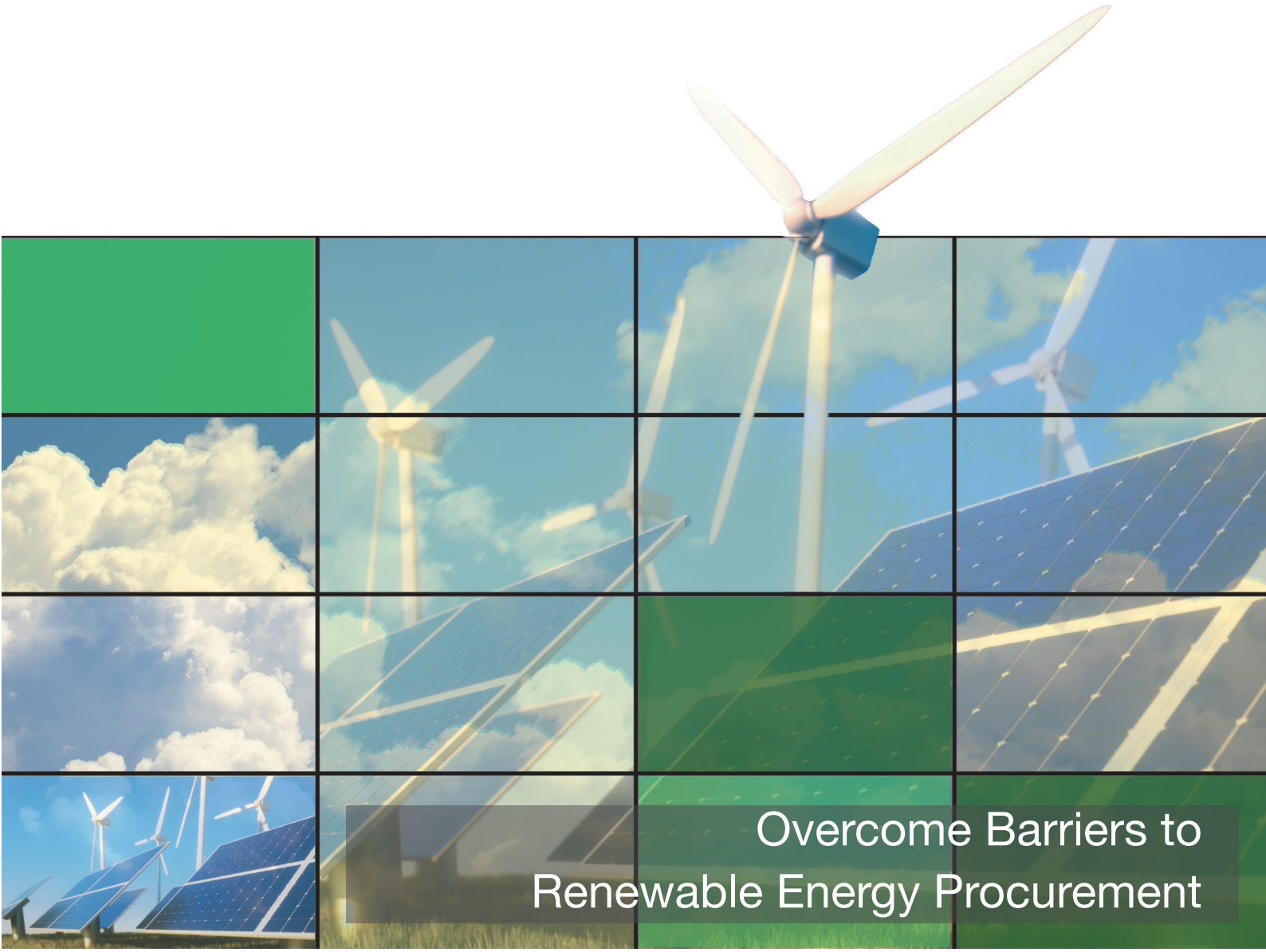


Overcome Barriers to Renewable Energy Procurement

WBCSD Leadership Program 2015

wbcsd education

Contents

Executive summary 3

Introduction 4

1. **Cost barriers to renewable energy procurement: Making the business case for diversified energy** 6
   - **Implications of falling costs** 6
   - **Solutions** 7
   - **1. Use the flexibility of power purchase agreements** 7
   - **2. Calculate "cost" more holistically** 7
   - **3. Analyze each region independently** 8
   - **4. Influence market forces to drive down costs** 8

2. **Internal barriers to renewable energy procurement: Bringing along the entire organization** 10
   - **Solutions** 10
   - **1. Connect renewable energy with the organization strategy** 10
   - **2. Make the business case payback** 10
   - **3. Measure total cost of ownership** 11
   - **4. External factors that remove internal barriers** 12

3. **Structural barriers to renewable energy procurement: Overcoming unfavorable government policy** 14
   - **Solutions** 14
   - **1. Spur market dynamics to overcome the unavailability of renewable energy technology** 14
   - **2. Advocate for change in the regulatory framework** 15

Conclusion 16

Appendix 1: Opportunities and challenges of a 100% renewable energy scenario 17

Appendix 2: Modern costs of renewable energy by source 18

Bibliography 21

Acknowledgements 22

End Notes 23

Executive Summary

Scaling-up renewable energy (RE) is a key solution to curb global carbon emissions. Corporations are uniquely positioned to scale-up renewable energy in the global electricity mix by meeting their own energy needs through renewable energy procurement. Leading corporations are investing in renewable energy procurement and breaking the perceived trade-off between environmental and economic value creation. According to an Energy Procurement survey conducted by the World Business Council for Sustainable Development (WBCSD) among its members, as well as individual reports by participants in the WBCSD Leadership Program Class of 2015, the three most frequently cited barriers to renewable energy procurement are cost, internal barriers and structural barriers.

Cost Barriers - Many companies have had success in using the flexibility of power purchase agreements to supply their energy needs from renewable sources. But it is necessary to take a more holistic approach to the concept of cost and consider the systemic benefits of diversified energy procurement that may compensate an organization for the additional cost of a renewable energy source. However, each region needs to be analyzed independently to discover the areas of operation where natural capital provides distinctive advantages for particular types of renewable energy use.

Internal Barriers - The internal barriers in each organization need to be addressed, shifting internal discussions from “why” to “how” in order to enable the discovery of creative solutions to overcome problems of internal buy-in. In addition, companies should measure projects with a different scale when they are of a strategic or transformational nature in order to properly assess them and to create realistic expectations that keep people motivated to reach for solutions to renewable energy procurement.

Structural Barriers -Structural barriers such as unfavourable government policy and the ensuing unavailability of renewable energy infrastructure and technology in a given market are also problems that must be addressed. To compensate for limited renewable energy availability, companies can spur market dynamics by leveraging their R&D capacity to increase supply, boost the demand for renewable energy among their peers, or choose to address the roots of the problem by advocating for a more favorable regulatory framework.

There is no one-size fit all solution to renewable energy procurement but instead a wealth of creative solutions to make it work.

