CoBANK™

OUTLOOK Economic Data and Commentary

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Quantitative Easing Explained

Anyone who follows financial headlines can be forgiven for getting the impression that the phrase "quantitative easing" has now entered the common lexicon. That's because the U.S. Federal Reserve's decision this fall to employ the rarely-used monetary tool as a way to stimulate the economy has been one of the most heavily debated economic issues of the year.

Despite significant and often heated debate on the merits of quantitative easing by economists and lawmakers over the past few months, the Fed on December 14, 2010, reaffirmed its intent to purchase $600 billion in long-term U.S. Treasury bonds. The question now is whether the move will give the U.S. economy a meaningful boost or create more problems than it solves.

Outlook turned to Carnegie Mellon economist Allan H. Meltzer to put quantitative easing into long-term context. An unabashed critic of quantitative easing, Meltzer is also the author of a two-volume history of the Fed, covering the years 1913 to 1986. During the 1990s, he also was an adviser to the Bank of Japan, which used quantitative easing as a monetary tool to address its economic problems. In addition, Meltzer has served as a consultant on economic policy for the Congress, U.S. Treasury, Federal Reserve, the World Bank and the U.S. and foreign governments.

OUTLOOK: Let's start with basics. Remind us about the central role the Federal Reserve is supposed to play in the U.S. economy.

Alan Meltzer: The Federal Reserve is a central bank. It's the place where, when banks need money, they can obtain it in exchange for securities. If a bank needs more reserves, it can take a Treasury obligation here, usually a Treasury bill, and sell it to the Fed at a fixed but adjustable interest rate that the Fed maintains. In addition, the Fed has developed the role of maintaining interest rates and money growth for the economy. The Fed does those things for the United States, and to a considerable extent, because of the role of the dollar as the world's leading reserve currency, it has an impact on the rest of the world.

The Fed influences the economy through buying and selling of securities with the banks. When the Fed wants the economy to expand more rapidly,

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Allan H. Meltzer is an economist and professor at Carnegie Mellon University's Tepper School of Business.

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it buys from the market and lowers interest rates. When it wants to slow the economy or stop inflation, it raises interest rates and sells into the market.

Typically, the Fed buys and sells 90-day Treasury bills, which are the shortest of short-term securities and the least risky of all securities in the world. However, in an effort to stimulate the economy due to the recession, the Fed has pushed the rate of interest on those securities down close to zero. At that level, it is no longer effective to buy and sell 90-day Treasury bills, because it's exchanging zero-interest reserves for essentially zero-interest Treasury bills. It doesn't make any substantial difference to the market.

Recently, however, the Fed has been buying longer-term securities – Treasury bills with a maturity period of up to 30 years. It's a substantial change from its normal operations, and that's what the much-discussed "quantitative easing" is all about – the decision to buy longer-term securities.

OUTLOOK: Before we dig into the details of quantitative easing, can you explain the Fed's role in stimulating employment?

AM: They have what is known as a dual mandate – which means they must both maintain low inflation and low unemployment. It's a mandate that was given to the Fed by Congress in the late 1970s, but it is a difficult task, because those two objectives are not necessarily complementary. The Fed managed to balance the dual mandates very well from about 1985 to 2003. We had long periods of growth punctuated by very short recessions and a very good period of low inflation and stable growth. Many economists refer to that period as the "Great Moderation." But I think we're coming to a period where achieving both low inflation and low unemployment will be more difficult going forward.

OUTLOOK: A lot of people are talking about quantitative easing as something completely new. Has the Fed used this monetary policy tool in the past?

AM: Generally, the Fed has stayed away from buying longer-term securities. But from 1942 to 1951 it put a ceiling on a number of rates, especially long-term rates, and whenever the market didn't want to hold long-term securities, the Fed bought them. So there is some tradition of having done that. After 1951, though, it didn't do much of that. During the early Kennedy years, there was an effort again to get the Fed to buy long-term securities

About this article

Allan H. Meltzer is an economist and professor at Carnegie Mellon University's Tepper School of Business. He is considered a foremost expert on monetary policy. His book, *A History of the Federal Reserve*, is considered the most comprehensive history of the central bank.

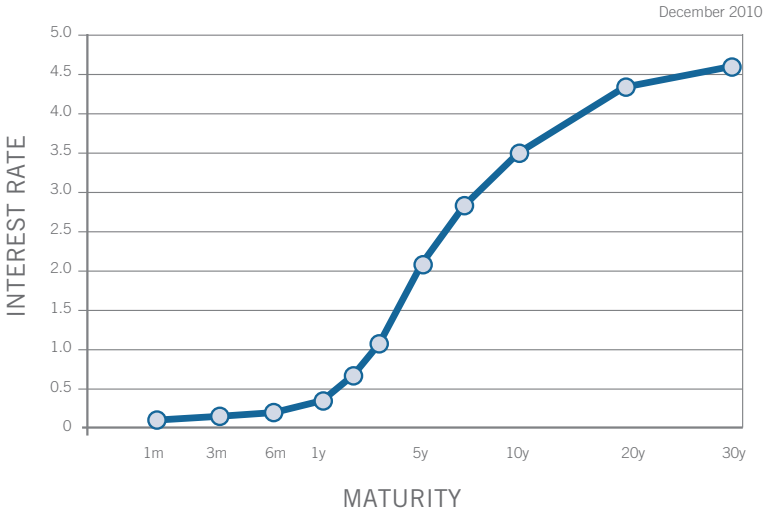
and sell short-term securities. It was an effort to move the difference between interest rates, which didn't succeed, but they did engage in some operations with long-term securities.

That was the last time, until recently, that the Fed used quantitative easing as a monetary policy. It started again during this recession – in 2008 and 2009. The Fed bought more than $1 trillion of long-term securities, including bonds and mortgages. Now, the Fed is moving ahead with a plan to do it again to the tune of $600 billion, which is what some people are referring to as "QE2."

OUTLOOK: What is the goal of quantitative easing?

AM: In theory, quantitative easing is a strategy which is employed to increase reserves for banks and spur lending. My own belief is that there are a couple of sources for the recent talk of quantitative easing. This summer, there was continued weakness in the economy showing up, and many people on Wall Street were concerned about a double-dip recession and the possibility of deflation. The second source driving quantitative easing was the notion that it has become clear politically that there is not going to be any more fiscal stimulus from the government. Now I don't personally agree with that assessment of the economy and I'm not a person who believes we need more fiscal stimulus, but I think those two factors put pressure on the Fed to do something by monetary means to provide a short-term stimulus for the economy. Obviously, the Fed couldn't lower short-term interest rates, since they were already at zero, so they turned to quantitative easing and the purchase of long-term securities to bring down long-term interest rates. The notion is that if longer-term interest rates drop, then perhaps it will spur additional investment and purchasing activity by consumers and businesses. The hope was it would be another avenue for giving the economy a quick, short-term boost.

TREASURY YIELD CURVE
as of December 2010



Source: U.S. Department of the Treasury

OUTLOOK: Do you believe it will be effective?

In my view, it is a mistake. Let me explain why. There is no shortage of liquidity right now. In fact, there is a surplus of liquidity. There's already more than $1 trillion of excess reserves in the banking system, so to the extent the banking system wants to make loans, it has more than $1 trillion of reserves sitting on the sidelines that it could use to make loans. It doesn't need more. Additionally, businesses are

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also sitting on a lot of cash, with more than $2 trillion worth of cash and short-term securities on their balance sheets. They don't need more money either. They're not spending the money because they're uncertain about a wide variety of issues, not the least of which is the tax environment and other government regulations.

OUTLOOK: What would be a more effective solution?

