Increasing Oil Recovery Factor

Current recovery factor in mature domestic oil reservoirs varies considerably depending on geographic region and reservoir specifics—it might be 30% average recovery in California and half that in many Midcontinent reservoirs. In both cases though, there is the potential to significantly increase the recovery factor being experienced. Two recent PTTC workshops, in Kansas and California, focused on doing just that. Addressing typical local operators in southeast Kansas, PTTC staff focused on the basics of identifying damage, quantifying additional potential, and practical approaches a smaller operator could implement.

California’s reservoirs and the increased technical capability of companies operating there allows more complex approaches. PTTC’s West Coast Director Iraj Ershaghi noted two basic approaches to increasing recovery—well work (workovers/redrills) and reservoir characterization that leads to additional development. In the well work arena, factors are excessive water production, formation damage and emulsion blocking. Several regional projects have addressed controlling water production. With formation damage it is critical to really study the damage (and the solution). Proving the point on additional reservoir characterization, Ershaghi cited Tidelands’ Wilmington field experience and the Venoco South Ellwood projects. There, detailed 3-D reservoir characterization and visualization identified undrained compartments that new wells are profitably draining. When taking a serious relook at a reservoir, there are insights to be gained from reservoir analog studies such as those C&C Reservoirs (www.ccreervoirs.com) has performed. Discussing their findings, C&C noted that fluid type (gas, conventional oil, or heavy oil), permeability and drive mechanism are primary factors affecting recovery.

Underbalanced drilling (UBD), often in conjunction with horizontals, is another important tool. Blade Energy Partners drove home the point that UBD means “always maintaining underbalance.” Damage from overbalanced drilling is particularly problematic in horizontals. UBD may cost the same or a little more, but there are real advantages from a cost avoidance (lost circulation, rate of penetration) and recovery standpoint. With UBD it’s not just higher initial production—long-term production trends indicate there is usually a true increase in estimated ultimate recovery.

Additional recovery need not be exotic. The LATA Group’s nitrate-based biocompetitive exclusion process (www.latagroup.com) addresses a common operational problem, reservoir souring. Beyond this, when applied downhole, there can be a beneficial enhanced oil recovery effect from microbial byproducts. Through videotape, Mike Dennis, LATA Group’s president, shared several California- and other U.S.-based case studies. Tex Boratko with Schlumberger described two of their tools that help get valuable behind pipe information: (1) the Cased Hole Formation Resistivity tool enables through pipe resistivity measurements and (2) the Cased Hole Dynamics Tester drills small holes through pipe into the reservoir, retrieves fluid samples, then mechanically plugs the holes. Fluid and pressure data are invaluable for evaluating recompletions or redrills.

Technology alone is not the complete answer. The West Coast Region’s 2005 Tech Transfer Award went to Oxy and the State Lands Commission. Oxy applied high angle, extend-ed-reach drilling to redevelop a previously abandoned (1990s) state lease in the Belmont Field. Drilling from existing Oxy facilities in Long Beach’s Chaffe Island, there was minimal environmental impact. Production rates from initial wells have been quite attractive and more are planned. The State Lands Commission demonstrated permitting flexibility that allowed this redevelopment to occur.☺
focus on tight gas. Several world-class speakers have already agreed to share their insights and experience for the benefit of others. Case studies will be shared to illustrate concepts. With a Houston location and effective promotion, high attendance is anticipated. We're leveraging this expertise by videotaping presentations and Q&A sessions to deliver them online so you can learn on your schedule.

Distance Learning Module Available Soon

There are already additional topics and experts in mind following this module—gas shale development is just one.

Another avenue where PTTC anticipates using online video is capturing brief (10-15 min.) clips from technology developers. This effort will efficiently connect producers with a myriad of developer technologies. Watch PTTC’s website (www.pttc.org) for further information. Over time, we anticipate there will be quite a collection of products and services for busy producers to peruse. There will be occasion, as we've already done with a presentation on horizontal drilling in mature reservoirs, where we capture more extended presentations. Contact us if you have a technology idea that can be briefed in the form of a video clip to be shown on the website.

There has already been an unforeseen use of the video approach. It is not always possible for speakers or attendees to meet at the same time and location for physical workshops. However, a provider with a highly relevant technology was unable to be in California for a recent West Coast workshop so the 15 minute presentation was recorded ahead of time and played during the workshop. Q&A took place normally with questions answered remotely over the phone and tied into the PA system. The technology fit in with the workshop and was able to be included in the program.

Distance learning potential is real and not meant to replace face-to-face meetings. Rather, the goal is to fit the busy schedules that the industry demands of us all and allow development of knowledge and provide a vehicle for technology transfer effectively. By capturing even a fraction of the workshop experience presented each year, a growing wealth of knowledge will populate the website and allow industry to learn from their desks.

Appalachian Region Public Outreach

2005 NRCCE Holiday Open House (Dec. 15): Featuring the unveiling of movie set panels donated by Columbia Pictures depicting West Virginia’s energy industries created for the film Spider-Man 2 from the original 1940s mural in WVU's White Hall by artist Robert Lepper.
Proposed Revisions to SPCC Rule

In early December, the Environmental Protection Agency (EPA) proposed two separate amendments to the Spill Prevention, Control, and Countermeasure (SPCC) Rule. One streamlines the regulatory requirements for qualified facilities and equipment. The second extends the SPCC compliance dates for all facilities.

The EPA proposes extending the compliance dates for both Plan amendment and implementation to October 31, 2007 for all regulated facilities. Extension would allow those facilities that may be affected by a final rule to take advantage of any streamlined provisions that may be promulgated.

The proposed rule revisions provides, among other things, two streamlining options for qualifying facilities/equipment. The proposal provides: (1) An option that would allow owners/operators of facilities that store less than 10,000 gallons of oil and meet other qualifying criteria, to self-certify their SPCC plan, in lieu of review and certification by a Professional Engineer and (2) An alternative to the secondary containment requirement, without requiring a determination of impracticability, for facilities that have certain types of oil-filled equipment.

