



Reducing SF₆ Emissions Means Better Business for Utilities

PG&E Case Study

Pacific Gas and Electric Company (PG&E) serves an area of 70,000 square miles in central and northern California. With a workforce of 21,800 people, PG&E provides gas and electric services for approximately one of every 20 Americans. In 2002, the Company met their goal to reduce their 1998 baseline emissions of sulfur hexafluoride (SF₆) by half. SF₆ is a gaseous dielectric used by electric utilities primarily in high voltage circuit breakers and gas-insulated substations. When released to the atmosphere, SF₆ is a highly potent and persistent greenhouse gas that contributes to global climate change. The experience of PG&E can help other utilities in meeting their environmental and operational goals through cost-effective solutions to reduce SF₆ loss.

The SF₆ Emission Reduction Partnership for Electric Power Systems is a voluntary program between the Environmental Protection Agency (EPA) and electric power companies. Its goal is to identify and implement cost-effective operational and technical solutions to reduce SF₆ emissions. By reducing SF₆ emissions where feasible, the electric power industry can play a key role in addressing climate change. This Partnership is one of several EPA voluntary programs working with specific industries that emit potent greenhouse gases.

Benefits of Reducing SF₆ Gas Loss and Joining the SF₆ Partnership

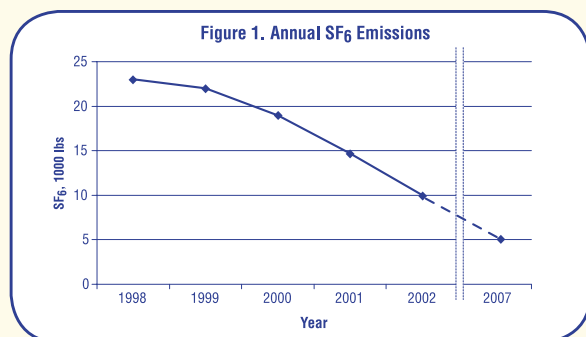
Pacific Gas and Electric Company chose to join the Partnership for three reasons:

- to respond to the issue of climate change;
- to learn SF₆ management and emission reduction techniques from other utilities; and
- to manage the escalating cost of SF₆ gas purchases.

Participation in the Partnership has led to a productive dialog between PG&E, the EPA and other utility partners, with benefits for all. For example, at EPA's 2002 SF₆ Conference, PG&E not only presented its successes to other utility partners and potential partners but also learned of an innovative new method for draining low pound/pressure SF₆-containing equipment such as circuit switches. The Company is currently investigating this new technique.

Company Achievements

In 1999, PG&E set a three-year goal of reducing annual SF₆ emissions by 50 percent from a 1998 baseline. The Company achieved this goal by implementing several key policies and procedures resulting in more efficient and cost-effective use of SF₆. The savings in avoided gas purchases totaled about \$400,000; the cost to implement the policies and procedures totaled about \$100,000 (and yielded a net savings of \$300,000).



In 2002, PG&E had one of the lowest SF₆ gas loss rates of all large partners, at 4 percent. The Company has set a second goal of reducing annual SF₆ emissions by 60 percent by 2007, compared to the 1998 baseline.

Key Policies and Procedures

Pacific Gas and Electric Company's success in reducing SF₆ emissions results from five key actions:

- **Corporate Support.** PG&E senior managers played a key role in initiating and sustaining progress in reducing SF₆ emissions. In 2003, corporate officials recognized members of the SF₆ Emission Reduction Team for their contribution to environmental protection. As an early Partner, PG&E participated in discussions with EPA and other industry representatives to develop the SF₆ Partnership.
- **Getting the Right Mix of People.** To meet its emission reduction target, PG&E established a team from its Electric Transmission and Environmental Affairs departments. Environmental Affairs and Electric Transmission staff collaborated in developing an SF₆ handling policy, while the Transmission department educated field employees and implemented the newly developed SF₆ policy and procedures.
- **SF₆ Handling Procedures.** The Company had a corporate environmental policy prior to joining the Partnership, but new SF₆-specific handling procedures were created to address issues such as transfers of SF₆ gas from cylinders, evacuation of SF₆ from circuit breakers, and leak detection procedures. These procedures provided additional guidance to field personnel.
- **Controlling SF₆ Purchases.** PG&E selected a single full-service vendor to replace multiple SF₆ suppliers, with the understanding that the Company and vendor



would work together in achieving the goal of tracking all SF₆ transactions and compiling an accurate SF₆ inventory. The vendor supplies SF₆, removes SF₆ for recycling off-site, conducts an annual SF₆ cylinder inventory and coordinates leak detection activities with a subcontractor. As a result, SF₆ costs are no longer hidden at the local facility level. Separating SF₆ purchases, inventory and recycling from other compressed gas purchases has allowed for better tracking of SF₆ usage. In addition, PG&E is able to purchase its own recycled SF₆ at a reduced cost.

