# Resource efficiency in supply chains: starting with emissions reductions

*White paper*

# Executive Summary

The Paris Agreement signed at the UN climate conference in December 2015 unites more than 190 countries behind the goal of limiting global greenhouse-gas emissions enough to keep the increase in global average temperatures to well below two degrees Celsius above pre-industrial levels. While the parties to the agreement have pledged to reduce their own greenhouse-gas emissions in pursuit of the two-degree limit, the success of the agreement ultimately depends on whether countries that emit the most greenhouse gases achieve major emissions reductions. China is foremost among the nations that will play decisive roles in this regard.

Analysts expect China's ongoing economic transformation to cause a noteworthy decline in its greenhouse-gas emissions—though not enough of a decline to reach, by 2050, the 41 to 72 percent reduction that the two-degree goal calls for. Similarly, 15 other high-emissions countries, including the US, have emissions-reduction plans that aim below the two-degree target. In the absence of more ambitious targets and corresponding public policies, reducing emissions in line with the Paris goal will require businesses to lower their emissions by more than what their national governments require.

Few companies will find it easy to do this while continuing to grow. Large consumer businesses, for example, would have to lessen their carbon intensity by more than 90 percent between 2015 and 2050 to produce Paris-level emissions reductions and simultaneously increase sales at the rate expected for their industry. That would be an unprecedented level of emissions reduction. Making such a reduction is especially difficult because most industrial carbon emissions occur in companies' supply chains —the parts of their business over which they have the least control. The fact that so many global supply chain links are located in China is part of the reason why the country's emissions are high in absolute terms, and why the country therefore has a significant part in reducing global emissions.

Several factors inhibit companies from lowering emissions in their supply chains. One is the length, complexity, and opacity of supply chains: less than one-fifth of companies surveyed by The Sustainability Consortium reported having a comprehensive view of their supply chains' sustainability performance. Another is that suppliers tend to be less capable of improving their sustainability performance than the large multinationals they serve. Few have the technical knowledge or management skill to lower their consumption of energy and resources. And many suppliers, particularly small ones, lack the capital to finance sustainability improvements.

Notwithstanding these challenges, some large companies are pursuing the benefits of helping their suppliers to improve their sustainability performance. Pioneering companies' reports about their supply-chain sustainability efforts suggest that the following five tactics are especially effective.

**1. Setting aggressive goals** helps companies achieve larger performance improvements and realize greater returns on their investments.

**2. Deploying renewable energy** lowers both the cost and the price volatility of energy.

**3. Advising and directly investing in suppliers** makes it easier and more rewarding for them to plan and implement sustainability programs.

**4. Engaging suppliers on a collective basis** gives them a consistent set of standards and common practices that make it easier to meet customers' expectations.

**5. Supporting policies and regulation** creates pro-sustainability incentives and sends powerful signals to guide business decisions and investments.

As some of the world's largest and most influential organizations, the companies represented by the members of the CEO

Council are in a strong position to demonstrate and promote these approaches to increasing resource efficiency. In doing so, both Chinese companies and US companies with operations or supply chains in China, can make a meaningful positive impact not only on global sustainability challenges, but also on core business performance.

# The challenge

In December 2015, under the auspices of a United Nations meeting in Paris, more than 190 countries reached an agreement aimed at reducing global greenhouse-gas emissions enough to keep the increase in average global temperature to well below 2 degrees Celsius above pre-industrial levels. In September 2016, the United States and China ratified the Paris climate change agreement. As the world's largest contributors to global greenhouse gas (GHG) emissions, this move represented a major step toward bringing the Paris Agreement into force. The Paris Agreement will enter into force on November 4, 2016, obliging the countries party to it, to enact their emissions-reduction pledges. Fulfilling these national pledges will require businesses and other institutions to make drastic improvements in sustainability performance.