AM: We don't have a monetary problem. What we have is an uncertainty problem, at least the perception of uncertainty. Businesses believe that they don't know what the tax rate is going to be, they don't know what the health care costs are going to be, they don't know what the energy costs are going to be, they don't know what new regulations may be coming. So there's great uncertainty, and they've decided not to spend money until they have less uncertainty. I have recommended many times, including at a hearing in Congress, that lawmakers put a moratorium for three years on new regulations and tax rates. That would be a much more effective solution, and give banks and businesses the confidence to begin making new investments.

OUTLOOK: Would fiscal policy – such as more government stimulus or tax cuts – be a more appropriate tool for rejuvenating the economy than monetary policy?

AM: Tax cuts, which are a fiscal action, would be helpful. Even President Obama's National Commission on Deficit Reduction and Reform called for a cut in both the corporate and individual income tax rates. Additionally, the recent agreement between the administration and congressional Republicans not only stopped tax increases, but it also allows businesses to write off the cost of new investments. Those are good moves. More fiscal action, however, like the stimulus program, would in my view be a waste of money. I don't think the first stimulus program was entirely successful. Where are all these so-called "shovel-ready" projects? There are very few. If you look around, you see all kinds of signs that say "this is being done by the federal government," but you don't see a lot of people working on those sites.

OUTLOOK: What are the potential problems with implementing a strategy of quantitative easing right now?

AM: As I've already noted, the Fed has over $1 trillion of excess reserves in the banking system that the banks aren't using. If we do more quantitative

easing, we're going to add another $600 billion to those unused reserves. If those reserves go unused, it can trigger higher inflation.

The history of the Fed is that in conditions much less extreme than the current ones, when they start to reduce the amount of excess reserves, they're going to do it by raising interest rates. When they do that, they're going to hear an outcry from the business community, from the labor unions, from the Congress, from the administration, from the general public. It just doesn't make sense to raise interest rates with the unemployment at 8 percent or more. In the past, Fed members have said they're not going to let inflation get out of hand. But when the unemployment rate would rise to 7 percent or more, then all that would be forgotten, and they would have to do something about unemployment. That's how we got the big inflation of the 1970s, and it's ultimately the problem we face now. The Fed doesn't have a way of handling it.

OUTLOOK: As a Fed historian, what patterns do you see in terms of how the Fed makes its decisions?

AM: The Fed is supposedly an independent agency, but what does that mean in practice? Nothing in Washington is going to be independent of the Congress, and the Fed is an agent of Congress. The Fed feels heat when the Congress wants it to feel the heat. If the Fed were to take interest rates to 6 or 7 percent to prevent inflation two years from now, I believe that there would be an outcry everywhere as unemployment rates inevitably went up. The political pressure on the Fed to stop trying to prevent inflation and do something about unemployment would force them to do something about unemployment.

When the Fed put in the first $1 trillion of easing into the banking system during the height of the financial crisis, immediately following the failure of Lehman Brothers, it was called a "short-term investment" that would soon run off. But when it ran off, the Fed bought even more long-term securities shortly thereafter. Now the Fed wants to do $600 billion in additional easing. That doesn't give you a lot of confidence that the Fed's going to be able to reduce bank reserves and prevent inflation. That's not an unusual predicament; it always happens when you have high unemployment. It's just that the problem is so much more extreme this time around.

OUTLOOK: Is there a risk of an asset bubble building with regard to Treasury securities?

AM: Oh yes. The foreign exchange market has already showing signs that it doesn't like what is happening, and the dollar has weakened substantially. The long-term trajectory is that the dollar is going to continue to weaken. And the same thing may happen in the bond market – at some point, people

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in the bond market are going to say, "Look, how are they going to get rid of those excess reserves? We don't think they're going to be able to do that without inflation, so we're just going to dump our government bonds." That's certainly a risk, and it's a risk that many members of the Fed's Open Market Committee have talked about in their meetings and in some cases publicly. That risk is one of the reasons the Fed has not historically used quantitative easing. But I think there's a real division within the Open Market Committee on whether it is a wise course of action. There are at least five or six presidents, in addition to members of the board, who do not like this policy, who think it's unnecessary and unwise.

OUTLOOK: What's the argument in favor of quantitative easing?

AM: If you read the newspapers and hear the public discussion in the marketplace, you hear that it will probably lower long-term interest rates. But interest rates aren't really the problem. The issue is what it's going to do to unemployment. One of the main advocates of quantitative easing, Larry Meyer, who used to be a governor of the Fed and now runs a very prominent consulting agency, says if you did $1.5 trillion in new easing – not $600 billion – it would add thee-tenths of one percent to GDP next year. That's not a lot. So $600 billion is definitely not going to do much in terms of putting people back to work. That's one problem – it's not big enough to really move the unemployment needle.

You also have to look closely at who is calling for more easing. There's a big difference between people in the bond market, who like quantitative easing because they were riding the bond prices up and making money, and the rest of us. The general public wants to know what it is going to do about employment and economic growth? I don't think it will make a big difference, and it will likely cause inflation. People are having a problem paying their mortgages, paying their rent. I don't think it's in the public interest to suddenly tell them, "Well, we're going to raise prices faster." The only people who would gain from this are the people in the bond market and anyone who holds long-term bonds.

OUTLOOK: Is inflation a greater risk than deflation?

AM: I make the following statement over and over and over again: There is no case in history, none whatsoever, for any country to experience deflation if they have a falling exchange rate, as we do; a huge budget deficit, as we do;

and a fast money growth, as we do. No country ever experienced deflation under those circumstances. This is a myth. There is no chance of deflation.

OUTLOOK: Much of the criticism of quantitative easing seems to come from the Republican side of the aisle. How much of it in your view is ideologically based vs. economics-based?

AM: I think the criticism of quantitative easing is fundamentally sound. I don't think it should be dismissed on the grounds that it's ideologically driven. The argument against this is simple – look, this is not going to do much. Sure, there's the risk that if you don't do anything, things will get worse, but the risk with quantitative easing is that things will be much worse a few years from now. I believe that's a perfectly intelligent and appropriate thing to say. But I don't think the Fed will listen to that line of reasoning because they typically have been focused on short-term results.

Outlook Special Report: The Smart Grid

Peter C. Honebein is co-founder of the Customer Performance Group, a management and marketing strategy consulting firm, and an adjunct professor at the University of Nevada, Reno and Indiana University.

Stephen C. Hadden, senior consultant at R. W. Beck, is an expert in advanced technologies and business issues in utility meter automation, demand management and customer service.

It's hard to believe that the modern power grid was designed roughly 125 years ago. Sure, things have changed a lot in that time, but the grid that delivers power to homes and businesses across the nation today is not fundamentally different from the 19th century vision of Nikola Tesla, the inventor whose theories are the basis for the modern power system.

Many experts believe that now, as we move deeper into the 21st century, the nation must create a more dynamic power grid that has the high-tech infrastructure needed to serve the nation's increasingly complex energy needs – a robust, stable and flexible grid that can still keep the lights on in millions of homes and businesses as well as charge fleets of electric vehicles, accommodate new energy sources and meet consumer demand for more control and flexibility. Perhaps it needs to be able to do things we haven't yet imagined.

Most experts and politicians call this new grid – still largely in a nascent state – the "smart grid." But the notion of a smart grid means different things to different people, and the blueprint for implementing smart grid technology is evolving. In a special report on the smart grid, CoBank asked nationally recognized experts Dr. Peter C. Honebein and Stephen C. Hadden to provide insights into the challenges and opportunities associated with smart grid.

