IRENA
International Renewable Energy Agency

Corporate Sourcing of Renewables:

Market and Industry Trends

REmade Index 2018

With input from:

CDP
DISCLOSURE INSIGHT ACTION

ISBN 978-92-9260-066-2

About IRENA

The International Renewable Energy Agency (IRENA) is an intergovernmental organisation that supports countries in their transition to a sustainable energy future and serves as the principal platform for international co-operation, a centre of excellence, and a repository of policy, technology, resource and financial knowledge on renewable energy. IRENA promotes the widespread adoption and sustainable use of all forms of renewable energy, including bioenergy, geothermal, hydropower, ocean, solar and wind energy, in the pursuit of sustainable development, energy access, energy security and low-carbon economic growth and prosperity. **www.irena.org**

Acknowledgements

Valuable external review was provided by Marius Backhaus (Germany), Kim Møller Porst (Denmark), Sam Kimmins, Constant Alarcon and Marie Reynolds (RE100), Mariana Heinrichs and Germain Augsburger (WBCSD), Jared Braslawsky (RECS International), Orrin Cook (CRS), Daniel Riley (WWF), Emily Farnworth (WEF) and Steven Vanholme (EKOenergy).

Valuable review and feedback were also provided by IRENA colleagues Elizabeth Press, Ahmed Abdel-Latif, Anindya Bhagirath, Xavier Casals, Anna Charles, Javier Esparrago, Ricardo Gorini, Laura Gutierrez, Paul Komor, Neil MacDonald and Michael Taylor.

The editors of this report were Stefanie Durbin and Steven Kennedy.

IRENA is grateful for the valuable contributions of Lori Bird, Jenny Heeter, Christina Volpi and Sam Koebrich (NREL) in the preparation of this report.

IRENA would like to express special thanks and gratitude to Pedro Faria, Alberto Carrillo Pineda, Shailesh Telang and Chiara Gilbert (CDP) for valuable contributions in preparing Chapter 1.

Contributing authors: This report was developed under the guidance of Henning Wuester and authored by Emma Åberg and Stephanie Weckend (IRENA).

IRENA is grateful for the generous support of the Federal Ministry for Economic Affairs and Energy of Germany, which made the publication of this report a reality under the Clean Energy Ministerial (CEM) Corporate Sourcing of Renewables Campaign.

Report citation

IRENA (2018), *Corporate Sourcing of Renewables: Market and Industry Trends – REmade Index 2018*. International Renewable Energy Agency, Abu Dhabi.

This report is available for download from www.irena.org/publications. For further information or to provide feedback, please contact IRENA at info@irena.org.

Disclaimer

Foreword

Adnan Z. Amin
Director-General
International Renewable Energy Agency

Rapidly evolving technologies and declining costs, coupled with favourable policy landscapes, have resulted in an unprecedented scale-up of renewables worldwide. These trends are set to continue in the coming decade, opening up new opportunities for a growing number of non-traditional energy players in the corporate sector.

Among them are private companies, which are increasingly sourcing renewable energy to meet their energy needs and power their businesses. One of their main motivations is to achieve cost savings and ensure long-term profitability as falling costs make this a sound business decision. With this shift, companies are taking an active part in the global energy transformation and helping to place sustainability at the heart of economic and social agendas.

This report provides the first-ever account of global trends in corporate sourcing of renewables. It examines the practices of over 2 400 companies, identifying drivers, achievements and barriers, and providing recommendations to strengthen the momentum. Findings of this report show that companies actively consumed about 465 terawatt-hours (TWh) of renewable electricity in 2017, comparable to the electricity consumption of a major economy such as France.

Corporate sourcing of renewables is already taking place in more than 75 countries, even though most governments are yet to adopt specific policies to encourage such demand. Our analysis shows that even light policy adjustments can stimulate a rapid scale-up of corporate sourcing activities, indicating the significant potential to grow the market in the years to come. The private and public sectors must work hand in hand to seize this opportunity.

The commercial and industrial sector is responsible for about two-thirds of the world's final electricity demand. Where and how companies in this sector source their electricity and other energy services will be a decisive factor in the world's pursuit of a sustainable future. The Clean Energy Ministerial "Corporate Sourcing of Renewables" campaign, co-ordinated by the International Renewable Energy Agency (IRENA), has promoted dialogue and helped draw attention to this growing trend. Going forward, IRENA will continue to develop the knowledge framework on this important issue. Platforms such as IRENA's Coalition for Action will provide an effective avenue for further public-private dialogue and the continuous exchange of experiences, in order to accelerate progress, overcome barriers and fully realise the benefits.

While the pace of renewable energy deployment in recent years has been remarkable, IRENA estimates that it has to be accelerated six-fold to meet climate goals and achieve the necessary decarbonisation of the energy sector by 2050. Engaging the private sector is key, and sourcing renewable energy is a signal of its commitment in this respect.

I hope this report brings increased understanding of corporate sourcing of renewables and will inspire more companies and policy-makers to become part of this growing momentum.

Abbreviations

EAC	Energy Attribute Certificate
GICS	Global Industry Classification Standard
GW	gigawatt
IPP	Independent Power Producer
IRENA	International Renewable Energy Agency
IT	Information Technology
kWh	kilowatt-hour
MW	megawatt
MWh	megawatt-hour
PPA	Power Purchase Agreement
PV	photovoltaic
SME	Small and Medium-sized Enterprises
TWh	terawatt-hour

Glossary

Additionality – The net incremental renewable capacity deployed or renewable energy generated as a direct result of corporate sourcing of renewable energy beyond what would occur in its absence.

Corporation – Publicly or privately owned company.

Corporate power purchase agreement (PPA) – An arrangement under which a company enters into a long-term contract with an independent power producer or a utility and commits to purchasing a specific amount of renewable electricity or the output from a specific asset (sleeved or virtual), at an agreed price.

Corporate sourcing of renewable electricity – A company actively procuring or self-generating renewable electricity to supply its own operations.

Energy attribute certificate (EAC) – A contractual instrument that represents information about the origin of the energy generated. Various energy attribute certificates exist in a variety of markets, e.g., guarantees of origin (GOs) in Europe, renewable energy certificates (RECs) in the United States and international certificates – such as I-RECs. In most markets. Unbundled EACs can be purchased separately from the generated electricity.

Green procurement from utility or electric supplier/Utility green procurement – Allows the corporate buyer to purchase renewable electricity through either green premium products or a tailored renewable energy contract, such as the green tariff programme offered by some utilities.

Renewable energy – All forms of energy produced from renewable sources in a sustainable manner, which include, inter alia: bioenergy; geothermal energy; hydropower; ocean energy, including tidal, wave and ocean thermal energy; solar energy; and wind energy.

Sleeved PPA – A contract under which the developer sells the electricity and associated attributes directly to a corporate off taker.

Virtual PPA – A PPA contract under which the developer sells its electricity in the spot market and then settles the difference between the variable market price and the strike price with the corporate off-taker that receives the generated electricity certificates – also known as Financial PPAs.

IRENA
International Renewable Energy Agency

Contents

Figures and Tables

Figures

Tables

Boxes

Maps

Executive Summary

Source: Enel Green Power

More and more companies around the world are voluntarily and actively procuring or investing in self-generation of renewable energy. Driven by the last decade's unprecedented reduction in the cost of renewables in combination with a growing demand for corporate sustainability among investors and consumers, renewables have become an attractive source of energy.

Corporate sourcing of renewables has the potential to drive significant additional investment in renewable energy. With the right framework in place, it can also help accelerate the energy transformation and move the world closer to achieving the Paris Agreement's objective of keeping the rise in global average temperatures to well below 2°C above pre-industrial levels.

As the first global comprehensive analysis of corporate sourcing of renewable electricity, this report highlights the latest trends and provides recommendations to more fully exploit its potential. The analysis builds on data collected from the member states of the International Renewable Energy Agency (IRENA) and from more than 2 400 large corporate entities headquartered in more than 40 countries.

The overall findings indicate that corporate sourcing occurs in roughly a third of the world's countries. The report also shows that there is substantial scope to further enable corporate entities to source more renewable electricity and ensure that their efforts result in additional deployment. The analysis further suggests that while roughly one in five corporations has committed to renewable electricity targets, an opportunity exists to strengthen these targets and ambitions across all industry sectors.

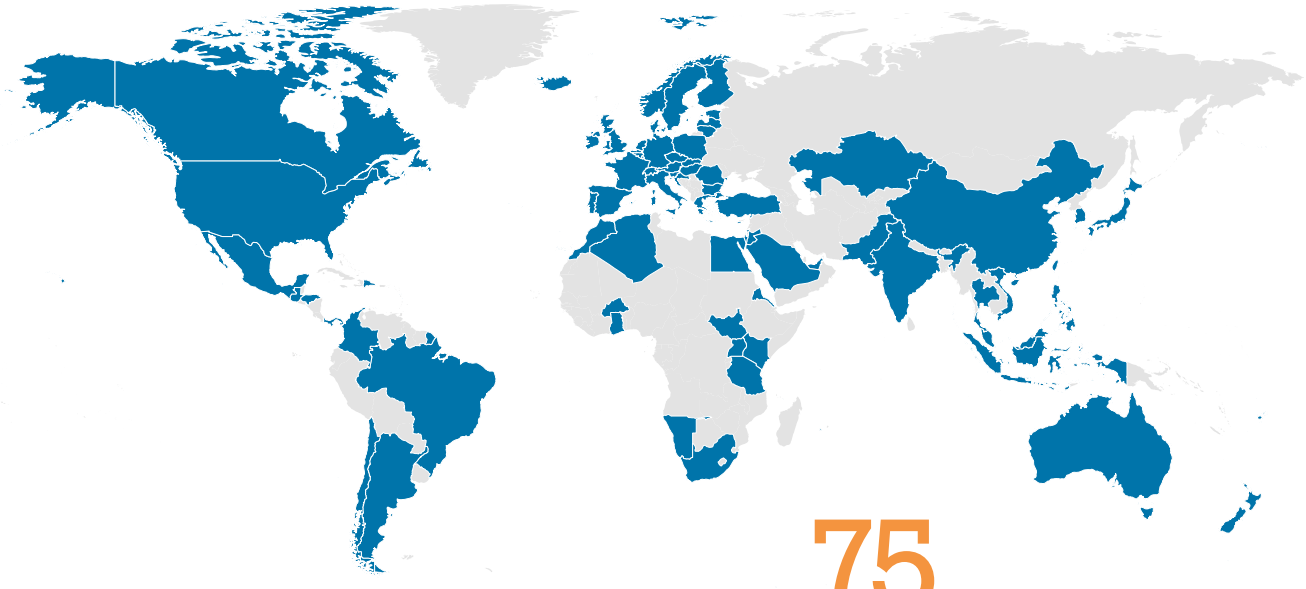
2 410
companies have been analysed for this report

Key findings

01 Corporate sourcing of renewable electricity is a growing global trend, already seen in more than 70 countries around the world. The majority of companies reporting active sourcing are head-quartered in Europe and North America, with emerging markets on the rise.

As of early 2018, companies sourced renewable electricity in 75 countries either through power purchase agreements (PPAs), utility green procurement programmes or unbundled energy attribute certificates (EACs) (see Map ES.1). Countries in Europe and North America continue to account for the bulk of corporate sourcing and are home to a large number of companies that are actively procuring renewables not only in the country where they are headquartered but also for their operations around the world. Lately, rising demand for renewable electricity has been noted among companies headquartered in the Asia Pacific region and Latin America. In Africa and the Middle East, few corporate procurement deals have been struck so far, but the region promises high potential.

Map ES.1. Corporate renewable electricity sourcing globally



75

countries have PPAs, utility green procurement programmes and/or unbundled EACs

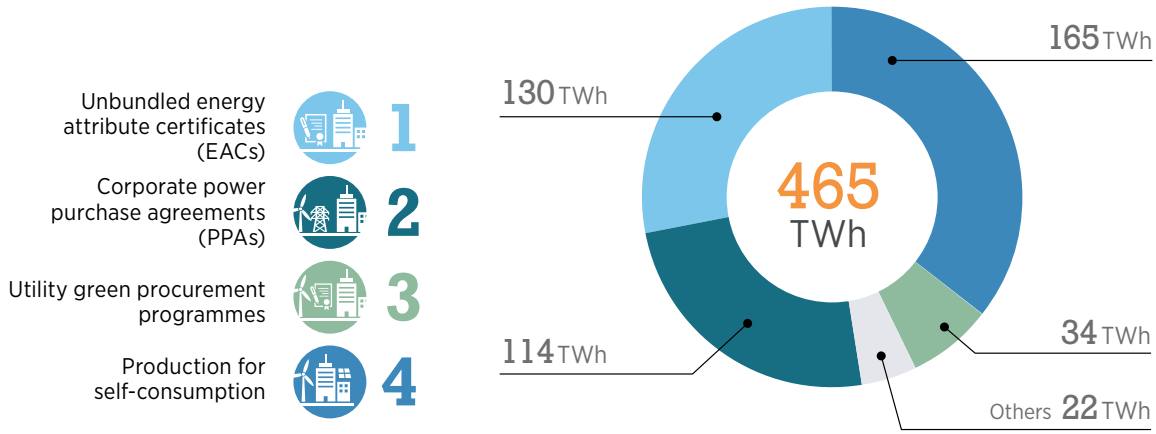
Note: This map shows countries where corporate sourcing takes place as of early 2018, either through power purchase agreements, utility green procurement programmes and/or the purchase of unbundled renewable energy attribute certificates. Direct investments in production for self-consumption are not included.

Disclaimer: The boundaries and names shown on this map do not imply any official endorsement or acceptance by IRENA. The term "country" as used in this material also refers, as appropriate, to territories or areas.

02 **The world market for corporate sourcing of renewables in 2017 reached about 465 terawatt-hours, placing it close to France's overall electricity demand.**

Active corporate sourcing of renewable electricity reached 465 terawatt-hours (TWh) in 2017, representing approximately 3.5% of total electricity demand in the Commercial & Industrial sector, and 18.5% of total renewable electricity demand in the Commercial & Industrial sector (see Figure ES.1). Production for self-consumption is the most common sourcing model, followed by the purchase of unbundled energy attribute certificates (EACs) and power purchase agreements (PPAs).

Figure ES.1. Global corporate sourcing of renewable electricity by sourcing model



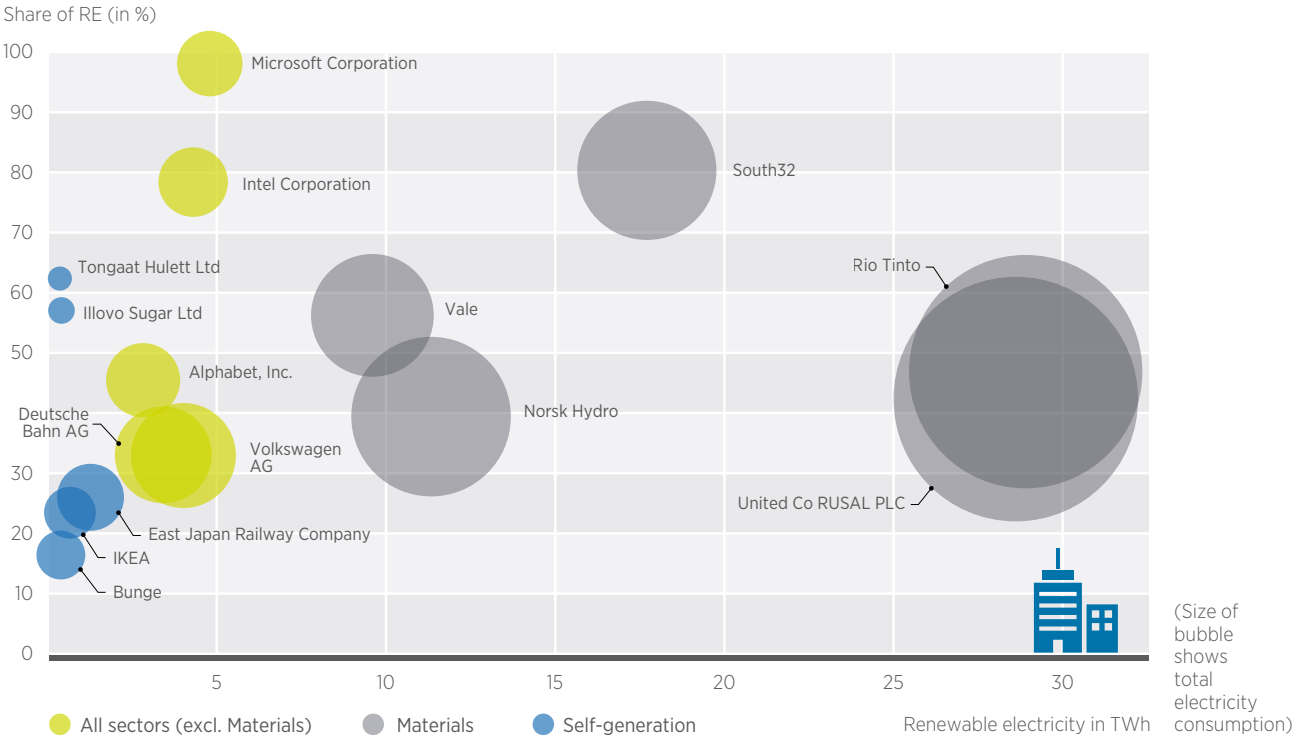
Ventikas 252 MW wind farms in Mexican state Nuevo Leon, of which cement manufacturer CEMEX is acquiring 25% of the generation for a period of 20 years.

Source: CEMEX

03 Companies sourcing renewable electricity come from various sectors, demonstrating that the trend is widespread and dynamic.

According to the data from 2 410 companies analysed, about 200 companies reported that more than half of the electricity they consumed was sourced from renewables; 50 companies reported a share of 100%. Companies sourcing renewable electricity come from a diverse set of sectors and geographic areas. By volume, the majority of renewable electricity was consumed in the Materials sector (165 TWh), which includes mining, pulp and paper, and chemicals (see Figure ES.2). The highest shares of renewable electricity consumption are found in the Financial (24%) and Information Technology (12%) sectors.

Figure ES.2. Major consumers and self-generators of renewable electricity (by volume)



Note: The information in the figure is based solely on data reported by each company in 2017. Accordingly, the amount of electricity from renewable sources generated or consumed by any given company may have changed since the data were reported.

Disclaimer: The presentation of material in this figure does not imply the expression of any opinion whatsoever concerning the company, including but not limited to any endorsement of or preference for the company relative to other companies that are not mentioned.

04 Corporate demand for renewable electricity has the potential to drive investment in renewables and accelerate the global energy transformation.