Just how drastic are the necessary changes? Looking at a sample of 50 of the largest consumer companies globally provides one indication. The average long-term growth expectation for these companies is 5.3 percent per year. This expected growth is already priced into the stock market capitalization of these companies and accounts for approximately 51 percent of their market value. To cut emissions in line with the Paris target while simultaneously increasing sales at the rate anticipated by shareholders, these 50 companies would have to lower their carbon intensity—the amount of greenhouse gas emitted per unit of output—by *more than 90 percent* between 2015 and 2050.

Achieving this level of emissions reductions will require businesses in most sectors to pay particular attention to their supply chains - for example with respect to material and energy sourcing, and component manufacturing - because that is where sustainability impact is concentrated. For the 50 large consumer companies we studied, supply chains account for more than 80 percent of greenhouse-gas emissions and more than 90 percent of the impact on air quality, land, water, biodiversity, and geological resources. This concentration of sustainability impacts in the supply chain is common to most industries. And because China has emerged as the largest global exporter during recent decades (for example, China exports over $150 billion worth of apparel annually, more than the next 8 apparel exporting countries combined), many of these supply chain impacts occur in China. Yet today, most companies focus their sustainability programs on their direct operations, and relatively few work with their suppliers to reduce sustainability impact and related risks in the supply chain.[1]

Several factors make it difficult for companies to influence their suppliers. First, supplier networks tend to be global, complex and multi-tiered. Primary suppliers routinely subcontract portions of large orders to other businesses. Second, those supplier networks can be difficult for companies to monitor closely. In a recent survey by The Sustainability Consortium (TSC), a nonprofit organization dedicated to improving the sustainability of consumer products, less than one-fifth of the 1,700 respondents said they have a comprehensive view of their supply chains' sustainability performance.[2]

Furthermore, suppliers and subcontractors are typically less sophisticated than the large companies they serve. Particularly when it comes to their sustainability performance, suppliers often lack both the technical knowledge to find or prioritize opportunities for improvement and the systems and processes they need to capture those opportunities. Academic studies have shown that larger firms tend to manage their energy use more effectively than small firms, with

[1] From Agreement to Action, CDP Supply Chain Report 2015/2016, CDP

[2] Greening Global Supply Chains: From blindspots to hotspots, 2016 Impact Report, The Sustainability Consortium

top-quartile performers lowering the energy intensity of their output 17% per unit of value versus bottom quartile performers.[3]

Finally, small suppliers in developing countries, who may have the best opportunities to improve resource efficiency, often have trouble paying for those improvements. The investment is usually more than a small supplier can fund from working capital, and loans can be prohibitively expensive. Academic researchers have found that few suppliers pursue all the opportunities they have to improve sustainability performance and that suppliers typically only consistently invest in energy-efficiency improvements that have a rate of return exceeding 50 percent.[4] Because of these challenges, many efficiency gains never take place.

These conditions make it difficult for companies to increase the resource efficiency of their supply bases. Fortunately, they can be overcome if leaders in global business, like the members of the CEO Council, take individual and coordinated actions to influence the choices of their companies' suppliers. With so many of the world's suppliers being located in China, large companies stand to make big improvements in their resource efficiency by working with Chinese suppliers. Fortunately, these suppliers there also have a demonstrated capacity for adapting to new customer requirements as well as ample opportunities to boost resource efficiency.

[3] Bloom et al. (2010)

[4] Anderson and Newell 2004

## Solutions

China's world-leading industrial sector consumes more energy than any other sector of its economy: 55 percent of the country's total energy consumption in 2013, according to the National Bureau of Statistics. As China's economic reform program and other factors cause its mix of economic activity to shift away from heavy industry and export-led manufacturing and toward services, its greenhouse-gas emissions should decline significantly.

