

## **New Frontiers in Climate Action: ODS Projects Expanding Carbon Markets & Innovating Environmental Performance**

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### **Summary**

The Montreal Protocol on Substances that Deplete the Ozone Layer is a model for how governments, businesses, and the public around the world can come together to address an urgent environmental problem. Ratified by 195 countries, the Montreal Protocol has reduced production of chlorofluorocarbons (CFCs) and other ozone depleting substances (ODS) by 98% from historic baseline levels. This has put the earth's protective ozone layer on a path to recovery by the end of the 21<sup>st</sup> century.

CFCs and other ODS are also powerful global warming gases, up to 11,000 times more potent than carbon dioxide (CO<sub>2</sub>). In addition to protecting the ozone layer, Montreal Protocol production phase-outs also bought the global community "breathing room" in the fight against climate change, preventing the equivalent of 135 billion tons of CO<sub>2</sub> emissions since 1990. This amount is estimated to exceed the Kyoto Protocol's initial targets by a factor of nine.<sup>1</sup>

Despite the Protocol's success, a large amount of ODS -- produced prior to their production phase-out deadlines -- remain in equipment, products, building infrastructure, and other inventories. These "banks" pose a threat not only to the ozone layer but to the climate system as well. Large quantities of these ODS banks are rapidly being released to the atmosphere. Absent proper incentives for recovery and destruction, all of the ODS banks, estimated to approach the equivalent of 16-18 billion tons of CO<sub>2</sub> (CO<sub>2</sub>eq), will eventually be emitted, effectively cancelling out other climate protection efforts taking place around the world.

Beginning in 2007, a concerted effort launched around creation of market-based incentives to prevent emissions of these ODS banks. These developments open the door to ODS projects playing an important role in compliance-grade offsets in California under AB 32, as well as voluntary offsets in the U.S. and internationally.

This paper summarizes these efforts, and how a combination of innovative government policy, technologies, and finance are mobilizing to address the problem and preserve the legacy of the Montreal Protocol. Key recommendations and future forecasts are also included.

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<sup>1</sup> Velders, G.J.M., et al (2007) Proceedings of National Academy of Sciences 104:4814.

## Ozone Depleting Substances: A Long Term Climate Threat with a Near Term Solution

Figure 1 compares the global warming potentials of two common CFCs, relative to CO<sub>2</sub>. A large quantity of these (and other) CFCs produced prior to their phase-out deadlines remain in older refrigeration and air conditioning equipment and in insulation foam in

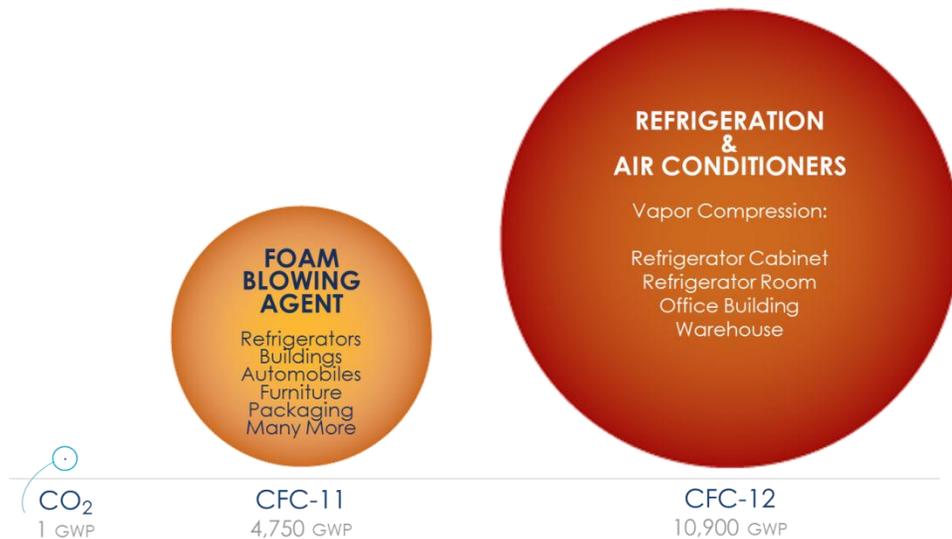


Figure 1. Scaled representation of the global warming potentials of CO<sub>2</sub> and two common CFCs.