Introduction

The threat of climate change is too great to be ignored. As US President Obama said in his speech introducing the Clean Power Plan in the United States, "When it comes to climate change, there is such a thing as being too late."[1] Indeed, the Intergovernmental Panel on Climate Change (IPCC)—the international body for assessing the science related to climate change—issued a report in 2014 showing that emissions have risen to unprecedented levels, growing more quickly between 2000 and 2010 than in the three previous decades. Reaching the goal of limiting the global mean temperature to 2°C above pre-industrial levels will require major institutional and technological changes[2] and cutting emissions from electricity production is a common feature of mitigation scenarios. In order to reduce CO_2 emissions by 61%, the global electricity mix needs to include at least 30% renewable energy (RE) by 2030.[3]

"Renewable energy is energy that is derived from natural processes (e.g. sunlight and wind) that are replenished at a higher rate than they are consumed. Solar, wind, geothermal, hydropower, bio energy and ocean power are sources of renewable energy."[4]

As individual purchasers of large volumes of electricity with predictable base load, corporations are uniquely positioned to influence the scale-up of renewable energy in the global electricity mix, and thereby make the 2°C scenario a reality. The basic hypothesis of this report is that by stimulating more corporate renewable energy procurement, we can stimulate a greater supply of renewable energy, while directly substituting fossil fuel demand with renewable energy and hastening the development of technology toward more cost-effective systems. To support this process, the report looks into the most common stumbling blocks corporations face when committing to ambitious renewable energy procurement targets and describes practical solutions to successfully overcome them.

WBCSD Energy Procurement Survey

The data and case studies in this report were extracted from a survey distributed to 25 World Business Council for Sustainable Development (WBCSD) member companies in the second quarter of 2015 to glean insights into their corporate renewable energy procurement practices. To bring in additional perspectives, we also reviewed reports by the WBCSD Leadership Program Class of 2015, which detail how WBCSD member companies are overcoming barriers to renewable energy procurement and improving the business case for their organizations. The companies surveyed span 13 sectors; cement and chemical companies represent an equal share of 40% of the total respondents and therefore are the predominant sectors.

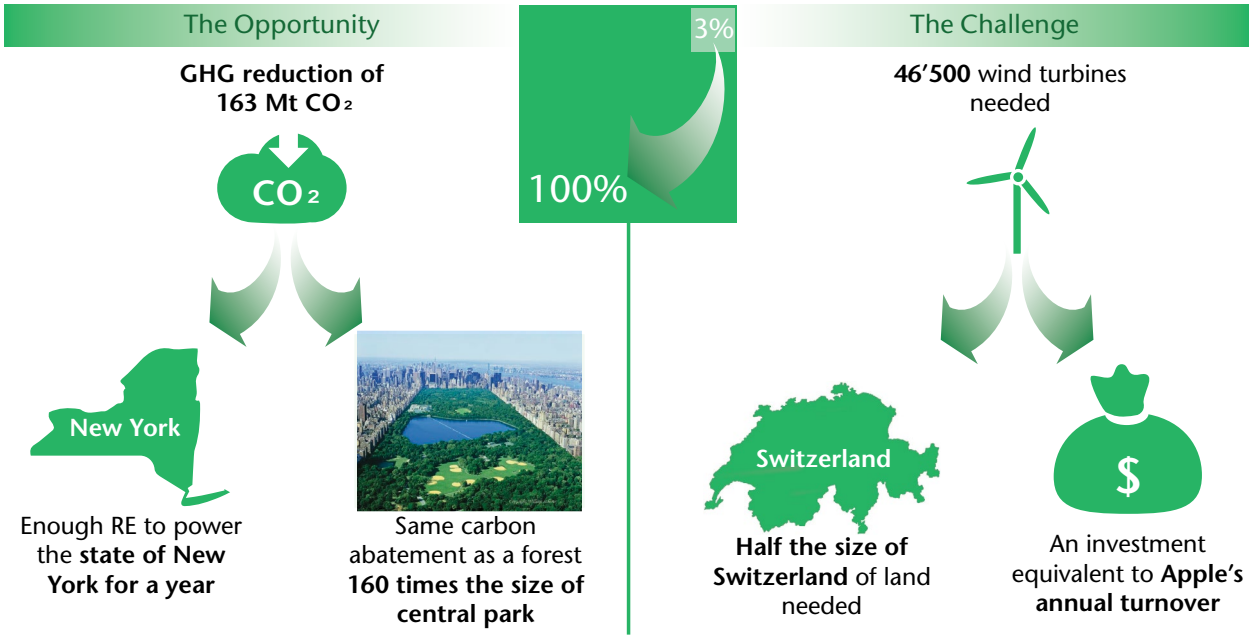
Key findings

While 84% of the companies surveyed procure renewable energy, on average only 3% of their total electricity consumption comes from renewable energy sources. This indicates a huge window of opportunity: Imagine a scenario where all respondents could meet their electricity needs with 100% renewable energy. Figure 1 below illustrates the important carbon abatement potential corporate renewable energy procurement holds and gives an indication of some technical and financial challenges corporations face.

The review of the WBCSD Energy Procurement survey and the individual reports from the WBCSD Leadership Program Class of 2015 allowed for the identification of the most commonly cited barriers hampering renewable energy procurement: (i)cost barriers; (ii)internal barriers; (iii)structural barriers.

The objective of this report is to demonstrate that none of these barriers are insurmountable and that there is a lot to learn from peers heading on the same journey.

Figure 1: Opportunities and challenges of a 100% renewable energy scenario



See the underlying assumptions in appendix 1

1. Cost barriers to renewable energy procurement: Making the business case for diversified energy

Concerns about higher energy costs and uncertain payback are among the most frequently cited barriers to scaling up renewable energy. It is difficult for cost-conscious companies to justify the choice to pay a higher price for electricity when the pay-off cannot be calculated with certainty. Although when surveyed the majority of consumers say they will pay more for a more sustainable product,[5] not many of them translate their words into action, shrinking the opportunity to simply pass the higher energy costs simply on to the consumer. In addition to meeting CO_2 targets and increasing energy security,[6] corporations that have identified value in renewable energy often consider it to be an extension of brand value by way of enhancing corporate image in the eyes of customers.[7] However, this attribute is most highly valued by consumers, making it difficult for businesses that are not consumer facing to capitalize on this. Thus for businesses higher up the value chain,the uncertainties surrounding costs and return on investment can seem insurmountable.

For energy-intensive industries like chemicals and cement, the cost issue is exacerbated by the link between various forms of energy (heat and electricity) due to the great economies created by combined heat and power (CHP) systems. In these industries, the cost of energy as a share of final product cost is substantial, while the margin on the finished product is often quite small due to commoditization. Yet among members surveyed, companies from these two industries appear to be finding ways to scale up the use of renewable energy in proportion to their electricity procurement needs. This shows that companies in energy-intensive industries have found renewable energy solutions that do not result in ruinous cost consequences and that take advantage of situations where heat and electricity are decoupled. Looking deeper into how these companies went about procuring renewable energy, it appears that each one of them had a very different solution. The diversity of these solutions is itself a cost-related barrier—there are no ready-made solutions that require only a minimal investment in terms of effort, which makes the search for suitable renewable energy projects more cost intensive.

Implications of falling costs

The costs of renewable technologies have been falling precipitously, particularly in the case of solar photovoltaic (PV).[8] Specific renewable energy cost trends are discussed in the appendix on “Modern costs of renewable energy by source”. This decline in costs has been enabled by favorable regulation in support of renewable energy investments, cheaper components and technological improvements.[9] It is likely that costs have also been favorably affected by increased competition due to the proliferation of renewable energy technologies and sustainability macro-trends that stress the need for diversified energy supplies and place pressure on firms to consider sourcing energy from renewables. These factors make this the right time to move past cost barriers: as with any market, profits will reach equilibrium as more people move in and erase opportunities for arbitrage. At some point, the cost of renewable energy will be driven exclusively by the market price for electricity, a commodity, which will remove the opportunity to find net present value positive projects. Therefore, now is the opportune time for companies to search for solutions that enable greater renewable energy use while also creating a positive return on investment.

