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Preparing for Carbon Pricing

Case Studies from Company Experience: Royal Dutch Shell, Rio Tinto, and Pacific Gas and Electric Company

Acknowledgments and Methodology

This Technical Note was prepared for the PMR Secretariat by Janet Peace, Tim Juliani, Anthony Mansell, and Jason Ye (Center for Climate and Energy Solutions—C2ES), with input and supervision from Pierre Guigon and Sarah Moyer (PMR Secretariat).

The note comprises case studies with three companies: Royal Dutch Shell, Rio Tinto, and Pacific Gas and Electric Company (PG&E). All three have operated in jurisdictions where carbon emissions are regulated. This note captures their experiences and lessons learned preparing for and operating under policies that price carbon emissions.

The following information sources were used during the research for these case studies:

1. Interviews conducted between February and October 2014 with current and former employees who had first-hand knowledge of these companies' activities related to preparing for and operating under carbon pricing regulation.
2. Publicly available resources, including corporate sustainability reports, annual reports, and Carbon Disclosure Project responses.
3. Internal company review of the draft case studies.
4. C2ES's history of engagement with corporations on carbon pricing policies.

Early insights from this research were presented at a business-government dialogue co-hosted by the PMR, the International Finance Corporation, and the Business-PMR of the International Emissions Trading Association (IETA) in Cologne, Germany, in May 2014. Feedback from that event has also been incorporated into the final version.

We would like to acknowledge experts at Royal Dutch Shell, Rio Tinto, and Pacific Gas and Electric Company (PG&E)—among whom Laurel Green, David Hone, Sue Lacey and Neil Marshman—for their collaboration and for sharing insights during the preparation of the report.

Please direct any comments and questions about this work to the PMR Secretariat (**pmrsecretariat@worldbank.org**).

For more information on the PMR, please visit **www.thepmr.org**.

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1 2 3 4 18 17 16 15

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Contents

Figures

Tables

1. Executive Summary

New carbon pricing regimes are on the horizon. This means an increasing number of companies will be subject to new climate change regulations in their countries or subnational jurisdictions. To prepare for this, and ensure their ability to operate effectively, businesses are taking steps to monitor their greenhouse gas (GHG) emissions, determine their carbon footprints, re-think their corporate strategies, and engage with policy makers and stakeholders in the carbon policy design process.

Several carbon pricing programs have provided companies with extensive experience in preparing for and implementing operations while complying with such carbon price compliance regimes. This report examines the experience of three companies, Royal Dutch Shell, Rio Tinto, and Pacific Gas and Electric Company, representing a variety of industries: oil and gas, metals and mining, and energy generation, transmission, and distribution.

These companies operate in one or several jurisdictions where emissions trading has been implemented and therefore provide useful insights for other companies facing similar circumstances. The lessons learned can also serve as a valuable resource for policy makers designing new systems to reduce emissions.

These case studies illustrate the benefits of incorporating climate change policies into corporate strategies; analyzing risks and opportunities in an environment of new public policies; and engaging effectively with relevant stakeholders—including governments. These case studies also show how carbon assets are traded and what systems are being constructed to monitor, report, and verify company level GHG emissions.

1.1. Lessons *from* Companies *for* Companies

1.1.1. Incorporate Climate Change into the Corporate Strategy

Climate change and regulatory efforts to curb GHG emissions can significantly impact operations of many industries, especially those that are energy intensive. For climate change policy to fully permeate a company, it is helpful to implement a comprehensive corporate strategy for climate change with top-level support and which leverages expertise across the company.

The CEO and senior-level leadership need to be on board to drive sustained climate action. Such commitment can benefit from a climate team that includes staff with an array of expertise, including "climate change champions" at all levels of the organization to inform on climate-related risks and opportunities, and to maintain an organizational culture that prioritizes GHG emission reductions—even when the leadership changes.

Moreover, transparency builds credibility, and making the company's climate policy visible helps to communicate its commitment.

1.1.2. Monitor, Report and Verify (MRV) GHG Emissions

Building a GHG inventory allows a company to better understand its direct and indirect emissions. It also helps anticipate the company's exposure to new carbon pricing regulation. Early establishment of MRV systems and practices provides a company with more time to prepare internally for regulatory reporting requirements.

Also, being ahead of the game with voluntary public reporting of GHG emissions can establish a credible baseline emissions level and quantify early mitigation actions as a company prepares for policy implementation.

1.1.3. Identify Risks and Opportunities

By engaging in the policy-making process, companies can reduce uncertainty and climate-related risk as well as identify possible opportunities of carbon pricing policies for their business. This is crucial to making strategic investment decisions.

Also, participating in voluntary mitigation programs or establishing internal emission reductions targets can be a low-risk way to identify cost-effective options and collect data in advance of a carbon policy and can encourage companies to become more efficient in their operations.

Using an internal or shadow carbon price that reflects the expected impact of policies can be useful for projects to anticipate the carbon cost risk. This can also help a company prepare for a cap-and-trade program. In addition, an internal abatement cost curve can assess the cost of different strategies.

1.1.4. Build Knowledge and Skills Early

There are many ways to increase company knowledge on future carbon policies. For example, participating in emissions trading simulations ahead of a cap-and-trade program can provide valuable hands-on experience. Also, participation in a voluntary offset market can help a company understand the methodologies, rules, and processes necessary for acquiring carbon credits for later compliance.

Also keep in mind that carbon trading is a highly specialized activity that is better handled by staff experienced in commercial transactions than by teams who typically cover environment, health, and safety or regulatory issues.

The purchase of carbon assets, including through financial instruments, may also require new internal procedures to minimize financial and regulatory risk. This is more complex for companies who are operating under several carbon compliance programs - they may need local policy expertise since each program has specific rules and requirements.

1.1.5. Engage with Stakeholders

For an emissions policy to be effective and meet government objectives in a way that is also workable for the business community, it is crucial to create an open and transparent dialogue between the two parties. Both the government and the private sector need to understand the implications of and options to address the impacts on competitiveness of carbon pricing regulation. Early leadership can build credibility.

Collaboration with other businesses, environmental groups, and key stakeholders can help build consensus on policy design and reduce the risk of future discord.

1.2. Key Insights *from* Companies *for* Policy Makers

While these case studies are primarily meant to guide private companies facing carbon pricing regulation, they also provide lessons for policy makers.

An environment of predictability, consistency, and flexibility are key to allow companies to plan for the future with confidence.

When designing a policy, consider introducing reporting requirements in advance of carbon pricing regulations to give companies sufficient time to build an inventory of accurate emissions data. As mentioned above, opt-in voluntary programs can provide valuable experience with emissions management before mandatory carbon regulations start. Establishing a transition period, for the use of pilot programs, can also help both companies and regulators familiarize themselves with carbon pricing mechanisms and make adjustments before full implementation begins.

In establishing a new carbon pricing regime, it is important to seek opportunities for price discovery because in the early stages of a carbon market there is likely limited trading as companies adjust to a new system.

Including certain design features, such as offsets and the banking and/or borrowing of allowances, can provide flexibility and improve the efficiency of a new program. Also in the design phase, consider provisions to minimize carbon leakage where there is evidence this is a potential risk.

Perhaps most importantly, keep in mind when designing a carbon pricing regime that each company and sector will have its own set of interests. The goal is to balance different interests and find solutions that are in the best interest of society as a whole.

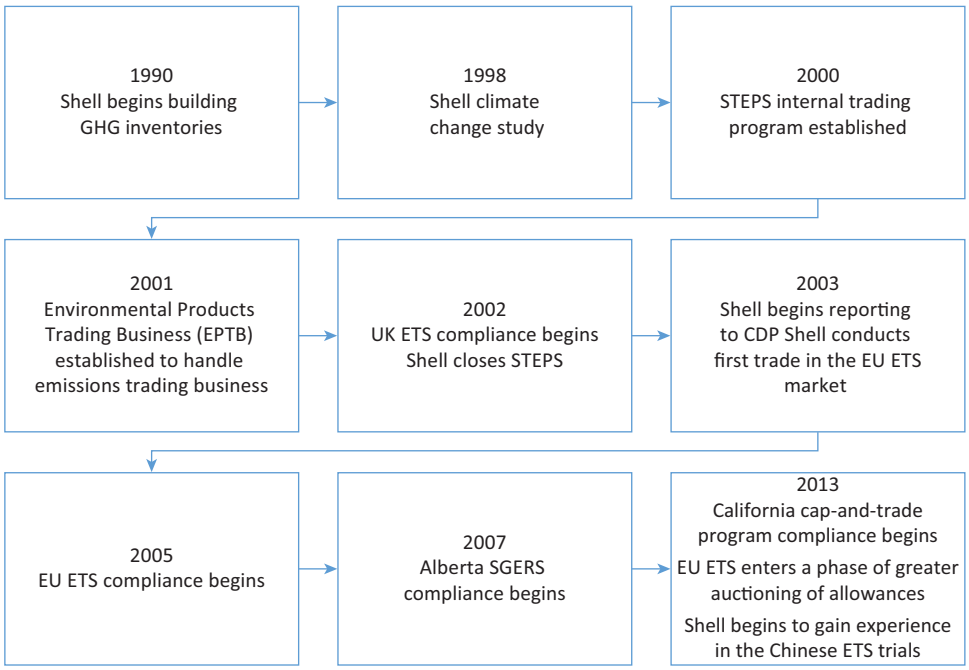
2. Preparing for Carbon Markets: A Case Study of Royal Dutch Shell

2.1. Company Profile

Royal Dutch Shell (Shell) is an international oil and gas company headquartered in The Hague, Netherlands. Founded in 1908, it operates in more than 70 countries and employs 87,000 people. In 2013 it produced two percent of the world's oil and three percent of global natural gas, and generated more than $459 billion in revenue.[1]

Shell's direct greenhouse gas emissions occur across the business, and are nearly evenly split between upstream exploration and production (46 percent) and downstream refining, chemicals production, and transportation of products (54 percent). In 2013, the company's direct emissions from operations totaled around 73 million metric tons of CO_2 equivalent ($MtCO_2e$), while indirect emissions from external purchases of electricity, heat, and steam accounted for around 10 $MtCO_2e$. The vast majority of overall emissions associated with Shell's production comes from customers' combustion of the company's products, which amounts to around 600 $MtCO_2e$ annually.[2]

Figure 2.1. Timeline of Key Developments in Shell's Carbon Market Preparation



Note: CDP = Carbon Disclosure Project; ETS = Emissions Trading System; GHG = greenhouse gas; STEPS = Shell Tradable Emissions Permit System; SGERS = Specified Gas Emissions Reduction System.

[1] Shell Annual Report 2013, http://reports.shell.com/annual-report/2013/servicepages/downloads/files/entire_shell_ar13.pdf.
[2] Shell Sustainability Report 2013, http://reports.shell.com/sustainability-report/2012/servicepages/welcome.html.

Table 2.1. Carbon Trading Regimes in Jurisdictions Where Shell Operates

Regime	Shell's compliance obligation
United Kingdom Emissions Trading Scheme (UK ETS) 2002–2007	Shell was a direct participant in the UK ETS and committed to reduce emissions 11.5 percent below baseline emissions (between 1998 and 2000) by 2006, a reduction of 439,000 tCO_2e.[a]
European Union Emissions Trading System (EU ETS) 2005–present	In 2012, Shell's facilities covered by the EU ETS emitted about 13.1 $MtCO_2e$.[b] These include refineries in Denmark, Germany, and Netherlands, gas plants in the United Kingdom, and a chemical production facility in Netherlands.
Alberta Specified Gas Emissions Reduction System (SGERS) 2007–present	Shell has large oil sands operations in Alberta. These emitted about 7.6 $MtCO_2e$ in 2012, accounting for nearly 10 percent of the company's direct emissions.[b]
California cap-and-trade program 2013–present	Shell operates a refinery with 2012 emissions of about 4.4 $MtCO_2e$.[c] The company also has obligations from a joint venture that owns four oil and gas production facilities that emitted about 3.3 $MtCO_2e$ in 2012.[c] California's system regulates electricity imports from other U.S. states. In 2012, this accounted for 186,370 tCO_2e for Shell.[c] The addition of emissions from the combustion of fuels (notably petroleum and natural gas) under the cap in 2015 will significantly increase Shell's covered emissions. In 2012, these amounted to about 10.4 $MtCO_2e$.[c]

Note: For background on each regime, refer to the World Bank report, State & Trends of Carbon Pricing 2014.

