



Adapting to Climate Change: A Guide for the Energy and Utility Industry

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This guide is part of a BSR industry series. For additional climate adaptation briefs, please visit www.bsr.org/adaptation.

Contents and Methodology

This brief covers:

Reporting on Risks and Opportunities: A synopsis based on reporting of climate risk in 2009 by 207 energy and utility companies to the Carbon Disclosure Project (CDP).

Current Practices: An outline of actions related to climate change adaptation based on reporting from the CDP, interviews, and other publications.

Emerging Practices: Synthesis of company disclosures, literature, reviews, and input from climate change professionals through interviews.

This primer on climate change adaptation in the energy and utility (E&U) industry:¹

- » Summarizes how E&U companies are reporting on climate change risks and opportunities;
- » Highlights current and emerging best practices and guidance for E&U companies on how to develop a proactive approach to climate change adaptation; and
- » Provides recommendations for next steps for company consideration.

The E&U industry is vast, encompassing upstream producers of fossil fuels, downstream processors and refiners, logistics and distribution networks, electric and gas utilities, renewable energy companies, and providers of energy management and other services, to name a few subsectors.² This brief summarizes some common key issues across this diverse industry.

Introduction

Climate change is expected to bring warmer temperatures, a rise in sea levels, ice melting in the Arctic, more frequent and severe extreme weather events, and decreased availability of natural resources such as fresh water.³ While the full impact of climate change on business is not entirely certain, these and other climate-related effects may result in new engineering challenges and increased capital costs for accessing and developing energy resources. They may also affect the reliability of transportation, logistics, and distribution channels to end users. In addition to the direct effects of climate-induced volatility, E&U companies will continue to experience increased political pressure as well as rising consumer and investor expectations for emissions accountability and expansion of the contribution of renewable energy-to-energy supply portfolios.

BSR's review of E&U disclosures to the Carbon Disclosure Project regarding climate-related business impacts and risks finds that company perceptions of climate risks and opportunities appear to vary significantly. Companies consistently reported being concerned over implications of increased policy pressure to reduce the greenhouse gas impacts from energy production and use. In addition, companies flagged issues such as production input constraints from natural resources, heightened safety concerns due to weather volatility, and rising insurance costs needed to support both capital and operating activities.

Several companies highlight diversification in distribution networks as a hedge against climate-related disruptions, while others point to more proactive

¹ Most of the information included in this brief is taken from public responses to the Carbon Disclosure Project by energy and utility companies.

² For briefs on mining and transportation, see www.bsr.org/adaptation.

³ Intergovernmental Panel on Climate Change. "Climate Change 2007 Impacts, Adaptation, and Vulnerability," Cambridge University Press. (2007). <http://www.ipcc.ch/ipccreports/ar4-wg2.htm>.

strategies and innovations, especially where financial returns or distinct market advantage are evident, such as customer engagement and new technology.

Some specific examples of climate adaptation issues that were cited included:

- » Water critical for cooling operations is becoming increasingly scarce due to reduced freshwater availability, yet demand for water as a coolant will likely continue increasing due to hotter weather.
- » A conflicting and shifting national and international regulatory landscape for greenhouse gas (GHG) management creates uncertainty for climate adaptation investments and threatens to create disjointed or inconsistent standards.
- » The industry is heavily reliant upon localized and mobile workforces and communities that can be particularly vulnerable to the physical risks of climate change.

Our analysis shows that while corporate climate change efforts focus on value protection and risk mitigation, overall adaptation initiatives remain limited in the sector, providing ample space for innovation and leadership. This condition appears consistent throughout the energy value chain from production and generation to consumption, management, and customer engagement.

Reporting on Risks and Opportunities

The following tables summarize 2009 company disclosures on climate change risks and opportunities to the Carbon Disclosure Project (CDP), one of the largest repositories of company reporting on climate change,⁴ as well as information gathered through publicly available sources. Company responses revealed common trends in reported risks and opportunities, which are grouped and summarized in the five areas below. Also included are examples furnished by companies in their CDP disclosures.

*Note that while company names are provided as examples, they do not constitute a comprehensive list of all companies that provided similar responses.*⁵

Mitigation refers to actions taken to reduce greenhouse gas emissions, which are primarily driven by energy use.