Solutions

1. Use the flexibility of power purchase agreements

Several member companies have begun using power purchase agreements (PPAs) to secure reliable electricity for certain production sites, with little to no upfront costs while increasing the supply of renewable energy to the markets in which these facilities operate. The energy rates offered by most PPAs are quite competitive with the market price of electricity. Some companies have collaborated to aggregate this demand and secure even better terms through their PPAs. While these agreements require long-term commitments, they often offer discounted market energy rates and can guarantee energy price stability over their term. They can be entered into for the purchase of electricity with or without the attached Renewable Energy Certificates. In either scenario, the agreement stimulates the development of more renewable energy capacity. They also remove the issue of traceability, as each contract points to a specific electricity generation asset.

The WBCSD Energy Procurement survey and the individual reports filed by the WBCSD Leadership Program Class of 2015 revealed many specific examples of companies that have incorporated PPAs into successful renewable energy procurement strategies. Eastman Chemical Company has used PPAs to stimulate wind and solar development in some of its areas of operation while securing a stable price and supply for its electricity base loads. Accenture used a PPA to secure 27 GWh of electricity generated by a wind farm in Bangalore, India, allowing them to obtain a more reliable source of electricity and to avoid complete reliance on a constrained power grid. As a power provider and producer, EDF offers a number of services to its customers, including PPAs. In the United States, EDF Renewable Energy offers a Synthetic PPA—a hedging instrument that protects the power producer from downward swings in energy prices. A key learning from these examples is that PPAs appear to be a viable renewable energy solution for companies from very different parts of the value chain and with very different energy needs.

2. Calculate “cost” more holistically

Analysis of renewable energy opportunities requires cross-functional teams that reach beyond the procurement organization. Such diverse teams can help reveal cost saving opportunities and place a more holistic value on the switch from a fossil energy source to one that is renewable. If only the cash cost of energy consumption is being considered, there is considerable likelihood that value from energy diversification and indirect cost savings will be left on the table. The teams that are composed should be able to appreciate the impacts on customers, suppliers, employees, local communities and the company’s overall reputation to ensure any value created in these areas is considered.

In assessing these projects, the cost of a renewable energy opportunity should incorporate more than just dollars per kilowatt hour. There is an undeniable value to securing energy supply for an operation located in a region with an unstable power grid. Furthermore, there are a number of notable benefits to moving to renewable sources of supply regardless of location, as summarized in the table[10] below:

Table 1: Benefits of moving to renewable sources of supply

	Traditional energy sources	Renewable energy sources
Diversity of supply	Limited fuel diversity	Diverse supply options
Pricing stability	Price volatility	Stable pricing models
System flexibility	Rigid, centralized	Flexible, distributed
Carbon risk	Significant emissions	Carbon neutral
Security	Delivery system vulnerability	Secure, resilient
Infrastructure issues	Rely on ageing infrastructure	Diverse infrastructure options

By diversifying sources of energy procurement, the risks associated with focusing on a single source of power can be partially mitigated. Costs are also mitigated through systemic efficiencies such as savings on the transportation of fuels from a more distant source. With some team diversity and critical thinking, these less obvious value drivers can be identified and can swing a renewable energy project from red to black.

3. Analyze each region independently

Perhaps the most important factor to take advantage of when evaluating renewable energy options is the vast cost differences and economic opportunities presented by different geographic and political locales. The particular geography of one area of operation may be much more “renewable rich” when compared to another. Likewise, the relevant governments may present tax incentives that help a company recoup its tax costs and offset the cost of a project. DuPont constructed a photovoltaic (PV) array for its operations in Kauai, Hawaii, which has higher energy market costs due to its island status. This also enabled the company to test and showcase some of its own materials going into the production of PV cells. Akzo Nobel has been able to convert one of its combined heat and power (CHP) facilities to biomass, enabling a renewable source of heat and power that is over 90% efficient. The geographic proximity of this particular site to the fuel source makes the overall cost of burning biomass cheaper than burning natural gas while reducing CO_2 emissions by about 130,000 tonnes per year.

4. Influence market forces to drive down costs

While the cost of converting to renewable energy has traditionally been a major barrier, cost parity is starting to set in as renewable energy capacity grows.[11] Therefore, the time is right for companies to re-examine their opportunities across all operating locations to see where renewable energy makes the most sense for them and which financing method will be most suitable. By recognizing conversion to and investment in renewables as an important corporate opportunity, the private sector can contribute to further growth in overall renewable energy capacity. This will in turn bring down the cost of renewable energy drastically and reduce the amount of carbon dioxide that is emitted each year. This is an area where the private sector can demonstrate leadership and contribute significantly to lasting change by bringing its resources and energy consumption capacity to bear. By voluntarily searching out cost-effective options today, companies could avoid being forced to select inferior options by regulators tomorrow.

Case study: Suez Cement, Italcementi Group

Suez Cement and Italgen, subsidiaries of Italcementi Group, found that, by focusing on a specific geography and more holistic investment criteria, they could identify cost-competitive renewable energy options for their operations. Italgen focuses specifically on examining best fits in renewable energy solutions for each of Italcementi's operational subsidiaries, like Suez Cement in Egypt. In the Gulf of Suez, wind speeds are regularly in the range of 8-10.5 m/s. Combining this with new public investments in load centers and transmission infrastructure to expand the national grid and the availability of uninhabited desert areas provides a location where wind energy can thrive, producing energy for costs at or below the going rate for energy from fossil fuels. Suez found that it was worthwhile to pursue the development of a private wind project based on a holistic assessment that included not only cost but also strategic fit and critical business needs.

Key learning: While this is not a globally scalable option, no true renewable energy solution is likely to fit that description. Instead, companies should think in terms of regional scalability, determining which renewable energy solutions fit best in each distinct natural environment. Where a renewable energy source draws from the abundance of nature, opportunities exist for renewable energy to produce cost-competitive electricity for the local population.



2. Internal barriers to renewable energy procurement: Bringing along the entire organization

Many organizations struggle to implement renewable energy options due to internal barriers. These can be due to internal politics, competing unit priorities or a lack of will within the organization itself. All change projects require a reason for change, direction and communication. Where the goals of the sustainability department are separated from those of the wider company, there is the risk of isolation and the formation of internal barriers.

The need to raise capital is often a logical consequence of developing a renewable energy project once an opportunity has been identified. For companies with little experience pursuing renewable energy projects, significant internal barriers relating to business case approval can arise that must be overcome in order to pursue a project even where positive value has been identified.

Solutions

1. Connect renewable energy with the organization's strategy

Organizations that have been successful in integrating renewable energy have done so by linking the positive outputs of renewable energy technology with wider business goals in order to remove internal barriers altogether. A strong example of this is where BT has committed publically and within its core strategy to carbon reduction via its Net Good program.[12]

Key learnings: Commitment to this program at the board and CEO level and a crucially timed commitment to RE100 (achieving 100% renewable energy by 2020) have broken down any internal barriers predicated upon why there must be renewable energy sourcing solutions.

