SF_6 Emissions Reduction Partnership For Electric Power Systems

Program Report

August 2002

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INTRODUCTION

Many industries are participating in voluntary programs with the United States Environmental Protection Agency (EPA) to reduce greenhouse gas emissions from their operations. EPA works closely with participating industries, providing technical information and helping them overcome barriers to making process improvements that reduce greenhouse gas emissions. The SF_6 Emissions Reduction Partnership for Electric Power Systems, launched in April 1999, is one such program. EPA works with the electric power industry to achieve the primary goal of reducing emissions of sulfur hexafluoride (SF_6), an extremely potent greenhouse gas that is emitted during the operation and maintenance of circuit breakers and other high voltage equipment used in the transmission and distribution of electricity. This report documents the partnership's history and successes from 1999 to 2001.

The Partnership for Electric Power Systems forms an integral part of the voluntary approach highlighted by President Bush in his U.S. Global Climate Change Policy. It helps to fulfill the administration's goal of providing a valuable forum for the sharing of information on new research initiatives and successful mitigation strategies as well as a mechanism for the industry to document emission reduction efforts. The partners' reported SF_6 emissions reductions illustrate the success possible in protecting our climate through collaborative government/industry initiatives. EPA hopes that each partner will develop an emissions reduction target and that these targets will provide a corporate focus for SF_6 mitigation strategies.

WHAT IS SF_6?

SF_6 is a colorless, odorless, non-flammable, and non-toxic synthetic gas that was first manufactured in 1902. It is a fluorinated compound that has an extremely stable molecular structure, which makes it virtually indestructible within human time frames. The unique chemical properties of SF_6 make it an efficient electrical insulator. The gas is used for electrical insulation, arc quenching, and current interruption in high-voltage electrical equipment.

Figure 1: Profile of U.S. Utilities by Ownership

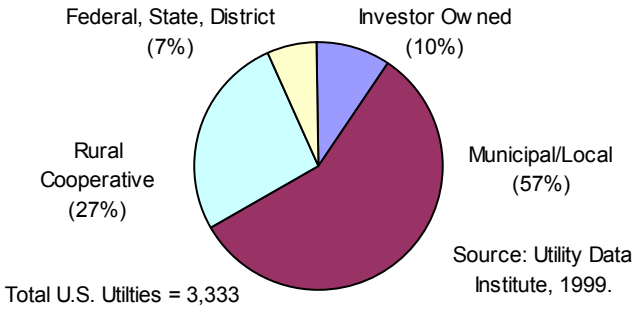
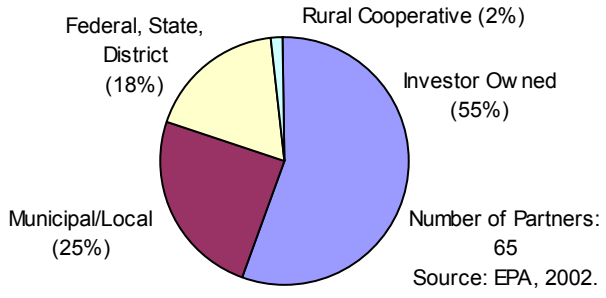


Figure 2: Profile of Partner Utilities by Ownership



SF_6 has some other applications but roughly 80 percent of all global SF_6 sales go to electric utilities and electrical equipment manufacturers.[1]