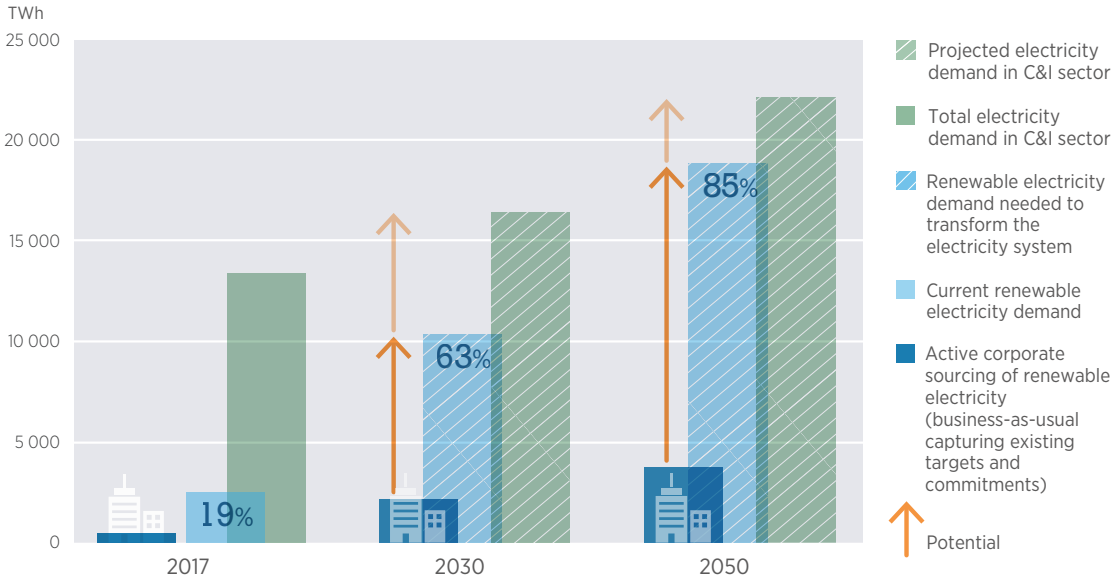
Companies in the Commercial & Industrial sector account for about two thirds of the world's end-use of electricity. As their demand for renewable energy increases, they have the potential to play an important role in driving investment in renewables and contributing to global climate objectives. IRENA analysis projects that to achieve a global energy transformation that can deliver on the climate objectives set in the Paris Agreement, the

111
companies have reached 85-100% renewable electricity

overall share of renewables in total electricity use would need to reach at least 85% by 2050, which translates into 19 000 TWh for the Commercial & Industrial sector. In the current trajectory, corporate global demand for renewable electricity will grow to at least 2 150 TWh by 2030 and 3 800 TWh by 2050 (see Figure ES.3). This would correspond to only 20% of the required renewable electricity demand in the Commercial and & Industrial sector in 2050, still not of the growth rate required. More than 111 companies have reached levels of in between 85-100% of renewable electricity sourcing, showing that high ambitions and significant acceleration of uptake is feasible.

To enable the full energy transformation, corporate renewable energy sourcing will need to go beyond the electricity sector and focus on all end-uses as well as energy efficiency measures.

Figure ES.3. Potential for corporate sourcing of renewable electricity in the Commercial & Industrial sector



Note: The figure compares current and future active corporate sourcing of renewable electricity based on existing targets and commitments with the amount of renewable electricity needed to transform the global electricity system and have a chance to reach the climate goals set out in the Paris Agreement.

17%
of companies have renewable electricity targets in place

05 Although more than half of the analysed companies source renewable electricity, only 17% have a target in place. Significant potential exists to strengthen corporate renewable electricity commitments.

Setting a specific renewable electricity target is still uncommon among companies. Although almost half of the companies analysed are actively sourcing renewable electricity, only 17% reported having a target. While only a relatively low number of companies are committing to a renewable electricity target, many more have actually set emission reduction targets. Of the existing renewable electricity targets, three quarters are short-term and will expire before 2020. This presents a significant opportunity to strengthen corporate ambitions in the years to come. Half of the companies that have a target in place have committed to sourcing more than 80% of their electricity from renewable resources. In addition to environmental and social benefits, such as cutting emissions and promoting corporate social responsibility, the economic benefits of sourcing renewables may also include cost savings, long-term price stability, security of supply and the possibility of new business opportunities.

Recommendations

To enable the energy transformation, corporate sourcing of renewables will need to be scaled up. This requires a broader participation of companies of all sizes to:

- **Establish, revise or increase their current corporate sourcing ambitions to accelerate the decarbonisation of their operations.**
- **Raise their efforts to support projects that trigger additional investment in renewable energy.**

Corporate sourcing of renewables will realise its full potential through long-term, stable and predictable policy frameworks. Already light policy adjustments can stimulate a rapid market pick-up.

While many countries have in place at least one option for companies to source renewables, there is ample scope for improved enabling frameworks to ensure that rising demand is translated into additional installed renewable electricity capacity. The strength and potential of corporate sourcing lay in the fact that relatively few and cost friendly policy adjustments can induce a quick increase in corporate procurement of electricity, both in vertically integrated and liberalised energy markets. IRENA's 2017 country survey indicates that a large majority of governments have not yet included or specifically addressed the potential of corporate sourcing of renewables in their energy strategies and policies. To fully capture the potential, governments may wish to:

- **Support an effective system for issuing and tracking of energy attribute certificates, enabling companies to make credible renewable electricity use claims.** An energy attribute scheme is crucial to support renewable electricity sourcing whether through PPAs, utility purchases, unbundled certificates or direct investment in self-generation. A transparent tracking system clarifies origin and ownership.
- **Ensure an energy market structure that allows for direct contracting between companies and renewable energy developers.** Increasingly popular corporate PPA deals thrive in markets which allow for direct contracts between companies and energy developers. Additional market conditions enabling the participation of companies of all sizes in the energy market include clearly defined grid transmission policies with priority access for renewables, as well as retail rates which closely track wholesale rates.
- **Work with utilities or electricity suppliers to provide corporate renewable procurement options.** Retail access and the tailoring of retail products to the specific needs of companies is a key enabler for increasing corporate renewable procurement. In vertically integrated markets, where direct trade is not an option, governments can encourage longer-term contracts (PPAs or so-called green tariff programmes) directly between the corporate buyer of electricity and the utility.
- **Stimulate direct investments in corporate production of renewable electricity for self-consumption.** Key policies to drive self-generation include clear and efficient interconnection and permitting practices, and, in the case of off-site projects, the ability to carry electricity to where it is needed. A mechanism to feed excess electricity into the grid, *e.g.* through a net metering/net billing scheme, may encourage direct investments in particular among small and medium-sized enterprises.

Introduction

Source: Kohls

Significant reductions in the cost of renewable energy technologies over the past decade and a favourable policy landscape have left their mark on the global energy system.

The cost of wind turbines has fallen by 37-56% (IRENA, 2018b) and that of solar photovoltaics (PVs) by approximately 80% (IRENA and IEA, 2017). With these developments, the global energy system has reached a watershed moment: renewable energy is now the cheapest source of power generation in many parts of the world, and investment in renewable energy is outpacing that in conventional energy.

Total renewable energy investments have reached around USD 280 billion annually over the last years – of which almost 90% came from private sources (IRENA & CPI, 2018). To limit the rise in the global average temperature to less than 2°C above pre-industrial levels in line with the Paris Agreement on climate change, a scaling up of renewable energy investment is essential. Analysis by the International Renewable Energy Agency (IRENA) shows that to achieve the objective of the Paris Agreement, cumulative investment in low-carbon technologies will have to rise to USD 120 trillion between 2015 and 2050, equivalent to 2% of global gross domestic product for the period. Renewable energy is expected to comprise almost 20% (USD 22.3 trillion) of the investment needed (IRENA, 2018a).

Companies in the Commercial & Industrial sector, account for about two thirds of the world's electricity end-use and are expected to remain the biggest consumer until 2050 (IRENA, 2018a). They use electricity to process, produce or assemble goods such as for manufacturing, mining, agriculture and construction; the operation of industrial motors and machinery; and servicing heating and cooling, lighting, ventilation and air-conditioning systems for their operations. Companies can thus play an important role in driving investments in renewable energy and in meeting global climate targets.

Corporate sourcing as a driver for accelerated growth of renewable energy

The world's non-energy producing companies are increasingly turning to renewables as their preferred energy choice. In addition to environmental and social benefits such as cutting emissions, the economic benefits of sourcing renewables often include cost savings, long-term price stability and security of supply.

Companies follow two broad approaches in their consumption of renewable electricity:

A passive approach in which consumption is based on the average renewable electricity content available in the grids from which companies source their electricity.

An active approach in which consumption is based on actions companies take to procure or produce the renewable electricity they consume.

Corporate sourcing of renewables occurs when a company **actively** consumes, produces or invests in renewable energy to sustain its operations – offices, factories, vehicle fleets and supply chains.

Companies have access to a variety of options when sourcing renewable electricity (see Figure I.1). By exercising the locally available options to meet their needs, corporate sourcing has emerged as an innovative driver of renewable energy growth. The advent of corporate power purchase agreements (PPAs) in various forms, amounting by early 2018 to more than 900 deals signed and a volume of over 20 gigawatts (GW), provides just one example (WBCSD, 2018a; RMI, 2018). Energy utilities in many countries have also responded to growing corporate demand by offering more flexible renewable energy purchasing programmes, such as green tariffs, in which companies can work with their utilities to source up to 100% of their electricity from renewable resources.

68 MW wind farm in US state Pennsylvania, made possible by a corporate PPA between Goldman Sachs and NextEra Energy Resources.

Source: Goldman Sachs

100%

of active corporate sourcing of renewable electricity is already feasible

Figure I.1. Models for corporate sourcing of renewable electricity

Unbundled energy attribute certificates (EACs) 1

A company purchases attribute certificates of renewable energy separately "unbundled" from its electricity. Examples of certificate systems are guarantees of origin (GOs) and renewable energy certificates (RECs).

Power Purchase Agreements (PPAs) 2

A company enters into a contract with an independent power producer, a utility or a financier and commits to purchasing a specific amount of renewable electricity, or the output from a specific asset, at an agreed price and for an agreed period of time.

Renewable energy offerings from utilities or electric suppliers 3

A company purchases renewable electricity from its utility either through green premium products or through a tailored renewable electricity contract, such as a green tariff programme.

Production for self-consumption 4

A company invests in its own renewable energy systems, on-site or off-site, to produce electricity primarily for self-consumption.

Objectives of this report

The aim of this report is to capture and analyse global trends in corporate sourcing of renewable electricity, including its current market share and potential, both within countries and industries. It is the first study to do so while providing a global analysis of the corporate and policy angles at the same time. The report acknowledges companies' efforts in sourcing renewable electricity, provides an overview of current corporate sourcing trends and practices on a country level, and discusses their impacts on renewable energy deployment globally. Further, the report supports the Corporate Sourcing of Renewables campaign launched at the Seventh Clean Energy Ministerial (CEM) in May 2016.

The following analysis focuses primarily on corporate sourcing of renewable electricity. Although many companies are sourcing renewables to meet their needs for thermal energy and transport, data regarding sourcing activities in these areas are still lacking or incomplete. As data collection improves, further assessment of broader renewable energy sourcing trends will be possible.

2
global surveys at corporate and country level conducted for this report

Box I.1. The approach used in this report

The report provides an overview of corporate sourcing activities through an analysis of 2 410 companies that voluntarily reported data in 2017 through three channels: CDP's[i] climate change programme, RE100's[ii] annual reporting and IRENA's corporate survey. Out of the reporting companies, most (>98%) are large publicly listed private-sector companies with more than 250 employees and an annual revenue of at least USD 200 million. The data has been reported following the Greenhouse Gas Protocol[iii] Scope 2 Guidance standardising how corporations measure emissions from purchased or acquired electricity. For more information on the sample and the methodology used in the report, see Annex 1.

The companies analysed together reported nearly 2 500 terawatt hours (TWh) of annual electricity consumption, equivalent to almost 20% of the total electricity consumption of the Commercial & Industrial sector (see Table I.2). Renewable electricity sourcing trends among these companies are broken down and analysed by geography, industry sector, type of sourcing and target ambition. For the purpose of this report, no evaluation has been made of the effectiveness of various sourcing options in generating additional renewable electricity capacity (further discussed in Chapter 3).

The report further includes a country breakdown and an analysis of various corporate sourcing practices based on data collected through IRENA's country survey (IRENA, 2017).

Table I.1. Sectoral distribution of companies analysed in this report

Sector	Number of companies	Annual electricity consumption (TWh)
Industrial	531	222
Consumer Discretionary	380	262
Financial	342	50
Materials	330	1247
Information Technology	270	186
Consumer Staples	221	284
Health Care	134	40
Real Estate	130	30
Telecommunication Services	72	142
Total	**2410**	**2463**

i CDP, formerly the Carbon Disclosure Project, is a not-for-profit charity. CDP runs a global disclosure system that enables companies, cities, states and regions to measure and manage their environmental impacts through a comprehensive collection of self-reported environmental data.

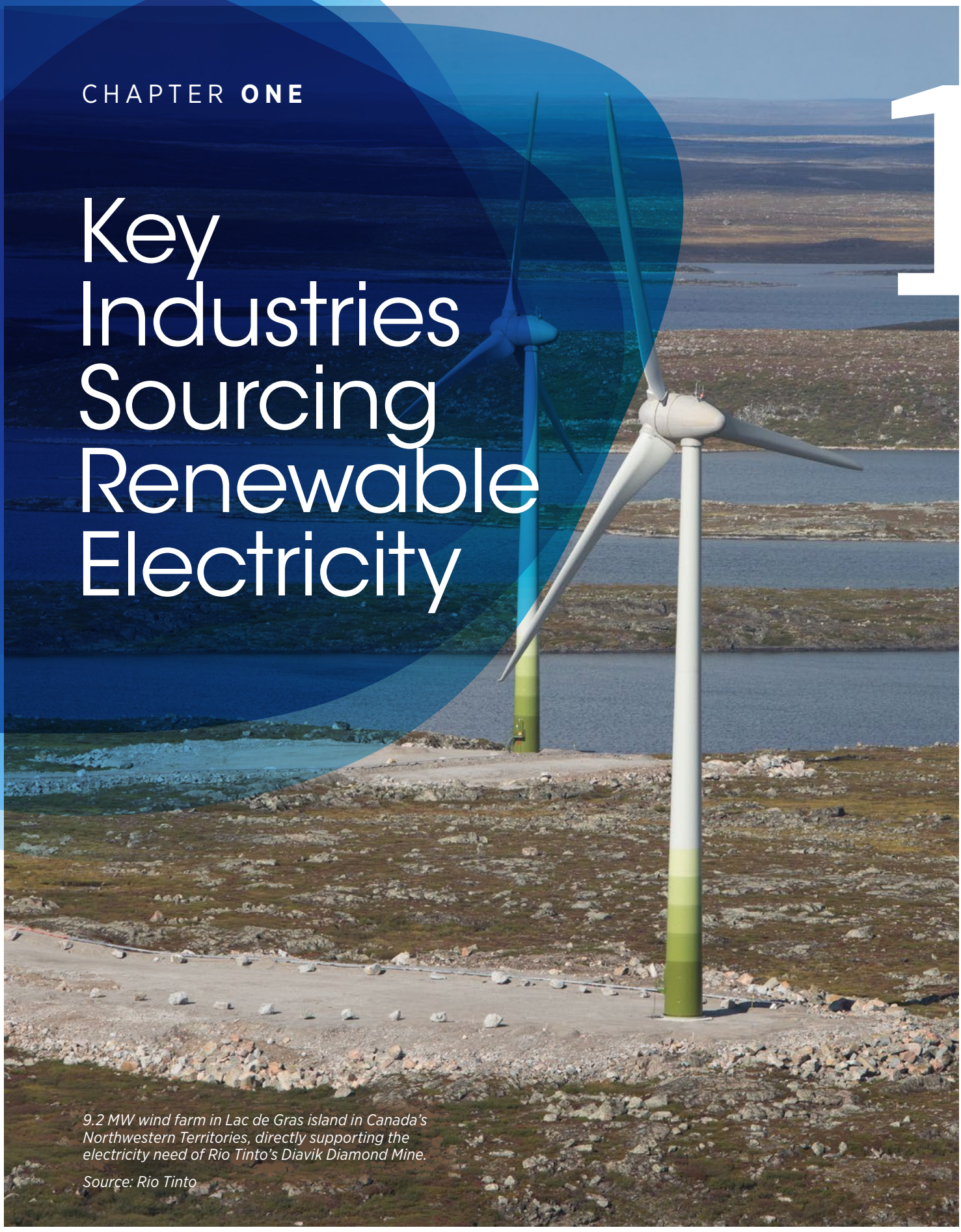
ii RE100 is a collaborative initiative led by The Climate Group in partnership with CDP bringing together influential businesses committed to 100% renewable electricity.

iii The Greenhouse Gas Protocol Scope 2 Guidance, standardises how corporations measure emissions from purchased or acquired electricity, steam, heat and cooling.

IRENA
International Renewable Energy Agency

CHAPTER **ONE**

Key Industries Sourcing Renewable Electricity



9.2 MW wind farm in Lac de Gras island in Canada's Northwestern Territories, directly supporting the electricity need of Rio Tinto's Diavik Diamond Mine.

Source: Rio Tinto

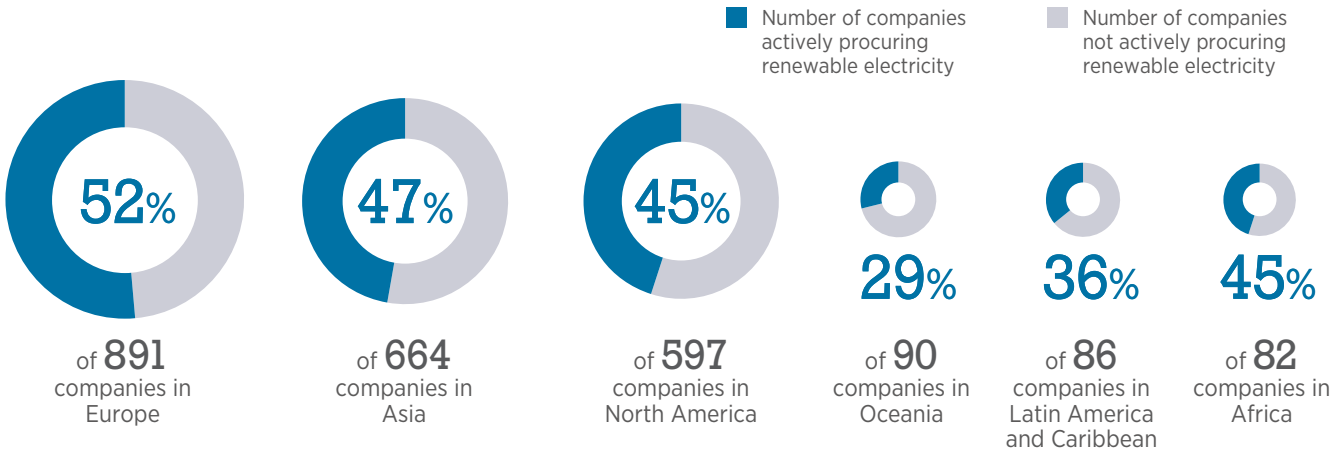
1.1. Sectors and companies reporting renewable electricity sourcing

Large companies have become important consumers and producers of renewable electricity. Of the 2 410 companies analysed in this report, with total annual revenue of USD 26.5 trillion, nearly half (47%) report that they are actively sourcing renewable electricity. However, considering these companies' efforts in reporting extensive data on their climate and energy efforts, it can be assumed that companies in this sample are more likely to be sourcing renewables. The majority of the companies reporting renewable electricity sourcing are headquartered in Europe, Asia and North America, as illustrated in Figure 1.1. Europe stands out as the region showing more companies reporting renewable electricity consumption than not.

