UNCONVENTIONAL OIL AND GAS RESERVOIRS
PETE 612
Tentative Syllabus and Administrative Procedures
Fall 2012

Class Meetings: T, TH: 9:35 – 10:50 a.m., RICH 208
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Office Hours: W: 3:30-4:30 p.m.; Th.: 3:30-4:30 p.m.; other hours by appt. or when door is open

As we deplete conventional oil and gas reserves, “unconventional” energy resources are increasingly important to U.S. and international energy supplies. In 2009, coal beds, shales, and low-permeability (tight) sandstones, combined, accounted for 55% of the U.S. dry gas production (DOE/EIA-0383, 2011). That year, U.S. production of coalbed methane, exceeded 1.8 trillion cubic ft (Tcf), which was 9% of the total dry gas production (21 Tcf); tight sands produced 6.6 Tcf, and shales produced 5.0 Tcf of dry gas (DOE/EIA-0383, 2011). The US DOE/EIA (2012) estimates that, by 2035, unconventional reservoirs will account for 75% of the total US dry gas production of 26.3 Tcf, led by shales, which will account for 49% (13.6 Tcf) of the dry gas produced, Today, shale gas and oil projects are among the most active hydrocarbon plays in North America. U.S. oil production grew approximately 6% from October 2011 through March 2012, largely due to increases in shale oil production from the Bakken and Eagle Ford Formations. For example, oil production from the Eagle Ford Shale accelerated from 36.6 million barrels in 2011, to 27.1 million barrels for the only the first four months of 2012, according to Texas Railroad Commission figures.

Internationally, there are tremendous unconventional hydrocarbon resources, including the heavy oil resources in Eastern Venezuela, Western Canada, and other areas, and we are beginning to evaluate and exploit these resources. Gas hydrates resources, although great, await development of technology that will lead to their economic production.

While resources of unconventional hydrocarbons are very large, economically recoverable volumes (reserves) are much smaller, because the greater costs and the additional technology required for economic production from wells. Many unconventional reservoirs have low matrix permeability, and natural fractures may be necessary for economic production rates. Therefore, optimal development of unconventional reservoirs requires knowledge of the optimal drilling, completion and stimulation methods for low-permeability reservoirs, as well as understanding of the role of natural fractures in fluid flow. Finally, the increased dependence on natural gas for generation of electricity in the U.S. necessitates increased storage capacity near consumers to meet peak demands. Thus, understanding of the geologic and engineering aspects of gas storage reservoirs is vital for optimum resource management.

The objectives of this course are to familiarize students with the unique aspects of unconventional gas and oil reservoirs, including their (1) resources and economic significance (2) geologic occurrences, (3) controls on production rates, (4) drilling and completion practices, (5) reservoir management, and (6) present activity.


Text and Materials: There is no assigned textbook. Materials will come from a variety of current reports, published texts, and papers. Reference materials and reading assignments will be handed out and/or placed on a website. Lectures will be recorded and available in e-learning, and slides will be posted for viewing.

Selected References:
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Basis for Grades:
Homework and Report (includes, peer evaluations) ........................................25 percent
Homework and Quizzes ...................................................................................25 percent
Midterm Examination (Oct. 19 – 22); online .................................................25 percent
Final Examination (Friday, Dec. 7, 12:30 – 2:30 p.m.) (and online) ............22 percent
Participation .........................................................................................................3 percent
Total = 100 percent

Grade Cutoffs: (Percentages)
A: ≥ 90  B: 89.99 to 80  C: 79.99 to 70  D: 69.99 to 60  F: ≤ 59.99

Student Papers and (GUIDELINES – SUBJECT TO REVISION)
Working in teams, students will write reports on topics related to unconventional
resource occurrences and development. Topics will be assigned by 20 September, and
preliminary outlines and references are due 11 October. You will be given general outlines
(guidelines) of topic to be covered. Reports will be submitted in both paper and digital
formats, following either SPE or AAPG publication guidelines. Text of reports will be 15-20
double-spaced pages; tables and figures may be either embedded in the text or placed at the end,
following the references. Use EndNote software for references. Reference papers used to
prepare reports will be submitted as pdf files embedded in EndNote. All reports will be due
by 5 p.m. on 4 December. Peer reviews will be submitted when you submit the reports. Also,
reports will be posted on the share drive and will be available to all class members. Finally, as a
homework assignment, each team will submit a “Class Exercise” pertinent to their research
topic.