- **Improved Leak Detection and Mitigation Measures.** PG&E's leak detection strategy involves tracking "topping off" events logged for circuit breakers. When a leaking breaker is identified, the Company first attempts to find the leak by spraying the breaker with a soap and water solution or by using a hand-held halogen gas detector. If these efforts fail to locate the leak, or if the equipment must be kept energized, a laser camera is used. PG&E's original SF₆ leak detection policy was to survey all SF₆ equipment with the laser camera. This policy was revised based on the realization that leaks could be more readily identified by whether or not the equipment required topping off. As a result, more selective use of the camera has reduced the originally estimated costs for the program and enabled the Company to focus on a smaller population of breakers. With increased awareness of SF₆ issues, field personnel also identified leaks in equipment that were previously overlooked, such as gas carts and gauges.

Before undertaking these leak detection and mitigation measures, the Company was losing roughly 20,000 to 30,000 pounds of SF₆ per year. Now the loss rate is down to about 11,000 pounds per year (approximately 4 percent of the Company's total nameplate capacity).

Additional Benefits

- **More Money Saved in the Future.** PG&E estimates that it can save an additional \$50,000 to \$100,000 annually over the next 10 years through improved SF₆ handling. These savings assume continuation of the aggressive leak mitigation measures, replacement of older SF₆-filled circuit breakers, SF₆ recycling and inventory reductions and extended warranties from equipment manufacturers.
- **Eliminated Cylinder Rental Fees and Cleaned Up Maintenance Yards.** Previously, a limited sense of "ownership" for stored SF₆ cylinders existed at substation maintenance yards. This led to occasional failures in returning leased cylinders, which then incurred unnecessary rental fees and cluttered the gas storage areas. Now (through tight inventory control), old cylinders have been removed, new cylinders are closely tracked and rental fees have been eliminated.



- **Reduced Maintenance.** Facility operators like getting rid of old leaky breakers, as it reduces maintenance demands, improves equipment reliability and allows crews to focus on higher priority activities.
- **Improved Safety.** Filling (topping off) breakers less frequently also improves worker safety, since operators have to handle the 250-pound cylinders less often, thus reducing the risk of injury.
- **SF₆ Management Linked to Other Environmental Concerns.** PG&E is a charter member of California's Climate Action Registry and is on its Technical Advisory Committee. The SF₆ emission reduction strategy is one component of the Company's overall climate protection program.



Pacific Gas and Electric Company's SF₆ program has been a "win-win" situation, resulting in less SF₆ usage, lower emissions of a potent greenhouse gas and cost savings for the company and its ratepayers. Management is convinced of the value of the program's cost-effectiveness and the operating staff appreciate the reduced workloads gained from implementing more efficient practices. Electric utility efforts such as those undertaken by PG&E in reducing SF₆ emissions can help create a better environment for the customers they serve.

Leaks = Lost Money

More Leaks Than You Think. Efforts to reduce SF₆ emissions at PG&E resulted in discovering that more equipment was leaking than was previously thought. Such leaks mean that more money was spent to purchase additional SF₆ gas. The improved leak detection program, including use of a laser camera to identify leaks, more than paid for itself through cost savings gained by leak reductions.

Tracking SF₆ Usage Saves Money. By tracking actual SF₆ used, the Company was able to identify numerous areas where SF₆ purchases could be reduced, such as purchasing its own recycled gas at a reduced rate and eliminating cylinder rental fees. The Company now recycles at least 90 percent of its SF₆ gas from decommissioned equipment. Reduced SF₆ loss has led to fewer purchases of SF₆ and resulted in significant cost savings.

For more information on the SF₆ Partnership go to:

Office of Atmospheric Programs
www.epa.gov/electricpower-sf6

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