buildings and appliances. Current global banks of ODS, not yet emitted into the atmosphere, are estimated to represent 16 to 18 *billion tons* of CO<sub>2</sub><sup>2</sup>-equivalent. To give a sense of scale, this volume of unreleased gas is comparable to 3 times the total annual GHG emissions of the United States. Unless properly collected and destroyed, gases from these banks will eventually find their way into the atmosphere, cancelling out all of the intended GHG reductions under the Kyoto Protocol's first commitment period.

### Regulatory Mandates: Practical and Cost Constraints

While the Montreal Protocol eliminated production of ODS chemicals, it does not control their emissions or require destruction of ODS prior to phase-out deadlines. Neither does the Kyoto Protocol, which targets emissions of CO<sub>2</sub> and other non-ODS greenhouse gases. The Montreal Protocol stops at ODS production, and accepted that all of the ODS produced prior to the phase-out deadlines would ultimately be emitted. Individual countries have imposed different types of controls on ODS emissions during use and end-of-life. For example, many countries, including the U.S., prohibit intentional venting, and require safe handling and recycling of ODS refrigerants.

<sup>2</sup> Intergovernmental Panel on Climate Change, *IPCC/TEAP Special Report, Safeguarding the Ozone Layer and the Global Climate System* (IPCC, Geneva, 2005).

Other industrialized countries prohibit reuse of CFCs once recovered from equipment. While an attractive option on paper, continued demand for recycled CFCs to service older equipment make these prohibitions difficult to enforce, absent a strong financial incentive. Explicit mandates to collect and destroy CFCs and halons create liabilities for tens of thousands of equipment and facility owners, and have been difficult - if not impossible - to enforce.

A Montreal Protocol Task Force has examined several approaches to address ODS banks in developing countries, including financial grants. They estimate that collection and destruction of the reachable ODS banks would cost between \$62 billion and \$180 billion. To put this into context, from 1990 to 2010 the Montreal Protocol Multilateral Fund has provided \$3 billion to assist developing countries comply with Protocol phase-out requirements. Clearly the additional ODS task of collection and destruction would present the Fund with an enormous financial challenge.

### Acceptance by Greenhouse Gas Markets

In contrast to regulatory mandates and direct government intervention, there is growing recognition that market-based incentives for collection and destruction of ODS banks can provide a viable, cost-effective solution. These incentives are becoming a reality now that adopted standards and protocols certify verified ODS destruction as a greenhouse gas reduction for emerging markets. Figure 2 compares the business as usual scenario, where ODS is reclaimed from old equipment, purified, and then returned for reuse in old cooling equipment, to the permanent destruction, whereby the ODS is aggregated, purified, destroyed, all paid for by the sale of the emission reduction generated.