Adaptation refers to activities that reduce harm or risk of harm, or realize benefits associated with climate variability and climate change.

Carbon Disclosure Project Highlight: Of 207 company disclosures in 2009, 82 percent stated that climate change represents physical risk to the company, and 56 percent said that physical impacts of climate change present opportunity.

Source: BSR Analysis

Key:
Risks
Opportunities

1. CHANGING ACCESS TO ENERGY FUEL SUPPLIES

Projected rises in sea level and more frequent and severe weather events, along with evolving consumer demands, will significantly affect access to energy sources.⁶

Impacts	Reporting Companies
Changes to the natural landscape, including rises in sea level, ice melt, and permafrost melt, will have an uncertain impact on access to, and sustainability of, fossil fuel reserves.	BG Group, Caltex Australia Ltd., GDF Suez, Halliburton, Sasol, Progress Energy, Total S.A., Capricorn

⁴ For more information on the Carbon Disclosure Project, see www.cdproject.net.

⁵ See the CDP Investor Questionnaire at <https://www.cdproject.net/en-US/Programmes/Pages/More-Questionnaires.aspx> and the U.S. Securities and Exchange Commission's Guidance Regarding Disclosure Related to Climate Change at <http://www.sec.gov/rules/interp/2010/33-9106.pdf>.

⁶ Congressional Budget Office, "The Macroeconomic Effects of Hurricanes Katrina and Rita," *The Budget and Economic Outlook: Fiscal Years 2007 to 2016* (2006). <http://www.cbo.gov/ftpdocs/70xx/doc7027/01-26-BudgetOutlook.pdf>.

Increased resource shortages and scarcity, in particular for fossil fuels, due to weather variability, will increase costs of exploration and extraction.	Anadarko Petroleum Corp.
As resource availability fluctuates, access to fossil fuels and water will change, driving up wholesale energy prices.	Arrow Energy, Bharat Petroleum

2. GREATER DEMAND FOR ENERGY MANAGEMENT SOLUTIONS

Temperature extremes and severe weather, partnered with a changing energy mix, are leading consumers, utilities, and energy companies toward management solutions for a changing climate.

Impacts	Reporting Companies
Changes in temperature will impact equipment operations, including heat exchange, cooling processes, and limited days for drilling wells, leading to increased costs for equipment modifications, new assets, and relocation.	Caltex, GDF Suez, Spectra Energy
A more variable and extreme climate will result in strains on the grid. In particular, the change in hot days and cold days geographically will result in decreased network reliability and increased power outages.	Arc Energy, Avista Corp., Caltex, Halliburton, Kansai Electric Power Company, NiSource
Unpredictable weather and temperature changes may lead to greater fluctuations in consumer demand for energy.	PG&E, Con Edison, Dominion, National Grid, NiSource, Pepco Holdings, Tokyo Gas Co.
As the electrification of vehicles increases, demand for electricity during off-peak times will rise.	Entergy Corp., Florida Power & Light Co., Exelon Corp., DTE Energy, Idaho Power, Fortum, Ameren Corp.
Increased consumer awareness of energy use and management will lead to an increase in demand for products and services, including home energy audits and energy tracking systems.	OGE Energy Corp., Origin Energy, Allegheny Power, Dominion, Pepco Holdings, Progress Energy

Several thousand offshore drilling platforms, dozens of refineries, and thousands of miles of pipeline are vulnerable to disruption and damage from storm surge and high winds from tropical storms, as was recently demonstrated by hurricanes Katrina and Rita.

Those hurricanes halted all oil and gas production from the Gulf of Mexico, disrupted nearly 20 percent of the nation's refinery capacity, and closed oil and gas pipelines.

Source: U.S. Congressional Budget Office.

3. WATER AVAILABILITY

As global temperatures increase, levels of both freshwater and seawater will change, depending on location, affecting E&U operations.