The challenge for employees and the organization then becomes "how" rather than "why", and this is filtered across all departments, including finance and procurement where traditional internal barriers may have existed.

2. Agree to dispensation for business case payback

Companies will have standard payback or "hurdle rates" for return on investment, particularly where there is a high capital outlay. It was identified in a number of member organizations that the upfront investment for renewable energy projects is often higher than the standard expected payback term. This is particularly true where there is no grid availability as the investment required for a project is more capital intensive. Organizations that have been successful in overcoming this barrier have agreed dispensation for business case payback at the CFO level in order to meet the organizational goals/strategy (see 1 above).

A strong example of thinking differently to make the case work is the master PPA agreement negotiated between NRG and Unilever (which has also committed at the CxO level to 100% renewable energy as a strategy). This has a specific focus on solar and wind supply via infrastructure implemented at manufacturing sites globally. In traditional agreements the payback and scope of the deal would be arranged site by site, which holds some sites back from implementation. The master agreement allows for the overall case to work at a global level, where locally some sites will be positive, allowing the negative sites to be offset. Internally, Unilever can then apportion budget to the sites where their local costs would be increased in order to not disenfranchise a site.[13]

Case study: Dow Chemical Aratu Project

The Dow Chemical Company wanted to source renewable energy in regions where grid availability is low or non-existent. The solution was to invest in a partnership with a company in the region that had a focus on renewable energy. Dow contributed to the partnership site's infrastructure and organization, and provided resources with expertise in the areas of engineering, procurement and construction. Dow also provided a demand guarantee for the energy produced, which would enable any risk premium in traditional renewable energy provider business cases to be offset by a predictable revenue stream. The Aratu Project resulted in net present value of US$ 36 million and natural gas savings of US$ 1.5 million, along with a net CO2 reduction of 160 tonnes per year.

What made this effective for Dow was that from a governance perspective, a dedicated Climate and Energy Steering Board was created to lead the organization through the decision-making and business case process, with particular focus on risk mitigation. This resulted in an agreement to specify separate financial expectations for the project given its classification as a transformational/strategic play. Objectives and return on investment were also set at a local level to ensure expectations were realistic for the site and geography.

3. Measure total cost of ownership

When creating the case for investment or cost increase due to renewable energy pricing where it is higher than the standard mix, taking a total cost of ownership (TCO) view is critical. Many decisions focus purely on the input costs. For example, if the total cost of electricity purchased is US$ 100 per year on standard mix, it could be that moving to renewable energy costs 10% more. In this case, the financial case does not work as the cost for 100% renewable energy would be out of budget.

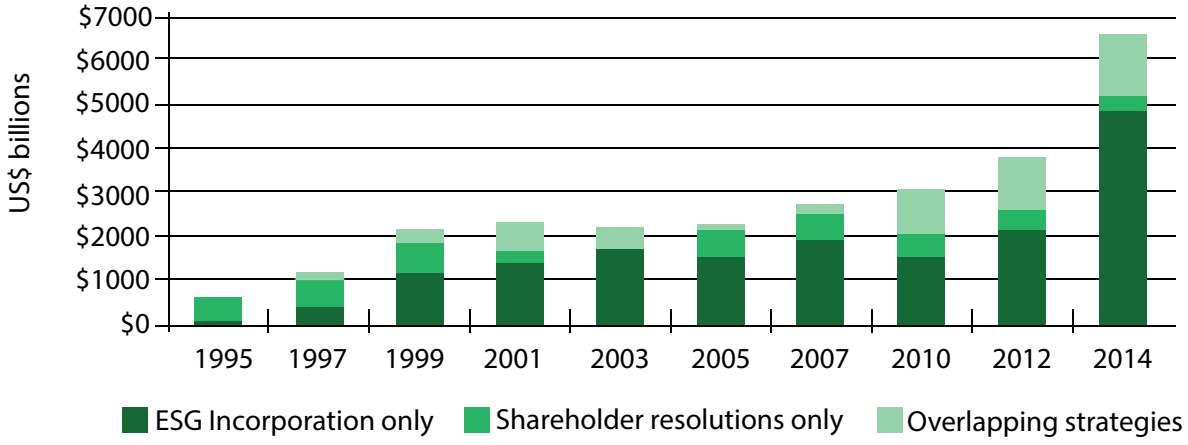
To overcome this, the organization needs to set internal budget challenges to reduce its overall charge to less than US$ 100. In order to do this, it will need to mitigate the additional US$ 10 increase by reducing consumption and creating internal efficiencies. In fact, setting a target charge of US$ 90 may be a stretch, but it will focus the organization on creative solutions to reduce consumption in order to mitigate any increase in spend from supply. The justification for the above should go in the business case (see 2) and can then be set into operational budgets. This removes the internal barrier as once budgets are set, each operational line within an organization will have to be active in reducing consumption in order to spend within their new energy envelope.

4. External factors that remove internal barriers

According to the US SIF Foundation, sustainable, responsible and impact investing (SRI) has grown substantially over the past two years. The total US-domiciled assets under management using SRI strategies increased 76% from 2012. These assets now account for more than one out of every six dollars under professional management in the United States.

The US SIF Foundation and its research partners identified 308 money managers and 880 community investing institutions that incorporate ESG (environmental, social and governance) issues into their investment decision-making, with a combined US$ 4.8 trillion in assets under management. This is 3.4 times the corresponding figure for 2012, when money managers and community investing institutions held US$ 1.41 trillion in ESG assets under management.

Figure 2: Sustainable and responsible investing in the United States, 1995-2014



SOURCE: US SIF Foundation

Figure 3: Investment funds incorporating ESG factors, 1995-2014

	1995	1997	1999	2001	2003	2005	2007	2010	2012	2014
Number of funds	55	144	168	181	200	201	260	493	720	925
Total net assets (in billions)	$12	$96	$154	$136	$151	$179	$202	$569	$1,013	$4,306

SOURCE: US SIF Foundation
NOTE: ESG funds include mutual funds, variable annuity funds, closed-end funds, exchange-traded funds, alternative investment funds and other pooled products, but exclude separate account vehicles and community investing institutions.

Given the potential investment upsides for stock market listed organizations, the internal case for investing in renewable energy where capital costs via traditional accounting methods are high should also be subject to this consideration. Any internal case should have an overlay detailing the potential benefit to share price based upon the individual company's investor relations department's research and analysis.



3.Structural barriers to renewable energy procurement: Overcoming unfavorable government policy

Beyond the scope of companies' direct control, a number of external factors can either support or complicate renewable energy procurement, most notably unfavorable government policy and the ensuing higher price or unavailability of renewable energy technology in a given market.

Transparency, longevity and certainty in policy frameworks are essential prerequisites to promote renewable energy investments. Policy also bears a strong correlation with the price and availability of renewable energy supplies, technology and infrastructure accessible to corporations in a given market.Feed-in tariffs, tax credits and renewable electricity standards that require electricity utilities to increase the amount of renewable energy in their power supplies are just a few policy tools that directly influence renewable energy supplies. Regulators also play a critical role in ensuring that the grid is able to absorb renewable energy deployment and that the value and costs are shared appropriately among local stakeholders.