[a] Stephen Smith and Joseph Swierzbinski (2007). "Assessing the Performance of the UK Emissions Trading Scheme." *Environmental and Resource Economics* 37(1): 131–58. ISSN 0924-6460. doi:10.1007/s10640-007-9108-5.

[b] Shell Response to CDP Investor Climate Survey 2013, 26.

[c] Data obtained from Annual Summary of GHG Mandatory Reporting: Non-Confidential Data for Calendar Year 2012, http://www.arb.ca.gov/cc/reporting/ghg-rep/reported-data/ghg-reports.htm.

As an international oil and gas company, Shell operates in a number of jurisdictions that have introduced emissions trading; as a result, it has had a wide range of carbon market experience (table 2.1). The first regime in which Shell participated was the UK Emissions Trading Scheme, a voluntary program that began in 2002. Participation in mandatory programs followed, including the European Union Emissions Trading Scheme (EU ETS), which superseded the UK program, and programs in California and Alberta. Shell also participated in the Australian Government's Carbon Pricing Mechanism (CPM), which took effect in July 2012 but was subsequently repealed in July 2014. While these programs cover the company's direct emissions, California's cap-and-trade is scheduled to expand coverage from 2015 to include emissions from the combustion of natural gas, distillate fuel oil, and petroleum for transport and heating. This will greatly increase Shell's compliance obligation.

2.2. Incorporating Climate Change into Corporate Strategy

Key Lessons:

- While companies' organizational structures change over time, having a senior champion in the organization, ideally the CEO or another top executive, is critical to establishing and maintaining an organizational culture that prioritizes efforts to reduce GHG emissions.

Against the backdrop of the adoption of the Kyoto Protocol in 1997, Shell in 1998 conducted its first formal study on the potential impact of climate-related regulation on its global businesses. Then managing director and later CEO Jeroen van der Veer was the driving force behind the study, which built an internal case to act on climate change based in part on:

- Vision that the company would eventually face a cost of carbon or carbon regulation of some form.
- Recognition that Shell would need to respond to calls from its investors and the public to act on the climate issue.
- Conviction that it was important to have a seat at the climate policymaking table with governments and other stakeholders.[3]

The resulting climate change strategy emphasized the need for building technical competence internally while participating in external policy development. Internally, activities included creating an inventory of company-wide GHG emissions, learning how to trade carbon assets, and integrating future carbon policy risk management within investment decision making. Externally, Shell became more involved in policy discussions, notably through organizations such as the Pew Center on Global Climate Change, the International Emissions Trading Association (IETA), and the U.S. Climate Action Partnership (USCAP).

While climate change has been a core strategic concern for Shell since the 1990s, responsibility for this issue has shifted over the years among departments. Initially, climate change was the purview of the Issues Management Team within the Corporate Affairs division. In 2014, direct responsibility lies with Group CO_2, a dedicated department created in 2005 with oversight for strategic questions regarding Shell's CO_2 emissions. The head of Group CO_2 reports to the executive vice president for safety, environment, and social performance in the Projects & Technology division. The team provides support for business units across the company to assess CO_2 risk, and becomes more directly involved in CO_2 risk management for larger carbon-intensive investments (e.g., an oil sands expansion in Canada). Technical processes, such as the measurement of GHG emissions, are the responsibility of the Group Reporting team, which is also in the Projects & Technology division.

Table 2.2. Shell's Organizational Structure for Climate Change

Competence	Responsible department
Strategic	Group CO_2
Political	Government affairs
Measurement & reporting	Group reporting
Trading	Shell trading

Source: Interview with Royal Dutch Shell.[4]

[3] Pew Center on Global Climate Change (2006). Getting Ahead of the Curve: Corporate Strategies that Address Climate Change. The Shell Group—Maintaining a Seat at the Table, pp.111–120.
[4] Personal communication with David Hone, Group Climate Change Advisor, Shell, March 18, 2014.

2.3. Monitoring, Reporting, and Verification (MRV) of GHG Emissions

Key Lessons:

- Gaining early experience with GHG inventories helps the company to prepare for similar requirements under compliance regimes.
- Voluntary disclosure of GHG emissions (e.g., through the Carbon Disclosure Project), as well as disclosure of climate risks and strategies, has served the needs of certain stakeholders.

A critical early step in Shell's climate strategy was to generate a reliable measurement of its GHG emissions profile. Beginning in 1990, Shell started to compile an annual inventory of GHG emissions from all facilities under its operational control. It first published a complete public inventory in its external Sustainability Report in 1997. This work helped prepare the company for the mandatory reporting requirements it would subsequently face.

MRV is overseen by the Group Reporting team within the Projects & Technology division, where GHG data are collected using International Standards Organization (ISO) 14064-1 and other international standards of practice for monitoring. Shell also uses reporting guidelines from the Global Reporting Initiative, as well as from the International Petroleum Industry Environmental Conservation Association (IPIECA), which is the global oil and gas industry association for environmental and social issues. Emissions factors for fuel combustion are derived from the International Energy Agency's guidelines. In addition, third-party verification is performed according to ISO 14064-3 methodologies for verification and is substantiated to the level required for "limited assurance."[5]

Shell also participates in some voluntary reporting programs in order to provide information on climate activities to certain stakeholders. For its global operations, Shell has publicly reported to CDP (formerly the Carbon Disclosure Project) since 2003. In addition to the inventory of corporate emissions, CDP provides a qualitative assessment of the company's climate strategy.

2.4. Identifying Risks and Opportunities in Upcoming Policies

Key Lessons:

- It is important to have a full understanding of the impacts that compliance within carbon trading systems will have on each business unit and to incorporate this understanding into financial decision making.
- Failure to adequately address future carbon regulation may result in additional costs, delayed investment projects, and/or reduced production in the future.
- An internal framework that reflects the future impact of expected external policy development can be used at a project level to manage the external carbon cost risk for said projects.

[5] For more information on GHG Assurance, see http://www.shell.com/global/environment-society/environment/climate-change/greenhouse-gas-emissions.html.

In response to the global emergence of GHG regulation, Shell recognized that emissions markets require commercial competences to manage carbon cost impacts on the company.[6] In 2005, Shell established Group CO_2 to take responsibility for the company's carbon strategy. Group CO_2 provides expertise within Shell to assess projects' potential CO_2 regulatory exposure. Part of this assessment process involves using an internal framework that incorporates a screening value for CO_2 to evaluate project investment decisions.[7] In 2014, Shell reported that this screening value was $40 per ton of CO_2. Asset investments have a life cycle of several decades, and an internal screening value can be used to anticipate the potential regulatory risks of capital investments as well as the opportunities, such as incentivizing greater energy efficiency in the design of projects.[8]

The lens through which Shell envisions the future is captured in its *Energy Scenarios* series, published every few years by Shell's scenarios team, which is led by the vice president of global business environment. These studies were first released in 1972 and provide projections across a range of issues, including climate change, by describing possible future scenarios across the energy and transportation sectors.[9] The scenarios team includes Shell's chief economist and chief political analyst, and works with experts from around the globe. The direction of future carbon regulation is also monitored as it poses a potential risk on the cost of upstream operations that must be anticipated and managed. Shell has reported that it expects a larger share of its future oil production will come from unconventional sources, which will likely increase the carbon intensity[10] of its upstream oil business. Climate regulation may, however, also bring opportunities; in the case of Shell, regulations may result in an increased use of natural gas, which is one of the company's primary products for both the power and transportation sectors.

While traditional command-and-control regulations specify technologies or measures companies must implement to comply, market-based policies are designed to incentivize GHG abatement where costs are lowest. For example, the EU ETS results in a market-established cost for emitting CO_2 which allows Shell to assess abatement opportunities throughout its operations in the EU, signaling where operational efficiencies and technology upgrades should be prioritized to reduce the company's exposure to the cost of carbon. The EU ETS also offers the option to purchase carbon dioxide allowances and/or offsets if this is more cost effective for compliance than internal GHG abatement measures. In addition, if the company exceeds its reduction targets, it has the opportunity to sell its excess allowances; this can help to repay the capital costs for emissions reduction investments. Consequently, Shell advocates globally for governmental promoted market-based policies that offer flexibility and opportunities in managing compliance.

To mitigate the risk of operating in a world with increasing constraints on GHG emissions globally, Shell focuses on two technologies in particular that will make fossil fuel use less carbon intensive: carbon capture and storage (CCS) and advanced biofuels. Shell views CCS as a key emissions reduction technology,

[6] Shell Response to CDP Investor Climate Survey 2013, p.3.
[7] Shell Response to CDP Investor Climate Survey 2013, p.9.
[8] CDP (2013). Use of Internal Carbon Price by Companies as Incentive and Strategic Planning Tool. https://www.cdp.net/CDPResults/companies-carbon-pricing-2013.pdf.
[9] http://www.shell.com/global/future-energy/scenarios.html.
[10] CO_2 emissions per unit of output.

and investments in CCS today are viewed as a potential future competitive advantage in the industry.[11] The company is involved in several CCS projects, including the Quest Project in Canada, the Technology Centre Mongstad in Norway,[12] and the Gorgon Gas project in Australia.[13] A further project is in the final planning stages in the United Kingdom. Shell's goal is to move this technology toward commercial and financial viability for potential deployment in regions with carbon constraints. In addition, Shell regards biofuels as the most efficient and commercially viable way to reduce CO_2 emissions from transport over the coming years.[14] The company has invested in research toward advanced biofuels as well as in large-scale biofuel projects, such as a joint venture in Brazil that produces two billion liters of sugar cane ethanol annually.

2.5. Trading Carbon Assets

Key Lessons:

- Carbon trading is a highly specialized activity that is better handled by the part of the company experienced in commercial transactions rather than by the environment, health, and safety or regulatory teams.
- Effective communication within the company is needed to ensure those responsible for carbon trading have the necessary—and timely—information to make the correct trading decisions for the company.
- Each carbon compliance program has specific rules and requirements that may evolve over time. Companies operating under multiple carbon regimes may therefore benefit from having local policy expertise.
- Generating offset credits from project-based activities requires specific knowledge and experience; outsourcing it to intermediaries, such as external offset project developers, may be more efficient than building the expertise in house.

As previously mentioned, Shell set its first voluntary, company-wide GHG reduction target in 1998, which consisted of reducing emissions to 10 percent below 1990 levels by 2002.[15] As part of the effort to meet this initial target, Shell piloted an internal carbon trading system. The Shell Tradable Emissions Permit System (STEPS) program was launched in 2000 by Shell's Health, Safety, and Environment team—two years before Shell joined the UK ETS. Internal units joined STEPS on a voluntary basis, with a goal to reduce their emissions by two percent below 1998 levels within three years. Emissions allowances were allocated based on historical emissions, and trading was allowed among the different units to drive GHG abatements cost-effectively across the company.

The STEPS program faced several challenges. First, the voluntary aspect resulted in low participation, and the units that did participate tended to be the ones with cheaper emissions reductions. Second, some units requested and received additional allowances from Shell headquarters, which led to low trading volume.