For more information on the proposed revisions, visit www.epa.gov/oilspill/nprm.htm. The EPA is requesting public comments on the proposed compliance date extension (before Jan. 10, 2006) and revised provisions (before Feb. 9, 2006).

Tundra Travel Model Extends Alaskan Winter Travel Season

The Alaska Department of Natural Resources has changed the way it measures ground hardness for North Slope tundra openings. The new standard, based on results of the tundra travel study sponsored by DOE NETL’s Arctic Energy Office, is based on snow cover and subsurface temperature measured by thermistors at 16 North Slope sites. Sounds nice, but what does this mean? Conditions will vary each year, but in general the new standards will lengthen the winter season when travel is allowed—often a month or more. Put simply, more time means more exploration means more reserves.

Green Completions Make Economic & Environmental Sense

Sharing in an EPA Natural Gas STAR workshop that Devon Energy Corporation (Devon) hosted in Casper, Wyo. last August, Devon noted that it “recently spent $15,000 to capture methane from a new natural gas well in the Wamsutter area as part of a pilot program. It then sold that methane for $35,000, making a quick net gain of $20,000.” There is a big opportunity to reduce emissions when completing new wells. When a well is first drilled and treated for production, there is usually a large volume of sand, water, methane and various condensate material that must be cleared out of the system before it is tied to a pipeline for sale on the market.

Devon, BP and others are developing so-called “green completion” systems that consist of a vessel that captures sands and solids, a three-phase separator and several fluid vessels. BP tested its first mobile unit in New Mexico at a cost of $1.4 million. The company used it on 106 well completions, recovered 350 million cubic feet (Mmcf) of gas and 6,700 barrels of petroleum condensate per year, and in two years the investment had reaped more than $1.6 million.

Note: PTTC is working with Natural Gas STAR to develop a “green completions” case study. Watch for it in the Petroleum Technology Digest in World Oil in 2006.


Texas RRC Offering Assistance for Brownfields Site Assessment

The Railroad Commission of Texas (RRC) is offering assistance with environmental assessments at abandoned O&G facilities. Through a brownfields grant from the U.S. Environmental Protection Agency (EPA), the RRC has created the Brownfields Response Program to identify brownfields sites associated with E&P activities and to promote voluntary cleanup by providing funding for environmental site assessments with little to no cost. The RRC Voluntary Cleanup Program will provide a framework for the oversight of assessments.

The RRC welcomes inquiries from anyone interested in applying for a no-cost, federally-funded assessment. Potential stakeholders may include local governments, non-profit organizations, tribes, universities, private landowners or developers.

For more information, visit www.rrc.state.tx.us/divisions/og/brownfield/index.html.
2005 World Oil Awards

On October 20 World Oil announced winners of its 2005 Awards. In its fourth year, the awards program recognizes technological advancements and innovative companies. Nominations are gathered over a three-month period, then short-listed to finalists in each category. Award winners are determined by the Awards Advisory Board (21 people) and the Next Generation Committee (15 recent graduates). Winners in selected categories shown below are:

**Best Drilling Technology**


**Best Production Technology**


**Best Completion Technology**

Easywell's Swell Packer Technology (www.ews.as/technology/swell): swells when exposed to hydrocarbons, can flex and stay sealed.

**Best Exploration Technology**


**Best Data Management Solution**

Transzap's SpendWorks (www.transzap.com/services/spendworks.html): a web-based system to streamline the procurement-to-pay process.

There are several finalists in each category. Producers are urged to review all finalists—technologies may not have won the award, but they may be just what one needs.

For more details and to view a complete list of recipients, visit: www.awards.worldoil.com.

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**Downhole Fluidic Oscillator Tool Removes Near Wellbore Damage**

The Downhole Fluidics Oscillator, offered by Downhole Fluidics, Inc., creates pulsating pressure waves to break up near wellbore damage. The tool is a true fluidic oscillator, based on the Coanda Effect (http://abcasia-pacific.com/nexus/stories/704526.htm). It does not rely on cavitation to create pressure waves. There are no packer elements to fail. Unlike mechanical tools, which suffer from high-energy losses, the tool maximizes the energy potential of the pumped fluid.

Downhole Fluidics' reports that they have treated more than 2,500 wells in 12 states and seven international areas. In their experience, the tool leads to longer-term production/injection increases than "similar" tools/processes. Limited case study data are presented on their website. Additional applications reported by them to PTTC include:

- **Injection well** (Texas)—cleaned perfs with water, then acid/xylene. Injection rate went from 48 bwpd @ 1,500 psi to 400 bwpd @ less than 2,000 psi.
- **Oil well** (Gulf of Mexico)—tool in conjunction with CO2 acid stimulation. Production increased from 1,100 bopd on a 22 choke to 2,100 bopd on a 28 choke.
- **Gas well** (south Texas)—tool in conjunction with acid job using the Gidley CO2 process (www.pttc.org/news/3qtr2005/v11n3p8.htm). Before treatment the well would not produce against line pressure (300 Mcfd @ 800 psi). Production limited by scale and fines in the pack. After treatment the well produced 2,000 Mcfd @ 4,800 psi.
- **Gas storage wells** (Oklahoma)—Gas deliverability was improved 32.5% in 14 wells (SPE 91390).

For more information, visit Downhole Fluidics' website (www.dhfluidics.com) or contact Andy Rowe (andy.rowe@dhfluidics.com).

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**Quickly Finding Infill-Drilling Potential in Mature Tight Reservoirs**

As opposed to performing a complete reservoir evaluation, which involves significant effort and time, a fast approach that extends the moving-window method is proposed. It consists of multiple local analyses, each in an areal window centered on an existing well. Going beyond empirical or statistical analyses, the model-based analysis combines the material balance equation and the equation for pseudosteady-state flow. Parameters used as proxies in the pseudosteady-state-flow model are best-year production (BYP, the best 12-consecutive month production period) and virgin best-year production (VBY, monthly average rate of a well at virgin-reservoir conditions). Well spacing is used as a proxy for drainage.

