Executive Summary Report
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PO Box 33518
Washington, DC 20033
Phone: (202) 393-0001
This year has already been a year of tremendous change for our country as well as for the renewable energy industry. In January, 2009, Barack Obama was inaugurated as the 44th President of the United States. Even before he took office, President-elect Obama made clear his focus on a renewable energy agenda for his administration:

"To finally spark the creation of a clean-energy economy, we will double the production of alternative energy in the next three years. We will modernize more than 75 percent of federal buildings and improve the energy efficiency of 2 million American homes, saving consumers and taxpayers billions on our energy bills. In the process, we will put Americans to work in new jobs that pay well and can’t be outsourced — jobs building solar panels and wind turbines, constructing fuel-efficient cars and buildings, and developing the new energy technologies that will lead to even more jobs, more savings, and a cleaner, safer planet in the bargain.... We will begin updating the way we get our electricity by starting to build a new smart grid that will save us money, protect our power sources from blackout or attack, and deliver clean, alternative forms of energy to every corner of our nation."

President-elect Barack Obama, January 8, 2009
After years of “the dog chasing the bus,” Dan Reicher of Google referred to the renewable energy industry’s seemingly endless pursuit for attention, “the dog caught the bus” in 2009. Suddenly, the industry was an integral part of the American Recovery and Renewal Act, President Obama’s legislation designed to pull the country out of a deep economic crisis. Now, in 2009, green building, alternative fuels, wind and solar energy and green job creation are part of a national agenda, and renewable energy has become the solution to not just an American “problem,” but the solution to a global climate and economic crisis.

As the convener of the renewable energy industry, ACORE responded to the challenge from the President, by refocusing the RETECH 2009 conference held in February, a month after the Inauguration, to bring into discussion how the industry was going to meet the President’s ambitious goals. ACORE also launched the DREAM Initiative (Doubling Renewable Energy in AMerica) to share industry plans to meet American’s energy goals.

RETECH 2009 was the largest US business-to-business gathering of the all-renewable energy industry with an attendance of nearly 5,000 participants and over 250 exhibiting companies. Packed with an exciting four track session agenda, 15 side events and multiple press and product launch events, RETECH continued to move renewable energy into the mainstream, and to support the renewable energy industry’s efforts to succeed.
Executive Summary Report

American Council on Renewable Energy

Business Conference
The business conference had six parallel tracks over two days, with industry-leading speakers on each of the key technologies, plus cross-cutting sessions on markets, finance and policy. The technologies included wind, solar, hydro, ocean, geothermal, biomass, biofuels, and waste energy. Additional discussion on clean technologies incorporated presentations on hydrogen, fuel cells, batteries and other energy storage, electric transmission, smart grid, cogeneration systems, distributed generation, energy efficiency, green buildings, and many others related to renewable energy. The business conference featured over 240 expert speakers.

Exposition
The exposition featured over 150 renewable energy technology suppliers, systems integrators, financiers, professional services firms, end users, utility companies, energy companies, government agencies, and many others.

Side Events
The purpose of the RETECH side events was to enhance participants’ capacity and knowledge across RETECH’s thematic areas. Side events were produced by major sponsors and non-profit groups, and offered a unique chance for the world community to discuss the opportunities and challenges of a major, rapid, global scale-up of renewable energy and advance the goals of energy security, climate change mitigation, and sustainable development.

The History of RETECH
As part of the famous Washington International Renewable Energy Conference (WIREC 2008) that was held at the Washington, DC Convention Center on March 4-6, 2008, ACORE created a model for a high-end conference and exhibition, which then transferred to the RETECH-branded conferences and exhibitions.

The Trade Show at WIREC 2008 was the largest business-to-business and business-to-government conference and exposition ever held on all-renewable energy in the US. It was global in scope, hosting exhibitors, speakers and delegates from more than 126 countries.

“The renewable energy industry assembled for WIREC 2008, which uniquely brought together over 8,600 people in government, industry, finance, and civil society,” said Michael Eckhart, ACORE president, in 2008. “We look forward to assembling again to continue our industry’s global growth and success, as well as highlight and advance the technological advances being made around the world. We intend for RETECH to be the number one place to be seen as a player in renewable energy and to do business.”
The highlights of WIREC 2008 included:

- 8,600 attendees
- 3 million hits on official event website
- Energy, environmental and economic ministers from over 80 countries
- Over 130 country pledges to advance renewable energy
- 250 speakers on wind, solar, hydro, geothermal, biomass and biofuels
- 246 exhibitors
- 40 sponsoring companies
- 11 international pavilions hosted by governments
- Two major receptions attended by 8,000 delegates
- 80 Official Side Events
- Over 300 media reporters
- Multiple product launches
OUT OF WIREC AND ON TO RETECH

Built on the outcomes and messages from WIREC 2008, and the Trade Show at WIREC, RETECH 2009 continued to highlight the top companies in the renewable energy industry as well as to encourage the global industry’s dialogue as we moved forward to India’s IREC in 2010.

RETECH 2009 was built on five key strengths of WIREC:

1. Advancement of clean technology and high tech renewable energy solutions both domestically and internationally through increased trade,

2. Involvement of the global industry, including India and China,

3. Convening of both Government and civil society to continue strategic dialogue to move industry forward,

4. Technological advancement of renewable communications and convening through inauguration of virtual attendance by internet,

5. Highlighting the top companies in the global renewable energy industry.

Predictions are that RETECH will increase in scale to 10,000 attendees and 500 exhibitors over the next three to five years. The RETECH conferences and exhibitions will be managed by ACORE and Access Intelligence—TradeFair Group.

This report highlights the key take-aways from RETECH 2009, take-aways which continue to inform and guide the industry.
## Conference Program

<table>
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<tr>
<th>Track:</th>
<th>A - Room N234</th>
<th>B - Room N242</th>
<th>C - Room N237</th>
<th>D - Room N241</th>
<th>E - Room N243</th>
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<td>9:00-12:00 pm</td>
<td>Opening Session</td>
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<td>12:00-2:00 pm</td>
<td>Opening Lunch in Exhibit Hall</td>
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<td>4:00-4:30 pm</td>
<td>Refreshment Break</td>
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<td>6:00-7:30 pm</td>
<td>DREAM Opening Reception in Exhibit Hall, sponsored by the Maryland Energy Administration, Maryland Department of Business and Economic Development, and the University of Maryland.</td>
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### Thursday, February 26th

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<tr>
<td>8:30-10:00 am</td>
<td>A3- PV Technology</td>
<td>B3- Wind Technology</td>
<td>C3- Utilities: Planning, Procurement &amp; Contracts</td>
<td>D3- Advanced Biofuels Production &amp; Policy (Heavy Duty Engines)</td>
<td>E3- Biofuels Market Development</td>
<td>F3- Green Cities</td>
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<tr>
<td>10:30-12:00 pm</td>
<td>A4- PV Economics, Finance &amp; Policy</td>
<td>B4- Wind Economics, Finance &amp; Policy</td>
<td>C4- Geothermal and Ocean Thermal Power</td>
<td>D4- Utilities: Energy Storage</td>
<td>E4- Advanced Conventional Biofuels</td>
<td>F4- Green Companies</td>
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<td>12:00-2:00 pm</td>
<td>Lunch in Exhibit Hall</td>
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<td>1:00-2:00 pm</td>
<td>Special Session: Dan Reicher, Director of Climate Change and Energy Initiatives, Google, Inc. - Room N256</td>
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<td>2:00-4:00 pm</td>
<td>A5- PV Markets &amp; Systems</td>
<td>B5- Wind Markets &amp; Projects</td>
<td>C5- Hydro &amp; Ocean Power</td>
<td>D5- Biomass Thermal Energy</td>
<td>E5- Utilities: Smart Grid and Distributed Generation</td>
<td>F5- Feed-in Tariffs</td>
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<tr>
<td>4:30-6:00 pm</td>
<td>A6- CSP Technology &amp; Cost</td>
<td>B6- Economic Development Workshop 1</td>
<td>C6- Environmental &amp; Carbon Finance</td>
<td>D6- International Markets &amp; Policy</td>
<td>E6- Biobased Products &amp; Integrated Biorefineries</td>
<td>F6- Utilities: Green Power Markets</td>
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<tr>
<td>6:00-7:30 pm</td>
<td>RETECH Happy Hour in Exhibit Hall, sponsored by Covanta Energy</td>
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### Friday, February 27th

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<tr>
<td>8:30-10:00 am</td>
<td>A7- CSP Projects</td>
<td>B7- Economic Development Workshop 2</td>
<td>C7- Venture Capital</td>
<td>D7- China</td>
<td>E7- Hydrogen, Fuel Cells &amp; Advanced Engines</td>
<td>F7- Green Buildings</td>
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<tr>
<td>10:30-12:00 pm</td>
<td>A8- Carbon/ REC Trading</td>
<td>B8- Economic Development Workshop 3</td>
<td>C8- Capital Access: Public and Private Markets</td>
<td>D8- Developing Countries</td>
<td>E8- Advanced Vehicle Technologies</td>
<td>F8- Green (DREAM) Jobs</td>
</tr>
<tr>
<td>12:00-1:00 pm</td>
<td>A9- Utility and Power Gen. Lunch</td>
<td>B9- Economic Development Lunch</td>
<td>C9- Venture Capital Lunch</td>
<td>D9- International Lunch</td>
<td>E9- Land-Use Lunch</td>
<td>F9- Green (DREAM) Jobs Lunch</td>
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**DREAM Opening Reception in Exhibit Hall, sponsored by the Maryland Energy Administration, Maryland Department of Business and Economic Development, and the University of Maryland.**

**Special Session: Dan Reicher, Director of Climate Change and Energy Initiatives, Google, Inc. - Room N256**

- Implementing the Stimulus: What Comes Next
- Energy Legislation: 2009 & Beyond
- What Google is up to: Technology, Policy, Finance

**RETech Happy Hour in Exhibit Hall, sponsored by Covanta Energy**
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### MEDIA PARTNERS

- American Council On Renewable Energy
- RETECH2009 Executive Summary Report
EXHIBITORS

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ACORE Cyber Cafe
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enerG Magazine
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Greater Houston Partnership
Green Innovation Connect by JETRO LA and Nikkei America
Hearth & Home Technologies
Hole Solutions Ltd.
Hurst Boiler
IDA Ireland
Illinois Finance Authority
International Business Forum
Investment in Denmark
Investment New Zealand
Italian Trade Commission
Japan External Trade Organization (JETRO)
Johnson Controls, Inc.
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Kubota Membrane USA Corp.
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McKenna Long & Alridge
Menova Energy Inc.
National City Energy Capital
National Renewable Energy Laboratory
Nebraska Department of Economic Development
NEED Project
Nevada Commission on Economic Development
New Zealand Trade and Enterprise
North American Clean Energy
North American Dismantling Corp.
North American Windpower/Solar Industry
NY Loves Clean Tech
Ormat Technologies
Overseas Private Investment Corporation
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Pennsylvania State University, The
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Riso Kagaku Corp.
RSMR Global Resources, Inc.
SCION Research
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Solar Stik
SolarDock
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Solid Sealing Technology, Inc.
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Sterling Planet
Stoel Rives LLP
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Suzlon Wind Energy Corp.
Tennessee Economic Partnership
Tetra Tech EC Inc
The High Ground of Texas
ThermaSource, Inc.
Today’s Energy Solutions Mag/GIE Media
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University of Maryland, A. James Clark School of Engineering
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UTC Power
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Waste Solutions
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Western Area Power Administration
WindLogics
Windpower Monthly News Magazine
WINPRO Co. Ltd.
Wyoming Business Council
Zephyr Corp.
Opening Session

Overview

In the opening session, industry leaders addressed the major issues facing renewable energy today, including the uplift from President Obama’s call for a doubling of renewable energy in three years, to the financial crisis and its downdraft effect on today’s markets.

Speakers

Michael Eckhart, President, American Council On Renewable Energy (ACORE)
Katrina Landis, Group Vice President, Alternative Energy, BP
Hermann Scheer, Member, German Bundestag
General Wesley Clark (Retired), Chairman of EWT Americas and Co-Chairman of Growth Energy
John Geesman, Former Commissioner, California Energy Commission
Nancy Floyd, Founder and Managing Director, Nth Power
Cathy Zoi, CEO, Alliance for Climate Protection, We Campaign
Kateri Callahan, President, Alliance to Save Energy
John Cavalier, Managing Partner, Hudson Clean Energy Partners

Katrina Landis

Group Vice President, Alternative Energy, BP

Summary

To begin the Opening Session of RETECH 2009, Katrina Landis spoke about today being the “best of times and the worst of times” for renewable energy. The current global and U.S. economic recessions pose challenges for all renewable energy businesses. The commodities and financial markets are reeling, but in many ways, Landis said, “the prospects for renewable energy have never been more robust.”

The ARRA contains the following items:

- Funds earmarked for the development of a smart grid to allow for widespread distribution and consumption of renewable energy,
- A three-year extension to the Production Tax Credit system and the option to use, instead, a 30% ITC,
- Funding for new projects to develop carbon-capture technology and business models, with $1.5 billion allotted to develop a competitive process for industrial projects,
- Project financing and credits for work on advanced biofuels, and
- The ability for the solar industry to monetize ITCs and to gain support for flagship deployments on public buildings.

“It’s clear that the Obama Administration and the Congress are just warming up...”

Congress is poised to enact a Renewable Energy Portfolio Standard, and the Administration is acting decisively to realize two of its critical energy goals:

1. To increase renewable energy production to 25% by 2025, and
2. To reduce carbon emissions by 80% by 2050.

Besides being an oil and gas company, BP is a major alternative energy company.

BP’s Alternative Energy Division was established in 2005, with a commitment to invest $8 billion over a 10-year time horizon. BP invested well over $1 billion last year, with 70% of that investment being made in the US.

“O ur investments are not gestures, but evidence of our belief that the world requires a mix of energy in which renewable and alternatives play an increasingly important part.”

BP has 20,000 MW of wind projects in development, with 1,000 MW currently in production. These projects have created over 1,000 jobs during construction, and over 60 full-time jobs for operations and maintenance in rural America.

The company is increasing its involvement in solar, industrial-scale hydrogen, carbon capture and storage, and in biofuels—notably in bio-butanol and cellulosic ethanol.

“What we do, all of us in this room, has moved center stage. The spotlight is on us and expectations are high. Once again, America has the opportunity to lead...”

BP has set some conditions it feels are needed in order to provide the huge amounts of energy the world will demand within the next 20 years.

- Energy companies and the government must have confidence in each other to move forward.
- Fiscal and regulatory policies must create a level playing field and the central mechanism is to price carbon; the cost of emissions needs to be factored into all energy products and services through cap and trade systems.
BP is an ardent supporter of a federal RPS, but based on the example of the UK, BP knows that a national RPS, alone, is not sufficient if we are to meet the 25 x 25 goal.

The US federal and state governments must remove barriers to the scale-up of transmission systems. Washington should authorize construction of interstate transmission lines. The latest smart grid proposal is a good first step.

“The future is in our hands. This is our industry’s big chance. Can we prove that we can deliver energy that is clean and secure? Can we help put America back to work? Can we perform efficiently and sustainably? I say yes, we definitely can.”

---

**Hermann Scheer**
Member, German Bundestag

**Summary**

Introduced as “the founder of the World Council for Renewable Energy,” Hermann Scheer gave a global perspective on the many crises that we face and the why renewable energy can provide solutions to many of the world’s problems.

“At WIREC, one year ago, I started a speech by saying, ‘There is good news and bad news. The bad news was: oil runs out. The good news was—and is—oil runs out.’”

It is not just one problem behind the need to change from fossil and nuclear fuels to renewable energy, said Scheer, but actually 7 different world energy crises that compel a global shift to clean, renewable sources:

- The climate change crisis,
- The power availability crisis,
- The crisis of third-world countries becoming more and more unable to pay their energy bills (currently 40 countries in the developing world pay more for oil than they earn through export of goods),
- The health care crisis, which, Scheer said, is caused in many ways by the world’s dependence on traditional energy,
- The increasingly dangerous threat of nuclear proliferation,
- The imminent and increasing water crisis (conventional energy production is one of the top three water consumers), and
- The increasing agri-crisis which encompasses loss of land, particularly the loss of arable soil due to the increased use of chemical fertilizers and pesticides.
“How do we organize ourselves to make use of renewable energy on a global scale? We need to think in terms of technological revolutions.”

Some other poignant quotes from Scheer’s speech including the following:

“*We cannot wait for a global treaty to begin our revolution.*

“*We can’t wait for governments and companies to decide they will make the shift after someone else does it first.*

“*We should make this revolution in renewables because it is right.*

---

**General Wesley Clark**

Chairman of EWT Americas and Co-Chairman of Growth Energy

**Summary**

Wesley Clark, a retired Army General and former candidate for President, spoke at the Opening Session of RETECH 2009, and framed his discussion around issues of national security. The United States remains dependent on imported fossil fuels, and also faces the long-term threat of global climate change. Additionally, not only does renewable energy provide energy security, but it is also an engine for economic growth and profit. General Clark said that “We’ve got the building blocks to really take the economy forward and the renewables sector forward in a way that it has never been taken before.”

“This is a national security issue because of what it means when you have a dependence on imported fuels.”
Our dependence on fossil fuels is a national security threat for two primary reasons.

1. Importing vast quantities of oil necessitates stability in oil-producing countries, and this stability can only be maintained with a strong American military presence in those countries.

2. Without proper action to mitigate climate change, the world could see conflict resulting from the displacement of people, disruption of agriculture, and the spread of disease.

“"If we're going to get our energy independence, if we're going to deal with climate change, if we're going to work harmoniously with developing powers in Asia, we have to get our own house in order."

General Clark offered three solutions.

1. Raise the 10% cap on ethanol blending to help reduce oil imports.

2. Open the financial markets with incentives and regulations.

3. Help enable small investors, entrepreneurs, and local communities to develop distributed wind and solar energy projects.

