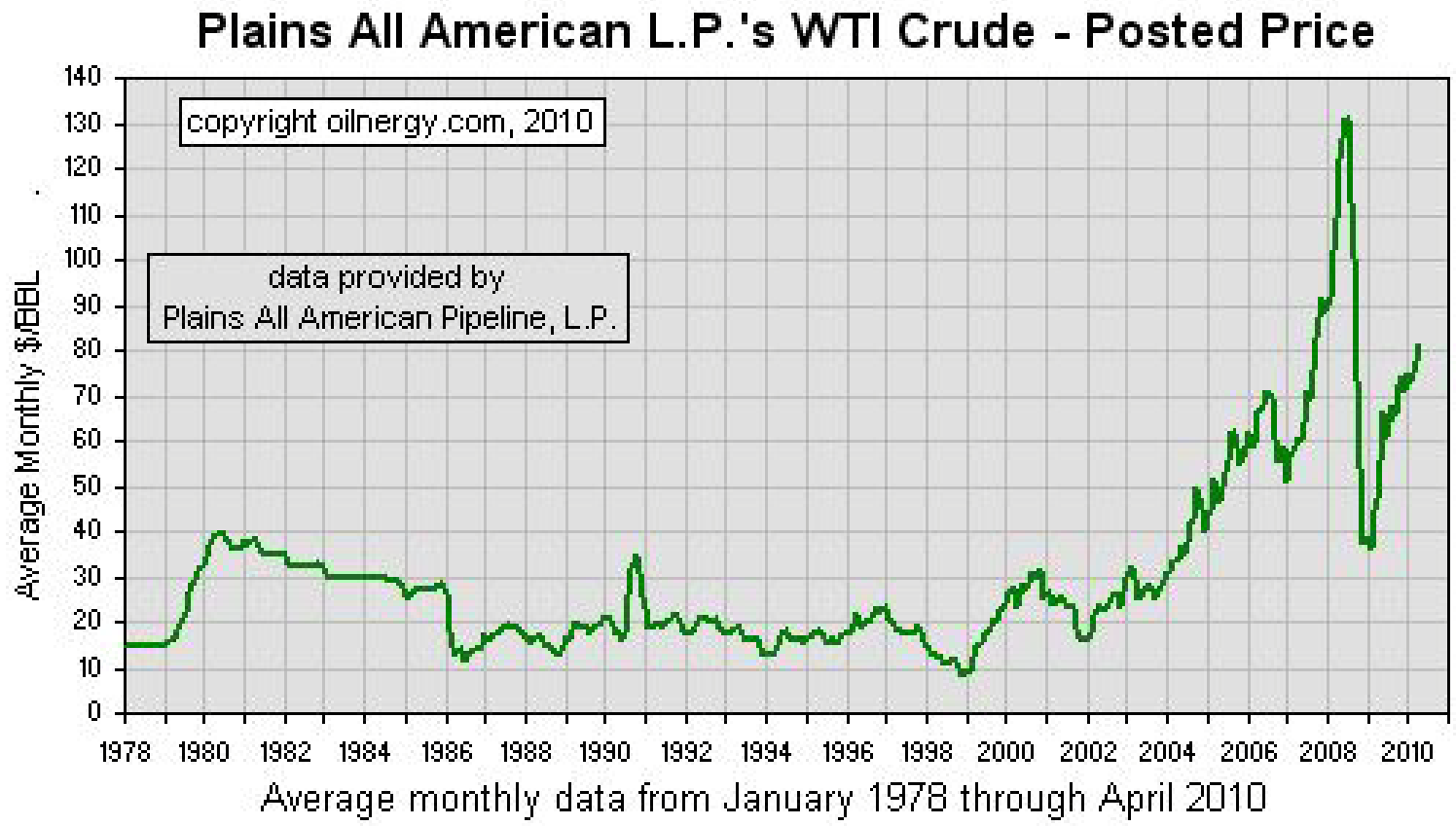
Innovative Technologies

Opportunities & Career Development for YP

Summary

Industry Challenges:

