



Greenhouse Gas Emissions Offsets: Programs, Protocols and Projects

This Program 201 (P201) back-pocket-insight (BPI) is the second of three BPIs designed to summarize key issues associated with electric company efforts to develop, procure, and use greenhouse gas (GHG) emissions offsets, and the role that offsets may play in the broader global goal of rapidly reducing global GHG emissions.

This second BPI provides an overview of GHG emission offset programs and project design, approval, and implementation. It highlights and describes the most common types of offset projects developed in the last fifteen years; and compares projects that *reduce* GHG emissions to projects that *remove* existing emissions from the atmosphere. This BPI is based on research recently completed as part of a supplemental project on *Exploring the Role of Greenhouse Gas Emissions Offsets to Achieve Corporate Decarbonization Goals* sponsored by Program 201 (*Energy and Environmental Policy Analysis*).¹

The [first BPI](#) describes key technical considerations and conceptual requirements for GHG offsets and provides a short overview of project monitoring and third-party verification associated with offset project implementation.

Overview of Existing GHG Offset Crediting Programs

GHG offset crediting programs typically perform three basic functions in both the compliance and voluntary carbon markets:

- (1) Establishing standards to govern program operations and protocols establishing requirements for offset project development, execution and crediting;
- (2) Evaluating proposed offset projects and overseeing validation, monitoring, reporting and verifications; and,
- (3) Operating a credit registry system to issue, transfer, retire, and cancel credits and make information on projects publicly accessible.

Regulatory markets, like the mandatory CO₂ cap-and-trade program in California, are driven by compliance with government regulations and are administered by government bodies. Several jurisdictions worldwide have established regulatory offset programs, often as part of the implementation of CO₂ cap-and-trade and carbon pricing policies.²

Voluntary carbon markets are driven by private actors acting and expending resources to offset GHG emissions on a voluntary basis, and typically are served by independent, non-governmental organizations (NGOs). Today there are several well respected,

independent GHG offset crediting programs that have been operating in the U.S. and internationally for more than a decade.³

Protocols, Project Development, and Credit Issuance

The initial step in developing a GHG offsets project is to identify an activity that can be expected to reduce, avoid, or remove GHG emissions and that is not required to be implemented by existing laws, regulations, or similar requirements.

The next step is to select an appropriate offset protocol relevant to the project's scope to be used as a foundation to *develop, validate, implement, and verify* the proposed offset project. If an approved protocol does not exist within an existing offset crediting program, an offsets project developer may need to create and obtain approval of a new project protocol.⁴

Understanding these elements is crucial for project proponents to assess their project's potential eligibility, adherence to protocol requirements, and the eventual issuance of credits. GHG offset programs establish standards and guidelines that specify in detail how new protocols can be developed and approved, as well as the substantive requirements all protocols must incorporate.

The overall process to develop a GHG offset project is shown in Figure 1. The planning phase begins with project *validation and registration*. During registration, project proponents create a detailed project description, engage in stakeholder consultations, and undergo project validation by an independent auditor to determine if the proposed project meets the eligibility criteria established by the GHG program and specific offsets protocol.

During project implementation, a project is monitored and verified to determine if the project has been executed consistent with its validated project description. The outcome of project verification determines how many offset credits may be issued.

Credit issuance is the last step and occurs only after successful verification of emissions reductions and a positive verification report has been reviewed and approved by the program administrator.

Offset credits, each representing one tonne of CO₂ equivalent (tCO₂e) of emissions reductions, are issued for the verified reductions achieved during the reporting period(s). Generally, credit issuance is considered final. In rare cases, programs may revoke or invalidate credits if monitoring data errors or misrepresentations are discovered after issuance.⁵

¹ *Exploring the Role of Greenhouse Gas Emissions Offsets to Achieve Corporate Decarbonization Goals: A Compendium of Technical Briefing Papers and Frequently Asked Questions*. EPRI, Palo Alto, CA: 2022. 3002025723. <https://www.epri.com/research/products/000000003002025723>.

² In North America, these include programs in California, Washington state and the 9 states that comprise the Regional Greenhouse Gas Initiative in the U.S., and existing Canadian programs operating in Quebec, Alberta, and British Columbia.

³ These include the American Carbon Registry (ACR), Climate Action Reserve (CAR), Gold Standard (GS), and Verified Carbon Standard (VCS). Each of these programs has unique origins and has evolved to serve different market segments.

⁴ For example, see *Developing Greenhouse Gas Emissions Offsets by Reducing Nitrous Oxide (N₂O) Emissions in Agricultural Crop Production: Experience Validating a New GHG Offset Protocol*, EPRI, Palo Alto, CA 2013. 1023669. <https://www.epri.com/research/products/00000000001023669>.

⁵ This differs from situations where emissions reductions or removals are *reversed*, such as when carbon stored in a forest is released due to wildfire.