[11] Shell Response to CDP Investor Climate Survey 2013, p.7.
[12] http://tcmda.com/en.
[13] http://chevronaustralia.com/our-businesses/gorgon.
[14] Ibid.
[15] Ibid.

Finally, financial trading of the internal allowances across borders between foreign subsidiaries would have generated a tax liability, which meant that only scorecard-style trading was permitted. While it did not achieve all of the desired outcomes, the STEPS program did provide some useful insights and experience to prepare the company for emissions trading.[16]

One takeaway from this experiment was that carbon trading is a highly specialized activity that is better run from the side of the company with experience in commercial transactions than from the Health, Safety, and Environment team. While the latter has the technical expertise to comply with regulations, such as measuring and reporting requirements, it may be less equipped to manage the company's trading activities in carbon markets (which includes buying, selling, and potentially hedging the upside and downside cost risk of carbon assets). Shell Trading, a separate division in the downstream business, which already had extensive experience trading energy commodities (e.g., petroleum, natural gas), was therefore the division of choice to manage the carbon assets of the company and nominate an expert responsible for emissions trading. In 2001, an Environmental Products Trading Business (EPTB) was established within Shell Trading to take responsibility for emissions markets, reflecting the specificities of carbon assets that require special expertise to best manage them and maximize their value.[17]

EPTB receives emissions data from facilities across Shell that operate in compliance markets and manages the flow of carbon allowances or offsets to ensure those facilities meet the compliance requirement. Effective communication within the company is therefore needed to ensure the trading desk has accurate and timely information to maximize the value of its carbon asset portfolio. The data management system and infrastructure, which were already in place to communicate production levels to Shell Trading, were upgraded to provide timely facility emissions data. Monitoring facility emissions data allows EPTB to adjust trading activity to changes in expected GHG emissions levels, such as when a facility halts production for scheduled maintenance or increases production to meet market needs.

The EPTB trading desk first operated in the UK ETS, and then in the EU ETS two years prior to the start of phase I (2005–2007)—executing the first trade of EU allowances in 2003.[18] This allowed Shell to design contracts on emissions units, establish relationships with potential trading partners, and experiment with inter-company emissions trading ahead of the start of the scheme. Early participation also allowed Shell to better engage and share lessons learned in policy circles as trading systems were designed.

Shell also participates in the market for certified emissions reductions (CERs), which are offset credits generated through the Kyoto Protocol's Clean Development Mechanism (CDM) that can be used to comply with the EU ETS. Initially, Shell developed CDM projects internally, which required specific technical expertise and knowledge of the CDM methodologies and development process prescribed by the United Nations Framework Convention on Climate Change (UNFCCC). Ultimately, Shell recognized this was not an

[16] Pew Center on Global Climate Change (2006). Getting Ahead of the Curve: Corporate Strategies that Address Climate Change. The Shell Group—Maintaining a Seat at the Table, pp.111–120.
[17] Shell Response to CDP Investor Climate Survey 2005, p.3.
[18] Pew Center on Global Climate Change (2006). Getting Ahead of the Curve: Corporate Strategies that Address Climate Change. The Shell Group—Maintaining a Seat at the Table, pp.111–120.

efficient use of company resources and that it was more efficient to purchase CERs issued from existing projects directly from the market. Such purchases do not always provide buyers with detailed knowledge of the projects from which the reductions were achieved, however, and this could eventually expose the company to certain regulatory and reputational risks. To reduce these risks, Shell typically contracts directly with CDM project developers and works with them from the project planning stages through to the delivery of CER credits.

In North America, Shell gained prior experience with environmental commodities through the Environmental Protection Agency's (EPA) sulfur dioxide and nitrous oxide trading programs as well as the market for renewable energy certificates (RECs).[19] Today, Shell is covered by the Alberta and California programs and actively participates in both markets. In Alberta, Shell both purchases and develops local offsets projects according to the rules and requirements of the Canadian Province. In California, Shell's Government Relations department actively engages in policy discussions around the implementation of climate regulations. Shell also participates in the RGGI—a cap-and-trade program regulating emissions from power generation in nine northeastern U.S. states—even though it has no direct compliance obligation under the program. Shell has trading personnel based in each of these North American jurisdictions as local regimes requires specific knowledge and expertise to understand how to comply at least cost.[20]

2.6. Engaging with Stakeholders

Key Lessons:

- Engaging with policy makers in the policy design process is critical. Policy design can affect the cost of compliance, and it is helpful for all parties to understand the different options available and their implications.
- Collaborating with NGOs and building broad coalitions (in compliance with antitrust and other laws) that support specific policy positions can increase credibility and buy-in from all parties when a policy is enacted.

Shell has made a significant effort to work with stakeholders (including governments, trade associations, and nongovernmental organizations) in an effort to understand and provide input into policy design in the jurisdictions where it operates and to support the emergence of a global carbon market. Group CO_2 works with other parts of the commercial side of the business, such as Shell Trading, to elaborate on the company's policy positions. The Government Relations department leads engagement with policy makers to understand external positions and to contribute to the development of final policy positions. Policy engagement is of particular importance for Shell because the design of governmental-promoted, market-based policies (e.g., allowance allocations, use of offsets), as well as the ambition of such policies (e.g., overall reduction requirements), directly impact the company's cost of compliance. In California, for

[19] Trading for compliance of the U.S federal Renewable Fuels Standard (RFS) is managed by Crude Products Trading team.

[20] California and RGGI trading operations are managed by Shell Energy North America, which is responsible for all trading by Shell in North America. They are based in Houston, Texas. A dedicated trading and sales team for Alberta's SGER is based in Calgary, Alberta.

example, Shell engaged in a policy debate to express concerns over a state Senate bill that would have restricted the eligibility of compliance offsets and therefore potentially raised costs.[21]

Engagement (in compliance with antitrust laws) through industry associations, civil society groups, and nongovernmental organizations helps to broaden support for market-based policies. It also allows companies to learn from one another and thus to inform policy positions. For instance, Shell was an early member of the USCAP, a coalition of six major nongovernmental organizations and 25 companies that provided recommendations on the design of a federal U.S. cap-and-trade system. The company is also a member of the International Emissions Trading Association (IETA) and sits on the steering committee of IETA's Business Partnership for Market Readiness (B-PMR). The B-PMR brings together companies to share experience and expertise with local businesses in the countries supported by the World Bank's Partnership for Market Readiness (PMR). The goal of this engagement is to enhance the private sector's preparedness for emerging governmental and inter-governmental carbon cost policies.[22] Such outreach also presents an opportunity for Shell to engage with governments that are designing upcoming regulations.

Shell also provides technical input to a wide range of nongovernmental organizations on climate and environmental issues to help develop operational best practices. For example, in 2012 Shell helped to found the Center for Sustainable Shale Development, a collaboration of industry, philanthropy, and environmental nongovernmental organizations—such as the Clean Air Task Force and the Environmental Defense Fund—that aims to develop performance standards for the development of shale resources.[23] Shell is also a strategic partner of the Center for Climate and Energy Solutions (C2ES)—formerly the Pew Center on Global Climate Change—and is a longtime member of its Business Environmental Leadership Council (BELC).

2.7. Conclusion

Governmental and inter-governmental promoted market-based policies, in contrast to command-and-control policies, provide a greater level of flexibility in carbon compliance strategies—but also require preparation and understanding to maximize their cost-efficiency and benefit. Shell's experience suggests a commercial approach to managing emissions reductions can help ensure that these efforts are cost-effective.

Getting early experience with market practices is important, but so is being able to alter the company's response over time. Appropriate transparency, sharing of best practices and broader engagement with other stakeholders is critical in working with policy makers during the design of carbon cost regimes. Shell's comprehensive approach to GHG management has given the company confidence in its ability to compete in a world of increasingly present CO_2 policies.

[21] http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201320140SB605.
[22] For more information, see www.ieta.org/b-pmr.
[23] https://www.sustainableshale.org.

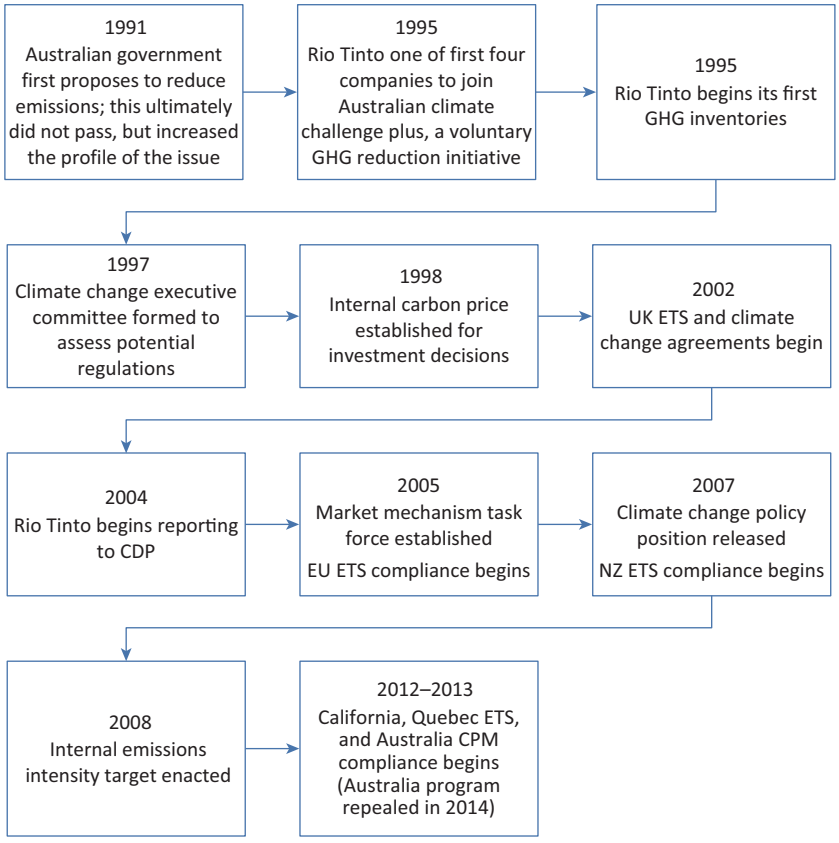
3. Preparing for Carbon Markets: A Case Study of Rio Tinto

3.1. Company Profile

Rio Tinto is a leading international mining group headquartered in London, United Kingdom. Founded in 1873, Rio Tinto's business consists of finding, extracting, and processing mineral resources, including aluminum, copper, diamonds, thermal and metallurgical coal, uranium, gold, iron ore, and industrial minerals (e.g., borax, titanium dioxide, and salt). In 2013, Rio Tinto generated revenues of $51 billion and employed 66,000 people.[1]

Rio Tinto's total emissions in 2013 were 37.2 million metric tons of CO_2 equivalent ($MtCO_2e$). Its direct emissions, which occur within the facilities for which Rio Tinto has operational control, were 23.4 $MtCO_2e$; its indirect emissions, which refer to energy (electricity, heat, and steam) that Rio Tinto purchases from

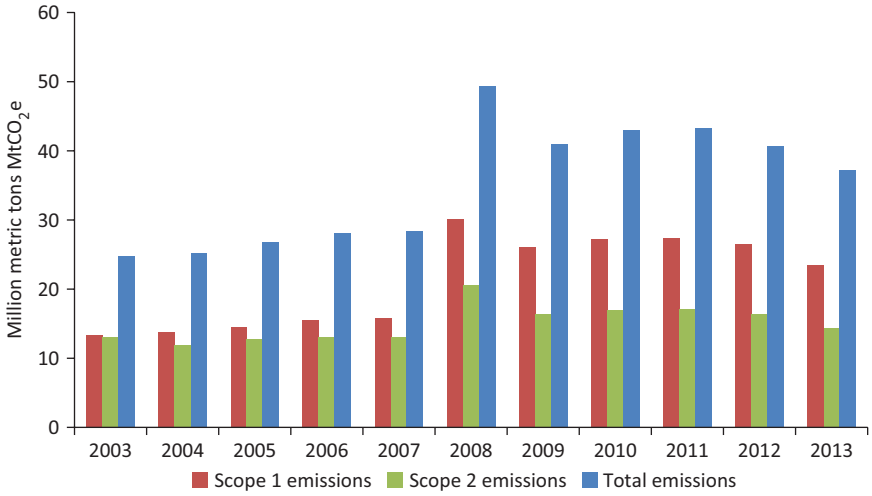
Figure 3.1. Timeline of Key Developments in Rio Tinto's Carbon Market Preparation



Note: CDP = Carbon Disclosure Project; CPM = Carbon Pricing Mechanism; ETS = Emissions Trading System; GHG = greenhouse gas.

