Industrial Distributed Generation

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Good afternoon. I am speaking on behalf of Bill Parks, who sends his sincere apologies for not being here today. He is attending the dedication of the Walden Mills facility. Bill is the Director of the DOE Office of Industrial Technologies within the Office of Energy Efficiency and Renewable Energy. The Office of Energy Efficiency and Renewable Energy is a sister office to the Office of Fossil Energy.

I'd like to open my talk with a segment from Secretary Richardson's dedication of the Walden Mills co-generation facility.

> *Walden Mills is a gas-fired co-generation plant that shows when the latest and best technologies are employed, our economy becomes more profitable, more productive and efficient, and the quality of our environment improves. Walden Mills is a shining example of the benefits that can accrue from this type of industrial renewal. The mill has been completely rebuilt with the most advanced technologies since the devastating fire that occurred here in 1995. All this is possible because of the innovative thinking at Walden Mills and the engineering achievements of Solar Turbines along with others who have participated in the Energy Department's Advanced Turbine Systems program.*

As I think of this, I am reminded of the partnership between DOE and industry. Over the years, this partnership has grown. Sometimes it has struggled, but most important, it is succeeding in getting technology from the drawing board or thoughts to a reality and a solution for improving the productivity, the competitiveness, and the environmental quality of the U.S.

When the ATS program started in 1992, we were looking at industrial gas turbine efficiencies around 28 to 30 percent. Now we are looking at efficiencies of close to 40 percent.

Where are we today in the program? At Walden Mills, we are demonstrating the continuous-fiber ceramic-composite combustor liner developed in this program in a joint partnership with the continuous fiber program and the Office of Industrial Technologies.

Composite liners have enjoyed over 11,800 total hours of service. This would not have been achieved without the total dedication and participation by researchers at Solar Turbines, the National Aeronautics and Space Administration (NASA), Oak Ridge and Argonne National Laboratories, BF Goodrich, Allied Signal Composites Incorporated, Pratt & Whitney, and DOE, from Headquarters and the Chicago Operations Office.

Allied Signal and Kyocera have demonstrated close to 22,000 hours of service on components. Rolls Royce Allison and Exxon have demonstrated over 800 hours in silicon nitride vanes. Ceramic blades have been demonstrated for over 14,000 hours by Solar Turbines and Texaco. With these demonstrations, we're one step closer to commercialization by understanding how ceramics react in gas turbine environments.

And what work still needs to be done in developing environmental barrier coatings and preventing foreign object damage? A highlight of the industrial program is the demonstration of the Mercury 50, Solar's ATS engine designed for utilities, which Solar will speak about tomorrow.

Because of the work at the national laboratories, Pratt & Whitney, General Electric, the National Institute of Standards and Technology (NIST), and Westinghouse, we now have a greater understanding of thermal barrier coatings, failure mechanisms, and new improved coatings under development to survive longer hours of operation and protect critical hot-section components.

Almost every participant has benefited from the ATS program and is incorporating technology and lessons-learned in their products. Have we succeeded in everything? And is our work finished? Have we accomplished the goals of the program? I would like to say yes, first of all, to the goals of the program. But have we accomplished everything? I would like to answer that by referring to the materials workshop held in Washington about 4 months ago. In the workshop, we reconfirmed the materials manufacturing plan that was developed way back in 1994 and updated in 1996. The discussions gave a clear signal that there's still a lot of work to be done in the materials area alone. Emphasis was placed on alloy development; continued low-cost manufacturing of forgings, castings, coatings, and ceramic materials; as well as repair and refurbishing techniques.

The list continues to grow. Besides materials, there's a lot more gas turbine work that needs to be done in design, combustion with low emissions, sensors, and packaging and controls, just to name a few.

And DOE will continue to live up to this challenge by helping industry and investing in focused technology efforts. The Office of Industrial Technologies will continue to support industry through solicitations in advanced materials for gas-turbine hot-section components, low-emission technology development, and advanced microturbines. Details of these solicitations will be available through the DOE Chicago regional office. So stay tuned.

Another lesson-learned from the Office of Energy Efficiency and Renewable Energy is that technology development is only one focus in a triangle for successful commercialization. The other two parts of the triangle are policies and markets. The Office of Energy Efficiency and Renewable Energy is proud to be facilitating a strategy developed by industry to address all three points of the triangle.