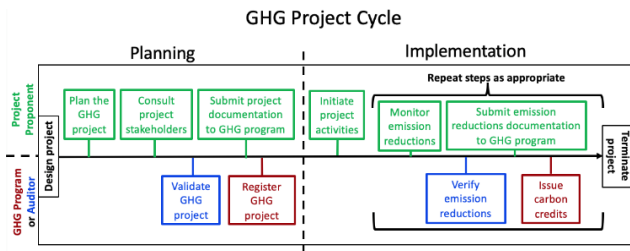


Figure 1: The GHG Emissions Offset Project Cycle

Source: EPRI and the Greenhouse Gas Management Institute.

For some project types, such as afforestation, a small quantity of issued offset credits may be held back in a “reserve” account that can be used to “pay back” any loss in stored GHG emissions due to unintentional “reversal” events, like a forest fire.

Offset crediting programs usually permit crediting period renewals. Renewals may involve the reevaluation of baseline conditions to assess continued eligibility. Projects with initial registration may seek crediting period renewal, wherein they must repeat certain steps, including validation and reapproval.

Offset Project Types

A wide range of activities can generate GHG offset credits, with more than 300 different types of project activities recognized in various domestic and international offset programs. Despite the diversity of offset project protocols available, a few project types have dominated offset credit issuances.

Seven project types have contributed nearly 80% of all credits issued in the voluntary carbon market since 1996, as shown in Figure 2.⁶ These dominant project types have evolved over time, with forestry and land-use projects (especially reduced emissions from deforestation and degradation or REDD+) playing a larger role in recent years. At the same time, renewable energy projects mainly focused on wind and hydropower projects in developing countries, and projects related to industrial manufacturing, waste management, and chemical processes have provided a decreasing share of total credits over time.

Emissions Reductions versus Removals

Climate change mitigation activities can impact GHG emissions by *reducing* future GHG emissions expected to be emitted to the atmosphere (aka avoided emissions projects) or by *removing* existing GHG emissions already in the atmosphere.

Emission reduction projects, like those designed to reduce future fossil fuel combustion, capture non-CO₂ GHGs (e.g., methane, nitrous oxide) as they are emitted or reduce N₂O emissions from using agricultural fertilizer, are designed to reduce or avoid

expected future GHG emissions as compared to a “business-as-usual” (BAU) baseline.

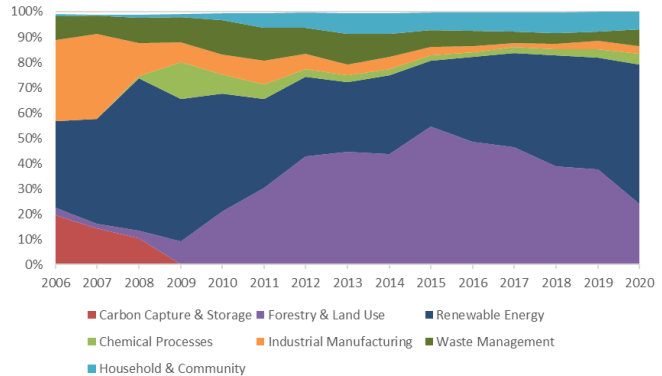


Figure 2: Composition of the global voluntary carbon offset market over time (VCS, GS, CAR, and ACR crediting programs).⁷

GHG emission *removal* projects are designed to remove existing GHG emissions already in the atmosphere. Removal project types include forest and grassland carbon sequestration projects, such as afforestation and reforestation, and carbon removal projects such as carbon capture and storage (CCS) and direct air capture (DAC). Some forest carbon projects can achieve both reductions and removals, such as avoided forest conversion projects.

In recent years, demand for removal credits has grown, driven in part by the perception that individuals and companies should seek to reduce their carbon “footprints” by supporting removal projects. The choice between acquiring and using reduction or removal credits depends on many factors including public policy, buyer preferences, project co-benefits, technology innovation, and cost-effectiveness.

While there are important distinctions between offset projects that reduce or remove GHG emissions, the important thing from a GHG mitigation perspective is whether GHG emissions to the atmosphere are reduced by implementing the offsets project as compared to the project baseline.⁸

Additional EPRI Resources

EPRI has developed a wide range of research reports and other resources on GHG emissions offsets that are available to EPRI members and the wider public.⁹

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⁶ The seven most common project types are: REDD+, Wind Energy, Hydropower, Landfill Methane Deconstruction, Solar – Centralized, Afforestation/Reforestation, and Cook stoves. So, I., Haya, B., Elias, M., 2022. Voluntary Registry Offsets Database. Berkeley Carbon Trading Project. University of California, Berkeley. Available: <https://gspp.berkeley.edu/faculty-and-impact/centers/cepp/projects/berkeley-carbon-trading-project/offsets-database>

⁷ So, I., Haya, B., Elias, M., 2022. Voluntary Registry Offsets Database. Berkeley Carbon Trading Project. University of California, Berkeley. Available:

<https://gspp.berkeley.edu/faculty-and-impact/centers/cepp/projects/berkeley-carbon-trading-project/offsets-database>

⁸ Some actors even maintain that reduction or removal activities are more credible as offsets than activities that “avoid” emissions – since “avoidance” often means the continuation of the prior activity or behavior. This is not inherently true; what matters for credibility is how certain the baseline is and whether the activity is additional.

⁹ <https://esca.epri.com/GHG-Accounting-Markets-and-Offsets.html>.