Testimony

"Unlocking America's Energy Resources: Next Generation"

Subcommittee on Energy and Air Quality

U.S. House of Representatives

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Introduction

I am John Novak, Executive Director of Federal and Industry Activities for the Environment and Generation Sectors of the Electric Power Research Institute. EPRI is a non-profit, collaborative R&D organization headquartered in Palo Alto, California. EPRI appreciates the opportunity to provide testimony to the Subcommittee on the next generation of electricity based technology.

Electricity Generation Options

Each year, the Advisory Council and Board of Directors of the Electric Power Research Institute convene a diverse group of leaders from industry, academia and government to discuss critical issues facing the electricity industry and society. The seminar format is designed to air diverse views, to explore common ground and, where possible, to develop a new pathway forward. Last year's Summer Seminar was focused on "Making Billion

Dollar Advanced Generation Investments in an Emission-Limited World." Attached is the background paper for last year's seminar.

The paper contains an outlook for generation technology for the years 2010 and 2020. We have updated information from the generation technology outlook to reflect more current events and trends and have provided some of this updated information in the table below.

Comparative Costs of 2010 Generation Options

Technology	Cost of Electricity, $/MWh	Key Assumptions
Pulverized Coal	41	Coal price: $1.50/mmbtu
Nuclear Power	46	Capital Cost: $1400 - $1700 per kW
IGCC without carbon capture	47	Coal price: $1.50/mmbtu
Natural Gas Combined Cycle	56	Fuel Cost: $6/mmbtu
Biomass	62	
Wind	75	Capacity Factor: 29%

Comparative Costs of 2020 Generation Options

Technology	Cost of Electricity, $/MWh	Key Assumptions
Pulverized Coal	64	Coal price: $1.50/mmbtu With CO_2 capture, transport, storage
Nuclear Power	46	Capital Cost: $1700 per kW
IGCC with CO_2 capture	54	Coal price: $1.50/mmbtu
Natural Gas Combined Cycle	52	Fuel Cost: $6/mmbtu
Biomass	44	New technologies to reduce cost
Wind	52	Capacity Factor: 29%; substantial technology improvement

Key Points

EPRI would like to make six key points drawn from the analysis in the attached paper and from the discussions at the summer seminar.

1. The U.S. must keep all of its energy options open to meet the uncertainties of the future. For electricity, this means building and sustaining a robust portfolio of clean,

affordable options for the future – ensuring the continued use of the "big five": coal, nuclear, gas, renewables, and end-use energy efficiency.

2. R&D can and will make a big difference. With sustained levels of R&D, the costs of these five electricity options can be substantially reduced over the next decade.

3. Investment decisions being made today about the next generation of electricity supply are complicated by four major uncertainties:
    a. Future cost of CO_2
    b. Future price of natural gas
    c. Spent nuclear fuel storage
    d. CO_2 capture and storage

4. We believe that prudent investment decisions for plants that have to produce electricity for the next 30-40 years will be increasingly based on the assumption of a carbon constrained future. Whether decision makers assume the future cost of CO_2 to be zero as it is today, or $30/ton, or $50/ton, dramatically changes the relative cost of the various supply options.

5. We have taken an objective look across all the major supply options, using variable costs for CO_2 and natural gas, and factored in the technical progress that we think is achievable over the next 10 years, and reached a central conclusion --- That is, <u>we have an extraordinary opportunity to put a low-carbon portfolio in place by 2020.</u>

This means the technology would be ready by 2015, and installed by 2020. This portfolio would be insensitive to the cost of CO_2, and yet still be affordable.

6. One reason this is so critical is that electricity is going to become more important in the future. We have run scenarios, and invariably, the tighter the limits on CO_2, the more electricity that's going to be required globally. You can think of it this way -- electricity is only practical way to deliver clean energy on a large scale.

For those of you interested seeing this picture unfold, I would recommend that you watch a presentation by our CEO, Steve Specker, recently given at Resources for the Future. The web link is http://www.eande.tv/transcripts/?date=040406#transcript

R&D Priorities

Following is a summary of EPRI's priorities for electricity based R&D in five key areas: coal, nuclear, gas, renewables and end-use energy efficiency. EPRI would be pleased to discuss these in greater detail with the Subcommittee.