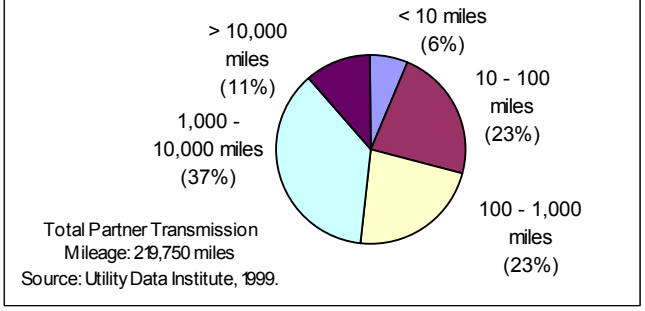
THE IMPACT OF SF_6 ON OUR CLIMATE

Under ideal operating conditions, SF_6 would remain contained within transmission and distribution equipment. In reality, however, SF_6 is inadvertently emitted into the atmosphere during various stages of the equipment's lifecycle. Leaks generally increase as equipment ages. Fugitive emissions often escape through valve fittings and at joints between flanges and porcelain bushings for example. SF_6 can be accidentally released at the time of equipment installation as well as during servicing. In 2000, SF_6 emissions from the United States electric power system were estimated at 604 metric tons SF_6, or 14.4 million metric tonnes of carbon dioxide equivalent ($MMTCO_2e$). This quantity of SF_6 emissions is equivalent to the carbon dioxide (CO_2) pollution from 2.8 million passenger cars.[2]

SF_6 has been described as the most potent greenhouse gas ever evaluated by the scientists of the Intergovernmental Panel on Climate Change (IPCC).[3] Its global warming potential (GWP) is estimated to be 23,900 over a 100-year time horizon.[4] Recent measurements have identified an increase in atmospheric SF_6 concentrations of approximately 7 percent per year since 1978.[5] Consequently, the need to eliminate or reduce releases of SF_6 into the atmosphere to an absolute minimum is becoming increasingly important.

WHAT IS BEING DONE? - THE SF_6 EMISSIONS REDUCTION PARTNERSHIP

Figure 3: Profile of Partner Utilties by Transmission Mileage



In order to address this challenge, members of the electric power industry and EPA have come together in a collaborative effort to reduce SF_6 emissions. The partnership provides critical information on cost-effective emissions reduction options, promotes environmental stewardship, and serves as a valuable forum for the exchange of information on SF_6 management strategies. Since the partnership's inception, significant progress has been made to identify and implement SF_6 emission reduction strategies. Some companies have established SF_6 emissions reduction goals and developed SF_6 management guidelines that have improved system

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[1] Smythe, K. "Production and Distribution of SF_6 by End-Use Application," Conference on SF_6 and the Environment: Emissions Reduction Strategies, San Diego, CA, November 1-2, 2000.

[2] Based on average highway statistics from Federal Highway Administration (FHWA), *Highway Statistics,* 2000.

[3] Garzon, R. D. (1997), *High Voltage Circuit Breakers Design and Applications*, Marcel Dekker, Inc., p. #165.

[4] The GWP provides a relative ranking of the ability of a specific greenhouse gas to trap heat in the atmosphere as compared to the most abundant anthropogenic greenhouse gas, CO_2. CO_2 has a GWP_{100} equal to 1. See Appendix A for an explanation of converting SF_6 emissions to carbon dioxide equivalent emissions.

[5] Maiss, M., Brenninkmeijer, C. (1998), "Atmospheric SF_6, Trends, Sources and Prospects," *Environmental Science & Technology*, 32:3077-3086.

reliability with respect to the prevention of SF_6 gas leaks. Since SF_6 gas is primarily used in transmission related electrical equipment; transmission miles provide a surrogate measure to estimate the quantity of SF_6 utilized by the partnership and the industry as a whole. Currently, partnership members own and operate approximately 219,750 transmission circuit miles (Figure 3). These miles account for approximately 35 percent of the U.S. high-voltage transmission grid; consequently, the partnership accounts for a large proportion of the banked SF_6 within the electric power system.

Partners determine the best abatement strategy for their particular operations. Such strategies may include a commitment to recycle (recover and reuse) SF_6, the implementation of an aggressive maintenance program for equipment, and the replacement of older leaking equipment with new higher performance equipment. This new equipment does the same job but often uses less SF_6 gas and has a much lower leak rate.

PARTNERSHIP ACCOMPLISHMENTS

WHAT'S NEW?