Honebein is cofounder of the Customer Performance Group, a management and marketing strategy consulting firm, and an adjunct professor at the University of Nevada, Reno and Indiana University. He helps utilities with the customer experience and consumer behavior aspects of the smart grid. Hadden, a senior consultant at R. W. Beck, is an expert in advanced technologies and business issues in utility meter automation, demand management and customer service. He provides both strategic and tactical technology decision support to utility management, and assists their direct interaction with regulators, consumer advocates, and other stakeholders.

OUTLOOK: What is smart grid and how would it improve the delivery of energy in the U.S.?

Steve Hadden: What we've got right now is a system that is utilized sub-optimally. That's most evident when we think of a hot summer afternoon, where all the generators available are pouring power into the grid to run air conditioning units. In some of those instances, we've seen outages and other problems because the grid is overstressed. But in the middle of the night the entire infrastructure is grossly underutilized; very few power

plants are running and the load is very light. Technology – what we call smart grid – will increase and optimize the utilization of that infrastructure. We've invested phenomenal sums of money in putting this infrastructure in place, and increasing the utilization of it will be not only economically good for everybody but environmentally good as well.

Peter Honebein: Another driving force is, according to Department of Energy (DOE) data, an increase of outages has been occurring over the past 10 to 20 years. The nation incurs a significant cost when these outages occur. When there is an outage, it affects businesses and the economics of those businesses that manufacture products and provide services.

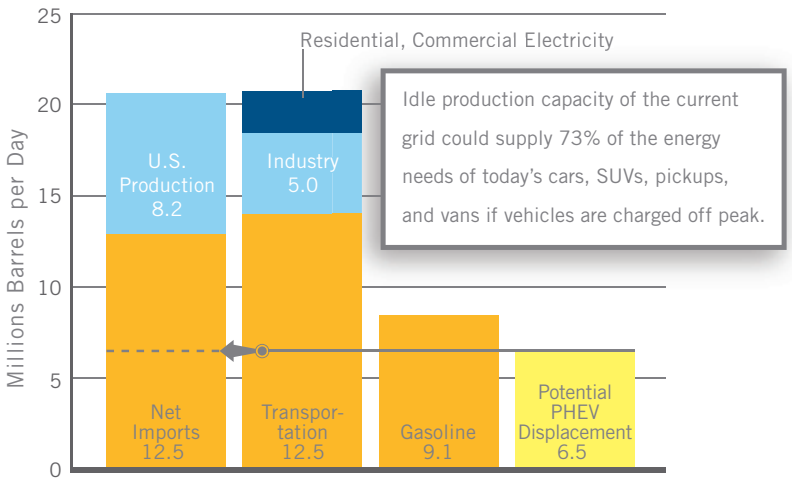
Lastly, according to DOE statistics, the nation is expecting a 30 percent growth in demand by 2030. But there's resistance to increasing generation capacity, whether we're talking about nuclear energy or some type of renewable energy, without increased efforts to achieve efficiencies. Smart grid technologies allow us to at least partially address that new demand through efficiencies.

OUTLOOK: Could the increase in demand be more severe if there's widespread acceptance and use of electric vehicles in the future?

PH: I don't know how much electrical demand is going to increase due to electric vehicles, but it will create some new challenges for the electric industry and the grid. One issue is the price of electricity at the time you're charging, and another issue is the demand on the system while charging. For instance, an interesting question that's been raised is: How do you manage rapid charging versus slow charging for electric vehicles? One consumer could plug in their car and charge it at the lowest cost possible over a long period of time so it's not over-taxing the system. But another scenario is that somebody comes home from work, and their electric vehicle is depleted. They need to go back out and want that vehicle charged as soon as possible – which may stress the system in terms of increased demand. A utility could charge a premium for that convenience. The smart grid gives us the flexibility to use price signals to manage those two scenarios.

SH: The ability of smart grid to deliver different pricing structures is very important. If everybody gets an electric vehicle for Christmas one year and plugs it in the next day, the demand for power will roughly double in the residential sector overnight. Though that scenario is unlikely, it would create two huge problems: We wouldn't

POTENTIAL IMPACTS OF HIGH PENETRATION OF PLUG-IN HYBRID ELECTRIC VEHICLES ON THE US POWER GRID



Source: U.S. Department of Energy

be able to generate enough power to meet that new demand nor would we have the ability to deliver it; the current delivery infrastructure isn't up to the job right now. We need a tool to manage the charging of those vehicles judiciously, which is where pricing comes in. With a smart grid, the person looking for a quick charge would pay more since they're putting a bigger stress on the system. The slow charger would pay a lower rate if they charge during times when there is excess capacity in the system. The smart grid will allow us to give people incentives for efficiency without requiring huge investments in new delivery infrastructure.

PH: It gets exciting when we start thinking about how we move that capacity into some other type of device. An electric vehicle that provides transportation also can provide energy storage. With a true smart grid system, a home could theoretically be run using the power stored in that vehicle for some period of time, disconnected from the power grid.

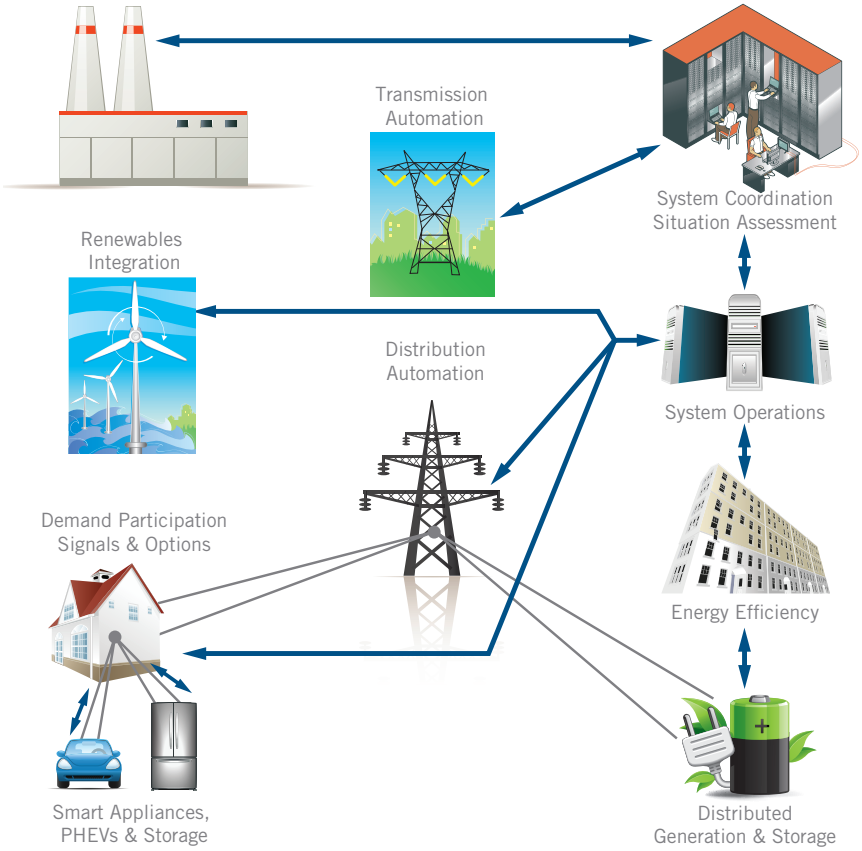
OUTLOOK: What exactly is a smart grid? What are the components and technical elements?

SH: A smart grid uses sensors, processors and communication devices to measure what's happening in the grid. These devices – which work in conjunction with a metering system – then make calculations about the grid, make inferences about it and communicate that information back to utilities, which can then use that information to better manage the grid.

I'm looking out the window of my office at a busy commercial area. I see lots of power distribution equipment – wires, switches and transformers. But the wires are just wires, the switches are dumb and the transformers are just transformers. There are no radios and no computers there in the grid. The switches are operated by people with what's called a "hot stick," which means they have to reach up and switch them manually. If they're overloaded, they pop open on their own, but that response is not a smart response; it's a mechanical response, not a calculated response. So that's a dumb grid.