Among the factors contributing to corporate reliance on renewable electricity are the level of maturity of climate and energy management of a given company, the cost-competitiveness of renewables and the availability of options that enables companies to source renewable electricity.

47%
of companies reported active renewable electricity sourcing

Figure 1.1. Regional overview of companies reporting renewable electricity consumption



Note: The information in the figure is based solely on data reported by each company in 2017. Accordingly, the amount of electricity from renewable sources generated or consumed by any given company may have changed since the data were reported.

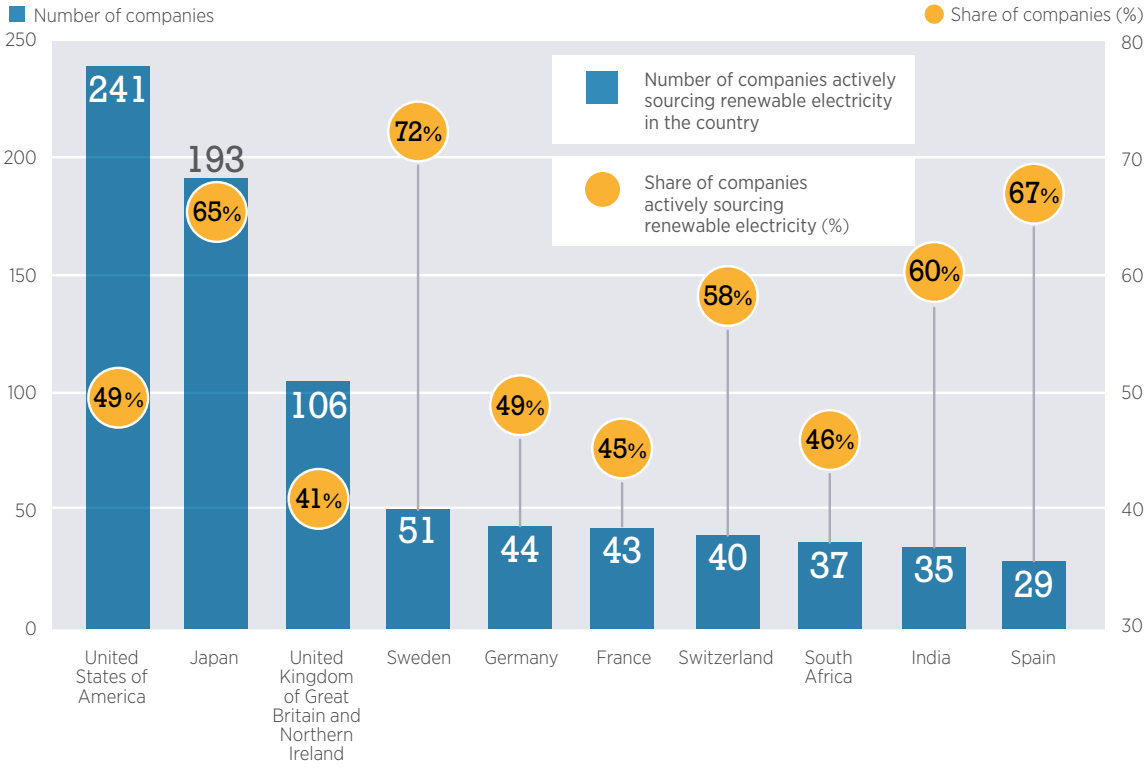
Eight of the ten countries with the largest number of companies reporting renewable electricity sourcing are developed countries (see Figure 1.2). Among emerging economies, South Africa and India are the two with the largest number of companies actively sourcing renewable electricity. In terms of geographical occurrence of corporate sourcing it is important to understand that many of the companies analysed in this report have global operations. Therefore, it is likely that any given company may source renewable electricity in several countries beyond the one in which it is headquartered.

Solar PV park in Japan supplying electronics company Ibiden (Apple supplier)

Source: Apple Inc.

Renewable electricity sourcing occurs in a broad range of companies. Although the largest number of those reporting renewable electricity consumption is in the Industrial sector (238 out of 531, representing 45% of companies reporting data), the largest proportion of companies sourcing renewable electricity is in the Telecommunication Services sector (46 out of 72, representing 64% of companies reporting data).

Figure 1.2. Number of companies actively sourcing renewable electricity by headquarter location (in top ten countries)



Note: The information in the figure is based solely on data reported by companies in 2017. The bars represent the number of reporting companies actively sourcing renewable electricity based on the headquarter location of the company. The orange bubbles represent the percentage of reporting companies in the sample, within the country, that are actively sourcing renewable electricity.

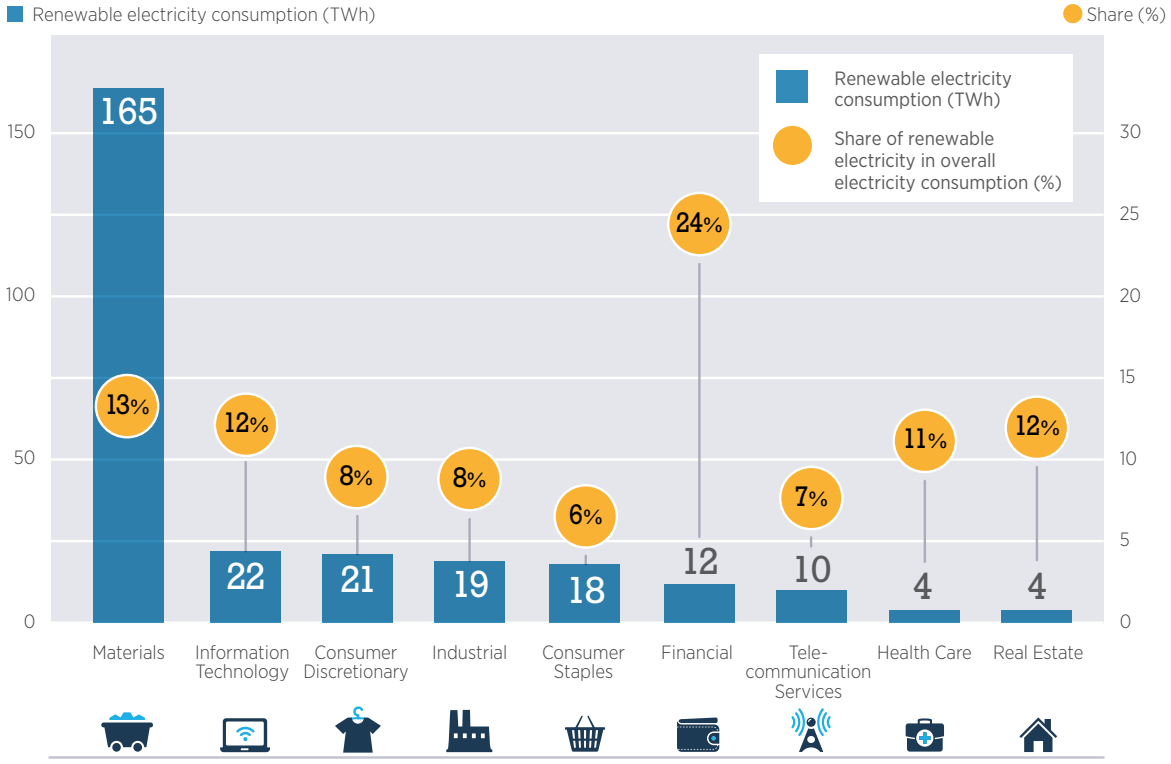
1.2. Index of corporate renewable electricity consumption

Of the 2 410 companies analysed in this report, 111 report that they are already procuring all or nearly all (>85%) of their electricity from renewable sources. Almost half of these companies operate in the Financial sector (40), followed by the Industrial (22) and Consumer Discretionary (17) sectors.

The overall volume of renewable electricity consumption from the reporting companies totalled 275 TWh in 2016, which represents 11% of their total electricity consumption. Figure 1.3 offers a inter-sectoral comparison demonstrating total electricity consumption and share of electricity from renewable sources. The chart shows marked differences when analysing renewable electricity consumption patterns at the sectoral level.

- The **Materials sector** is the largest user of electricity (both renewable and non-renewable), not surprisingly, since it includes some of the most energy-intensive industries, such as mining and metals, chemicals, and pulp and paper.
- The **Financial sector** has the largest share of renewable electricity consumption. Although this sector is notably less energy-intensive than some of the others, it has the largest number of companies reporting renewable electricity targets.
- The **Information Technology (IT)** sector is pioneering some of the most innovative corporate sourcing models, including different forms of PPAs entered into to supply operations such as data centres.

Figure 1.3. Inter-sectoral comparison of renewable electricity sourcing



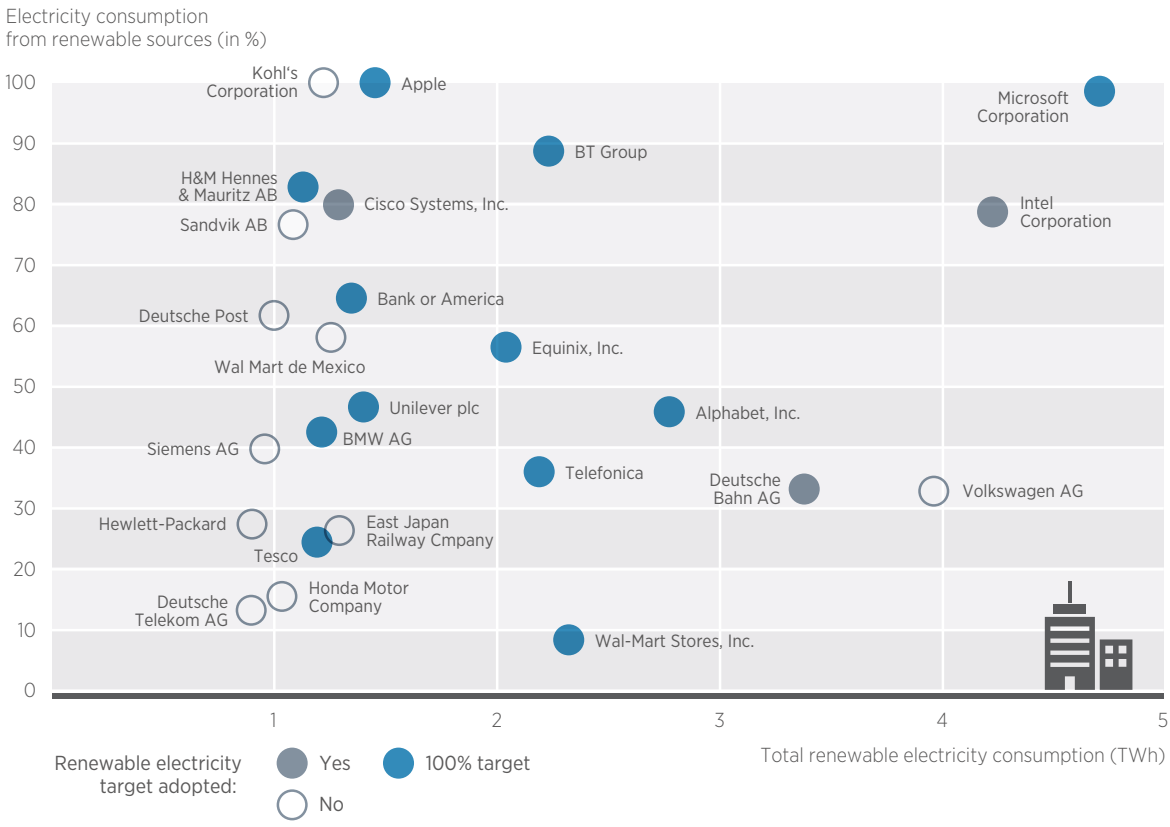
Note: The information in the figure is based solely on data reported by companies in 2017. Accordingly, the amount of electricity from renewable sources generated or consumed by any given company may have changed since the data were reported. The orange bubbles represent the share of renewable electricity in the total electricity consumption of the respective sector.

An overview of the 25 largest corporate consumers of renewable electricity (excluding companies in the energy-intensive Materials sector)[1] is presented in Figure 1.4. In 2016, these 25 companies together consumed 17% (47 TWh) of the renewable electricity reported by all companies in the sample. Of this, over 50% came from EACs, 25% from PPAs, 14% from utility contracts and 6% from self-generation. Of the 25 largest renewable electricity consumers, 15 have renewable electricity targets in place, and 12 have committed to procuring 100% of their electricity from renewable sources. More details in Annex 2.

Within this group, **Apple Inc.**, **Kohl's Corporation**, **Microsoft Corporation, BT Group** and **H&M Hennes & Mauritz AB** are top performers in terms of the share of electricity sourced from renewables, amounting to between 85% and 100% (see Figure 1.4). Looking at the total volume of renewable electricity sourced, leading companies include **Microsoft Corporation**, **Intel Corporation, Volkswagen AG, Deutsche Bahn AG** and **Alphabet Inc.** (the holding company of Google), all of which procure more than 2.5 TWh yearly. A detailed overview can be found in Table 1.1.

1 The Materials sector has been excluded in this graph and will be analysed in detail in Figure 1.5.

Figure 1.4. Corporate renewable electricity consumption index (excluding companies in the Materials sector)



Note: The information in the figure is based solely on data reported by each company in 2017. Accordingly, the amount of electricity from renewable sources generated or consumed by any given company may have changed since the data were reported.

Disclaimer: The presentation of material in this figure does not imply the expression of any opinion whatsoever concerning the company, including but not limited to any endorsement of or preference for the company relative to other companies that are not mentioned.

Table 1.1. Top performing companies excluding the Materials sector (by volume and share of renewable electricity consumption)

Company	Electricity consumption (TWh)	Renewable electricity consumption (TWh)	Share of renewable electricity (%)	→ of which: Renewable electricity offerings from utilities or electric suppliers	→ of which: Corporate power purchase agreements	→ of which: Energy attribute certificates	→ of which: Production for self-consumption
Alphabet, Inc.	6.21	2.82	**45%**		100%		
Apple Inc.	1.45	1.45	**100%**	3%	41%	32%	24%
BT Group	2.56	2.27	**89%**	100%			
Deutsche Bahn AG	10.50	3.44	**33%**			98%	2%
H&M Hennes & Mauritz AB	1.39	1.15	**83%**			100%	
Intel Corporation	5.46	4.30	**79%**			99%	1%
Kohl's Corporation	1.24	1.24	**100%**			100%	
Microsoft Corporation	4.85	4.79	**99%**		17%	83%	
Volkswagen AG	12.36	4.03	**33%**		92%		8%

Materials

The Materials sector comprises the largest corporate users of electricity, with several companies reporting consumption on the order of tens of terawatt-hours per year. In some of these energy-intensive industries, the use of renewable electricity, often from hydropower or bio-waste sources, is a well-established practice that helps them secure a stable source of power while keeping operational costs at a competitive level.

Although it represents only 15% of all companies analysed in this report, out of the entire sample this sector consumes roughly 60% of all the renewable electricity and nearly 90% of all the renewable electricity produced by companies for their own consumption. On average, about 13% of the total electricity consumed by companies in the Materials sector came from renewable sources, amounting in 2016 to 165 TWh of renewable electricity. Of that total, more than 60% came from self-generation and 30% from PPAs. Figure 1.5 provides an overview of the top 25 users of renewable electricity in the sector. More details in Annex 2.

Top performers in terms of share of renewable electricity were pulp and paper companies **Empresas CMPC**, **FIBRIA Celulose and Holmen**; mining and metals company **South 32**; and chemical company **Akzo Nobel**. In terms of absolute volume, the largest consumers of renewable electricity were mining and metals companies **Rio Tinto, South 32** and **Vale** and aluminium producers **United Co Rusal PLC** and **Norsk Hydro**. A detailed overview appears in Table 1.2.

165 TWh

of renewable electricity was consumed by the Materials sector

Figure 1.5. Corporate renewable electricity consumption index, Materials sector

Note: The information in the figure is based solely on data reported by each company in 2017. Accordingly, the amount of electricity from renewable sources generated or consumed by any given company may have changed since the data were reported.

Disclaimer: The presentation of material in this figure does not imply the expression of any opinion whatsoever concerning the company, including but not limited to any endorsement of or preference for the company relative to other companies that are not mentioned.

On-site solar PV system at Akzo Nobel headquarters in Amsterdam, Netherlands.

Source: Akzo Nobel

Table 1.2. Top performing companies in the Materials sector (by volume and share of renewable electricity consumption)

Company	Electricity consumption (TWh)	Renewable electricity consumption (TWh)	Share of renewable electricity (%)	→ of which: Renewable electricity offerings from utilities or electric suppliers	→ of which: Corporate power purchase agreements	→ of which: Energy attribute certificates	→ of which: Production for self-consumption
Akzo Nobel	8.81	5.46	**62%**		91%		9%
Empresas CMPC	2.00	2.00	**100%**				
FIBRIA Celulose S/A	2.92	2.48	**85%**				100%
Holmen	3.95	2.67	**68%**	33%			
Norsk Hydro	28.80	11.33	**39%**				100%
Rio Tinto	61.60	28.90	**47%**		11%		
South32	21.91	17.71	**81%**		46%		54%
United Co RUSAL PLC	67.64	28.61	**42%**		99%		1%
Vale	17.02	9.60	**56%**		61%		39%

Several industries in the sector either own energy-generating assets or have established bilateral energy contracts directly with generators. In the mining and metal industries, the manufacture of basic metals (e.g., aluminium) from ores is one of the most electricity-intensive industrial processes. Not surprisingly, several metal production sites have traditionally been developed near low-cost hydroelectric power plants to ensure competitive supply.

In total, about a fourth of the electricity used in the aluminium sector in 2016 came from hydropower and less than 1% came from other renewable electricity sources (International Aluminium Institute, 2018). Since 2016, Norsk Hydro, one of the largest aluminium producers in Europe, has contracted for a total of 650 megawatts (MW) of wind energy (Ward, 2017). Its 483 MW PPA deal in 2017 in Sweden represents one of the largest wind energy transactions involving a corporate user (Ward, 2017). Another aluminium producer investing in wind energy is Argentinian Aluar, which in early 2018 placed a 50 MW order for the second phase of a wind park that would double the company's wind power capacity for self-generation (Reve, 2018).

The pulp and paper industry likewise includes some of the largest users of renewable electricity. In total, 20% of the total electricity consumed by pulp and paper companies came from renewable sources, and 13% of reporting companies have a target in place. Over 90% of the renewable electricity consumption by these companies was self-generated.

Only 40 of the 330 companies (12%) in the Materials sector reported having a renewable electricity target in place. Of the 40, 11 have 100% renewable electricity targets.