These expected emissions reductions should make it relatively easy for China to achieve the targets it established in its Intended Nationally Determined Contribution (INDC), a plan it submitted to the United Nations prior to the Paris climate conference. Projections suggest that China would probably meet its INDC targets thanks to policies it has enacted already, along with the expected economic shift toward services. On the other hand, China's INDC targets, like those of some other large emitters, appear modest compared with the ambitions of the Paris Agreement. A recent paper by the Energy Transition Commission (ETC) assessing the INDCs of more than 15 countries, including China's, found that while they will slow emissions growth, it will not be enough to achieve the Paris Agreement's goal of restricting the global temperature rise to well below two degrees Celsius. In the six largest carbon emitting countries and regions (including China, the US, and the EU), plans suggest that energy productivity will improve by 1.8% a year on average until 2030, compared to 1.2% a year over the last 15 years.[5] But reaching the Paris goal would require a 3 percent annual improvement in global energy productivity and a 1 percent annual increase in zero-carbon energy's share of the global energy mix every year until 2050[6].

Earlier analyses also suggested that limiting global temperature increases will require large emissions reductions. In 2013, CDP and World Wildlife Fund (WWF) estimated that the US corporate sector would need to cut its greenhouse gas emissions by 3 percent per year, in absolute terms, between 2010 and 2020 in order to adhere to the Intergovernmental Panel on Climate Change's (IPCC) recommendations for reducing greenhouse-gas emissions. The report found that achieving this goal is not only realistic, but would also be financially advantageous, producing cost savings for US companies of up to $190 billion annually by 2020.[6] Furthermore, efforts by utilities, customers and suppliers could reduce GHG emissions by another gigatonne in 2020.

The global reach of supply chains means that companies will have to work closely with suppliers in many countries to capitalize on the financial opportunity for improving resource efficiency. It also creates a measure of reputation risk: companies that fail to engage their suppliers could be seen as implicitly exporting their sustainability impacts to the countries they source from.

Businesses can help their suppliers capture opportunities using two main tactics: improving energy efficiency with technological upgrades, new workplace behaviors and processes, and changes in management practices; and using more low-carbon energy. Worldwide, some companies are aggressively pursuing these opportunities; but many more are not. Low-performing companies can thus create substantial value by aggressively implementing good practices in resource efficiency within their own operations as well as their supply chains.

So far, Chinese companies, including manufacturers and other suppliers, have been relatively slow to embrace

[5] Pathways from Paris - Assessing the INDC Opportunity, Energy Transitions Commission, Apr 2016

[6] Shaping Energy Transitions, Position Paper of the Energy Transitions Commission, April 2016

opportunities to improve their resource efficiency. Energy management practices and performance varies widely among companies, even within the same sector. But things are beginning to change. A recent report indicates that more than 150 companies, including eight companies in China, are using an internal carbon price to help lower risk exposure from existing or emerging carbon regulation and to guide investment decisions—a relatively sophisticated practice.[7] Given their market share and influence, these kinds of efforts, taken by US and Chinese businesses in particular, could help increase global energy productivity and put the world on a 1.5 degree path (and make money doing so).

Below, we describe five approaches that leading companies are using to improve the performance of their supply chains, which might serve as models for other companies that wish to create value by extending their sustainability efforts beyond their direct operations.

## 1. Setting Aggressive Goals

Research suggests that setting aggressive emissions-reduction targets helps companies to achieve these goals while also realizing greater returns on their investments in reducing emissions. An analysis of S&P 500 companies found that companies which set greenhouse-gas reduction targets (as reported to CDP) achieved a return on invested capital on their carbon-reduction investments that was 9 percentage points more, on average, than the returns of companies that did not have reduction targets.[8]

In China, most companies that have targets are state-owned enterprises with direct links to the national plan to reduce carbon intensity. Private companies thus have more opportunity to set targets, deliver performance improvements, and create financial value. In light of the ETC's recommendation that global energy productivity improve by 3 percent each year, applying targets for every factory in a global supply chain can help large companies magnify their energy productivity efforts.

Cities in China are also setting targets for energy intensity. China's National Development and Reform Commission established China's Alliance of Pioneer Peaking Cities (APPC) to encourage cities to curb their emissions by 2030. In June 2016, the APPC had collected such commitments from 23 member cities and provinces.