Most utilities are already transitioning away from that. For instance, if one of these switches fails because it's too old to be reliable, the incremental cost to replace it with a switch that has some smarts and a radio is relatively small. It's a no-brainer that we should do that and that is what's happening. So all over America infrastructure is being replaced with new devices and new infrastructure to monitor what's going on, report voltages and communicate these things back to engineers and grid managers. That's the smart grid starting to creep in. But what will really make it smart is when all of those things are integrated so that the information produced by one device is utilized by another device to make a decision about ways to operate the grid.

WHAT IS THE SMART GRID ?



PH: One way I envision the smart grid is in categories – home, distribution networks, transmission networks and power generation. When you're at the distribution, transmission and generation level, the smart grid is infrastructure that most people won't notice. It's going to be devices sitting on a telephone pole; it will be switches embedded into the transformers, and those types of things. But most customers won't notice it except for the fact that they won't have as many outages.

When you move from distribution, transmission and generation and into a home or a business, then smart grid takes on a different form. Now we're talking about digital systems that track a building's energy use and make decisions in an effort to improve efficiency and manage peak load. For instance, smart grid digital technology could monitor the use of energy by household appliances and then automatically turn on or turn off that appliance to respond to certain demand events. Let's go back to the example of a very hot day, which is when we typically see peak power demand due to increased air conditioner usage. An in-home smart grid system could automatically raise the thermostat to 78 degrees on a hot day to ease a home's demand on the power grid, and people will really notice that.

In addition to that automation, there's also the motivational component that can occur in the home, and by that I mean price structure. Digital smart grid technology can let consumers know when electricity costs are higher. It can provide consumers information about their electricity use so they can begin to discover how to reduce energy waste. The types of services that smart grid enables will increase the reliability of the whole distribution network, but in the home it has the potential of providing new types of services that we have not yet dreamed up.

OUTLOOK: What kind of costs will be involved with integrating homes into the grid? Do you expect the market to adopt these changes by itself, or will government incentives be needed?

PH: Customer adoption of smart grid innovations for homes and businesses will need incentives. All industries have had to use incentives to motivate customers to adopt new innovations. To shift customers to self-service gasoline fueling in the 1970s and 1980s, self service had a lower price than full service. To encourage customers to book tickets online rather than through the phone, airlines offered customers incentives –

and sometimes disincentives – to use the online services. To encourage customers to manage their banking online, banks paid customers to sign-up for online services. To expect that a critical mass of customers will adopt smart grid technologies without some kind of incentives, financial or otherwise, from government or other entities, is naive.

Depending upon which side of the motivation vs. automation debate you are on, the cost to drive customer performance will range from negligible to several thousand dollars per household. Changing a customer's pricing plan from a flat rate to an hourly rate has a negligible cost, and studies have shown that these kinds of dynamic prices motivate customers to change their energy usage behaviors. But there is significant political risk in making a mass market rate change like this. For instance, Hydro One in Canada has run into significant consumer backlash related to its mandatory time-of-use pricing. Automation, in the form of direct load control devices, smart thermostats, smart refrigerators and other appliances, has a significant up-front capital cost for either the utility or customer, with a payback period that is measured in years. Yet in the U.S., major appliance replacements each year number in the millions. Thus, if smart appliances become the standard and are marketed in a way that is attractive to customers, the speed of adoption can be accelerated.

SH: For some smart grid technologies, no customer participation is required. Meter automation, for example, produces many efficiencies in traditional utility operations without any customer response at all. Though the capital costs are substantial, over time these investments will save consumers money by making electric production and delivery more efficient, mitigating the rising cost of energy. These technologies make many new things possible, and many of those involve customer response.

OUTLOOK: What benefit do utilities see to moving their infrastructure toward smart grid technology?

SH: Automation will be a big benefit. Their lives will become easier in that some things that now require people to go out into the field and get their hands dirty will be able to be done from the office. For some utilities, automating their metering produces a pretty immediate benefit in just routine, traditional utility operations. Automation has been creeping into electric operations over the last 25 years in lots of applications where it makes total sense. But the move to smart grid – including smart metering, distribution switching and various kinds of substation management – creates real opportunities for sharply expanding automation that ultimately will make utilities more productive.

It will also create a scenario where it's easier for power companies to utilize renewable energy sources. For example, if 2 percent of the supply in a region is from wind and the wind drops off suddenly, then that's not too

serious a problem. The conventional supply can easily ramp up and meet the demand. But if 20 percent of the supply in a region is from wind and the wind stops, it's a more serious problem. It takes 10 seconds for the wind to stop, but it takes 15 minutes to respond using conventional energy sources – such as fossil fuels and nuclear power. In that time, you could see the entire grid in a region go down. Smart grid gives us a more efficient way to handle those situations through managing demand and the flow of power. But you really can't get there without a smart infrastructure that allows utilities to automate and manage the grid to respond to variations in the energy supply. Smart grid will make it possible to have the amount of wind and solar that people have talked about for years without realizing that you can't do it unless you automate the management of the grid to respond to variations in wind and sun.

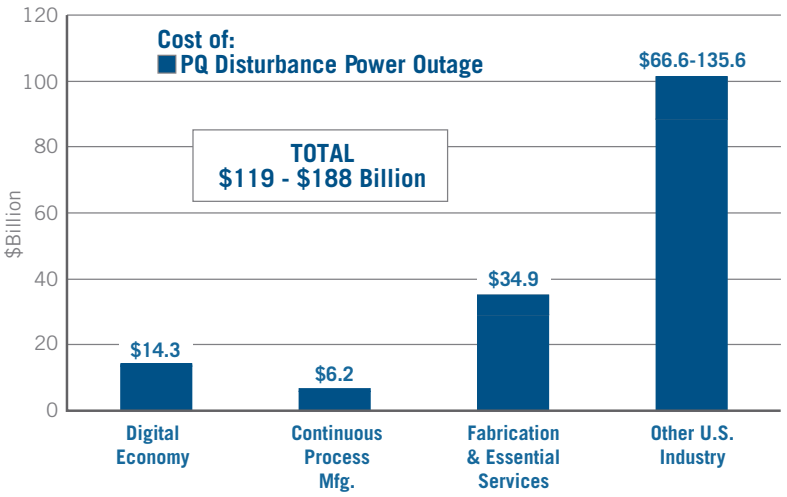
PH: Think of it in terms of "I, YOU and WE." The "I" reflects consumer benefits. What do "I" get out of this? A lot of the arguments for the consumer benefits are along the lines of saving money. That's wonderful, but potential benefits go far beyond that. Utilities will be able to offer consumers customized pricing packages that are tied to a person's lifestyle. It's a concept that's similar to going to the gas station, where we have regular, mid-grade and premium fuel options. Smart grid would allow utilities to offer similar options to consumers. So you might have customers who desire to live a green lifestyle. A utility could offer products that are 25 percent renewable, 50 percent renewable or 100 percent renewable – each with a different pricing plan. You might have a consumer that is cost-conscious or frugal, and utilities could provide a pricing package that is low-cost and no frills. Other people might lead more of a techno-centric lifestyle – they like playing with cool, geeky high-tech stuff – and companies could offer a package that allows those consumers to control their energy usage with computers, smart phones and the like.

TODAY's GRID. AND TOMORROW's.