Tested through simulation, the influences of various parameters were found to be:

- **Heterogeneity**: Estimates of average infill-well performance are conservative and become more scattered as the reservoir becomes more heterogeneous.
- **Average Permeability**: Estimates become more scattered as average permeability increases (comparing results in 0.2 md and 1.0 md analyses).
- **Search Area**: The smaller the search area the better, as long as there are enough wells. Geologically, the search-area size should be small enough to avoid large changes in reservoir properties.

Estimates for individual "picked" locations can vary widely, but it is significant that "average" infill-well performance for different windows was accurately predicted. Thus, while not a tool for estimating individual well performance, the approach is reliable for defining infill-drilling potential in different local areas. Knowing this, operators can avoid infill drilling in the wrong area and focus their development effort in areas of highest potential.


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Optimizing Mature Assets

In a recent article in Hart's E&P, Jorge Manrique, Knowledge Reservoir, L.P. insightfully stated some concepts that operators should consider as they strive to optimize performance of mature producing assets. Optimization does not necessarily mean implementing the cheapest option. Neither does it mean blindly choosing the most sophisticated option. In practice, one needs to identify the level of complexity of the problem at hand and match the tool accordingly. Understanding the reservoir through proper diagnostics and knowing what can be achieved with technology is absolutely critical. The goal is simple—to close the gap between current production and the reservoir potential in a multi-well system.

Common thoughts that need challenging are:

- *I need more data*—maybe not? Has all the existing data been analyzed and understood? Do you really have to know everything, or is it just key points? Optimization is analysis conducive to action.

- *Let's deal with the problems rather than create opportunities*—often makes sense to help good wells become even better as opposed to working with the "dogs."

- *Let's focus on other issues*—they will always be there, don't let the urgent displace the important.

The tools for optimization are there if the approach and will are. Go forth and optimize.


Sucker Rod Handling
- Parts 2 and 3

Last quarter we highlighted a "Part 1" article on rod storage and transportation. Now Parts 2 and 3 of this four-part series by Russell Stevens and Scott Malone of Norris have been published in Well Servicing:

- Part 2: Running and Re-Running (September/October 2005)

Again, these are recommended reading whether as a refresher course or as training for a new hand.◆

SPE’s Industry Search Engine

Nearly all are familiar with keyword-based search engines like Google. Although effective in locating material, they can generate a large number of hits that require extended time to wade through. In contrast, SPE’s industry search engine uses a concept-based search technology, going beyond just looking for occurrences of words. This means the finds will be more focused.

One can simultaneously search SPE websites, the eLibrary (papers) and E&P industry sites or any combination of the above. There are now nearly 500 E&P-related websites (this includes the PTTC network) that SPE “spiders” for inclusion within the E&P industry sites and this list continues to grow. Sources include research institutes, news sources, government entities, universities, service companies, professional organizations, oil and gas companies and environmental groups. Hits returned from an industry-specific search engine run a much higher probability of being qualified than with keyword-based systems.

PTTC urges people to try it out (www.spe.org/mainsearch/basicSearch.do). Nothing to lose and time to gain. And the finds may be more on target too.◆

Juckett Named Director of AAPG’s Washington Geoscience and Energy Office

Don Juckett, retired in 2003 from DOE’s Office of Natural Gas and Petroleum Import and Export Activities, was recently named Director of GEO-DC (AAPG’s Geoscience and Energy Office in Washington). Prior to joining DOE, Juckett held various positions with Phillips Petroleum in research and research management. GEO-DC’s goal is to become a recognized, informed and responsible member of the community of non-governmental organizations in Washington that is recognized for its ability to educate government, media and other non-governmental organizations. Nine individuals within AAPG leadership will serve on GEO-DC’s board. GEO-DC is located in the American Geological Institute's office in Alexandria, Virginia. There will be a full report on AAPG’s GEO-DC initiative in the January issue of Explorer.

O&G Resources in the Appalachian and Illinois Basins

Developed by IOGCC’s Appalachian and Illinois Basin Directors with DOE support, this higher-level strategic report estimates remaining technically recoverable resources, including proved reserves, in the range of 4.8 billion barrels of oil and 79 to 96 Tcf of natural gas. The majority of the remaining hydrocarbon resources exist in unconventional settings (coal seams, Devonian-age shales, and tight gas sands) and previously untapped deeper formations. The study outlines how and basin-wide perspectives will be fundamental in tackling the above prerequisites.


Free Google Earth (www.earth.google.com)

Pick anywhere on earth and Google Earth will deliver it, based on satellite and aerial photography. Although data is usually 2 or 3 years old, and resolution may be limited in less populated areas, this service still can be of use to check out potential well sites, plan surface facilities and other tasks that require knowing the lay of the land.

Google Earth is an offshoot of Google Maps, a free directions service. Users can input coordinates or search for specific places and addresses. One neat feature is that you can view the terrain from any angle and "fly" over an area. Nominally-priced Plus and Pro packages with additional capabilities are available.

Thanks to PTTC Rocky Mountain Region for alerting us to Google Earth.

SWD (Surveying-While-Drilling) in Vertical Land Wells

It’s becoming ever more costly to drill. At the same time, the cost of developing and deploying measurement-while-drilling (MWD) tools and support hardware is declining. Forces are in place for "stripped down" SWD tools, such as those offered by UltraDrilling Technologies since 2003. Stripped down means transmitting full survey measurements of inclination and azimuth on demand at connection time (not tool face orientation during sliding as in full-blown MWD tools, so this is only for vertical hole operation). By transmitting only when off bottom and not while drilling, battery life is increased and costs are reduced. Additionally, since pulses are detected more easily with pumps on and off bottom, staff requirements are less. If wells are within a reasonable distance of one another, one SWD operator can service four or five rigs.