11

Materials companies have a 100% renewable electricity target

24%

of total electricity consumption in the Financial sector came from renewables

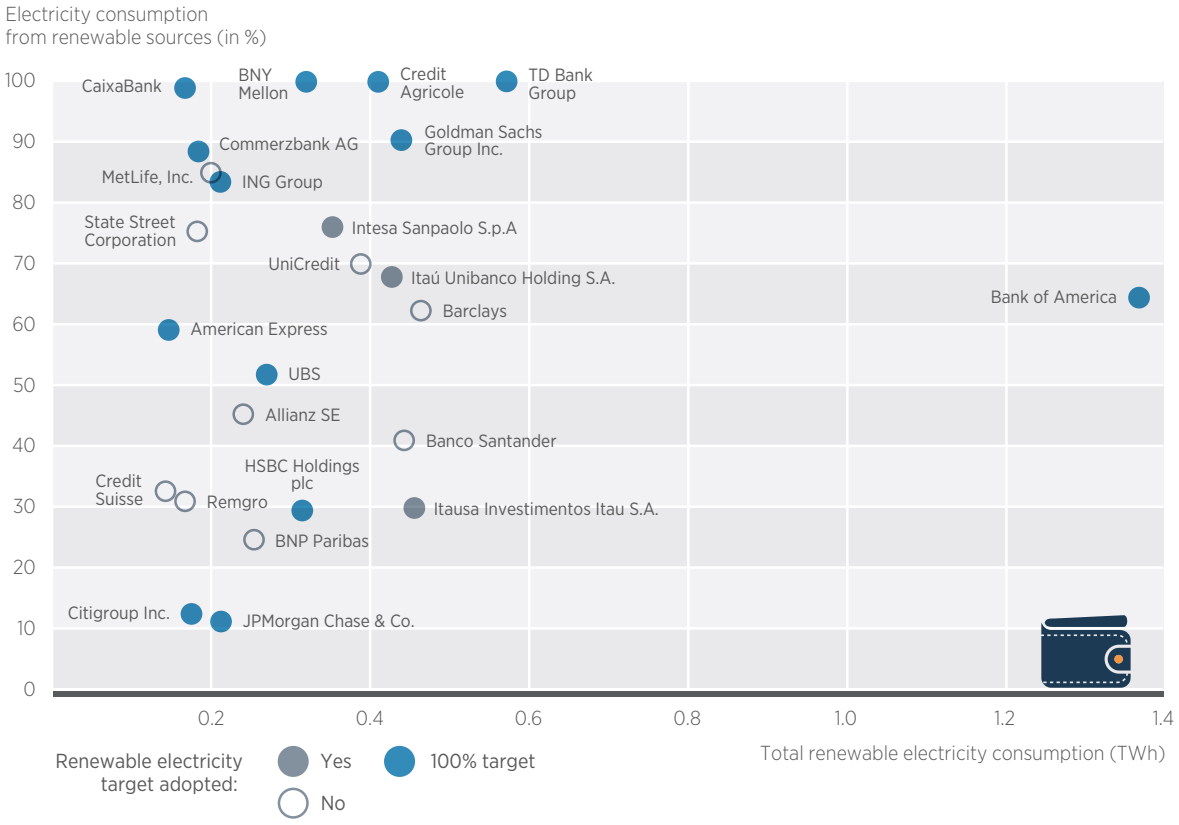
Financial

The Financial sector – including banks, insurance providers and other financial institutions – shows the largest share of renewable electricity consumption (24%) among the reporting companies.

About 43% of analysed companies in this sector consume renewable electricity, and 21% of these have renewable electricity targets. Over 70% of these targets are to achieve 100% renewable electricity. This makes the Financial sector one of the most ambitious, in terms of commitments, along with Telecommunication Services, Consumer Staples and Real Estate.

Figure 1.6 provides an overview of the top 25 largest users. The top performers by share of renewable electricity used were **TD Bank Group, Crédit Agricole, BNY Mellon, CaixaBank**, and **Goldman Sachs Group Inc.** In terms of volume of renewable electricity consumed, top performers include **Bank of America, TD Bank Group, Barclays, Itausa Investimentos Itau S.A.** and **Banco Santander.** A detailed overview appears in Table 1.3.

Figure 1.6. Corporate renewable electricity consumption index, Financial sector



Note: The information in the figure is based solely on data reported by each company in 2017. Accordingly, the amount of electricity from renewable sources generated or consumed by any given company may have changed since the data were reported.

Disclaimer: The presentation of material in this figure does not imply the expression of any opinion whatsoever concerning the company, including but not limited to any endorsement of or preference for the company relative to other companies that are not mentioned.

Table 1.3. Top performing companies in the Financial sector (by volume and share of renewable electricity consumption)

Company	Electricity consumption (TWh)	Renewable electricity consumption (TWh)	Share of renewable electricity (%)	→ of which: Renewable electricity offerings from utilities or electric suppliers	→ of which: Corporate power purchase agreements	→ of which: Energy attribute certificates	→ of which: Production for self-consumption
Banco Santander	11.05	4.48	**41%**	100%			
Bank of America	21.31	13.69	**64%**			100%	
Barclays	7.59	4.69	**62%**	100%			
BNY Mellon	3.24	3.24	**100%**			100%	
CaixaBank	1.72	1.71	**99%**			100%	
Crédit Agricole	4.13	4.13	**100%**	n/a	n/a	n/a	n/a
Goldman Sachs Group Inc.	4.88	4.41	**90%**			100%	
Itausa Investimentos Itau S.A.	15.49	4.58	**30%**		94%		6%
TD Bank Group	5.74	5.74	**100%**			100%	

With its relatively small share of overall electricity demand (2%), the Financial sector may not have as much impact as other sectors in driving demand for renewable electricity. However, in their roles as lenders and investors, companies in the sector play a critical part in enabling other companies to increase their share of renewable electricity consumption. From this perspective, it is important that financial institutions participate as consumers in renewable electricity markets. Experiencing first-hand the financial challenges that end-users face in scaling up their consumption of renewable electricity gives Financial sector companies insight into their influence and ability to help remove some of these barriers.

According to the data analysed, 80% of companies in the Financial sector source their renewable electricity through unbundled attribute certificates. With respect to the sourcing models used by the sector, it is important to acknowledge some of the operational barriers companies face. For example, it is common for companies in the sector to operate in leased premises, for electricity demand to be very low, and for the prospects of cost savings at the facility level to be small. More details about the 25 largest users of renewable electricity in the Financial sector are included in Annex 2.

Solar PV system on Bank of America's financial center in Kissimmee, Florida (US).

Source: Bank of America

Information Technology

The IT sector is one of the pioneers in the sourcing of renewable electricity, and it continues to account for the largest corporate purchases of renewable electricity from wind and solar PV sources (RMI, 2018). A significant share of expenses faced by companies in the sector can be attributed to the costs associated with the large amounts of electricity required to run their data centres and cloud computing services. Companies are increasingly using renewable electricity to reduce these costs and mitigate electricity price volatility, while simultaneously meeting their respective greenhouse gas emission reduction targets.

Nearly 50% of IT sector companies in the sample reported consuming renewable electricity, and 12% (22 TWh) of all the electricity consumed in the sector came from renewable sources. According to data reported for 2017, most of the renewable electricity consumed was purchased through unbundled attribute certificates (almost 62%) followed by PPAs (24%). The companies produced a very small share for self-consumption (4%). Figure 1.7 shows an overview of the 25 largest users of renewable electricity in the sector.

17%

of IT sector companies have renewable electricity targets

Figure 1.7. Corporate renewable electricity consumption index, IT sector

Note: The information in the figure is based solely on data reported by each company in 2017. Accordingly, the amount of electricity from renewable sources generated or consumed by any given company may have changed since the data were reported.

Disclaimer: The presentation of material in this figure does not imply the expression of any opinion whatsoever concerning the company, including but not limited to any endorsement of or preference for the company relative to other companies that are not mentioned.

Table 1.4. Top performing companies in the IT sector (by volume and share of renewable electricity consumption)

Company	Electricity consumption (TWh)	Renewable electricity consumption (TWh)	Share of renewable electricity (%)	→ of which: Renewable electricity offerings from utilities or electric suppliers	→ of which: Corporate power purchase agreements	→ of which: Energy attribute certificates	→ of which: Production for self-consumption
Alphabet, Inc.	6.21	2.82	**45%**		100%		
Apple Inc.	1.45	1.45	**100%**		41%	32%	24%
Cisco Systems, Inc.	1.64	1.31	**80%**	2%		98%	
Intel Corporation	5.46	4.30	**79%**			99%	1%
Microsoft Corporation	4.85	4.79	**99%**		17%	83%	
SAP SE	0.35	0.44	**100%**			100%	

Top-performing companies in terms of both share and total volume of renewable electricity consumed were **Alphabet Inc. (Google), Apple Inc., Cisco Systems Inc., Intel Corporation** and **Microsoft Corporation**. In terms of share, **SAP SE** is also in the top five. These companies consumed 20 TWh of renewable electricity in 2016, of which 60% took the form of EACs and 30% came from PPAs. A detailed overview can be found in Annex 2.

Corporate consumption of renewable electricity in the sector, especially through PPAs, has increased significantly since the data presented here were reported. In 2017, the largest global buyers of renewable electricity were in fact IT companies (RMI, 2018). Apple, Google and Microsoft all announced in 2017 that they had reached their 100% renewable electricity targets (RE100, 2018).

About 17% of IT sector companies have renewable electricity targets in place, and 17 have publicly pledged to reach the goal of using 100% renewable electricity. Most of these 100% targets have been adopted by companies in the software and services sub-sector.

Eneco solar PV parc to supply Google datacenters in the Netherlands.

Source: Eneco, Sunport Delfzijl

Box 1.1. Sourcing of renewables by small and medium-sized enterprises

Small and medium-sized enterprises (SMEs) are important engines of economic and industrial growth because they contribute significantly to the local economy. Wanting to be part of a sustainable and low-carbon future and incentivised through falling renewable electricity costs, SMEs are increasingly turning to renewables to run their operations.

Although most of the companies analysed in this report are large, publicly listed corporations, findings reveal efforts by SMEs across different sectors. Examples include furniture company Keilhauer and real estate investment advisors Bentall Kennedy from Canada, which sourced 100% of their electricity requirements from renewable energy sources in 2016 through renewable energy certificates, amounting to 1 200 MWh and 700 MWh, respectively. Other SMEs, such as food producer Califia Farms and electric vehicle car racing company Formula-e, have joined the RE100 campaign and committed to source 100% of their electricity requirements from renewable sources by 2020.

As corporations increase their renewable electricity sourcing throughout their value chain, spill-over effects are created on supplying companies, often SMEs. Out of the over 130 RE100 companies, more than one third work with their suppliers to encourage renewable electricity consumption. Some leading corporations pioneering renewable electricity supply chain programmes include Apple, BT, H&M, IKEA and Walmart (RE100, 2018).

To further accelerate and drive corporate sourcing among SMEs, procurement mechanisms will need to further develop. Adaptations include tailoring green utility programmes to the needs of different customer categories, creating more flexible and aggregated PPAs to accommodate and offering better access to financing for direct investments in self-generation.

1.3. Index of corporate renewable electricity production for self-consumption

The previous section dealt broadly with corporate consumption of renewable electricity. This section examines companies that produce their own electricity primarily to power their own operations, a practice known commonly as self-generation.

The proportions of purchased and self-generated renewable electricity vary greatly between companies in energy-intensive sectors and those in less energy-intensive sectors. Looking at all sectors together, 39% of the renewable electricity consumed came through self-generation, for a total volume of 107 TWh (see Figure 1.8). As much as 96 TWh of that came from companies in the Materials sector, which have very particular circumstances (especially in the pulp and paper and aluminium sub-sectors) that result in high shares of self-generated renewable electricity.

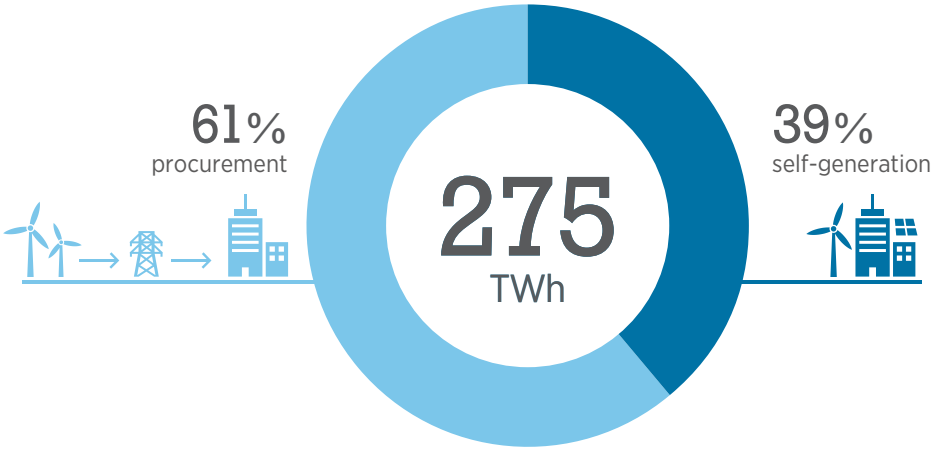
A few large multinational companies in the sector, including **Rio Tinto, Norsk Hydro, South 32** and **Stora Enso Oyj**, account for a very large share of self-generation. In fact, the four companies named produce more than half of all self-generated renewable electricity in the Materials sector and 47% of the total self-generation of all companies analysed.

In sectors other than Materials, self-generation accounts for just 10% of the renewable electricity consumed, on average. This includes not only companies that install small-scale, on site rooftop solar PV systems but also industries outside the Materials sector that produce electricity from by-products. Examples are breweries that have invested in biomass-based combined heat and power plants to run their operations and sugar producers in Southeast Asia, Australia and Africa that use bagasse – a by-product from their sugarcane mills – to power their own systems.

4

companies account for almost half of the total self-generation of all companies analysed

Figure 1.8. Share of renewable electricity sourced from procurement vs. self-generation in all sectors



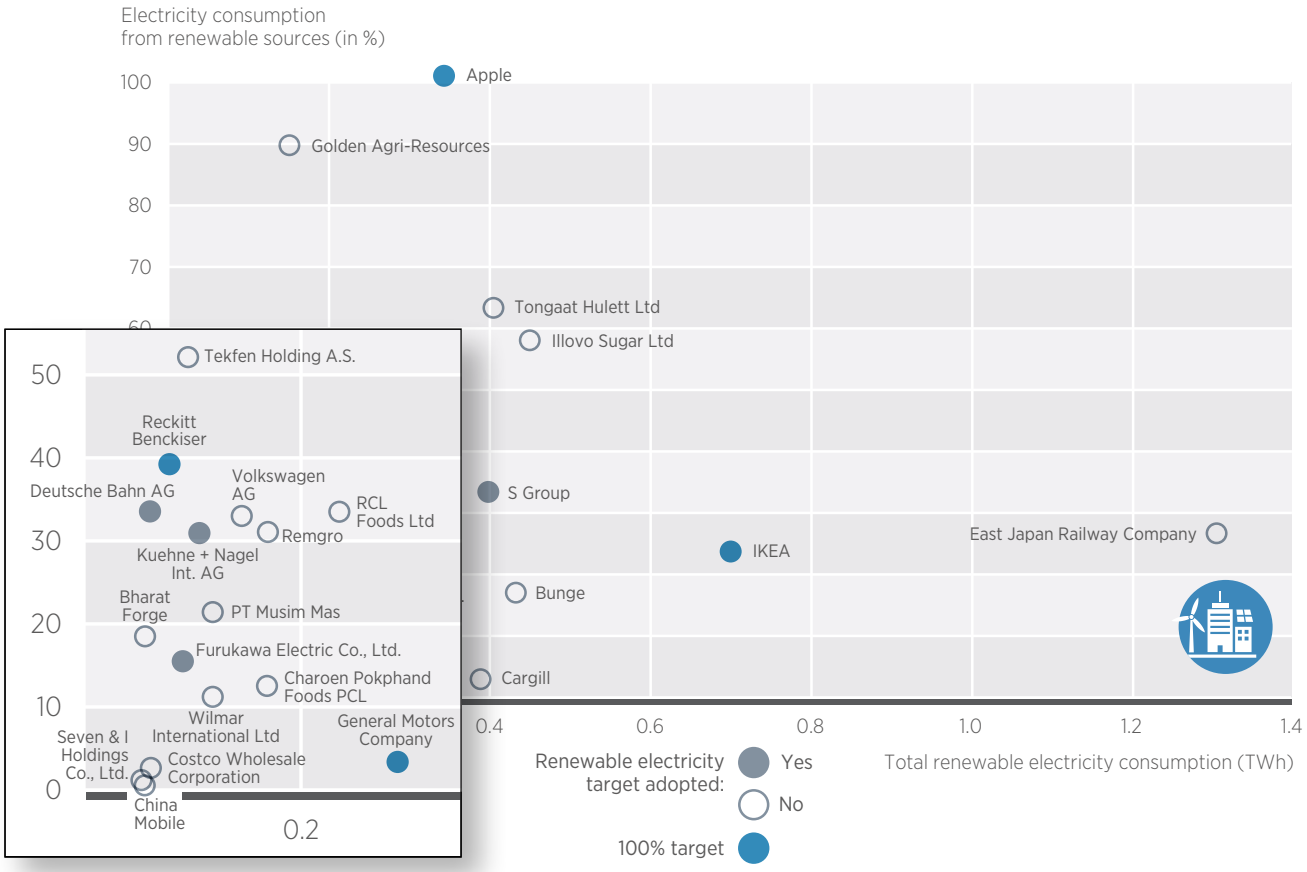
8

out of the 25 largest producers of renewable electricity for self-consumption have targets in place

Figure 1.9 shows the 25 largest producers of renewable electricity for self-consumption outside the Materials sector. Eight have renewable electricity targets in place, and three have the ambition of sourcing 100% of their electricity from renewable sources. Among the top performing companies by volume of renewable electricity production for self-consumption are **East Japan Railway Company, IKEA, Illovo Sugar Ltd., Bunge** and **Tongaat Hulett Ltd**. East Japan Railway Company is investing in captive renewable energy projects and innovative technologies such as ticket gates that generate electricity as commuters walk through (JFS, 2013; Toshiba, 2016).

Retail giant IKEA bought its second wind farm in Canada in early 2017, thereby increasing its direct ownership of wind energy assets for self-generation in North America to almost 400 MW (The Local, 2017). Agribusiness and food companies Bunge in the United States and Tongaat Hulett Ltd. and Illovo Sugar Ltd. in southern Africa generate a large share of their electricity through co-generation facilities running on sugarcane bagasse (Bunge, 2016; Illovo Sugar Africa, 2018; Tongaat Hulett, 2017). In addition to powering their own facilities, Tongaat Hulett Ltd. and Illovo Sugar Ltd. also export a large amount of renewable electricity to the local grid.

Figure 1.9. Corporate renewable electricity production for self-consumption index (excluding companies in the Materials sector)



Note: The information in the figure is based solely on data reported by each company in 2017. Accordingly, the amount of electricity from renewable sources generated or consumed by any given company may have changed since the data were reported.

Disclaimer: The presentation of material in this figure does not imply the expression of any opinion whatsoever concerning the company, including but not limited to any endorsement of or preference for the company relative to other companies that are not mentioned.

In terms of largest share of renewable electricity consumption in the group of self-generators, top performers include **Apple Inc., Golden Agri-Resources, Tongaat Hulett Ltd., Illovo Sugar Ltd.** and **Tekfen Holding A.S**. Except for Apple, these companies generated all of the renewable electricity they consumed. Golden Agri-Resources is a palm company based in Singapore generating a large amount of biofuels. Tekfen Holding, a large Turkish industrial player, generated most of its electricity from geothermal and solar PV. A detailed overview can be found in Table 1.5.

With 1.31 TWh, East Japan Railways is one of the largest self-generators of renewable electricity in the world.