Today's Grid	Smart Grid
Consumers are uninformed and non-participative with power system	Informed, involved, and active consumers; demand response and distributed energy resources
Dominated by central generation; many obstacles exist for distributed energy resources interconnection	Many distributed energy resources with plug-and-play convenience; focus on renewables
Limited wholesale markets, not well integrated; limited opportunities for consumers	Mature, well-integrated wholesale markets, growth of new electricity markets for consumers
Focus on outages; slow response to power quality issues	Power quality is a priority with a variety of quality/price options; rapid resolution of issues
Little integration of operational data with asset management; business-process silos	Greatly expanded data acquisition of grid parameters; focus on prevention, minimizing impact to consumers
Responds to prevent further damage; focus is on protecting assets following fault	Automatically detects and responds to problems; focus on prevention, minimizing impact to consumer
Vulnerable to malicious acts of terror and natural disasters	Resilient to attack and natural disasters with rapid restoration capabilities

Source: U.S. Department of Energy

ANNUAL COST OF POWER OUTAGES AND POWER QUALITY DISTURBANCES



Source: Primen, "The Cost of Power Disturbances to Industrial & Digital Economy Companies"

When you move to "YOU," we're talking about the electric company or the utility. Those benefits could range from increased reliability to increased safety. Imagine a utility not having to do as many truck rolls to start service because they are using the remote connect/disconnect feature of smart meters to start and stop service for customers as they move. That provides operational and employee safety benefits and speeds up service to the customers. But utilities also have to generate revenues as well. Through the smart grid there may be an opening for new types of revenues. Some utilities are already beginning to look at this and say, "How can we leverage this technology to provide more value-added services that, potentially, customers will pay for as an option?"

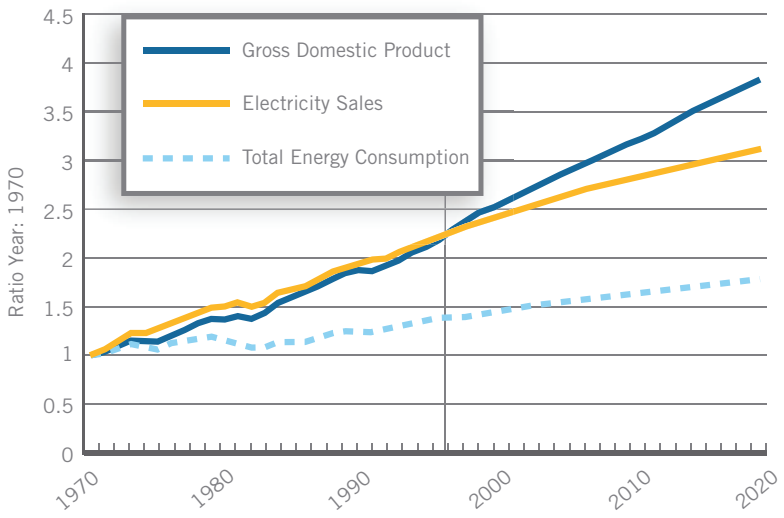
The last element is "WE." The smart grid delivers the ability to increase reliability for all of us and the ability to reduce our carbon footprint. These kinds of benefits are driven and governed by regulatory forces, making sure that whatever is implemented has a broader social good. Some other benefits include national security, better privacy for all utility customers and a better platform for serving low-income customers.

OUTLOOK: What's driving smart grid growth and innovation?

PH: Today, the smart grid is being pushed more through the political process, regulators and the federal government. That's evidenced by the work that's been done in California, where the state has developed an energy action plan that is only enabled through the smart grid. When you look at California's plan, energy efficiency is the No. 1 priority and demand response is No. 2. As you begin to work toward that and integrate renewables into the picture, this plan is a key driver that is leading many of the California utilities – investor-owned, municipal, co-op, etc – to invest in the smart grid.

On the federal side, we have Smart Grid Investment Grants that were part of the economic stimulus bill. Essentially, the federal government will pay half the cost. That has created a situation where the economic constraints of implementation have been significantly reduced. It helps the utility with the issue of who's going to pay for the new infrastructure; it doesn't have to entirely rest on the shoulders of ratepayers. When that's coupled with the operational efficiency benefits to a utility, it makes the business case for moving to smart grid much stronger.

ELECTRICITY AND ECONOMIC GROWTH



Source: U.S. Department of Energy

SH: The economic costs of the rolling blackouts in California in 2000 were just apocalyptic and prompted the effort to produce the energy action plan that Peter referred to. Federal policy really followed that. But there are a lot of regulatory and planning obstacles for utilities. Another issue is just the amount of money associated with implementing smart grid. You have to take a deep breath before deciding to spend this amount of money, and look carefully at the business case. When you do that, you find the business case frequently is positive. But when you're dealing with a highly regulated industry, the process can be arduous.

OUTLOOK: You've stated that smart grid is necessary for increasing the amount of renewable energy within the power supply system, but are there benefits to smart grid for utilities that are not heavily invested in renewables?

SH: Yes, consumers will get the benefit even if there are no renewable energy sources in the mix. If we back up to 50,000 feet, the benefit is in automation and in the application of capital to replace labor. Today, nobody questions the wisdom of building cars by investing a lot of money up-front in robots and machines and then hiring a few workers to man the factory floor. But in the beginning, cars were made by hand, one at a time. That conversion to a capital-intensive process, where you invest a lot of money up-front and then make cars more efficiently, essentially resulted in cars being available to a lot of people who would never have been able to afford a car. As a result of having those cars, our culture has evolved and achieved many things that would never have been possible otherwise.

Smart grid is really just this same kind of step for the power industry, a step we've seen in many other industries – invest money up-front, make the process more productive, more efficient, and that's going to produce a lot of benefits. Just as Henry Ford couldn't predict how mass production of the automobile would shape America, we don't yet know all of the benefits that will be afforded by smart grid. Maybe there are ways for people to choose energy options that we just don't know about now.

However, smart grid is closely tied to the push for renewable power supplies, many of which cannot be controlled with the same precision that you can control supplies from fossil fuels, hydro and nuclear. If you can't control the supply, you have to control the load because they have to be matched. The system will become unstable if those aren't matched. The electric business is quite unique; there aren't very many other businesses in which the product is produced and consumed at the same

instant. The smart grid is very much necessary to integrate the production end of the business with the consumption end all the way through the delivery chain.

PH: Think of a modern, F-18 jet fighter. It's a very complex machine, with integrated fly-by-wire systems that control speed, radar, maneuverability, weapons systems and a whole variety of other things. Previous generations of military fighters were flown more mechanically. But to take flight up to the next level – to increase the safety, speed and maneuverability – there has to be more automation to take humans beyond what they could physically do in a mechanical system. It's very analogous to the smart grid. The grid, as Steve indicated earlier, is basically controlled by people who are turning dials. There's a lot of manual control with this grid. The smart grid is like being able to fly by wire; it takes the tool beyond what humans can control just by themselves – regardless of where the energy comes from.

OUTLOOK: Can you give some examples of utilities that are successfully implementing smart grid technology?

SH: Starting in the early 1990s, Kansas City Power & Light and Northern States Power Company were the first to go into metering automation with fixed networks on a large scale. It was what everybody called smart grid at the time, but it was still a one-way network. Both those companies [now operating under different names] are looking at two-way networks now, true smart grids. The California utilities are all putting in two-way networks, the Texas utilities have all been ordered to do it, and so have the Pennsylvania and Michigan utilities. But success is something that we may have to judge in retrospect, a few years down the pike. The government's going to study this eights ways to Sunday and spend a lot of money on consultants and reporting. They'll come out with a set of reports that document what works, what doesn't work, and what it costs.