Responding to demand from citizens, scientists and business, nearly every government has passed legislation to promote renewable energy investments and reduce the dependence of the power sector on fossil fuels. A recent report from the International Renewable Energy Agency (IRENA) reveals that 164 countries around the world have adopted at least one type of renewable energy target, up almost four-fold from 43 countries in 2005. However, most analysts conclude that government support and ambition still remain below the level required to drive the level of investment needed for large-scale deployment of renewable energy.[14] For example, in some provinces in India and the US, regulations specify that non-utilities cannot sign PPAs.At the corporate level, a combination of local, state and federal policies will influence the business case for renewable energy procurement. Therefore, uncertainty around the price, supply and deployment of renewable energy resulting from short-term and inconsistent policies can be a serious roadblock for ambitious renewable energy procurement strategies.

Solutions

The WBCSD Energy Procurement survey confirms that companies highly value a stable and predictable regulatory framework as a prerequisite for renewable energy procurement. To compensate for the limited availability of renewable energy technologies, survey respondents have resorted to a number of approaches, such as spurring market dynamics by leveraging their R&D capacity to increase supply, while others found ways to boost the demand for renewable energy among their peers. Some companies have also chosen to address the root of the problem by advocating for a more favorable regulatory framework as standalone actors or as part of a collective.

1. Spur market dynamics to overcome the unavailability of renewable energy technology

The seemingly most straightforward way of compensating for the unavailability of renewable energy technology in a given market is to import the electricity or the renewable energy technology to produce it. A more long-term approach would consist of boosting renewable energy supply and/or demand to gradually increase the size of the market and thus increase the incentive to develop the required infrastructure.

Leverage R&D capacity to increase supply

Companies with renewable energy-related product portfolios such as DuPont, Dow or ABB can directly influence the availability of renewable energy technologies in a specific market and globally by investing in their own R&D and using onsite direct investments to test new products from the company's portfolio. For example, as part of its effort to address growing demand for renewable energy, DuPont has invested in a solar park with the capacity to power 2,000 homes at its facility in Cernay, France, using its own photovoltaic solutions.15 Such activities could spur the development of add-on capacity and promote the growth of renewable energy infrastructure in the region.

Inspire fellowship by boosting demand

For companies that are not in the energy business, action on the demand side can lead to increased availability of renewable energy in their operating markets when accompanied by the right mechanisms and fellowship from peers. As part of BT's commitment to source 100% of its electricity from renewable energy, it became one of the largest commercial companies in the United Kingdom to sign an agreement with npower, a UK gas and electricity provider. Under this contract, npower pioneered the carbon labeling of electricity to assure customers of its carbon status. Electricity is rated from A-G, with A having the lowest carbon content. The label provides BT with the assurance that for every unit of electricity consumed, a matching number of units from renewable sources are fed back into the electricity network by npower. BT hopes that providing visibility into the carbon intensity of its sources of electricity will stimulate demand for more A-rated electricity, which will in turn encourage energy companies to invest in renewable energy infrastructure.16

2. Advocate for change in the regulatory framework

While market mechanisms hold the potential to change the rules of the game on renewable energy procurement considerably, they are often not sufficient to make a deep and lasting change in the regulatory framework. Companies that desire more external support for renewable energy procurement should identify opportunities to develop and support policies that remove barriers to scaling up renewable energy while considering how they can stimulate infrastructure development through their own activities. These actions will increase the availability of renewable energy, enable lower renewable energy prices and pull corporate commitments and public policy positions into positive alignment.[17]

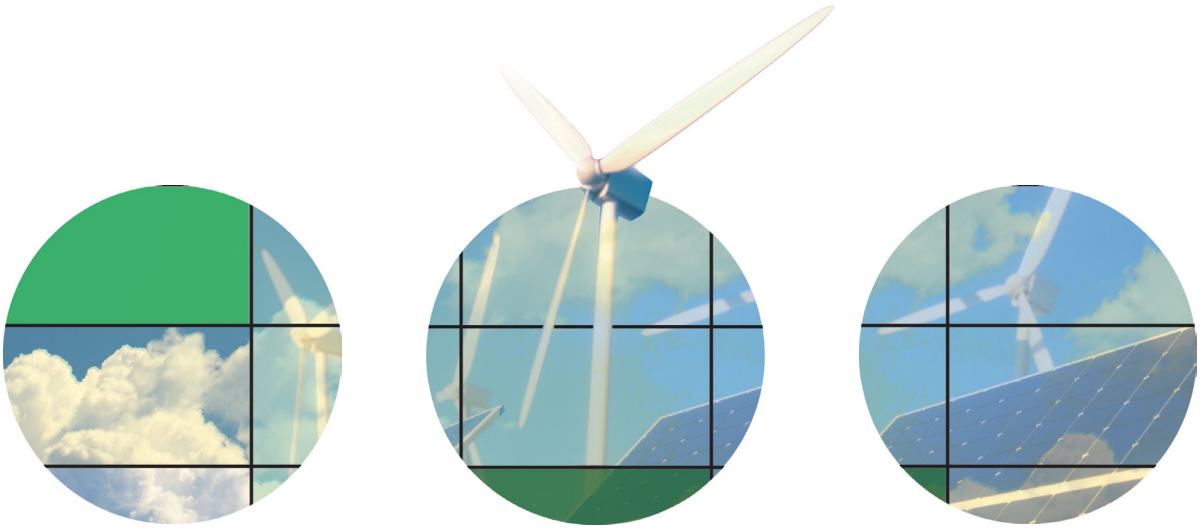
While some corporations can exert the level of influence, resources and leadership required to change regulatory environments, this daunting task can have a more profound impact when voices and resources are combined, aligned and pitched at the right level. The WBCSD's Low Carbon Technology Partnership initiative, launched in partnership with the Sustainable Development Solutions Network and the International Energy Agency, is a good example of such an effort to engage with policy-makers and regulators to develop policy recommendations and guidelines that will enable the scaling up of renewable energy deployment globally.[18]

Conclusion

The critical finding of this research report is that organizations have considerable flexibility in choosing renewable energy solutions that best address their energy needs. Corporations have been endlessly creative in crafting individualized solutions that address barriers that previously would have seemed insurmountable. Furthermore, no company is entirely alone in this endeavor. By looking at peers who are similarly situated geographically, politically and economically, companies can begin to develop and share best practices for making renewable energy work in their business. A variety of examples of real companies scaling up renewable energy in their organizations in order to inspire readers to take similar action within their own companies already exist.

Corporate involvement in the transition from fossil fuels to renewable energy will be critical to the success of any climate agreement. Using an acumen that enables their success, these corporations can ensure this transition takes place in a way that is profitable both to the individual corporate participants and to the public at large. Innovative companies have the opportunity to take the lead by seeking out and committing to investments in renewable energy procurement in their own operations. This will ensure an optimal path toward mainstream renewable energy adoption that is good for society, the environment and the world economy.

Today's economic system is in a difficult position, but not an impossible one. What is needed is the resolve of private and public organizations to find solutions to these problems "not because they are easy, but because they are hard,"[19] and because they need to be solved to ensure the security of our future. This objective is vital not only to the continued success of the economic system, but also to the well-being of society as a whole.