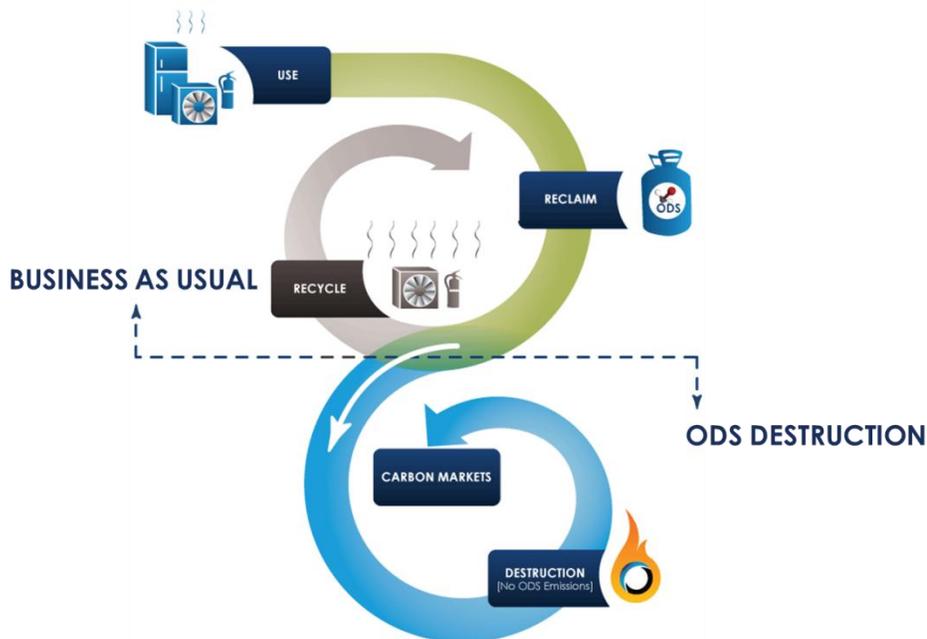


Figure 2. Comparison of business as usual or diversion to permanent destruction.

In 2007, the Chicago Climate Exchange was the first organization to adopt a protocol quantifying and certifying destruction of phased-out ODS. In 2010, following working group and public review, the Climate Action Reserve (CAR) adopted a more detailed and comprehensive set of protocols for generating GHG reduction credits from verified destruction of ODS.<sup>3</sup> CAR has adopted two separate but related protocols. The first is for ODS that originates in the U.S. and is destroyed in the U.S. The second is for ODS that originates in Article 5 countries<sup>4</sup>, and is imported for destruction in the U.S. These protocols, and the original one by EOS Climate and submitted to CAR in 2008, conform to greenhouse gas standards under ISO 14064-2.<sup>5</sup> In 2010, the Voluntary Carbon Standard, recently re-named the Verified Carbon Standard, also incorporated an ODS destruction program by establishing eligibility criteria for individual projects.

Voluntary carbon markets have played a critical role in spurring development of protocols, verification systems, infrastructure and financing. The CCX's ODS destruction protocol led to a total of 787,000 mt of CO<sub>2</sub> emission reductions being generated over three years (2007-2009). When the value of the CCX's emission reduction unit (CFI) collapsed the ODS destruction ceased, showing directly how critical the financial incentive, in this case price on carbon, is to ensure ODS is diverted to destruction as opposed to being released through reuse.

Policymakers, environmental NGOs, and the GHG markets have embraced the Climate Action Reserve protocol for U.S. domestic project. In the 12 months since adoption of the protocol (2010-2011), the Climate Action Reserve issued more than 1.4 million Climate Reserve Tons (CRTs) for U.S. domestic projects. These projects will continue in the coming months and years, as they intervene in the business-as-usual cycle of recycling CFCs back into older equipment and eventual release into the atmosphere.<sup>6</sup>

Similar projects are expected under the CAR "Article 5" protocol, where used CFC refrigerants are collected from equipment and other banks in developing countries and then destroyed in the U.S. In 2011, Parties to the Montreal Protocol began supporting pilot projects examining how voluntary carbon markets could provide financing to collect and destroy ODS inventories in several developing countries.

The problem remains that the size of global ODS banks far exceeds the capacity of voluntary carbon markets alone to create enough incentive.<sup>7</sup> To adequately address the

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<sup>3</sup> <http://www.climateactionreserve.org/how/protocols/adopted/ods/current/>

<sup>4</sup> Article 5 countries are defined under the Montreal Protocol as a developing country and whose annual calculated level of consumption of CFCs and Halons is less than 0.3 kilograms per capita. Article 5 countries are allowed to delay implementation of control provisions and may receive assistance under the Multilateral Fund. Over 120 countries hold Article 5 status.

<sup>5</sup> In 2010, the Voluntary Carbon Standard, recently re-named the Verified Carbon Standard, also incorporated an ODS destruction program by establishing eligibility criteria for individual projects.

<sup>6</sup> An additional 2.5 million CRTs have been issued by CAR for projects under the "Article 5" protocol where virgin (never used) CFCs were imported from developing countries and destroyed in the U.S. These projects are no longer eligible under the CAR Article 5 protocol.

<sup>7</sup> Cohen, J., Rau, A., Bruning, K. (2009) *Bridging the Montreal-Kyoto Gap*, Science, 326(940-941).

problem, ODS destruction credits must be included in state, regional, or national GHG compliance programs.