After that, it's going to be much easier for any utility to decide to do this and to get it right. They'll have all the lessons learned written down for them, and that will be very important. A lot of utilities won't move ahead without that. Right now, for utilities to make an investment in, say, meter automation, that investment is among the biggest investments that utility has ever made, unless they're a primary partner in a nuclear plant. The investment is huge and to justify that they have to go through a lot of trouble – several years of study, interaction with their regulators, public hearings and much more. Going back to the federal grant program that helps utilities offset the costs of implementing smart grid, that could be a really important driver. If this all goes the way it's supposed to go, this federal smart grid investment program will be a big help in accelerating the nation's ability to take advantage of this technology.

OUTLOOK: Given that, where would you say that we are in the development of smart grid technology?

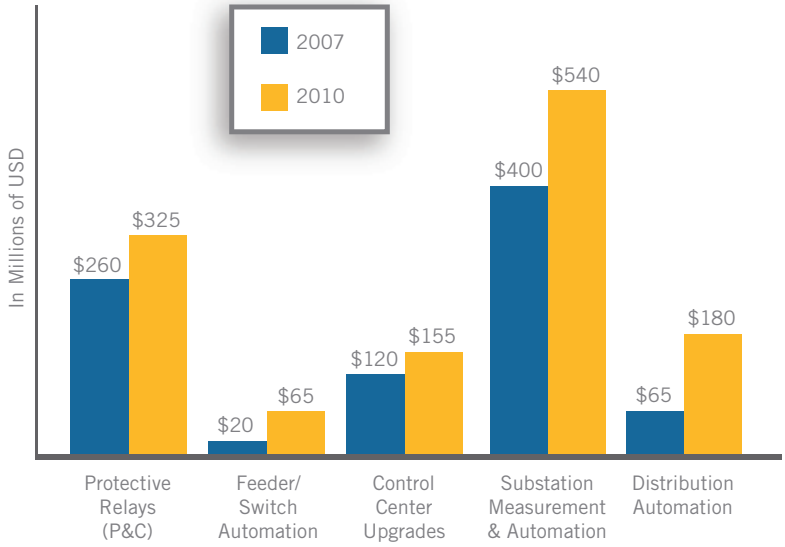
SH: We're not up against technological limitations. From an engineering standpoint, we know a lot about how to do this. While there are some broader uncertainties, there aren't many technical or engineering obstacles. Sure there will be bugs, but it's going to work. I think there's much more uncertainty in the human end of it.

PH: From the social side, the consumer side of the grid, it's in its relative infancy. Most utilities that are beginning to provide smart grid services are basically trying to make sure the meter gets in and the bill is sent out correctly. The industry, right now, is trying to convince consumers of the accuracy, security and privacy of smart meters. Consumers need confidence in the system and the technology. They need to know that their bills are for the right amount. They need to feel confident that individuals or other nations aren't going to be able to infiltrate the system and take the whole grid down. And because these new systems give utilities more personal information about customers than ever before, consumers want to know that utilities are keeping personal information private, especially if one can look at it and infer things about consumer behavior based on electricity usage patterns. Those types of issues are getting resolved.

The accuracy question has moved up in maturity. Both California and Texas have had third parties evaluate their smart meters. All the data that I've seen shows that smart meters are accurate. The accuracy question has been answered, and we're now in the process of communicating those results and ensuring consumers have confidence in smart meter accuracy.

Security and privacy are still being worked out, though. In the projects that I'm involved with, one of the things that we do to address privacy is, when a customer contacts our call center and wants help figuring out a bill or understanding a rate, we ask for permission to look at their interval data, which is the hourly data that we're collecting from the smart meters. By allowing a customer service representative to look at a customer's interval data, you're allowing that representative to look into another person's life and make inferences regarding a customer's behavior: "It looks like at 2 a.m. you're shutting down your air conditioning," or "Based on this pattern, it looks like you went on vacation on July 7." While we can

NORTH AMERICAN ELECTRIC POWER SMART GRID EXPENDITURES (non-metering)



Source: Newton Evans Research 2008

use the data to help people eliminate energy waste, it can be intrusive and breach the sanctity of the home. Those are some basic elements that we are beginning to work through.

But we also have challenges with the technology's user-interface, such as in-home displays and programmable communicating thermostats. Those are technologies in their infancy, and there are a lot of questions about them right now.

Another big challenge is how utilities communicate with their customers. Smart grid requires utilities to communicate in a very different way than they have done in the past. Utility databases have pretty limited data about customers. It's not like Williams-Sonoma or Land's End, direct marketers who have lots of data about customers and can create targeted marketing messages for the right people. Currently, utilities know only that they have a customer, where the customer lives, what the monthly electricity usage is and whether they're in a multi-family or single-family building – that's it. There are a lot of challenges just opening up a communications channel that has never been there before.

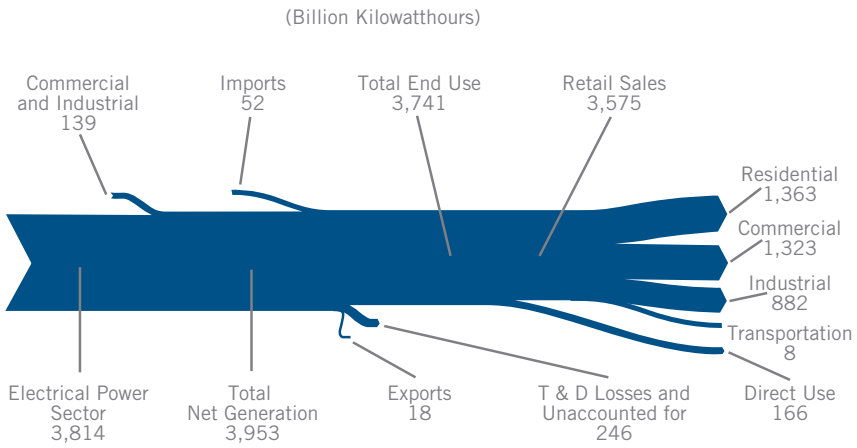
OUTLOOK: Consumers are used to flipping a switch, having electricity whenever they need it, paying the bill once a month and generally forgetting about it. Smart grid asks them to move from being a passive user to being a much more active participant, a major change in behavior. How do you begin to have that conversation with consumers and manage the transition?

PH: The current relationship that a utility has with its customers is called a marriage of convenience. It is not a voluntary relationship. Utilities provide customers with electricity, customers really like electricity, and they pay the utility money for it. That's pretty much it.

The pinnacle of any consumer relationship is a partnership. A partnership is voluntary, it involves trust and it's mutually beneficial. Smart grid requires customers to be involved in a sort of co-creation role. It's very similar to the co-creation role that happens at a Subway sandwich shop, where the sandwich maker and the customer enter into a 3-minute relationship of building a sandwich that is customized and provides greater value because it is customized to the customer's specifications. Some of the pricing options we talked about earlier begin to get at this same kind of relationship within the electric utility space. What you're trying to do is to increase customer engagement by giving customers choices. I can opt into a choice that best reflects my particular lifestyle.

One way utilities can be part of that co-creation is to be proactive in these relationships, which is a major shift. For instance, smart grid technology means that a utility could inform a customer of when their well pump is

NET-GENERATION-TO-END-USE FLOW, 2009



Source: U.S. Department of Energy

beginning to deteriorate, which could be detected by an algorithm that looks at electricity usage patterns. Based upon this information, a customer could fix the problem before it breaks, saving money in the long-run. That's mutually beneficial.

OUTLOOK: What about utilities who are not currently thinking about smart grid? What should they be paying attention to and how should they be positioning themselves?

SH: The corporate culture in utilities varies a lot, as it does in all businesses. Some are very conservative because their customers get angry with them if they do things that don't work out. Others are more adventurous, and their customers are tolerant of exploratory efforts and believe, on the whole, that it's valuable to keep looking for value in new technologies. The utilities that are exploratory are out there now; they're trying it and finding where the value is in smart grid. Quite a few of them are doing Smart Grid Investment Grant projects, the DOE will write it all down, and that will help the more conservative companies get on it next.