Increasingly, companies are basing their sustainability goals on the internationally agreed target of lessening emissions from 2010 levels between 41 to 72 percent by 2050. General Mills, for example, used this approach to set its goal of reducing greenhouse gas emissions "from farm to fork" by 28 percent within ten years. Because its supply chain emits more than two-thirds of the greenhouse gas associated with its products, the company is working with its agricultural suppliers, through coalitions such as Field to Market, to provide access to data about land, water, energy and GHG emissions impacts related to farming practices.

Beyond energy and emissions, companies and municipalities are setting goals for how they manage resources. A common goal is to send zero waste to landfills. For example, as part of the #OneNYC program, New York City aims to send zero waste to landfills by 2030. Similarly, Walmart has committed to achieving zero waste across its global operations. It has managed to divert more than 70 percent of its waste from landfills in

[7] Embedding a carbon price into business strategy, CDP, Sep 2016

[8] The 3% Solution – Driving Profits Through Carbon Reduction, World Wildlife Fund and CDP, 2013

Mexico, more than 80 percent in the US, and more than 90 percent in Japan.[9]

## 2. Increasing renewable energy deployment

Although electricity prices, regulatory structures, and financing mechanisms for renewable energy vary around the world, more and more companies are increasing their purchases of renewable energy and investing in renewable energy capacity of their own. Utility-scale solar power is becoming cost-competitive with traditional energy sources in many places. Recent tenders for such projects have seen prices of less than US$0.03 per kilowatt hour (KWh) in the Middle East[10] (compared to an average price of electricity of US$0.703 per KWh for the US industrial segment,[11] and approximately US$0.10 per KWh in China[12]).

Some corporations will wait for their utilities to source more clean energy. But leading businesses are choosing to move faster than that and develop renewable energy sources for their own operations as well as their supply chains. Apple is working with component, assembly, and packaging companies in its global supply chain to install more than 4 gigawatts of new clean energy capacity, including 200 megawatts in China.[13] Google is investing US$2.5 billion in wind and solar projects representing 3.7 gigawatts of capacity. Ikea has committed to meet all its energy needs using renewable sources by 2020. The company has spent $US 1.5 billion since 2009 to install more than 300 offsite wind turbines and to place more than 700,000 solar panels on IKEA buildings.

In China, many companies are taking advantage of the renewable energy feed-in tariffs introduced by the Chinese government in 2013 to invest in new clean-energy capacity. Haier announced a 20 megawatt solar project in 2014. Around the same time, Saic and Galanz each invested in 50 megawatt solar projects. Given that Chinese companies make the majority of the world's photovoltaic cells and wind turbines,[14] policies that encourage Chinese companies to use renewable energy should stimulate further growth of the Chinese renewable energy equipment sector.

## 3. Working with suppliers

Companies have greatly refined and expanded their approaches to influencing their suppliers' sustainability practices. Only 10 or so years ago, their efforts mostly consisted of disseminating codes of conduct and performing audits to track compliance. Others surveyed their suppliers using questionnaires—a practice that quickly became onerous for suppliers, since suppliers typically work with a multitude of buyers and each buyer has a unique questionnaire. Newer approaches streamline the measurement and reporting aspects of managing suppliers' sustainability performance. Some companies go as far as helping suppliers to design and implement resource efficiency programs and even provide financial support for the programs. Examples include:

- Action Exchange, sponsored by CDP and the Institute for Industrial Productivity, is a program to help companies that participate in CDP[15] to move beyond disclosing supply-chain performance to improving it. By providing suppliers with access to

[9] http://corporate.walmart.com/global-responsibility/sustainability/

[10] Irena Quarterly, International Renewable Energy Agency, Q3 2016

[11] Electric Power Monthly, US Energy Information Administration, Jun 2016

[12] For Shangdong province; Mass industrial electricity price may continue to decline in China, PV Magazine, Jul 2016

[13] http://www.apple.com/environment/climate-change/

[14] China's Goldwind is the market leader with 12.5% market share according to statista.com

[15] Those participating in CDP Supply Chain Program; over 4,000 companies disclosed climate change and water information in 2015

information and technology, the program helps them identify energy efficiency measures that yield the best return on investment. It also connects suppliers with companies that offer cost-effective solutions for reducing emissions. Companies like Philips, Jaguar, and Diageo are participating in Action Exchange to help them meet the GHG reduction targets they have set for their supply chains.