Table 1.5. Top performing companies in production for self-consumption of renewable electricity

Company	Electricity consumption (TWh)	Renewable electricity consumption (TWh)	Renewable electricity production for self-consumption (TWh)	Share of renewable electricity (%)	Share of renewable electricity production for self-consumption (%)
Apple Inc.	1.45	1.45	0.35	**100%**	24%
Bunge	2.68	0.44	0.44	**16%**	16%
East Japan Railway Co.	5.04	1.31	1.31	**26%**	26%
Golden Agri-Resources	0.17	0.15	0.15	**89%**	89%
Illovo Sugar Ltd	0.79	0.45	0.45	**57%**	57%
IKEA	3.01	0.70	0.70	**23%**	23%
TEKFEN HOLDING A.S.	0.19	0.099	0.099	**52%**	52%
Tongaat Hulett Ltd	0.65	0.41	0.41	**63%**	63%

65 TWh
of renewable electricity was generated alone by the 25 largest producers

1.4. Corporate renewable electricity commitments and target setting

Setting renewable electricity targets can provide a clear signal to the public, shareholders, customers and governments that companies are seeking to make their operations more sustainable and to contribute to global climate and environmental objectives. In addition, targets can also become an important internal tool to measure the company's sustainability performance against current business strategies and plans.

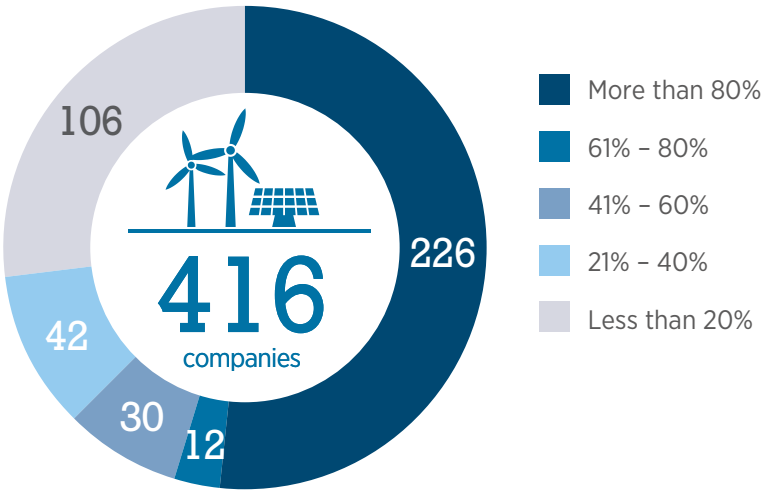
Renewable electricity target setting is not yet common practice. While almost half of the analysed companies source renewable electricity, only 17% (416) of the 2 410 companies reported having adopted a renewable electricity target. Of these targets, about three quarters are set to expire before 2020, presenting a significant opportunity to encourage additional and more ambitious target setting in the years to come.

The level of ambition of the targets reported by companies is a strong indicator of the potential of corporate sourcing to drive renewable energy deployment. Within the group of 416 companies reporting renewable electricity targets, as many as half aim to procure at least 80% of their electricity from renewable sources (see Figure 1.10).

Roof of Unilever detergent factory, Silvassa, India.

Source: Photo by Apoorva Singh

Figure 1.10. Corporate renewable electricity targets by level of ambition



50

companies have achieved their target of 100% renewable electricity consumption/production

In terms of share, target setting is much more common in less-energy-intensive sectors, as shown in Figure 1.11. A potential explanation for why so few companies have yet committed to a renewable electricity target is that instituting emission reduction targets is a much more common practice within the corporate sector. Today's emission reduction targets cover a wide range of sustainability parameters, sometimes including renewable energy. A previous analysis of the largest companies by emissions and market capitalisation showed that 89% of such companies had adopted an emission reduction target. In contrast, only 23% reported having a renewable electricity consumption target in place (CDP, 2017). It goes without saying that emission reduction targets also help drive the sourcing of renewable electricity.

Figure 1.11. Adoption of renewable electricity targets by sector

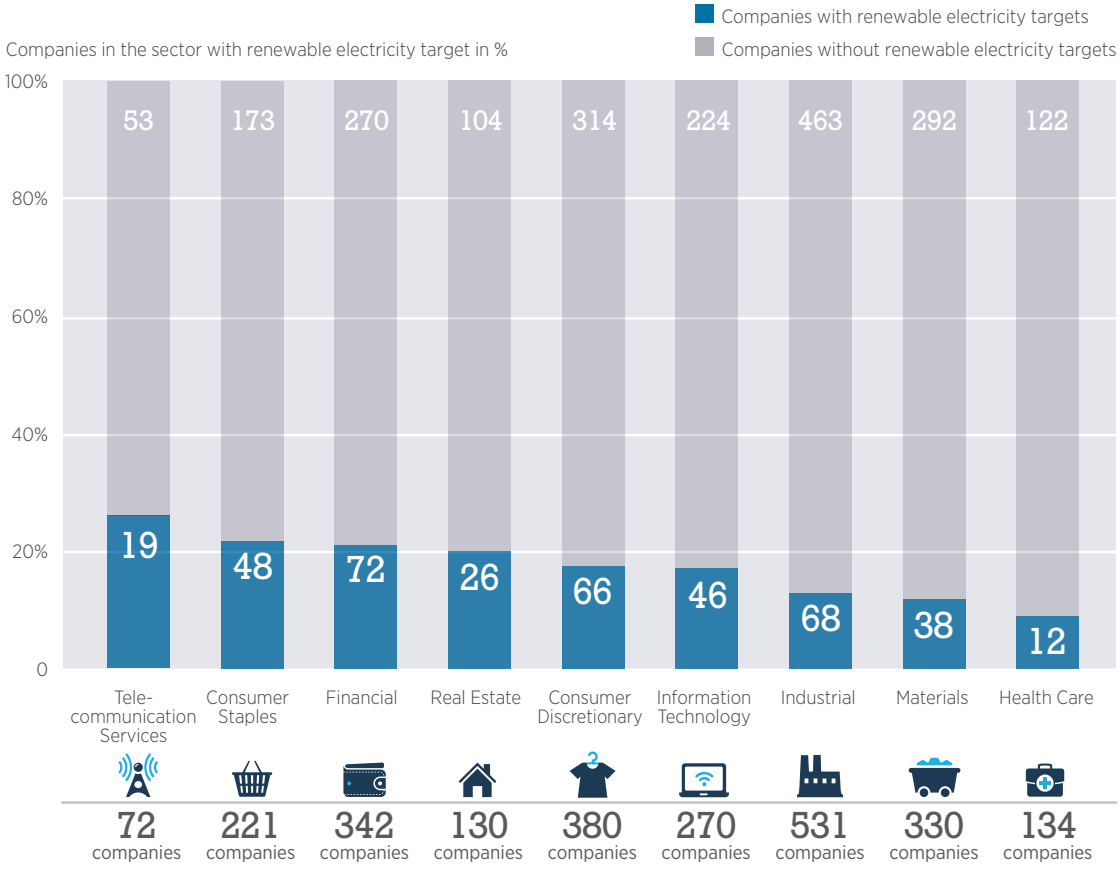
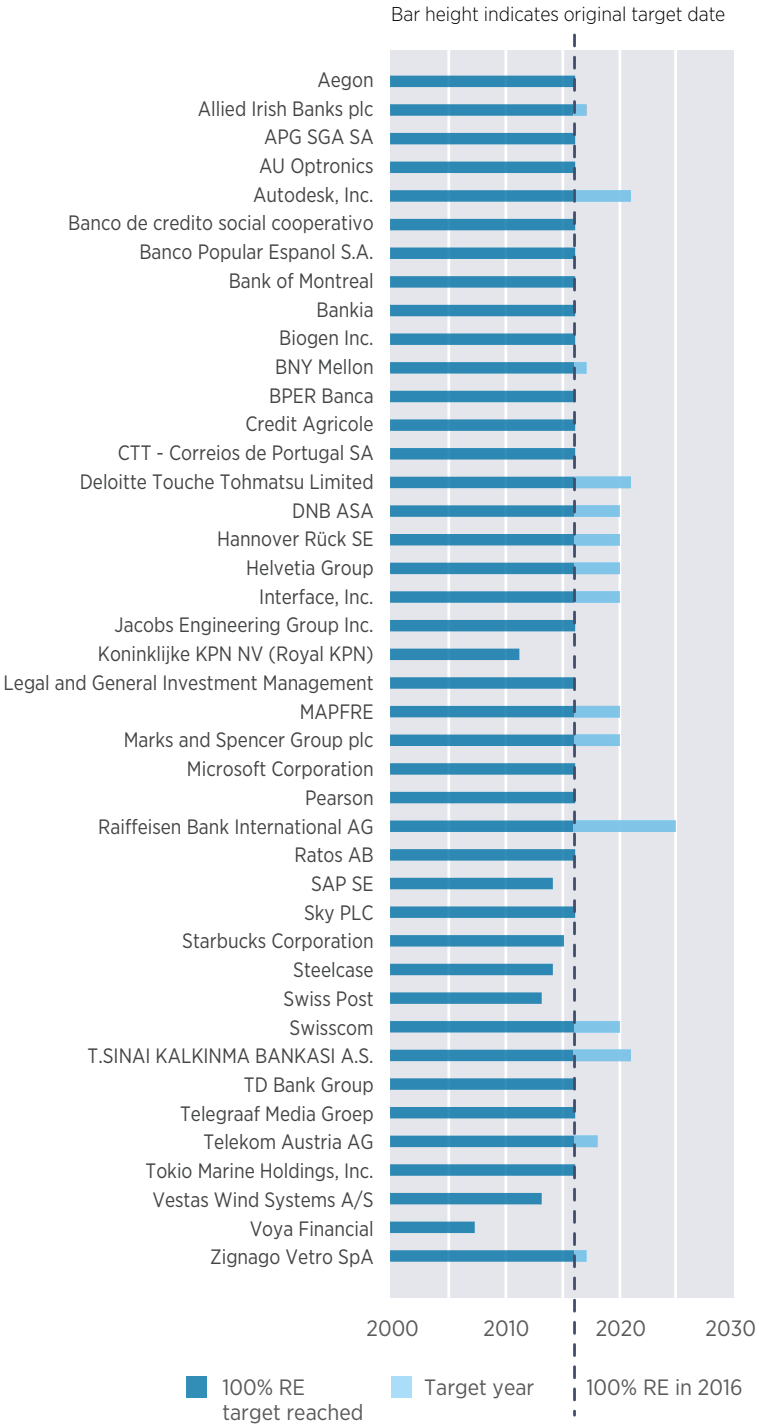
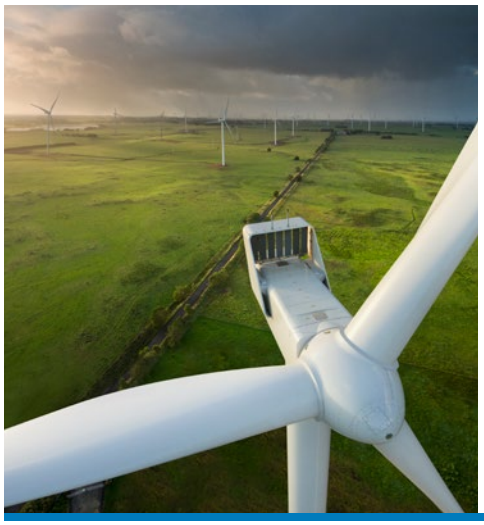


Figure 1.12. Companies that have achieved their 100% renewable electricity target



By the end of 2016, 50 companies had achieved their targets of 100% renewable electricity consumption/production (see Figure 1.12), representing a total of 11 TWh of renewable electricity. Of these, 15 reached their targets well ahead of time. Examples include Raiffeisen Bank International AG (whose initial 100% target was 2025), Autodesk Inc. (2021) and Deloitte Touche Tohmatsu Limited (2021).



Vestas Wind Systems A/S reached their 100% renewable electricity target in 2013.
Source: Vestas

Note: This graph illustrates companies that have reached their 100% renewable electricity targets as well as their original target date. The figure includes only 42 of the 50 reporting companies, owing to public disclosure constraints. The information in the figure is based solely on data reported by companies in 2017. Since then, several additional companies have publicly announced having reached their targets, including Apple, Google and Microsoft.

Disclaimer: The presentation of material in this figure does not imply the expression of any opinion whatsoever concerning the company, including but not limited to any endorsement of or preference for the company relative to other companies that are not mentioned.

Not only are companies adopting targets that would have seemed unimaginable a few years ago, they are also committed to a high level of transparency and scrutiny by making their targets public. A good example of recognition and encouragement of corporate sourcing of renewable electricity is the RE100 initiative. More than 130 companies have joined RE100 and publicly committed to sourcing 100% renewable electricity (see Box 1.2.).

RE100 companies represent an aggregated demand of 160 TWh

Box 1.2. RE100

RE100 is a collaborative initiative led by The Climate Group in partnership with CDP. It brings together influential businesses committed to 100% renewable electricity, works to increase demand for – and delivery of – renewable energy. Companies that join RE100 set a public goal to source 100% of their electricity from renewable sources, to share their progress and to encourage other businesses to join them. RE100 reached its 100 member milestone in July 2017 – three years earlier than expected. By April 2018, over 130 companies had joined RE100.

RE100 drives transparent reporting through a dedicated reporting template for data collection, run and supported by CDP's disclosure platform, and by setting standards for credible claims on sourcing renewables through technical criteria. These criteria have been developed and agreed by an independent advisory group of non-governmental organisations and international experts led by CDP, with participation from Rocky Mountain Institute, World Wildlife Fund, World Resource Institute, RECS International, the US Environmental Protection Agency and the Centre for Resource Solutions. On average, RE100 members are already sourcing 32% of their electricity from renewables, with over 25 RE100 companies having achieved their 100% target by the end of 2017. RE100 companies cover a broad range of sectors and geographies and together represent an aggregate demand for more than 160 TWh of renewable electricity.

10 MW of wind energy at the BMW manufacturing facility in Leipzig, Germany.

Source: BMW Media

IRENA
International Renewable Energy Agency

CHAPTER **TWO**

Global Corporate Sourcing Landscape: Markets and Models

2

246 MW El Romero solar PV plant in the Atacama desert, Chile, developed by Acciona to supply 80 MW to Google's data centres in the country.

Source: Acciona

Global electricity markets are constantly evolving to meet growing demand for renewable energy from all categories of consumers, including companies. While some markets around the world offer multiple ways for companies to procure renewable electricity, sourcing remains challenging, if not impossible, in others.

The models available to companies depend greatly on the policy frameworks under which they operate, and on the nature of each company's operations and its internal capacity to procure and produce electricity.

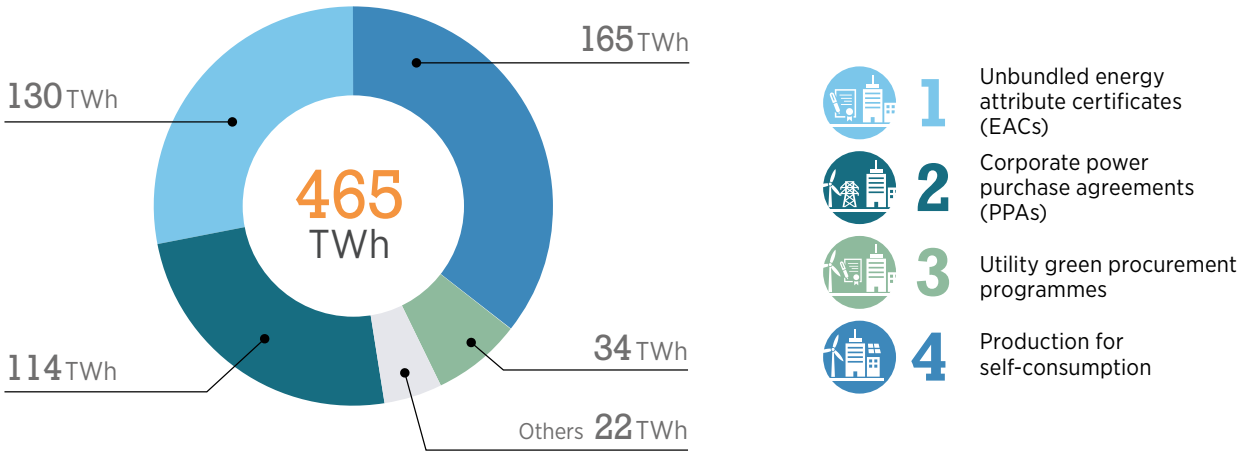
The International Renewable Energy Agency (IRENA) estimates that at the end of 2017 the corporate renewable electricity market reached **465 terrawatt hours (TWh)** in 2017, representing approximately 3.5% of total electricity demand in the Commercial & Industrial sector, and 18.5% of renewable electricity demand in the Commercial & Industrial sector. This estimate is based on available market data and a conservative extrapolation of data reported by some 2 400 companies. It takes into account that the sample of companies reporting data is not necessarily representative of the entire Commercial & Industrial sector, but rather is reflective of early adopters.

Most of the active sourcing of renewables was self-generated (165 TWh), followed by the purchase of unbundled EACs (130 TWh), corporate PPAs (114 TWh) and procurement through utilities or electricity suppliers (34 TWh), with the remainder coming through other forms (see Figure 2.1). The energy-intensive Materials sector accounts for a majority of self-generation; if that sector is excluded, the findings show that almost half of renewable electricity is purchased through unbundled EACs, followed by PPAs and utility purchase programmes. Although the data do not permit an exact breakdown by renewable energy source, analysis suggests that more than half of the 465 TWh of renewable electricity obtained by corporations is likely produced from hydropower, followed by bioenergy, wind and solar. The high shares of hydropower and bioenergy reflect renewable electricity procurement in the Materials sector.

3.5%

of total electricity demand came from renewables actively sourced by companies in the Commercial & Industrial sector

Figure 2.1. Global corporate sourcing of renewable electricity by sourcing model



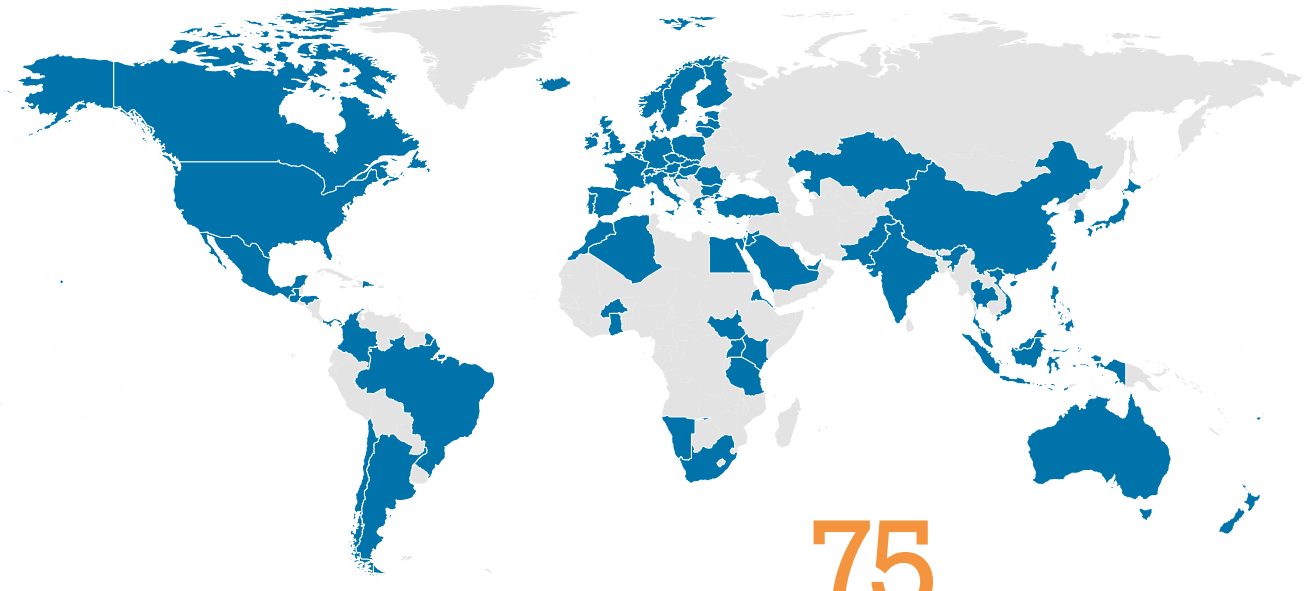
Note: The market size for corporate sourcing of renewable electricity is an estimate as of end of 2017. It is based on available market data and a conservative extrapolation of reported company data. The estimate takes into account that the sample is not necessarily representative of the entire Commercial & Industrial sector, but is characterised by early adopters. These figures are subject to change and may be updated as more data become available. "Others" includes alternative procurement options, such as off-grid generation not covered under other procurement models.