[1] http://www.riotinto.com/annualreport2013/performance/five-year-review.html.

Figure 3.2. Rio Tinto's Total GHG Emissions 2003–2013



Source: Rio Tinto Sustainable Development Reports for 2011, 2012, and 2013.

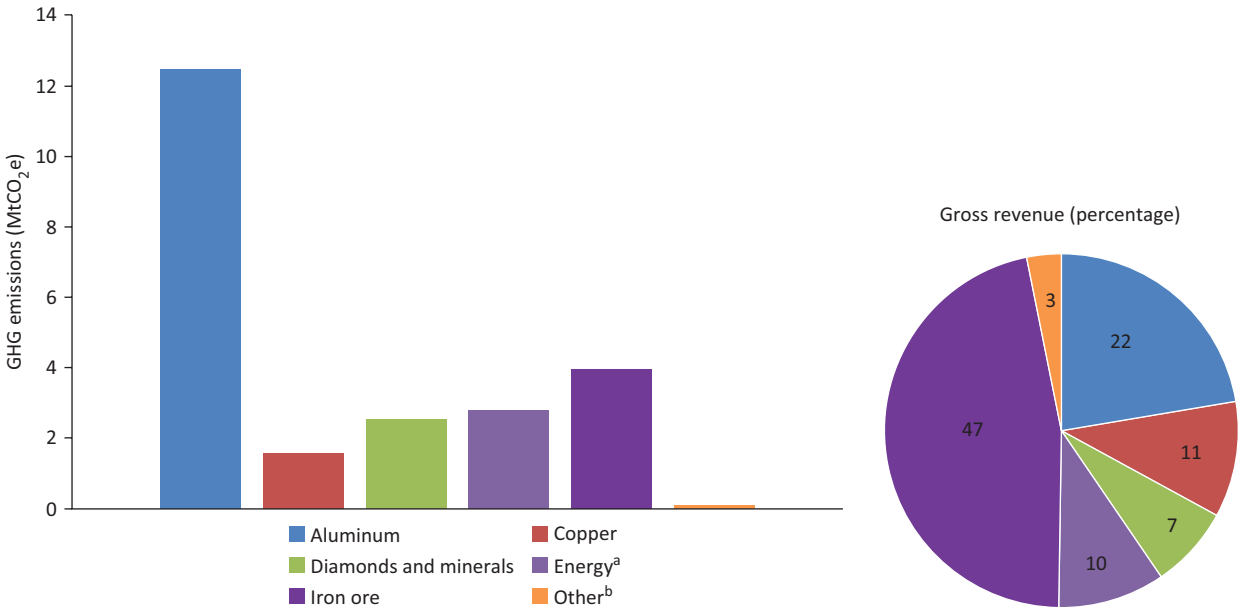
external sources, were 14.4 $MtCO_2e$.[2] Figure 3.2 shows Rio Tinto's direct (scope 1) and indirect (scope 2) GHG emissions from 2003 to 2013. The company's emissions initially spiked following its 2008 purchase of Alcan, another mining company and aluminum manufacturer,[3] then decreased by 2009 primarily due to both the economic recession and the curtailing or closing of about 600,000 metric tons of higher-cost and less-efficient aluminum production capacity.[4]

Aluminum production is the largest source of Rio Tinto's direct GHG emissions (figure 3.3). These come primarily from the smelting process and from some on-site electricity and steam generation from fossil fuel sources. Iron ore production is the next largest source of direct emissions, followed by coal and uranium, diamonds and minerals, and copper production.

As a global business, carbon pricing regulations such as carbon taxes and emissions trading cover a growing proportion of Rio Tinto's operations—and because each country program is unique, Rio Tinto has acquired broad experience and expertise with carbon pricing policies.[5] In 2013, more than two-thirds of Rio Tinto's total GHG emissions were covered by a carbon price,[6] although this proportion has since significantly reduced following the repeal of legislation in Australia. Table 3.1 below describes the various carbon pricing regimes in which Rio Tinto has participated.

[2] In this case study, scope 1 emissions include all facilities where Rio Tinto has operational control. Equity investments are excluded from the totals.
[3] Alcan was a mining company and aluminum manufacturer that was purchased by Rio Tinto in 2007, becoming Rio Tinto Alcan in 2008. This case study refers to Alcan assets pre-merger as Rio Tinto Alcan.
[4] http://www.riotinto.com/annualreport2013/performance/aluminium.html.
[5] For an overview of international trading programs, see World Bank, State and Trends of Carbon Pricing 2014, http://documents.worldbank.org/curated/en/2014/05/19572833/state-trends-carbon-pricing-2014.
[6] Rio Tinto Group. 2013 Annual Report (London, UK: Rio Tinto Group, 2014), http://www.riotinto.com/annualreport2013.

Figure 3.3. Rio Tinto's Direct (Scope 1) GHG Emissions ($MtCO_2e$) and Gross Revenue (percentage) 2013 by Business Unit



Source: Rio Tinto Sustainable Development Report 2013; Rio Tinto 2013 Earnings Report (Feb 16, 2014).

[a] Energy production comprises coal and uranium

[b] "Other" includes exploration, technology, and innovation, corporate offices, etc.

3.2. Incorporating Climate Change into Corporate Strategy

Key Lessons:

- Strong senior leadership is necessary to drive a company-wide commitment on carbon mitigation, but recruiting other climate change champions throughout the organization can help with education on climate-related risks and opportunities.
- Preparing internally before regulations come into effect eases the transition to compliance markets.

With strong support from its chairman, Robert Wilson, Rio Tinto began to engage on climate change when it first emerged as a public policy issue in the early 1990s. In Australia, where nearly half of the company's operations are located, the government began efforts to constrain emissions in 1991 with a proposal from the cabinet of ministers limiting emissions to 20 percent below 1991 levels by 2005. The draft legislation ultimately did not become law, but it was an important turning point for Rio Tinto as it prompted the company to begin preparing for future carbon regulation. Several subsequent efforts to curb emissions in Australia, including the 1995 voluntary Greenhouse Gas (GHG) Challenge Plus, the proposed Carbon Pollution Reduction Scheme in in 2009–2010, and the Carbon Pricing Mechanism that operated from mid-2012 until its repeal in 2014, all provided insights and valuable experience that helped to shape the company's preference for market-based policies and climate strategy.

Table 3.1. Carbon Pricing Regimes in Jurisdictions Where Rio Tinto Operates

Regime	Rio Tinto's compliance obligation
United Kingdom Emissions Trading Scheme (UK ETS) and Climate Change Agreements 2002–present* *UK ETS ended in 2007, but the Climate Change Agreements continue	Rio Tinto reported about two $MtCO_2e$ scope 1 emissions in the UK in 2012 from a smelter and associated coal plant.[a] The company entered the UK ETS through a Climate Change Agreement (CCA), which set voluntary emissions intensity targets for the aluminum sector. After the launch of the EU ETS, the smelter continued to work toward its voluntary intensity target under the CCA while complying with mandatory targets under the EU ETS.[b]
European Union Emissions Trading System (EU ETS) 2005–present	During Phases I and II of the EU ETS, Rio Tinto's compliance was limited to a coal plant supplying power to an aluminum smelter in the United Kingdom. In both phases, the government allocated allowances to the plant equal to its historical emissions as part of the United Kingdom's National Allocation Plan (NAP).[b] In 2012, the company reported about two $MtCO_2e$ scope 1 emissions in the EU ETS.[c] Phase III of the EU ETS commenced in 2013 and widened the program's scope to include perfluorocarbon (PFC) emissions from the company's five aluminum smelters in Europe.[d]
New Zealand Emissions Trading Scheme (NZ ETS) 2007–present	Rio Tinto operates an aluminum smelter in New Zealand. In 2012, the facility emitted about 630,000 tCO_2e, and received an allowance allocation that did not require it to purchase additional allowances.[c]
California cap-and-trade program 2013–present	Rio Tinto emitted 292,000 tCO_2e in California in 2012[c] from a borate mine and refinery.
Quebec cap-and-trade program 2013–present	The program covers eight Rio Tinto facilities.[e] These include aluminum smelters and a metallurgical complex which produces iron and titanium. Combined, their 2012 verified emissions were 4.5 $MtCO_2e$.[f]
Australia Carbon Price Mechanism (CPM) Mid-2012–mid-2014	Around half of Rio Tinto's global assets are in Australia. The company produces iron ore, coal, bauxite, alumina, aluminum, uranium, diamonds, and salt from more than 30 operating sites and processing plants around the country. Liable entities under the Carbon Pricing Mechanism included entities from four business units covering iron ore, coal, bauxite, alumina and aluminum production. In financial year 2012–13, Rio Tinto reported verified emissions totaling 11.4 million metric tons of CO_2e to the Australian regulator.[g]

Note: For background on each regime, refer to the World Bank report, State & Trends of Carbon Pricing 2014.

[a] Rio Tinto Response to CDP Investor Climate Survey 2013, p.9.

[b] Rio Tinto Alcan, Lynemouth Smelter and Power Station Environmental Report 2008, http://ec.europa.eu/environment/emas/pdf/es_library/27_4_uk_alcan_smelting_and_power_08.pdf.

[c] Rio Tinto Response to CDP Investor Climate Survey 2013, p.13.

[d] Aluminum smelters' process emissions were not covered by Phase I and II of the EU ETS. See http://www.riotintoalcan.com/ENG/ouroperations/1337_europe.asp.

[e] http://www.mddep.gouv.qc.ca/changements/carbone/liste-etablissements-visesRSPEDE.pdf.

[f] Quebec Ministry of Sustainable Development, Environment, Forestry and Parks. Quebec List of Emitters and Participants 2013, http://www.mddep.gouv.qc.ca/changements/carbone/liste-etablissements-visesRSPEDE.pdf.

[g] Rio Tinto CDP Disclosure 2013.

An important component of the company's strategy came in 2005 when Rio Tinto set up the Market Mechanism Task Force, composed of "climate champions" from each business unit. The Task Force was formed to bring together a broad expertise and to ensure that awareness of the risks and opportunities of climate regulation was built across the entire company. It also helped to build the knowledge necessary to engage with governments and other stakeholders on options for designing market-based emissions reduction programs. The work of the task force led to Rio Tinto's first Climate Policy Position Statement in 2005 (updated and revised in 2012), which acknowledged the contribution of individuals and businesses to climate change and voiced the company's support for market-based regulations.[7]

Rio Tinto's organizational structure to address climate change has changed over time, as implementation and compliance activities intensified alongside policy analysis and advocacy. The highest level of direct responsibility over climate change corporate issues sits with the Board's Sustainability Committee. The committee oversees the company's actions and response to its social and environmental sustainability commitments.[8] In 2002, the company also established a Group Climate Change Executive, who was responsible for the definition and implementation of the overall climate change program.