- Urjanet offers a technology platform for owners of large networks of property that aggregates data directly from the utilities that provide electricity, natural gas, water, and waste collection services to their buildings. Since this data often comes in different formats from a disparate network, Urjanet makes the data easier to use by converting it into standard formats. Companies can then analyze the data to develop strategies for improving resource efficiency and lowering utility costs.
- China Mobile requires its suppliers to use lightweight packaging for their shipments. In 2015, the company achieved 60 percent compliance among its suppliers. The company also collects information from suppliers about employees' working hours, compensation, health, and safety.
- Unilever and an academic partner developed a company tool to identify which farmers are pursuing sustainable agricultural practices. In support of Unilever's aim to procure 100 percent of their agricultural input from sustainable sources by 2020, the company provides the tool to farmers at no cost to them.
- Levi Strauss established a $500 million Global Trade Supplier Finance program, together with the International Finance Corporation, to provide low-interest, short-term loans to suppliers that perform well on Levi's sustainability scorecards.

## 4. Boosting industry collaboration

Corporate supply chains often overlap, with the same supplier or logistics company providing products and services to multiple companies in the same industry. When these various companies set different standards and targets for sustainability performance, suppliers find it much more difficult to fulfill all these expectations at once. To simplify matters, companies are coming together to compare and unify their supplier-engagement approaches. Examples include:

- The Electronic Industry Citizenship Coalition is a group of companies that collaborate to improve environmental and social impacts and governance in global electronic supply chains. It offers more than 100 members, across 17 industries,[16] a standard approach to measuring and reporting on GHG emissions, water, and waste in the supply chain. The association also developed a set of standards on social, environmental, and ethical issues in supply chains. Through the association, members share best practices and take part in training courses on improving environmental sustainability. EICC also participates in CDP's supply chain program, which helps EICC members to lessen the reporting burden on their suppliers and improve visibility of key issues and efficiencies across the electronics value chain.
- RE100 is a global initiative to support the transition to 100 percent renewable energy, by sharing the business case and effective practices for using renewable energy and working together to overcome barriers. Since 2014, 81 companies have joined RE100, including some of the world's most influential businesses.

[16] http://www.eiccoalition.org/join-us/

- The Sustainability Consortium (TSC) is a nonprofit organization dedicated to improving the sustainability of consumer products. TSC offers its 100 members a scientific approach to measuring performance, tools and methods for improving performance, and mechanisms for sharing knowledge and collaborating on shared challenges.
- Together for Sustainability (TfS) is a joint initiative formed by chemical companies with the aim of creating a global program for engaging suppliers on measuring and improving their sustainability performance. The initiative facilitates supplier engagement by offering suppliers a single platform they can use to share assessment and audit results with multiple buyers.

## 5. Encouraging supportive policies and regulation

China has enacted policies and regulations to stimulate improvements in industrial energy efficiency and support the nationwide deployment of renewable energy. In March 2015, China's State Council released its "Opinions Regarding the Deepening of the Power Sector's Reform" encouraging competition in China's electricity sector and changes to the existing pricing system. The proposed reforms would allow private and foreign companies to participate in the electricity industry.[17] In March 2016, China's National Energy Administration released its "Guiding Opinions on Establishing Renewable Energy Portfolio Standards" which indicated that renewable energy should account for 15 percent of total primary energy consumption by 2020 and 20 percent by 2030. (As mentioned above, the government has introduced some feed-in tariffs to support the transition to solar.) China is also planning to launch a national emissions trading scheme in 2017, which would cover eight sectors and expand the scope of traded emissions from the 9 percent of global emissions that are included in its current city-level emissions-trading systems to 16 percent.[18]

To reach the 1.5 degree target set forth by the Paris Agreement, the CEO Council could advocate more ambitious commitments and stronger supporting mechanisms. These would send an important signal to guide consumption choices and investments. For example, in the run-up to the Paris climate change summit, a coalition of 10 global companies known as the B Team advocated limiting the global temperature rise to 1.5 degrees Celsius, set a goal of reaching net-zero greenhouse gas emissions by 2050, and called on governments to do the same. The B Team also advocated for meaningful, effective carbon pricing[19].