“"What we should be hoping for is to replace imported petroleum with biofuels that are environmentally friendly, and leading us into an era of greater reliance on electric transportation and electric power, commensurate with our ability to create renewable and sustainable electric power, as opposed to drawing on our sources that contribute to global warming problems."

General Clark said that biofuels are crucial if we are to reduce our consumption on foreign oil in any meaningful way. Vehicle electrification offers a feasible long-term option for clean transportation, but only when we are able to produce significant amounts of electricity from clean energy resources. Before this is a possibility, we need to build new transmission lines and other infrastructure. Biofuel, on the other hand, provides a near-term solution.

“"It's a national security issue. It's a global issue. The government is going to help us, but we're in charge. This is a private enterprise operation. We have to articulate our needs, and we have to bring the technology, the investors, and the landowners and developers together to do this. It's the only way it's going to get done, and we're the ones who are going to do it.""
Summary

John Geesman, former Commissioner of the California Energy Commission, focused his speech around renewable energy policy, at both the state and federal level. He sees President Obama’s administration as a turning point for renewable energy policy and the industry in general.

“The President has set a clear, measurable, tangible near-term goal that will occur or not on his watch to double the American use of renewable energy in the next three years. That provides a benchmark against which every governmental initiative, the performance of every bureaucracy in the executive branch, the resistance or support of every interest group among American society, can and will be measured.”

A number of important policy changes are likely to occur in the near future.

1. A national renewable portfolio standard is on the horizon, as well as climate change legislation.

2. Instead of supply-side legislation, like tax incentives to promote development, the country will begin to see demand-side policies as well.

3. In order to double renewable energy in three years, massive transmission expansion is needed.

4. To create a demand-side market for renewable energy, states and localities will begin to pass feed-in tariff policies modeled after the European policy.

“I would argue that the imperative for federal jurisdiction in the area is to create virtuous cycles where states are both allowed and encouraged to exceed federal performance standards.”

State and local governments have initiated much of the progress in renewable energy development so far. Federal policy must allow them to continue to be innovative and creative with their policymaking efforts.

“There is something that everyone in this country can do, no matter where you live, to influence your government at the appropriate level to take action to encourage renewable energy. Come down and make your voices heard.”
Summary

Nancy Floyd, one of the first venture capitalists to invest in renewable energy, spoke at RETECH about the history of venture capital investment in renewable energy, and how the energy trends have shifted since the 1970s.

“We’ve had unprecedented break-throughs in technology in part fueled by the flow of investment capital that only started in earnest eight years ago.”

- Government R&D fuels technological breakthroughs that lead to venture capital investment.
- Research and development funding for energy fell between 1987 and 1997, but increased beginning in 2007.

“We are seeing not only break-throughs in technology, but unprecedented shifts in the marketplace and consumer mindset.”

There is currently a “perfect storm” for renewable energy development, driven by the following factors:

1. Perfect competition for energy,
2. Dwindling resources,
3. Expensive resources,
4. Energy security concerns, and
5. Climate change.

“This is the industry that is going to lead the economic recovery of this country and of the world.”

In the late 1970s, as oil prices rose as a result of the OPEC oil embargo, President Carter called for energy independence. These high prices led to new research and development funding for renewable energy technologies, comprehensive energy legislation, and the first commercial wind farm in 1982.

As oil prices declined and came back to “normal,” however, government support for renewable energy disappeared, and so did venture capital investment. Even as government support and private investment dwindled, the problems associated with fossil fuel dependence and carbon emissions were exacerbated.

“The new president has connected the dots, that renewable energy addresses all of these issues, and addresses them in a way that is going to create jobs, that is going to create the flow of investment capital.”
Cathy Zoi
CEO, Alliance for Climate Protection, We Campaign

Summary

Cathy Zoi, CEO of the Alliance for Climate Protection, explained the importance of communicating the problems associated with climate change—and the potential solutions—to the American public. The Alliance for Climate Protection seeks to educate and engage the public to ultimately “create that political space for better policies.”

“Our job is to persuade the American people and people elsewhere in the world of the urgency and solvability of the climate crisis.”

The Alliance for Climate Protection has over two million members in all 50 states. The organization’s goal is to move people “up the ladder of engagement,” from “deniers” at the bottom, to “activists” at the top.

1. Activists
2. The engaged
3. The confused
4. The deniers

“We can address all those things if we spend the next ten years and transform our energy economy once and for all and become 100% clean.”

To do it, we need the factors below:

1. Energy efficiency,
2. Renewable energy,
3. A unified national smart grid, and
4. A renewable energy “ramp-up.”

A 100% clean energy goal does not necessarily mean 100% renewable electricity in 10 years. The We Campaign’s plan necessitates what equates to a 50% renewable electricity standard, with the balance of electricity being met by energy efficiency and other non-carbon emitting generation facilities, like nuclear and existing hydropower. This plan will get the country to 20% below 1990 levels of carbon emissions by 2020.

“The naysayers are very well-funded and are going to continue to lobby against the policies that are going to transition us to a new economy.”

“Tis is possible if we can allow ourselves to imagine it.”

The clean energy movement must always compete with well-funded fossil fuel interests, who can pay millions of dollars for television advertisements in addition to lobbying campaigns. The We Campaign is the first group with adequate resources to compete with and, hopefully, weaken the negative message presented by fossil fuel advocates.

In a speech in July of 2008, Al Gore called for the United States to adopt a goal of 100% clean energy within ten years, as a way of improving the economy and the environment, and improving our national security.
Kateri Callahan
President, Alliance to Save Energy

Summary

Kateri Callahan of the Alliance to Save Energy highlighted the natural and symbiotic relationship between the energy efficiency and renewable energy industries. The two industries have similar interests and goals, and the technologies complement each other.

“It’s a prerequisite to work with renewable energy if we’re going to achieve our goal of widespread deployment of energy efficiency.”

“I think it’s in the best interest of the renewable energy community as well to use us, to work with us, to realize your goal of widespread deployment.”

The Alliance to Save Energy has a narrow mission: to promote energy efficiency, for a healthier economy, a cleaner environment, and greater energy security.

“Energy efficiency can be a foundation for renewable technologies and can make their use cost-effective, particularly in the built environment.”

Cabinet officials who are devoted to the cause. The president’s platform on energy efficiency includes:

- Reducing electricity demand,
- Building net zero energy buildings,
- Overhauling appliance standards, and
- Weatherizing a million homes a year.

“More is coming.”

Additional policy actions are on the horizon that will boost energy efficiency.

- An Energy Efficiency Resource Standard (EERS)
- A national renewable portfolio standard
- Climate legislation

“We’re about to rebuild our economy on development and deployment of energy efficiency and clean energy.”

Callahan cautions that we are facing long-term problems, like climate change and energy security, that are easy to overlook in the short-term. Thus, it is important to stay focused on long-term issues and solutions.

“The US economy is now the least efficient of any industrialized economy in the world. We need to be the most efficient. And when we do that, and as we do that, we can become a global leader in the production and use of renewable energy.”

President Obama has a sound policy agenda related to energy and efficiency and renewable energy, and he understands how the two work together, and he has put together an “A team” of
Summary

John Cavalier presented a cautious but somewhat optimistic outlook on renewable energy finance and policy in 2009. He affirmed the actions of President Obama and his administration and asserted his support for the stimulus bill, but also acknowledged that policy cannot solve the crisis—the private sector must act to stabilize the financial markets.

These macroeconomic influences are as follows:

1. Equity is now more expensive, and capital is less accessible.
2. Banks are less willing to lend.

“There are macroeconomic influences at work that are well beyond the influences of the president.”

Strong businesses with good management, sound business plans, and viable technologies will find funding. However, when the cost of capital escalates and fluctuates, capital does freeze. Thus, to initiate the flow of capital, we must have stability in the financial system.

With the stimulus bill, the administration has “opened the door,” but the industry must take advantage of the opportunity. And consumers need to be educated if they are going to be supportive of renewable energy and climate policies.

“The renewable energy community must be very careful in its legislative dialogue. ACORE does a tremendous job in facilitating that dialogue.”

The renewable energy industry must stay unified in its message and goals, and cannot permit our “detractors to conquer us.” It is also important to set realistic goals for the industry and for policy, to increase the perception of the industry’s viability.

“It is the entrepreneur that has driven the success in this industry. Let’s protect the entrepreneur as we go forward.”

“We are at a wonderful inflection point in this industry. Let us all seize the day.”
Disclaimer

The following report is a collection of summaries from presentations made at RETECH 2009: Renewable Energy Technology Conference and Exhibition in Las Vegas, Nevada between February 25 and February 27, 2009. The opinions expressed in the following report do not necessarily reflect the views of the American Council On Renewable Energy (ACORE) as an organization or any individual employed by that organization. The opinions in the report are those of the speakers at the conference and any opinions conveyed in their presentations given at that time. Citations in the report only reference the materials, such as presentations, documents, and other files, given to ACORE by the speakers at the conference for educational purposes. The report does not attempt to cite other sources outside of the speakers’ materials and any reference to an external source has been transposed from materials given to ACORE.

Speakers

Plenary
Dan Reicher, Director of Climate Change and Energy Initiatives, Google, Inc.
Hermann Scheer, Member, German Bundestag
Kateri Callahan, President, ASE
Katrina Landis, Group Vice President, Alternative Energy, BP
Michael Eckhart, President, American Council On Renewable Energy (ACORE)
Cathy Zoi, CEO, Repower America
John Geesman, Former Commissioner, California Energy Commission
Nancy Floyd, Founder and Managing Director, Nth Power
John Cavalier, Managing Partner, Hudson Clean Energy Partners
General Wesley Clark (Ret.), Chairman of EWT Americas and Co-Chairman of Growth Energy

Advanced Vehicles
Eddie Sturman, Engineer, Sturman Industries
Pat Cadam, President, Green Gears
Sanjeev Choudhary, General Manager, PHEV Systems, A123 Systems
Tom Mack, President & CEO, AHL-TECH, Inc.
Todd Suckow, Senior Engineer, Hyundai-Kia America Technical Engineer
Mike Harrigan, Vice President of Business Development, Coulomb Technologies
Kathryn Clay, Director of Research, Alliance of Automobile Manufacturers
Biofuels

Christopher Groobey, Partner, Baker & McKenzie LLP
Maxwell Shauck, University Research Professor, Biofuels and Aviation, University of Houston
Craig Shealy, CEO and President, Osage
Dan Nolan, Strategic Management Services, Sabot 6, Inc
Doug Berven, Director of Corporate Affairs, POET
Ernie Shea, Project Coordinator, 25x25
Greg Keenan, Vice President of Business Development , Virent Energy Systems, Inc.
Helena Chum, Senior Advisor, National Renewable Energy Lab
Joel Velasco, Chief Representative, UNICA
John Walker, Chief Executive Officer, P.R.I.M.E., Corp
Jonathan Gorham, Director, Business Development, Qteros
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Richard Mount, President, North Shore Energy
Robert Do, Solena Group
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Dan Henry, Vice President and Chief Technical Officer , Pellet Fuels Institute
Dick Carmical, CEO, The Price Companies
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Brian Murphy, Stratex Energy
Gary Elliott, Principal, International Applied Engineering, Biomass Conversion and Alternative Fuels Specialist
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Janet Hawkes, Strategic Partner, RPM Ecosystems
John Ganzi, President, Environment Finance
Jon Strimling, President, American Biomass Distribution, LLC
Melissa VanOrnum, Marketing Manager, GHD, Inc
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Richard Munson, Senior Vice President, Recycled Energy
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Mark Niederschulte, Chie Operating Officer, INEOS Bio
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Dr. Marion Gilliland, Chief Communications Officer, Farmer’s Ethanol LLC
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Michael Naylor, Director and Founder, Canopy Capital Limited; Chairman, Advisory Board The Prince’s Rainforests Project
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Aimee Christensen, Founder & CEO, Christensen Global Strategies
Billy Parish, Co-Founder, Energy Action Coalition
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Howard Learner, President, Environmental Law and Policy Center
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Executive Summary Report
American Council On Renewable Energy

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Overview
Currently, there are major opportunities in the biopower field given the rising cost of quality coal, new federal requirements for increased production of renewable electricity, demands from the federal government for the reduction of greenhouse gas emissions, and the availability of Renewable Energy and Carbon Credits.

Consensus
At RETECH, it was determined that biopower is an essential renewable energy solution to many of our energy problems. Biopower encourages best practices in forest management, reduces reliance on fossil fuels, and contributes to our energy security. Biopower is also CO₂-neutral as CO₂ is captured by feedstock growth. Additionally, biopower has the potential to be a highly efficient energy source for transmission lines built in support of renewable energy and energy efficiency. Biopower is the ideal complimentary technology to solar and wind energy given its ability to consistently meet baseload requirements.

Biopower Economics & Finance
Development constraints inhibit biopower projects. These constraints must be overcome through federal energy legislation.

Seven serious project development constraints on biopower projects were identified: feedstock and processing; energy conversion technology; siting (size and location); environmental impact; finance; operation and maintenance (O&M); and (technological) know-how.

It was clear at RETECH that biopower market development is necessary to overcome project development constraints.

The need for a standardized national electric code was also discussed as every utility employs different regulations for connection and (these differences can delay connection between different markets. Delays on transmission can be expensive and time-consuming.

So far, federal incentives for the biopower market are largely based around the American Recovery and Reinvestment Act. This legislation has allowed the Investment Tax Credit to be used as an alternative to the PTC; extending the tax credit deadline through 2013; and expanded and simplified the Loan Guarantee program.

In order for the biomass power industry to meet its full potential, additional incentives will be required to increase fuel supplies and lower costs. The federal and state governments must support deployment of “state of the art” wood waste equipment. For collection, processing and transportation (improvements there must be an evaluation of successful strategies to access state and federal lands. Wildfires are one of the largest CO₂ sources in the US; we must consider improved land clearing techniques for diseased or infested trees.

The development of conventional and advanced biofuels is fast paced, involving a variety of different feedstocks and technologies.

“New high corn oil hybrids are available for producing biodiesel without lowering the available fermentable sugars in the corn. With 10 million gallons of biodiesel per 110 million gallon ethanol, the net carbon intensity of the resulting fuel streams is substantially reduced.”

– Jim Schreck, Chief Technology Officer, BEST Energies
The most popular and successful biofuel feedstocks, include cellulosic and woody biomass, biomass waste streams, algae, and other resources. The technologies responsible for converting these biomass feedstocks into biofuels are surprisingly multifaceted, ranging from thermal, thermal chemical, yeasts, enzymes, acids and other chemicals, metals, chemical catalysts, and more. These technologies will emerge from their early demonstration phase in 2009, and are expected to be in commercial production by 2010.

Policy support for advanced biofuels is coming from state and federal governments in the form of grants, loan guarantees and incentives – and most importantly, through the Renewable Fuels Standards and the Volumetric Ethanol Excise Tax Credit.

**The sector must increase speed to market, providing an opportunity to streamline the permitting process and de-risk capital for scaling-up operations.**

There must also be a focus on market-based solutions, including leveling the playing field in terms of technology and incentives, in addition to rewarding performance for efficiency, volume, and quality. There must also be the encouragement of private investment to drive volume and job creation. This can be done through carbon pricing and long term policy commitments.

The vision of the advanced biofuel industry is to utilize waste and low cost carbon to produce fuel and energy, to reduce green house gas emissions, and deliver cost effective and sustainable solutions.

**Market development for the biofuel industry consists of advanced forms of transportation by truck, rail, barge, ship and pipelines.**

A second critical step for biofuel market development is providing more blender pumps which will give drivers a choice of E-10, E-20, E-30 and E-85, in addition to gasoline. Legislation is underway at both the state and federal levels to increase the number of blender pump fueling stations. However, more flexibility within the Federal government and EPA regulations is needed to increase the choices towards E-20 and E-30 blends.

In addition to market development a public informational campaign is needed to create awareness regarding the facts of the “food versus fuel” issue.

Can biomass streams be competitive fossil fuels? –Yes. Biomass becomes more competitive as fuel prices rise. Additionally, profits are made on co-products not just fuels and this results in proportionate funding of research and commercial support in addition to the establishment of homogenous standards and testing.

– Jonathan Gorham, Director, Business Development, Qteros

This campaign should include information about indirect land use issues as facts and public perceptions are being manipulated to the disadvantage of the biofuels industry and its market development.

Currently, the biofuel industry is facing a financial standstill.

Most operating plants are tight on capital. To alleviate this problem, many plants are undergoing rampant “restructurings” – or worse, refiners are becoming biofuels producers.

Elements of energy security revolve around three main factors; fuel, infrastructure and prices. With energy security comes the need to build a global market, building global markets means meeting demands sustainably.

– Joel Velasco, Chief Representative, UNICA

There are two agreements which could alleviate these financial issues; off-take agreements and tolling agreements. Off-take agreements are long-term purchase agreements with pricing that takes into account the producer’s variable costs (including feedstock and energy). Whereas, tolling agreements are opportunistic “rentals” of the producer’s plant to those who can supply feedstock and sell the final product.

If biofuel plants were to explore one of these two agreements, they would potentially be able to provide a steady revenue stream for financing, alleviate working capital concerns, provide a post-restructuring revenue solution, transform arms-length relationships to partnerships, and finally, bring in much needed capital.
Critical development opportunities for biofuels involve a variety of agencies, and actors.

- Government Laboratories
- Acquisition and Purchasing Agents
- Service Test and Evaluation Centers
- Operational Requirements Developers
- Contracting Officers
- Bankers (Congress, Military and Acquisition Leadership)
- Operational Commanders
- Defense Contractors

Bio-based products are one of the fastest growing and ubiquitous sectors in the panoply of renewable energy products.

In many cases, the best products are made from a combination of petrochemicals and biomass materials with a larger component derived from biomass.

The growth of the bio-based product industry has placed a bigger burden on biomass feedstocks, highlighting the need to optimize biomass production while advancing natural systems.