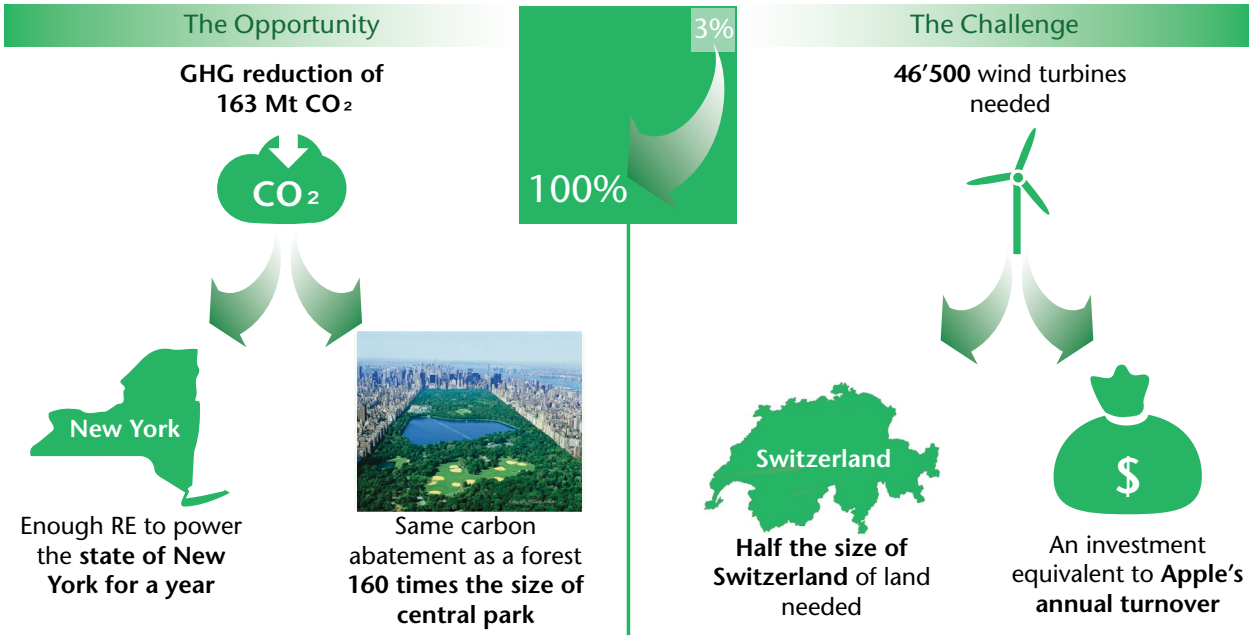


Appendix 1: Opportunities and challenges of a 100% renewable energy scenario

The high ratio of heavy industry representation weighs on the aggregate total electricity consumption of all survey respondents, equivalent to approximately 246 TWh/year. This is twice the annual electricity consumption of the state of New York.[20] To grasp the tremendous opportunity the combined action of all respondents would represent, imagine a scenario where all respondents could commit to source 100% of this 246 TWh/year of electricity from renewable energy sources. This would represent a greenhouse gas (GHG) reduction of 163 Mt CO_2.[21] It would require 133,000 acres of US forest to achieve the same amount of carbon sequestration in a year,[22] or roughly 160 times the size of New York's Central Park.[23]

While 84% of respondents procure renewable energy, on average renewable energy only represents 3% of their total electricity consumption, or 7 TWh/y. In order to understand why this ratio is so low, it is necessary to dig deeper into the technical and financial implications that stem from a 100% renewable energy scenario. Indeed, to generate 246 TWh/year of renewable energy would require the equivalent of 46,500 wind turbines,[24] which would require a land surface of 22,000 km^2.[25] This represents half of the surface of Switzerland.[26] The size of the investment required to purchase all these wind turbines is estimated to represent US$ 163 billion,[27] which is roughly the equivalent to the turnover of a company such as Apple.[28] To date, survey respondents have invested a total of US$ 3.5 billion, almost half of which comes from one single company.

Figure 1: Opportunities and challenges of a 100% renewable energy scenario



Appendix 2: Modern costs of renewable energy by source

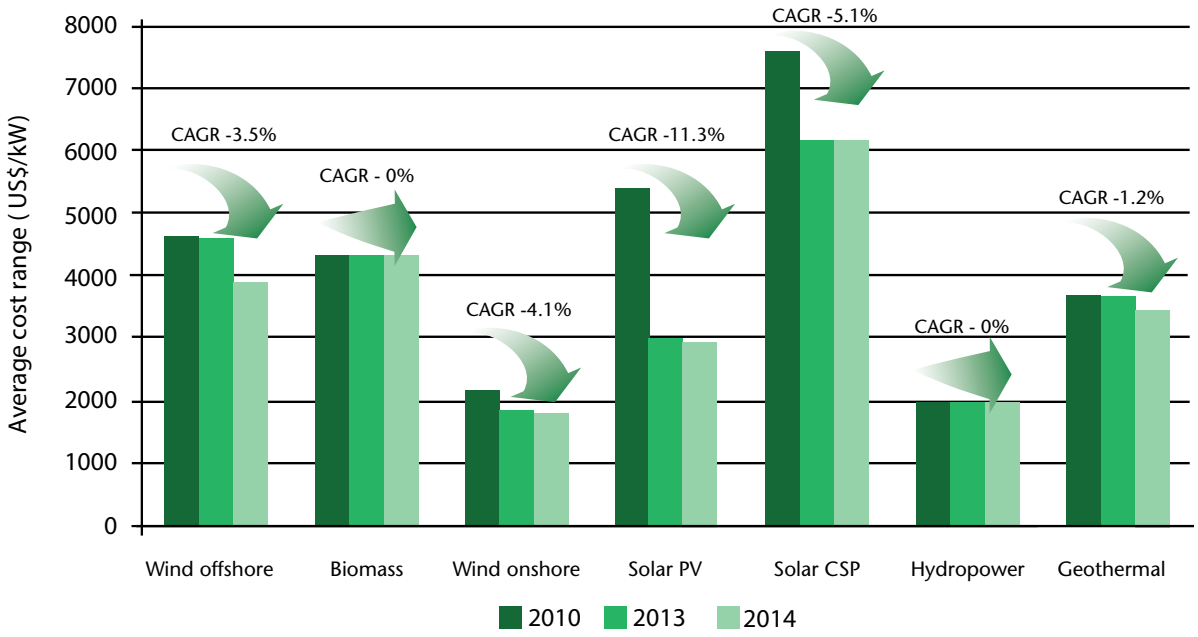
Renewable energy has been a major technological focus for a number of years for both state and local entities. This attention has made the renewable energy space highly dynamic, particularly with regard to overall system and running costs. Though some technologies are proceeding faster than others, there is a definite downward trend in costs. Below is a brief overview of the costs associated with each renewable energy technology, expressed in US$, according to the most recent reports from the International Renewable Energy Agency (IRENA) and Renewables 2015 global status report.

Figure 4 shows how the technology cost drops over time in different rates according to the technology evolution. Global new investment increased to US$ 270.2 billion in 2014 from US$ 232 billion in 2013.

Reasons for the increase:

- Increase in solar power installations in China and Japan
- Investment in solar power up 25%
- Record investment in offshore wind projects in Europe.

Figure 4: Renewable energy investment evolution per unit cost



Note: CAGR means compound annual growth rate

Wind

Onshore wind power is currently one of the lowest cost sources of electricity available. The weighted average levelized cost of energy (LCOE) is now in the range of US$ 0.06 to US$ 0.09 per kilowatt-hour. Some of the best wind farms in the world produce energy at US$ 0.05/kWh without financial support. This positions wind power in direct competition with fossil fuels in many markets. The weighted average installed cost of wind power capacity is in the range of US$ 1,280 to US$ 2,290 per kilowatt. Further cost reductions are expected through 2020, but offshore wind is predicted to remain more expensive than onshore.