Other groups, such as the World Bank Partnership for Market Readiness and the Carbon Pricing Leadership Coalition launched at the Paris summit, bring together leaders from the public, private, and civil-society sectors to implement and expand the new carbon policy. The CEO Council could lend its support to such organizations' efforts. It could also back the introduction of the planned national emissions trading system in China, especially since such the launch of such a market will have major international implications.

[17] China's fast track to a renewable future, RE100 China Analysis 2015, The Climate Group

[18] China's National Emissions Trading System, Jeff Swartz, International Emissions Trading Association (IETA), March 2016

[19] Bteam.org

# Case studies

This section offers a closer look at how certain companies, NGOs, and governments are improving resource efficiency in supply chains and across sectors. The practices described here might provide useful models for the organizations represented by the members of the CEO Council, as well as ideas that the CEO Council might promote in China and other key markets.

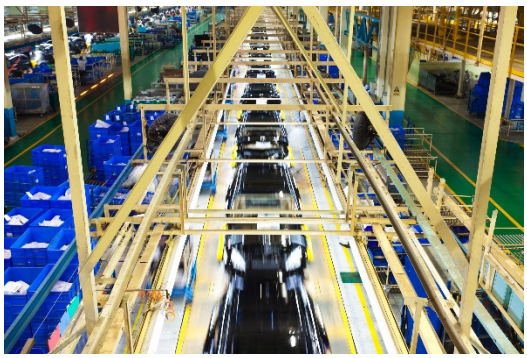
## A. Walmart's factory energy efficiency program

In 2010, Walmart set an ambitious goal to reduce emissions in its global supply chain by 20 million metric tons – an amount roughly equal to the emissions from its direct operations – by 2015. A factory energy efficiency program in China was an integral part of delivering this commitment. Initially, the factory energy efficiency program aimed for a 20 percent improvement at more than 200 factories in China, which would generate more than $270 million in cost savings for suppliers, as well as a reduction of 2 million metric tons of greenhouse gas emissions. The early approach was to use "boots on the ground." However, progress proved somewhat slow, because suppliers had limited on-site expertise and resources, diverse processes, and inadequate reporting tools. Initial results suggested it would take years to reach the full supply chain.

To accelerate the program, Walmart and McKinsey Solutions developed an online tool called RedE that enables corporate buyers and supply chain factory managers to identify, size, and track the implementation of resource efficiency projects in a variety of operational settings. The tool, available in Chinese, was designed for use in a range of industries including manufacturing, assembly, mining and metals, food, electronics, and retail. After users enter basic information about their facilities (e.g., types of equipment and processes, types and amounts of utilities consumed, and production information), an advanced algorithm recommends projects that are suited to the facilities. The results of using RedE contributed to Walmart surpassing its goal of reducing supply-chain emissions by 20 million metric tons.

## B. Automotive suppliers in Shandong

In 2016, the Shandong Energy Savings Office, the Massachusetts Institute of Technology, and McKinsey worked with a cluster of 90 automotive component suppliers in Jinan city to assess the relationship between a factory's overall management performance and its resource efficiency performance. The initial review showed significant variation in energy efficiency. The least efficient casting and forging processes, for example, were found to consume nearly three times more energy per yuan of revenue than the most efficient processes. The variation among machining processes was even greater, with the least efficient companies using about four times as much energy as the most efficient to generate the same amount of revenue.



The study also found that energy productivity is strongly correlated with overall management capability. Less sophisticated management tends to focus on optimizing energy costs (e.g., load shifting to cheaper times of the day, driving higher utilization of energy intensive processes); more sophisticated management shifts focus to energy intensity, with the aim of reducing amount of energy used per unit of output.

Now that the initial phase of the assessment is completed, the supplier cluster is working on an ongoing basis to develop and share ideas for improving resource efficiency with

the aim of improving the cluster's overall competitiveness.