New, bio-based products can be found in vehicle interiors, paints, solvents, cleaners, oils and other lubricants, including adjutants for agriculture, fertilizers, pesticides, and pharmaceuticals. Federal regulations, concern over public health, and the need to decrease our use of fossil fuels are the principal drivers of the transition from oil to renewable fuels. Increased funding is needed for the USDA’s Office of Bioenergy and Bio-based Products to further advance the potential for this new set of products.

Major factors influencing the market development of bio-based products heavily involve supply chain changes; new product timelines/ regulatory approvals; resolution of food vs. fuel controversies; market segmentation; and the successes of early movers.

In the next three years, the industry is uniquely positioned to focus on platform-wide development and scale up of commercial product offerings. This scale-up would include product introduction of lower volumes of feedstock the use of higher value materials; the development of an industry-wide strategy, which will work at national and state levels to introduce important incentives that stimulate industry growth and create industry influence on the regulatory environment; and finally, transportation and regulation supply chain development.

Hydrogen is another alternative fuel in the biomass realm that was highlighted as a legitimate substitution for imported oil. Hydrogen is being made from many sources including biomass, but the cost, distribution, and marketing of hydrogen offers major challenges.

The biggest obstacle is low electrical rates. We need standard renewable energy tariff rates to ensure that producing renewable energy is economical.

- Melissa VanOrum, Marketing Manager, GHD, Inc.

There are many hydrogen production opportunities available through various new technologies. These opportunities include the following:

- Hydrogen electrolyzed from water, generated by utilities to make substitute natural hydrogen gas for “peaker” plants with side streams for H2 supply,
- Hydrogen from gasified biomass,
- Hydrogen from landfill gas,
- Hydrogen from geothermal gas, and finally
- Hydrogen from natural gas.
Advanced Vehicle Technologies

Today, advanced operational transportation systems are essentially old dogs that have been taught new tricks—such as FFVs, airplanes and ships/boats that are simply retrofitted commercial systems.

The Toyota Prius and Camry, and other hybrid vehicles are yesterday’s models. Plug-in versions are, today, retrofits and they are not designed to run on alternative fuels.

The next application of advanced vehicle technologies could be large-sized transportation systems like trucks, buses, trains and boats.

At RETECH 2009, panelists discussed at great length the future of vehicles that will run on any renewable liquid fuel and electricity with the assumption that there is more than enough renewable electricity to meet the needs of these vehicles for years to come.

Another old dog being taught a new trick, are legacy vehicles being retrofitted to run on E-10, not on higher blends. A small but significant number of pioneering drivers are running blends of ethanol up to E-40 in their standard vehicles. These vehicles seem to be working even better than FFVs, but some automakers and state officials object, and a not-yet certain disapproval from the EPA could affect opportunities for advanced transportation technologies in the future.

In moving advanced vehicles forward, the industry must focus on smart engines, maximum efficiency, fuel flexibility, no emissions, and minimum changes.

In order to put advanced vehicle plans into action and move the industry forward, companies in this space must work together to retro-fit commercial vehicles NOW by adding new engine applications.

Alternative vehicle stake-holders must also promote the development of distributed power generation throughout the country.

On the policy side, the industry must (1) promote public and private partnerships on advanced manufacturing R&D for batteries and other critical components, (2) invest in next generation battery technologies, and (3) endorse tax credits and government purchasing to create early market certainty.

In order for the transition to more advanced transportation to occur, a progression of seed/series A funds for around $2.5-5 million are needed to develop “shovel ready” projects. Given that states seem ready, customers are ready, and the technologies are present, new funding can galvanize the industry.

Already the transportation sector has made great strides towards energy efficiency and alternative fuel uses.

On road auto and truck use has experienced an increased presence of E-10, E-85, FFV, blender pumps and biodiesel. In aviation, Air New Zealand and Continental are using blends up to B50, and Virgin Atlantic with B20.

Panelists discussed the importance of opening up new fields for renewables such as the development of true flex-fuel vehicles by GM autos, GE locomotives, and P&W jets. New fuel production technologies are not enough to create progress for advanced vehicle technologies; manufacturers must invest money, time and R&D into developing new transportation alternatives.

What’s wrong with existing engines? One hundred and twenty year-old technology without flexibility or intelligence. Imagine being able to make minor changes to existing engines, that will make them clean and efficient and capable of using any fuel.

– Eddie Sturman, Engineer, Sturman Industries

The key challenge for electric vehicles is domestic manufacturing of advanced batteries. A strong domestic battery supplier base will help all automakers in bringing electric vehicles, including plug-in hybrids, to market.

– Kathryn Clay, Alliance of Automobile Manufacturers
Conclusions

Speakers at RETECH 2009 maintained an optimistic view of biomass and biofuels and their ability to answer many of the nation’s energy, economic and security uncertainties. Despite the substantial potential of these biomass/biofuel industries, it is clear that in moving forward, there are three key needs: greater investment, policy incentives, and market development.

Session References

D2 - Biomass Power
Reed Wills, President, Adage (Chair) [slides]
Ervan Hancock, Manager, Renewable & Green Strategies, Georgia Power [slides]
Brian Murphy, Stratex Energy [slides]
Melissa VanOrnum, Marketing Manager, GHD, Inc [slides]
Gary Elliott, President, International Applied Engineering [slides]

D3 - Advanced Biofuels Production & Policy (Heavy Duty Engines)
Robert Do, President & CEO, Solena Group (Chair) [slides]
Michael McAdams, Policy Director, Brownstein, Hyatt, Farber & Shreck LLP
Helena Chum, Research Fellow, National Renewable Energy Laboratory (NREL) [slides]
Mark Cherry, Chief Scientist, Smart Plugs Corporation [slides]
Maxwell Shauck, University Research Professor, Biofuels and Aviation, University of Houston [slides]

D5 - Biomass Thermal Energy
Richard Munson, Senior Vice President, Recycled Energy (Chair)
Dan Henry, Vice President and Chief Technical Officer, Pellet Fuels Institute [slides]
John Ganzi, President, Environmental Finance [slides]
Gary Elliott, Principal, International Applied Engineering, Biomass Conversion and Alternative Fuel Specialist [slides]
Bruce Lisle, Past President, Pellet Fuels Institute [slides]

E1 - Biomass Supply Management
Geoffrey R. Morgan, Partner, Michael, Best & Friedrich LLP (Chair) [slides]
Jon Strimling, President, American Biomass Distribution LLC [slides]
Dick Carmical, CEO, The Price Companies [slides]
Janet Hawkes, Strategic Partner, RPM Ecosystems [slides]
Michael Totten, Chief Advisor, Climate, Water and Ecosystem Services, Conservation International [slides]
**E2 - Advanced Biofuels Production & Policy (Light Duty Engines)**
Greg Keenan, Vice President of Business Development, Virent Energy Systems, Inc. (Chair) [slides]
Jonathan Gorham, Director, Business Development, Qteros [slides]
Richard Mount, President, North Shore Energy [slides]
John Walker, CEO, P.R.I.M.E. [slides]
Mark Niederschulte, Chief Operating Officer, INEOS Bio [slides]

**E3 - Biofuels Market Development**
Kevin Kephart, Vice President for Research and Dean of the Graduate School, South Dakota State University (Chair)
Joel Velasco, Chief Representative, UNICA [slides]
Ernie Shea, Project Coordinator, 25x25
Christopher Groobey, Partner, Baker & McKenzie LLP [slides]
Dan Nolan, Strategic Management Services, Sabot 6, Inc. [slides]

**E4 – Advanced Conventional Biofuels**
Phil Madson, President, KATZEN International, Inc. (Chair) [slides]
Doug Berven, Director of Corporate Affairs, POET [slides]
Craig Shealy, President and CEO, Osage Bioenergy [slides]
Wendel Dreve, Managing Member, Farmer’s Ethanol LLC [slides]
Marion Gilliland, Chief Communications Officer, Farmer’s Ethanol LLC [slides]

**E6 - Biobased Products & Integrated Biorefineries**
Jim Schreck, Chief Technology Officer, BEST Energies (Chair) [slides]
John McKee, Senior Project Manager, Nova Biosource Fuels, Inc. [slides]
Bill Faulkner, VP Business Development, Draths Corporation [slides]

**E7 - Hydrogen, Fuel Cells & Advanced Engines**
Jeff Serfass, President, National Hydrogen Association (Chair) [slides]
Robert Remick, Director, Hydrogen Technologies & Systems Center, National Renewable Energy Laboratory (NREL) [slides]
Robert Friedland, President & CEO, Proton Energy Systems, Inc. [slides]
David Haberman, President, IF LLC [slides]
Sandy Thomas, President, H2Gen Innovations [slides]

**E8 - Advanced Vehicle Technologies**
Pat Cadam, Founder & Owner, Green Gears (Chair)
Sanjeev Choudhary, General Manager- PHEV Systems, A123 Systems
Tom Mack, President & CEO, AHL-TECH, Inc. [slides]
Eddie Sturman, Engineer, Sturman Industries [slides]
Todd Suckow, Senior Engineer, Hyundai-Kia America Technical Engineer
Mike Harrigan, Vice President of Business Development, Coulomb Technologies [slides]
Kathryn Clay, Director of Research, Alliance of Automobile Manufacturers [slides]
Geothermal Power

Overview

The United States is currently the world leader in electricity generated from geothermal power, with 3000 MW installed, and plans for an additional 3300 MW. World capacity currently totals around 10,000 MW from power generated in over 20 countries. The economic decline has put extreme pressure on geothermal companies seeking financing for both project development and resource appraisals; however, the economic stimulus bill has provided the industry with new hope. The geothermal session at RETECH reviewed the status and direction of geothermal technologies, installed and planned projects, financing, and outlook on the industry.

Consensus

The presenters concurred that although the geothermal industry will face temporary economic challenges, the technology’s unique combination of dependability, cost-competitiveness, scalable potential and zero-emissions secures its long term success and support from governments and the private sector. New technological developments, such as Enhanced Geothermal Systems (EGS) and drilling innovations from the oil and gas sectors, are expected to drive down costs. As a result, an estimated 100 GW of geothermal resource should be available for power generation by 2050.

Geothermal Technology

Geothermal is both a mature and proven technology, yet it is still underdeveloped.

Geothermal provides base-load power and up to a 95% capacity factor. The United States, although the lead producer of geothermal energy, is only accessing a small portion of its potential.

Technological advancements will cost-effectively derive heat for geothermal power generation from greater depths, greatly expanding resource potential.

The coal and oil industry’s engineering improvements in drilling will drive down the costs of extracting heat from beyond 3000 meters. In addition, the Department of Energy is currently developing the technology base to create and sustain commercial-scale EGS reservoirs to access vast resources of heat left previously untapped. EGS has the capacity of providing at least 100,000 MW of electricity over the next 50 years.

Development of low-temperature resources would help meet renewable energy demand in the Gulf Coast region.

The Department of Energy is expanding the research and development of low temperature hydrothermal resources and co-produced fluids from oil and gas. This would greatly expand resource potential in several regions of the United States with no installed capacity.

Geothermal heat pumps are the most efficient way to use green power for carbon free heating, cooling, and water heating.

Heat pumps are 400-600% efficient (1 kWh purchased from grid could yield 4-6 kWh for the building) and produce the lowest carbon dioxide emissions of all available space-conditioning technologies.

The high capacity factor inherent in geothermal power production has great promise to positively impact both climate change and energy security

— Jeffrey Eckel, President & CEO, Hannon Armstrong Capital
Finance and Economics

The geothermal industry has doubled its workforce over the past 2 years and will continue to increase. Additional tax credits, state RPS demand, natural gas price fluctuation, and slower coal plant permitting processes will maintain its growth.

The economic downturn of late 2008 and 2009 has contributed to several market hurdles. In February, shares in geothermal companies were down roughly 56% YTD, causing extreme pressure on their ability to finance developments. Resource verification costs, already much higher than other renewable technologies, are impeding project development. However, The American Recovery and Reinvestment Act (ARRA) has provided much hope to the geothermal finance community for its Department of Energy loan guarantees and Treasury Department tax grants.

Policy

The American Recovery and Reinvestment Act supports the continued development of geothermal energy.

The stimulus bill extends the PTC deadline through 2013 and also gives the option to forego the PTC for a 30% ITC through 2010. In addition, there is an option to receive a cash grant for 30% of the project cost in place of these tax credits.

Conclusions

Despite their acknowledgment that the industry would experience a temporary low-growth period during the economic downturn, the presenters conveyed a positive outlook for the long term growth of the geothermal thermal industry. As the technology improves, geothermal power plants will be brought to new regions and the costs of constructing and operating new plants will be driven down. Aided by strong government and private sector backing, the technology’s share in global power production will continue to increase, providing thousands of new jobs and clean, cost-effective power.

Session References

C4 - Geothermal Power

Paul Thomsen, Director for Policy and Business Development, Ormat Technologies, Inc. (Chair)
Edward James Wall, Geothermal Technologies Program Manager, Department of Energy [slides]
Dita Bronicki, CEO, Ormat Technologies, Inc. [slides]
Jeff Eckel, President & CEO, Hannon Armstrong Capital [slides]
Paul Bony, Director of Residential Market Development, ClimateMaster [slides]
Tracy McKibben, Managing Director, Environmental Banking Strategy, Citigroup Global Markets [slides]

Renewable Portfolio Standards (RPS) promote regional demand for geothermal power in the United States.

Twenty-six states and the District of Columbia recognize geothermal electric as eligible for RPS. California, Nevada, and Hawaii have a particularly high geothermal potential.

Despite challenging economic conditions, public and regulatory support for alternative energy development remains robust.

- Tracy McKibben, Managing Director, Environmental Banking Strategy, Citigroup
Green Buildings and Communities

Overview

A green building is not only an investment in the environment, it is also an investment in future generations. Green buildings use less energy, water, and other resources which will in turn save money over the lifetime of the building. These buildings facilitate a healthy, safe environment in which to work and live. A green community employs a large group of people, and multiple buildings create a cohesive unit that drives conservation, efficiency, and energy generation from renewable sources. Through these buildings and communities, individuals can develop and exemplify green lifestyle choices. It is through a combination of environmentally-conscious behavior and green infrastructure that a truly sustainable world can be achieved.

Consensus

A consensus was reached among the speakers that children must be taught that the environment is in grave danger of irreversible damage from increasing greenhouse gas emissions, leading to climate change. The younger generation will only inherit a better world if action is taken now. Therefore, a child’s education must include a deep understanding of energy conservation, energy efficiency, and renewable energy. Green buildings and communities give individuals and groups the opportunity to lead by example.

Education

The United States has a responsibility to provide students with an education that enables them to be successful in green careers.

The stimulus bill will allocate $122 billion over the next two years to renewable energy growth and energy efficiency reforms. Of that total, $22 billion will go specifically to construction bonds for schools. It is imperative that these funds be used for more than routine maintenance and new to-code construction. The funds should support energy efficiency and conservation measures as well as new renewable energy systems. Jerome Ringo, President, Apollo Alliance said that, “the stimulus package will not fix this country; it is just a down payment... We can—and will [solve the climate crisis]—and the change begins in our cities... There must now be a level of accountability in our cities to invest in green education and employment programs in a reasonable and controlled manner.”

Education about the environment starts at home.

There is much to both learn and teach children about the environment, and this education needs to begin at home. There are lifestyle choices that must be addressed between the children and their parents, such that the family is living in environmentally-friendly home and in a sustainable fashion. Community and school development is secondary to a sustainable, healthy lifestyle at home. However, that is not to say that green schools are not a priority; in fact, students should be encouraged to bring home the environmental lessons being taught at school—things such as starting a compost pile or changing to lighting with compact fluorescent bulbs.

Awareness about environmental and energy issues needs to be ubiquitous.
We can and will [solve the climate crisis] and it begins in our cities.

- Jerome Ringo, President, Apollo Alliance

Jerome Ringo cited the failure of local and national leadership to raise awareness about energy issues. How to increase popular awareness of the importance of clean energy and energy efficiency is one of the biggest challenges America faces.

The damaging effects of global warming are often felt most by the poorest communities, whose voices in the environmental movement are rarely heard. The United States has the opportunity to engage low income communities by training people from all walks of life for jobs bettering their environment.

The poor are deeply affected by negative environmental factors, and have significantly less power to combat these changes.

The poor are more occupied with daily life and their immediate future than wealthier Americans. They have less money to invest in alternative energy, and must spend 50% of their disposable income on fossil fuel-generated energy. A disproportionate number of impoverished students are affected by infrastructure inefficiency and degradation at their schools and homes, as there are drastically more health issues—like a higher percentage of children with asthma, or dangerous levels of lead in children’s bloodstreams—in older and dilapidated buildings.

The stimulus bill presents an once-in-a-lifetime opportunity for energy and the environment to be placed in the forefront of the American education system.

Now that the American Recovery and Reinvestment Act of 2009 has been passed and signed into law, there is a unique chance for educators and administrators to set their agendas, curricula, and plans around renewable energy and energy efficiency. This is the time for schools to create holistic and grand strategies to greatly reduce their carbon footprints and greenhouse gas emissions.

Teachers need to be well-versed and confident in leading environmental education lessons, and need to exude a green lifestyle themselves.

The administrators of a green school should look to employ teachers of all subjects who have studied or have a background in environmental science, sustainability, or green design. The school can provide training for teachers in specific “green” areas, or in particular lessons that they may not be familiar with. Teachers and administrators should also understand the green features of their school.

**Green Buildings**

Buildings should look to other forms of energy generation, such as distributed generation and on-site generation from renewable sources.

A green building can greatly decrease its energy usage from fossil fuels with the adoption of energy generation from solar, wind, or geothermal resources on site. By having distributed combined-heat-and-power generation systems installed, buildings can greatly increase their efficiency.

There are real barriers to entering the green buildings arena, so the process to receive siting, zoning, and planning permits needs to be made easier.

The federal government has a real obligation to facilitate the requests of, and issuing of permits on green building projects. There are real challenges that have to be faced in the process of installing new energy generation systems, including net metering limitations, third-party ownership of renewable energy generation equipment, and interconnection fees to the electric grid.