Oil Prices January 1978 – April 2010

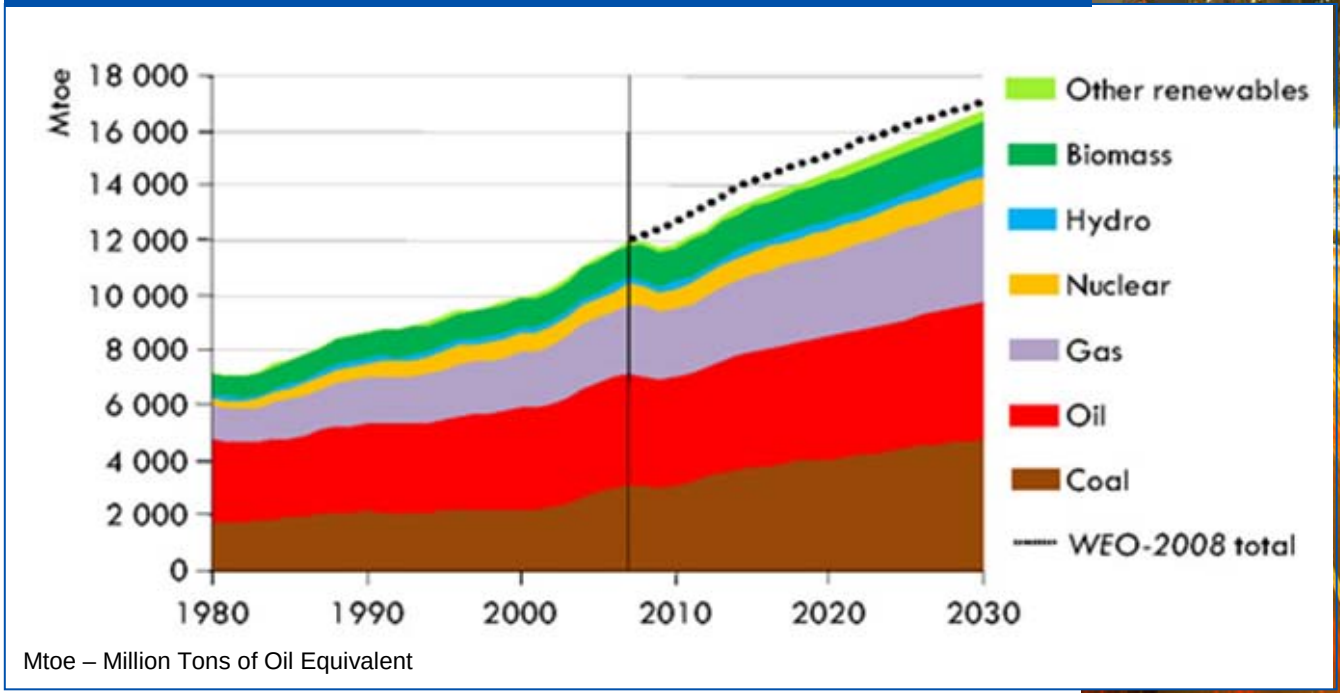


Source: Oilnergy.com, 2010

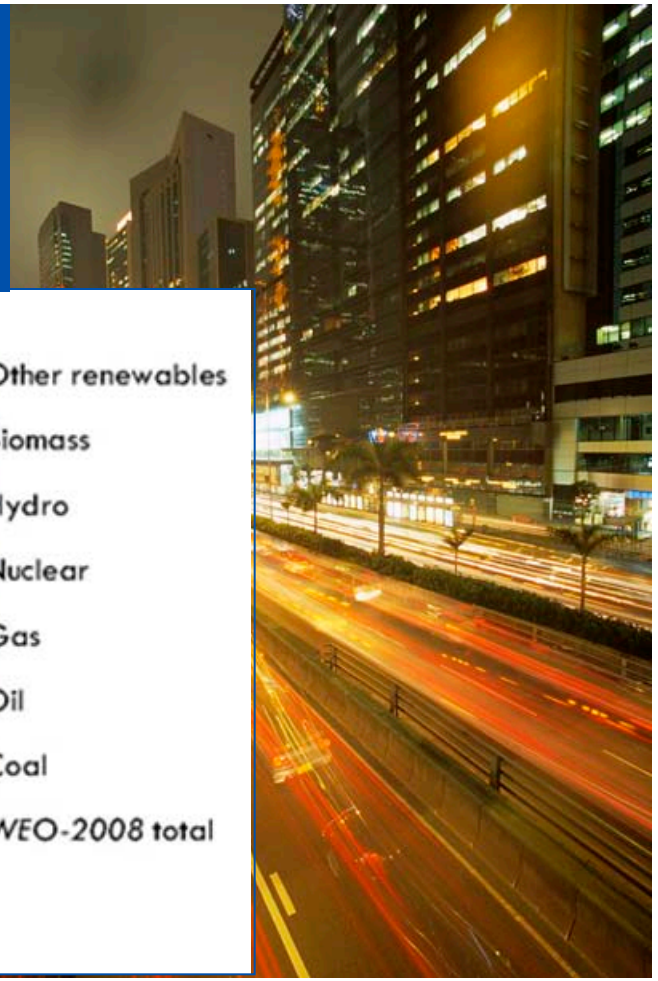
Industry Challenges: Energy Demand

World Primary Energy Demand by Fuel:

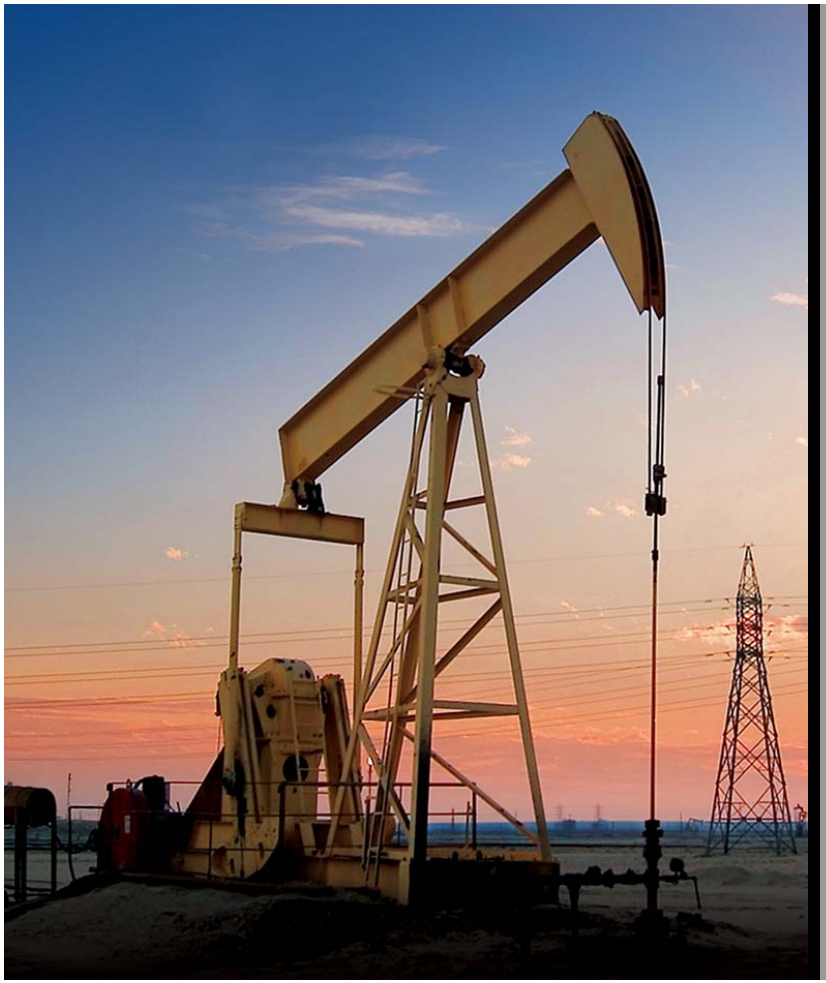
- Reference Scenario – Global demand grows by 40% between 2007 and 2030, with coal use rising most in absolute terms