1. The SF_6 Emissions Reduction Partnership for Electric Power Systems welcomed three new partners during 2001 and 2002. *Edison International* and *Nashville Electric Service* joined in the spring of 2001, and *Lower Colorado River Authority* joined in February 2002. These additions increased the partnership to a total of 65 members (a list of existing partners is provided in Appendix B).

2. Since the publication of the last program report in 2001, EPA has released two new publications:

   - *The Catalog of Guidelines and Standards for the Handling and Management of Sulfur Hexafluoride (SF_6)*; and
   - *Byproducts of Sulfur Hexafluoride (SF_6) Use in the Electric Power Industry.*

   Both are available on the Electric Power Systems Partnership website, located at http://www.epa.gov/highgwp1/sf6/.

3. Starting in 2003, partners will have the opportunity to submit their annual reports via email using an electronic form. If partners wish to utilize this option, the form can be obtained from the EPA partnership website.

PARTNER REPORTED EMISSIONS

Partners have achieved significant emissions reductions through efforts to replace older, leaking equipment with newer, tighter gas-insulated equipment, and through measures to enhance the management and handling of SF_6 gas. These measures include SF_6 management training, use of improved gas cart technology, and the use of improved leak detection

technology and services. Table 1 provides a summary of total name-plate capacity and SF_6 emissions for all reporting partners between 1999 and 2001.

Table 1: Aggregated Statistics for all Reporting Partners[a]

	Reporting Year		
	1999	**2000**	**2001**
Number of Reporting Partners	49	49	48
Total Name-Plate Capacity (lbs.)	3,465,872	3,648,884	3,458,964
Total SF_6 Emissions (lbs.)	594,902	544,523	514,621

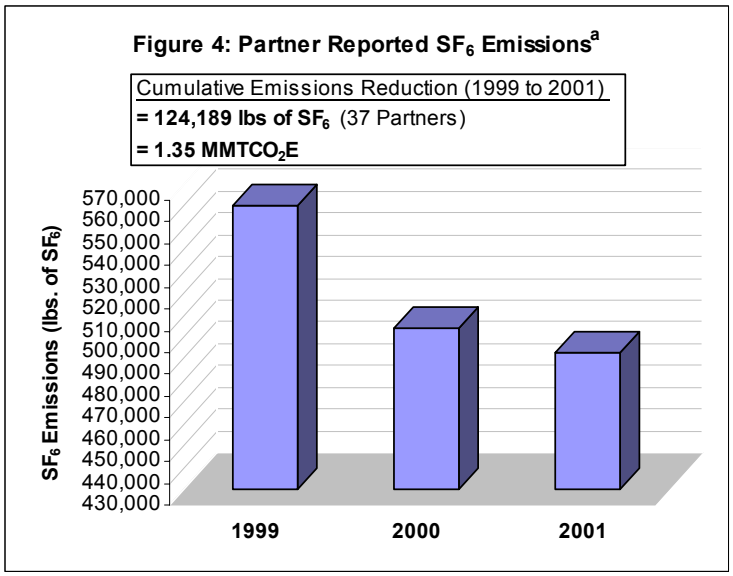
[a]Several reporting partners have not provided data for consecutive years; consequently, the aggregated statistics should not be used to compare annual SF_6 emissions.

In order to properly compare emissions over time, Table 2 and Figure 4 present a summary of SF_6 emissions data for partners that have reported during each of the three reporting years.

Table 2: Aggregated Statistics for Partners that have Consecutively Reported for each Year[a]

	Reporting Year		
	1999	**2000**	**2001**
Total Name-Plate Capacity (lbs.)	3,129,590	3,154,289	3,126,072
Total SF_6 Emissions (lbs.)	560,535	504,328	492,554
Average Partner Emissions Rate	11.0%	10.9%	10.1%
Absolute Emissions Reduction From 1999 Baseline (lbs.)	—	56,207	67,982
Absolute Emissions Reduction From 1999 Baseline ($MMTCO_2E$)	—	0.61	0.74