### **California Steps into the Lead**

In the fall of 2010, California became the first government body in the world to recognize ODS destruction as a compliance “offset” under a mandatory GHG program. Under its AB 32 legislation, a range of regulations and market mechanisms will take effect on January 1, 2012, designed to bring the state’s greenhouse gas emissions back to 1990 levels by 2020. The state will reach these targets through a mix of new fuel economy/fuel content and energy efficiency standards, renewable energy incentives, direct controls on specific industrial sources, land use planning, and a cap and trade system.

The cap and trade system will allow regulated entities -- primarily electric utilities, energy companies, and other major emission sources -- flexibility to reduce emissions through their own internal actions, or through purchase of surplus emission permits from other regulated entities (able to achieve additional reductions), or through the purchase of a limited number of offset credits from sources outside the cap coverage.

With primary responsibility for the AB 32 program, California’s Air Resources Board (ARB) regulations allow four types of offsets: forest protection/avoided deforestation in California urban areas and across the U.S., livestock manure digestion and destruction of ODS that originates in the U.S.

### **Supply of ODS Destruction Credits for AB 32 and Other Potential Compliance Markets in North America**

California ARB projects that ODS destruction will deliver a significant percentage of the total offsets projected to be needed in California between 2012 and 2020, or over 200 million metric tons of CO<sub>2</sub>e. The demand for compliance offsets could expand outside California as the AB 32 program is integrated into the Western Climate Initiative, including several Canadian provinces and Western U.S. states. After 2014, possible linkage to the Regional Greenhouse Gas Initiative (RGGI) might also increase demand for high quality verified offsets, like CRTs delivered through ODS destruction.

There has been some debate about whether or not there will be sufficient supply of ODS destruction credits. The answer will depend on whether demand for the credits keeps pace with increasing project costs, as well as other factors:

- Continued competition for recycled CFC refrigerants in servicing older equipment will drive up prices.
- Costs for extraction/aggregation of CFCs will increase for less accessible sources, e.g., insulation foam.

- Costs of ODS destruction will continue to rise as demand for current capacity increases.
- At scale, project implementation meeting CAR's specifications will require significant infrastructure and operational expertise.
- Finally the ODS eligible under the CAR protocols are converted to CRTs at different ratios, depending upon their GWP and the avoided emissions based upon typical use. At low carbon prices only the ODS with a significant multiplier effect, such as CFC-12, will be aggregated and destroyed. As the carbon price increases the economic driver will increase the volume of ODS diverted from recirculation to destruction. Figure 3 shows the four ODS, eligible for destruction under the current CAR protocol, and plots their ozone depleting potential against their GWP. The size of the circle represents the equivalent number of metric tonnes CO2 avoided under the CAR Protocol for domestic ODS. For example one pound of CFC-11 destroyed will avoid approximately 1.8 mt CO2e.

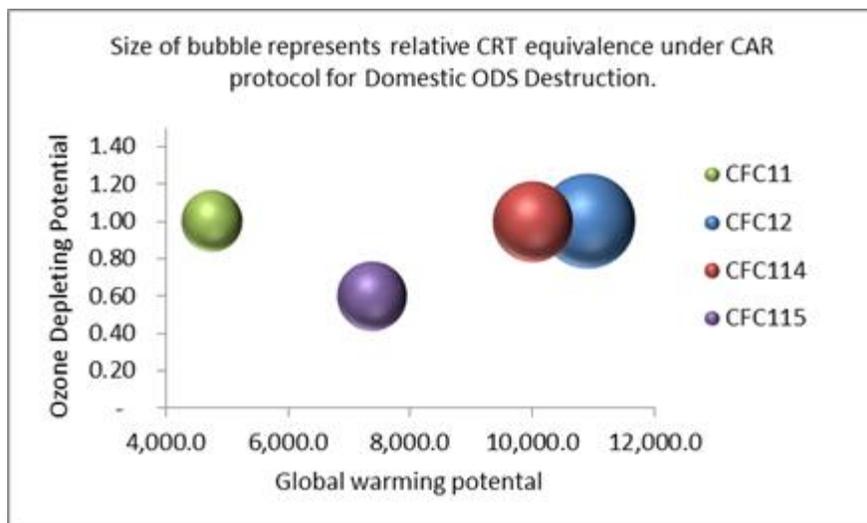


Figure 3. Comparison of CRT equivalence, ozone depleting potential and global warming potential for all eligible ODS from domestic sources.