The SWD day rate falls out to be about half that of typical MWD services. When one considers rig cost and time required for conventional wireline surveys, SWD becomes attractive on a cost basis alone. Additional intangible benefits might include: (1) reduced chance of sticking since pipe not sitting for surveys, (2) more surveys when deviation problems are there, and (3) immediate correction of slight deviations.


New GasGun™ Design Addresses Debris Problem

Used the initial GasGun propellant with the expendable rubber canister but found the debris after shooting a pain? GasGun listened and redesigned to use a high-strength hollowsteel carrier. Add on some improvements to the ignition system that produces a more uniform burn and, according to GasGun after a couple hundred treatments with the new tool, results are very positive.

Traditionally, this State-of-the-Art section has focused on those technologies that are leading edge usually commercial products and services that have been proven in the field and are available to the industry to help find and produce oil and gas more efficiently: faster, cheaper, cleaner than what has been available before. This article looks earlier in the development cycle, considering emerging technologies with a promise of commerciality and the companies that are formed to bring those ideas to commercial fruition. This feature is about the Rice Alliance for Technology and Entrepreneurship and the 3rd Annual Energy Technology Venture Forum held in Houston on September 30, 2005.

Supporting Early Stage Technology Ventures and Technology Transfer

The Rice Alliance for Technology and Entrepreneurship was founded in 1999 and is Rice University's flagship initiative devoted to the support of technology entrepreneurship. The mission of the Rice Alliance is to support the creation of technology-based companies and the commercialization of new technologies in the Houston and Southwest Region through education, collaboration and research. The Rice Alliance has assisted in the launch of over 150 new technologies, raising more than $300 million in early-stage funding. The Rice Alliance mentors early-stage technology companies, provides educational programs, coordinates a business plan competition, and hosts a variety of Technology Venture Forums in such areas as Information Technology, Nanotechnology, Life Sciences and Energy. The papers described below were presented at the third such forum on energy.

The Rice Alliance and the Petroleum Technology Transfer Council have overlapping missions, that being an endpoint where a good idea is nurtured, the means to bring it to a commercial product encouraged, the business plan executed, and new technology put into the hands of customers to make their businesses thrive, benefitting the technology company and their investors, the customers and the public. While the PTTC focuses more in moving new, but proven technologies into the hands of the customer (producers) to improve the way they search for and produce hydrocarbons, the Rice Alliance focuses earlier in the product life cycle to ensure that the good idea is given the resources to become commercial. However, the Rice Alliance is broader in scope, considering technologies in a number of fields other than energy. That said, it's also narrower in scope in that it is focused on technology providers in the Southeastern Region and smaller startup companies that lack the resources that the mainstream larger companies enjoy. While all energy topics are considered, from petroleum exploration to fuel cells and power generation, the Houston focus tends to tilt the mix toward Exploration and Production. And while the geographic focus may seem narrow, it encompasses a large segment of the petroleum industry.

The Rice Alliance Energy Venture Forum is dedicated to the "best of the best." Six new startup technology companies are featured each year along with research organizations. The candidate companies to be featured in the forum are screened on a number of rigorous criteria:

- Viability of the company - ability to generate revenues and profit
- Proprietary technology - strength of the technology and problem solved
- Competitive advantage and ability to sustain that advantage
- Size of the market and potential revenue stream
- Strength of the management team
- Proof of concept from bench testing or field trials
- A sound marketing and business plan
- Attractiveness of the company from an investors perspective

And the Winners Are: (In no particular order)

Focus Energy Corporation, headquartered in Roswell, New Mexico was founded in 2003 by Jim Manatt, former President and Chief Operating Officer of Permian Exploration Corporation. The mission statement of Focus is "To see what has not been seen before in the subsurface ahead of the competition creating distinct economic advantage for our shareholders, clients and company." (www.focusenergy.com) Their proprietary technology is a robust 3-D seismic spatial mapping system for reservoir visualization. With this technology, they have demonstrated the capability to directly detect and map porosity and the bypassed oil and gas in carbonate reefs. In 2002, Focus teamed with Sandia National Laboratory to demonstrate the ability to image bypassed reserves, making a quantum leap over current imaging technology. The project was successful, resulting in a bypassed porosity model of a producing field.

Focus is now prepared to go forward with commercial implementation. The initial target is the carbonate reefs of the 2,100 square mile Central Basin Platform in West Texas and Southeastern New Mexico. According to the Texas University Bureau of Economic Geology, the reef system originally had 12 billion barrels in place, with 3 billion recoverable from wells drilled to date. The remaining "addressable oil" is estimated at 5 billion barrels. Initially, Focus seeks to trade their services for a carried working interest and back-in. The average target is estimated at 375,000 barrels/well and Focus hopes to participate in 40 wells. In Phase II, expected to begin in 2007, Focus plans to take a full working interest in an additional 60 wells. Worldwide reef targets are large and plentiful, including onshore and offshore fields in the

State-of-the-Art Summary

Highlighting and Supporting Startup Energy Technology Providers
by Dwight Rychel, P.E., Petroleum Technology Transfer Council
State-of-the-Art Summary

Middle East, West Texas and New Mexico, Michigan, Western Canada, Indonesia, Africa and Australia.

Jaeco Technology, Inc. of Houston was formed in 2002. They develop, license and sell simple and compact process solutions for offshore operations based on their proprietary and patented technologies. The focus for these technologies is currently offshore drilling and production, but the potential for applications onshore and in other industries is substantial.

The primary technology currently being successfully marketed to the offshore operators is the TEKTOTETM Solution. It is a premixed and packaged 4-, 6-, or 8-barrel container of concentrated cross-linked polymers used to control fluid loss in the perforated interval of the reservoir. It utilizes compressed air to drive a pipeline pig to extrude the viscous material out of the container. The customer is credited for any unused material. Pre-blending eliminates problems for the operator in pumping viscous gel materials, as well as problems with blending on-site or container disposal. Jaeco has recently ramped their fleet to 20 rental units and intends to grow the business by expanding from the Gulf of Mexico to Brazil, West Africa and Norway. Additional growth opportunity exists in expanding their product line to larger 100- or 150-barrel containers and applying a similar strategy to the delivery of concentrated hydraulic fracturing gels.

