17.906 The Geopolitics and Geoeconomics of Global Energy, Spring 2007
Prof. Flynt Leverett

**Lecture 1: Introduction to Course. The Economic and Strategic Importance of Hydrocarbon-Based Energy.**

Requirements for the class:
- Stay on top of readings from syllabus.
- At each week in discussion sections come prepared to participate actively.
- 30% quality of your participation in discussions.
- 35% take-home exam #1
- 35% take-home exam #2

Mistake on front page of syllabus in paragraph on requirements about take home exams:
- First will be distributed in class March 22. Turned in during class on April 5.
- Second distributed May 3, turned in during class May 17.
- Take homes should synthesize all that input and provide analytic framework for your thinking about energy issues. Short essay questions.

No final exam given during regular final exam period, no major paper required for undergrads. Grads have option of taking this class, sign up for grad readings course in political science department. Each week given additional readings, no take home exams, write paper at the end of the semester topics NLT spring break.

## *Readings*

Several books through COOP, which are there and available for purchase.

Books are listed on syllabus. One additional book ordered that hasn't been published yet, which will be coming in within the next month or so. Does not show up on reading assignments until late in the semester. Besides readings from the books you will see on the schedule he has assigned a number of readings/articles that you can obtain online, relevant websites are on syllabus. For 2 pieces that aren't on the syllabus they will be given to us when we get to them.

## *Schedule*

Next 3 weeks we will go through historical evolution, current status, and possible futures for global energy industry, markets, balance. We will pick up basic realities of global energy scene, tease out what this has to do with politics, international relations and politics in the world.

Next 2 weeks is the introduction to hydrocarbon based energy today, giving trends on global energy scene that have important strategic and political implications.

March we will be getting into ways current trends in energy empower major energy producing states, and the consequences of that empowerment.

After that we will be looking at OPEC. We will spend a couple of weeks on Russia, its current and potential future role, and how Russia is seeking to derive greater influence based on its position with energy.

After spring break we will look at demand side of global energy markets. In particular China, India, rising Asian economies, and their perceived energy security needs.

April we will discuss energy battlegrounds: places where interests and agendas of major producer states, where efforts intersect with efforts by consumers to protect their interests.

3 energy battlegrounds:
- 1st is East Asia, and we will discuss what competition over access to energy resources might mean and the US role.
- 2nd is Central Asia, Caspian, Iran.
- 3rd is Western Hemisphere, how the US in particular is dealing with challenges from increasingly assertive energy producers, such as Venezuela under Chavez.

Last 2 weeks is what this means for the US. Next to last session May 3 is energy security as foreign policy issue for US. Last class is geoeconomics of energy, how trends in global energy market intersect trends in global economy, how this may be devastating for status of dollar, and for America's financial dominance in world.

Readings for February 22nd, another article of Leverett, published in National Interest, Summer 2006 issue. www.newamerica.net, go to Leverett's page and find it there.

Readings for April 19 – article coauthored by Leverett December 2005 issue of Washington quarterly, access online at www.twq.com, go to archives section.

- Readings are to be read before that date, have readings done at beginning of class.
- Discussion sessions follow lecture, Thursday evening, Friday afternoon or following Monday.

## *Hydrocarbon based energy*

Hydrocarbon = compounds that consist of various combinations of carbons and hydrogens.

What is crude oil?
- Naturally occurring liquid hydrocarbon chain that can be combusted to release energy. Most is located underground.

What is natural gas?
- Methane, naturally occurring gaseous hydrocarbons, that under surface conditions are in gaseous state.

Where do you find crude oil and natural gas?
- What matters is what it was in prehistoric times, found in sea beds of prehistoric oceans.
- Find parts of prehistoric seabeds that were near where prehistoric streams were feeding into their oceans.
- In percentage terms that is where most of the worlds oil and natural gas are found.

- Doesn't matter if these places are oceans today. Many prehistoric seas are covered up today.

Leading theory for oil and natural gas is an **organic theory**. Hydrocarbons are organic not just in that they contain carbon, also probably derived from remains of prehistoric plants and animals. Some people out there will talk about an inorganic theory, formed geologically like gold, silver, but most everyone buys into the organic theory.

## Formation

Way back in prehistoric times with prehistoric seas, tiny plants and animals went through life cycle and died, their remains falling to sea bed, on top of remains. This made layer after layer of mud silt sand, continually accumulating. Builds up and through geologic processes spanning millions of years, layers of sand, mud, silt, and organic remains were transformed into sedimentary rock layers. Some of the organic matter was transformed into liquid and gaseous hydrocarbons.

That means this oil is all trapped in rock, how do you get to the creation of reservoirs (significant accumulations that can be drilled into)? Earth is not geologically static, surface and subsurface movements cause layers of sedimentary rock to tilt, fold, buckle. Undulating patterns of layer upon layer. Rock is not uniform.

Two characteristics important when thinking about finding and extracting natural gas: **porosity and permeability**.

**Porosity** = percentage of space in rock that is occupied with pores. Want high degree of porosity because then there is more space in which hydrocarbons can accumulate.

**Permeability** = how well connected are the pores.

Water, crude oil, natural gas. Lightest is gas, then oil, then water. As geological processes occur these liquids will be pushed up. How far they move up and accumulate is affected by porosity and permeability. In some places on the planet it has played out that you get sizable accumulations that have moved upward forming reservoirs, which sometimes can go all the way to the earths surface. Most of the oil and natural gas in the world gets trapped, and bumps up against a layer of rock that is relatively impermeable, where it stops. That layer is called the **cap rock** or **dome rock** of reservoir.

Typical structure of a reservoir, gas at the top, oil next, water lowest. When we are looking at Saudi Iranian Russian oil policy this is a critical issue. Initially gas and oil almost come out by themselves, but over time pressure levels drop, it becomes harder and harder to get gas and oil out, and if you aren't managing it right, water seeps in to what you are taking out. A complicated problem to manage.

Will those countries be able to manage their aging oil fields, water cut rates, without involving international energy companies?

What does that say about their future production possibilities?

In some cases you get reservoirs with no oil, just natural gas and water.
**Associated gas** occurs in association with crude oil and **non associated gas** does not.

"Reservoir" term is fundamentally misleading, creates image that this is a giant geological milk carton that is filled with oil, all oil company needs to do is drill is straw in the milk carton. It is not that easy. In structure if you went down and took a piece of it out and brought it back up, looks like a chunk of solid rock. All of the stuff is trapped in the microscopic pores, what you do when you drill is try to create a pressure lift where you find enough oil trapped in the pores and the rock is permeable enough that oil and gas will come up to the surface. Oil and gas comes out of microscopic pores.

Oil gushing out is a **blowout**, stuff is under tremendous pressure if you don't manage it right, case of poor performance and it might blow up.

Next week more about exploration production distribution and marketing.

Economic/Strategic influence of this – why is it worlds biggest industry – transportation agenda is huge.
Efficient, high density, storage is cheap relative to alternatives, cheap to produce. Barrel of oil contains roughly 42 gallons. Fills up a bath tub. Lets say $84 a barrel (price is actually even lower), $2 a gallon, at that price, still the cheapest liquid in the world. Alternative fuels have to be comparable in price to this, no one is even close to being able to doing it.

Lifeblood of industrial society. No economically viable replacements in sight. Can't live without it.