Mtoe – Million Tons of Oil Equivalent

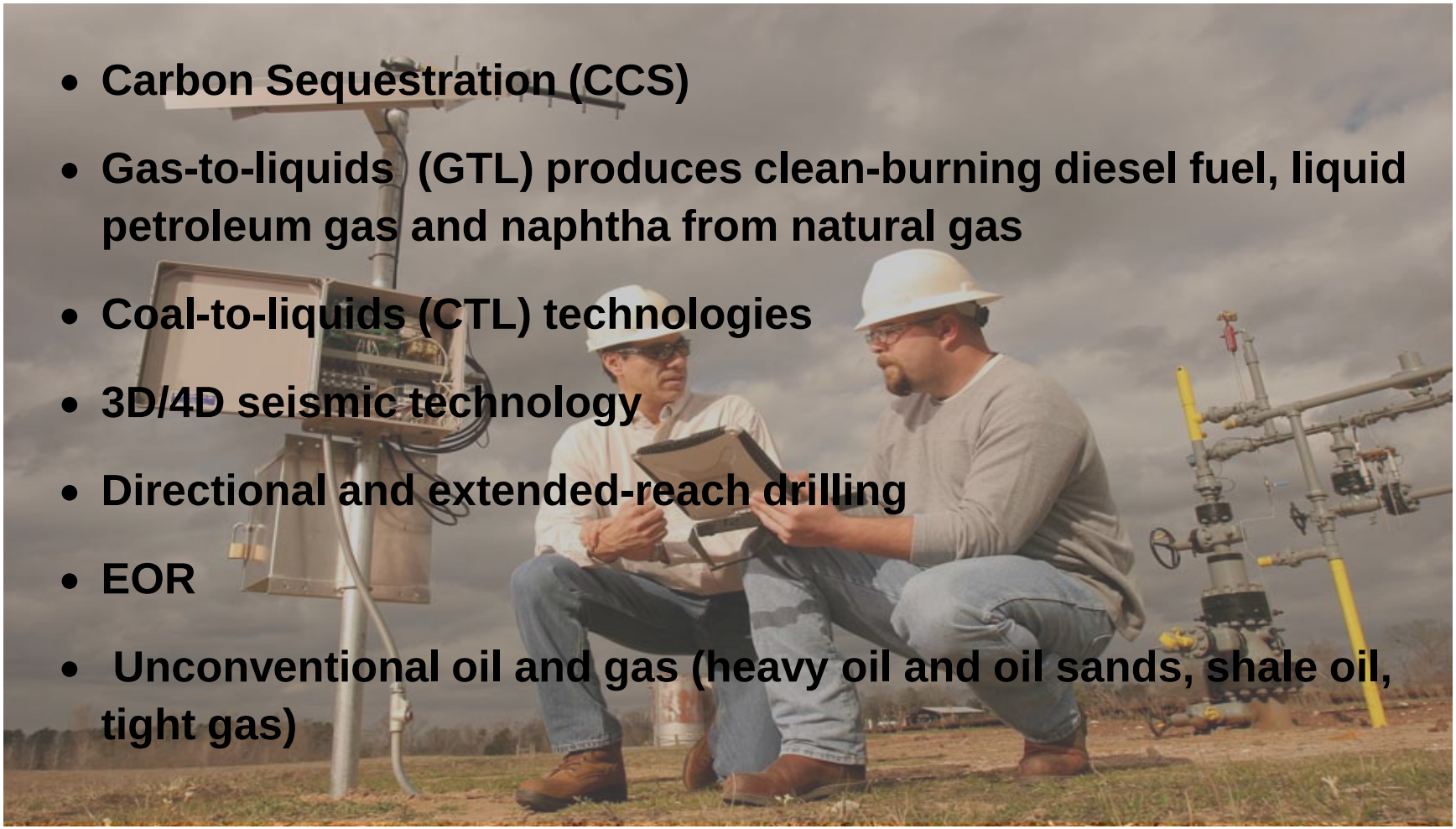


Industry Challenges: Fossil Fuels



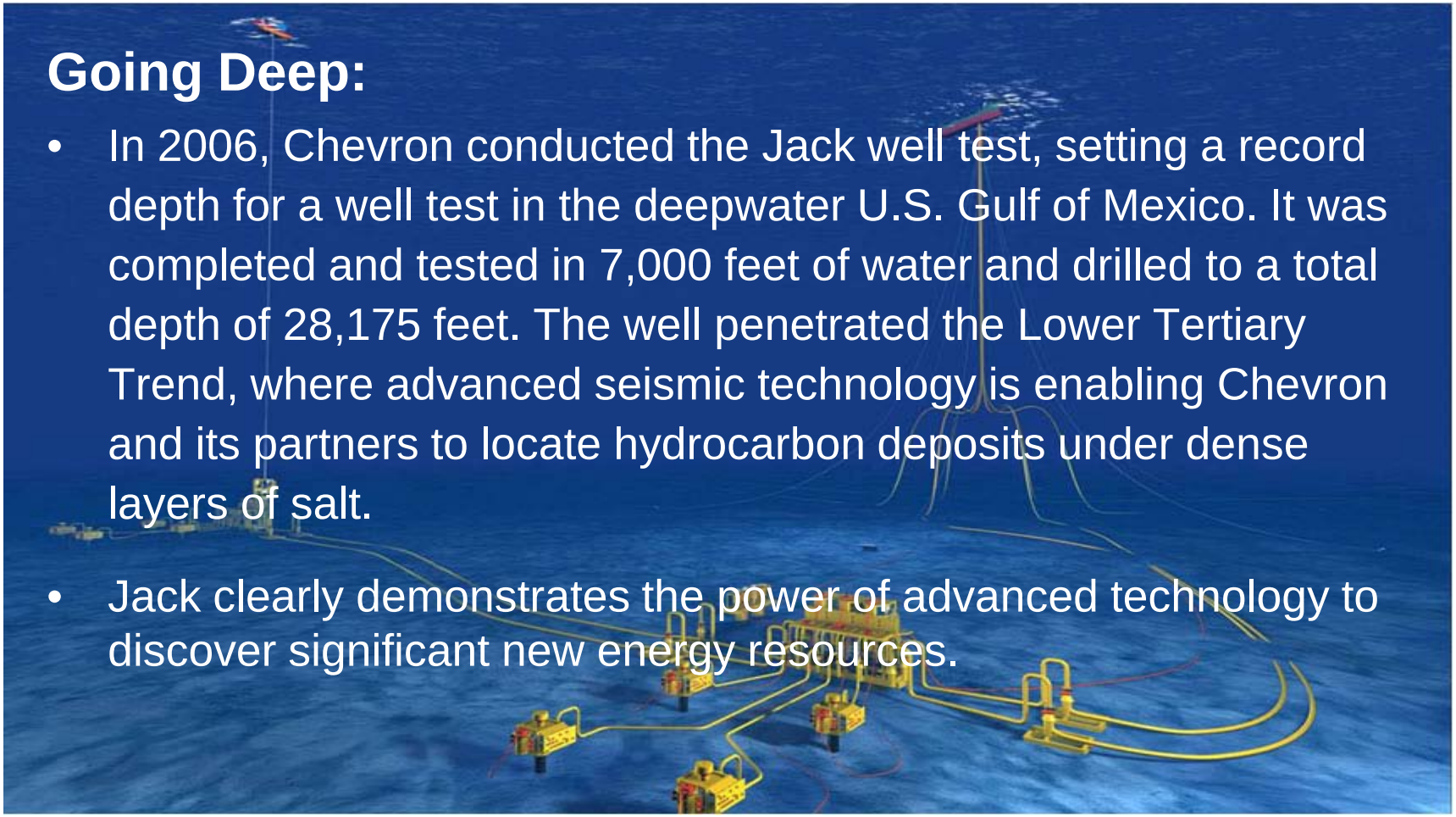
- Limited supplies
- Geopolitics
- Extraction and risk
- Environmental impacts
- Finding additional reserves
- Enhancing recovery rates
- Expanding unconventional fossil fuel
- Improving the carbon profile: CCS
- Timing and levels of necessary investment