Coal

Coal Based Generation

- EPRI believes RD&D should be accelerated for both combustion-based technologies and for gasification technology. Three major areas of work need to be emphasized,
    - 1) Integrated Gasification Combined Cycle work on hydrogen turbines, reliability, cost reduction, and integration with CO_2 ;
    - 2) very efficient pulverized coal combustion with options for CO_2 capture and

    - 3) fluidized bed combustion with options for near zero pollutant emissions and CO_2 capture.
- Related technology deployment to reduce costs (initially without CO_2 capture until storage is demonstrated) as is being done in conjunction with EPRI's CoalFleet for Tomorrow® Program and as a result of the EPACT 2005 enactment.

CO_2

- To assure public acceptance, multiple (~5) large scale (> 1 MTY), long term CO_2 storage demonstrations in different geologies and locations will be needed in addition to FutureGen and DOE RD&D, to assure that storage is safe and effective.
- Post combustion capture for existing and new PC-fired plants needs to be developed and demonstrated.

Emissions

- Near-term work in mercury control and demonstration to assure that all equipment and coal types can be reliably controlled require completion of the field testing program currently underway by industry and government

Gas

- Cost reduction in natural gas supply, including the ability to site and obtain LNG, since LNG use is projected to grow rapidly.
- Distributed generation (DG) cost reduction and efficiency increases in DG to allow DG to compete on the system with larger generation.

- Fuel Cells and applications which support combined heat and power will also find niche applications and require RD&D until they are cost competitive with central stations.

Nuclear

- Significant R&D needs exist for the current fleet and the new fleet, especially in areas of age-related materials degradation, fuel reliability, equipment reliability and obsolescence, plant security, cyber security, and low-level waste minimization.
- Development of a new generation of high reliability LWR fuel with much higher burnup that will better utilize uranium resources, improve operating flexibility, and significantly reduce spent fuel volume and transportation needs, resulting in additional improvements in nuclear energy economics. These are mid-term R&D needs whose impact would be considerable if accelerated with government investment.
- In the longer term develop a nuclear system having hydrogen production capability. Many believe that a hydrogen economy is essential for revolutionizing transportation, in which case the demand for competitive and environmentally responsible hydrogen production will greatly increase. A large-scale, economical nuclear source would hasten that future.

Renewables

- Integration of large intermittent resources, including power electronics for more effective conversion, smoothing and control of renewable resources

- Interconnection, communication and control of distributed generation
- Incremental, low impact hydropower expansions, advanced hydro turbine concepts and performance optimization tools
- Cost-effective energy storage technology for utility T&D applications with renewable resources
- Demonstration of ocean renewable wave, tidal and wind-wave hybrid concepts for power generation (see also EPRI Ocean Energy work)

End Use Efficiency and Demand Response

- Development of an advanced communications infrastructure that links electricity consumers with a fully dynamic electricity marketplace. Information could be exchanged directly with smart end-use devices, for example, so consumers would not have to make hourly or daily energy choices. This "prices to devices" approach would allow the appliance itself to optimize its operation under varying costs and conditions.
- Ensure we have regulatory and market structures that support end-use efficiency and demand response objectives.
- Continue development of smart end-use devices. An essential premise of efficiency and demand response strategies (as well as of the provisions of the U.S. Energy Policy Act of 2005) is an infrastructure of intelligent electricity meters and end-use devices capable of two way communication with the electricity system. Many end-use technologies are beginning to evolve, through advances in distributed intelligence, from static devices to devices with much more dynamic capabilities.

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The Electric Power Research Institute was established in 1973 as an independent, nonprofit center for public interest energy and environmental research. EPRI brings together members, participants, the Institute's scientists and engineers, and other leading experts to work collaboratively on solutions to the challenges of electric power. These solutions span nearly every area of electricity generation, delivery and use, including health, safety, and environment. EPRI's members represent over 90% of the electricity generated in the United States.