



IN THE KNOW: Tech experts look to the months ahead

by Sherry Bithell

Virginia Tech's status as a versatile international university is due in part to its numerous campus experts on a wide range of topics. Here, several Tech professors prognosticate what lies ahead for the U.S. in the Middle East: Iraq's oil reserves, the post-war economy, and alternate fuel resources.

The lay of Middle Eastern lands

"The U.S. did a remarkable job in prosecuting the war, but so far, we don't seem to have carried out the peace very well," says Tech professor of Middle Eastern history William Ochsenwald of post-war Iraq, where the population is growing increasingly frustrated by the lack of progress in restoring basic needs such as electricity supplies, and jobs. Reports say that American forces in Iraq are also troubled by their inability to help the Iraqis, which may be why new U.S. civilian administrator L. Paul Bremer was appointed in mid-May to take charge of the efforts to restore the country's infrastructure.

As the senior U.S. official in Iraq, Bremer also faces the challenge of creating a new government. Like many other countries in the Middle East, Iraq is a conflicted nation whose history has led to a population strongly divided by language and ethnicity, which will make the task of bringing democracy to Iraq a difficult one. "It's not an easy country to hold together," Ochsenwald says, citing the linguistic and ethnic division between Iraqis: Arabs and Kurds, as well as the religious differences between the Shi'ites--a more appropriate term than the popular "Shi'ite," he notes--and the Sunnis.

Professor of international relations Douglas Borer points out that despite the efforts of Shi'ite clerics to form a theocracy in Iraq, "of all the Islamic sects, Shi'ites are more inclined to have a separation of mosque and state. Sunnis [Hussein's regime] are more inclined to see the merger between mosque and state. So the Iranian government, which is Shi'ite, goes against the tradition of Shi'ism."

Perhaps that explains why the Bush administration was so surprised by the strong, organized efforts of the clerics whom Ochsenwald believes are receiving support from Iran. Because most Iraqis have long memories of the hostilities between the two countries, he says, Iran's support may be a double-edged sword for the Iraqi clerics. "By no means do all Shi'ites support a theocratic government in Iraq like that of Iran. Iran is not a shining beacon for most Iraqis."

Another consideration in shaping the new Iraqi government is the conflict in the north between the Kurds and Iraqi Arabs. Twenty years ago, in the region around the oil-rich cities of Kirkuk and Mosul, Saddam Hussein began evicting Kurds from hundreds of villages, resettling the land with members of loyal Arab Sunni tribes. Now, the Kurds are recovering their former homes in northern Iraq and are, in turn, evicting the Iraqis. "This is one of the really ugly, tragic, and painful consequences of warfare," says Borer. "The Iraqi Arabs who benefited from Saddam's occupation policies are now going to be the victims, and I don't see this as something the U.S. can deal with very easily, other than keeping violence to a minimum."

According to Borer, creating a new Iraq that meets the needs of all its citizens will require restrictions and structures that can help balance the various groups and not allow a single Iraqi group to gain preeminence. "Whether that can be achieved is the \$64 million question." To successfully do so would require the creation of a federal system of autonomous provinces, he believes.

Retaliatory rounds of terror attacks began in the Middle East in mid-May, indicating that there are still tough times to come for Americans in the regions. "I think our troops are going to become targets for terrorist attacks Borer notes. "This is something where the U.S. would be well-advised to bring in other forces that are less considered a political agitator, such as bringing in the UN or some sort of international involvement. It would be well within our interest."

The vision of long-term peace in the Middle East, however, hinges on finally resolving the longstanding Israel-Palestine conflict. "For Bush's peace plan to work, Israel and Palestine have to be convinced to back off on attacking each other. It's going to require the U.S. putting pressure on the Israelis in a way it's never done," Borer says.

A CNN.com poll on the efforts for peace showed that as of late April, 78 percent of those surveyed believed that the "road map for peace" will lead to "a dead end." Ochsenwald says he is inclined to agree. "At the moment, I see only a very slight chance of peace."

Eyeing the economy

Although many people still believe that the Sept. 11 terrorist attacks triggered the decline of the U.S. economy, Vijay Singal, head of Tech's Department of Finance, says that things had already been headed toward a downturn as far back as May 2000, after the Federal Reserve Board (the Fed) "practically crippled the economy with a .5 percent increase in interest rates--even though rates were already high at 6 percent---because it perceived that inflation would rise because of the increase in asset prices."

He says that the Fed realized its error and cut interest rates a few months later, and in an attempt to jump-start the economy, continued to cut rates during 2001, before the terrorist attacks.