Innovative Technologies: Fossil Fuels



- **Carbon Sequestration (CCS)**
- **Gas-to-liquids (GTL) produces clean-burning diesel fuel, liquid petroleum gas and naphtha from natural gas**
- **Coal-to-liquids (CTL) technologies**
- **3D/4D seismic technology**
- **Directional and extended-reach drilling**
- **EOR**
- **Unconventional oil and gas (heavy oil and oil sands, shale oil, tight gas)**

Technology Example
Case Study: Jack Well Test

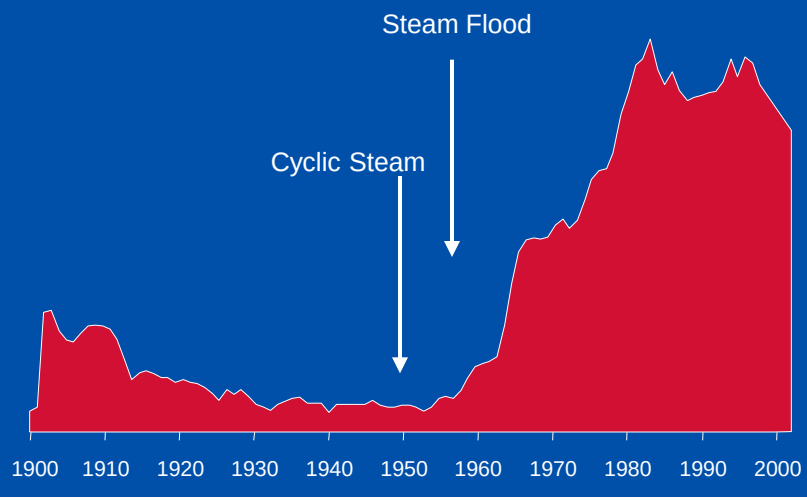


Going Deep:

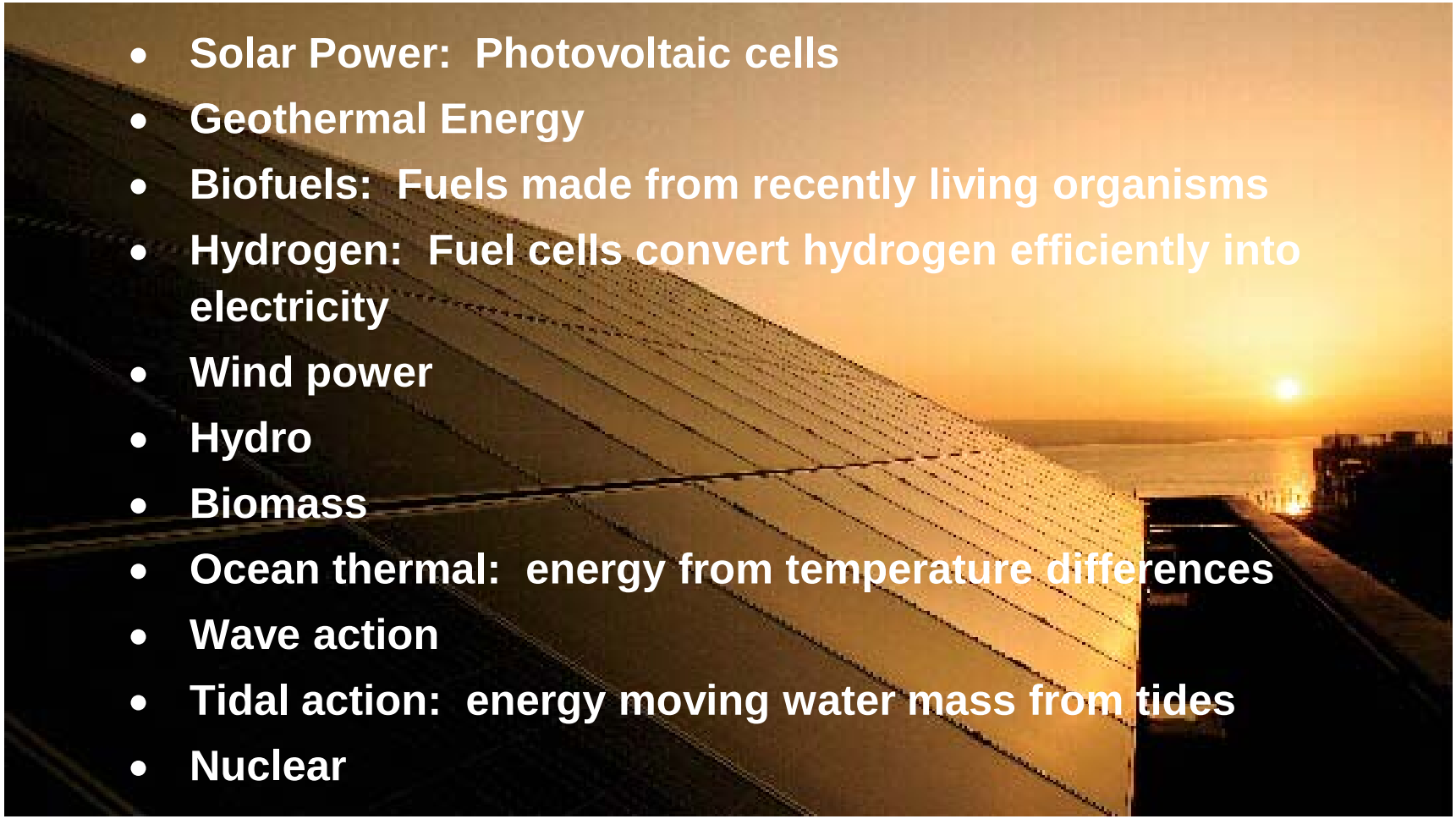
- In 2006, Chevron conducted the Jack well test, setting a record depth for a well test in the deepwater U.S. Gulf of Mexico. It was completed and tested in 7,000 feet of water and drilled to a total depth of 28,175 feet. The well penetrated the Lower Tertiary Trend, where advanced seismic technology is enabling Chevron and its partners to locate hydrocarbon deposits under dense layers of salt.
- Jack clearly demonstrates the power of advanced technology to discover significant new energy resources.

Heavy Oil Assets – Kern River Field

- Project Facts
  - Discovered in 1899
  - 8,000 producers / 1,000 injectors
  - 600 thermal observation wells
- Reservoir Properties
  - Depth: 1,000 ft
  - API Gravity: 13°
  - Permeability: 1-2 Darcys
  - OOIP: 3+ Billion BBLS
- Recovery Efficiency
  - Estimated to date (2009): 67%
  - Estimated final: 75+%