The planners and designers of a green school, or any green building, should know their assets and try to utilize their natural resources.

In the case of the University of Minnesota-Morris, there was huge wind potential in the western part of the state as well as agricultural waste that the school began buying and using in a biomass gasification generator. The university also put up a large, 1.65 MW wind turbine and is about to begin construction on another turbine of similar size. Minnesota-Morris was able to utilize their local resources to maximize the amount of renewable energy on their campus.
Green construction and renovation should be viewed as a life-cycle cost rather than an initial upfront cost.

Nearly all of the energy and monetary savings from a green building will be accumulated as the facility matures. The assumption that a green building will have a higher upfront cost is generally true, yet usually this cost is not significantly greater. Nonetheless, the initial costs of a green building may be more expensive than a school built to code, but added expenses will be paid off through conservation, efficiency, and renewables—not just once, but many times over—during the lifetime of the building.

Efficient use of energy in buildings is one of the most effective ways to drastically reduce greenhouse gas emissions.

Mary Tucker, Energy Program Manager, City of San Jose, California spoke about the city’s use of green goals to both reduce greenhouse gas emissions and stimulate the local economy. Green buildings play a large role in curbing municipal emissions and can be responsible for a 60% reduction in carbon emissions. Energy efficiency programs in city buildings spell huge monetary savings for cities, with projects at sixteen San Jose buildings expected to save $435,000 in general fund energy costs.

Green Schools

Attendees shared a vision that every student attend a green school within one generation.

Roughly 20% of the American population, including students, teachers, and administrators, go to school every day, so there is huge potential to affect millions of lives with green schools. By the time that today’s children are sending their children to school, a green school should be the standard building practice.

A green school in operation saves energy and money.

Over the course of a year, a typical new green school will use only 2/3 of the energy that a school built to today’s code would use. An average green school will also save around $100,000 per year in operations comparison to an ordinary school. This savings means that green schools would have the available funding to hire a few new, well-qualified teachers each year.

Every state should mandate green school requirements. There are currently 10 states that have instituted some form of green building regulations for new school construction, and/or for existing school renovations. Another 17 states are in the process of passing similar requirements. The United States’ Green Building Council (USGBC) encourages a goal for all 50 states to pass and implement green school legislation. On Capitol Hill, the green schools caucus is one of the fastest growing federal movements.

A concerted effort on the state level can lead to bold and influential green school policy.

State governments will play an important role in the expansion and pervasiveness of green schools. For example, Ohio has made a commitment to build 205 green schools over the next two years. Studies estimate that these schools will save the state $1.4 billion annually on energy consumption, and nearly 1/3 of all new school construction costs will be recouped. From these savings, the state can pay for the salaries of new school staff. As another benefit, it has been shown that the retention rate among teachers in green schools is higher than in other, traditional schools.

A green school should be an interactive building and encourage a hands-on learning experience.

Of equal importance to constructing a green school is labeling the special design features of the school. Labeling facilitates class lessons on these features, integrating seamlessly with the students’ education. For example, features such as reclaimed and reused wood from an old factory should have appropriate signage for students to read, or there should be diagrams explaining how the low-flush toilets in the bathrooms work.

Lastly, students should have access to the data from an on-site renewable energy installation. There could be, for example, touch-screen equipment in a public area of the school (i.e. the library or main foyer), which displays the output from the solar photovoltaic array on the roof.

If both the public and private sector decided to prioritize and incentivize the building of green schools, green schools would proliferate.

One of the largest factors in the proliferation of green schools is the reception of assistance from the utility companies. It would be very beneficial to the green school movement if utilities could alleviate some of the operational costs from green schools’ renewable energy
systems, agree to buy green power during the summer when the schools are not using it, and place price guarantees on the electricity that a green school consumes—especially the electricity it produces. If federal incentives or rebates were linked directly to green schools, that would make green school construction and renovation even more affordable.

**Transportation**

A green school is not complete without greening the transportation to and from school—and that starts with the buses.

The United States has a fleet of 60,000 school buses, and for every bus on the road, 30 cars are eliminated. While the newest school buses can achieve 7 mpg, if we factor in the number of passengers ferried, the fuel efficiency improves to 252 mpg. Considered in this light, buses can be seen to be a highly efficient and effective mode of transportation. In addition, half of the new buses have a special idling shut-off which cuts out 50% of their fuel consumption. In fact, new technology allows for diesel buses to have lower emissions and to run cleaner than traditional gasoline-powered cars.

Drivers and maintenance workers must be trained properly and be aware of the school’s mission to have a cleaner, greener school bus fleet.

Green schools should provide training to school bus drivers and maintenance workers to reduce bus idling when possible, check tire pressure, and to start and stop busses efficiently. The EPA runs a comprehensive Green School Bus Program and all schools are encouraged to join.

**Green Jobs**

Renewable energy industries create more jobs than the oil industry does.

Renewable energy industries can create nearly four times more total jobs than the oil industry can create with the same amount of money. Further, renewable energy industries create roughly triple the number of good jobs—paying at least $16 dollars an hour—as the oil industry could create with the same amount of money.

Green jobs will revitalize the American economy and substantially curb the rising unemployment rates.

Green jobs have the potential to reduce the unemployment rate to 4.4 percent, from 5.7 percent (calculated within the framework of US labor market conditions in July 2008). Green job training would bolster employment, especially in domestic construction and manufacturing. Specifically, the Green Recovery program can, at least, bring back 800,000 construction and skilled labor jobs.

**Conclusions**

With 40 percent of all energy consumed in the United States being consumed by buildings, there is substantial room for improvement in conservation and efficiency across the American infrastructure. Building renovations and modifications can significantly reduce total energy usage and greenhouse gas emissions. A standard for new construction of green buildings and communities would ensure that future buildings will be more environmentally-friendly and sustainable. These conservation and efficiency measures would breed the adoption of environmental awareness and green lifestyle choices, and coupled with increased renewable energy production, could easily make a better tomorrow for the next generation.
Session References

**Green Schools Breakfast**
Jerome Ringo, President, Apollo Alliance
Lowell Rasmusen, Vice Chancellor, University of Minnesota-Morris
Rachel Gutter, Senior Manager, Education Sector, U.S. Green Building Council (USGBC)
Rich Costello, President, Acela Energy
Brett KenCairn, Executive Director, Veterans Green Jobs
Steven Pucke, First Group Transit
William Naubert, President, Project EverGreen Schools
J. Paul Gerner, Associate Superintendent of Utilities, Clark County School District, Nevada
Mel Jones, CEO, Sterling Planet

### F2 – Green Schools
Rachel Gutter, Sr. Manager, Education Sector, U.S. Green Building Council (Chair) [slides]
Paul Polizzotto, CEO, EcoMedia [slides]
Gary Westerholm, Executive Advisor, Project Evergreen Schools [slides]
Paul Gerner, Associate Superintendent of Utilities, Clark County School District, Las Vegas, Nevada [slides]

### F3 – Green Cities
Christine Ervin, President, Christine Ervin Company (Chair)
Mary Tucker, Energy Program Manager, City of San Jose [slides]
Lowell Rasmusen, Vice Chancellor, University of Minnesota Morris [slides]
Jerome Ringo, President, Apollo Alliance

### F4 – Green Companies
Matt Clouse, Director, Renewable Energy Policy and Programs, US Environmental Protection Agency (Chair)
Roger Ballentine, President, Green Strategies
Jeff Krech, Global Facilities Global Sustainability Program Manager, Dell Inc. [slides]
Marty Sedler, Director, Global Utilities and Infrastructure, Intel Corporation [slides]
Andrew Singer, Senior Vice President, Constellation NewEnergy [slides]

### F7 – Green Buildings
Curtis Clark, Sustainability & Energy Consultant, GSBS Architects (Chair) [slides]
Ralph DiNola, Principal, Green Building Services, Inc. [slides]
Shelley Fidler, Principal, Governmental Affairs, Energy & Environmental Policy, VanNess Feldman [slides]
Elizabeth Francis, Partner, Mario Cucinella Architects
Deb Kuo, Director, Real Estate, Exelon Corporation [slides]
Kevin Hydes, CEO, Integral and Past Chair, World Green Building Council [slides]

### F8 – Green (DREAM) Jobs
Cheri Olf, Director of Education and International Workforce, American Council On Renewable Energy (ACORE) (Chair)
Brett KenCairn, Executive Director, Veterans Green Jobs
Dawn Dzurilla, President, Gaia Human Capital Consultants
Hydro/Ocean/Tidal/Offshore Wind Power

Overview
Harnessed water power is one of the world’s oldest renewable energy sources. Hydropower accounts for more capacity than any other renewable source today. At RETECH 2009, hydro innovators presented on the changing manner in which developers are harnessing the power of water—and offshore wind. As technology opens new areas to offshore development, national leaders in ocean, wave, tidal energy, and offshore wind convened in Las Vegas to discuss the field’s successes, challenges and visions looking forward.

Consensus
New technologies are bringing changes to offshore energy generation, with innovators rising to the challenge of providing clean energy to America’s growing coastal cities. With minimal environmental impact, developers are finding new ways to harness water’s abundant kinetic potential—and changing the way the world thinks about hydroelectric power.

Offshore Wind Energy
The benefits of offshore wind energy are numerous.

Burton Hamner, President of Grays Harbor Ocean Energy Co. LLC, described the benefits of offshore compared with traditional land turbines. To start, offshore turbines enjoy a reduced load turbulence blowing at a higher mean rate on a steadier basis and mitigating some of the intermittency issues of traditional wind. Offshore wind is also more aesthetically benign. Commonly located about ten miles from shore, turbines present a small visual impact and no bird impacts. With good siting options offshore from high volume load centers, offshore wind enjoys increased transmission options compared to traditional wind that rely on heavily loaded lines. Lastly, offshore wind farms avoid constraints on turbine size—larger turbines can be more economical to use, generating more power and but not easily transportable by land.

Offshore turbines enjoy a reduced load turbulence blowing at a higher mean rate on a steadier basis and mitigating some of the intermittency issues of traditional wind.

– Burton Hamner, President of Grays Harbor Ocean Energy Co. LLC

There is a list of eight criteria for developing offshore wind and wave farms.

Burt Hamner also offered eight criteria for evaluating a site’s feasibility for offshore wind:
1. The local electric power market must be in the top quartile of electricity costs in the USA, averaging less than 15 cents/kW.

2. The state must have significant incentives and requirements for renewable power generation.

3. The local grid and load are adequate to absorb 1000MW of power and to balance it when the wind/wave energy drops off.

4. The site must have at least 100 square miles of area to develop.

5. A suitable harbor and construction site and clear access are available.

6. The inner side of the site must be at least 10 miles offshore to maximize wave and wind power and minimize visual impacts.

7. The site must not be in a commercial shipping navigation lane.

8. The site depth must not exceed 250 feet.

With these eight criteria in mind, there are seven sites off America’s coastlines that fit the bill:

1. MA—south of Nantucket
2. RI—south of Block Isle
3. NY—Hamptons; south of Long Island
4. NJ—off Atlantic City
5. CA—off Farallon Islands
6. CA—off Ventura
7. HI—off Moloka’ii

Proposals have also been submitted in locations along the Texas Gulf Coast, locations in the Great Lakes, and the Alaskan Peninsula.

Of course, as with other renewable energy technologies, offshore wind faces challenges, such as siting and positioning.

The United States’ continental shelf slopes deeper more quickly than the one in Europe, limiting the number of feasible sites with sufficient wind capacity and proximity to load. Further technological improvements are necessary to open more area to development.

In addition, the Jones Act restricts use of foreign vessels in installation process, so European boats designed for turbine installation can’t be used.

The logistics of building and erecting offshore wind turbines present some complex engineering challenges, and the projects may be even more difficult off the American coastline than it would be off the European coastline.

Offshore wind turbine foundations vary in size and foundation type. With water under 30 meters deep, a monopole design is used, anchoring the turbine to the seabed with a single pillar. This design has been used for most existing projects in Europe’s shallow continental shelf, but proves difficult off the deeper, more turbulent North American Continental Shelf.

Between 30 and 60 meters of water, demonstration phase designs are typically ‘jacket tower’ or ‘jack-up’ platforms, where turbines are affixed to a floating tripod onshore, then towed to the site, attached to pillars anchored in the seabed and ‘jacked up’ above the waves. This medium-depth design requires no special ships and avoids the lengthy and costly installations characteristic of a single-platform design.

Above 60 meters, ‘floating spar’ or ‘tension leg’ platforms might be used to anchor the turbine, allowing it to drift a bit with the deeper, more powerful currents. With these advances in anchoring technology, sites previously out of the realm of possibility for US offshore wind have become new options for wind farms.

There is potential to combine the technologies of offshore wind and wave energy into one generation system.

With good wind and wave potential, the western United States holds promise for joint wind-wave ventures, with some designs incorporating wave power into turbine platforms. There are many designs for independent wave farms encompassing buoy farms that capture the rise and fall of waves, to long, tubular floats that capture the water’s longer periodic motion. These technologies aren’t as far along in the development stage as turbines, but should help to moderate fluctuations in offshore wind velocity.
New Water Technology

There are opportunities to improve existing water technology as well as the invention of new technology.

Opportunities exist to harness moving water in rivers and estuaries, as exhibited at RETECH by New York’s Verdant Power and SeaGen from the United Kingdom. Using underwater rotors, these companies harness water’s density to spin underwater rotors, generating electricity. With their pilot farm located in New York City’s East River between Roosevelt Island and Brooklyn, Verdant Power utilizes a three-blade turbine design, anchored by cable to the riverbed. Since the river reverses its flow during the day, the turbine’s design allows it to easily pivot 180° and continue functioning.

SeaGen, a project of Marine Current Turbines Ltd, was installed in a channel in Strangford Narrows, Northern Ireland, using a platform design, resembling something of an in-sea lighthouse. SeaGen incorporates two large, two-blade turbines that extend from arms on either side of the platform. The platform rises and lowers to best harness the tidal current, and can raise the rotors above water to perform maintenance. The next frontier is open-sea underwater turbines, with submerged floating designs that utilize the kinetic power of deepwater currents.

Both engineers and entrepreneurs alike are revisiting the standard hydroelectric dam.

CEO Wayne Krouse of Hydro Green Energy wants to make America’s dams work a little harder, retrofitting them to generate hydrokinetic energy. Of the thousands of dams in the continental United States, he figures that 60% to 2/3 of them are compatible for a modification the company performed on Hastings Dam, over the Mississippi River in Minnesota. The company uses an underwater kinetic turbine to capture high-velocity current from the dam’s tailrace, adding 5.7% of renewable energy generation to the existing site. Making America’s existing dams more efficient without inhibiting any more waterways or adding substantial amounts of additional transmission is what makes this add-on so alluring.

Conclusions

Still one of the most abundant renewable energy sources, hydropower’s next century promises to look much different than its last. From offshore wind to innovative underwater approaches, the world is just beginning to unlock the kinetic force of water and the new opportunities anchoring technologies provide. At RETECH 2009, the hydropower delegation showed the renewable energy world it’s serious about low impact, high yield and efficient transmission.

Session References

C5 - Hydropower and Ocean Power
Trey Taylor, President, Verdant Power (Chair) [slides]
Burt Hamner, President, Grays Harbor Ocean Energy Co. LLC [slides]
Peter Fraenkel, Technical Director, Marine Current Turbines Ltd. [slides]
Wayne Krouse, Chairman & CEO, Hydro Green
International Renewable Energy Industry and Market

Overview

Speakers presented an overview of the state of the renewable energy industry around the world, including a breakdown of the top players and their locations. Also included was an analysis of the industry’s major trends, as well as a forecast of renewable energy’s growth within the context of worldwide economic downturn.

Consensus

This year is a pivotal point in the history of the global renewable energy industry. European countries, such as Germany, Denmark, the United Kingdom, and Spain have demonstrated the viability and success of solar and wind power with advanced economic policies, large-scale manufacturing, and a continually increasing capacity of on and offshore renewable energy generation systems over the last decade. The new international players, China and India, have nearly insatiable energy demands that can be met in two ways: 1) under the ‘business as usual’ model using petroleum and coal; or 2) with an innovative strategy that emphasizes energy production from renewable sources. While China and India have taken steps towards the latter option, they have taken equally as many steps towards the former. There is no certainty that their massive needs can be sustained through renewable energy generation. It is here, at this crossroads, that the United States must step in and demonstrate global leadership with its own renewable energy generation. The US has the ability to greatly ramp up the development, manufacturing, and legislation of renewable energy and to significantly increase the percentage of renewables in its national energy load, which could serve as an example to China and India, as well as to the rest of the world.

United Kingdom

The United Kingdom has enormous wind power potential—especially in offshore projects, where the UK has the largest capacity for wind in the world.

According to Mike Rosenfeld of UK Trade and Investment, the United Kingdom has over 2,500 MW installed onshore wind power projects, with 400 MW installed in 2008, and 300 MW installed so far in 2009. There is an extensive pipeline of projects in development: 1,060 MW under construction, 3,159 MW have been proposed and consented, and 6,890 MW are in planning. Delays in the planning system and grid capacity are being addressed, but, in some instances, project financing could be an obstacle. The next phase of offshore wind development in the UK, proposes a total installed capacity of 25 GW. Funding will be allocated in 2009, and the projects should be operational in 2015, with a £50 billion investment opportunity. Currently, 7 offshore wind projects are in operation with a capacity of 404 MW and 8 projects are under construction with potential capacity of additional 936 MW, while another 3,113 MW of capacity have been consented.

The UK’s potential electricity generation is greater than its potential electricity demand.

Rosenfeld also commented that there is an obligation on electricity suppliers for a growing percentage of their electricity to come from renewable energy sources. This level will rise to up to 20% by 2020, and the obligation runs to
2037. Accredited Renewables Generators earn Renewable Obligation Certificates for each MWh generated, the certificates which can be traded. Suppliers must have the necessary number of certificates at the year end, or else pay a buy out fee (~£35.76/MWh). Buy out fees are recycled to suppliers who have met their obligation, therefore increasing the ROC’s value. Generators can secure medium term contracts for supply of power, ROC’s, and other benefits. An excess of electricity would mean that the UK can consider exporting some of energy to other parts of the European Union.