Impacts	Reporting Companies
Water supply shortages will constrain cooling operations, leading to equipment malfunctions, depreciation, and electricity outages.	Florida Power & Light Co., Electricite de France, Iberdrola Renewables, Korea Electric Power Corp.
Drastic variations in the water supply could result in the temporary or permanent closure of hydroelectric generation plants due to drought or excessive flooding.	Exelon Corp., Pinnacle Energy Services, Xcel Energy, ATCO Ltd., Cemig, Endesa, Epcor Utilities Inc., Tepco, Scottish and Southern Energy
Increased competition for water supplies among sectors and communities will lead to higher costs, reduced availability, and regulation of water permits.	Cairn Energy
Hydroelectric generation may outcompete other energy generation sources due to favorable water supply conditions in certain geographical regions.	Idacorp Inc.

4. POLICY AND INVESTOR PRESSURE

The expectation of carbon-reducing climate change policies, and in turn, investor concerns about companies' ability to effectively respond, puts significant pressure on E&U companies to show how they are positioned to thrive in a low-carbon economy.

Impacts	Reporting Companies
Investors may seek companies with fewer risks related to fossil fuels, and greater opportunities for renewable energy and technology development.	Centrica, Devon Energy, Lundin Petroleum, Origin Energy, Penn West Petroleum, Spectra Energy
Increased public scrutiny involving corporate energy and water use may lead to decreased investment and damage to companies' reputations.	Centrica
Companies face a changing and uncertain policy landscape, in particular on the global level, resulting in increased risks in connection with inaction.	Hafslund, AMEC, Ratchaburi Generating Holding Company, Xcel Energy
Policy incentives have been designed to reward utilities for achieving energy efficiency that can be achieved through consumer engagement as well as new adaptive product and service offerings.	PG&E, British Gas

5. WORKFORCE SAFETY AND SECURITY

Adverse weather conditions may lead to increases in health and safety risks, along with workplace security, including accessibility.

Impacts	Reporting Companies
As sea levels rise and severity and frequency of storms, fire, and other dangerous environmental changes increase, physical risks to employees will rise.	Hess
Higher temperatures and changes in water tables will increase the spread of disease, threatening employees in high-risk locations.	BG Group, Cairn Energy, Caltex, Pepco Holdings, Halliburton
As unpredictable weather events increase, accessibility to the workplace and available work in functioning facilities may decrease, resulting in uncertain working hours for employees and a restless workforce.	ARC Energy, Marathon Oil Corp.
As migration attributed to climate change increases, it will force employees out of their current residences, causing a shift in workforce availability, including an increase in climate refugees.	Cairn Energy, GDF Suez

Current Practices

In response to these risks and opportunities, companies are pursuing a range of adaptive practices to stay ahead of climate-related impacts. In some cases, these practices are intended to **protect value** of existing assets and systems. In others, practices are aimed more at **creating value** through innovation and meeting new needs that stem from climate change effects.

The following examples of practices and innovations are drawn primarily from the 2009 CDP responses, and are supplemented by conversations and publicly available data, including corporate social responsibility reports from companies.

VALUE PROTECTION

These practices provide examples of how companies are promoting resilience of physical assets and improving system responses to effectively execute on existing plans and expectations to maintain business as usual.

About Adaptive Practices

Based on identified risks and opportunities, companies report that they are pursuing a range of adaptive responses, which are included in this section.

Adaptive practices are grouped by two types:

- **Value Protection:** Ensuring resilience of physical assets and planning responses to maintain business as usual.
- **Value Creation:** Devising solutions that contribute to the ability to pursue new revenue-generating opportunities and help suppliers, stakeholders, and customers adapt to a changing climate.