3.3. Monitoring, Reporting, and Verification (MRV) of GHG Emissions

Key Lessons:

- Building GHG inventories allows a company to determine its direct and indirect emissions profiles. Companies should recognize that this process can take a number of years to perfect and that data accuracy will improve over time.
- The earlier a company inventories its GHG emissions, the more prepared it will be when compliance reporting is established or regulators require historical data for determining allowance allocation in emissions trading systems.
- Because climate change and carbon pricing policies will have implications for the company, it is imperative to communicate the corporate strategy for addressing these risks effectively to investors and shareholders.

Table 3.2. Rio Tinto's Organizational Structure for Climate Change

Competence	Responsible department
Strategic	Executive committee of the board
Political	External Affairs; Health, safety, environment, and communities
Measurement & reporting	Health, safety, environment, and communities; Business units
Trading	Responsibility is within each business unit

Source: Interviews with Rio Tinto.[9]

[7] http://www.riotintoalcan.com/eng/ourapproach/34_climate_change.asp. Or http://www.riotintoalcan.com/documents/Reports_September2008_PolicyClimateChange_EN.pdf.
[8] Rio Tinto Response to CDP Investor Climate Survey 2013, p.1.
[9] Personal communication with Jeff Hopkins, former principal adviser, energy and climate strategy, Rio Tinto, March 13, 2014; Personal communication with Adam Whitmore, chief adviser, energy and climate policy, Rio Tinto, March 24, 2014.

Some of Rio Tinto's units made efforts to inventory emissions beginning in the mid-1990s, several years before any regulation required the company to do so. About 10 years later, Rio Tinto was conducting a company-wide inventory. Initially, emissions data were collected using a paper-based methodology developed in cooperation with BHP Billiton and other companies.

Rio Tinto today measures and reports direct (scope 1) and indirect (scope 2) GHG emissions from most operations, as well as the three highest sources in their supply chain (scope 3) emissions, even in jurisdictions where there is no reporting obligation.[10] The company relies on internationally established methodologies such as those developed by the Intergovernmental Panel on Climate Change (IPCC) and the International Standards Organization (ISO) 16064-1. Emissions and energy use data are collected through a web-based portal and subsequently verified by a third party.[11] All operations with emissions greater than 3,000 tCO_2e, and some operations and sites below this threshold, are required to report GHG emissions annually. Monthly reporting is required for those with annual emissions exceeding 50,000 tCO_2e, which account for more than 95 percent of the company's GHG inventory.

Such consistent reporting practices were adopted throughout the company to raise the visibility and performance of its GHG emissions mitigation efforts and to prepare for when carbon pricing will be widely applied.[12] Accordingly, GHG emissions have become one of seven key performance indicators alongside operational, safety, and financial data, which are reported to the Executive Committee on a monthly basis and to the public in Rio Tinto's annual report.[13]

A carbon-constrained world will have substantial implications for Rio Tinto's business model, and the company considers it imperative to ensure effective communication of its climate change strategy to shareholders, investors, and the public. Rio Tinto therefore releases an annual sustainable development report, which takes stock of its progress to reduce its GHG footprint and highlights specific investments made in energy efficiency projects.[14] The company also responds publicly to the annual questionnaire from CDP (formerly the Carbon Disclosure Project), which has become one of the most recognized methods of disclosing climate-change-related information, including GHG emissions data and strategy to address risks and opportunities, to both investors and the public.[15]

[10] Rio Tinto recognizes that there are significant emissions associated with the transportation, processing and use of their products. In 2013, the three most significant sources in their supply chain included third-party transport of their products and raw materials, emissions from the use of coal during electricity generation, and use of their iron ore to produce steel. See http://www.riotinto.com/sustainabledevelopment2011/environment/energy_and_climate_change/climate_change.html.

[11] Rio Tinto Response to CDP Investor Climate Survey 2013, p.9.

[12] http://www.riotinto.com/sustainabledevelopment2011/environment/energy_and_climate_change/climate_change.html.

[13] Jeff Hopkins. (2012). "Role of MRV in Effective Emissions Trading Programs: Rio Tinto's Perspective." U.S.-China Workshop Domestic MRV of Climate Efforts, Washington, DC.

[14] See, for example, http://www.riotinto.com/sustainabledevelopment2013/_pdf/rio_tinto_2013_sustainable_development.pdf.

[15] International Council on Mining and Metals (2013). Adapting to a Changing Climate: Implications for the Mining and Metals Industry, https://www.icmm.com/document/5173.

Early experience with measuring and reporting its emissions gave Rio Tinto an advantage when carbon compliance programs began requiring similar reporting. This is the case, for example, in California's cap-and-trade program where the Air Resources Board called on energy-intensive, trade-exposed (EITE) companies to provide 2010–2012 GHG emissions data in order for them to apply for an allocation of free carbon allowances. Notably, companies were also invited to voluntarily report GHG data from 2000 to 2010 for regulators to track a larger range of historical GHG emissions. Rio Tinto, whose boron mine had an inventory system in place over this period, was able to do so. Disclosure of earlier GHG data was critical to demonstrating the impacts of the 2008–2009 economic turndown on emissions levels and to establishing the appropriate allocation of free allowances.

3.4. Identifying Risks and Opportunities in Upcoming Policies

Key Lessons:

- Strategic investment decision making requires a complete understanding of the potential climate-related risks and opportunities that carbon pricing policies will have on each business unit.
- The development of an internal abatement cost curve can help assess the relative costs of different strategies to reduce emissions.
- Establishing an internal carbon price can provide guidance for longer-term investment decisions based on the company's expectations of future policy actions.
- Setting an internal emissions reduction target provides an incentive across the company to find efficiency gains and operational optimizations. It may also place the company in a stronger position to comply with regulations as they come into force.

In 1997, Rio Tinto formed an executive-level committee to perform a "strengths, weaknesses, opportunities, and threats" (SWOT) analysis of the company under the scenario of a carbon constrained world. Because carbon regulations may affect not only the production costs of Rio Tinto's products but also the markets for these products, the company had to reassess its business strategy for each. Risks were identified for high carbon content products such as coal, which would face decreasing demand in the absence of new technologies such as carbon capture and storage (CCS). At the same time, other commodities would likely benefit from carbon regulation. For example, this is the case for copper, which is a major component of high-efficiency electrical motors and therefore may be in stronger demand as the transportation sector seeks to lower the carbon footprint of new vehicles. Similarly, borates, which are used in the production of fiberglass insulation, would face increasing demand driven by energy efficiency measures and policies.

Potential risks and opportunities also exist in how the company chooses to respond to carbon policies through changes in its operations and investment planning. This first requires a complete understanding of the impacts that regulation will have on each business unit and the company as a whole. Rio Tinto's long-standing emissions inventory allowed for the production of an internal cost curve to assess the relative marginal abatement options across its operations, including the use of different operational improvements and technology upgrades. Evaluating and ranking the relative costs enabled business units to understand the menu of options available and, importantly, to identify where options would be limited. For example, there are limited short-term internal abatement options for aluminum production, leaving

offsetting, or the purchase of carbon allowances, as the only means for reducing emissions from that activity. Once the options were identified, the company could assess how to meet most effectively its compliance obligations using the identified potential operational changes and investments. Where carbon markets are in place, compliance options also include the purchase of carbon allowances or offset credits.

To reflect the carbon constraint in larger and longer-term capital investments, Rio Tinto established an internal price on carbon by 1998 (i.e., before the introduction of any external carbon pricing regulation). This internal price provides a long-term price signal on carbon, which is necessary for long-term decision making. All business units, including those in regions where carbon regulations have yet to emerge, must factor a uniform internal carbon price into long-term investment decisions. Where carbon markets are in place, however, local carbon prices are used for short-term compliance decisions, such as on-site emissions reductions (e.g., fuel switching) and the purchase of carbon allowances or offset credits.

In addition to an internal carbon price, Rio Tinto has also been using emissions intensity targets since 1998. In 2009, the company set a target to reduce emissions per production unit by 10 percent below 2008 levels by 2015. (This was an amendment to the goal set in 2008 of six percent below 2008 levels by 2013). The target applies to all of Rio Tinto's facilities, not only those currently covered by carbon price regimes. The internal target provides an incentive across the company to find efficiencies and operational optimizations to reduce emissions, and it places the company in a stronger position to comply with regulations as they come into force.

3.5. Trading Carbon Assets

Key Lessons:

- Straightforward compliance tasks, such as executing bids at allowance auctions, can be conducted by staff at a facility level, but more complex operations, such as purchasing offsets or derivatives, can require professional trading staff.
- The purchase and use of some carbon assets, such as offsets and financial derivatives (e.g., forward contracts on future carbon assets) may require the development of new internal procedures to ensure that financial and regulatory risks are understood and minimized.

Market-based policies in the EU, New Zealand, and North America have made carbon another commodity traded in each of Rio Tinto's business units. The company divides the responsibility for emissions trading between its participating facilities, its regional offices of business units, and its headquarters in London. Staff at each facility execute allowance purchasing operations at auctions, while trading professionals within each regional business unit manage more sophisticated tasks, such as defining purchasing strategies, the procurement of offset credits through project developers, or engaging in derivatives markets. Financial responsibility (i.e., profits and losses) for GHG compliance rests within each business unit, rather than at the corporate level, to encourage each unit to take ownership of its GHG management and operations. To ensure consistency and transparency across all units, however, guidelines and procedures that govern the company's trading activities are defined at the corporate level.

Since 2005, when Rio Tinto first participated in carbon markets with the EU ETS, a number of changes in corporate policy have been necessary in order to accommodate commercial transactions on carbon.

Emissions trading may entail hedging carbon prices with derivative contracts (e.g., options, futures), but Rio Tinto's Treasury department prohibits market speculation. As a result, the European trading team worked with the company's Treasury department to develop specific guidelines and procedures for carbon trading, including restrictions to minimize risks. These are now also applied to the company's carbon market operations in California and Quebec, and will likely be used in other future carbon markets.

A similar progressive approach was taken to manage the procurement for offset credits, such as the certified emissions reductions (CERs) and emission reduction units (ERUs) generated by project activities under the Kyoto Protocol. Given the recent emergence of these carbon assets and the limited experience in managing them, these assets posed a potential high financial risk for Rio Tinto. Indeed, there were concerns that regulators could revoke the credits or not allow them for compliance. In addition, low market liquidity would make it difficult to resell the credits in cases where they were no longer needed. Consequently, the company purchased assets on a case-by-case basis after approval from the company's Treasury department. As the market matured and the company became more familiar with it, traders worked with the company's Treasury department to assess risks and establish guidelines and due diligence procedures to streamline the procurement process.

3.6. Engaging with Stakeholders

Key Lessons:

- Engagement in the policy-making process can help all parties understand the implications and options for addressing the potential impacts of carbon regulation on competitiveness, especially for EITE industries.
- Collaborating with nongovernmental organizations that provide forums for policy discussion and joint advocacy can improve the company's credibility in policy-making discussions.

Rio Tinto has long engaged with government officials and other stakeholders in the design of GHG regulations in the various countries in which it operates. Given the company's exposure to the global commodities market (e.g., aluminum), engagement efforts focus particularly on competitiveness issues. In particular, Rio Tinto has advocated for the inclusion of assistance to energy-intensive, trade-exposed (EITE) companies in the ETS programs in which it participates (EU ETS and the California and Quebec cap-and-trade programs). Table 3.3 provides an overview of these measures, which are intended to address "carbon leakage" (i.e., a production shift from regulated to non-regulated jurisdictions).