"Sept. 11, of course, made the markets uncertain because of terrorist risk. Even then, we recovered most of that uncertainty in the next six months or so, and then [the debate over] Iraq started, and that, of course, made it much worse."

In addition, he says, the age-old belief that "war is good for the economy" is not always true. Previously, conquering new lands meant gaining control over their resources, but today, the benefits are questionable. "It's good, certainly, for the companies that are engaged in the business of manufacturing for war, such as defense companies, which get money from the government, but you have to look at it as a whole. Where is that money coming from? Is the government increasing budget deficits, for example? If you're financing the war [that way] that's not good for the long-term health of well-developed economies, like the U.S."

His dubiousness about debt as a source of funding also applies to President Bush's tax cuts. "I don't think [his plan] is good for the long-term health of the economy," Singal says. "Over the last several years, when we went from budget deficits to a balanced budget, interest rates fell significantly, and that is one of the reasons that the economy was doing so well. Budget deficits increase the risk of inflation and therefore increase interest rates. When the government has to borrow money, that also pushes up the interest rates."

Looking toward the remainder of 2003, Singal says he is always an optimist. In this case, that's partially because

until recently, consumer spending did not fall as much as was anticipated. Another factor is the war's quick conclusion, which means that the country can turn its attention to the economy--assuming that nothing else happens to affect the market, such as conflict with North Korea or future terrorist attacks.

However, he notes, the recovery process is going to take some time. "Businesses have to become more confident about the geopolitical situation and about the administration's ability to pursue the right economic policies. If the businesses will start hiring pretty soon. There was so much uncertainty with the war and there is still some kind of uncertainty, wondering whether we are we going to get back into rebuilding the economy."

The overall unemployment rate has remained around 6 percent, with more than 8.4 million people unemployed March--a fifth of whom have been out of work for at least six months--but Singal's guess is that businesses will begin hiring again anywhere from two to five months from now, which should lure more investors back into the market. "Right now [early June], the market is below what it should be because of the fear and the skepticism of a lot of investors. The price-to-earning ratios are high even now, but you have earnings that are unusually low because of the situation that we are in, so any price is going to look high. That's why investors need to have a much longer horizon to really evaluate where we are going to go."

Singal, who recently finished a book on market efficiency, *Beyond the Random Walk: A Guide to Stock Market Anomalies and Low-Risk Investing*, which will be published this fall, adds that "we are at a stage where there's much risk in the market that your expected return should be relatively high, and that's what I think is going to happen. But like I said, I'm an optimist."

The impact of Iraq's black gold

The issue of Iraq's oil resources became a source of contention during the months leading up to the Iraq war and throughout the course of it, but professor of economics Djavad Salehi-Isfahani, who specializes in oil markets, is skeptical that it was a leading factor in the decision to remove Hussein from power.

"It's hard to see what the U.S. could get from Iraq in terms of oil that it couldn't get from other countries more friendly to the U.S.," he says. "I think that Iraq's oil production, in terms of the U.S. economy, is too small to constitute a major motive for the war. Of course, there are people with interest in lucrative Iraqi oil contracts, which may have played a role. Conflict over contracts also played a role in the dispute between the U.S., Russia and France. But in the end, Iraqi oil is not going to be anyone's but the Iraqi people's."

When oil production in Iraq resumes, Salehi-Isfahani expects--because "the least damage was done to the oil installations"--to see the country producing 2 million barrels per day by the end of the summer, if the sanctions are lifted, and for production to grow to 4 million barrels a day in the next year or two, if order is restored. This may have a considerable impact on international markets. World production is estimated to be 75 to 77 billion barrels per day, but the oil markets are sensitive to the movements of as little as 1 or 2 million barrels per day.

However, Salehi-Isfahani is concerned about the long-term effects of the war. Typically, the U.S.'s prime sources of oil are Venezuela, Mexico, and Saudi Arabia, in that order, but because of Venezuela's current political problems, he says, Saudi Arabia has become a major supplier of oil to America. And that, in conjunction with the Iraq war, may lead to problems.

"The challenge is how the U.S. manages the oil sector without being seen as looting the Arab wealth. There's so much mistrust from the past that it's not hard to imagine people will believe anything bad about the U.S. I don't think the U.S. carefully thought through the aftermath--I think we are going to be seen in a worse light because of this military action, and that jeopardizes oil security."

One potential consequence is the destabilization of Saudi Arabia, which "cannot be good for the future of the oil market." For a number of years, the U.S. presence in Saudi Arabia has been an increasing source of tension between the ruling royal family and the majority of the Saudi people. Most U.S. forces will have left their bases in Saudi Arabia by the end of the summer. The remaining troops will help train Saudi forces.