Companies are increasingly procuring renewable electricity worldwide

Currently, corporate sourcing of renewable electricity through unbundled EACs, corporate PPAs and utility purchasing programmes takes place in **75 countries** (see Map 2.1). Direct investment in production for self-consumption is not included in this number because this sourcing model is feasible in almost any country, although it is not always supported by an enabling policy or regulatory framework.

In the following section, the four models (unbundled EACs, corporate PPAs, utility green procurement and production for self-consumption) will be analysed according to their key markets and availability.

Map 2.1. Corporate renewable electricity sourcing globally



Note: This map shows countries where corporate sourcing takes place as of early 2018, either through power purchase agreements, utility green procurement programmes and/or the purchase of unbundled renewable energy attribute certificates. Direct investments in production for self-consumption are not included.

Disclaimer: The boundaries and names shown on this map do not imply any official endorsement or acceptance by IRENA. The term "country" as used in this material also refers, as appropriate, to territories or areas.

2.1. Unbundled energy attribute certificates (EACs)

An EAC is a contractual instrument that represents information about the origin of the energy generated. It allows markets to track renewable energy production and permits consumers to make credible claims of renewable energy use. Each certificate acquired and then retired (indicating that the certificate is taken out of the marketplace) certifies the use of a specific quantity of renewable electricity (typically 1 megawatt hour, MWh).

In most markets with an EAC scheme in place, attribute certificates can be acquired "bundled" (renewable electricity and certificates are sold and delivered together) or be purchased "unbundled" (certificates are purchased separately from any specific purchase of physical electricity).

This section analyses the purchase of unbundled EACs, which are usually purchased from a third-party supplier or broker (see Figure 2.2).

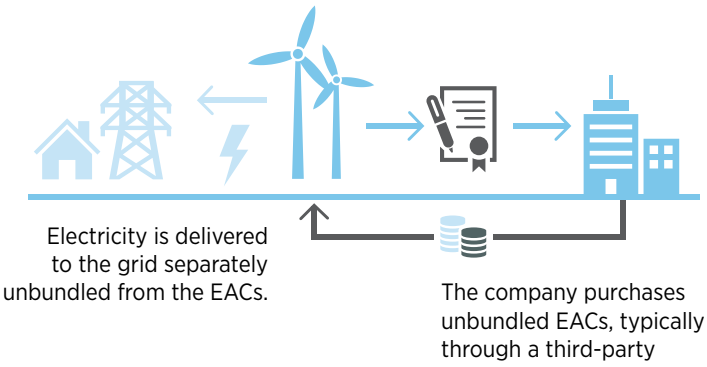
The purchase of unbundled renewable EACs is a popular form of corporate sourcing of renewable electricity that is available in many markets where an energy attribute tracking mechanism is in place. This includes most of the liberalised electricity markets, where customers can choose the source and attribute of their electricity. Best practice is considered to be the sourcing of certificates within the geographical region where a company's electricity purchasing takes place.

130 TWh

of corporate renewable electricity sourcing through EACs

The active market in corporate procurement of renewable electricity through unbundled EACs was roughly 130 TWh in 2017. The most widely used energy attribute systems are guarantees of origin (GOs) in Europe and renewable energy certificates (RECs) in the US.

Figure 2.2. Unbundled energy certificate model



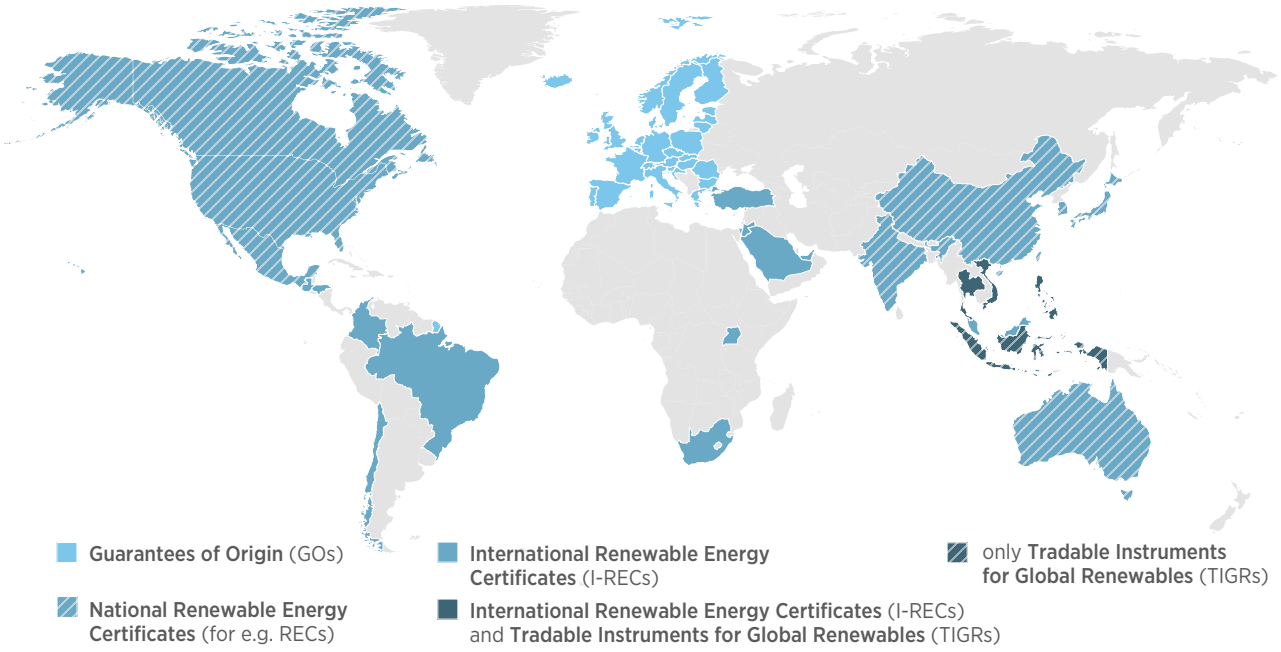
In Europe, the market for GOs, bundled and unbundled, was estimated at 300 TWh in 2016 (AIB, 2017); in the United States, unbundled and bundled transactions for RECs were estimated at 95 TWh in the same year (O'Shaughnessy et al., 2017), with unbundled certificates totalling 52 TWh.

Another popular scheme for unbundled EACs is the International Renewable Energy Certificates (I-RECs) programme. At the end of 2017, I-RECs accounted for approximately 5 TWh (I-REC International, 2018). Box 2.1 provides an overview of some of the most well-known EACs systems.

Companies can procure EACs in as many as 57 countries (see Map 2.2). Next to Europe and North America, Asia-Pacific and Latin America have seen rapid expansion in national energy attribute tracking schemes.

As of end of 2017, several countries are introducing EAC systems or are considering doing so. China's 2017 national renewable energy certificate pilot programme allows generators to choose between a feed-in tariff and an attribute certificate that can be sold as a means to finance operations. Mexico also has a newly created EAC system. Its energy reform, and the related restructuring of the wholesale market, provides new flexibility to corporate purchasers. Paired with this flexibility is a yearly renewable quota mandate for corporate and industrial customers to be met through the retirement of EACs. Other countries, such as Costa Rica, are also considering launching an EAC system to provide the market with renewable electricity claim options.

Map 2.2. Global overview of energy attribute certificates (EACs) systems



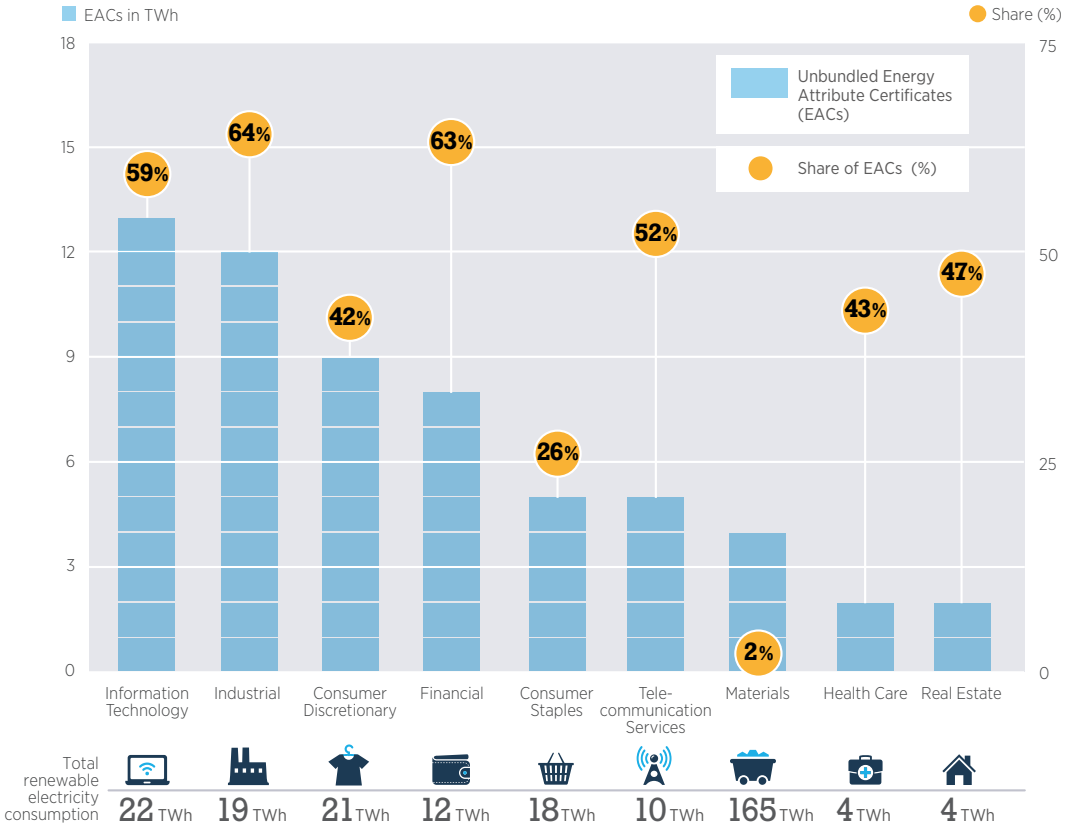
Note: This map shows countries with energy attribute certificates in place. In some countries, there are multiple systems in place. National, regional and international attribute certificates are available in China, India and Singapore. National and international attribute certificates are available in Mexico.

Disclaimer: The boundaries and names shown on this map do not imply any official endorsement or acceptance by IRENA. The term "country" as used in this material also refers, as appropriate, to territories or areas.

Prices for EACs (and their variants) vary depending on local supply and demand, technology, locational attributes and contract length. They differ significantly from country to country and have undergone major fluctuations in the past. Prices for unbundled certificates in the United States used in the voluntary market (i.e., not to meet renewable portfolio standards) were less than USD 0.50 per MWh (O'Shaughnessy, et al., 2017). In India, non-solar certificate trading volumes increased significantly in February 2018, resulting in a subsequent cost surge as prices reached a record high of more than USD 23 per MWh (Prateek, 2018). Green Energy certificates in Japan ranged between USD 27 and USD 46 per MWh for large long-term purchases, and up to USD 140 MWh for one-off purchases in 2017 (BNEF, 2018). As guarantees of origin are traded bilaterally within the European Union, their prices are predominantly confidential and determined by user preference. Typically, the price for a guarantee of origin is well below USD 1.20 per MWh (Jansen, et al., 2016).

Unbundled EACs have been popular among companies in many sectors, representing about 40% of corporate sourcing when the Materials and Consumer Staples sectors are excluded (see Figure 2.3). Though EACs have the advantage of offering flexibility, simplicity and lower operational risks, the low average prices of unbundled EACs cast doubt on the extent to which trading them will help to support existing or create new additional capacity.

Figure 2.3. Use of renewable energy attribute certificates (EACs), by sector



Box 2.1. Energy attribute certificates (EACs) issuing and tracking and systems

Around the globe, there are many systems to issue and track EACs. Whereas some operate in multiple countries, others are country-specific.

International systems

» **Guarantees of origin (GOs):** European Union law mandates its Member States to develop and maintain guarantee-of-origin systems to track renewable energy production and permit consumers to make credible claims of renewable energy use. Each Member State establishes its resource criteria and vintage (year of generation) requirements.

» **International Renewable Energy Certificate (I-REC) standard:** I-REC Standard is a non-profit organisation that maintains a framework for standardisation across EAC tracking systems. It provides a central tracking platform that local tracking registries can use for international trade.

» **Tradable instruments for global renewables (TIGRs):** Developed by APX, a provider of environmental registry services, these instruments provide a tracking platform and standards for eligible generation types. They are predominantly used in Southeast Asia, Singapore and the Philippines.

Country-specific systems

» **Australia's large-scale generation certificates (LGCs):** The Australian government supports a renewable energy certificate registry that tracks and allows for the transfer of large-scale generation certificates and small-scale technology certificates. The large-scale certificates are used to demonstrate compliance with the country's renewable energy target. They have broad resource eligibility, are produced by more than 500 generators and target wholesale markets.

» **Japan's green energy certificates:** Japan has two attribute certificate systems available for corporations. Green Energy Certificates and GHG emissions reduction certificates or so-called J-Credits. The availability of certificates is limited and can be purchased directly from generators or brokers.

» **Mexico's Certificados de Energía Limpia:** CELs were established for compliance with national clean energy requirements for corporate and industrial customers. They have broad resource eligibility, including nuclear and co-generation in addition to renewable generation, though the formula for calculating CEL generation favours renewables and distributed generation.

» **South Africa's zaRECS:** This energy attribute certificate market is based on the same model as the European guarantees of origin system. It has 29 registered generators.

» **The United States' renewable energy certificates (RECs):** In the US, RECs were established for compliance with state-level renewable portfolio standards as well as for voluntary markets and are widely used across all industry sectors and company sizes in the country.

Sources: AIB, 2018; International REC Standard, 2018; APX, 2018; Australian Government Clean Energy Regulator, 2018; Bird, et al., 2017; Comision Reguladora de Energia, 2018; US Environmental Protection Agency, 2018; zaRECs, 2018

GOs and RECs are the most used EAC systems

2.2. Corporate power purchase agreements (PPAs)

Under a corporate PPA, the corporate buyer enters into a contract with an independent power producer, a utility or a financier and commits to purchasing a specific amount of renewable electricity, or the output from a specific asset, at an agreed price and for an agreed period of time (see Figure 2.4). The typical duration of a PPA for a newly built project is ten years or longer. The contract period varies among sectors and jurisdictions.

A virtual PPA is a contract under which the developer sells its electricity in the spot market. The developer and the corporate off-taker then settle the difference between the variable market price and the strike price, and the off-taker receives the electricity certificates that are generated. This is in contrast to traditional "sleeved" PPAs, under which the developer sells electricity to the off-taker directly.

Corporate PPAs caught on in the mid-2000s and have since emerged as an attractive option for companies to source renewable electricity while locking in a cost-competitive price. Virtual PPAs have become the norm in most larger PPA markets because they do not require the developer and the off-taker to be connected to the same electricity grid.

Based on the company analysis for this report and market data, the global cumulative market for corporate PPAs amounted to roughly 114 TWh in 2017. This number includes all renewable electricity procured through PPAs. In 2017, a record level of new corporate PPAs was reached, with over 5 GW of capacity contracted (predominantly wind and solar), up almost a third from the 2016 level (RMI, 2018).

114 TWh

of corporate renewable electricity sourcing through PPAs

Figure 2.4. Corporate power purchase agreement model

The renewable energy generator sells its electricity in the spot market and then settles the price (based on the difference between the variable market price and the strike price) with the company who receives the associated EACs.

The renewable energy generator sells the electricity and associated EACs directly to a company.

Source: Based on WBCSD (2018a).

Although most of the PPAs are contracted in Europe and North America, they are found in **35 countries** around the world, as shown in Map 2.3 (see Annex 3 for a detailed country breakdown). Most are signed directly between a company and an independent power producer. The high level of PPA activity in Mexico is described in Box 2.2.

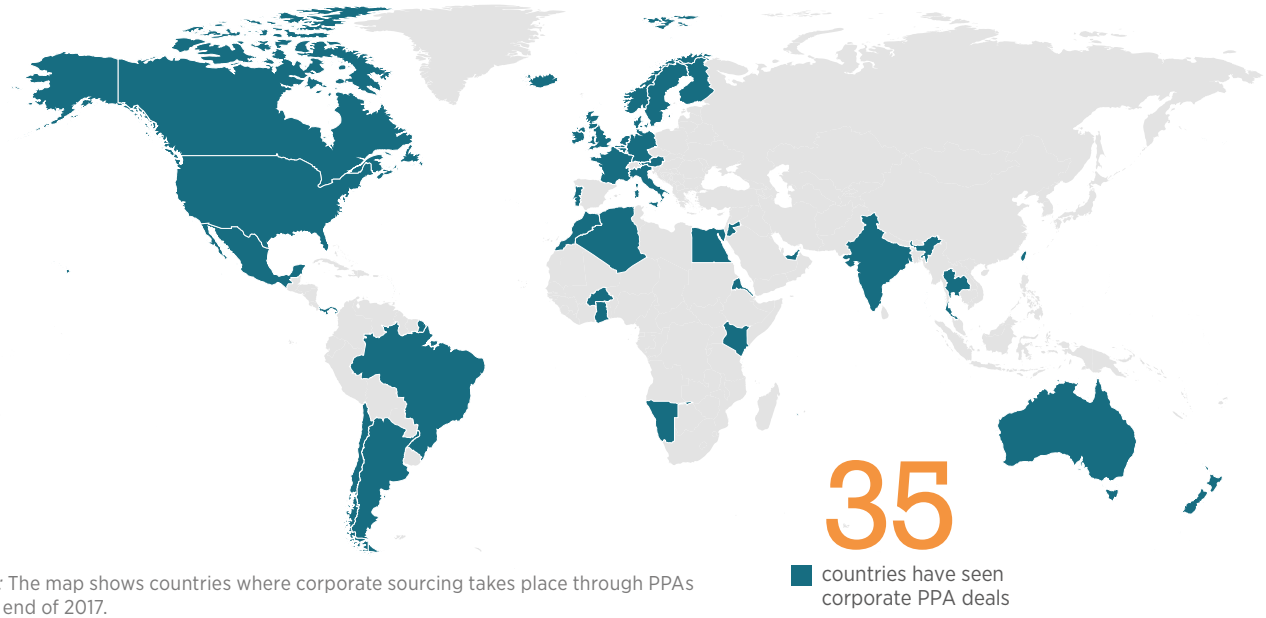
In **North America**, new corporate PPAs representing a combined 2.78 GW of renewable electricity were signed in 2017, with most deals concentrated in the IT sector. An even larger amount may be procured in 2018, as 2.04 GW had been signed in the first quarter alone (RMI, 2018).