Rio Tinto is also currently engaged with policy makers in countries where carbon pricing policies are emerging. These include countries like South Africa, where the company has been active in discussions on the design of the national carbon tax and domestic offset program to be introduced in 2016, as well as China, where Rio Tinto has a large customer base impacted by the sub-national emissions trading pilot programs and the planned national scheme. In Australia, Rio Tinto is engaging with government on their alternative Direct Action policy, which will provide government incentives to achieve emissions reductions.

In addition, Rio Tinto participates in policy-making discussions in wider forums, such as through industry associations and nongovernmental organizations. For example, Rio Tinto is a member of the Business

Table 3.3. EITE Measures in Market-Based Regimes Where Rio Tinto Operates

Program	EITE assistance measures
EU ETS	Companies receive free carbon allowances based on product-based emissions intensity benchmarks reflecting average GHG emissions performance of the 10 percent best-performing facilities in the EU producing that product. If the sector is at risk of carbon leakage,[a] then facilities receive 100 percent allocation based on the product's benchmark, multiplied by historical production and additional factors to reflect a declining emissions cap.
California cap-and-trade program	Firms receive free allocation based on an emissions intensity benchmark, a cap adjustment factor (to reflect the required decline in emissions over time), and an industry assistance factor, which ranks the level of trade exposure each industry faces. The California Air Resources Board categorizes sectors as high, medium, or low risk of carbon leakage. Depending on the sector, a company will receive its benchmarked allowance allocation at a factor of 90, 75, or 50 percent, respectively.
Quebec cap-and-trade program	In 2013 and 2014, free allocation is based on the historical emissions intensity from 2007 to 2011, multiplied by production output. The government determines the sectors at risk of carbon leakage, and companies in these sectors receive 100 percent free allocation for process emissions, 80 percent for combustion emissions, and 100 percent for all other emissions sources. From 2015 to 2020, the level of free allocation will decrease annually. In addition, a sectoral emissions intensity target will be set and will decline each year.
Australia carbon pricing mechanism	Using the period 2006–08 as base years, allocation was determined using the weighted average of emissions per unit of production for the sector as a whole. The government defined trade exposed as having industry with more than 10 percent of production as imports and exports. Emissions intensity was based on emissions as a percentage of revenue. Qualifying facilities could receive up to 94 percent of allowances freely, with the percentage declining by 1.3 percent per year.

Source: International Emissions Trading Association and Environmental Defense Fund (2014), *The World's Carbon Markets.*

[a] The criteria for determining whether a sector is at risk of carbon leakage is available at http://ec.europa.eu/clima/policies/ets/cap/leakage/index_en.htm.

Partnership for Market Readiness (B-PMR), which brings together companies to share experience and expertise with local businesses in the countries supported by the World Bank's Partnership for Market Readiness.[16] The B-PMR has held multiple missions in China where Rio Tinto and other companies shared experience and advice with peers to enhance China's private sector preparedness for carbon markets.

The company is also an active member of the International Council on Mining and Metals, which conveys the views of major mining companies and industry associations in the sector, notably with regard to

[16] www.ieta.org/b-pmr.

policy developments related to carbon regulations. Rio Tinto has also been a member of the Business Environmental Leadership Council (BELC) of the Center for Climate and Energy Solutions (formerly the Pew Center on Global Climate Change), and the U.S. Climate Action Partnership (USCAP). Leveraging the leading think tanks, NGOs and businesses that these forums bring together, Rio Tinto has scaled up its participation in technical policy discussions and built a broad coalition around carbon pricing instruments.

3.7. Conclusion

Rio Tinto started to engage in climate change action long before it had to face climate regulation, and this strategy has proved advantageous as regulatory restrictions on GHG emissions have emerged across the globe. Through the early establishment of its emissions inventories, abatement cost curves, and internal carbon pricing, the company has progressively established institutional structures and capacity to handle carbon regulations, including the delegation of responsibilities to multiple departments. Early action also provided sufficient time and experience to inform the policy-making process. Rio Tinto also learned that it needed to be flexible and adaptable to changing needs, such as streamlining the process to allow the trading desk to purchase futures for allowances and offsets. With this experience, the company is well prepared to comply with additional carbon pricing regimes as they emerge around the globe.

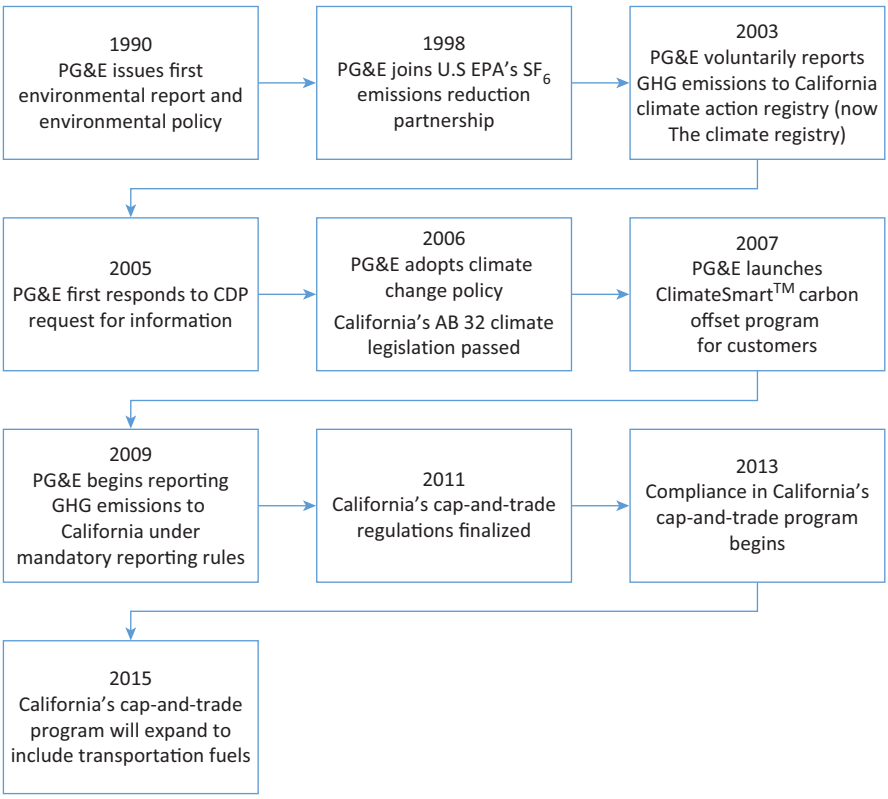
4. Preparing for Carbon Markets: A Case Study of Pacific Gas and Electric Company (PG&E)

4.1. Company Profile

Headquartered in San Francisco, PG&E is the largest combined natural gas and electric utility in California, providing services to nearly 16 million people in the northern and central part of the state. In 2013, the company employed about 22,000 people and generated $15.6 billion in revenues.[1] PG&E is regulated by numerous government agencies, including the California Public Utilities Commission (CPUC) and the Federal Energy Regulatory Commission.[2]

PG&E's bundled retail sales totaled 75,705 gigawatt hours (GWh) of electricity in 2013; approximately 40 percent was generated by the company and the remainder was purchased from third-party generators. PG&E's generated and purchased power mix in 2012 emitted 445 pounds of CO_2 per

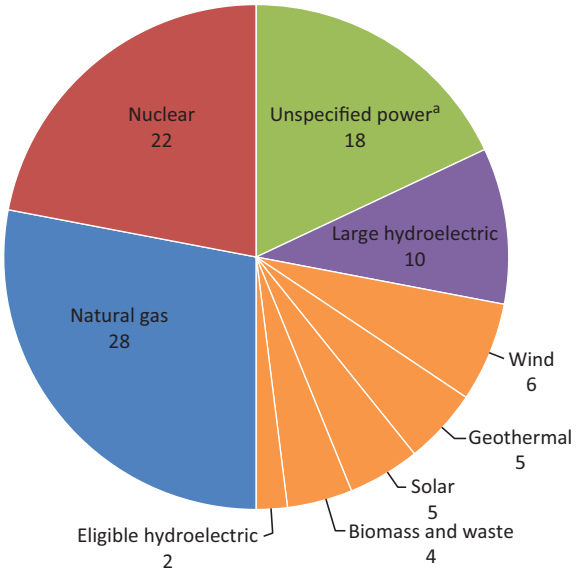
Figure 4.1. Timeline of Key Developments in PG&E's Carbon Market Preparation



Note: CDP = Carbon Disclosure Project; EPA = Environmental Protection Agency; GHG = greenhouse gas; PG&E = Pacific Gas and Electric Company.

[1] http://www.pgecorp.com/corp_responsibility/reports/2014/bu01_pge_overview.jsp.
[2] http://investor.pgecorp.com/files/doc_financials/2013/2013%20Annual%20Report%20-%20final.pdf.

Figure 4.2. PG&E's Delivered Electricity Mix (Including Purchased Power) in 2013



Source: PG&E.[3]

[a] "Unspecified Power" refers to electricity generated that is not traceable to specific generation sources by any auditable contract trail.

megawatt-hour (MWh), which is about a third of the U.S. power mix average of 1,232 pounds per MWh. More than half of PG&E's delivered electricity came from non-GHG emitting sources, including nuclear, large hydroelectric, and renewable resources (wind, geothermal, biomass, small-scale hydroelectric, and solar). An additional 28 percent came from natural gas, and 18 percent was purchased from unspecified sources that are not traceable to specific generation types (see figure 4.2).[4]

The company owns generation facilities with a combined capacity of 7.68 gigawatts (GW). In 2013, the installed capacity consisted of 51 percent hydroelectric, 29 percent nuclear, 18 percent natural gas, and two percent solar.[5] In addition to electricity generation, PG&E provides natural gas to 4.4 million residential and commercial customers. The company operates approximately 159,115 miles of electric transmission and distribution lines and 49,200 miles of natural gas transmission and distribution pipelines.[6]

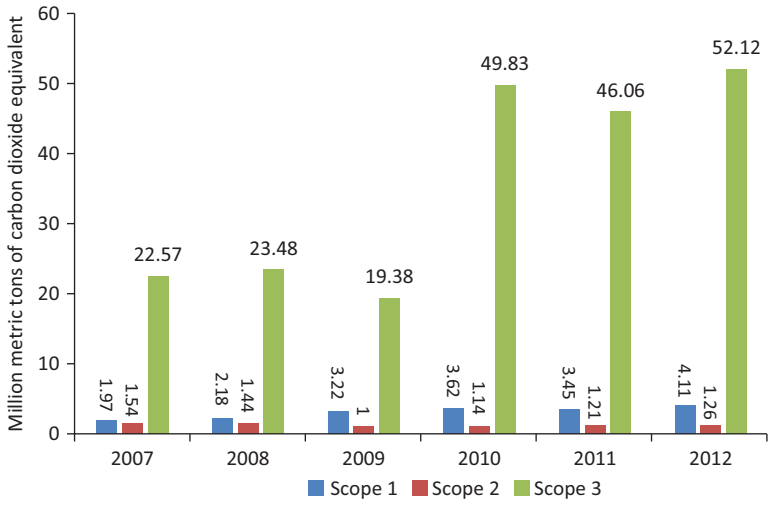
As part of its GHG inventory voluntarily reported to The Climate Registry (a climate change NGO based in California), PG&E reported 4.1 million metric tons CO_2 equivalent ($MtCO_2e$) of direct, or scope 1, emissions in 2012.[7] These emissions resulted primarily from electricity generation (60 percent) and

[3] http://www.pgecorp.com/sustainability/bu04_clean_energy_future.jsp.
[4] http://www.pgecorp.com/corp_responsibility/reports/2014/bu04_clean_energy_future.jsp.
[5] http://www.pgecorp.com/corp_responsibility/reports/2014/bu01_pge_overview.jsp.
[6] http://www.pgecorp.com/corp_responsibility/reports/2014/bu01_pge_overview.jsp.
[7] The U.S. EPA and California Air and Resources Board (CARB) define GHG emissions in three categories: Scopes 1, 2 and 3. Scope 1 refers to emissions directly from the source that are owned or controlled by the entity. Scope 2 emissions are indirect GHG emissions resulting from the use of electricity, heating and cooling, or steam purchased

fugitive emissions from PG&E's natural gas transmission and distribution system (26 percent). The majority (about 95 percent) of the company's indirect emissions (scope 2), which amounted to 1.26 $MtCO_2e$ in 2012, resulted from electricity transmission and distribution line losses from delivering electricity. PG&E's other indirect emissions (scope 3) were 52.1 $MtCO_2e$ in 2012, which were largely produced through the combustion of natural gas by PG&E's customers as well as by the electricity generated by third parties and delivered to PG&E customers.[8] These scope 3 emissions are the largest sources of PG&E's overall GHG emissions (see figure 4.3).