Salehi-Isfahani, who grew up in Iran, believes that the idea of encouraging democracy in the Middle East is good and will help diffuse some tension. "Many American policy makers have for too long thought that democracy cannot survive in the Middle East--and that's very cynical. Today, with a much more developed world oil market, a supply of oil no longer means controlling the politics of the oil-exporting countries. In fact, Iran, which is hostile to the U.S., continues to supply the West with as much oil as when it was friendly to the West.

"I have doubts about America's determination to foster democracy in the region, but if one were to just take the Bush administration on its words, the words sound good. It's a good basis to start on."

Alternatives to oil

During his 2003 State of the Union address, President Bush proposed to dramatically strengthen commitment to fuel cells as a source of energy, promising \$1.2 billion in research funding. In doing so, he tapped into an area of Virginia Tech's expertise.

For years, university chemists and engineers have been bringing fuel cell technology closer to reality in numerous ways. Chemistry professor James McGrath, along with researchers from Tech's College of Engineering, Los Alamos National Lab, and Virginia Commonwealth University, is developing new polymers for the proton exchange membranes (PEMs) within fuel cells. By using inexpensive polymers instead of Nafion, the Teflon-like material used by NASA in its fuel-cell technology, the group is bringing future mass production of the cells a step closer. They are also looking at a methanol-based fuel cell. A simple alcohol, methanol would be easy to dispense using the current fuel delivery infrastructure to provide energy for computers and cell phones. "A container something like an ink jet cartridge would power a cell phone for days instead of hours," McGrath says.

At the Center for Automotive Fuel Cell Systems, Virginia Tech engineers are working to bring fuel cell technology into everyday use by focusing on the performance and systems integration of fuel cell stacks and associated subsystems in vehicles. Based on this research, Tech engineering students have already built a hybrid fuel-cell powered SUV that meets manufacturer requirements for power and performance.

Highlighting another practical opportunity for daily use of fuel cells is the Energy Management Institute (EMI) guide *Fuel Cells for Building Applications*, written by ME professor Michael Ellis, that helps building designers assess the opportunities for using fuel cell systems. "The goal is to create a system that would supply heat, cooling, hot water, and power for a residence," says EMI director Michael von Spakovsky. Ellis and College of Architecture and Urban Studies faculty members are developing a system to produce eight-to-10 kilowatts of power, and Von Spakovsky is working to optimize the system so that it meets the needs of a home or a cluster of homes.

Researchers and students in the Center for Power Electronic Systems, led by electrical and computer engineering (ECE) professor Fred Lee, have patented more efficient auxiliary switches and bi-directional power converters switching between power sources in hybrid electric and fuel cell vehicles. A co-inventor, ECE associate professor Jason Lai also has launched the Future Energy Electronics Center to focus on fuel cell and distributed energy power conversions. "Our major research is to develop fuel cell power conditioning that converts unregulated DC output from fuel cells to well-regulated AC output with emphases on efficiency and control of energy management," says Lai.

But when will consumers begin to see some of these fuel cell applications in their own lives? Frank Jakob, a fuel cells commercialization manager at Battelle who works closely with Tech on marketing its successful research, says that concerns about emissions and energy security will continue to drive development. As the reliability and durability of fuel cell materials improve, the new national commitment to them should jump-start the production of fuel cell powered vehicles and the formation of companies supplying fuel cells before the end of the decade, "particularly if high-value, portable power applications, such as direct-methanol fuel cells, have their breakthroughs," Jakob says. "The potential market is very large--if the price points are met."

As for the future of oil, it will still be needed to make polymers, but the amount used will be less than 5 percent the amount used for fuel. "In fact," says Jakob, "oil and natural gas will be the predominant source of hydrogen in the early years of fuel cell commercialization" because of the additional technical problems of getting hydrogen from non-fossil, renewable energy sources.

Another future energy solution underway at Virginia Tech is solar photovoltaic (PV) electricity. While evaluating various PV designs and cell characteristics, the Center for Energy and the Global Environment maintains a solar photovoltaic facility that has supplied a part of the electricity in Whittemore Hall for the past 15 years. The facility has an active PV array that supplies electricity to some of the exterior lighting found on the building. Meanwhile, researchers from physics, chemistry, and chemical engineering and the Center for Self-Assembled Nanostructures and Devices are working to create organic (carbon-based) thin-film solar cells that will provide large-area, flexible, lightweight conversion of light into electricity.

As with all of the university's experts on matters of worldwide interest, alternate fuel research is just another way that Virginia Tech is shining light on the future.

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