The United Kingdom stands at the forefront of renewable energy market development. The UK government recognizes that the most efficient way to meet its goals is to establish an open market system with a free market pricing mechanism.

– Mike Rosenfeld, Vice Consul, UK Trade and Invest

Germany

Germany has set ambitious targets for 2020. Jürgen Morhard of the German Embassy related that the targets for 2020 include 40% less greenhouse gas (GHG) emissions (270 m. tons), a 30% share of renewable energy in electricity (compared to 15.3% in 2008), a 14% share of renewable energy in heating, doubling of energy efficiency, and doubling of co-generation (CHP). Germany’s Integrated Climate and Energy Policy (ICEP) has goals of climate protection, energy security, economic growth, employment opportunities, and industrial innovation. One of the major goals of the ICEP is a total annual reduction of 270 million metric tons CO2 by 2020.

The keys to success of Germany’s Renewable Energy Sources Act rely on a few factors.

Morhard also told RETECH attendees the success of the Renewable Energy Sources Act rests on the following principles:

- **Reliability** - long term planning security for investors
- **Innovation** - technology-specific incentives create lead markets
- **Flexibility** - adapts to technological and market development

There needs to be a specific but simple approach for both private households and businesses; grid operators have to feed in electricity from renewable energy sources and give priority to transmission and distribution of RE; price guarantee should be valid for 20 years; the total costs of the EEG for tax payers would be €4,4 billion, so that families pay less than €3/month, and private households pay 1 cent/kWh per month.

**Germany is a world leader in renewables.**

According to David Wortmann of Germany Trade and Investment, Germany had the largest sales worldwide of photovoltaic cells and wind turbines, and Germany occupied a 10% share of the global renewables market in 2007. During the same year in the labor market, there were 249,300 Germans employed domestically in the renewable energy industry. Germany had €10,7 billion of domestic investments in renewables during 2007 in addition to exporting €9 billion of renewable energy system products. Total sales in Germany for 2007 equaled €25 billion.

Germany is one of the world’s largest PV market, with a turnover of €7 billion in 2008. In 2007, Germany held a 47% share of the world PV market. While in 2008, Germany’s total installed PV power was 5.3 GW, newly installed PV power was 1,500 MW, PV industry turnover was €7 billion, and the number of employees in PV industry was 48,000.

The Germans also have a well developed wind energy market. In 2007, Germany held a 24% share of the world wind market. Newly consented wind projects in Germany profit by a broad and steady domestic market and excellent export conditions. Wind power accounted 7% of electricity consumption in Germany during 2008. Data from 2007 show that the total number of installed wind turbines in Germany was 22,247 MW; the number of German employees working domestically in the wind industry was 85,000; the share of worldwide turbine
production was 37%; the domestic turnover was €5.6 billion and export turnover was €7.5 billion. In Germany, 26 offshore wind projects with a capacity of greater than 25 GW have been approved, and another 19 projects are currently pending approval. There is now space for hundreds of small wind developers, which opens the market for new and bigger players. Capacity shortages in several areas offer significant business opportunities.

China

Over the next twenty years, China will need to find an alternative to coal-fired power generation in order to meet its expanding national energy consumption.

According to Louis Schwartz of China Strategies, LLC, between 2005 and 2030, China will be spending $1.2 trillion US on electrical power investments. In 2006, power generated from coal accounted for 69% of total energy consumption in China; by 2050, coal-fired power plants will account for 30% to 50% of China’s energy needs. In 2006 alone, China added an additional 92,000 MW of coal-fired power plants. In 2007, 11,000 MW of the worst coal-fired power plants were closed. In 2008, another 13,000 MW of outdated capacity will be closed.

China is choosing renewable energy for economic, social, and environmental reasons.

Between 2005 and 2030, China will account for 23 percent of the world’s investment in electrical power. Renewable energy will help to curb greenhouse gas emissions, increase energy security, and provide sustainable distributed generation options to those 10 million Chinese who do not have access to electrical power.

Louis Schwartz, President, China Strategies, LLC

Investments, research, and development of renewable energy offer opportunities to alleviate degradation of the environment, meet growing demands for energy, implement energy security, and enhance economic development in rural areas. Beijing plans to invest approximately $263 billion US through 2020 to foster the development of China’s renewable energy resources. Officials are projecting that China can generate 16% of their total energy load from renewables by 2020. By 2020, there will be 300,000 MW of hydropower, 30,000 MW of wind power, 30,000 MW of bio-mass, 1800 MW of solar power, 300 million sq. meters coverage of solar hot water heaters, 20 million tpy of bio-fuels and 44 billion sq. meters of methane gas.

Many Chinese have little or no access to power.

Schwartz reported there are more than 10 million Chinese who do not have access to electric power and tens of millions more rural Chinese with only spotty access. To combat this lack of electrification, Beijing has specific goals for rural power development, including strengthening the construction of small-scale rural hydropower plants and power grids, local wind power, biomass and solar projects. By 2010, Beijing plans to have in place 300,000 small-scale wind turbines in rural areas of China, to have 40 million households using methane gas, 50 million square meters of solar-powered hot water heaters and 1 million solar-powered stoves in use.

China’s growing middle class has generated an unparalleled demand for energy.

Between 2005 and 2030, China will account for 23 percent of the world’s investment in electrical power. Renewable energy will help to curb greenhouse gas emissions, increase energy security, and provide sustainable distributed generation options to those 10 million Chinese who do not have access to electrical power.

“New” energy equated to roughly 9% of the energy mix in 2008.

One of the most important aspects of China’s imminent growth rests on the expansion and improvement of its national grid system over the next few years.

China’s existing power grid, the largest power network in the world, is the one of the biggest hindrances to further development. The smart grid remains an emerging concept. However, the outlook is positive; in China’s stimulus package of $585 billion, China’s state grid corporation will invest $170 billion in new grid construction.
Grid resistance in China cannot be decreed; better incentives are needed.

Sebastian Meyer of Azure International stated that there is a stability challenge for high penetration areas. A renewable energy surcharge mechanism creates a working capital drain, a slow refund mechanism. It appears that except where local grid companies have stakes in wind projects, generally they do not benefit from increased renewable energy penetration under the existing system. The Chinese have taken some administrative measures to attempt to address and improve the situation. The grid companies have also responded with interconnection agreements, but these agreements often place the renewable energy developers at risk.

Domestic manufacturing of wind turbines and parts in China is growing quickly.

Chinese wind turbine manufacturers are now producing 1.5 MW, 2 MW and even 3 MW turbines, said Schwartz. Factors contributing to growth in Chinese wind turbine manufacturing include growth in the pace of construction of new wind farms, requirements that 70% of wind power equipment be sourced domestically, the elimination of tax rebates on purchases of domestically produced equipment by foreign invested enterprises, and the elimination of duty free imports of wind turbines of 2.5MW or less. There has been a rapid increase in the number and capabilities of China’s indigenous wind turbine parts industry. There are now more than 50 companies producing gearboxes, generators, and blades.

Schwartz added that China remains dependent on imports for such key wind turbine components as precision bearings, electrical and control systems, and inverters. US companies such as American Superconductor Corp. (AMSC) have been very successful in supplying the Chinese wind turbine industry. To facilitate the import of components not manufactured widely in China, the Ministry of Finance instituted a program of rebates of tariffs and VAT taxes. As more wind turbines and their component parts are sourced domestically, the Chinese are driving down the cost of wind power. Presently wind power costs ~0.5-0.6 Yuan/kWh compared to ~0.2-0.3 Yuan/kWh for power from coal-fired power plants. The Chinese estimate that if 70% of wind turbines are manufactured domestically, the cost of wind turbines will decline by ~15% and the cost of wind power would decrease to 0.375 Yuan/kWh.

The government is at the forefront of the growth of wind power in China and it is through Beijing’s efforts that success will be attained.

Schwartz believes the Chinese government has been very adept at creating the conditions for the development of particular industries by setting goals, putting in place laws, regulations and policies, creating incentives, nurturing key enterprises, convening government agencies and enterprises to develop plans, while allowing market forces to flourish. Beijing’s nurturing of the wind power industry displays all of these policies.
There have been a number of incentives implemented to trigger the growth of the wind industry in China. In 2001, Beijing reduced the value-added taxes due on the production of wind power by one-half. Between October 2007 and June 2008, the Chinese government provided approximately 1.4 billion Yuan (~$206 million US dollars) in financial subsidies for the wind industry. Financial subsidies include a 600 Yuan/kW payment to domestic wind turbine and component manufacturers for the first 50 MW-class wind turbines that domestic wind turbine manufacturers produce. The Chinese government is supporting the construction of power grids that connect far flung centers of wind power production with population centers and energy consumption hotspots. Industrial policy, including the use of the “special permitting” process to select investors in wind farm development projects and the utilization of domestically produced equipment for the construction and operation of those wind farms has been a significant impetus to development of the wind industry in China. Beijing also has incentivized wind farm development through the requirement that power generating companies have an installed capacity of 5000 MW or more. A Renewable Portfolio Standard requires that power companies must produce at least 3% renewable energy by 2010 and 8% by 2020, excluding large hydropower sources.

The gaps in China’s plan to fully develop its emerging wind sector still need to be addressed, including the pricing of wind power and development of power grids.

Schwartz continued that trial measures for renewable energy power generation pricing and cost sharing were promulgated by the National Development and Reform Commission in 2006 to provide for the on-grid price of wind power to be determined by the administrative department of the State Council in Charge of Pricing, based on local conditions, and in accordance with the general principal of cost plus profit margins. Power pricing for wind power “special permitting” projects are to be determined by bid, but are not to exceed the level set by the administrative department of the State Council in Charge of Pricing. Development of power grids to serve the wind farm installations being constructed is lagging, causing difficulties in connecting and distributing power generated from wind farms. This, in turn, results in wasted energy.

So while some measures to govern purchases by power grid companies were enacted in August 2007 to provide a market for renewable energy, the lack of a fully developed grid makes that promise somewhat illusory. In 2007, for example, the State Power Grid Co. distributed only 1/10th (5 billion Kwh) of the maximum potential of total KWhs that China’s wind farms were able to produce. The technological level of domestic wind turbine manufacturers still needs to be improved and the quality of some of the domestic wind turbine components is not high.

China is very adept at using tax policy to meet its goals.

– Louis Schwartz, President, China Strategies, LLC

India

Like China, India has rapidly growing energy demands.

Today, approximately 147,402 MW of electric power capacity (including nearly 30,000 MW of captive generation) is generated in India, including 13,242 MW of renewable power. This power capacity also consists of 93,392 MW of thermal power, 36,647 MW of hydroelectric and 4,120 MW of nuclear power. However, larger hydropower is scored/counted outside of the renewable power figures.

The 11th 5-Year Plan (2008-2013) initially required 77,778 MW of new electric power to be built, including 10,000 MW of renewable power. The government of India has increased that new capacity figure to 100,000 MW required in the 11th 5-year Plan. In the 10th 5-Year Plan, India built 24,000 MW of its required 34,000 MW of electric power. The Indian government has stated that the 11th 5-Year Plan for infrastructure, including power, would require approximately $492 Billion U.S. (of which approximately $240 Billion U.S. would represent debt, and $140 Billion U.S. of this debt will come from the private sector). The Indian power sector received investments worth $44.76 billion U.S. in the first half of 2008. India is working to build up its installed capacity of wind and solar power in the coming years.

India’s installed capacity for wind power is approximately 9,600 MW with the potential for approximately 45,000 MW. Purchasers can buy wind machines of 500 KW to
1000 KW off the shelf in India. The Indian Ministry of New & Renewable Energy (MNRE) will provide a new wind incentive of Rs. 0.50 (U.S. 1 cent) per kWh up to the first 49 MW of overall new production with the expectation to raise the cap significantly over time to further encourage additional new construction.

India also has commenced a major solar power initiative. It is encouraging the installation of solar photovoltaic technology systems for the generation of electricity and solar thermal technology for the production and capture of heat. Solar thermal power plants are expected to be constructed in the near future. Solar PV panels are being installed on rooftops as thin sheets plugged into household wiring systems. Recently, the Maharashtra Energy Development Agency received proposals for 25 MW of solar photovoltaic and solar thermal electricity generation. Nagpur is slated to be India’s first “solar city.”

**Biomass and biofuel production are nascent industries in India, entirely based in the private sector, and present tremendous upside potential.**

India has a new biofuels policy with an emphasis on biodiesel production from Jatropha. The biodiesel market is targeted to be at nearly $32 billion in installed projects by 2017. Indian Railways has floated a tender inviting proposal for setting up four biodiesel methyl esterification plants for 20 years, targeting a capacity of 50,000 liters of biodiesel from each unit per day. Today, approximately 100 million gallons per year of biodiesel capacity (versus nearly 2.61 billion gallons per year current capacity in the US) and 767 million gallons per year of fuel ethanol capacity (versus approximately 13 billion gallons per year capacity in the US by the end of 2009) exist in India. On last available information, by December 31, 2007, India’s fuel ethanol capacity was projected to be in a range of 1.3–1.6 billion gallons per year. Similarly, biodiesel capacity was projected to be more than 150 million gallons per year at the end of 2007.

Since early 2000, the government of India has repeatedly set fuel ethanol-blend mandates on a regional basis for petrol. However, the government has not carried out the mandates in any dedicated manner. As of November 1, 2007, the government had mandated fuel-ethanol blending in petrol nationwide at 5%, and mandatory. As of October 1, 2008, the mandatory blend percentage was increased to 10%. However, the government recently delayed implementing this mandate nationwide and, instead, established pilot programs at that blend percentages in two districts in the States of Karnataka and Uttar Pradesh. The government intends a further increase of this blend mandate to 20% by 2017. The government does not have a similar mandate for biodiesel. Nevertheless, it has considered a mandated biodiesel blend range of 5% to 20% in diesel fuel.

**Developing Countries**

**Rural electrification is not only an energy issue, it is an education, health, environmental, social, humanitarian, economic, agricultural, communication, and water issue as well.**

The Alliance for Rural Electrification reported that 1.6 billion people worldwide—more than one-quarter of the world’s population—do not have access to electricity in their homes. Four out of five people without electricity live in rural areas of the developing world. A total capital investment of $8.1 trillion US, equivalent to an average of $300 billion US per year is needed until 2030 for the developing and transitional economies to meet their energy needs. Most developing countries offer excellent natural conditions for the use of renewable energy systems (RES) for rural electrification. RES are more cost effective than traditional diesel generator sets. Moreover, these standards can make important contributions in fighting climate change.

**Rural electrification means more than just lighting. Electrification provides a sustainable electricity power supply.**

The rural electricity supply, the same as in developed countries, has a significant social impact on communication and social activities, health and educational services, and on facilities. Rural electrification also prevents urban migration, provides a stronger sense of community,

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**1.6 billion people worldwide—more than one-quarter of the world’s population—do not have access to electricity in their homes.**

- Ernesto Macias Galan, President, Alliance for Rural Electrification
reduces mortality and improves gender equality. Electricity has also a substantial impact in terms of economic development by increasing productivity and economic growth.

World electricity demand is expected to double between now and 2030.

Most of the growth of the world’s electricity demand is occurring in developing countries, where electrification rates are not keeping up with population growth. There are 2.5 billion people who rely on traditional biomass as their principal source of energy. This has terrible consequences on land use and degradation, but also on human health. Indoor air pollution is directly responsible for 1.3 million deaths per year. The cost of fossil-fuel imports is unbearable for many developing countries. Sudden price increases cause economic interference and can disrupt economic growth. In many less developed countries, a large percentage of export earnings (i.e., up to 40 percent in Nepal) are diverted to pay for the importation of petroleum fuels.

Off-grid power generation is often the best solution for bringing an electricity supply to rural areas.

Due to low potential electricity demand, and severe physical limitations, grid extension is often not a feasible option. According to the International Energy Agency, the figures regarding access to energy will remain largely unchanged in 2015 unless new strategies are adopted to expand access to modern services. Therefore, new approaches are needed to increase the production of electricity in rural areas, and to improve local living standards. One of the best solutions is a hybrid off-grid power system. This type of system offers the following benefits:

- Higher flexibility by coupling all consumers and generators on AC (alternative current) transmission line,
- Standard AC used technology in the power range above several kilowatts,
- Different local renewable and conventional energy sources are suitable to form a hybrid grid,
- Simple expandability,
- Extension of an existing diesel based power system, and
- Use as a backup solution for unstable public grids.

A number of opportunities arise in the process of rural electrification.

Opportunities from rural electrification include stimulating further investments from the private sector, promoting win-win situations between all stakeholders involved (foreign industry, local industry, users, local installers and distributors), fostering economic development through the generation of wealth and employment, and increasing electrification rates in a sustainable way.

Solar power is an excellent option for energy generation in developing countries.

Photovoltaics and solar thermal systems have many applications in remote and rural areas because the technology has no moving parts, generates electricity that can be used immediately or stored in batteries, and does not depend on the reliability of the grid infrastructure, or on the fluctuating price of oil. Solar power in developing countries creates opportunities for water pumping and purification, electrification of rural schools and clinics, microenterprise, household and community lighting, and wireless internet.

International Climate and Energy Policy

International attention, appeal, and collaboration is being garnered by investments in clean technology and renewable energy projects.

At the 2008 Investor Summit on Climate Risk at the United Nations, signatories of the Summit’s Action Plan agreed to a total investment of $1.75 trillion. The action plan initiated the deployment of $10 billion immediately to start mitigating the effects of climate change. The action plan also called for other measures, including improving energy performance of real estate portfolios and investments, bettering corporate disclosure of financial and material risks posed by climate change, requiring investment managers to assess climate in portfolios, and factoring in carbon costs into valuations and investment analysis. Clean technology and renewable energy are viable solutions to the headline issues that will be raised at both COP 15 Conference in December 2009 and the 2010 Investor Summit at the United Nations.
IRENA, the International Renewable Energy Agency, was specifically created to aid the finance and development of renewable energy projects worldwide.