### Beyond North America, Beyond 2012

The year 2012 will mark a turning point in how the world's environmental, policy and industry communities addresses ODS banks. In January 2012, California's AB 32 is scheduled to take effect, becoming the first government regulatory program recognizing destruction of ODS as eligible for compliance offsets. California's leadership will have important, short-term impacts in the U.S., and will also help demonstrate to international policymakers that it is possible, and feasible, to leverage carbon financing in the race to manage ODS banks.

The end of 2012 will also mark the end of the first compliance period for the Kyoto Protocol. The original Protocol, and by extension, the Clean Development Mechanism

(CDM), excludes ODS. New GHG commitments – national, regional, or bilateral - may emerge to replace Kyoto. In close coordination with the Montreal Protocol, any of these programs has the potential to follow California's lead, and establish standards to include additional, permanent, verified ODS destruction as an eligible GHG reduction.

A comprehensive, systematic approach to dealing with ODS banks internationally, coupled with incentives (via leveraged private capital from carbon markets,) together would help establish a relatively rapid, readily verifiable, and cost effective path towards additional greenhouse emissions on the scale of CDM. According to the TEAP Task Force, the cost to separate, collect, and destroy "reachable" sources would range between US\$15 and above \$35 per ton of CO<sub>2</sub>e (e.g., refrigeration and air conditioning equipment in urban and sparsely populated areas, respectively).<sup>8</sup> These costs are comparable to, and for the low effort sources, below the cost of abatement, for the majority of greenhouse gas reduction measures<sup>9</sup>, as well as prices of emissions permits under the European Union Emissions Trading Scheme.<sup>10</sup>

### **Benefits Relative to Other Credit Types**

Amid increasingly selective GHG markets, ODS destruction credits offer both compliance and voluntary buyers a number of benefits that in many ways exceed criteria for other types of offsets. Here is a breakdown of several benefits:

#### Real Reductions/Clear Additionality

- Under business as usual, ODS that are destroyed would have been emitted to the atmosphere relatively rapidly, either through intentional venting, or through recycling/reuse to recharge older, leaky equipment.
- There are no CFC or other ODS destruction requirements in the U.S. (or in developing countries).
- ODS are destroyed at facilities that meet a minimum 99.99% destruction efficiency.

#### Immediate and Permanent Reductions

- Only CFC refrigerants completely phased out of production worldwide are eligible under CAR's protocol. Destroyed CFCs cannot be replaced with new production, therefore eliminating concern about "perverse incentives."

#### Predictability and Timeliness

- ODS projects offer clear predictability; the volume of eligible ODS available for destruction defines the quantity of GHG emission reductions created. There is no guesswork or speculation as to the credit yield, i.e. a defined (project) input creates a defined (project) output.

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<sup>8</sup> UNEP Technology and Economic Assessment Panel, Task Force Decision XX/7, *Environmentally Sound Management of Ozone-Depleting Substances*, (June 2009).

<sup>9</sup> "Pathways to a Low-Carbon Economy: Version 2 of the global greenhouse gas abatement cost curve", McKinsey & Company (January 2009).

<sup>10</sup> In 2010 the weighted-average price per tonne of CO<sub>2</sub>e on the EU ETS was €13.99 per tonne (approx. \$20), <http://www.pointcarbon.com>

- Qualified project developers with operational expertise can complete projects in as little as 3 to 6 months. This short turnaround time allows for fast delivery of credits to GHG markets, relative to other types with longer lead-times.

#### Verifiability and Transparency

- ODS protocols require extensive, chain of custody monitoring and documentation, from origin to destruction.
- Projects are verified by certified 3<sup>rd</sup> parties, and are subject to California Air Resources Board audits.