1. **Site risk assessment and disaster planning:** To better prepare for extreme weather events, disasters, and equipment malfunctions, companies are investing in extensive physical risk assessments to operations, including employee safety, and subsequent disaster planning specific to climate change threats.
 - » **EVN** has leveraged its geology branch, EVN Geoinfo GmbH, to analyze and integrate detailed data, such as floodwater studies, into its planning processes for site identification, environmental protection, and crisis management. The company has also packaged this into a commercial product for governments, the tourism industry, and environmental management bodies.
 - » **Centrica** has created extensive employee and customer well-being planning in the wake of the several hurricanes that have affected operations to address workplace accessibility, home relocation and/or damage, and employee safety in the event of an emergency.
2. **Investments in climate-resilient assets:** To minimize disruption and damage to services and operation sites from sudden weather events and changes in temperature, companies are investing in new technology and improvements to existing infrastructure, and incorporating such considerations into plans for future facilities.
 - » **Con Edison** has put in place an internal energy reduction and efficiency plan, based on lighting, windows, insulation, and HVAC system upgrades, with a payback period of four years or less and a CO₂ reduction goal of 1,250 metric tons per year.
 - » **Entergy** is investing in a wide range of equipment upgrades, including coal retrofits, smart-grid investments, and combined gas turbine plants. As the energy industry enters into a stage in which assets are quickly depreciating, retrofits and asset investment will become a critical investment for resilience against a changing climate.
 - » **Transocean** has invested in increased water recycling for effluent to allow reuse of residual water. The company has also developed a new drainage management system for its rigs to reduce water intake. This will result in an overall reduction of energy and water consumption.
3. **Strategic Diversification:** To account for predicted customer and equipment losses in high-risk areas, companies are expanding their operations to high-density locations to meet the increasing demand of urbanization.
 - » **FirstEnergy**, among other companies, relies on geographic distribution to provide resilience to the business as a whole, regardless of site-specific consequences. For example, all business locations in a particular region may be shut down due to severe hurricane damage, so the company as a whole expects other business locations to absorb the loss in place of investments in climate change adaptation measures.
 - » **DTE Energy** is attacking the carbon issue through several avenues, including carbon capture and sequestration investments, ionic liquids for carbon-capture research, oxy-combustion research for carbon capture, and afforestation.

VALUE CREATION

These practices offer examples of how companies are creating adaptation solutions and innovations that support new forms of revenue generation and potential direct savings opportunities.

1. **Customer energy management:** As awareness of individual impacts upon the environment grows, the demand for renewable energy sources and energy management systems is already increasing. In response, companies are developing customized solutions.
 - » **The EDF Group** has designed an interactive game that teaches customers about energy efficiency measures and materials for their home. On the commercial side, EDF has developed a suite of solutions for companies subject to carbon emission quotas.
 - » **PHI's** subsidiary utility companies are offering smart-meter programs that allow customers to monitor, better understand, and modify the patterns of their energy use. The more advanced systems will support demand-side management. Its subsidiaries, including Pepco, DPL Energy, and Ace Energy, offer rebates, bill credits, and other financial incentives to residential and commercial customers for installing energy-efficient appliances.

2. **Renewable energy technology investments:** Companies are increasingly investigating and investing in new technology to produce energy and shift away from fossil-fuel dependent processes, such as through the evolution of electric vehicles. Yet there is a balance between technological innovations and market readiness that hinders commitment to low- or no-carbon alternatives for some companies.
 - » **Progress Energy** has developed the second generation of compressed air energy storage (CAES) technology to store off-peak energy in the form of compressed air, which can be applied to growing forms of renewable energy, including wind.
 - » **Sempra Generation** created one of the largest solar energy power-generation facility in North America with panels that do not use water or other liquids in the power-generation process, giving it, in desert and semi-arid regions, a distinct advantage over other solar technology.
 - » **Chevron** is adding diversity to the fuels market by investing in first-generation biofuel production. It is also contributing to second- and third-generation biofuel studies through sustainable and scalable feedstock research and improved conversion technology to produce fuels that are compatible with existing vehicles.

3. **Strategic partnerships:** Companies are finding a variety of interested parties to collaborate on research and development that will enable advanced energy solutions and technology:
 - » **British Gas** has partnered with Romag Holdings to test, market, distribute, and install British Gas' solar power canopies and other products related to the solar car parking suite for shopping centers, airports, office buildings, and other facilities.
 - » **Con Edison**, the Electric Power Research Institute, and electric cable manufacturers are working together to use superconductor technology to improve substation feeder power routing and networks, adding to network reliability.
 - » **Exxon** has partnered with General Electric, **Schlumberger**, and Toyota through Stanford University's Global Climate and Energy Project to research low-emission, high-efficiency, and scalable technology that

could diversify future energy options. The research has spanned multiple industries and both develops new technologies and provides potential solutions for shortfalls of current technologies. Some of the many investments to date include better controls for reliable grid operation for renewables, plasmonic photovoltaics, and photosynthetic bioelectricity.