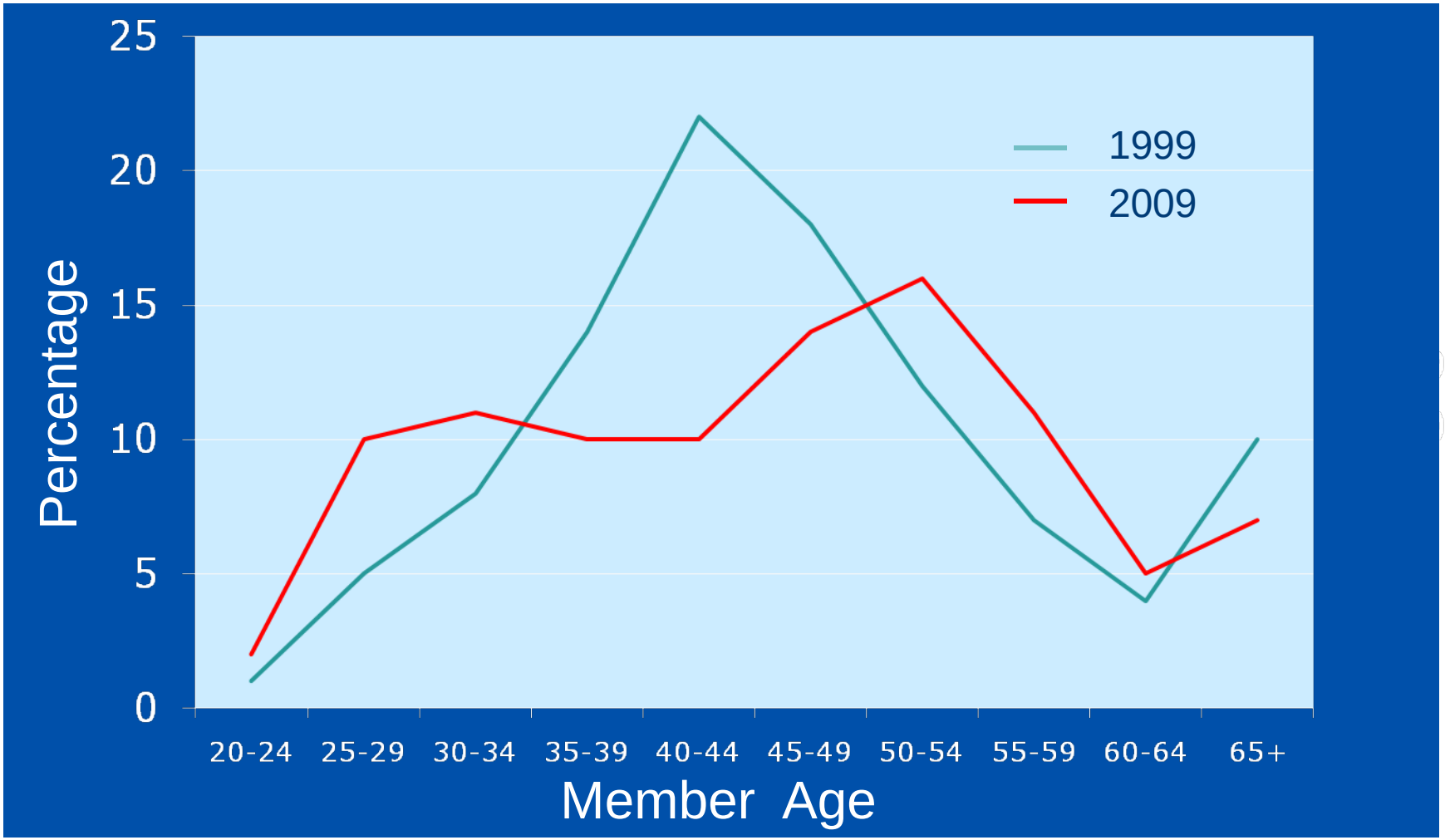


Innovative Technologies: Alternative and Renewable Energy



- Solar Power: Photovoltaic cells
- Geothermal Energy
- Biofuels: Fuels made from recently living organisms
- Hydrogen: Fuel cells convert hydrogen efficiently into electricity
- Wind power
- Hydro
- Biomass
- Ocean thermal: energy from temperature differences
- Wave action
- Tidal action: energy moving water mass from tides
- Nuclear

Number of SPE Young Members Increases



How to Become Competent? Able to Contribute Immediately

- Technical competence
  - Engineering and Science skills
  - Understand technology
- "Soft" skills
  - Leadership
  - Teamwork
  - Communications
  - Diversity
  - Attitude
- Building competence takes time

How to Take Charge of Your Career

- Seek mentoring from professionals in your section or region
- Seek an online SPE “eMentor”
- Build a network through SPE

Build Your Technical Expertise

- Take advantage of the technical resources
- Join a Technical Interest Group
- Read SPE papers
- Learn from experts at SPE

Fig. 4 shows the typical pressure test results on a porosity vs depth plot. The valid pressure tests are on the left plot and unsuccessful tests on the right plot. The black solid line is a 12% porosity reference. The color dots represent the data set was collected from multiple wells in the same field.

Shear Radial Profiling

Because the shear velocity responds to the solid framework of the rock and is not sensitive to fluid effects, further evaluation can be obtained by analyzing the shear velocity in the frequency domain to obtain a shear radial profile. This radial profile is derived from the dipole slowness in the frequency domain. A requirement for this technique to be effective is a dipole source that provides a large amount of energy across a wide frequency band and a tool model that compensates for the effect of the sonic tool in the borehole. This is particularly important in small wellbores, as are found in the Gulf of Thailand, as the physical tool occupies a large portion of the borehole. Previous measurements attempted to analyze the effects of formation damage in the near-wellbore region after failure. This has been done in the past using caliper logs and electrical imaging techniques to evaluate if the formation has yielded in the near-wellbore. This new technique can determine the effects of stress on the formation prior to yielding or the development of breakout behavior. By analyzing the change in slowness with frequency, we can provide significant insight into complex acoustic signatures commonly observed in most wellbores today. The principle of shear radial profiling is well documented by Sinha et al.[3]

Fig. 5 is a dipole dispersion curve showing the relationship among dipole slowness, frequency, and radius.

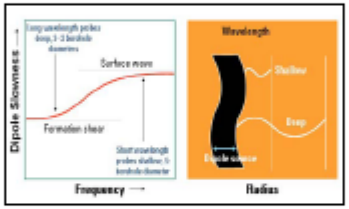


Fig. 5—Dipole dispersion curve.

The shear radial profile principle is illustrated in **Fig. 6**. The black curve represents the model. The red and blue curves are the measured fast and slow shear slowness, respectively.

