

# **SF<sub>6</sub> Emission Reduction Partnership for Electric Power Systems**

**2004 Annual Report**

**July 2005**





# 1 Preface—The SF<sub>6</sub> Emission Reduction Partnership for Electric Power Systems

The SF<sub>6</sub> Emission Reduction Partnership (SF<sub>6</sub> Partnership) for Electric Power Systems reached its five year mark in 2004. As part of a suite of voluntary industry program offerings within EPA's Climate Change Division, the Partnership has enabled over 70 electric utilities to take progressive and comprehensive actions in addressing greenhouse gases by reducing sulfur hexafluoride (SF<sub>6</sub>) emissions. SF<sub>6</sub> is the most potent greenhouse gas used in the electric power industry (23,900 times greater than CO<sub>2</sub>), and is primarily used as an insulating and arc quenching medium in equipment that transmits and distributes electricity (high voltage electrical switchgear and circuit breakers). With an atmospheric life of 3,200 years, every pound emitted accumulates in the atmosphere for centuries. For this reason, it is important that electric companies take practical steps to reduce inadvertent SF<sub>6</sub> emissions. Reductions to SF<sub>6</sub> emissions, however small, ultimately contribute to the long term health of our planet.

The SF<sub>6</sub> Partners listed in the Appendix are making great strides in reducing SF<sub>6</sub> emissions by implementing technically feasible and cost-effective actions in their operations and management systems. Not only have these companies reported significant SF<sub>6</sub> emission reductions, but in the process, most have witnessed financial benefits, such as reduced SF<sub>6</sub> gas purchases and reduced maintenance and service costs.

This year's annual report presents cumulative SF<sub>6</sub> emissions avoided by partners since 1999 through 2004.



# Partner Accomplishments

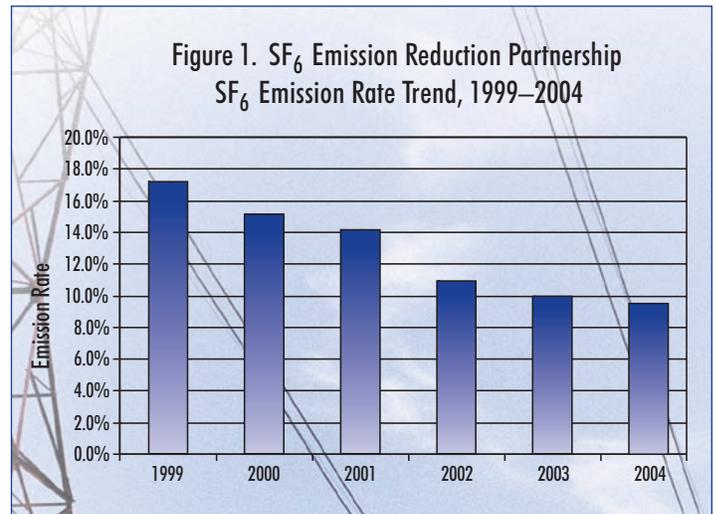
In 1999, the SF<sub>6</sub> Partnership began with 49 electric utilities as Charter Partners. During the intervening five years, an additional 25 utilities have joined the Partnership, such that currently, the program represents over 38 percent of U.S. transmission mileage. In 2004, SF<sub>6</sub> Partners managed equipment on their systems with a total SF<sub>6</sub> capacity (nameplate capacity) of 4,635,465 pounds. As detailed in this Section, the last five years are noted for a significant decrease in SF<sub>6</sub> emissions.

## 2.1 Partner-Reported Emissions

2004 was another record year, with 85 percent of Partners reporting emissions of 439,010 pounds in total. Table 1 provides a summary of total nameplate capacity, SF<sub>6</sub> emissions as reported by the Partners, and the calculated emission rates for 1999 through 2004.

SF<sub>6</sub> emission rates reported by Partners in 2004 ranged from zero to 45 percent. The overall Partnership's SF<sub>6</sub> emission rate equaled 9.5 percent; a decline of 0.5 percent from the previous year. With a Global Warming Potential (GWP) of 23,900, even this small decline in SF<sub>6</sub> emissions has a profound effect on reducing the impact of climate change. Overall, between 1999 and 2004, the Partnership's SF<sub>6</sub> emission rate has decreased by over 45 percent (Figure 1).