IRENA includes developing countries and involves them in the climate change negotiation process. Currently, 136 countries have joined IRENA by signing the Agency’s statute, but notably missing from the membership are India and China. There have been positive responses from developing and emerging economies and there has been a real demand for an international renewable energy agency. The first session and founding meeting of IRENA’s Preparatory Commission was held in Bonn, Germany at the end of January 2009. During the second session late last month in Sharm El Sheikh, Egypt, the Preparatory Commission named Abu Dhabi as the interim host location of the agency’s headquarters and the Commission named Héléne Pelosse of France as the interim Director-General. The US, a major international renewable energy player, only joined IRENA recently at this last session in June.

Conclusions

The United States and China will have the most impact on the global renewable energy market in coming years. These two countries must lead by example in renewable energy development, investment, and financing. The United States appears to be on the right track with a large portion of the American Recovery and Reinvestment Act slated to go to renewable energy and energy efficiency projects and research. President Obama and his new administration have prioritized energy and environmental issues, and now the world waits to see what action is taken. China has a responsibility to develop its renewable energy resources instead of relying on petroleum to fuel its vehicles, and coal to produce its electricity. The rest of the world will look to both countries to bring the future of renewable energy.

Session References

**B1 - Global Renewable Energy Industry**

Michael Eckhart, President, American Council On Renewable Energy (ACORE) (Chair)
David Wortmann, Director Renewable Energy & Resources, Germany Trade & Invest [slides]
Suresh Hurry, Director, IT Power [slides]
Ernesto Macias Galan, President, European Photovoltaic Industry Association [slides]
Juergen Morhard, Counselor, Head of the Economic and Commercial Section, German Embassy Washington [slides]
Fredrick Potter, Executive Vice President, Hart Energy Consulting
Tammy Klein, Executive Director, Global Biofuels, Hart Energy Consulting [slides]

**D6 - International Markets & Policy**

Peter Richards, Communications Director, REEEP (Chair) [slides]
Mike Rosenfeld, Vice Consul, UK Trade & Investment [slides]
Craig O’Connor, Director, Environmental Exports, Export-Import Bank of the U.S. [slides]
David Fulton, Advisor & Director of Business Liaison, The World Bank [slides]
Lynn Tabernacki, Senior Manager, Renewable Energy and Sustainable Development Finance, OPIC [slides]
**D7 – China**

Jing Su, Director of US-China Program, American Council On Renewable Energy (ACORE) (Chair)
Louis Schwartz, President, China Strategies LLC [slides]
Sebastian Meyer, Director, Research & Advisory, Azure International [slides]
Yong X. Tao, Ph.D., Associate Dean and Professor, Florida International University [slides]
Ryan Hodum, Senior Associate, David Gardiner and Associate LLC [slides]

**D8 - Developing Countries**

Judy Siegel, President, Energy & Security Group (Chair) [slides]
Mark Riedy, Partner, Andrews Kurth LLP [slides]
Ohene Akoto, Country Director, Jatropha Africa
Bob Freling, Executive Director, Solar Electric Light Fund (SELF) [slides]
Ernesto Macias Galan, President, European Photovoltaic Industry Association [slides]
Stephanie Hollis, Chairman of the Board, Solar Stik [slides]

**F1 - Sustainability and Climate Policy**

Howard Learner, President, Environmental Law and Policy Center (Chair)
Aimee Christensen, Founder & CEO, Christensen Global Strategies
Fredrick R. Anderson, Partner, McKenna Long & Aldridge LLP
John Kadyszewski, Director, American Carbon Registry, Winrock International [slides]
Billy Parish, Co-Founder, Energy Action Coalition
Renewable Energy Economics, Marketplace, and Finance

Overview

Because RETECH was held just weeks into a new Presidential administration, and amidst the biggest economic crises in generations, economics were of vital interest at RETECH 2009. Discussion regarding various aspects of the economy took place in nearly every session, spanning the implications of the American Recovery and Reinvestment Act, the state of financial markets, and the prospect of RPS and carbon legislation at the national level. Leaders from state and national government, finance, and policy convened to discuss how to get the renewable energy economy—and the national economy—moving once more.

Consensus

At RETECH 2009, there was a sense of optimism regarding renewable energy economics and the federal government’s commitment to renewable energy. There was also a humble acknowledgement of the problems yet to be solved. With a once-in-a-generation stimulus plan sitting astride a once-in-a-generation market crisis, hope and uncertainty both abounded. The innovative action taken by Congress to mobilize renewable energy development as part of the American Recovery and Reinvestment Act presented the industry with many new opportunities. These opportunities were laid out in great detail by RETECH panelists.

Economic Drivers

State Renewable Portfolio Standards (RPS) are paramount to systematically increasing renewable energy generation in the US.

The rising, volatile price of fossil fuel-generated energy is the main economic driver of the renewable energy industry. State Renewable Portfolio Standards (RPS) have played and still play a key role in mobilizing renewable production.

Renewable Portfolio Standards were born in 1995. Today, 28 states have mandatory standards, 16 of them in excess of 20%, and 6 have voluntary standards, explained panelist Alan Nogee, Director, Union of Concerned Scientists.

Under a business-as-usual scenario, by 2025 these standards will yield 77,000 MW of new renewable energy, reducing carbon emissions by 183,000 tons, the equivalent of taking 30 million cars off the road for a year. In this scenario, renewable energy would mostly displace gas- and coal-fired plants, which Mr. Nogee forecasted would be replaced by 53% wind and 21% solar, with biomass assuming a large role in the early transitional years. On top of a 1.6% ($95 billion) consumer savings compared with a business-as-usual model by 2030, the world would enjoy massive environmental benefits from the switch.

With state and federal tax incentives, renewable energy can be more affordable and competitive with other energy sources.

State and federal subsidies such as the Production and Investment Tax Credits have provided the short-term cost viability of renewable energy options. These credits have been extended and are compatible with a credit-constrained environment in the American Recovery and Reinvestment Act (ARRA). The ARRA extends the Production Tax Credit (PTC) for Wind to 2012, and all other renewables to 2013, explained Eli Katz of Chadbourne & Park. The extension should help guard against the boom and bust cycles renewable energy has suffered during the...
past, uncertain legislative environment. The ARRA also extended the Investment Tax Credit (ITC), and expanded its use to wind projects as an alternative to the PTC. Katz forecasted that due to current credit shortages, the ITC/PTC choice will boil down to the option that requires less capital on day one.

Other factors affecting renewable energy finance and economics include bonus depreciation, cash grant, and manufacturing tax credits.

The American Recovery and Reinvestment Act also extends the 2008 Stimulus Act which grants developers 50% of the Bonus Depreciation upon implementation on projects completed before the end of 2009, with the remainder of the depreciation written off on the normal schedule. A new stimulus package option is the Cash Grant program, where the government essentially buys a developer’s investment tax credit of 30% of the total project cost, another mechanism to decrease the up-front capital necessary to develop projects. Lastly, a new 30% Manufacturing Investment Tax Credit is now available for projects that re-equip or expand manufacturing facilities to facilitate the production of renewable energy, energy efficiency and fuel cell technologies.

The Department of Energy’s role in scaling up renewable energy

The Department of Energy is expected to assume a much larger role in the renewable energy project implementation process, by granting increased funding with an emphasis on the Loan Guarantee Program. The program, with $60 million in new credit set aside for clean energy projects, is designed to catalyze the commercialization of innovative carbon-reducing technologies. While funding was slow to move out the DOE’s door in the past, the success of the program hinges on efficient implementation. At RETECH 2009, Wendolyn Holland, of the Energy Efficiency/Renewable Energy (EERE) Administration, spoke on the history of the Department of Energy and its approach to the coming stimulus effort:

“The DOE began with the Manhattan Project and spends much of its time looking over the nuclear arsenal. So administering the new stimulus programs is a bit of a cultural challenge for the organization," said Holland. “Secretary Chu wants to focus on management within the agency, cutting down on people doubling up on the same work. With $4 billion for the Smart Grid, and much for weatherization and state & local energy grants, the DOE is excited to begin work.”

State-Level Economic Development

While national policies take shape, leaders from the state level convened to discuss the approaches they’ve taken to building up their renewable energy markets.

New York: Facilitating a Diverse Portfolio of Renewable Resources

Don LaVada, Director of the New York State Energy Research and Development Authority (NYSERDA), spoke about the agency’s approach to helping the state’s renewable energy industry. “The old jobs are gone”, said LaVada, “and they’re not coming back. But new jobs are coming in.”

NYSERDA is focused on improving on the mistakes and shortcomings of the last renewable energy boom in the 1970s. By re-orienting the state’s shrinking manufacturing and maintenance base toward a renewable energy-oriented focus, the government can be a facilitator of renewable energy.

NYSERDA currently sponsors a technician certification program and an International Brotherhood of Electric Workers (IBEW) training program. Another of the agency’s distinguishing traits is its diverse orientation, mirroring a state of many cultures and landscapes. Maintaining this diversity by seeing all types of technologies to success NYSERDA's goal.

Oregon: Job Creation in a Zero Sales Tax Environment

In Oregon, the Office of the Governor is working toward green job creation. In a state without a sales tax, income tax is everything. “Losing jobs is losing money”, explains Nancy Hamilton, a senior policy advisor to Governor Ted Kulongoski. The national economy’s struggles are magnified in a state that has already lost a great deal in the logging industries.

The old jobs are gone and they’re not coming back. But new [green] jobs are coming in.

- Don LaVada, Director of Consumer Services and Events Management, NYSERDA

NYSERDA
Oregon is orienting much of its Stimulus Plan cash toward energy efficiency, saving the state millions, while growing the state’s renewable energy portfolio through a wind technician training program, and business energy tax credit that returns 35% of eligible project costs for projects that invest in energy conservation, recycling, renewable energy resources, and less-polluting transportation fuels.

Massachusetts: University Spinoffs to Commercial Viability

In 2008, Governor Deval Patrick signed the Massachusetts Green Jobs Act, creating the Massachusetts Clean Energy Fund. The Fund provides grant money to stimulate clean energy companies, create green jobs, and provide job training programs to ensure all people have access to new green jobs.

The Fund’s Executive Director, Patrick Cloney, discussed Massachusetts’s approach to renewable energy development. Home to several high-profile research institutions, Massachusetts cannot provide large financial incentives, but it can shrink the growth calendar for companies, and facilitate better communication between research and commercial entities.

Founded in 2004, the Massachusetts Technology Transfer Center is one of the state’s multiple business development programs that help young research projects spin off into private investment. Part of the Fund’s goals are accelerating “ecosystem” interaction between entities of various sizes, and navigating between municipalities.

Some states have implemented economic development plans utilizing renewable energy resources.

Texas: A Workforce Boom

Doug Ridge, Director of Employer Initiatives with the Texas Workforce Commission, spoke to the group about Texas’s wind boom and the resultant “bump” in job creation, with solar right behind. With more wind capacity than any other US state, growing at the rate of one utility-scale installation a week, it is no surprise that Texas’s renewable energy workforce grew by 130% between 2000 and 2007. The resultant economic benefits revert not only to installers, but also to landowners and manufacturers.

Kansas: A Rising Wind Powerhouse

Envisioning the manufacturing development a renewable energy boom in Kansas would create, Lieutenant Governor Mark Parkinson of Kansas pointed out that 200,000 turbines “means 200,000 generators, gearboxes, and 600,000 blades,” a huge manufacturing opportunity.

Renewable energy is an ecosystem. – Patrick Cloney, Executive Director, Massachusetts Clean Energy Fund

Kansas is increasingly realizing its huge wind capacity, going from 3 installed megawatts in 1997 to 365 megawatts in 2007. In 2008, 900 MW were installed, and in January 2009, alone, 1,000 more. To Parkinson, renewables can be scaled by regulators, making fossil power artificially more expensive and green less so—or by naturally achieving economies of scale in the marketplace.

A national RPS is a difficult political proposition but would be very effective, and subsidized research can help the private sector lower costs more rapidly.

Economic Challenges

Renewable energy markets continue to be sensitive to volatility.

Barriers exist for developers under uncertain energy, credit, and carbon prices. It is more difficult to evaluate the economic risks associated with various project ownerships and financial structures under the current market state.

The transmission of renewable energy from remote generation facilities to higher density load centers is one of the greatest challenges we are facing.

There are many economic barriers to large-scale renewable energy adoption, not least of which is that of transmission. Transmission constraints limit the delivery capacity for renewable energy, with new transmission facing high integration costs associated with accommodating a large amount of intermittent resources.

Changing supply dynamics play a critical role in the renewable energy marketplace.

Ethan Zindler of New Energy Finance spoke on the changing market dynamics of the renewable energy world. The period between 2004 and 2007 saw historic, now understood to be dangerous, amounts of leverage in the
marketplace, accelerating and deepening the housing crash. For renewables, the economic crisis of 2008-2009 spells a transition from the equipment shortages endemic during boom years that preceded it to supply-chain glut in this climate of credit shortage. Supply of commodities such as silicone have increased in the face of rising demand, likely leading to great decreases in price.

So how do we double renewable energy? The most important action is policy implementation, especially the loan guarantee program, transmission permitting, and, to a lesser extent, the Stimulus Grant Program offered in lieu of the ITC. Also key to the health of the sector is new policy—whether it be an RES or carbon tax. Lastly, capital availability has to be present to see any substantial investments take off.

**Environmental Offsets and Credits**

Deforestation is the second largest contributor to global carbon emissions behind only the power generation industry. Founder of Canopy Capital Limited, Michael Naylor conveyed that tropical rainforests cover 1.2 billion hectares of land, an area larger than Europe, and store a quarter of all the carbon on land. Every day, deforestation emits CO2 equivalent to 12.5 million people flying from New York to London. Tropical deforestation emits about 1.5 billion tons of carbon each year—more than the entire global transport sector. Every year, deforestation emits the same amount of CO2 as 580 mid-size coal-fired power stations, equivalent to the total annual CO₂ emissions of the US or China. Unless action is taken, the impact of forest emissions on climate change will cost around $1 trillion a year by 2100.

**Carbon Financing and Trading**

The current financial crisis is fostering structural, behavioral, and regulatory changes. Michael Zimmer of Thompson Hine LLP called for the financing of companies, innovation and technology—not just projects. Among other changes, international diversification of industry is undermined, and therefore many non-US markets have fallen worse than US markets. When liquidity is deep and credit available, developing economies thrive. With such velocity and credit constraints, those developing markets fall harder. Look for values of risk modeling and ratings agencies to diminish in value. Sophisticated risk modeling has experienced its downfall for derivatives, dynamic hedging. Consolidation in industry and financial sector concentration will become more powerful. Loss of investment bank capacity, financial innovation and smaller, medium-sized institutions will mean higher interest rates and fees. Financial concentration means different scale, aversion to smaller projects like renewables, and increased conflicts of interest with continued price volatility. Managing multiple roles in securities underwriting, carbon trading, lending, investing, secondary market development and money management will prove daunting.

The lack of a common American standard makes defining an offset and following the guidelines set forth even more important.

A carbon offset credit (or “offset”) is an instrument reflecting the value of the direct reduction, avoidance or sequestration of a unit of carbon dioxide equivalent (CO₂e) that is generated from an unregulated sector or facility. Certain common attributes that define a high-value offset:

- Additional – A project must not be required by any regulatory or legal mandate and should clearly be beyond “business as usual”.
- Permanent – Emission reductions must be permanent and appropriate contingencies should be instituted for sequestration projects that carry a risk of reversal.
- Real – Tradable offset credits should only be awarded after emission reductions have occurred.
- Verified – At inception, projects, baselines, and protocols should be reviewed and approved by an independent third-party.
Independent third-parties should also undertake in periodic verifications of emission reductions realized.

- **Measurable** – The reduction should be measured using accepted methodologies. After measurement, the offset credit must only be counted once and then retired through a credible registry system.

Carbon projects developed today in a manner consistent with expected federal US standards will have the best chance of future recognition and value.

Josh Green, CEO of the Verdeo Group, predicts that no compliance for carbon projects will be required in the US until 2013. The Clean Air Act is unlikely to be used to regulate greenhouse gas emissions. However, new carbon projects must be “over and above” existing regulations to be eligible for credit. It appears that a significant percentage of allowances for these particular carbon projects will be auctioned initially, and will continue to increase over time. There will be set-asides for early action granted to projects certified and registered using “best practice” standards. Finally, offset credits from a variety of sectors will be allowed to lower the cost of compliance.

There is a forecast of growth in carbon market trading.

Zimmer described that most of current global carbon market has come from nitrous oxides, HFC-23 refrigerants, captured in industry. They have higher value and lower costs of recovery. These waste gas recovery projects (75% of total credits traded) will decline to 25% of total trading value by 2012, according to New Energy Finance. Their costs of recovery are at $1.30, while renewable energy and efficiency costs range from $6.50 to $20 for comparable reductions. There has been an increased patent activity for clean technology and carbon trading tools and administration. The US leads with largest number of renewable energy patents followed by Japan and Australia. Financial sector difficulties will mean tightening credit markets. With growing environmental concern, it is likely that a shift will occur from waste gas recovery and this movement to a clean technology base will favor renewables.

The transition to a low-carbon economy is a strategic process.

An emissions trading system is an essential, yet insufficient, policy tool on its own in accelerating the transition towards a low-carbon economy. This is true for three main reasons. First, given the urgency of climate change and the combination of policy objectives governments are trying to achieve (i.e. technology leadership, energy security, local air quality); a spectrum of measures will be required. Second, not all sectors respond well to carbon pricing. Third, still in early days, it remains to be seen if carbon trading strategies will be fully successful in encouraging new investment. The precise program details can significantly influence the results, in terms of prices that customers have to pay, investment decisions and actual abatement achieved (lessons from Europe). Carbon prices are determined, influenced and formed by the three key factors of fundamentals, design and behavior.