Recommendations

This paper has cited a range of climate-related risk and opportunities and provided a sampling of reported climate adaptation responses. **There remains significant opportunity for the E&U industry to play a larger role in the proactive and responsible management of climate change adaptation.**

Given the expected magnitude and emerging understanding of climate-related impacts, company responses seen so far are unlikely to meet all of these challenges. Many companies have yet to integrate awareness of climate change issues, management, and adaptation into their short or long-term planning processes.

In addition, climate change presents E&U companies with a whole new set of considerations to navigate, such as how to pursue opportunities in more remote and difficult operating environments, how to work responsibly in pristine ecosystems and local communities that are opening up to business for the first time, and how to respond to stakeholder scrutiny on operations in contentious places, such as the melting Arctic.

The E&U sector is positioned to provide additional turnkey solutions for addressing climate change. Since the industry spans the value chain, and directly affects the type, reliability, and climate impact of consumer energy, there is a breadth of possibility for innovation. The sector is also markedly vulnerable due to the weather-related risks specific to its operations, and the increased public interest in its operations, products, and services.

For these reasons, BSR recommends that E&U companies establish climate change adaptation strategies that contain the following key components:

1. Customer engagement. Engagement programs can expand beyond energy-tracking programs to engage customers about their energy use and to identify innovative ways to reduce GHG emissions together. Such investments let E&U companies invite customers to understand their energy footprint and specifically invest in types of energy that may dictate which providers a utility will partner with or source its energy from to maintain market share.

2. Policy formulation and incentives. Since regulatory uncertainty and policy misalignment can complicate investments in climate adaptation solutions, E&U companies can play a growing role in shaping energy policies. As governments increasingly rely upon incentive programs to shift the energy mix and consumption patterns, early adopters of sustainable energy sources and management tools stand to see long-term commercial benefits, improved reputation, and an expanded customer base.

3. Cross-sector collaboration for new technology. Companies can work with other key sectors to understand the potential for overlap and market readiness of technological innovations. Engaging with the transportation and information and

communications technology industries, E&U companies may identify new, mutually beneficial investments, including opportunities to develop GHG-reducing technology.

4. Secure water contracts. Water is a key resource for the majority of E&U operations, so forecasting availability and need will be crucial to securing supplies through contracts and partnerships.

5. Risk and innovation for climate readiness. E&U companies should approach climate change management on two fronts. First, investing in risk management that may include various weather instruments to help monitor change over time at each site, which can feed into an overarching strategy for adaptation. Second, developing innovative business models, with the potential to collaborate, that address key sector needs. For instance, through partnering with an online company, utilities can inform customers how and when to reduce their energy usage to alleviate network stress during peak days.

6. Expand community engagement to include climate change risks. E&U companies have a long tradition of community engagement and are well-positioned to consider climate change adaptation. Their project impact, outreach, and social investment activities can address key issues, including fresh water, access to energy, and safety. In addition, increasing recognition of cumulative social and environmental impacts from multiple capital projects in a given region may offer another venue for addressing climate change adaptation with peers and other industries. For more on in mining, see our brief for that industry at www.bsr.org/adaptation.

In summary, many E&U companies are proactively increasing energy efficiency, investing in resilient clean technology, and incorporating stakeholder considerations in their climate change strategies. Significant progress is evident in equipment upgrades and water management to ensure safe and cost-effective operations. Leading companies have identified key personnel that are responsible for creating and managing climate strategies that address the environmental and societal risks specific to the industry and companies.

Other companies have taken on a diverse set of research and innovation objectives aimed at longer-term technological investments. These include investing in the electrification of transportation through battery research for vehicles, or in the power of consumers through extensive engagement programs aimed at behavior change. Companies are also buttressing existing plans and programs to protect employees from potential climate impacts through safety, training, and job assurance. Lastly, companies are unlocking new ways to engage and reward customers and investors for supporting efforts to reduce GHG emissions. Through a combination of management and proactive investments, E&U companies have the unique potential to unlock commercially viable energy solutions to the negative effects of climate change while providing adaptive opportunities for energy customers. This set of examples points the way forward for the diverse E&U industry in starting to adapt to a changing and uncertain climate.

For more tools on managing climate change adaptation, visit: www.bsr.org/adaptation.