Table 2 presents a summary of total annual SF<sub>6</sub> emission reductions achieved by all reporting Partners through 2004. The information presented is derived by evaluating emissions data provided by reporting Partners for each year (see Table 1), and is not adjusted to account for Partners who have not reported consecutively. Emissions reductions are also presented in terms of million metric tonnes of carbon dioxide equivalent (MMTCO<sub>2</sub>e) with 1999 as the baseline year, the start of EPA's SF<sub>6</sub> Partnership.



**Table 1: Aggregated Statistics for all Reporting Partners**

	1999	2000	2001	2002	2003	2004
Reporting Partners	80%	77%	80%	71%	85%	85%
Total SF <sub>6</sub> Emissions (lbs.) <sup>a</sup>	601,699	583,524	555,867	486,858	444,691	439,010
Total Name-Plate Capacity (lbs.)	3,467,872	3,858,884	3,918,809	4,438,867	4,479,091	4,635,465
SF <sub>6</sub> Emission Rate <sup>b</sup>	17%	15%	14%	11%	10%	9.5%

<sup>a</sup> Since several reporting Partners have not provided data for consecutive years, the aggregated statistics should not be used to compare annual SF<sub>6</sub> emissions.

<sup>b</sup> SF<sub>6</sub> emission rate is calculated by dividing total emissions by total name-plate capacity (i.e., the total quantity of SF<sub>6</sub> contained in electrical equipment)

2004 SF<sub>6</sub> emissions from reporting Partners are more than 25 percent lower than emissions in 1999. The Partnership's baseline emissions have been reduced by approximately 163,000 pounds of SF<sub>6</sub>, or 1.76 MMTCO<sub>2e</sub> as of 2004. Cumulatively, emission reductions total 498,545 pounds or 5.40 MMTCO<sub>2e</sub> (Table 2).

From 1999 through 2004, Partners have deferred spending \$3 to \$4.5 million dollars in SF<sub>6</sub> gas purchases by preventing the escape of 5.40 MMTCO<sub>2e</sub>, or 498,545 pounds of SF<sub>6</sub> into the atmosphere.

**Table 2: Summary of Partnership SF<sub>6</sub> Emissions and Reductions**

	1999 <sup>1</sup>	2000	2001	2002	2003	2004
Total Partner-Reported SF <sub>6</sub> Emissions (lbs)	601,699	583,524	555,867	486,858	444,691	439,010
Total Partner-Reported SF <sub>6</sub> Emissions (MMTCo <sub>2e</sub> )	6.52	6.32	6.03	5.28	4.82	4.76
Reduction from Baseline (MMTCo <sub>2e</sub> )		0.20	0.50	1.24	1.70	1.76
Percent Reduction from Baseline	-	3%	8%	19%	26%	27%

<sup>1</sup> Baseline year.

*Preventing the escape of 498,545 pounds of SF<sub>6</sub> is a major accomplishment in climate protection. In terms of carbon dioxide emissions prevented, it is equivalent to:*

*44,300 acres of Forest preserved from deforestation; or*

*1.2 million Passenger cars NOT driven for one year; or*

*1.4 million Households reducing electricity use by 50 percent for one year!*

<sup>1</sup>Source: <http://www.usctgateway.net/tool/>

# 3 Partnership Update

The SF<sub>6</sub> Emission Reduction Partnership has grown over the past five years in size and in its capability of providing important resources to Partner utilities. Starting with 49 Charter Partners, the program now contains 74 participants. Three biannual conferences on SF<sub>6</sub> and the environment have been held bringing Partners together to relay technical information and learn of new, innovative techniques and strategies for managing and mitigating SF<sub>6</sub> gas. New studies, such as the field study on circuit breakers, are helping to identify the frequency and size of SF<sub>6</sub> emissions from manufactured equipment. This section covers the most recent developments in the program.