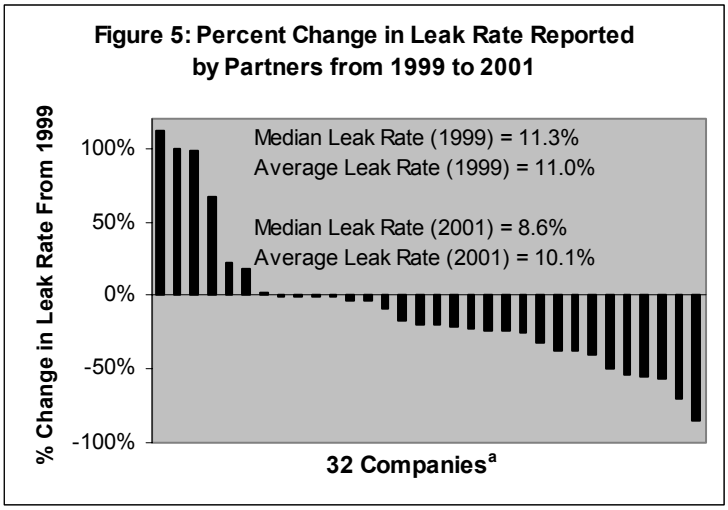
[a]A total of 37 partners have submitted reports for each reporting year (1999, 2000, and 2001).



[a]Only for the 37 partners that reported in each of the reporting years, 1999, 2000, and 2001.

As Figure 4 demonstrates, partner emissions decreased by 10 percent in 2000, and dropped by a further 2 percent in 2001. Furthermore, as illustrated in Figure 5, a majority of partner

companies have experienced a significant percentage reduction in their system leak rates (i.e., SF_6 emissions divided by name plate capacity) between 1999 and 2001. These results clearly illustrate the success of their efforts to improve the efficiency of their SF_6 containing equipment.



[a]Companies that have not reported a leak rate (i.e., no nameplate capacity provided) are not included in Figure 5.

RESULTS AND IMPACTS OF PARTNERSHIP ACTIVITES

In 2001, the SF_6 emissions reported by the 37 partner utilities presented in Table 2 were approximately 12 percent lower than 1999 baseline levels. Between 1999 and 2001, these 37 partners reported cumulative emissions reductions of 124,189 lbs. (56.3 metric tonnes of SF_6). With a cost range for gas of $8.00 to $9.00 per pound, this reduction represents a financial benefit to these companies. These emissions reductions translate into an industry-wide financial saving ranging from $1 to $1.1 million dollars during this time period.

The potential environmental value of this emissions reduction is even more impressive. It is equivalent to a total cumulative reduction of 1.35 million metric tonnes of carbon dioxide equivalent ($MMTCO_2E$) or removing the CO_2 pollution of approximately **264,000 cars** in 2001.

FUTURE GOALS

The SF_6 Emissions Reduction Partnership for Electric Power Systems provides an important forum for the dissemination of information on a wide array of issues relating to the use, handling, and management of SF_6. EPA routinely sponsors an international conference on *SF_6 and the Environment: Emission Reduction Strategies*. The next conference will be held on November 21-22, 2002 in San Diego, CA. EPA is confident that the partnership will continue to grow and further contribute to the goal of reducing SF_6 emissions. Over the next few years, EPA is targeting program participation by 50 percent of the industry, and plans to cultivate relationships between the program and original equipment manufacturers and SF_6 gas suppliers.

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PARTNER CASE STUDY 1: BONNEVILLE POWER ADMINISTRATION

As a partner in the SF_6 Emissions Reductions Partnership, Bonneville Power Administration (BPA) has demonstrated its concern for the environment while continuing their mission of providing energy to customers. BPA has been able to save money and simultaneously help address global climate change through their SF_6 management strategy.

BPA is a "Main Grid" power transmission system providing service and power to Oregon, Washington, Idaho, and portions of Wyoming, Nevada, Utah, California, and Montana. BPA owns and operates more than three-fourths of the high-voltage transmission grid in the Pacific Northwest. The grid stretches some 15,012 circuit miles across a service area of 300,000 square miles.