The most recent technology developed by Jaeco is in the area of compact processing equipment: reactors, distillation, absorption, stripping and dehydration. The initial focus will be proving up the technology in the application of offshore seawater deoxygenation for reinjection back into the reservoir for pressure maintenance. The RAPERTM Solution will be capable of processing 100,000 barrels/day of seawater, with an outlet of 15 parts per billion of oxygen, all at a small fraction of the size of existing modules. The RAPERTM is a mass transfer exchanger reactor that contacts gas and liquid together. It generates a huge liquid surface area with micron-sized gas bubbles. It is scalable and motion insensitive. Due to its compact size, it will reduce operators’ capital expenses as well as operating expenses. The initial niche to prove and establish the technology is the offshore water processing market, but ultimately the technology can be adapted to the larger markets of evaporation, stripping, absorption, dehydration, distillation, and chemical reaction in oil and gas, petrochemical, wastewater and other industries. Jaeco has recently received the patents for this technology and is in the process of fabricating a larger prototype process module. They are seeking an industry partner for field trials, funding to accelerate the development and marketing, and distribution channels.

Houston-based Ultima Labs, Inc. was founded in 2002 by the four principals, formerly of Innova Electronics (www.ultimalabs.com). Ultima is an engineering firm with expertise in sonic, electrical and nuclear magnetic resonance (NMR) logging for wireline, logging while drilling (LWD), measurement while drilling (MWD) and industrial applications. Their products and services include MWD sensor products, MWD board products, industrial control products and custom engineering services. Chief among those is the Compact Propagation Resistivity CPRTM tool. LWD was introduced to the drilling industry in the 1980s and has been dominated by the large service providers. It has the advantage of “geosteering” in deviated wells, but has traditionally been expensive and produced poorer quality data than a wireline. The Ultima tool is designed to overcome these drawbacks. It will be considerably more affordable to the drillers and produce data with quality equal to the wireline data. It was launched in the 3rd quarter of 2002 and the first 6.75-in. low resistivity field test was in the 3rd quarter of 2004. An order for the development of a 4.75-in. tool was received in the 3rd quarter of 2003 and delivered a year later. And as an illustration of the common mission of Rice Alliance and PTTC, Ultima was awarded a DOE Microhole project (DE-FC26-05NT15487 “Microhole Coiled Tubing Bottomhole Assemblies”) for the development of a 3 1/8-in. MWD/LWD collar and is featured on the PTTC website www.microtech.thepttc.org/ultima_labs/ultima_labs.htm#top. This product should be commercial in early 2007. Ultima asserts that the large service companies have done a good job of growing the LWD market, 500 to 1,000 sets globally. They view their market as the smaller service companies and project a market potential of 100 to 200 resistivity collars with annual rental revenues in the $14 to $28 million range.

WOW Energies, based in Houston and established in 2004, offers energy efficiency and pollution reduction technologies. The company owns the patented technology called the Cascading Closed Loop Cycle (CCLC), a breakthrough in energy efficiency that generates electricity from nearly any heat source (www.wowtechnologies.com). It is an advanced technology that converts heat at...
State-of-the-Art Summary

Franklin Fuel Cells of Malvern, Pennsylvania was founded in November 2001 (www.franklinfuelcells.com). Their mission is "to accelerate fuel cell commercialization by developing and producing a unique solid oxide fuel cell technology which is capable of operating directly on today's hydrocarbon fuels." The problem this technology addresses is that current fuel cell technologies need pure hydrogen or need to reform current fuels. The technology is currently in Phase II, Proof of Commercial Viability with initial product revenues expected in 2008. The Phase I Proof of Concept suggests that this fuel cell will compete with internal combustion engines, being twice as efficient and competitive in cost per horsepower. Early applications are expected to be in auxiliary power units for trucks and recreational vehicles and distributed generation, then expanding into the traditional internal combustion transportation market. The potential applications in the oil and gas industry include remote power for offshore applications and in-situ oil shale and heavy oil heating.

The final featured company was 10 Charge, Inc. of Dallas. Their proprietary technology was initially developed in 2001 in Europe. The technology was purchased and brought to the U.S. in 2004. The primary technology is the development of smart, fast battery chargers that deliver the optimal charge for a given battery's unique and dynamic conditions. It is capable of performing as a multi-chemistry charger across a range of previously incompatible battery sizes and types, reducing charge time by up to 90%, and extending the life of the battery by 200% or more. The initial market will be for use with power tools and consumer electronics, then eventually into industrial markets. The product recently completed testing of the first commercially-designed product.

In addition to the six featured technologies and companies, two of last year's featured firms were invited to provide an update on their products and progress. The first was TerraVici Drilling Solutions, of Houston (www.terravici.com). TerraVici is a technology development firm that provides low-cost drilling and completion tools to the oil and gas industry. Their first product is a full 3-D, low-cost, point-the-bit rotary steerable system (RSS) that is designed to outperform most rotary steerable systems on drilling performance at a fraction of the price. The X2 Rotary Steerable System® will be ready for commercial use in 2006. At 15 feet long, the X2 is half as long as the conventional rotary steerable tool configuration, providing savings in capital and operating expenses. The enabling technology is a novel control mechanism, adapted from the automotive industry, that reduces control costs by a factor of 10 without sacrificing performance. The lower cost of the tool will substantially expand the RSS market to include the smaller directional drilling and operating companies.

The other company providing an update from the previous forum was Oxane Materials, Inc. (www.oxanematerials.com), a Rice University nanotechnology spinoff. Oxane is exploring two innovations, aluminates and ferroxanes to enable the development of next generation fuel cell membranes, catalyst supports, coatings, adsorbents, and other high-value products.