## 3.1 New Partners

In late 2004 and through July 2005, EPA welcomed the following new Partners into the SF<sub>6</sub> Emission Reduction Partnership for Electric Power Systems:

1. *LG&E Energy – Louisville, KY*
2. *Otter Tail Power – Fergus Falls, MN*
3. *Great River Energy – Elk River, MN*
4. *Exelon Energy Delivery (EED) – Oakbrook Terrace, IL*
5. *PECO Energy Delivery – Philadelphia, PA*

Through this partnership with EED, EPA also recognizes **PECO Energy Delivery**, in addition to **ComEd Energy Delivery**, one of the program's Charter Partners; both are the operating distribution companies of EED.

EPA is continuing to communicate with electric utility companies to join the SF<sub>6</sub> Emission Reduction Partnership in 2005. Including subsidiaries, the Partnership now totals 74 Partners. Appendix A contains a list of participating utilities as of July 2005.

## 3.2 New Features on SF<sub>6</sub> Web Site: [www.epa.gov/electricpower-sf6](http://www.epa.gov/electricpower-sf6)

The Service Provider Directory is a new feature available on the Partnership's website. The directory contains contact information for various companies that are knowledgeable in SF<sub>6</sub> emission reduction strategies and can offer assistance with SF<sub>6</sub> emission mitigation projects. The directory is grouped into four categories:

- SF<sub>6</sub> Recycling Equipment
- Laser Leak Detection – Leak Detection Equipment/Services
- SF<sub>6</sub> Gas Management/Handling Services
- SF<sub>6</sub> Gas Equipment Leak Repair

Contact information on over 20 service companies is included. The directory is available under the Documents, Tools & Resources page.

Recently expanded is the list of SF<sub>6</sub> handling policies and procedures from SF<sub>6</sub> Partners, which now includes: **First Energy**; **National Grid**; **Northeast Utilities**; and **Public Utility District No. 1 of Douglas County**. These submitted documents offer examples of how corporate SF<sub>6</sub> maintenance and gas handling procedures can be organized and customized for various companies and departments. These documents are available under the Documents, Tools & Resources page.

## 3.3 Other Resources

### *Benchmarking Reports*

Last year the SF<sub>6</sub> Partnership provided a progress report to Partners that highlighted their specific accomplishments and provided different benchmarks to chart their progress. Due to positive response, EPA will be updating these reports using data provided by Partners in 2005.

### *Online Webcasts*

EPA has developed on-line webcasts as a new approach to collaborate and communicate with SF<sub>6</sub> Partners and others.

The first webcasts will cover estimating and reporting SF<sub>6</sub> emissions with EPA's SF<sub>6</sub> Emission Inventory Reporting Protocol. Several webcasts will be held in the Summer and Fall of 2005.

### **Partner Case Study: Southern California Edison (SCE)**

Recently, EPA featured the accomplishments made by SF<sub>6</sub> Partner, Southern California Edison (SCE), in an article scheduled to be published in *Electric Light & Power* in the Fall of 2005. SCE incorporated SF<sub>6</sub> into their work management system, which is used to identify and prioritize equipment for maintenance activities. This move has enabled SCE to annually budget and replace numerous circuit breakers that have been identified with high leak rates, or repair leaking equipment where replacement is not financially viable.

According to their 2004 data, SCE is within five percent of their five year SF<sub>6</sub> emission reduction goal of 45 percent. The cornerstone to their success has been the shift in viewing SF<sub>6</sub> as another unavoidable cost of doing business to managing SF<sub>6</sub> as a strategic asset.

### **Equipment Field Study – Preliminary Observations**

At the 2004 Conference on SF<sub>6</sub> and the Environment held in Scottsdale, AZ, EPA shared preliminary observations from a survey study on SF<sub>6</sub> leak rates in circuit breakers manufactured between 1998 and 2002. The summary report will be presented at the next SF<sub>6</sub> Conference and also shared with key industry stakeholders.

## **3.4 The 2004 International Conference on SF<sub>6</sub> and the Environment – Partner Awards**

In December of 2004, the Partnership held the 3<sup>rd</sup> International Conference on SF<sub>6</sub> and the Environment. Proceedings from the conference are available on the Partnership's web site under the Conferences/Workshops page.