BPA services over:

- 320 substations;
- 774 SF_6 circuit breakers;
- 306 SF_6 current transformers;
- Four SF_6 gas insulated substations (GIS); and
- Nine SF_6 high speed ground switches.

SF_6 MANAGEMENT

At BPA the SF_6 management program is tied directly to their maintenance program. SF_6 monitoring is part of the regularly scheduled maintenance and inspection protocol. When operational commitments permit, BPA Substation Maintenance crews will take leaking equipment out of service, evacuate gas, put the vessel under vacuum, and perform leak tests to diagnose and make repairs. By closely monitoring SF_6 usage through their network tracking program, BPA is able to identify those equipment that are losing large amounts of SF_6. These maintenance and repair operations on existing equipment have reduced leaks by **585 lbs**.

In order to minimize leaks, BPA has also contracted outside services for SF_6 laser leak detection. Through this service leaks that are difficult to locate by conventional methods (e.g., gas sniffers, soaping) can be detected. For example, a leak in the casting of a circuit breaker, that may otherwise have gone undetected, was identified and repaired. BPA will continue to use these services for difficult leak detection.

TRAINING FOR PERSONNEL

BPA offers training in "SF_6 Theory and Application," in conjunction with training on "Operating SF_6 Gas Handling Carts." New substation maintenance electricians and apprentices are also trained in the operation of gas leak detection and gas quality test equipment.

Utilization and review of SF_6-specific Standards, Procedures, Instructions, and Information documents (SPIFs), provides personnel easy access to information covering the spectrum of SF_6 theory, monitoring, handling, filling, safety, sampling, leak rate, gas cart operation, quality

testing, arc product detection, and procedures to minimize loss. Substation field personnel have increased their diligence in monitoring SF_6 loss and they have become more proactive in using monitoring data to prioritize and schedule equipment replacement.

TECHNOLOGY AND PRODUCTS

Much of the older equipment BPA still has in service was manufactured to specifications that allow for leakage of up to 1 percent or more per year. New equipment manufacturers claim specifications that allow for only 0.5 percent or less leakage per year. BPA continues taking an active role in requiring new equipment to be below the current standard of 0.5 percent leak rate per year. With new equipment replacing the old, BPA anticipates a continued decline in leak rates in the future. Between 2000 and 2001, BPA has replaced:

- 36 circuit breakers, accounting for more than **2000 lbs**. of SF_6 lost through leakage; and
- 39 current transformers, accounting for more than **180 lbs**. of SF_6 lost through leakage.

In addition to the replacement of existing electrical equipment with models that offer lower tolerances in manufacturer listed leak rates, BPA progressively upgrades their gas handling carts and equipment. These upgrades include moving to self sealing hoses and improving the integrity of gas transfer storage and handling systems.

COST OF IMPLEMENTATION

- Leak detection and repair by field personnel are part of BPA's Corrective Maintenance Program, and thus require no additional expenses. Furthermore, BPA developed their SF_6 tracking system "in-house", and so no additional software purchase was required.

- BPA contracted "Laser Leak Detection Services" in 2001 to conduct leak detection at components that were difficult to identify using standard leak detection equipment. This service cost BPA approximately $6,000. The current rate ranges from $1,500 to $2,600 per day depending on vendor, location, and number of days required.

- The cost to outfit 25 maintenance districts with proper heavy-duty weighing scales was approximately $5,000 dollars. These scales allow the gas storage cylinders to be weighed before and after SF_6 gas is added to the equipment. The difference of the two weights provides an accurate estimate of the quantity of gas used.

- The personnel cost was approximately $10,000 dollars. These costs are associated with the weighing and reporting of SF_6 usage to a network drive, and the compilation and review of data by the SF_6 coordinator.