**Certain risks become apparent with an American cap and trade system.**

The following risks make implementing cap and trade legislation in the United States difficult:

- Regulatory risks, such as project approval, validation, and verification of emissions-reduction projects.
- Political risks, that could alter climate change policies and obligations, such as host-country instability, expropriation of credits, contract frustration, credit confiscation, failed validation, and more.
- Technology-performance risks, timing of cap goals with technology availability.
- Carbon-financing risks, including an inability to secure or maintain financing based on projected or volatile carbon-revenue streams. Credit value once received for carbon is at risk of market flux.
- Carbon-performance risks, associated with variability in the generation, permanence, and ownership of emissions reductions.
- Counterparty credit risks, including the failure to deliver credits as contracted; and credit support for risk transfers.
Complexity and operating costs of new environmental derivatives after prior Wall Street experiences with various risk management products, and linkages of international carbon markets.

- Clean Development Mechanism (CDM) credits from projects in renewables, methane gas reductions, cement and coal bed methane reductions, supply energy efficiency, demand side energy efficiency, fuel switching, forestation projects, and other reductions.
- Supply constraints, because Kyoto signatories are behind in their greenhouse gas reduction commitments, and there is a shortage of good projects with carbon credits content.
- Project financing gap growing, with up front finance required, only “pay on delivery contracts,” project risks not shared but allocated to developer and not truly global project markets yet.

**Capital Access**

There are some real benefits for a private clean technology company to go public at an early stage.

According to Robert Peterman of the Toronto Stock Exchange, these benefits include the following advantages: use share capital to acquire other companies and augment organic business growth with strategic M&A activities, utilization of option plan to retain key employees and conserve cash for growth, on-going ability to finance growth by accessing capital markets as business objectives are achieved, and liquidity premium from investors, particularly given current market conditions.

By watching some strategic investors, a trend towards renewable energy and energy efficiency emerges.

In the utility and oil industries, Duke Energy acquired Catamount Energy, a wind power company, for $240 million. Shell has invested $1 billion over the past five years in renewable energy technologies. Chevron has committed to invest $100 million per year in renewable energy. PG&E will invest $1.4 billion in developing solar power facilities.

In the industrial sector, General Electric Energy Financial Services has a $4 billion portfolio of renewable energy assets, including Ionics, Converge, SunPower, A123 Systems, and number of Wind projects. GE will also invest $6 billion in renewables by 2010. There is a joint venture between DuPont and Genencor, where they have committed to $140 million over 3 years to develop cellulosic ethanol solutions.

The automotive industry has seen General Motors invest in a biofuels start-up, Coskata, to speed the flow of ethanol for GM’s flex-fuel vehicles. In addition, all major car manufacturers in the US and abroad have invested in developing electric cars and related battery technologies. Finally, Google is planning to invest in solutions to generate 1 GW of renewable energy from a coal-fired plant. They have also committed up to “hundreds of millions” of dollars to bring new technologies to market. Currently, Google is working with eSolar on its solar thermal power initiative as well as advancing geothermal power technology and systems. They too have invested in a wind power company, Makini Power.

**Conclusions**

The state of renewable energy economics evoked feelings of optimism and promise amidst the uncertainty of a national and global economic crisis. The American Reinvestment and Recovery Act extended existing renewable energy tax incentives, and created new ones to catalyze the market in a time of credit shortage. Attendees’ confidence was also bolstered by the many state-level success stories shared, each, microcosms of the economic growth a national renewable energy standard would created. Infrastructure barriers still inhibit renewable energy scale-up, and economic uncertainties linger on in the volatile market. But all in attendance were inspired by the expanded national commitment to renewable energy discussed at RETECH 2009.
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Graham Noyes, Of Counsel, Stoel Rives (Chair) [slides]
Peter L. Gray, Partner, McKenna Long & Aldridge, LLP  [slides]
Graeme Martin, Manager of Business Development - Environmental Products, Shell Energy North America  [slides]
Brian Prusnek, Vice President, Climate Change Capital  [slides]
Sonia Medina, US Country Director, EcoSecurities [slides]

**B6 - Economic Development Workshop 1**
Moana Erickson, Executive Director of the Center for Economic Research, American Council On Renewable Energy (ACORE) (Chair)
Mark Parkinson, Lieutenant Governor of Kansas  [slides]

**B7 - Economic Development Workshop 2**
Don LaVada, Director of Consumer Services and Events Management, NYSERDA (Co-Chair) [slides]
Douglas Ridge, Director, Employer Initiatives, Texas Workforce Commission (Co-Chair)  [slides]
Ross Tyler, Director of Clean Energy, Maryland Energy Administration  [slides]
Patrick Cloney, Executive Director, Massachusetts Clean Energy Center [slides]
John Filan, Executive Director, Illinois Finance Authority [slides]
Nancy Hamilton, Senior Policy Advisor, Oregon Economic Development & Workforce, Office of the Governor

**B8 - Economic Development Workshop 3**
Michael Butler, Chairman & CEO, Cascadia Capital (Chair)
Daniel Kammen, Class of 1935 Distinguished Professor of Energy, Energy and Resources Group, Founding Director, Renewable and Appropriate Energy Laboratory, University of California [slides]
Michael Peck, Spokesman & Head of Media Relations, Gamesa
David Benson, Partner, Stoel Rives LLP [slides]
Kenneth Locklin, Director – Finance & Investment, Clean Energy Group [slides]

**C1 - U.S. Renewable Energy Marketplace**
Lisa Frantzis, Managing Director, Navigant Consulting (Chair) [slides]
Mark Parkinson, Lt Governor of Kansas  [slides]
Alan Nogee, Director, Union of Concerned Scientists [slides]
Eli Katz, Counsel, Chadbourne & Parke LLP  [slides]
Wendolyn Holland, Special Advisor, Commercialization, Department of Energy [slides]
Ethan Zindler, Head of North American Research, New Energy Finance [slides]
C6 - Environmental and Carbon Financing
Michael Zimmer, Of Counsel, Thompson Hine LLP and Executive in Residence, Ohio University, Voinovich School of Leadership and Public Affairs (Chair)  [slides]
Michael Naylor, Director and Founder, Canopy Capital Limited; Chairman, Advisory Board The Prince’s Rainforests Project  [slides]
John Cavalier, Managing Partner, Hudson Clean Energy Partners
Josh Green, CEO, Verdeo Group  [slides]
Fabrizio Donini-Ferretti, Head of Energy, Dexia Credit Local  [slides]

C7 - Venture Capital
Ira Ehrenpreis, General Partner, Technology Partners (Chair)
Erik Straser, Partner, Mohr Davidow Ventures
Michael Ware, Managing Director, Good Energies
Don Wood, Managing Director, Draper Fisher Jurvetson

C8 – Capital Access: Public and Private Markets
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Adam Oliveri, Managing Director, SecondMarket  [slides]
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D1 - Renewable Energy Project Finance
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Solar: Markets, Technologies, and Policy

Overview

Solar energy was one of the most-discussed topics at RETECH 2009, ranging from technology to policy, scale, and more. Decreasing costs, raising efficiency and maximizing its presence in concentrated, distributed and building-integrated form are the goals of the solar sector.

Consensus

The consensus at RETECH 2009 was that solar energy is an extremely diverse renewable energy source whose benefits are still being discovered. From traditional crystalline applications, solar energy is expanding outward to concentrated installations as well as adapting itself to buildings and windows through thin-film photovoltaics. Grid parity is the endgame for solar energy, with the combination of technological innovation and supportive policy poised to deliver it. The American Recovery and Reinvestment Act provides some needed catalyzing factors for projects in the current period of tight debt and credit markets.

Solar Technology

Solar energy has a demonstrable value proposition.

Over its 50 years of use, solar energy has demonstrated merits on several levels. Delivering megawatts interchangeable with less climate-friendly energy generation options, solar power’s fuel is free, and without constraints on both supply and price. Solar installations have a 25 to 50-year life, and close to a one-year energy payback period under its improving cost curve, said Paul Wormser, Senior Director, Engineering and Product Development of Sharp Solar. Generating no pollution and no noise, solar power is available anywhere in the United States and globally. Solar power generation is viable on residential and commercial buildings, in centralized power plants, all the way down to calculators, making it one of the most versatile and scalable forms of renewable energy.

Solar cells are the basic building blocks of solar modules, or solar collectors.

The solar cell makes up any PV system, with silicon as their fundamental element. Placed into ingots and arranged onto wafers, solar cells are the building blocks of solar modules. Cells are arranged into modules, combined with electronic components and installed on a structure.

Solar energy has a relatively long history and a bright future.

Utilization of solar energy began in 1963 with crystalline panels, off-grid panels that were usually found on residential and commercial buildings. For today and in the future, crystalline panels can provide durability, efficiency (nearing 20% efficiency) and a proven performance record.

A relatively new technology, thin film solar is a low-profile, low-cost, photovoltaic technology that has been “the next big thing in solar energy” for some time as it struggles to bolster its stability and enhance its durability.
The technology debate: thin film versus panels

There was discussion at RETECH about which technology—solar panels or thin film—would be the PV application of the future, with some consensus that a mixture of traditional panels and thin-film will bring the most benefit.

The two technologies can coexist, said Wormser, forecasting that a price increase spurred by heightened demand for silicon will cause the market to go the thin film route, which requires less silicon. “From an efficiency standpoint, thin film can beat the cost per kWh of multi-crystalline PV panel in some applications, delivering superior energy per unit of power capacity but less energy per unit of surface area.” Thin-film has a lower manufacturing cost, pointed out Wormser, but only at a higher volume, and it requires more man-hours to produce an equivalent output from traditional PV as a result of being generally less efficient. Clear, low-profile and increasingly durable, thin-film can be installed on windows, clear rooftops, and other new surfaces where panels cannot be installed. From a pre-recession forecast of 70% growth per year for thin-film technologies, Christopher O’Brien of Oerlikon Solar predicts a still-substantial 50% rate of growth over the next five years.

Solar energy’s cost curve is headed the right direction.

The upward curve of module production is mirrored by a decreasing cost per MWh of electricity in solar energy’s quest for grid parity. The weighted average price for a blended PV module in 2008 hovered between $3.00 and $3.50/watt, down from over $3.50 in 2006, and expected to drop below $2.50 this year as thin film gains market share. The average price per mWh of electricity in the United States is currently 8.6 cents and rising as a result of rising grid costs and increased demand. Electricity generated from solar panels currently stands at around $0.20/kWh, but Christopher O’Brien expects innovation and economies of scale to bring the cost to grid parity sometime after 2013 at about $0.13/kWh, resulting in a huge solar boom.

A dramatic increase in electricity prices make solar’s price per kilowatt-hour more attractive.

Demand for solar modules is expected to stabilize in the neighborhood of 4,500-5,000 MW in 2009, resume growth as markets recover in 2010 and continue to grow by an average of 32%, says Christopher O’Brien of Oerlikon Solar, taking the average of a number of studies on the topic. A 32% rate of annual growth would mean over 18,000 MW of modules in 2013, over four times the current output.

Finance and Economics

Solar photovoltaic growth continues its upswing.

Accordingly, demand for photovoltaics has skyrocketed since 2000, rising from less than 200 MW in 2000 to 4,500 in 2008, with Germany and Spain’s feed-in tariffs catalyzing today’s two largest markets. A consistent rise in Germany’s electricity prices, paired with a decreasing incentive curve have Germany’s cost/KWh of solar and traditional electricity meeting at some point between 2012 and 2017, according to Travis Bradford, President of the Prometheus Institute.

Spain’s first feed-in tariff debuted in 2007 with a goal of 400 MW to be installed by 2010. The program was hugely popular, with 344 MW installed by September of 2007 causing the government to temporarily suspend and restructure the program, which went back into effect earlier this year. Spain is currently the world leader in installed solar capacity.

Materials have become a high percentage of solar module costs.

If its versatility is solar’s greatest merit, the high percentage of the materials used in solar equipment is its biggest hurdle to overcome. Material costs account for more than half the total cost of module production, according to Solar Module Assembly Science and Technology Manager...
of Dow Corning Solar Solutions. The current economic conditions have slowed the pre-recession solar boom’s demand glut into an inventory surplus, but as the ARRA stimulus programs kick in, finding solutions to material costs and availability will again be a key challenge for solar energy to overcome.

There are several solar power-generation ownership models.

There are four major solar ownership models, says Steve Chadima, Chairman of the Solar Alliance. In some cases, a customer or third-party owned distributed generation can offset load, in other cases, customers buy “shares” in utility-owned projects. Additionally, some third-party system owners sell wholesale electricity to the utility under a Power Purchasing Agreement (PPA). The last ownership model is utility-owned generation, where the sale of solar energy works much in the same way as through traditional power plants.

Getting down to business: Solar incentives in detail

Solar has been incentivized in different ways, falling under the following general headings: tax incentives, direct incentives, REC incentives, feed-in tariffs, and standard-offer contracts.

- **With tax incentives**, a fixed percentage of system cost is subtracted from taxes owed, reducing the cost of implementation, not impacting electricity prices, and providing easy implementation. Tax incentives do not, however, have a built-in mechanism to maximize solar implementation or to drive prices lower. They may strain a state budget if many projects are implemented in a short amount of time. And as seen during the current recession, a simple reduction in taxes often leaves behind still-high costs that are difficult to account for in a tight credit market.

- **Direct incentives** come up-front, usually for smaller systems, rewarding performance at a decreasing rate over time. While reducing costs for smaller users, direct incentives can also help ease energy prices by encouraging performance. Direct incentives are an appealing choice as they drive down prices and maximize production, but there is speculation about how scaleable direct incentives may be without significant impact to energy prices, and whether incentives fall in line with a sustained rate of growth in the solar sector.

- **In REC purchase programs**, the sale of a Renewable Energy Certificate (REC) generated as an attribute of solar energy, is used to offset energy costs. There are three models, known as payment, auction, and negotiated solar REC contracts, all falling under the REC incentive program. REC programs help ensure a low, market-subsidized cost of electricity to ratepayers, but do not help developers with the high costs of implementation that tax and direct incentives seek to negate.

- **With feed-in tariffs**, payment for energy is based on cost plus guaranteed profit, with no REC transfer. Easy to understand, this program has led to runaway costs in the past in Spain.

- **With standard-offer contracts**, payment is based on the value delivered, encompassing GHG attributes, RECs, utilities paying fair market value on the quantities delivered. These benefits, however, are often difficult to calculate, and costs often do not compete against the energy they displace, possibly favoring the implementation of low-cost technologies.

There are a few examples of feed-in tariffs that have been implemented successfully on local, state, or regional level.

Feed-in tariffs (FITs) are a long-term, fixed-price payment agreement in dollars per kWh, based on the cost of generation. They guarantee interconnection as well as a reasonable profit; “If you build it, we buy it” said panelist Wilson Rickerson, though programs are differentiated by technology, size, application, and by resource. Gainesville, Florida, became the first location in America in which a utility to adopt a feed-in tariff in February, 2009, covering only PV at a rate of $0.32/kWh for 20 years with a 4MW annual cap. Gainesville’s model is just one of many models being considered in the United States—California currently has one for generators under 1.5 MW based on time-differentiated avoided cost, but it hasn’t proved very popular to date, says Rickerson. The California model packages electricity and RECs, but this isn’t the case everywhere.

A Michigan feed-in proposal only includes electricity in the agreement, while a New Jersey proposal only incorporates RECs. Another key question in the modeling of these programs is how feed-in tariffs are to coexist with net metering, if at all. Under the Gainesville model, the tariff replaces net metering, but under the New Jersey proposal the FIT is a premium atop net metering, and in Hawaii, it is a premium only for excess generation.
FITs have grown in popularity over the past 2 years as mechanisms to help states meet RPS goals. There is work to be done to broaden the scale and type of technologies covered, which an increased portfolio of functional models can help promote. The uncertain economic environment has bolstered FIT credibility, providing investors a guarantee of returns.

Concentrated Solar Power

Concentrated Solar Power (CSP) encompasses several different designs.

CSP is divided into Concentrated Solar Thermal and Concentrated Photovoltaics; the first using the sun’s energy as a heat source for a traditional power plant, and the second utilizing a one-stage process involving PV panels. Built in hot, sunny areas, these installations are designed to handle peak load demand and have increasingly developed into viable storage options as well. The scale and method of tracking and harnessing the sun varies from company to company, and region to region, with many such models represented at RETECH 2009.

Concentrated Solar Thermal (CST) technology uses heat generated from the Sun.

CST projects use lenses or mirrors to reflect a concentrated beam of reflected sunlight into a receiver that uses the thermal energy to drive the electricity generation process. These projects often incorporate hyperbolic troughs, some focusing the light on a centralized thermal receiver and some on a tube in the middle of the trough, both creating superheated steam that drives a boiler and produces energy. Concentrated Solar Thermal projects can also incorporate rectangular mirrors arranged in rays around a central tower, dishes that reflect into central receivers, as well as modular designs that include multiple receivers, making scaling easy. With advances in thermal storage, such as molten salt tanks, solar thermal can go beyond augmenting summer peak load and become a short-term reserve option.

Concentrated Photovoltaics (CPV) use energy from the Sun to create electricity.

CPV projects are a centralized and scaled-up version of conventional PV panels, which in recent years have adopted dual tracking axes to optimize their angle to the sun. CPV units require minimal amounts of water compared to solar thermal—but due to their one-step energy conversion process—must rely on battery advances if they are to be viable storage options as well. Modular in design, CPV projects have little impact on the surrounding area and can be assembled in days, not months.

Some challenges for CSP still remain.

To secure grid stability under such bold RE build-out scenario, dispatchable CSP plants with thermal storage are needed at least for critical summer on-peaks

- Rainer Aringhoff, President Solar Millennium LLC

As with other solar technologies, bringing down the cost of CSP installations is at the top of the list, as well as smoothing integration issues with the grid. Performance is another challenging characteristic of the industry, as well as maximizing its capacity for energy storage.

Policy and Incentives

The American Recovery and Reinvestment Act (ARRA) will stimulate the solar industry.