Policies and Procedures
1. Students are expected to attend every class.
2. All work shall be done in a professional manner; work shall be as complete as possible.
3. Policy on Grading
   a. Homework and exams will be graded on the basis of answers only — partial credit, if
given, is given solely at the discretion of the instructor.
   b. All work requiring calculations shall be properly and completely documented for
credit.
   c. All grading shall be done by the instructor, or under his direction and supervision,
and the decision of the instructor is final.
4. Policy on Regrading
   a. Only in very rare cases will work be considered for regrading; e.g., when the total number of points deducted is not consistent with the assigned grade. Partial credit (if any) is not subject to appeal.
   b. Work that, while correct, cannot be followed, will be considered incorrect and will not be considered for a grade change.
5. The grade for a late assignment is zero. Homework will be considered late if it is not turned in at the start of class on the due date. Late or not, all assignments must be turned in. A course grade of Incomplete will be given if any assignment is missing, and this grade will be changed only after all required work has been submitted.
6. Each student should review the University Regulations concerning attendance, grades, and scholastic dishonesty. Anyone caught cheating on an examination or collaborating on an assignment where collaboration is not specifically allowed may be removed from the class roster and given an F (failure grade) in the course.

Course Description

Primary responsibility for the review topics will lie with the student. Recorded lectures and slides covering these topics will be posted for your review.

1. Introduction to Unconventional Energy Resources
   - What are unconventional resources?
   - Where do they occur?
   - Economic significance of each
   - Technical, economic, political, and environmental constraints on development

2. Petroleum Systems (review)
   - Systematic approaches to resource assessment
   - Hydrocarbon origin
   - Hydrocarbon migration
   - Hydrocarbon entrapment

3. Natural Fractures (review)
   - Importance in unconventional reservoirs
   - Origin, occurrence, and predictability
   - Fracture effects on HC storage, porosity, and permeability
     - Permeability anisotropy
     - Coning
     - Breakthrough
     - Boundaries
   - Roles in exploration
   - Roles in reservoir management - primary and enhanced recovery
   - In-situ stress - importance in unconventional reservoir performance
   - Classification of fractured reservoirs
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Low-permeability (Tight) Sands
- Occurrences, hydrocarbon origins, resources, explor. methods, reservoir characteristics
- Drilling, completion, and stimulation methods
- Facilities, reservoir management, limitations on development, present activity

Coalbed Gas
- Occurrences, hydrocarbon origins, resources, explor. methods, reservoir characteristics
- Drilling, completion, and stimulation methods
- Facilities, reservoir management, limitations on development, present activity
- Water and environmental issues

Shale Reservoirs (Gas and Oil)
- Occurrences, hydrocarbon origins, resources, explor. methods, reservoir characteristics
- Drilling, completion, and stimulation methods
- Facilities, reservoir management, limitations on development, present activity
- Water and environmental issues

Gas Hydrates
- Occurrences, hydrocarbon origins, resources, explor. methods, reservoir characteristics
- Recovery methods
- Limitations on development, present activity
- Environmental issues

Heavy Oil
- Occurrences, hydrocarbon origins, resources, explor. methods, reservoir characteristics
- Drilling, completion, and stimulation methods
- Facilities, reservoir management, limitations on development, present activity
- Environmental issues

Gas Storage (Depending on Available Time)
- Types and locations of gas storage reservoirs
- Technical issues and terminology
- Gas storage volumes and economics

Other Unconventional Energy Resources and Issues That May be Addressed
- Geothermal Energy
- Coal
  - Conversion to gas
  - In-situ gasification
Americans with Disabilities Act (ADA) Policy Statement

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact the Disability Services in Room B118 of Cain Hall, or call 845-1637. For additional information visit http://disability.tamu.edu

Coursework Copyright Statement (Texas A&M University Policy Statement)

The handouts used in this course are copyrighted. By "handouts," this means all materials generated for this class, which include but are not limited to syllabi, quizzes, exams, homework, lab problems, in-class materials, review sheets, and additional problem sets. Because these materials are copyrighted, you do not have the right to copy them, unless you are expressly granted permission.

As commonly defined, plagiarism consists of passing off as one's own the ideas, words, writing, etc., that belong to another. In accordance with this definition, you are committing plagiarism if you copy the work of another person and turn it in as your own, even if you should have the permission of that person. Plagiarism is one of the worst academic sins, for the plagiarist destroys the trust among colleagues without which research cannot be safely communicated.

If you have any questions about plagiarism and/or copying, please consult the latest issue of the Texas A&M University Student Rules, under the section "Scholastic Dishonesty."

“Aggie Honor Code”

“An Aggie does not lie, cheat, or steal or tolerate those who do.” Upon accepting admission to Texas A&M University, a student immediately assumes a commitment to uphold the Honor Code, to accept responsibility for learning and to follow the philosophy and rules of the Honor System. Students will be required to state their commitment on examinations, research papers, and other academic work. Ignorance of the rules does not exclude any member of the Texas A&M University community from the requirements or the processes of the Honor System. For additional information please visit: www.tamu.edu/aggiehonor/ On all submitted course work, assignments, and examinations in this class, recognition and acceptance of the following Honor Pledge is implicit in the student’s signature on the class materials: “On my honor, as an Aggie, I have neither given nor received unauthorized aid on this academic work.”