- *The total estimated cost of setting up and administrating the SF_6 management and tracking system was approximately **$21,000**.*

SAVINGS FROM IMPROVED SF_6 MANAGEMENT

- BPA has been able to significantly reduce expenses associated with the purchase of additional SF_6 and the man-hours required to service leaking equipment. The savings in man-hours from repairing and replacing leaking equipment identified by this program greatly exceeds the estimated $10,000 dollars spent in recording, compiling, and reviewing the SF_6 monitoring data.

- In 2001, BPA was able to reduce SF_6 loss by repair and replacement of leaking equipment by **2,765 lbs**. A conservative estimate of the price of SF_6 is approximately $9 per lb. This calculates to an SF_6 gas savings of approximately $25,000 in 2001 alone.

- *The net value savings of SF_6 gas from BPA's Monitoring Program, based on the repair and replacement of leaking equipment in 2001, was approximately* ***$14,000.***

CONCLUSION

Being a Federal Agency, BPA prides itself in being an industry leader in the reduction of greenhouse gasses, and has set a target to maintain a system-wide SF_6 leak rate of less than 1 percent. BPA strives to demonstrate environmental stewardship while continuing to perform the service of providing energy to their customers. In 2001, SF_6 loss from leaking equipment was reduced by 2,765 lbs. This improvement represents a 62 percent reduction compared to their previous emissions report and one of the largest percentage improvements of any partner in the SF_6 Emissions Reduction Partnership for Electric Power Systems.

PARTNER CASE STUDY 2: CONSOLIDATED EDISON COMPANY OF NEW YORK, INC. (CON EDISON)

Con Edison serves 3.1 million customers in the state of New York. As a dedicated partner in the SF_6 Emissions Reductions Partnership, Con Edison is committed to taking a leadership role in working with the EPA to develop better ways to protect the environment from SF_6 gas. The company is emerging as an environmental leader in the industry while also experiencing financial savings through the implementation of an aggressive SF_6 management program.

SF_6 MANAGEMENT AND TRAINING FOR PERSONNEL

Con Edison has developed an "on the job" training session for personnel to understand the characteristics of SF_6 gas, its function within the electric power systems, and the proper handling and safety precautions associated with using the gas. The company's Substations Operations group has also instituted an SF_6 Maintenance Management Program, where all purchases of SF_6 cylinders are inventoried, identified, weighed, and leak checked by the vendor. "Empty" cylinders are returned to the vendor where they are weighed to determine the amount of gas used and the amount of gas remaining in the cylinder. The vendor recycles any remaining gas and Con Edison receives a credit for the unused gas. The vendor creates a log of these activities and provides reports to Con Edison, in order to establish trends.

TECHNOLOGY AND PRODUCTS

To aid Con Edison's SF_6 management activities, the EPRI GasVue camera is used to identify gas leaks in substation equipment. With this laser-imaging camera, the utility detects even minor leaks without taking equipment out of service and incurring hefty downtime costs. As a result of locating leaks more quickly and accurately, Con Edison reduces purchases of SF_6 gas.

SAVINGS FROM IMPROVED SF_6 MANAGEMENT

Through the use of the GasVue camera, Con Edison has been able to benefit through significant financial savings. The use of the laser imaging camera and subsequent repairs are estimated to reduce SF_6 usage by 500 cylinders or 57,500 pounds, the utility realizes a savings of $517,500 per year, where the cost of the gas is assumed to be $9 per pound.

CONCLUSION

Con Edison has set a goal of reducing SF_6 emissions annually by using five percent fewer SF_6 cylinders than were used in 1996 (their baseline year). By 2001, the utility met and greatly exceeded their goal by reducing SF_6 emissions by approximately 29 percent since 1996. Con Edison explains that the most valuable effort in reaching this goal has been through the establishment of an aggressive plan on how to manage SF_6 gas. The company has clearly demonstrated that a proactive approach to reducing SF_6 emissions to the atmosphere is feasible and effective, and that such an approach provides benefits for both the company and the environment at large.