## C. Resource efficiency at Dow

In 2015, Dow announced it sustainability goals for 2025, and set a target to use 400 megawatts of clean power. Having met that goal within a year, it reset its target to 750 megawatts. To help meet this commitment, in mid-2016 Dow announced a ten-year agreement to purchase 150 megawatts of renewable power from NRG wind farms[20]. The renewable energy goal, as well as a pledge to reduce water intake and waste production by 20 percent over a 10-year period, applies across Dow's network of facilities, including those in China.

As part of its 2025 sustainability goals, Dow has also committed to advancing its use of circular economy principles, which calls for the elimination of waste and the prolonged, repeated use of goods in a manner that maximizes the value of the original energy and material inputs. Because it takes much more energy and material to produce goods initially, reusing goods has significantly less sustainability impact and thus presents substantial opportunities to improve the resource efficiency of factories. With its expertise in material innovation and science, Dow is searching for ways to make the design, production, use, and recovery of materials more efficient. Dow's position at the center of material systems and at the forefront of research and development also enables the company to educate its customers about the sustainability impact of material and design choices.

## D. CDP's Supplier Disclosure Program

Over the last decade, CDP has become a leading global platform for large companies to publicly disclose the greenhouse gas emissions associated with their operations. CDP has also expanded its capabilities to help companies track the sustainability performance of their supply chains. In 2016, 89 large companies chose to participate in CDP's supply chain program, including lead members General Motors and Walmart. At the request of these 89 companies, more than 4,300 supplier facilities, including 238 Chinese suppliers, completed CDP's supplier questionnaire during the 2016 reporting cycle. Twenty-four companies also asked their suppliers to disclose data on water productivity.

By asking suppliers to participate in this program, a company can gauge the sustainability performance of its supply chain and make comparisons with peer companies. Participating in supplier reporting programs like CDP's provides management with data to use in making decisions and sends suppliers a signal about the importance of measuring and reporting their sustainability performance.

# Conclusion: A framework for collaboration

Climate change, water scarcity, and other global environmental challenges create risk for companies, particularly large, complex businesses with operations and suppliers around the world. Customers, regulators, and other stakeholders increasingly expect companies to help address these challenges, as it becomes evident that existing or expected policy mandates may not be enough to slow harmful environmental change. These pressures apply in particular to companies that do business in China, which accounts for a significant share of global greenhouse-gas emissions and is home to many of the world's suppliers.

The case examples described in this paper illustrate how the companies represented by

[20] "Dow Increases Clean Energy Targets Aligned to 2025 Sustainability Goals", Dow press release, May 17, 2016

CEO Council members are already acting on many of these dimensions. It is now up to the CEO Council to take full advantage of the individual programs and successes of its member companies by working together to create a larger-scale, higher-impact, higher-value approach to improving the resource efficiency of the world's factories.

While it is undeniably challenging for a company to get its suppliers to improve their resource efficiency, the tactics we review in this paper have proven effective in this regard. These tactics include:

1. Setting ambitious goals for your own company and your suppliers.
2. Taking responsibility for sustainability impacts in supply chains, and working as hard with your suppliers to mitigate them as you do in your own business.
3. Replicating the successful model of renewable energy deployment being used at large companies at all tiers of the supply chain.
4. Collaborating with industry peers to unlock resource-efficiency opportunities that span entire supply networks and are too complex for individual companies to pursue alone.
5. Supporting policies and regulations that are consistent with making progress toward the internationally-agreed, science-based targets in a manner that creates a level playing field for all companies.

For the companies represented by the members of the CEO Council, improving resource efficiency in supply chains is a profit-enhancing way of responding to the business and reputational pressures triggered by global environmental challenges. Companies that improve their resource productivity benefit from cost advantages, lower exposure to supply disruption and commodity-price volatility, and reduced risk from potential environmental regulations. Engaging supply chains in a coordinated fashion would also allow CEO Council companies to make a positive impact on a much greater scale than any member company could create on its own.