The cost of assessing the options is very small compared to the potential benefit. Any utility is well-advised to be looking at smart grid now. Utilities that aren't looking at it are at high risk of getting the cadence of technology investment wrong. I'd like to give an example of that. What everybody called "drive-by" metering, what is now widely called AMR (Automated Meter Reading), came into wide availability in the early 1990s. The utilities that invested in that in the early- to mid-1990s have harvested a very generous benefit for their rate payers and their shareholders. It turned out to be much more productive then people said it would be at the time. It's grown like gangbusters since.

But utilities that waited until 2005 to deploy drive-by metering now have a challenge in front of them. They've just made this investment in new infrastructure, but now are faced with new government policies pressuring them to produce benefits through smart grid, which requires more investment. So there's a cadence to this technology investment. You don't want to be on the bleeding edge, but you don't want to be a laggard either if one of your goals is to provide efficient, productive, quality service to your customers. The way to do that is assess your options early and keep looking at them. The cost is small compared to the benefit. You'll have a handle on the opportunities and challenges so that, when the time comes, you can go ahead and make a timely investment.

OUTLOOK: What will the nation's power grid look like in 50 years?

PH: The crystal ball that I have tells me that a significant percentage of the population is going to be on some type of dynamic, time-based rate. There will be more distributed generation in the form of either wind or solar. Electric vehicles will be more prevalent. Most importantly, the types of electric services that we as a nation invent will provide consumers with services and benefits that are yet to be defined.

One scenario: Say an auto body shop has a number of air compressors. They can allow the utility, or maybe a third party, to monitor those compressors as part of a service package. When those compressors start to show some type of degradation, which can be determined by their electrical signature, then the service provider can proactively intervene, either by dispatching a repair service, informing the customer that there is an issue, or offering a more energy-efficient replacement that perhaps comes with a rebate. So there becomes this collaborative, mutually beneficial relationship between the utility and the customer in both the commercial and in residential markets that reduces the amount of energy waste.

SH: Fifty years from now, we'll see all these things that are in the press now about smart grid engineering and the nuts and bolts of electric operations. For example, voltage in distribution systems, right now, is often 5 volts or more higher than it needs to be. The voltage will be managed much more closely and the savings will be huge – just huge. That number isn't in most people's calculus for what the benefits are going to be. It's only now becoming clear that this is a giant benefit we can all get from smart metering. There will be a lot of these benefits that are not yet recognized. Predicting the future is famously difficult, and we can't know now what all the benefits will be. But the history of automation is that it produces many benefits that are not foreseen when it is first created.

When I was a green, young engineer and I joined the automated systems division of something that became General Electric, one of my mentors asked me, "What do you think a dishwashing robot would look like?" I said, "I don't know. I suppose it would go in front of the sink, and it would move the dishes from the left, through the sink, to the right and would somehow wash them." He pointed out that I was wrong. Dishwashing robots don't look like that at all. They go under the counter. You have to load and unload them yourself, and they wash and dry the dishes. His point was that people typically don't correctly anticipate what automation is going to be and look like in the future.

It is easy to talk about what we do now and how will we use this smart grid technology to do those things differently in the future. But what we don't see is all the new stuff that pops up. For example, cell phones used to come in a suitcase, and you had to have a car battery to run the things.

Nobody foresaw that someday the cellular providers would make a lot of money selling ring tones for $2 each. There are all of these consumer wrinkles that will pop up with smart grid because somebody has a brilliant idea. We can't foresee the ring tone equivalent in the electric industry. Consumers will decide they like something, and there will be some synergy between the energy that something uses and some other attribute that will create a business opportunity for some third party. Smart grid will make it possible for there to be transactions related to that, and people will optimize that. Who knows? It's hard to foresee, but it's definitely going to be pretty exciting.

Interest Rates and Economic Indicators

The interest rate and economic data on this page were updated as of 11/30/10. They are intended to provide rate or cost indications only and are for notional amounts in excess of $5 million except for forward fixed rates.

KEY ECONOMIC INDICATORS

Gross Domestic Product (GDP) measures the change in total output of the U.S. economy. The Consumer Price Index (CPI) is a measure of consumer inflation. The federal funds rate is the rate charged by banks to one another on overnight funds. The target federal funds rate is set by the Federal Reserve as one of the tools of monetary policy. The interest rate on the 10-year U.S. Treasury Note is considered a reflection of the market's view of longer-term macroeconomic performance; the 2-year projection provides a view of more near-term economic performance.

ECONOMIC AND INTEREST RATE PROJECTIONS

Source: Insight Economics, LLC & Blue Chip Economic Indicators

				US Treasury Securities	
2010	**GDP**	**CPI**	**Fed Funds**	**2-year**	**10-year**
Q3	2.00%	1.50%	0.19%	0.50%	2.80%
Q4	2.20%	1.80%	0.20%	0.40%	2.70%
2011	**GDP**	**CPI**	**Funds**	**2-year**	**10-year**
Q1	2.40%	1.70%	0.20%	0.50%	2.80%
Q2	2.70%	1.50%	0.20%	0.50%	2.80%
Q3	3.00%	1.80%	0.22%	0.60%	2.80%

PROJECTIONS OF FUTURE INTEREST RATES

The table below reflects current market expectations about interest rates at given points in the future. Implied forward rates are the most commonly used measure of the outlook for interest rates. The forward rates listed are derived from the current interest rate curve using a mathematical formula to project future interest rate levels.

IMPLIED FORWARD RATES

Years Forward	3-month LIBOR	1-year Swap	3-year Swap	5-year Swap	7-year Swap	10-year Swap
Today	0.30%	0.54%	1.01%	1.72%	2.35%	2.94%
0.25	0.52%	0.65%	1.15%	1.86%	2.47%	3.04%
0.50	0.62%	0.73%	1.29%	2.05%	2.60%	3.14%
0.75	0.68%	0.82%	1.45%	2.20%	2.76%	3.25%
1.00	0.76%	0.93%	1.61%	2.39%	2.88%	3.34%
1.50	0.99%	1.20%	2.00%	2.72%	3.17%	3.57%
2.00	1.25%	1.51%	2.38%	3.02%	3.41%	3.77%
2.50	1.68%	1.96%	2.78%	3.32%	3.65%	3.94%
3.00	2.10%	2.41%	3.17%	3.62%	3.88%	4.12%
4.00	2.93%	3.24%	3.79%	4.06%	4.23%	4.39%
5.00	3.58%	3.91%	4.26%	4.37%	4.47%	4.56%

HEDGING THE COST OF FUTURE LOANS

A forward fixed rate is a fixed loan rate on a specified balance that can be drawn on or before a predetermined future date. The table below lists the additional cost incurred today to fix a loan at a future date.

FORWARD FIXED RATES

Cost of Forward Funds

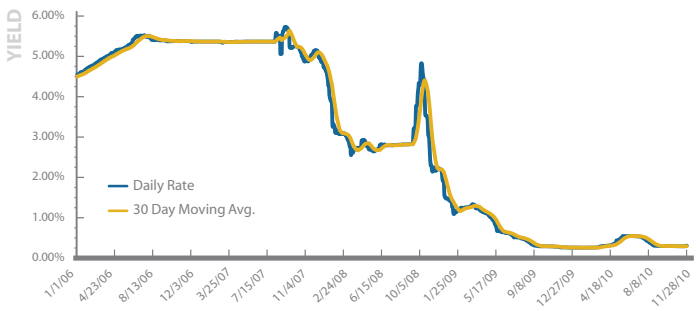
Forward Period (Days)	Average Life of Loan			
	2-yr	3-yr	5-yr	10-yr
30	5	7	8	6
90	11	17	20	14
180	17	30	37	26
365	33	53	69	47

Costs are stated in basis points per year.