PARTNER CASE STUDY 3: EL PASO ELECTRIC COMPANY

El Paso Electric Co. represents another success story of the SF_6 Emissions Reduction Partnership through their acknowledged efforts to protect the global climate. The company serves both Texas and New Mexico, providing electricity to 309,221 customers in 2001. El Paso Electric Co. has taken substantial strides in improving the management of SF_6 gas used in equipment operation and for maintenance of breakers at their substations.

SF_6 MANAGEMENT AND TRAINING FOR PERSONNEL

El Paso Electric Co. contracted Environmental Services to develop their SF_6 management plan, and to evaluate processes that enhance SF_6 handling procedures for their distribution area. In 2002, El Paso Electric Co. initiated the first yearly SF_6 training program for substation crews.

TECHNOLOGY AND PRODUCTS

In order to facilitate SF_6 management activities, El Paso Electric contracted Equipment Imaging and Solutions, Inc. to perform leak detection activities. State of the art laser detection systems were used to locate the origin of SF_6 emissions. This inspection was performed to assist El Paso Electric on focusing their maintenance efforts towards actual leaking areas.

COST OF IMPLEMENTATION AND SAVINGS FROM IMPROVED SF_6 MANAGEMENT

The leak detection survey cost El Paso Electric Co. a total of $23,000 dollars. This cost includes the cost of service, equipment, and software used to implement the SF_6 management system.

El Paso Electric Co. estimates that approximately $27,000 dollars in 2000 and $22,000 dollars in 2001 were saved through improved SF_6 management. By reducing the need for purchasing SF_6 gas for operation and maintenance of breakers at substations, El Paso has reaped a significant financial benefit as a result of reducing SF_6 leakage.

CONCLUSION

El Paso Electric met their goal of reducing SF_6 emissions by ten percent over the past two years. Their current target is to reduce emissions by a further five percent. The company recognizes the assistance of substation crews and support from their administrative supervisors as the largest key to their success in reducing SF_6 emissions from El Paso Electric's operations. Overall, El Paso Electric Co. resides as one of the largest companies in the city of El Paso. Their contribution towards improving the environment serves as a huge success for their local community. El Paso Electric Co. is at the forefront of environmental leadership not only in their local community but also within the industry as their efforts greatly contribute to the progress made by the SF_6 Emissions Reductions Partnership in reducing the release of SF_6 into the atmosphere.

APPENDIX A: ANALYZING EMISSIONS OF SF_6 GAS

In order to compare the ability of SF_6 to trap heat in the atmosphere relative to another gas, the concept of Global Warming Potential (GWP) is employed that uses carbon dioxide (CO_2) as the reference gas for comparison. The GWP of a greenhouse gas is the ratio of global warming from one unit mass of greenhouse gas to that of one unit mass of CO_2 over a period of time. The 100-year GWP is the standard time period used for estimating emissions of greenhouse gases in the United States.[6] GWP weighted emissions of SF_6 are expressed in terms of equivalent emissions of carbon dioxide (CO_2), using units of million metric tonnes of carbon dioxide equivalents ($MMTCO_2E$). The following three steps illustrate the process by which pounds of SF_6 gas is converted into $MMTCO_2E$.

1. First, convert from pounds of SF_6 gas to pounds of CO_2 equivalent, where the GWP of SF_6 equals 23,900:

$$X\ lbs\ of\ SF_6 \times \frac{23{,}900\ CO_2}{SF_6} = Y\ lbs\ CO_2E$$

For example, the CO_2E of 56,207 lbs of SF_6 is:

$$56{,}207\ lbs\ of\ SF_6 \times \frac{23{,}900\ CO_2}{SF_6} = 1{,}343{,}347\ lbs\ CO_2E$$

2. Convert lbs. of CO_2E into metric tonnes of carbon dioxide equivalent ($MTCO_2E$):

$$Y\ lbs\ of\ CO_2E \times \frac{1\ kg}{2.205\ lbs} \times \frac{1\ Metric\ Tonne}{1{,}000\ kg} = Z\ Metric\ Tonnes\ CO_2E$$

For example, the metric tonnes CO_2E of 1,343,346 lbs CO_2E is:

$$1{,}343{,}347\ lbs\ of\ CO_2E \times \frac{1\ kg}{2.205\ lbs} \times \frac{1\ Metric\ Tonne}{1{,}000\ kg} = 609.23\ Metric\ Tonnes\ of\ CO_2E$$

3. Lastly, SF_6 emissions are expressed in million metric tonnes of CO_2E ($MMTCO_2E$) by dividing metric tonnes of CO_2E by one million.