At the conference, EPA presented awards to **Pacific Gas and Electric (PG&E)** and **American Electric Power (AEP)** in recognition for their commitments and successful accomplishments in reducing SF<sub>6</sub> emissions.

PG&E provides power to 70,000 square miles in central and northern California. In 2004, PG&E coordinated with EPA to develop the case study, "Reducing SF<sub>6</sub> Emissions Means Better Business for Utilities." In the case study, PG&E highlighted the benefits of reducing SF<sub>6</sub> gas loss. By developing an SF<sub>6</sub> handling policy, educating field employees, working with their SF<sub>6</sub> vendor to conduct storage inventory tracking, and implementing leak detection and repair projects,

PG&E successfully achieved their goal, established in 1999, to reduce annual SF<sub>6</sub> emissions by 50 percent from a 1998 baseline. The utility decreased their emission rate to 4 percent in 2002 and have benefited from the more efficient and cost-effective use of SF<sub>6</sub>, saving a net total of \$300,000.

AEP provides electricity to customers in 11 mid-western states and their service territory covers 197,500 square miles. Since 1999, AEP's emission rate has dropped from 10 percent to 0.5 percent in 2004.



Jerome Blackman, Program Manager for the SF<sub>6</sub> Emission Reduction Partnership and award recipient, Sven Thesen, representing Pacific Gas and Electric.



Jerome Blackman, Program Manager for the SF<sub>6</sub> Emission Reduction Partnership and award recipient, Bruce Braine, representing American Electric Power.

## **AEP Wins 2005 Climate Protection Award**

*In early 2005, EPA acknowledged AEP for their actions to protect the climate. In addition to the SF<sub>6</sub> Emission Reduction Partnership, AEP is a member of EPA's Climate Leaders and is involved in several other projects and programs to abate greenhouse gases, particularly carbon dioxide. Their outstanding greenhouse gas portfolio also includes various projects and efforts such as piloting a biomass project, doubling the amount of wind generation by 2006, and supporting conservation and reforestation projects in the U.S. and abroad. AEP's plan is to reduce or offset a cumulative 10 percent of its total greenhouse gas emissions, between 2003 and 2006, preventing the release of approximately 18 million cumulative tons of carbon dioxide through participation in these projects and programs.*



# 4 Conclusion

*In its fifth year, the SF<sub>6</sub> Emission Reduction Partnership for Electric Power Systems now totals more than 74 participating utilities, representing more than 38 percent of the industry (in terms of U.S. transmission mileage). In the Partnership's five years additionally, the SF<sub>6</sub> emission rate has dropped from 17 percent to 9.5 percent. Together, Partners have effectively prevented the escape of 498,545 pounds of SF<sub>6</sub>, or 5.40 MMTCO<sub>2e</sub>, into the atmosphere since 1999. Strategies, such as managing SF<sub>6</sub> as an asset, and technical information, such as the circuit breaker field study, continue to emerge as the Partnership grows, leveraging Partners to further develop and refine their SF<sub>6</sub> management plans.*

*One pound of SF<sub>6</sub> lost to the air is equivalent to 11 metric tons of carbon dioxide. Therefore, it should be clear to utilities concerned about their total greenhouse gas profile, that even small changes in SF<sub>6</sub> emissions are meaningful. As the predominant consumer of SF<sub>6</sub>, the electric utility industry has an important stewardship responsibility in regard to this industrial gas. EPA invites all U.S. electric utilities that support voluntary efforts to reduce emissions of this potent greenhouse gas to join the SF<sub>6</sub> Emission Reduction Partnership for Electric Power Systems.*

## **For additional information please contact:**

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# Appendix: List of Partners (as of July 2005)