PG&E only operates in California; therefore, its GHG compliance obligations rest almost completely within the state (it must also comply with federal U.S. Environmental Protection Agency (EPA) GHG reporting requirements).[9] Enacted in 2006, California Assembly Bill 32 (AB 32) mandated a statewide GHG emissions reduction target of returning to 1990 levels by 2020. The legislation assigned the California Air Resources Board (CARB) with identifying and implementing policy options that would achieve these goals; cap and trade was one of several programs adopted. The current program runs from 2013 through 2020, with a declining emissions cap that covers power generation and industrial facilities emitting 25,000 or more metric tons CO_2e (tCO_2e) per year. From 2015 onward, the program will expand to include distribution

Figure 4.3. PG&E's GHG Emissions, 2007–2012



Source: The Climate Registry, 2007, 2008, 2009, 2010, 2011, 2012.

Note: PG&E's direct or Scope 1 emissions increased in 2009 when a new natural gas generating station became operational. Scope 3 data began to include emissions from customer natural gas use in 2010.

by the entity, and Scope 3 emissions include indirect GHG emissions from sources not owned or directly controlled by the entity but related to the entity's activities (such as those related to consumption of the product it sells).

[8] PG&E Corporation (2012). Report to The Climate Registry, accessed June 26 2014. Available at https://www.crisreport.org/web/guest;jsessionid=69F7B9DD9F76F817C2F52352636B3021.

[9] California and Quebec have officially linked their GHG cap-and-trade programs, and GHG emissions allowances and offsets are now interchangeable for compliance purposes in each jurisdiction. This represents the first multisector cap-and-trade program linkage in North America.

of natural gas and fuels for heating and transportation. Other policies that cover the power sector include customer energy efficiency mandates and a renewable portfolio standard that requires utilities to derive 33 percent of their retail electricity sales from eligible renewable sources by the end of 2020.

PG&E's facilities covered by California's cap-and-trade program include three natural-gas-fired electricity generation stations and a number of natural gas compressor stations that exceed the reporting threshold of 25,000 tCO_2e. In 2012, covered emissions from PG&E's natural-gas-fired generating stations totaled 2.47 $MtCO_2e$ and covered emissions from compressor stations totaled nearly 0.31 $MtCO_2e$. In addition, PG&E has a compliance obligation for specific emissions generated from the electricity that it purchases from out-of-state power plants, which totaled roughly 0.58 $MtCO_2e$ in 2012.[10] From 2015 onward, the cap-and-trade program will also include the emissions derived from the combustion of the natural gas supplied to customers, less the fuel that is delivered to covered entities as calculated by CARB. In 2012, for PG&E, these covered natural gas emissions totaled 18.9 $MtCO_2e$.

4.2. Incorporating Climate Change into Corporate Strategy

Key Lessons:

- A publicly stated climate change policy helps a company both communicate its commitment to climate change mitigation and build credibility with stakeholders.
- CEO-level commitment is an important driver for climate action.
- A cross-functional climate change team that includes staff with an array of expertise can be helpful when establishing and implementing a corporate strategy for addressing climate change because it is a multi-faceted and evolving issue.

Climate change is an integral part of PG&E's core business strategy, and its efforts are supported and required by a number of regulations in California in addition to AB 32. For instance, California "decouples" investor-owned utility profits from the sale of energy, which enables PG&E to pursue customer energy efficiency without the disincentive of a financial loss from selling less electricity. In U.S. electricity markets, utility revenues typically depend on the amount of electricity provided to consumers. This type of system can make utilities averse to conservation and efficiency measures because their implementation ultimately cuts into profits by decreasing sales and therefore revenues. "Decoupling" removes the pressures placed on utilities to sell more energy by eliminating the relationship between earnings and sales volume. Under such a compensation scheme, revenues are "decoupled" from the quantity sold and are instead allowed to adjust by means of an adjusted price so that utilities receive similar compensation regardless of fluctuations in sales.[11]

[10] Data obtained from Annual Summary of GHG Mandatory Reporting: Non-Confidential Data for Calendar Year 2012, http://www.arb.ca.gov/cc/reporting/ghg-rep/reported-data/ghg-reports.htm.

[11] For more information on decoupling see http://www.c2es.org/us-states-regions/policy-maps/decoupling/detail; National Association of Regulatory Utility Commissions (2007). Decoupling For Electric & Gas Utilities: Frequently Asked Questions (FAQ), http://www.epa.gov/statelocalclimate/documents/pdf/supp_mat_decoupling_elec_gas_utilities.pdf.

California also has a long history of prioritizing customer energy efficiency with energy savings targets for the state's investor-owned utilities; in 2013, for example, the CPUC set an energy savings target for PG&E at 599 GWh and a peak demand target of 114 MW. These types of complementary programs help reduce the need for electricity production and the associated GHGs.

In 1990, PG&E published its first Environmental Report, publicly disclosing information about the company's environmental performance including energy efficiency measures and the deployment of renewable energy generation capacity. This report has now evolved into an annual Corporate Responsibility and Sustainability Report, which communicates PG&E's progress toward its environmental, social, and economic goals.

The company also adopted its first public Environmental Policy in 1990, which articulated the company's overall environmental commitment to both PG&E employees and external stakeholders.[12] PG&E took this step before most other large U.S. utilities, motivated by then-Chairman and CEO Richard Clarke, who was a driving force behind the company's early environmental commitment.

In 2006, PG&E adopted an additional Climate Change Policy Framework to specify the company's view with regard to climate change issues. It committed PG&E to maintaining a GHG profile that is among the lowest compared to large U.S utilities, and to supporting the development of national, market-based GHG regulations.[13] Although the company had already begun to take actions on its GHG emissions, the release of the Climate Change Policy Framework clarified publicly the company's policy positions that it would advocate with authorities.

Climate change policies such as California's cap-and-trade program impact multiple departments within PG&E, which requires open channels of communication to share expertise within the company. In 2007, PG&E set up a cross-functional, management-level GHG Coordination team that encompassed staff from the departments of Energy Procurement; Safety, Health, and Environment; Gas Operations; Law; Regulatory Affairs; Corporate Affairs; and Customer Energy Solutions. This team meets monthly with the GHG Policy Review Committee to share the latest climate-change-related developments at the state and federal level and to request approval of proposed policy positions.[14]

Table 4.1. PG&E's Organizational Structure for Climate Change

Competence	Responsible department
Strategic	CEO
Political	Corporate affairs
Measurement & reporting	Safety, health, and environment
Cap-and-trade compliance	Energy procurement
Regulatory engagement	Regulatory relations

[12] http://www.pgecorp.com/corp_responsibility/environmental/policies/.
[13] PG&E Corporation (2006). Climate Change Policy Framework, http://www.pgecorp.com/corp_responsibility/pdf/pge_climate_change_policy_framework.pdf.
[14] Carbon Disclosure Project 2013. Climate Change Report, PG&E Corporation, p.12.

Responsibility for leading the GHG Coordination team has changed over time. During policy discussions during the AB 32 legislative debate and the design of California's regulatory regime, the senior vice president for corporate affairs led the GHG Coordination team. Since California has transitioned from policy and program design to regulatory implementation, leadership of the team has transitioned to the senior vice president for regulatory relations. Responsibility for compliance with California's cap-and-trade program rests with the Energy Procurement department.

4.3. Monitoring, Reporting, and Verification (MRV) of GHG Emissions

Key Lessons:

- Early establishment of MRV systems and practices across facilities can provide a company with more time to prepare for subsequent regulatory reporting requirements.
- Voluntary public reporting can help to establish a credible baseline emissions level and quantify the benefits of early mitigation actions as a company prepares for policy implementation.

PG&E began monitoring, reporting, and verifying its GHG emissions prior to any regulatory requirement. The rationale for PG&E's early GHG reporting was threefold. First, the company's commitment to transparency necessitated that metrics on environmental performance be available to external stakeholders, such as customers, investors, and NGOs. Second, monitoring and reporting was seen as an essential tool for effective emissions management. Third, PG&E believed that mandatory reporting was inevitable, and regarded early reporting to a voluntary registry as a way to gain experience ahead of regulation.

Accordingly, in 2001, PG&E became a founding charter member of an emissions registry known as the California Climate Action Registry (now The Climate Registry), and publicly reported its first emissions inventory in 2003.[15] PG&E's knowledge of the electricity generation and distribution sectors helped inform the development of methodologies adopted by The Climate Registry to enable utilities to calculate, report, and verify their GHG emissions.

In 2009, PG&E began its first mandatory GHG emissions reporting to the California Air Resources Board.[16] PG&E's voluntary inventories with The Climate Registry provided information that was shared with California regulators as they began the allocation process under California's cap-and-trade program. Providing emissions data over a longer period than required by the program allowed PG&E to provide a more accurate emissions baseline.

Since 2010, PG&E has also been subject to the U.S. EPA's mandatory GHG Reporting Program, which requires reporting by all U.S. facilities with annual emissions above 25,000 tCO_2e.[17] The company

[15] The California Climate Action Registry was created by the State of California in 2001 to promote early action by businesses to measure, manage, and reduce GHG emissions. The California Climate Action Registry established guidelines for emissions inventories and served as a central database for emissions reports. It was instrumental in establishing The Climate Registry, with the mission of expanding emissions reporting work to include all of North America, http://www.climateactionreserve.org/about-us/california-climate-action-registry.
[16] http://www.arb.ca.gov/cc/reporting/ghg-rep/reported-data/ghg-reports.htm.
[17] For more information, see http://www.c2es.org/federal/executive/epa/ghg-reporting-rule.

advocates for more consistency between EPA's and California's programs to help reduce related administrative costs.

4.4. Identifying Risks and Opportunities in Upcoming Policies

Key Lessons:

- Regulated companies need to proactively work with regulators on market design and development of compliance plans both to ensure smooth market operations and to reduce the risk of disproportionate price impacts for customers.
- Participating in voluntary mitigation programs can be a low-risk opportunity for identifying cost-effective options and sharing information in advance of a carbon pricing program.
- Complementary policies to cap and trade, such as renewable energy targets or customer energy efficiency goals, will also impact GHG emissions; understanding their impact is necessary for identifying the most cost-effective options for meeting cap-and-trade compliance obligations.
- Early use of an internal or shadow carbon price for energy or fuel procurement transactions prior to implementation of a regulatory program can help prepare a company for a cap-and-trade program.

Utilities tend to be more risk-averse than many other industries. Their investments in energy infrastructure typically last decades, which means that decisions about generation capacity, technology, and fuel type have implications over a long time horizon. In addition, utilities are often heavily regulated and strategic changes must be considered and evaluated well in advance because the regulatory approval process can involve many stakeholders and take multiple years. Unlike other industries that operate in a competitive market where expansion is a goal, regulated utilities tend to focus on minimizing customer costs and business risk.