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[6] EPA, 2002. *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2000*. Office of Atmospheric Programs, U.S. Environmental Protection Agency, Washington, DC. (Available on the Internet at http://www.epa.gov/globalwarming/emissions/national/download.html).

APPENDIX B: EXISTING PARTNERS AS OF JULY, 2002

The SF_6 Emissions Reduction Partnership for Electric Power Systems currently consists of 65 electric utility companies[a]:

Allegheny Power (Greensburg, PA)
American Electric Power (Columbus, OH)
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)
Central Maine Power Company (Augusta, ME)
Central Vermont Public Service Corporation (Rutland, VT)
Cinergy Power Generation Services Inc., (on behalf of The Cincinnati Gas & Electric Company and PSI Energy, Inc.), (Cincinnati, OH)
City of Monroe (Monroe, NC)
Columbia River People's Utility District (St. Helens, OR)
Commonwealth Edison (Chicago, IL)
Commonwealth Electric (Wareham, MA)
Connecticut Light and Power Company (Northeast Utilities) (Berlin, CT)
Consolidated Edison Company of New York, Inc. (New York, NY)
Crisp County Power Commission (Cordele, GA)
Duquesne Light Company (Pittsburgh, PA)
Edison International (Rosemead, CA)
El Paso Electric Company (El Paso, TX)
Eugene Water & Electric Board (Eugene, OR)
FirstEnergy Corporation (Akron, OH)
Florida Power & Light Company (Juno Beach, FL)
Fort Pierce Utilities Authority (Fort Pierce, FL)
GPU Energy (Reading, PA)
Grand Island Utilities Department (Grand Island, NE)
Hastings Utilities (Hastings, NE)
Kings River Conservation District (Fresno, CA)
Lower Colorado River Authority (Austin, TX)
Maine Public Service Company (Presque Isle, ME)
Manitowoc Public Utilities (Manitowoc, WI)
Memphis Light, Gas & Water Division (Memphis, TN)
Menasha Electric and Water Utilities (Menasha, WI)
Montana Power Company (Butte, MT)
Muscatine Power & Water (Muscatine, IA)
Nashville Electric Service (Nashville, TN)
Nebraska Public Power District (Doniphan, NE)
New York Power Authority (New York, NY)
Niagara Mohawk Power Corp (Syracuse, NY)

North Atlantic Energy Service Corporation (Seabrook, NH)
Northeast Utilities Services Company (Hartford, CT)
Northern Indiana Public Service Company (NIPSCO) (Merriville, IN)
Oklahoma Gas and Electric Co (OG&E) (Oklahoma City, OK)
Pacific Gas and Electric Co (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)
Public Service Company of New Hampshire (Northeast Utilities) (Manchester, CT)
Reliant Energy HL & P (Houston, TX)
Rochester Gas and Electric Corp (Rochester, NY)
Salt River Project Power District (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)
Southwestern Electric Power Company (Shreveport, LA)
Tennessee Valley Authority (Knoxville, TN)
Texas Municipal Power Agency (Bryan, TX)
TXU (Dallas, TX)
Village of Prairie du Sac (Prairie du Sac, WI)
Wallingford Electric Division (Wallingford, CT)
Wellton-Mohawk Irrigation & Drainage Dist (Wellton, AZ)
West Texas Utilities Co (Abilene, TX)
Western Massachusetts Electric Company (Northeast Utilities) (West Springfield, MA)
Wisconsin Electric Power Co (Milwaukee, WI)

[a]The 37 partners identified in bold have established emissions reduction goals.