Solar photovoltaic

Solar photovoltaic (PV) modules have dramatically decreased in cost over the past several years, falling about 75% from 2009 to 2014. In the past four years, the global average LCOE of utility-scale solar has fallen by half, down to US$ 0.08/kWh. In the presence of abundant resources and low-cost financing, costs as low as US$ 0.06/kWh have been realized. Costs of residential solar have fallen by 42% to 64% since 2008 in selected countries, making it an attractive alternative for individuals seeking to reduce their own carbon footprint. The global capacity of solar PV is 177 GW, with 40 GW capacity added in 2014.More than 60% of all PV capacity in operation worldwide at the end of 2014 was added over the past three years.

Concentrated solar power

Concentrated solar power (CSP) is still in early stages of deployment, with only 5 GW of CSP installed worldwide at the end of 2014. The weighted average LCOE is in the range of US$ 0.20 to US$ 0.25/kWh, with costs varying significantly from one project to the next. The total installed cost of CSP ranges from US$ 3,550 to US$ 8,760 per kilowatt, with financing costs and energy storage capacity being dominant factors. A distinct advantage of CSP is the ability to store thermal energy at a low-cost, allowing energy to be dispatched as needed.

Hydropower

Hydropower plants produce some of the cheapest electricity available, ranging from US$ 0.02 to US$ 0.05/kWh. Hydropower costs have been flat for quite some time due to the maturity of the technology. It represents a great means of producing low-cost renewable energy in remote areas and for the grid. It is currently the largest source of renewable energy, with about 1,025 GW global capacity as of the end of 2013.In 2014, 37 GW of new capacity wereadded.

In general, hydropower enjoys steady industry growth driven by:

- Expansion in China
- The modernization of ageing hydropower facilities.

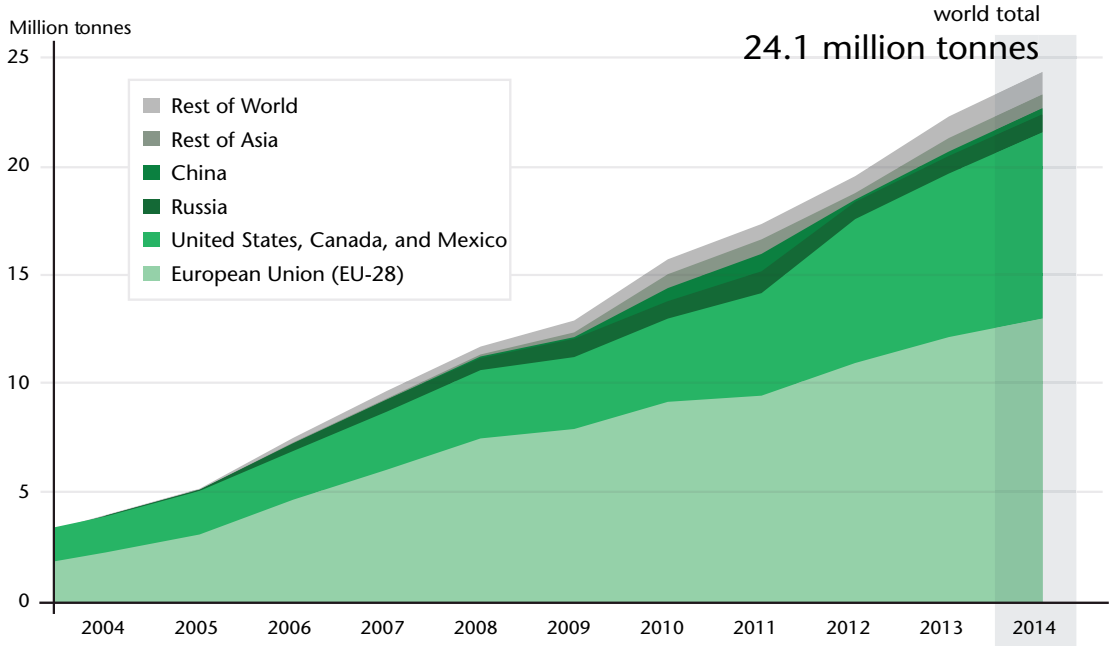
Biomass

Biomass is a competitive power generation technology wherever low-cost agricultural or forestry waste is available. The weighted average LCOE is US$ 0.04 to US$0.085/kWh, with new technologies emerging that carry the promise of even lower costs in the future. Installed costs in Organisation for Economic Co-operation and Development (OECD) countries are in the range of US$ 1,880to US$6,820/kW, but costs in the range of US$ 400to US$2,000/kW are more typical in countries where older, less-efficient technologies are the norm. Low-cost, sustainably sourced feed stocks are a critical requirement for these systems and can sometimes be provided at zero cost in the form of wastes such as black liquor from pulp/paper mills or bagasse from sugar mills. In some instances, using these wastes can save the provider on disposal costs.

Geothermal

Geothermal power generation is another mature technology that can provide on-demand, low-cost base load capacity to areas where high-temperature resources are present close to the Earth's surface. The weighted average LCOE varied from US$ 0.04/kWh for second-stage developments to US$ 0.14/kWh for greenfield developments. Geothermal plants require higher capital investments but provide low, predictable running costs. Installed costs appear to have stabilized, but projects planned between 2015 and 2020 anticipate lower installed costs.

Figure 5: Wood pellet global production, by country or region, 2004-2014 Geothermal



SOURCE: Renewables 2015 global status report

Arvizu, Dan E., 2015. *Maximizing the Potential of Renewable Energy.* National Laboratory of the U.S. Department of Energy (NREL), Office of Energy Efficiency and Renewable Energy. Available at **http://www.nrel.gov/about/assets/pdfs/20150615-cmcee-vancouver.pdf.** Accessed September 2015.

Bloomberg New Energy Finance, 2012. *"Renewable Energy Overview".* InGlobal Corporate Renewable Energy Index (CREX), p.10-14.

BT, 2013. *"BT source 100% renewable electricity from npower".* 20 May 2013. Available at **http://www.btplc.com/news/articles/showarticle.cfm?articleid=%7Bc5b8c544-a575-485c-8123-81f67cd9ac07%7D.** Accessed September 2015.

BT, no date. *"Our Net Good Methodology"*. Available at **http://www.btplc.com/Betterfuture/NetGood/OurNetGoodMethodology/index.htm.** Accessed September 2015.

David Gardiner & Associates, no date. *Power Forward: Why the World's Largest Companies Are Investing in Renewable Energy.* Calvert Investments, Ceres and WWF. Available at **http://www.ceres.org/resources/reports/power-forward-why-the-world2019s-largest-companies-are-investing-in-renewable-energy. Accessed September 2015.**

DuPont, no date. *"Solar Park in Cernay Powers Up With DuPont Photovoltaic Solutions"*. Available at **http://www.dupont.com/products-and-services/solar-photovoltaic-materials/case-studies/cernay-solar-park.html.** Accessed September 2015.

Galrao, Edgar and Maria Mendiluce, no date. *"The electricity sector and climate challenge"*. Low Carbon Technology Partnerships initiative (LCTPi). Available at **http://lctpi.wbcsdservers.org/wp-content/uploads/2015/04/LO2-LCTPi-Renewables.pdf.** Accessed September 2015.