#### Enforceability

- Each step in a project -- including ODS extraction/recovery, transport, processing/purification, lab analysis and destruction, is subject to rigorous regulatory and/or permitting controls. Applicable laws/authorities include the U.S. Clean Air Act, Resource Conservation and Recovery Act, the U.S. Department of Transportation, and -- for imported material -- U.S. Customs Service.

#### Low Risk

- Verified ODS destruction projects conforming to the protocol have negligible risk of reversal by regulating agency/registry. Each step is readily monitored, data recorded and kept, and all the techniques used are well established and understood.

#### Added Co-Benefits

- By permanently dealing with ODS near or at end-of-life, these projects help to prevent additional damage to the Earth's stratospheric ozone layer, which has important health benefits: reduction in skin cancers and cataracts.
- In addition to the direct emissions reductions benefits, ODS project incentives are helping to accelerate the transition to more advanced, energy efficient, climate-friendly technologies.
- ODS destruction projects are helping to generate jobs in manufacturing/installation of new refrigeration and air conditioning systems, in addition to appliance de-manufacturing/recycling.

Finally, from the perspective of GHG markets, another important distinction is the difference between destruction of ODS and destruction of HFC-23. HFC-23 is a chemical by-product from manufacture of HCFC-22, a refrigerant that is still legally produced and use widely in the U.S. and elsewhere. HFC-23 can be captured at the chemical manufacturing facility and subsequently destroyed. Several HFC-23 projects under the CDM have met with lingering concern, for providing "incentives" for extra production of HCFC-22 that would not have otherwise occurred.

By contrast, destruction of used CFCs cannot trigger new CFC production under the Montreal Protocol and governing domestic regulations.

## **Recommendations**

Domestic and international climate negotiations forge a tentative path toward and beyond 2012, as carbon markets continue to evolve and expand. As these forces play out, governments, policymakers, registries and business leaders can play an important role in shaping a near term solution to a long term and very real climate threat, by incorporating these recommendations:

- 1) While carbon markets have been a positive way to deal with ODS, the size of global banks far exceeds the capacity of voluntary markets alone to create enough incentives. Government regulators and policymakers are encouraged to count banked ODS that have been phased out of production as controlled GHG, and to allow creation of GHG offsets from verified ODS destruction.
- 2) Rigorous protocols must continue so that only verified ODS extraction and destruction projects with clear additionality and transparent third party verification qualify for offsets.
- 3) Financial incentives are strongly encouraged to accelerate the development and adoption of advanced replacement technologies, avoiding substitution with other high-GWP GHGs.
- 4) Business leaders are encouraged to proactively deal with end-of-life management for refrigerants. Up-front commitments to verified, complete destruction, rather than the “cycle of recycling” will demonstrate vision, leadership, and environmental stewardship.

## **Closing**

In 1985, policymakers, academia, the media, and forward-thinking industry partners played an active role in prompting public action on ozone depletion. The answer to the challenge was the Montreal Protocol. Twenty five years later, we are faced with both a challenge and an opportunity to preserve the Protocol’s legacy, in efforts to head off climate change. Market actors, buyers, policy makers, and leading companies are already changing the picture. Will we be able to complete the circle?

## About the Authors

*Jill Abelson, an environmental consultant/writer based in San Francisco, has worked on climate change issues since 1996. She supported pioneering advocacy campaigns at the Environmental Information Center (now the National Environmental Trust) and at Greenpeace. For ten years, she was marketing/ communications director for U.S. EPA's prestigious Energy Star program. She graduated from Mount Holyoke College.*

*Jeff Cohen, SVP of Science and Policy for EOS Climate, is responsible for acceptance of ODS destruction as a greenhouse gas reduction in newly emerging GHG compliance programs. Jeff has over 25 years of national and international experience developing and implementing policies designed to protect the environment. He was among the 2008 Nobel Peace Prize honorees for his contribution to the IPCC Special Working Group on Ozone Protection and Greenhouse Gases and is included in the Montreal Protocol's "Who's Who". He holds an M.B.A. in Sustainable Management from Presidio School of Management in San Francisco, California, an M.S. in Public Health from University of North Carolina, Chapel Hill, and a B.S. in Biology from the State University of New York, Albany.*

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