In the **European region**, the Nordic countries account for the largest portion of corporate procurement through PPAs, sourcing almost 800 MW of wind in 2017 (RE-Source, 2018). Most of these PPA deals are struck by IT companies that have placed data centres in northern Europe to save on equipment cooling costs.

Latin American markets such as **Argentina**, **Brazil** and **Chile** have witnessed companies entering into PPAs to buffer potential volatility in retail rates. In **Brazil**, retail rates unexpectedly increased by 45% in 2015, leading larger companies to access the wholesale market (larger than 500 kilowatts).

In **Argentina**, corporate customers must meet renewable quotas – which are set to rise from 8% in 2017 to 20% in 2025. Previously, renewable energy had to be purchased through a wholesale market administered by the state. A regulation introduced in 2017 (Resolution no. 281-E/2017, Argentine Ministry of Energy and Mining) now allows companies to choose from a variety of procurement options. Preliminary reports indicate that PPAs will become a popular choice for corporations looking to meet mandates, as evidenced by several international developers like Enel entering the Argentine market to sign corporate PPAs (WBCSD, 2018b).

Map 2.3. Countries in which corporate power purchase agreements (PPAs) are found



Note: The map shows countries where corporate sourcing takes place through PPAs as of end of 2017.

Disclaimer: The boundaries and names shown on this map do not imply any official endorsement or acceptance by IRENA. The term "country" as used in this material also refers, as appropriate, to territories or areas.

Box 2.2. Corporations signing PPAs in Mexico

PPAs for the procurement of renewables were popular with Mexican companies before the country began its market reform in 2014. Companies could contract directly with third-party developers, thus providing an alternative to paying retail rates. Coupled with favourable grid transport and banking policies, PPAs became an attractive energy procurement model. As a result, corporations signed more than 3.4 GW worth of PPAs between 2008 and 2017, a vast majority of which were for wind energy (BNEF, 2018).

Under the new liberalised electricity market structure, corporate PPAs are possible but have yet to reach the levels seen before the reform. An auction process run by the system operator selects the lowest possible bids for capacity, power and clean energy certificates (CELs). The winning bidders can then sign PPAs with corporate buyer of electricity. Currently, larger power consumers are obliged under the renewable portfolio standard to purchase a set amount of renewable energy, helping ensure an even market for CELs (Ley de Transición Energetica, 2015).

A recent implementation of the new scheme involved two corporate PPAs signed by developer IEnova in early 2018 after winning an auction for rights to develop solar power projects. Subsequently, IEnova secured a 15-year PPA with large Mexican retailer El Puerto de Liverpool. Commercial operations are expected in late 2019. IEnova signed a second 20-year PPA for another 110 MW PV project with local steel manufacturer Deacero. That project is expected to be in commercial operation by the end of 2018.

3.4 GW

of PPAs were signed in Mexico between 2008 and 2017

Source: IEnova

In **Chile**, copper miners in particular have identified renewable PPAs as a cost-competitive way to source electricity. In March 2018, state-owned mining company ENAMI signed a solar PPA with Spanish developer Acciona to supply 100% of its electricity consumption from renewables. Acciona already operates a 246 MW solar plant, of which Google receives 80 MW through a PPA signed in January 2017 (Acciona, 2018).

Corporate PPAs are equally rapidly gaining traction in the **Asia-Pacific region**, particularly in Australia and India. In Australia, the combination of a doubling of wholesale electricity prices, an equivalent rise in the price of mandated large-scale generation certificates, grid constraints and reliability concerns have pushed corporations towards PPAs. Recently, RES Australia signed a 226 MW PPA with a consortium to develop the Murra Warra wind farm. The companies include Telstra, Coca-Cola, ANZ Bank and the University of Melbourne (RES, 2018; Telstra, 2017; PwC, 2017).

In **India**, many commercial and industrial customers pay high retail electricity rates to cross-subsidise residential and agricultural customers. However, the Electricity Act of 2003 exempted customers from paying cross-subsidy charges if they participate in a "group captive" project: one in which they own a share of the energy generator (Heeter et al., 2016). PPAs in India are used both by multinational corporations such as Adobe, which signed a 3 MW PPA with CleanMax Solar in late 2017 to supply 100% of its Bangalore campus, and national companies such as the Chennai Metro system, which signed a 25 year PPA with CleanMax in 2017 to provide 6 MW of rooftop solar energy.

In the **Middle East** and **North Africa**, apart from gigawatt scale solar projects receiving PPAs contracts at record low prices from national governments across the region, there has been little adoption in the corporate sector, although huge potential remains. Two instances involve French conglomerate Lafarge Holcim securing a 15 MW PPA for a cement factory in Jordan and Egyptian Agriculture firm Dakahlia signing a PPA with developer KarmaSolar for 53 MW of PV to supply their poultry breeding operations (Egypt Independent, 2017).

The **African Materials** sector has also experienced a strong uptake in corporate renewable PPAs. In **Burkina Faso**, Canadian gold mine operator IAMGOLD signed a 15 year PPA for 15 MW of solar PV (IAMGOLD, 2017). In Namibia, Ohorongo Cement signed a 15 year PPA with German developer SunEQ for a 5 MW PV array (Ohorongo Cement, 2017). In 2017, corporate PPAs were also signed in Eritrea (BNEF, 2018). These agreements underscore that smaller PPAs can be cost-competitive for a variety of corporations, not just large IT companies.

2.3. Renewable energy offerings from utilities or electric suppliers

Utility green procurement allows the corporate buyer to purchase renewable electricity either through green premium products or through a tailored renewable electricity contract, such as green tariff programmes offered by certain utilities.

Green premium products enable corporate buyers to conveniently purchase renewable electricity directly from the utility without a long-term commitment (see Figure 2.5). In contrast, utility green tariffs (also known as utility renewable contracts) are longer term agreements whereby customers purchase renewable electricity bundled to a specific renewable energy asset, usually from a new system, but this may vary between markets and programmes (see Figure 2.6).

Utilities are expanding their product portfolios to meet the growing corporate demand for renewable electricity. In liberalised electricity markets, such as Australia, parts of the United States and many European countries, electricity customers can choose their electricity supplier and are increasingly seeing renewable energy offerings from those suppliers. While so-called green tariff programmes are being introduced by utilities to meet the growing demand from large-scale industrial customers, green premium products typically target residential or small-scale commercial customers.

IRENA estimates that the market for renewable electricity purchased through utility programmes or other offerings was 34 TWh in 2017. This estimate is based on available market data and extrapolations from the corporate data provided by companies for this report. Purchasing through utility programmes is particularly popular among companies in the Healthcare, Real Estate and Telecommunications Services sectors, with about 40% of their electricity purchased through various utility contracts.

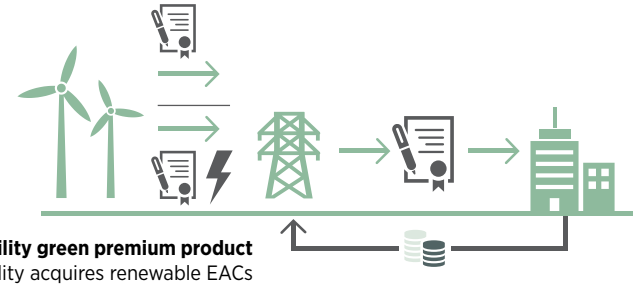
In the Materials sector, on the other hand, this purchasing option represented less than 1% of renewable electricity consumption.

Utilities or other suppliers presently offer renewable energy products in at least 39 countries, most of them in Europe, where many large utilities offer at least some sort of green premium product supported by the European guarantee of origin scheme. For a detailed country breakdown, see Annex 3.

34 TWh

of corporate renewable electricity sourcing through utility green procurement programmes

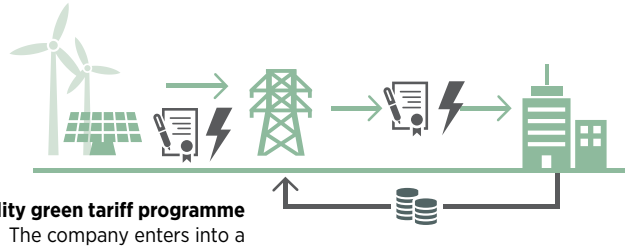
Figure 2.5. Utility green premium product model



Utility green premium product
The utility acquires renewable EACs either through its own generation of renewables or through purchasing EACs from a third-party.

The utility retires the EACs on behalf of the renewable electricity sold to the corporate customer, who pays for the EACs through a premium price on the utility bill.

Figure 2.6. Utility green tariff programmes model



Utility green tariff programme
The company enters into a longer-term contract to purchase renewable electricity and associated EACs, usually from a determined resource or asset.

The utility provides the electricity and EACs to the corporate customer who pays the utility and may retain associated potential cost savings.

Developed in response to growing renewable electricity demand from large-scale corporate customers, **green tariff programmes** offer consumers opportunities to cut their electricity bill. These programmes enable companies to purchase renewable electricity from a specific asset through a longer-term utility contract similar to a PPA. In the United States, utilities in 13 states and the District of Columbia were offering green tariff programmes as of late 2017. Through these programmes, deals totalling more than 950 MW were contracted over the 2013 17 period. The IT sector alone contracted 560 MW in 2017. An additional 465 MW of contracted capacity was under negotiation at the end of 2017 (Bird et al., 2017).

In Europe, green tariffs have been used in various ways. For example, the Dutch national rail company Nederlandse Spoorwegen (NS) issued a tender in 2015 for a long-term green tariff contract, accepting bids for electricity only from new renewable energy installations. The utility that won the bid agreed to supply NS with renewable electricity from new wind farms under a 10-year contract (The Guardian, 2017).

Green premium products, which are often targeted towards smaller-scale commercial and industrial customers as well as residential consumers, enable corporations to conveniently purchase renewable electricity without a long-term commitment but generally also without the prospect of price savings. These products offer companies the ability to purchase a fraction or all of their electricity from renewable sources at a specified price premium per kilowatt hour (kWh). In the United States, premiums for utility programmes in 2016 ranged from USD 0.001 per kWh to USD 0.05 per kWh, with the average price for non-residential customers at USD 0.017 per kWh (O'Shaughnessy et al., 2017).

39
countries have utility green procurement programmes

Green utility programme examples are numerous. In Australia, more than 25 utilities offer renewable energy purchase options to residential and business customers. Customers can switch to alternative providers to procure renewable energy, in some cases cutting their costs in the process. Through these programmes, more than 31 500 organisations purchase accredited renewable electricity (GreenPower, 2018a). In Japan, utilities Tokyo Electric and Kansai Electric offer corporate wind and solar green power packages. Other countries, such as Germany provide premiums on green products that are primarily 100% renewable based (EnergieDienst, 2016); (Bird, et al., 2002).

Green premium products offered by utilities are not necessarily backed by the utilities' own renewable electricity production, but in some cases by unbundled EACs acquired by the utility on the open market. For this reason, the market for green premium products has on several occasions been criticised for a lack of transparency with respect to the origin of the products offered and questions about to the extent to which these products support additional renewable electricity deployment (RECS International, 2018)

The Greenhouse Gas Protocol recommends that corporations, where possible, purchase certified green premium electricity products (e.g., EKOenergy, Green-e, GreenPower). Thirty-six European electricity suppliers offer products certified by EKOenergy across 19 countries (EKOenergy, 2018). In the United States, commercial premium products certified by Green-e are offered by 45 providers across 40 states (Green-e, n.d.). There are 28 GreenPower providers across Australia. Further information on consumer labels can be found in Chapter 3.

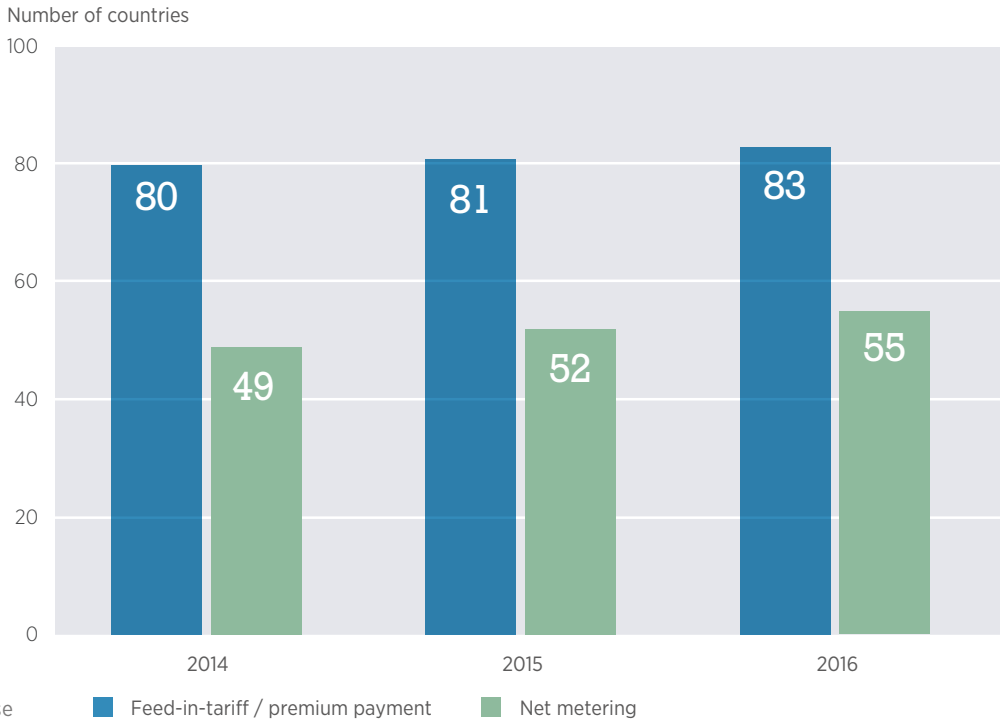
2.4. Direct investment in production for self-consumption

Companies in a large number of markets also have the option of deploying renewable energy systems, on-site or off-site, to generate power for their own use. In most direct investments in self-generation, the company becomes responsible for the entire project life cycle, from commissioning to de-commissioning, assuming the associated risks and financing responsibilities. In some markets, alternative models involve a third-party developer installing an on-site system for self-generation under a lease (or similar) contract, thus limiting the end user's risk. Even though such arrangements involve a third party and often some sort of PPA, they are usually categorised as self-generation.

IRENA estimates that the market for production for self-consumption was 165 TWh in 2017. This estimate is based on available market data and extrapolations from the corporate data provided by companies for this report.

Direct investment for self-generation takes place in almost every country that permits some form of grid connection at a rate of compensation; e.g., through a net-metering or feed-in tariff scheme. As of 2016, 83 countries had feed-in tariffs or premium payment policies in place and 55 countries had a net metering policy, as Figure 2.7 shows (REN21, 2017). Self-generation using off-grid solutions is explored in Box 2.3.

Figure 2.7. Number of countries with feed-in tariffs or net metering schemes



Source: REN21 Policy Database

165 TWh

of renewable electricity produced for self-consumption

Most commonly, self-generation projects are located on-site, but in some cases electricity is generated off-site and transferred (either physically or under a financial contract) to the end user. For off-site projects, transmission or wheeling charges may apply, if access to transmission assets is required to deliver the electricity to the site. Such transactions may not be allowed in all jurisdictions and are more common in liberalised electricity markets.

In comparison to other sourcing models, corporate direct investment has gained traction in developing countries, with a range of innovative policy and financing mechanisms in place. One example is a novel financing structure that involves a revolving-loan fund. Once established, the fund targets mid-sized energy transformation projects by providing low- to no-interest loans. The savings from such projects are typically used as the basis for payback over a five- to ten-year period. Thailand has a renewable revolving-loan fund that companies can turn to for direct investment. It offers buildings and factories access to upwards of USD 1.4 million of investment at a maximum interest rate of 4%. Programmes like this excel at providing medium-sized corporations in middle-income countries access to financing for direct investment in renewables (Frankfurt School, 2012).

Other examples of direct investments for self-generation include companies with agricultural by products capable of producing biomass or biogas for renewable generation. Several sugar producers in Africa, Australia and Southeast Asia, e.g., Tongaat Hulett Ltd (0.4 TWh) and Illovo Sugar Ltd (0.45 TWh), own such systems, allowing them to exert direct control over the conversion of their waste products into energy. (For more information, see Section 1.3.)

Sourcing trends indicate that direct investment will rapidly increase its share in the years to come as the costs of renewable energy systems continue to decline and companies seek to source renewable electricity more directly (RE100 2018).

Box 2.3. Off-grid solutions for corporate self-generation

Generating renewable electricity off the grid has become an attractive option for companies wanting to secure a sustainable energy supply. In most cases, companies choose off-grid solutions when they are located far away from the grid, when operating in countries where other sourcing alternatives are limited or when off-grid generation from renewable sources is the most economically attractive energy option.

Of the more than 2 400 companies analysed for this report, some 200 across different regions sourced a combined 11 TWh of renewable electricity off-grid in 2016.

Off-grid users relying primarily on hydropower include large companies in the Materials sector such as China Steel Corporation (2 TWh), ArcelorMittal (1.5 TWh) and Braskem (1.3 TWh). The Brazilian metal and mining corporation Vale self-generated up to 62% (1 TWh) of its renewable electricity consumption through hydropower projects (Vale, 2013). Wind power accounts for a large share of the 1.8 TWh of off-grid renewable consumption of Germany's Thyssen Krupp.

Choosing off-grid solutions for self-generation has become increasingly popular in other sectors as well, particularly the Industrial, Consumer Discretionary and IT sectors. Examples include car and tyre companies such as Volkswagen (150 MW), Yokohama Rubber (220 MW) and Michelin (160 MW). In the Consumer Discretionary sector, leading companies sourcing off-grid include Paris Le Bourget Airport, which primarily sources renewable energy from solar PV and geothermal (Groupe ADP, 2017) and LG Innotek, which generates approximately 60 MWh of off-grid through solar PV (LEDinside, 2011).

11 TWh

of off-grid renewable electricity sourced by companies

Thyssen Krupp sources 1.8 TWh of renewable electricity off-grid through on-site installations.