Where is Today's Research?

A number of research institutions in the Gulf are engaged in energy and energy-related research, not the least of which are Rice and the University of Houston. Forum participants heard details from four ongoing projects. Topics ranged from produced water issues to EOR surfactants and asphaltene gasification will come into play. In the longer term, gas hydrates and in-situ coal gasification will enter the supply. The technologies that will be required to economically extract that gas are in the early R&D stages.

Looking at oil, the short-term supplies will require higher recovery rates of conventional oil and the exploitation of increasingly mature fields. The medium term will bring in more heavy oil, recovered both cold (7 - 20 degrees API) and with thermal assist (7 to 12 degrees API). In the long term, the mining of bitumen will grow from the traditional onshore, to offshore resources. The commercial technologies on the leading edge today are being directed at the conventional resources and mature field. For heavy oil, technology improvements will be needed in lifting (increasing mobility downhole, chemically and thermally) and transportation, decreasing viscosity and partial upgrades in the field. Possible technology for recovery of offshore bitumen would include applying heat downhole or in-situ retorting.

In the short term, unconventional gas supplies, tight gas, coalbed methane, and shales, will continue to grow in the supply mix. In the medium term, coal gasification and asphaltene gasification will come into play. In the longer term, gas hydrates and in-situ coal gasification will enter the supply. The technologies that will be required to economically extract that gas are in the early R&D stages.

Learn more about the Rice Alliance for Technology and Entrepreneurship through their website (www.alliance.rice.edu). Read about past and upcoming events and success stories, sign up for the newsletter, even become a member, or become a sponsor.
Identifying and Remediating High Water Production Problems in Basin-Centered Formations

Tight fractured gas reservoirs are plagued by interstitial and formation brines that readily overcome gas production during high gas flow rates. In a DOE-supported project, Advanced Resources International, Inc. (ARI) developed a database of 8,000 chemical analyses of produced water from 3,200 wells in the Greater Green River and Wind River Basins. This database and other geologic studies allowed ARI to construct regional atlases and conceptual models of producible water. These products and field work within the Wild Rose Field (Wamsutter area of Greater Green River Basin) provide useful information to operators to reduce costs, improve production rates, and increase the longevity of wells.

Work is finished and the draft report is expected to be finalized soon. The database can be downloaded from DOE's National Energy Technology Laboratory's website.

View project information online at www.netl.doe.gov/technologies/oil-gas/NaturalGas/Projects_r_E&P/Adv%20Diagnostics/RA_A_41437RemediatingHighWater.html. For further technical information, contact DOE's Tom Mroz (Thomas.Mroz@netl.doe.gov) or ARI's Randy Billingsley (rbillingsley@qwest.com).

FutureGen Project Launched

In early December, DOE Secretary Samuel Bodman signed an agreement with the FutureGen Industrial Alliance to build FutureGen. The nearly $1 billion government-industry project will produce electricity and hydrogen with zero emissions, including CO2. Over the next year, site selection, design activities, and environmental analyses will lay the groundwork for final project design, construction, and operation.

The FutureGen Industrial Alliance, which includes both domestic and international companies, will contribute $250 million. The Industrial Alliance plans to issue a site selection solicitation in early 2006, to develop a candidate short list by mid-2006, and to select the final site in mid to late 2007. The FutureGen plant will be sized to generate approximately 275 megawatts of electricity, which is roughly equivalent to a medium-size coal-fired power plant. The plant is expected to start operations around 2012.

FutureGen's goal is to generate electric power with zero emissions that is only 10% higher in cost than today's electricity. At the heart of the project will be coal gasification technologies that can eliminate common air pollutants and convert them to useable by-products. Mercury pollutants will also be removed. These technologies also will turn coal into a highly enriched hydrogen gas, which can be burned much more cleanly than coal or, alternatively, it can be used in a fuel cell or fed to a refinery to help upgrade petroleum products.

For carbon sequestration, the initial goal will be to capture 90 percent of the plant's CO2. Beyond mere disposal in saline aquifers, the CO2 might be applied in enhanced oil or coalbed methane recovery.


NETL-Supported E&P Technologies Receive R&D 100 Awards

Two of four DOE-supported technologies that recently earned "R&D 100 Awards" from R&D 100 Magazine are for E&P applications. The R&D 100 Awards are presented annually to the 100 most technologically significant products introduced into the marketplace over the past year. The O&G-related winning technologies include:

Drill String Radar™—Stolar Research Corporation's Drill String Radar™ is a breakthrough technology using radar navigation for horizontal directional drilling in an undulating coalbed or oil/gas reservoir. Developed for use on a drill string, the technology sends electromagnetic waves into the earth that react with the underground rock layers to provide a "map" of the geologic structure around the drill bit. Stolar's research partners also include CONSOL Energy Inc. and West Virginia University.

Short-Radius Composite Drill Pipe—Advanced Composite Products and Technology Inc., in cooperation with NETL, has developed a short-radius composite drill pipe made from carbon fiber composites rather than steel. The flexible, lightweight drill pipe is particularly amenable to horizontal drilling. Able to stay bent for extended periods without suffering fatigue damage, the composite pipe allows access to these formations from old wells.


Industry Coiled Tubing Drilling/Re-entry Experience

Recent presentations during PTTC/DOE Microhole Technology Integration (MHT) meetings highlighted industry experience with coiled tubing drilling/re-entry.