The Production Tax Credit/Investment Tax Credit (PTC/ITC) options within the ARRA are likely to be popular, possibly encouraging new tax equity and bringing the cost/KWh down to wind’s levels if high yields are sustained in that sector.

The stimulus bill also removed the barrier to using the ITC option for projects of under $2,000, as well as for utility-owned projects. The 30% manufacturing tax credit is a major boost to solar manufacturers, who face the high material costs previously described. The accelerated depreciation program is also helpful, though it does not address project finance purposes. Finally, the Federal Loan Guarantee Program has the potential to support weaker credits and enable more projects if administered quickly and with low transaction costs.

The Investment Tax Credit (ITC) grant program
Under the ARRA option of taking the 30% ITC as a cash grant, the demand for tax equity eases, possibly lowering yields and supporting more projects. Tax equity is still needed to monetize project depreciation, however, and will most likely be used to finance the grant.

The Solar Marketplace

Where we stand: current solar market conditions

The current market conditions pose some difficulties for solar energy and other renewable sources. With debt less available to non-investment-grade projects, and more risk embedded into bank spreads (borrowing cost plus risk), more projects are unable to be financed and those that can carry less leverage than before, said Gianluca Signorelli of MMA Renewable Ventures. These debts are usually repayable over ten years, versus the previous 15-year-plus horizon. With many tax equity players vanished in the wake of the credit crisis, there is a much smaller appetite for tax equity than in 2008. With a smaller pool and higher demand, higher yields are present in the tax equity market.

The stimulus bill will provide funding for larger solar projects, including ones with CSP.

The ARRA helps boost the market for CSP since high capital costs require the 30% federal ITC, says Abengoa Solar’s Chief Operating Officer, Scott Frier. The accelerated depreciation bonus is also a necessary driver to bring the energy cost down for the purchaser. Still, under ideal market conditions, tax equity investors are needed to monetize the ITC to make the project viable over the first five years. These tax equity investors have dwindled as a result of the economic crisis, causing developers to looking to finance projects via debt, but the health of the financial sector during RETECH 2009 made restricted the terms and amount of debt available.

Along with the other ARRA actions, expedited enactment of the Federal Loan Guarantee Program and siting processes will determine the health of solar development as tax equity and debt markets get back on their feet.

Policies and incentives aimed at kick-starting the CSP market are essential. Gains from these incentives will far outweigh their implementation costs.

– Scott Frier, Chief Operating Officer, Abengoa Solar

Conclusions

The past 50 years have seen the birth and rapid growth of the solar energy sector, both toward better efficiency and cost as well as breadth of application. Solar is unique in its applicability to buildings, appliances, centralized power generation and residential use. The road ahead demands utilization of new materials and new applications, the continued availability of silicon, all with the goal of generating more electricity in more places for less money, and supplying it to the grid. Solar energy’s representation at RETECH 2009 should be noted for its breadth of content, and promise of the many new ideas that dot solar’s quest for grid parity and beyond.

Session References

A3 - PV Technology

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Utilities and Electricity Transmission

Overview
Changes in energy policy at every level – federal, state and local – have changed the face of utilities across the nation. With a majority of states already establishing a renewable portfolio standard (RPS) and the possibility of a federal RPS lurking in the future, the industry has begun to ramp up investment in renewable energy and supporting technology. Leaders from across the electric utility industry convened to discuss recent trends, technological developments, and major issues facing the industry.

Consensus
A common theme that emerged among the speakers was how utilities can meet the energy challenges of the 21st century. Solutions included in the discussions were: addressing energy reliability and security; updating archaic hardware and energy storage technology; investing in power generation and grid infrastructure, and constructing energy policy to stimulate renewables. In the end, the answer was that no single approach or technological advancement alone can solve the challenges. Rather, the speakers concluded, it will take a combined effort of federal and state policy backed with support from a responsive consumer base.

Infrastructure and Technological Development
The United States needs a reliable power system that provides electricity 24 hours a day, 365 days a year.

The United States must not rely on 20th century infrastructure to meet 21st century energy demands. The grid is operating very close to capacity and is dangerously vulnerable to physical and cyber attack. It is designed to link specific generators with specific distributors, with no larger national vision. Over the next 20 years, investments must be made to replace and modernize electricity production, transmission and distribution infrastructure.

Inadequate transmission investment is the primary obstacle to delivery of renewable energy to customers.

As it is, the grid is ill-equipped to handle a large percentage of renewable power. Transmission development needs to remain ahead of the renewable supply in order to promote new entry in resource-rich areas. To overcome these obstacles we need a well functioning regional planning process, clear cost allocation and recovery mechanisms and adequate incentives for new transmission.

There is a need for transmission policies to move large scale renewable resources to market.

Competitive regional electricity markets have a proven track record of improving operating efficiency, which allows us to do more with less.

- William Massey, Partner, Covington & Burling, Counsel to COMPETE Coalition

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Currently, planning is geographically fragmented and locally focused. Siting multi-state transmission facilities is a long and contentious process involving numerous states and local agencies each with the power to block an entire project. Further, cost allocation of transmission investments makes it difficult to finance a coherent interstate transmission network for renewables.

The answer is a national clean energy smart grid designed to build new interstate transmission capacity to bring renewable energy from remote areas to population centers that demand it. Smart grid technologies will manage power flows, improve reliability, facilitate end-use efficiency, and assist with the integration of clean distributed resources.

The future of the industry relies on the convergence of distributed renewable energy resources and a smart grid.

A national clean energy smart grid will expand renewable electricity, enhance reliability of the electricity system and strengthen our economy by creating jobs and opportunities for business. This upgraded transmission grid will allow utility companies and consumers to monitor and adjust their electricity use, while providing a pricing system to integrate new renewable energy sources and energy storage devices.

Distributed energy will provide greater stability to the electricity grid by helping meet baseload power, peaking power, backup power, remote power, power quality, as well as cooling and heating needs. It will also allow customers to feed any excess power they produce back to the grid for other consumers to use.

Energy storage technologies will be one of the most transformative technologies for the electricity industry.

The grid needs a consistent, stable supply of energy that can be adjusted during times of peak demand. New energy storage options can help provide such a supply and are essential for stabilizing the grid, ensuring a continuity of supply, increasing energy autonomy, mediating against intermittent power production and expanding renewable energy sources.

Grid improvements could help move renewable energy to the Southeast—the fastest growing region in the nation.

The Southeast will have a significant need for new generation in the future due to rapid population growth. This will be a great opportunity for renewable energy growth. However, because there is a limited amount of renewable resources actually located in the region, the success of renewable energy development in the Southeast depends on grid improvements and the increased capacity to move the renewable energy resources.

With competitive pricing for baseload renewables utilities will have to consider these generation sources to meet their supply needs.

– D’Juan Hernandez, President & CEO, Sun Energy Group

There are overlooked benefits of placing distributed energy projects on industrial or brownfield real estate.

Currently, the trend is to place green projects on green land, with the assumption that agricultural land is an easier option, though far from the grid. But, the land is not properly zoned, is environmentally sensitive and extensive environmental reviews are required.

Further, building new transmission lines from the middle of the country to cities takes roughly 10 years, whereas distributed generation on previously zoned industrial land takes between 1 to 9 years. Using land use law to our advantage will get projects built on sites where municipalities cannot say no. Industrial zoned lands are zoned to include electric generation, have minimal environmental review and are often in non-environment sensitive areas. One example is the Buffalo Steel Wind Project in Lackawanna, New York – just outside of a city where power is needed and close to the grid.

**Energy Security and US Competitiveness in the Global Market**

Investments in renewable energy can decrease America’s oil dependence and improve national security.

The US imports roughly 13 barrels of oil each day – over 60% of its total daily consumption. This dependence on imported oil ties the US economy to unstable and often undemocratic nations. We can decrease this dependence on foreign sources of energy by
developing domestically produced low-carbon and renewable sources of energy.

The US must lead by example.

Changes and improvements in renewable energy and energy efficiency policy need to happen first domestically before the US can export their models to other countries.

The US must maintain its competitiveness in the global economy.

To maintain its competitiveness in the global economy the US must act now. Annual global investments in renewable energy are over $35 billion and are driving down costs and spurring rapid advances in technology. The rapid growth rates are also creating new economic opportunities for people around the world.

The US needs a strong commitment to renewable energy and must make innovation, efficiency and cost containment an imperative for the electricity sector.

Expanding the use of renewable energy will have a positive impact on employment.

Studies show investment in renewable energy will have a positive impact on the US economy by creating new jobs and stabilizing energy prices. A 20% national RPS in 2020 would produce more than 200,000 additional jobs than the case where 20% of generation is produced by coal and natural gas.

Through energy efficiency over 800,000 jobs will be created in 2020, under the assumption of a 1% annual demand reduction achieved through energy efficiency measures. Among the common RPS technologies, solar PV creates the most jobs per average megawatts - a “business as usual” RPS with 50% biomass produces 170,000 in 2020, while an RPS with a 50% solar contribution produces 570,000 jobs.

Carbon capture and storage and nuclear power have the following sensitivities in 2020: 25% deployment of CCS produces 170,000 jobs and an increase in nuclear power from 19% to 35% produces 156,000 jobs. All statistics provided were from the Renewable and Appropriate Energy Laboratory.

Policy Issues

America needs a world-class energy policy based on a sustained and consistent framework at the local, state and national levels.

In the past, US energy policies have been a constantly changing patchwork, deterring investors and stifling innovation. America needs strong and enduring energy policies that create markets for renewable energy technologies, encourage the development of new manufacturing industries, and provide incentives for investors.

States with renewable portfolio standards illustrate the potential for renewable growth.

Texas is home to country’s largest collection of wind turbines. California gets over 12% of its electricity needs from non-hydro renewable sources such as wind and solar. Boulder, Colorado is a comprehensive demonstration of an intelligent grid community. With federal leadership, rapid progress is possible.

Federal regulations should support current State and local regulations.

While strong federal leadership is needed, federal policy should not undo progress made by state and local governments. Federal policy should allow states and local governments to establish targets beyond federal requirements.

A robust partnership between government and the private sector is needed to provide a jumpstart to new energy industries while minimizing the cost to American taxpayers.

Government financing should provide long-term, low interest loans to address upfront costs and reduce risks involved in renewable energy projects. Incentives should performance-based and should evolve predictably to ensure investment and innovation. These financial instruments and incentives will provide time for investors to adjust to the new investment requirements of renewable energy.
Federal policy should allow for a competitive electricity market while still promoting increased use of renewable energy.

Competitive electricity markets drive renewable energy, demand response and innovation. In regions with organized competitive electricity markets and transparent market prices, customer choice and renewable standards are providing a favorable environment for renewables. Further, additional safeguards such as price caps, credit-worthiness requirements and real-time monitoring by independent market monitors protect customers.

Green Power Markets

Spanning the gap between consumers’ expressed interest in receiving environmentally sound energy and their willingness to make the correct decision at the point of purchase is a challenge.

While there is high consumer interest in sustainability, participation rates are low. How do we increase understanding and participation? Programs offers have to be simple and provide an emotional connection so consumers feel they are part of a community working together to make a difference. Solutions must also be meaningful and effective for generations. Lastly, offers must be viewed as trustworthy, transparent, and reliable.

Voluntary purchases play a major role in driving the US renewable energy market.

The future of the industry relies on getting customers into the market with distributed renewable energy resources, smart grid enabled technology, energy efficiency and controllable demand.

– Joseph Kerecman, Senior Vice President Viridity Energy

In 2007 renewable energy sales were 15.7 million MWh, up 60% from 2006. Voluntary purchasers of renewable power pay a premium price for electricity, but in some instances customers are now paying less than non-subscribers due to rising natural gas prices. Successful programs offer clear choices, find support from local leaders and utilize media sources to convey program benefits. Programs that have not proven successful tend to have confusing enrollment offers and spend too much money on marketing and administrative costs.

Conclusions

Recognizing the urgency of the 21st century energy challenges, the utility industry is working to transform the way we generate, supply, transmit, store and use energy. A strong and enduring energy policy that reduces US independence on foreign oil, invests in new technologies, and results in the diversifying of energy sources is necessary if the utility sector is to succeed in the transition.

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A1 - Utilities: Strategic Issues in Renewable Energy

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Wind: Markets, Technologies, and Policy

Overview

Wind energy currently makes up most of the renewable power capacity in the United States (excluding large hydroelectric projects), with over 25 GW of wind power capacity as of 2008. The amount of wind energy will continue to increase nationwide as engineering improvements drive down the cost of turbines, making electricity from wind cost-effective with traditional forms of power generation. The market for wind power is, however, still sensitive to policy and incentive changes, so it is important to assess the factors that affect the wind energy industry. The wind energy sessions at RETECH covered issues related to wind turbine technology, the current status of wind markets, and the related policy environment.

Consensus

Most of the speakers envisioned a future in which wind power will make up about 20% of the nation’s electricity by 2030. This future will necessitate increases in turbine size, improvements in offshore wind technology, and a vast expansion of the nation’s transmission system. Cost will continue to decrease as the market grows and technologies improve. Additionally, the market for small wind applications will grow, due to the advantages associated with distributed generation, and the benefits of local ownership. However, most of the speakers predicted a significant decrease in wind turbine installations in 2009 (compared to 2008), but expect the market to rebound in 2010 as a result of the stimulus package and other supportive policies. The Investment Tax Credit for wind was predicted to be an important incentive for developers, and the option for cash grants will enable more developers to reap the benefits of the tax credit.

Wind Technology

Engineering improvements will continue to increase the efficiency of utility-scale turbines, allowing turbines to produce more energy per hour.

Turbine improvements include taller towers, larger rotors on smaller generators, improved grid support, and slower turning generators. Turbine size will continue to increase to about 5 MW for land-based turbines and up to 10 MW for offshore turbines.

More wind projects will be located offshore in the future.

The market for offshore wind power will be driven by technology improvements that allow turbines to be located farther from the shore in deeper water, as well as engineering improvements that create turbines with much larger capacity.

Demand for small-scale wind applications will also increase.

Not only will utility-scale wind turbines continue to improve and become more efficient, but small-scale residential and community based turbines will benefit from engineering enhancements as well. Because small-wind applications do not face many of the constraints of large-scale wind projects—notably transmission access—the market for these projects will continue to grow. Small wind systems may be grid-tied or off-grid, and can also be used with battery storage systems to open new markets and make systems more useful. Additionally, small wind systems may be used jointly with solar PV systems.

Small wind allows customers to put the power where they want it.
- Mike Hess, CEO, Mariah Power

Despite the positive outlook for the wind industry, barriers to wind energy deployment remain.
Barriers for the wind industry include lack of transmission infrastructure, constrained supply of copper and steel, policy inconsistency, high cost, and additional regulatory barriers. Turbine technology will continue to improve only with a supportive policy environment and incentives for research and development.

Small wind turbine applications face challenges as well.

Many of the same obstacles to large-scale wind apply to small wind, including cost issues and resource variability.

**Federal Policy**

The Production Tax Credit (PTC) has helped generate a strong wind industry in the US.

The primary federal policy that has supported the wind energy industry historically is the Production Tax Credit (PTC), a $0.021/kWh credit for wind energy. With the PTC, the federal government engages in a public-private partnership with wind farm developers, paying up to 2/3 of the capital cost of new wind projects.

Changes in federal policy will help wind developers and provide flexibility.

Under the American Recovery and Reinvestment Act (ARRA), the PTC was extended through 2012, and developers may receive an Investment Tax Credit (ITC) instead, which gives developers an up-front credit for investment instead of a credit after the project is completed.

Cash grants make the federal incentives even more accessible.

Another important change in the law is that developers may elect to receive a cash grant in lieu of the ITC. These changes in policy affect the market by lowering costs for developers—making wind energy cost-competitive with coal—and increasing consumer demand for wind energy.

**Finance**

The wind market has been heavily reliant on tax equity financing, but this model experienced a downturn in late 2008.

Although the number of wind installations was greater in 2008 than in any other year, asset transactions decreased steadily from the beginning of 2008 through the end of the year as a result of the capital market crash.

With a supportive policy environment, markets will rebound.

The ARRA, or stimulus bill, is expected to boost markets. Also, the DOE’s loan guarantee program will be especially popular, and although markets will continue to slow in 2009, the market will pick up again in 2010.

Wind markets are still heavily reliant on federal tax credits.

In coming years, the wind industry must find ways to be less reliant on tax credits, since these are set to expire at the end of 2012.

**Wind Resource and Economics**

Knowing the strength and quality of a wind resource can affect the economics of wind projects.

Strong, consistent resources create the ideal conditions for wind energy projects, because they allow turbines to generate the most energy per hour.

Wind resource patterns are not consistent, creating wind integration costs related to variability and uncertainty of the resource.

It is important for developers to have accurate forecasts of wind resource patterns, since wind speeds can typically change from year to year. Power system operators want reliability above all else. Demand management, storage, and plug-in hybrid vehicles can help reduce uncertainty and help with wind integration.
Regional Factors

Besides federal policy, state and local policies affect wind energy deployment.

State renewable portfolio standards, tax incentives, and other state policies and regulations have a significant effect on wind energy installations on a state by state basis.

There are no fundamental barriers to achieving 20-30% electricity from wind.

- James Lyons, Chief Technology Officer, Novus Energy Partners

Other regional factors affect wind energy capacity installed as well.

These factors include the local wind resource, wholesale power prices, access to a merchant market, access to transmission, siting issues, and eligibility to meet RPS demand.

Conclusions

Speakers in the RETECH wind energy sessions offered a sober but optimistic view of the US wind market for 2009. Though they expect wind energy installations to be modest in 2009, the market is expected to rebound in 2010. Additionally, as wind turbine engineering improvements drive down the cost of turbine components, demand for wind energy will increase. As long as the barriers to large-scale wind deployment are removed—including an expansion of the transmission grid and the enactment of supportive policies—the market for wind energy in America will continue to grow, helping to ensure a clean energy future for the country.

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B3 - Wind Technology
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