SHORT-TERM INTEREST RATES

This graph depicts the recent history of the cost to fund floating rate loans. Three-month LIBOR is the most commonly used index for short-term financing.

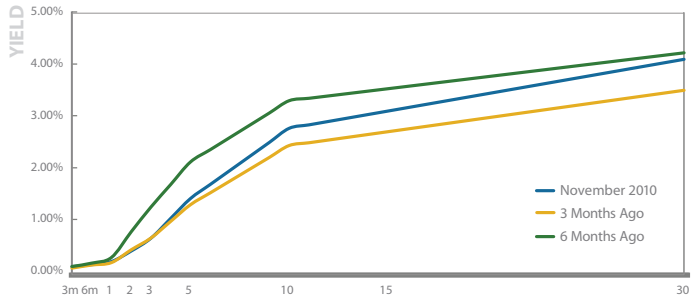
3-MONTH LIBOR



RELATION OF INTEREST RATE TO MATURITY

The yield curve is the relation between the cost of borrowing and the time to maturity of debt for a given borrower in a given currency. Typically, interest rates on long-term securities are higher than rates on short-term securities. Long-term securities generally require a risk premium for inflation uncertainty, for liquidity, and for potential default risk.

TREASURY YIELD CURVE



U.S. AgBank and CoBank Announce Pursuit of Merger

Merger Proposal Requires Approval Of Banks' Stockholders And Farm Credit Administration

U.S. AgBank and CoBank, two of the five banks in the Farm Credit System, recently announced that they intend to pursue a merger in 2011. The banks' boards of directors have executed a Letter of Intent that sets forth key terms and conditions of the proposed transaction, which also requires regulatory and stockholder approval.

The merged bank would serve as a wholesale provider of financing to Farm Credit associations that provide credit and financial services to more than 70,000 farmers, ranchers and other rural borrowers in 23 states. It would also serve as a direct lender to agribusinesses and rural electric, water and communications service providers throughout the country.

The merged bank would continue to do business under the CoBank name and be headquartered outside Denver, Colorado, but it would maintain U.S. AgBank's existing presence and operations in Wichita, Kansas, and Sacramento, California. Robert B. Engel, CoBank's president & chief executive officer, would be the chief executive of the combined entity.

"Over the course of the past year, the U.S. AgBank board has engaged in a strategic review of our business to determine the course that would best serve our associations and the farmers and ranchers in our territory for the long term," said John Eisenhut, chairman of U.S. AgBank. "Throughout that very deliberate process, we have followed the guiding principle that we will pursue the solution that best positions our customers to continue receiving reliable credit at a reasonable and competitive cost. The AgBank board has determined that a merger with CoBank best achieves that principle, and we look forward to working closely with CoBank as we move to the next steps in the merger review and approval process."

"We're extremely pleased to be pursuing this transaction, which offers significant benefits to the customer-owners of both organizations," said Everett Dobrinski, chairman of CoBank. "The merger will bring together two financially sound, profitable banks to create an even stronger cooperative financial services institution, under a governance structure that will offer associations, cooperatives and other customer-owners a fair and equitable voice in the governance process. Our two boards are strongly aligned

About CoBank

CoBank is a $60 billion cooperative bank serving vital industries across rural America. The bank provides loans, leases, export financing and other financial services to agribusinesses and rural power, water and communications providers in all 50 states.

CoBank is a member of the Farm Credit System, a nationwide network of banks and retail lending associations chartered to support the borrowing needs of U.S. agriculture and the nation's rural economy. In addition to serving its direct borrowers, the bank also provides wholesale loans and other financial services to affiliated Farm Credit associations and other partners across the country.

Headquartered outside Denver, Colorado, CoBank serves customers from regional banking centers across the U.S. and also maintains an international representative office in Singapore. For more information about CoBank, visit the bank's web site at www.cobank.com.

around the merits of the merger, which we believe significantly enhances the banks' ability to fulfill their mission of service to rural America."

U.S. AgBank is headquartered in Wichita and provides wholesale loan funds and financial services to Farm Credit Associations and Other Financing Institutions (OFIs) in the states of Arizona, California, Colorado, Hawaii, Kansas, Nevada, New Mexico, Oklahoma, Utah, southeastern Idaho and the western edge of Wyoming. It had approximately $25 billion in total assets at September 30, 2010.

CoBank is headquartered in Denver, Colorado and provides wholesale funds to Farm Credit associations serving Alaska, Connecticut, Idaho, Maine, Massachusetts, Montana, New Hampshire, New Jersey, New York, Oregon, Rhode Island, Vermont and Washington. The bank also provides retail loans, leases, export financing and other financial services to agribusinesses and rural power, water and communications service providers in all 50 states. CoBank had approximately $60 billion in total assets at September 30, 2010.

Engel noted that the geographic diversity of the merged bank's service territory would be matched by the diversity of the industries served, which would include virtually every key agricultural commodity as well as infrastructure providers that help form the backbone of rural communities throughout the country.

"The merged bank will enjoy substantial diversification benefits through the combination of two highly complementary loan portfolios, enhancing its ability to withstand risk," Engel said. "Its varied and diversified income streams will protect customer-owners in volatile market conditions, and the bank will have a robust capacity to generate earnings, build capital and deliver patronage to its customer-owners for generations to come."

Darryl W. Rhodes, chief executive officer of U.S. AgBank, who will be retiring shortly after the merger effective date, said the merger would create a larger pool of capital over which to spread risk and create a portfolio in which wholesale loan risk is well balanced with retail loan risk. "In addition, the merger would strengthen human capital by combining the AgBank staff expertise in wholesale lending services with the wholesale and retail lending expertise of CoBank. Staff reductions are not planned as part of the merger. This merger is all about strengthening the organization for the future and not about cost reductions," Rhodes said.

Jamie Stewart, president and chief executive officer of the Federal Farm Credit Banks Funding Corporation, the entity that issues debt securities that all System institutions use to fund loans, said: "While the financial markets generally view the Farm Credit System as one entity, investors and rating agencies are very familiar with both CoBank and U.S. AgBank as individual

institutions. Given the diversification benefits of this transaction, we expect the merger will be viewed in a very positive light and further strengthen the appeal of our securities to investors."

The merged bank would continue to be organized and operate as a cooperative, with eligible borrowers earning cash and equity patronage based on the amount of business they do with the organization. On the effective date of the merger, the CoBank and U.S. AgBank boards would be temporarily combined. Following a transition period, the merged bank's board would have directors elected from six regions across the country under both a one-member-one-vote and modified equity basis – an arrangement that has been successfully used at CoBank for over 20 years. The board would also have a number of outside and appointed directors. Complete details on the governance structure will be provided to stockholders in mid-2011 when merger disclosure materials are finalized.

"Good governance is at the heart of the cooperative model, and we are committed to a governance structure that will serve our owners and the bank effectively for the long term," Dobrinski said.

Detailed due diligence will soon be underway by both banks. There will also be a formal effort to solicit input from the other Farm Credit Banks and other System institutions on the impacts and implications the merger might have at the System level. In late March, the banks plan to submit a merger disclosure document to the Farm Credit Administration (FCA), the independent regulator for the Farm Credit System, for its review and preliminary approval.

The merger proposal will also need to be presented to and approved by stockholders of the two banks. If stockholders endorse the transaction, the merger is expected to close on October 1, 2011. ■

Commentary in Outlook is for general information only and does not necessarily reflect the opinion of CoBank. The information was obtained from sources that CoBank believes to be reliable but is not intended to provide specific advice.