- BP: Alaska Experience and Anadarko Basin Tight Gas (Cleveland) Horizontal Re-entry Program www.microtech.thepttc.org/current_industry_effort/bp_08172005.pdf
- IPS: Coiled Tubing Drilling: Last 4 slides relate to BP's Cleveland Horizontal Re-entry Program (see above) www.microtech.thepttc.org/current_industry_effort/ips_procoil_11162005.pdf

Watch for details about the next MHT Integration meeting—March 22, 2006 in Houston (www.microtech.thepttc.org).
Interview with John Curtis, Colorado School of Mines, Executive Director of Potential Gas Committee

In September the Potential Gas Committee (PGC) celebrated its 40th year of service to the natural gas community and released its latest biennial report (year-end 2004) on the U.S. natural gas resource base. Their latest assessment of technically-recoverable natural gas resources is 1,110 Tcf (excluding proved reserves), which includes 950 Tcf attributable to traditional reservoirs and 169 Tcf in coalbed reservoirs. Compared to year-end 2002, the traditional resources decreased by 8 Tcf, a less than 1% change, and the coalbed gas resource increased by 0.4 Tcf. These minor changes occurred even though approximately 38 Tcf of domestic natural gas has been produced in the two-year period between reports. The PGC has shown a net increase in the U.S.’s natural gas resource base for the last 10 years, primarily as a result of assessment of new, unconventional natural gas plays and application of new drilling and completion technology. Since independents drill the vast majority of U.S. gas wells, PTTC felt it beneficial to ask John Curtis, Director of the PGC, about the process PGC uses to develop their analysis.

**Q:** What is the level of detail of published PGC estimates?

**A:** The PGC reports gas resource estimates biennially in categories of decreasing certainty: Probable, Possible and Speculative. For each category, a minimum, most likely, and maximum resource volume is estimated for each of 89 geological provinces. Mean values are then calculated by statistical aggregation of the minimum, most likely and maximum values for each category of potential resource. This procedure allows for direct comparison of PGC’s estimates with gas resource assessments made by other organizations, such as the USGS/MMS and the National Petroleum Council. PGC’s work is separate from, and complements the work of these other assessment groups.

**Q:** Who is involved in making the analyses and how do they work together?

**A:** The PGC consists of 145 volunteer members from the natural gas industry, government agencies and academic institutions. Those who determine the remaining gas resource base are a subset of the total membership and are selected because they make their living exploring for and developing gas in the basins that they assess. This is truly applied research, using the most knowledgeable people that we can identify. The PGC members use both public and private company data sources. We assess the resource at the formation or play level, depending on data availability, before reporting it at the province level, which allows us to preserve data confidentiality. The results of each updated assessment are formally peer-reviewed by other PGC members to ensure the most accurate (and credible) estimates.

**Q:** What are some new features of the 2003-2004 report?

**A:** New and enhanced features of the report include: Historical gas production trends; "Top-ten" rankings of gas producers and well production trends and performance; Canadian and Mexican natural gas resource assessments; liquefied natural gas (LNG) and methane hydrates; realities of developing offshore gas resources; access to federal lands for future exploration and production, and a comparison with U.S. gas resource assessments reported by other organizations.

**Q:** How can someone obtain the latest report?

**A:** The 357-page PGC report, Potential Supply of Natural Gas in the United States (December 31, 2004) may be ordered from the Potential Gas Agency, Colorado School of Mines, Golden, CO 80401-1887 (Email jbcurtis@mines.edu, phone 303-273-3886 or fax 303-273-3574). The cost of the printed report is US$495 (US$515 for foreign shipment), if payment accompanies the order. The printed report and companion CD-ROM, are available for US$950 (US$970 for foreign shipment). The CD-ROM also contains a wealth of new information on historical production trends and forecasts for seven onshore and offshore petroleum-producing regions and 39 separate provinces in the Lower 48 States and for Alaska.

Updates ([www.mines.edu/research/pga](http://www.mines.edu/research/pga)) are planned early in 2006.

**Q:** Looking ahead, when will work begin on the year-end 2006 analyses? What can industry do to help ensure the PGC’s effort continues?

**A:** We will begin training and the new assessment process in the summer of 2006 and have the estimates completed by January 2007. We plan to release the estimates and the other sections that examine North American supply and demand in the Spring of 2007. The Committee is always looking for volunteers to assist us in making credible estimates of the nation’s remaining natural gas resources. Continued financial support is also needed and welcomed. The Potential Gas Committee functions independently but with the guidance and technical assistance of the Potential Gas Agency of the Colorado School of Mines. The CSM Potential Gas Agency currently receives financial support from the American Gas Association, Colorado Energy Research Institute and Gas Technology Institute, as well as other industry and government organizations and private individuals. Tax-deductible donations can be made to the Potential Gas Agency of the Colorado School of Mines.

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**John B. Curtis,** associate professor in the Department of Geology and Geological Engineering at the Colorado School of Mines, has served as Executive Director of the Potential Gas Committee, and Director of the CSM Potential Gas Agency since 1991. He spent 15 years in the petroleum industry prior to joining CSM. His skill areas include hydrocarbon resource assessment, petroleum geochemistry and petroleum exploration and development. A certified professional geologist and licensed geologist (Wyoming), Curtis is active in the American Association of Petroleum Geologists, Rocky Mountain Association of Geologists, and other organizations. Appointed by the Governor of Colorado to the Interstate Oil and Gas Compact Commission, he is also active on expert panels of the National Research Council. Curtis received a B.A. and M.Sc. in geology from Miami University, and a Ph.D. in geology from The Ohio State University. He teaches undergraduate and graduate courses in sedimentology and stratigraphy, petroleum geology, petroleum geochemistry and a multi-disciplinary design course at CSM.
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Summaries of PTTC region-sponsored workshops. For summaries of more than 100 workshops (of more than 1,000 conducted) and for a listing of the workshops held, logon to: www.pttc.org or for more details, contact 1-888-THE-PTTC, e-mail:hq@pttc.org. For some of the workshops, speaker presentations have been posted online.

**The EPA Natural Gas STAR Program** — Based on a Producers Technology Transfer Workshop sponsored by Devon Energy Corporation on August 30, 2005, Casper, WY.

**Candidate Selection for Horizontal Drilling with Case Studies in Pennsylvania Sandstone** — Based on a workshop sponsored by PTTC’s North Midcontinent Region on September 15, 2005, Chanute, KS.