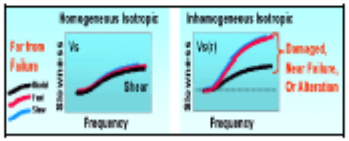


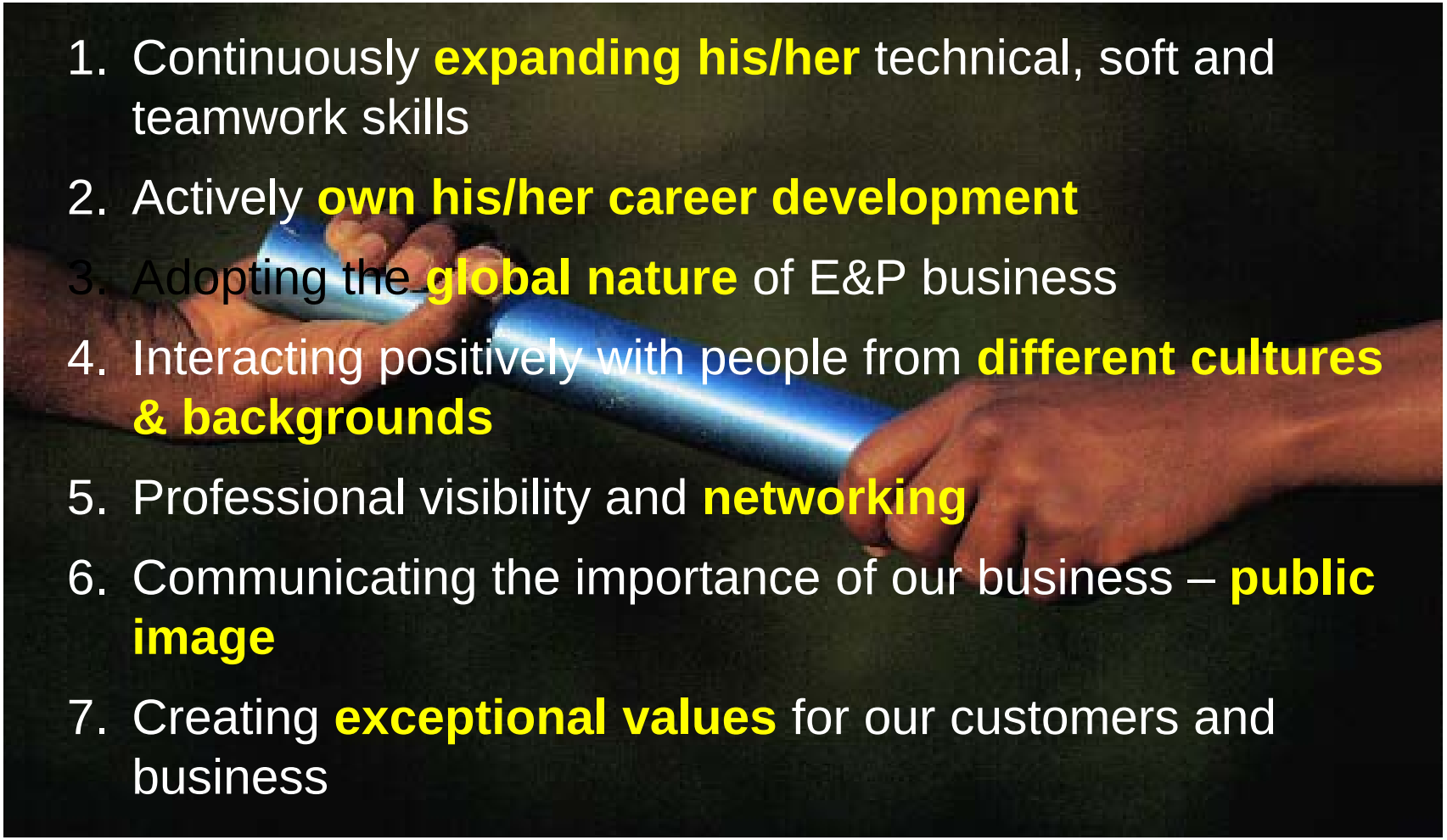
Fig. 6—Principle of shear radial profiling.

Field Example. Data in **Fig. 7** shows the shear radial profiling across the same depth interval as in Fig. 3. From left to right, the hole size and gamma ray are in Track 1, the shear radial variation profile is in Track 2. Track 3 shows the shear radial variation difference. Delta-T shear (DTS) curves in Track 4 are the shear slowness at different depths of investigation. The color maps in tracks 2 and 3 are scaled from the center of the borehole to 30 inches into the formation. The blue shading represents the borehole radius.

Move Beyond Your Comfort Zone – Volunteer

- Take on new assignments
- Serve on a section committee, or lead one
- Introduce a speaker
- Plan an event
- Write a technical paper
- Make presentations

How Can SPE YPs Become More Valuable?



1. Continuously **expanding his/her** technical, soft and teamwork skills
2. Actively **own his/her career development**
3. Adopting the **global nature** of E&P business
4. Interacting positively with people from **different cultures & backgrounds**
5. Professional visibility and **networking**
6. Communicating the importance of our business – **public image**
7. Creating **exceptional values** for our customers and business

The Future of Energy!