Institutional Investors Group on Climate Change (IIGCC), 2011. *"2011 global investor statement on climate change".* Available at **http://www.ceres.org/files/press-files/2011-global-investor-statement-on-climate-change.** Accessed September 2015.

Intergovernmental Panel on Climate Change (IPCC), 2015. *"IPCC: Greenhouse gas emissions accelerate despite reduction efforts - Many pathways to substantial emissions reductions are available".* 13 April 2015. Available at **http://www.ipcc-wg3.de/news/ipcc-greenhouse-gas-emissions-accelerate-despite-reduction-efforts-many-pathways-to-substantial-emissions-reductions-are-available.** Accessed September 2015.

International Energy Agency (IEA), no date. *"Renewable Energy"*. Available at **http://www.iea.org/aboutus/faqs/renewableenergy/**. Accessed September 2015.

International Renewable Energy Agency, 2015. *Renewable Power Generation Costs in 2014.* Available at **http://www.irena.org/DocumentDownloads/Publications/IRENA_RE_Power_Costs_2014_report.pdf.** Accessed September 2015.

Low Carbon Technology Partnerships initiative (LCTPi), no date. LCTPi website. Available at **http://lctpi.wbcsdservers.org/**. Accessed September 2015.

NRG and Unilever, 2015. *"NRG and Unilever on their long-term solar partnership"*. 16 July 2015. Available at **https://www.youtube.com/watch?v=vzsuZfLlxik.** Accessed September 2015.

Obama, Barack, 2015. *"Remarks by the President in Announcing the Clean Power Plan".* The White House; Office of the Press Secretary. 3 August 2015. Available at **https://www.whitehouse.gov/the-press-office/2015/08/03/remarks-president-announcing-clean-power-plan.** Accessed September 2015.

Shah, Vishal and Jerimiah Booream-Phelps, 2015. *Crossing the Chasm,* p. 9. Deutsche Bank Markets Research.Available at **https://www.db.com/cr/en/docs/GRCM2015PROD033635_Web.pdf.** Accessed November 2015.

Sustainable Brands, 2014. *Power Forward 2.0: How American Companies Are Setting Clean Energy Targets and Capturing Greater Business Value*. Available at **http://www.sustainablebrands.com/digital_learning/research_report/cleantech/power_forward_20_how_american_companies_are_setting_clean.** Accessed September 2015.

The Nielsen Company, 2014. *Doing Well by Doing Good*. Available at **http://www.nielsen.com/content/dam/nielsenglobal/apac/docs/reports/2014/Nielsen-Global-Corporate-Social-Responsibility-Report-June-2014.pdf.** Accessed September 2015.

TRAMSoft, no date. *"Geography of Switzerland"; "Geo Dimensions".* Available at **http://www.about.ch/geography/index.html#CH_Geo_Dimensions.** Accessed September 2015.

United States Department of Energy, Energy Efficiency and Renewable Energy, no date. *"New York Electricity Generation".* Available at **http://apps1.eere.energy.gov/states/electricity_generation.cfm/state=NY.** Accessed September 2015.

United States Environmental Protect Agency, no date. *"Energy and the Environment"*.Available at **http://www.epa.gov/cleanenergy/energy-resources/calculator.html#results** Accessed September 2015.

United States Environmental Protect Agency, no date. *"Size of Central Park: 843 acres".* Available at **http://www.epa.gov/cleanenergy/energy-resources/refs.html#pineforests.** Accessed September 2015.

Wikipedia, no date. *"List of largest companies by revenue"*. Available at **https://en.wikipedia.org/wiki/List_of_largest_companies_by_revenue.** Accessed September 2015.

World Business Council for Sustainable Development, 2015. *Renewable Energy Survey*. Available at **www.wbcsd.org**. Accessed on September 2015.

Acknowledgments

We would like to express sincere gratitude to all WBCSD companies who provided the survey feedback upon which this report is built and our fellow FLP Class of 2015 colleagues whose individual efforts gave more context to those responses. We would also like to thank Cathy Combs and Manuela Ojan for their edits and approvals on this report. A special thanks to Edgar Galrao for his insightful feedback and comments, and to Suzanne Feinmann and Dr. Rodney Irwin for the inspiring lessons they taught us along the way

Authors

Angela Barmettler

Sherif Beshady

Andrew Green

Imran Rasul

Ayman Shehata

Alessandra Tostes

Designer:

Sukie Procter

About the World Business Council for Sustainable Development (WBCSD)

The World Business Council for Sustainable Development (WBCSD), a CEO-led organization of some 200 forward-thinking global companies, is committed to galvanizing the global business community to create a sustainable future for business, society and the environment. Together with its members, the council applies its respected thought leadership and effective advocacy to generate constructive solutions and take shared action. Leveraging its strong relationships with stakeholders as the leading advocate for business, the council helps drive debate and policy change in favor of sustainable development solutions.

The WBCSD provides a forum for its member companies - who represent all business sectors, all continents and a combined revenue of more than $8.5 trillion, 19 million employees - to share best practices on sustainable development issues and to develop innovative tools that change the status quo. The council also benefits from a network of 70 national and regional business councils and partner organizations, a majority of which are based in developing countries

www.wbcsd.org

Disclaimer

Endnotes

1. Obama, Barack, 2015.
2. Intergovernmental Panel on Climate Change, 2015.
3. Galrao, Edgar and Maria Mendiluce, no date.
4. International Energy Agency (IEA), no date.
5. The Nielsen Company, 2014.
6. World Business Council for Sustainable Development, 2015.
7. David Gardiner & Associates, no date.
8. International Renewable Energy Agency, 2015.
9. Bloomberg New Energy Finance, 2012.
10. Arvizu, Dan E., 2015.
11. Shah, Vishal and Jerimiah Booream-Phelps, 2015.
12. BT, no date.
13. NRG and Unilever, 2015.
14. Institutional Investors Group on Climate Change (IIGCC), 2011.
15. DuPont, no date.
16. BT, 2013.
17. Sustainable Brands, 2014.
18. Low Carbon Technology Partnerships initiative, no date.
19. As said by US President John F. Kennedy on 12 September 1963; "…because that goal will serve to organize and measure the best of our energies and skills, because that challenge is one that we are willing to accept, one we are unwilling to postpone, and one which we intend to win, and the others, too."
20. United States Department of Energy, Energy Efficiency and Renewable Energy, no date.
21. Global average – emission factor: 0.0005 tCO2/KWh;
22. United States Environmental Protect Agency, no date. "Energy and the Environment".
23. United States Environmental Protect Agency, no date. "Size of Central Park: 843 acres".
24. 246 TWh/year = 93 GW (capacity factor: 30%) / 1 windmill = 2MW capacity
25. Assumption: Wind onshore 0.0024 km2 /MW
26. TRAMSoft, no date.
27. *2MW turbine = US$ 3.5 million (cost)
28. Wikipedia, no date.

www.wbcsd.org/work-program/capacity-building/sdmi/wbcsd-leadership-program.aspx

World Business Council for Sustainable Development www.wbcsd.org
Maison de la Paix, Chemin Eugene-Rigot 2, CP 246,1211 Geneve 21, Switzerland.Tel: +41 (0)22 839 31 00, E-mail: info@wbcsd.org