**SPCC Rules and 2002 Revisions** — Based on a workshop sponsored by PTTC’s South Midcontinent Region on August 10, 2005, Smackover, AR.

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**American Oil and Gas Reporter Tech Connection Column**

**December**

USGS Assessment, New Technology Point To Michigan Potential

**November**

Mature Areas Respond To Variety Of Technologies

**October**

Varied Data And Information Target Independents

**4th Quarter 2005 Case Studies Petroleum Technology Digest**

Airlift pumping reduces costs, boosts revenue in Illinois stripper wells (Oct.)

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**Tech Developers**—Your Case Study Needed! Contact Lance Cole, lcole@pttc.org.

Petroleum Technology Digest is a joint project of Gulf Publishing (World Oil) and PTTC. See case studies online at www.pttc.org/case_studies/case_studies.htm. Contact lcole@pttc.org.

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**AWARDS**

**Bennett Bearden,** University of Alabama and PTTC’s Eastern Gulf Region, was recently appointed to AAPG’s Public Outreach Committee.

**Fred Mark,** formerly associated with PTTC Rockies, received RMAG’s Distinguished Public Service to the Earth Sciences Award.

**Ernie Mancini,** University of Alabama and Director of PTTC’s Eastern Gulf Region, recently added another task, serving as elected president of the American Geological Institute. Best wishes to Ernie in his multi-tasking. Ernie has become recognized as the University’s “Rock Star.”

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**Alerts Via E-Mail: Another PTTC Service**

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Director: Doug Patchen
West Virginia University
304-293-2867 ext. 5443
Coordinator: Mark Hoffman, 304-293-2867 Ext. 5446
www.karl.nrcc.wvu.edu

**Central Gulf Region**
Director: Bob Baumann,
Louisiana State University
225-578-4500
Coordinator: Don Goddard, 225-578-4538
www.cgrpttc.lsu.edu

**Eastern Gulf Region**
Director: Ernest Mancini
University of Alabama
205-348-4219
Coordinator: Bennett Bearden, 205-348-1880
http://egrpttc.geo.ua.edu

**Midwest Region**
Director: David Morse
Illinois State Geological Survey
217-344-5527
Coordinator: Steve Gustisson, 217-244-9337
www.isgs.uiuc.edu/pttc

**North Midcontinent Region**
Director: Rodney Reynolds
Kansas University Energy Research Center
785-864-7388
Coordinator: Dwayne McCune, 785-864-7398
www.nmcppttc.org

**Rocky Mountain Region**
Director: Sandra Mark
Colorado School of Mines
303-272-5107
www.prtcokies.org

**South Midcontinent Region**
Director: Charles Mark
Oklahoma Geological Survey
405-325-3031
Coordinator: Michelle Summers, 405-325-3031
www.ogs.ou.edu/PTTC/

**Southwest Region**
Director: Robert Lee
Petroleum Recovery Research Center
505-835-5408
Coordinator: Martha Cather, 505-835-5685
http://octane.nmt.edu/sw-pttc

**Texas Region**
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Bureau of Economic Geology
University of Texas at Austin
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Coordinator: Sigrid Clift, 512-471-0320
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**West Coast Region**
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University of Southern California
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January 2006

1/17-18 Texas core workshop: *Tight Gas Sands of the Cotton Valley Formation of East Texas* (Matador Resources) - Austin, TX. Contact: 512-471-0320
1/TBD Southwest: *Kickoff meeting for San Juan Database Project* - Farmington, NM. Contact: 505-835-5685

February 2006

2/2 Rocky Mountain: *How To Use GIS and GPS To Map Oilfield Assets* - Golden, CO. Contact: 303-514-4098
2/8 Texas/Central Gulf: *Horizontal Well Technologies and CBM Applications* - Houston, TX. Contact: 512-471-0320
2/13-14 South Midcontinent: *Oklahoma Aggregates Association Annual Meeting* - Oklahoma City, OK. Contact: 405-524-7680
2/21 PTTC Workshop Series: *Hydraulic Fracturing Module* - Houston, TX.
2/23 West Coast software training: *Transformation of Old Data Sets Software Training* - Valencia, CA. Contact: 213-740-8076
2/TBD Midwest: *Log Interpretation* - Location TBD

March 2006

3/21 South Midcontinent: *Coalbed Methane and Gas Shales in the Southern Midcontinent* (Oklahoma Geological Survey) - Oklahoma City, OK. Contact: 405-325-3031
3/23 Midwest: *Michigan Field Experiences; Focus on Carbonate Reservoirs* - Mt. Pleasant, MI. Contact: 269-387-8633
3/23 Central Gulf: *Work Production Performance Toolbox for Independents* - Shreveport, LA. Contact: 225-578-4538
3/TBD Eastern Gulf core workshop: *Smackover (MSBRPG)* - Tuscaloosa, LA. Contact: 205-348-1880
3/TBD North Midcontinent: *PJEFFER and Oil and Gas Data and Analysis Tools Available Online* - Wichita, KS. Contact: 785-864-7398
3/TBD North Midcontinent: *Kansas Reservoir Log Analysis Catalog* - Lawrence, KS. Contact: 785-864-7398
3/TBD Southwest/Texas: *Permian Basin Horizontal Drilling Update* - Midland, TX. Contact: 505-835-5685

April 2006

4/11 North Midcontinent: *Maintenance and Repair of Casing Integrity* (SPE Wichita) - Wichita, KS. Contact: 785-864-7398
4/25 or 26 South Midcontinent: *Fayetteville Play* - Ft. Smith or Little Rock, AR. Contact: 405-325-3031
4/25 North/South Midcontinent: *Independents' Day @ SPE Improved Oil Recovery Symposium* - Tulsa, OK. Contact: 918-241-5801
4/TBD Eastern Gulf: *Environmental* (MSBRPG) - Jackson, MS. Contact: 205-348-1880
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