## **Allegheny Power**

Greensburg, PA

## **American Electric Power (AEP)**

Columbus, OH

## **Arizona Public Service Company (APS)**

Phoenix, AZ

## **Athens Electric Department**

Athens, AL

## **Austin Energy**

Austin, TX

## **Bangor Hydro-Electric Company**

Bangor, ME

## **Big Rivers Electric Corporation**

Henderson, KY

## **Bonneville Power Administration**

Portland, OR

## **CenterPoint Energy**

Houston, TX

## **Central Maine Power Company**

Augusta, ME

## **Central Vermont Public Service Corporation**

Rutland, VT

## **Cinergy Corporation**

Cincinnati, OH

## **City of Monroe**

Monroe, NC

## **Columbia River People's Utility District St.**

Helens, OR

## **Consolidated Edison Company of New York, Inc.**

New York, NY

## **Crisp County Power Commission**

Cordele, GA

## **Duquesne Light Company**

Pittsburg, PA

## **Edison International**

### **Southern California Edison**

Rosemead, CA

## **El Paso Electric Company**

El Paso, TX

## **Eugene Water and Electric Board**

Eugene, OR

## **Exelon Energy Delivery (EED)**

### **ComEd Energy Delivery**

Chicago, IL

### **PECO Energy Delivery**

Philadelphia, PA

## **FirstEnergy Corporation**

Akron, OH

## **Florida Power and Light Company (FPL)**

Juno Beach, FL

### **FPL Energy Seabrook Station**

Seabrook, NH

## **Fort Pierce Utilities Authority**

Fort Pierce, FL

## **Grand Island Utilities Department**

Grand Island, NE

## **Great River Energy**

Elk River, MN

## **Hastings Utilities**

Hastings, NE

## **Kings River Conservation District**

Fresno, CA

## **LG&E Energy**

Louisville, KY

## **Lower Colorado River Authority (LCRA)**

Austin, TX

## **Maine Public Service Company**

Presque Isle, ME

## **Manitowoc Public Utilities**

Manitowoc, WI

## **Memphis Light, Gas & Water Division**

Memphis, TN

## **Menasha Utilities**

Menasha, WI

# Appendix: List of Partners (continued)

## **MidAmerican Energy**

Des Moines, IA

## **Muscatine Power & Water**

Muscatine, IA

## **Nashville Electric Service (NES)**

Nashville, TN

## **National Grid**

### **Granite State Electric**

Northborough, MA

### **Massachusetts Electric**

Northborough, MA

### **Nantucket Electric**

Nantucket, MA

### **Narragansett Electric**

Providence, RI

### **New England Power Company**

Westborough, MA

### **New England Electric Transmission Corporation**

Westborough, MA

### **New England Hydro-Transmissions Company Inc.**

Westborough, MA

### **Niagara Mohawk Power Corporation**

Syracuse, NY

## **Nebraska Public Power District**

Doniphan, NE

## **New York Power Authority**

New York, NY

## **Northeast Utilities Services Company**

### **Connecticut Light and Power Company**

Berlin, CT

### **Public Service Company of New Hampshire**

Manchester, CT

### **Western Massachusetts Electric Company**

West Springfield, MA

## **Northern Indiana Public Service Company (NIPSCO)**

Merrville, IN

## **Oklahoma Gas and Electric Corporation (OG&E)**

Oklahoma City, OK

## **Otter Tail Power Company**

Fergus Falls, MN

## **Pacific Gas and Electric Corporation (PG&E)**

San Francisco, CA

## **Paragould City Light & Water**

Paragould, AR

## **Public Utility District No. 1 of Douglas County**

East Wenatchee, WA

## **Public Utility District No. 1 of Pend Oreille County**

Newport, WA

## **Rochester Gas and Electric Corporation**

Rochester, NY

## **Salt River Project (SRP)**

Phoenix, AZ

## **San Antonio City Public Service Board**

San Antonio, TX

## **Silicon Valley Power**

Santa Clara, CA

## **South Carolina Electric & Gas Company**

Columbia, SC

## **Southern Company**

Atlanta, GA

## **TXU**

Dallas, TX

## **Tennessee Valley Authority (TVA)**

Knoxville, TN

## **Texas Municipal Power Agency**

Bryan, TX

## **Wallingford Electric Division**

Wallingford, CT

## **We Energies**

Milwaukee, WI

## **Wellton-Mohawk Irrigation & Drainage District**

Wellton, AZ



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