In the combined heat and power vision for distributed generation technology, the vision calls for advancing the efficiency of all primary technologies as well as ensuring that they are cost effective. Technologies include gas turbines, microturbines, fuel cells, and reciprocating engines.

Within the Office of Industrial Technologies, we have been given the lead to continue to develop industrial natural-gas-based distributed generation technologies, specifically microturbines and reciprocating engines. In each of these technologies, we hope to raise the playing field as we did with ATS. For microturbines, we're looking toward a goal of 40-percent efficiency and for reciprocating and industrial combustion engines, we're looking at 50-percent efficiency. In addition, we're striving for the end users to maximize the fuel conversion efficiencies of the total system by utilizing the waste heat from these systems — a combined heat and power (CHP) plant. Our strategy also outlines the barriers to installing distributed-generation CHP technologies in today's market. These barriers include interconnection with the grid, utility pricing practices and tariff structures, environmental regulations and permitting, and current business models and practices.

Utility requirements for interconnecting non-utility-owned distributed generation with utility distribution systems can severely delay a distributed power project, substantially increasing the costs of pulling it together. Our first speaker, John Siegel, spoke about larger systems, and noted that they are being put in basically because of siting and permitting issues. So while essential safety and reliability power pole issues are fully addressed when these systems are interconnected, many requirements presently proposed by utilities appear to have little purpose other than to discourage the installation of distributed generation.

Historic charges and back charges are just two of several ways in which utilities charge customers who want to provide some or all of their own electricity. In many cases, these charges are excessive and make distributed power less attractive. Air permitting, water use permits, zoning, approval of comprehensive plans, and other regulatory processes can both delay and increase the costs of distributed power projects and small-scale generation.

In general, distributed power technologies are not covered in national building, electrical, and safety codes. Codes do address photovoltaics, but this is a result of many years of effort by the Department of Energy, its national labs, and industry standards organizations.

Local code and zoning officials are typically not familiar with these technologies. And more important, environmental regulations are not generally administered in a way that gives credit for the overall pollution reduction effects of high-efficiency distributed-power technologies, such as CHP systems.

Along with the existing regulatory barriers, existing business practices and business models often reflect the old regulated electric industry, dominated by vertically integrated monopoly utilities and central-station power plants. New business models are needed to capture the value of non-utility-owned distributed power in delaying or avoiding transmission and even distribution system upgrades. The use of distributed power for ancillary services is also important.

Even today, I know of at least one company that is aggregating small, distributed generation, standby generators into 100-MW blocks to offer to an independent service operator (ISO) to meet peak loads in transmission and distribution in constrained areas.

The Energy Department, within the Office of Energy Efficiency and Renewable Energy, has several program and policy initiatives to address these barriers. As a result of a workshop held in December with industry and other stakeholders, the Office of Power Technologies within EE is developing a distributed power program: (1) to focus on the issue of interconnecting distributed power with the grid, and (2) to address the regulatory and institutional barriers to distributed power technologies that both renewable and fossil-fired fuels face. The industry told us that the number one priority is to remove the barriers to interconnection with the electric power grid that exist today.

About nine states have already adopted interconnection standards for small-scale renewable energy, primarily residential photovoltaics. But the standards, which vary from state to state, address certain technologies and not others and will not support a robust market in optimizing power generation technologies.

What is needed is a non-discriminatory national standard that applies to all distributed power technologies and assures that these systems are properly integrated into the grid in a manner that addresses critical safety, reliability, and power quality issues. Within the Office of Industrial Technologies, the CHP challenge is working with industries to address additional barriers, especially environmental permitting policies, that affect CHP and other distributed-power technologies. We're working with the Environmental Protection Agency (EPA) and the states to accommodate efficient distributed technologies within the framework of the Clean Air Act by increasing the use of performance- and output-based environmental standards and streamlining the permitting process for small-scale generation.

One of the successes in this area occurred at the EPA Energy Earth Forum last month. EPA announced an Energy Star Award for CHP facilities. In this case, once a year, DOE and EPA officials go in the field to evaluate the efficiencies of various plants with the specific purpose of giving the Energy Star Award to facilities.

In summary, the office of Energy Efficiency and Renewable Energy is striving to completely address the technology development and policies that will prohibit commercialization of distributed generation and CHP technologies. I would like to say that I am very proud of the ATS community and the accomplishments that we have achieved and the benefits that have been realized by end-use customers. I do look forward to continued successes in the future through existing and new partnerships.

Thank you.