An early low-risk opportunity to reduce GHGs came from the U.S. EPA's SF_6 Emission Reduction Partnership. This voluntary collaboration worked to identify and implement cost-effective strategies for the power sector to reduce emissions of SF_6, a highly potent GHG with a global warming potential of 23,900 compared to CO_2.[18] In 1999, PG&E set an initial three-year goal of reducing annual SF_6 emissions by 50 percent from 1998 levels. To achieve this goal, the company set up a cross-functional team taken from both the Electrical Transmission and Environmental Affairs departments to devise new procedures for handling SF_6.[19] Since 1998, PG&E has reduced its SF_6 emissions by about 75 percent, from 249,297 tCO_2e to 65,190 tCO_2e in 2013. Working toward this voluntary goal helped the company gain early experience implementing a GHG management plan. Additionally, the actions undertaken for SF_6 were subsequently mandated under AB 32, and PG&E was well-positioned when this requirement came into force.[20]

Another early step came in 2004, when the CPUC passed a rule that required California utilities to factor in an initial carbon price of $8 per metric ton for electricity procured from other generators in order to

[18] http://www.epa.gov/electricpower-sf6/.
[19] http://www.epa.gov/electricpower-sf6/documents/pge_casestudy.pdf.
[20] http://www.arb.ca.gov/cc/sf6elec/sf6elec.htm.

reflect an expected future cost of carbon.[21] The ruling came at a time when it was unclear when climate change legislation would be enacted, but the CPUC felt utilities should integrate a shadow carbon price into their long-term procurement plans to hedge against likely future regulations.[22] For PG&E's Energy Supply team, this meant factoring in the cost of carbon when negotiating power purchase agreements with other electricity providers for electricity they would sell into the California market. This experience prepared the company for when a regulatory cost of carbon was introduced years later.

Many of PG&E's strategies have been shaped by voluntary and mandatory programs administered by the U.S. EPA and California regulators. California has many mandatory programs that complement its cap-and-trade program and impact PG&E's GHG emissions, including those aimed at promoting renewable energy or increasing customer energy efficiency. For example, California has had a renewable portfolio standard in place since 2002. This standard requires that an increasing proportion of the state's electricity come from renewable sources. For 2014–2016, the standard requires that on average 23 percent must come from renewable sources (excluding large-scale hydro), increasing to an average of 33 percent per year after 2020. To the extent that increasing renewables displaces PG&E's natural gas generation or electricity purchased from fossil fuel sources, it will have the effect of reducing PG&E's GHG emissions.

Similarly, increasing customer energy efficiency will also reduce emissions. Since the mid-1970s, PG&E has strongly encouraged its customers to improve efficiency. California's policy of electricity decoupling separates utility earnings from revenues and power sales, encouraging investment in energy efficiency.[23] For example, in the 2010–2012 timeframe, PG&E had a $1.3 billion CPUC-approved budget to encourage customer energy efficiency that saved over 2.7 $MtCO_2e$.[24] In addition, the CPUC offers financial incentives to utility shareholders if the company exceeds energy efficiency targets. Based on savings achieved through its programs, the CPUC awarded PG&E's shareholders $21.6 million in incentives in 2013.[25]

Complementary programs like those that focus on renewable energy or customer energy efficiency not only help offset fossil fuel generation but also reduce the level of emissions PG&E must manage under the cap-and-trade program. California's initial scoping plan for its GHG emissions reduction program estimated that complementary measures, taken together, would account for over three-quarters of the emissions reductions required to meet the state's target of returning to 1990 levels by 2020.[26] The other 25 percent of the emissions reductions were to come from the cap-and-trade program.

PG&E analysts forecast the expected reductions in GHG emissions from all regulations that impact their production activity, including the renewable portfolio standard and customer energy efficiency programs, and factor these into their mitigation and cap-and-trade compliance strategy to meet their compliance obligation.

[21] http://www.c2es.org/us-states-regions/news/2004/california-approves-carbon-adder-electric-utility-plans.
[22] http://docs.cpuc.ca.gov/word_pdf/FINAL_DECISION/43224.pdf.
[23] National Association of Regulatory Utility Commissions (2007). Decoupling for Electric & Gas Utilities: Frequently Asked Questions (FAQ), http://www.epa.gov/statelocalclimate/documents/pdf/supp_mat_decoupling_elec_gas_utilities.pdf.
[24] http://www.pgecorp.com/corp_responsibility/reports/2012/co03_cee.jsp.
[25] http://www.pgecorp.com/corp_responsibility/reports/2014/cu03_cee.jsp.
[26] http://www.arb.ca.gov/cc/scopingplan/status_of_scoping_plan_measures.pdf.

4.5. Cap-and-Trade Compliance

Key Lessons:

- Participation in emissions trading simulations and voluntary offset programs can give hands-on experience to a company ahead of a cap-and-trade program.
- Participating in the development or purchase of carbon offsets in the voluntary market can help a company understand the protocols, risks, and processes involved in acquiring such credits for compliance.

To gain knowledge and experience regarding cap-and-trade programs, PG&E and seven other companies[27] to be covered in California's cap-and-trade program funded the University of Virginia and a consultant to perform emissions trading simulations that tested the implications of various policy design features. The results provided PG&E with important information on how these design elements could impact the cap-and-trade program. For example, the analysis demonstrated that "holding limits" on the number of allowances one entity can have in its account could have negative impacts on market liquidity and thus increase price volatility. The study also demonstrated, however, that an allowance price containment reserve, a mechanism that auctions additional allowances, could be helpful in reducing the risk of sudden price spikes.[28] Not only were these results useful for the company, but they were also given to CARB to provide information on the potential impacts of these policy features on the market and its participants.

Under California's cap-and-trade program, utilities have a two-step compliance process. First, CARB directly allocates allowances each year to local distribution companies in a predetermined amount that declines year over year. Rather than being surrendered for compliance, however, these allowances must be consigned to CARB for resale at quarterly auctions. PG&E must then acquire allowances or offsets to cover its emissions. Auction revenues from consigned allowances must be passed on to customers as directed by the CPUC. Revenues are returned via a rebate (known as the California Climate Credit) to households and small businesses to compensate for potentially higher electricity bills.

While CARB and the CPUC forbid utilities from detailing their trading activities, the CPUC authorized PG&E and the other utilities to make use of the following channels to procure GHG compliance instruments:

- Participation in CARB's auctions and its Allowance Price Containment Reserve.
- Purchase of allowances and offsets through bilateral transactions.
- Acquiring compliance instruments from Commission-approved exchanges.[29]

[27] Pacific Gas and Electric Company, Southern California Edison Company, Chevron, NRG Energy, Los Angeles Department of Water & Power, Sacramento Municipal Utility District, Northern California Power Agency, and Southern California Public Power Authority.

[28] University of Virginia—PEAR Project Team. Investigation of the Effects of Emission Market Design on the Market-Based Compliance Mechanism of the California Cap on Greenhouse Gas Emissions, February 2013, http://econ.ccps.virginia.edu/RePEc_docs/ceps_docs/FINAL_REPORT_CA_Cap_and_Trade_Market_Simulation_Results.pdf.

[29] California Public Utilities Commission D12.04.046. Decision on Long-Term Procurement Plan Proceeding and Approving Settlement, http://docs.cpuc.ca.gov/PublishedDocs/WORD_PDF/FINAL_DECISION/164799.PDF.

The amount of PG&E's emissions regulated by the program will increase in 2015 when the program expands to cover the combustion of natural gas by its retail customers.[30]

Another program change that will impact PG&E is California linking its cap-and-trade program to Quebec's program, meaning that allowances and offsets from one program can be used for compliance in the other jurisdiction. This introduces new supply and demand into the market. PG&E has conducted a comparative analysis of the Quebec and California regulations, and has used its own research as well as third-party studies to determine the price impacts of linking.

One strategy that PG&E can use to lower the cost of compliance under California's cap-and-trade program is the use of carbon offsets. Carbon offsets provide a compliance option that may come as a potentially lower-cost alternative to internal abatements or the purchase of allowances. Under California's program, these can be used for up to eight percent of a participant's compliance obligations.

PG&E gained experience with offsets in 2007 through its ClimateSmart™ program, an initiative that offered customers the option to buy offset credits to compensate for their emissions associated with the use of electricity and natural gas. Working with the Climate Action Reserve, PG&E supported the development of several offset protocols, including those for forestry and methane capture from dairy farms and landfills. The eight U.S.-based offset projects in which PG&E has invested have collectively reduced more than 1.3 $MtCO_2e$.[31] Some of the protocols used by the program were eventually adapted and adopted by CARB for use in California's cap-and-trade program.[32]

While ClimateSmart™ was intended as a demonstration program, it provided PG&E staff with early technical understanding of offset project activities and useful operational experience working with offset project developers. The experience acquired from drafting offset purchase agreements was also very relevant preparation for the introduction of California's compliance program.

4.6. Engaging with Stakeholders

Key Lessons:

- Taking an early leadership role on climate change policy can give a company credibility with policy makers during the regulatory development and implementation phases of a carbon market.
- Collaboration with other businesses, environmental groups, and key stakeholders can help build consensus on policy design and result in better outcomes.

As a large utility with significant GHG emissions, PG&E has had a prominent role in California's climate change policy discussions. Its early commitment to voluntarily report to the California Climate Action Registry, and advocacy for market mechanisms during the AB 32 legislation discussions, gave the company

[30] Data obtained from Annual Summary of GHG Mandatory Reporting: Non-Confidential Data for Calendar Year 2012, http://www.arb.ca.gov/cc/reporting/ghg-rep/reported-data/ghg-reports.htm.
[31] PG&E Corporation. Carbon Disclosure Project 2013 Climate Change Report, p.10.
[32] PG&E Corporation. Carbon Disclosure Project 2013 Climate Change Report, p.6.

credibility with policy makers and stakeholders. In particular, PG&E provided CARB with technical input as the agency developed the rules on the inclusion of electricity imports in the cap-and-trade program. It also worked with other utilities and CARB to determine default emissions factors for electricity generation from unknown or unspecified sources.

By working collaboratively with academics, regulators, legislators, other businesses, and nonprofit environmental organizations, the company has sought early consensus on policy and an understanding of potential competing viewpoints. In addition, the company believes that a coalition with shared views represents a stronger voice when advocating for specific policies. To this end, PG&E was a founding member of the Clean Energy Group in 2000, a group of utilities that supported federal GHG regulations, and of the U.S. Climate Action Partnership (USCAP) in 2007, a coalition of companies and NGOs that advocated for federal market-based policies to address climate change.

PG&E currently engages with a broad range of nongovernmental organizations on climate change policy, such as the International Emissions Trading Association (IETA), the Center for Climate and Energy Solutions (C2ES), and many of California's local governments. For example, as of 2013, PG&E has provided both technical and financial support for the development of over 270 local government GHG inventories and more than 60 climate action plans. It also partners with ICLEI–Local Governments for Sustainability, an international association of local and metropolitan governments dedicated to sustainable development. Working with local governments gives PG&E an opportunity to help them reduce their energy demand and their local emissions.[33]

4.7. Conclusion

PG&E's business is closely tied to policy developments in California, a state that is often at the forefront of environmental issues. Through actions such as engaging with a range of stakeholders, creating a voluntary offset program, and preparing for cap-and-trade compliance through simulations and other analyses of market design, PG&E was prepared to meet its compliance obligations. PG&E's clear support of climate change policy also gave the company a credible voice throughout the development of California's regulations and with other stakeholders, including local governments. The lessons learned for PG&E will help the company to continue to adapt as California's program changes over time.

[33] http://www.pgecorp.com/corp_responsibility/reports/2014/en02_climate_change.jsp.

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