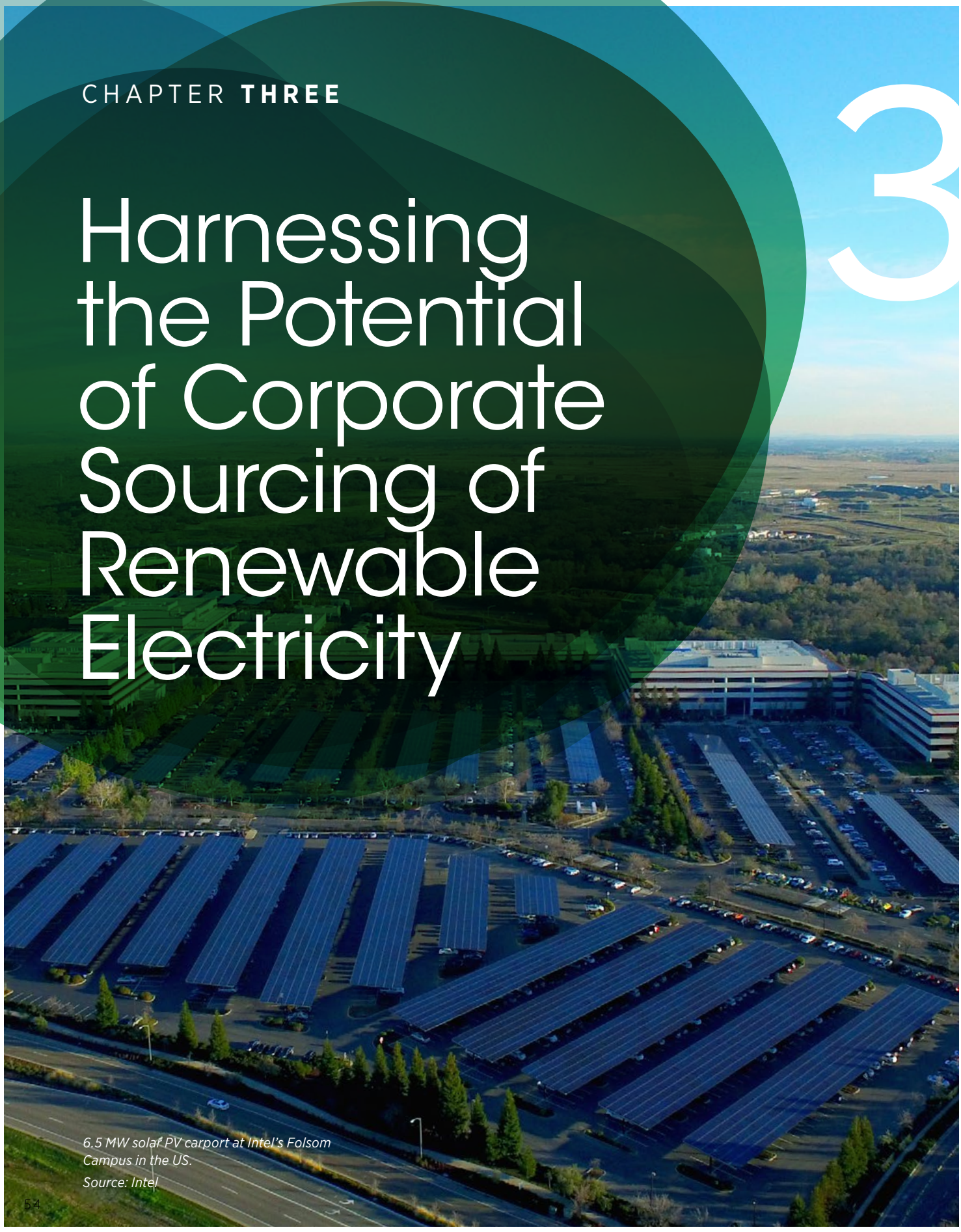
Source: Thyssen Krupp Steel Europe

IRENA
International Renewable Energy Agency

CHAPTER **THREE**

3

Harnessing the Potential of Corporate Sourcing of Renewable Electricity



6.5 MW solar PV carport at Intel's Folsom Campus in the US.
Source: Intel

Renewable energy, together with energy efficiency, is an important driver for accelerating the global energy transformation.

Given that two-thirds of CO_2 emissions come from the energy sector, renewable energy can clearly play a role, but it will have to be scaled up six times its current growth rates to meet the objectives of the Paris Agreement (IRENA, 2018a). It is here that corporate sourcing of renewable energy will be critical.

Companies can significantly contribute to the energy transformation if they increase their renewable energy commitments and shift investments so that additional renewable electricity capacity is built. Corporate sourcing is still in its infancy owing to its perceived complexity and the technical and financial risks associated with changing existing patterns of energy consumption. Furthermore, many countries still lack the appropriate policy and regulatory frameworks to permit broad corporate sourcing of renewables. Hence the untapped potential for corporate participation in the renewable energy space is enormous.

Companies can significantly contribute to the energy transformation if they increase commitments and shift to more direct investments

298 MW Thunder Ranch wind project by Enel Green Power of which Anheuser-Busch purchases a portion of the generated electricity through a corporate PPA.

Source: Enel Green Power

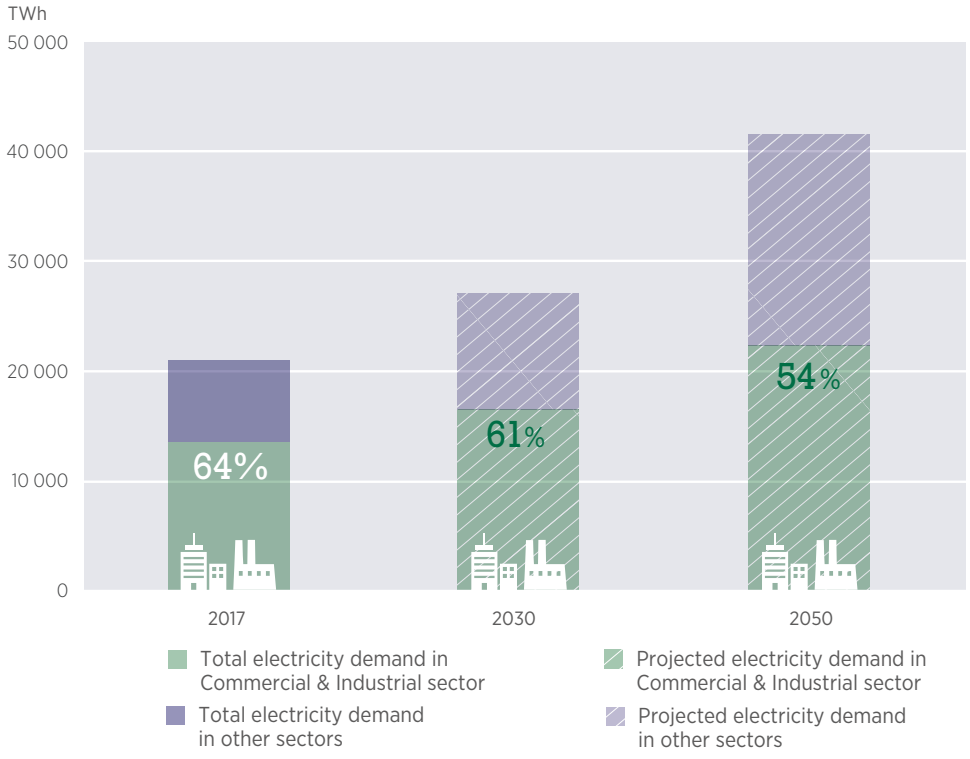
3.1. Corporate market potential and contribution to the energy transformation

The Commercial & Industrial sector consumed almost two-thirds of global electricity in 2016 (see Figure 3.1). According to analysis by the International Renewable Energy Agency (IRENA), that share will decrease to 61% by 2030 and to 54% by 2050 with improved energy efficiency and the on-going electrification of sectors such as transport. Nevertheless, absolute demand in the Commercial & Industrial sector will grow from 13 500 TWh in 2016 to 22 000 TWh by 2050.

Electricity is used in the Commercial & Industrial sector for a wide range of purposes depending on a country's economic activity and level of technological development. Major uses include the electricity needed to process, produce or assemble goods in electricity-intensive industries such as manufacturing, mining, agriculture and construction; the operation of industrial motors and machinery; and servicing heating and cooling, lighting, ventilation and air conditioning systems for their operations.

IRENA analysis projects a global energy transformation that delivers on the climate objectives set out in the Paris Agreement, a transformation that is technically feasible and economically beneficial. In it, the share of renewables in total electricity use would increase from 20% in 2016 to **at least 85% by 2050** (IRENA, 2018a). For the Commercial & Industrial sector, attaining this share would translate into 10 400 TWh and 19 000 TWh of renewable electricity demand by 2030 and 2050, respectively (adapted from IRENA, 2018a; IRENA and IEA, 2017).

Figure 3.1. Volume and share of the Commercial & Industrial sector in global electricity demand



In addition to existing and planned public incentive schemes such as auctions, feed-in tariffs and other policy mechanisms, corporations can significantly contribute to this needed acceleration of renewable energy deployment through active and more direct procurement of renewable electricity.

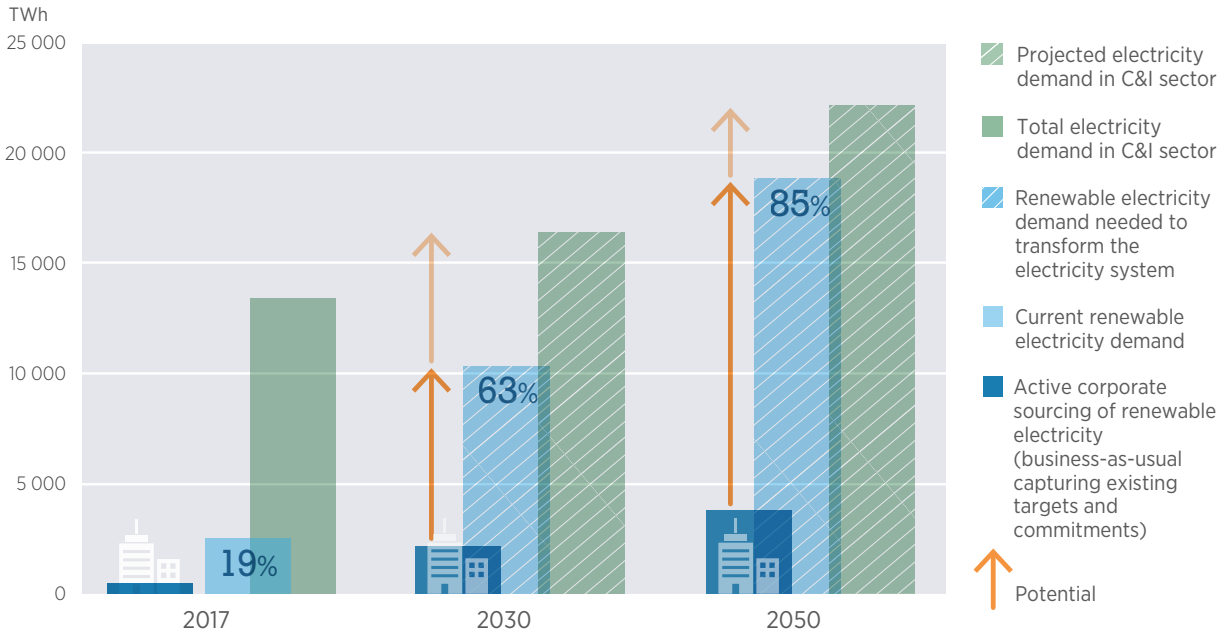
Taking into account current and planned corporate sourcing of renewable electricity on the global level, active sourcing is estimated to reach 2 150 TWh by 2030 and 3 800 TWh by 2050. This includes existing company targets, commitments and ambitions – in other words, it presents a business-as-usual perspective. Corresponding to 20% of the total renewable electricity demand in the Commercial & Industrial sector in 2050, it is far from the 85% (19 000 TWh) that would be required to meet the objectives of the Paris Agreement. Figure 3.2 outlines active corporate renewable electricity procurement to 2050 and shows the potential of companies to drive the global energy transformation.

If corporations continue to raise their ambitions with support from the right enabling frameworks, the potential for corporate sourcing is vast; its contribution to the energy transformation could reach levels of up to 100% of the total renewable electricity demand (22 000 TWh) in the Commercial & Industrial sector. As observed in Chapter 1, more than 111 companies were already obtaining at least 85% of their electricity from renewable sources at the end of 2017, demonstrating that high ambitions are feasible. But to drive the energy transformation, **all companies will have to strive for a higher share of direct renewable electricity in their energy consumption.**

19 000 TWh

of renewable electricity needed to transform the Commercial & Industrial sector

Figure 3.2. Corporate sourcing of renewable electricity in the Commercial & Industrial sector



Note: The figure compares current and future active corporate sourcing of renewable electricity based on existing targets and commitments with the amount of renewable electricity needed to transform the global electricity system and have a chance to reach the climate goals set out in the Paris Agreement.

3.2 Reaching the potential: The corporate perspective

No single approach dominates corporate sourcing of renewable electricity. Companies pursue different energy strategies, reflecting their motivations, needs and constraints in operations in diverse geographic and regulatory settings. To date, reaching environmental targets and demonstrating corporate responsibility have been the most important drivers behind corporate sourcing of renewables. As renewables become even more cost-competitive in the energy marketplace, energy management and economic and financial drivers, such as cost savings, long-term price stability and security of supply, will likely increase in importance in the coming years (see Box 3.2).

Nevertheless, it must be remembered that energy is not the core business of most companies, but rather a running operational cost to be dealt with by the procurement and finance departments. Acquiring alternative energy supplies, including renewable electricity, can be an unfamiliar process for a company accustomed to relying on conventional wholesale or retail electricity. Companies may perceive renewable energy as less cost-competitive and more risky than conventional sources.

Once internal support has been secured and renewable energy has become part of a company's procurement strategy, identifying the right sourcing model adds another level of complexity. The rapidly maturing corporate sourcing market provides several options that come with various levels of ownership, financial participation and additionality (defined in Box 3.1). Many companies rely on external consultancies to aid in the process, which translates into an additional cost. Other sourcing challenges may include regulatory barriers in many markets as well as artificially low wholesale and retail prices of conventionally produced electricity, which make it less likely that renewable electricity will make economic sense for a company.

Companies have innovated in procuring renewable electricity but have not yet reached full speed or potential.

Although the purchase of unbundled EACs still represents the predominant model of sourcing renewable electricity outside the Materials sector, recent years have seen a marked increase in corporate investment in new, innovative and more direct procurement models that result in more renewable energy capacity being added to the grid. An important accelerator of this trend has been the declining costs of renewables in comparison to conventional energy sources.

Companies wanting to engage in procurement of renewable electricity or existing buyers seeking to accelerate or diversify their purchases may want to consider the recommendations outlined in the following pages.

Recommendations

Adopt a target and renewable energy sourcing strategy deliberating on ambition and types of claims.

Committing to a renewable electricity target is an important first step and tool to measure the corporation's performance against a baseline year. Setting a renewable energy target also provides a clear signal internally as well as to shareholders and potential investors of the company's ambitions to capture the benefits associated with renewable electricity sourcing, including the potential to hedge against volatility. A strategy should weigh options for the company to meet its energy needs through renewables as well as the type of public claims that the corporation wishes to make about its use of or support for renewable energy. Most companies sourcing higher shares of renewable electricity, whether in one or several locations, use a mix of procurement options with various capacity to contribute to the energy transformation. In most companies, top executives drive renewable energy procurement and are setting the strategic direction when it comes to targets, policies, and projects (CEF-WWF, 2016).

Consider renewable energy sourcing options that carry a higher level of additionality.

Renewable sourcing choices that lead to additional investment and bring additional renewable capacity to the grid are crucial to accelerate the energy transformation; they also help companies make more credible claims about their sourcing of renewable energy. For more information on how companies can exert greater impact in transforming the energy systems, see Box 3.1. In recent years, various guidelines and reporting standards have been developed to provide specific guidance on how corporations can use their purchasing power to raise investment in renewable energy capacity and underpin renewable usage claims – among them, guidelines by the Greenhouse Gas Protocol and RE100/CDP.

Source: Ørsted

Report transparently on renewable electricity consumption claims.

Companies can contribute to further raising the profile of corporate sourcing of renewable electricity by improving self-reporting processes following best practice available. Guidelines for credible claims and reporting already exist, including the Greenhouse Gas Protocol and RE100's Technical Criteria and Making Credible Claims. As corporate sourcing evolves and local specifications increase, these guidelines will need to be strengthened and further adapted. Companies can use the above-mentioned guidelines already when reporting claims through their corporate social responsibility report or to investors through various disclosing programmes. To further strengthen the ability of companies to report, governments should facilitate and encourage these systems as discussed in the next section.

Drive corporate procurement innovation and global change management across private and public sectors.

Companies are increasingly turning to renewable electricity to sustain their energy supply, as innovative procurement options emerge. This, in return, creates important spill-over effects among peers and competitors. It also encourages supply chains, through a top-down approach, to engage in renewable electricity purchasing. By working with governments and utilities, and explaining corporate procurement requirements, companies have influenced and must continue to inform supporting policies and enabling frameworks needed to scale up renewable electricity sourcing.

Box 3.1. Additionality

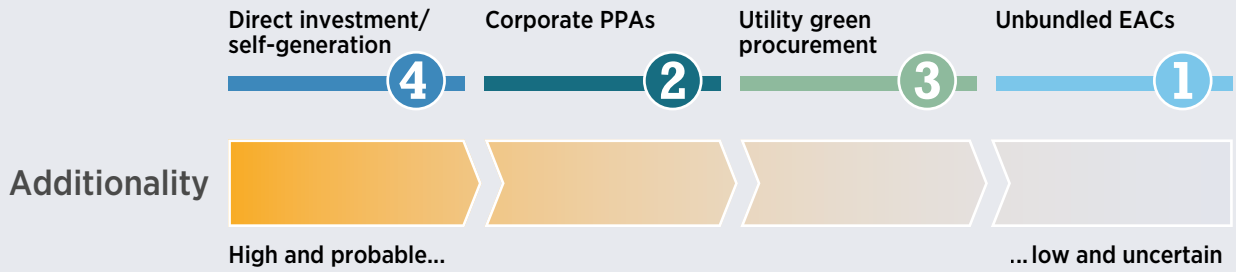
Additionality refers to the net incremental capacity added to the energy system as a direct result of corporate sourcing, beyond what would have occurred in its absence. While direct investments in self-generation in most cases contribute to additional renewable energy capacity being deployed (may not qualify as additional in some markets where the system has benefitted from public support), the additionality of other corporate sourcing options and models may be difficult to measure and is not a given.

As corporate sourcing markets mature, the aspect of additionality is receiving increased attention from corporations.

The illustration below gives an indication of the level of additionality associated with different sourcing models. However, this is just an indication and various sourcing models can present very different levels of additionality depending on their design and market.

Defining general rules about a certain sourcing model's ability to generate additional capacity to the energy system is challenging and complex, often depending greatly on the local context. For the purpose of this report and the analysis of companies reporting data, no evaluation has been made of the sourcing models the companies have used to reach a certain share or volume of renewable electricity (see methodology in Annex 1).

Figure 3.3. Corporate sourcing options, by likely degree of additionality



In general, four different paths may be considered by companies planning to source renewables in the coming years:

Path 1: The corporation sources electricity derived from new renewable energy installations not benefitting from existing policy schemes and that may therefore not have been built or financed without the corporate engagement. Here, corporations act as an enabler of additional renewable energy generation by becoming the project sponsor as they drive implementation and financing. This sourcing approach can be pursued through certain corporate PPA models or through direct investment in self-generation.

Path 2: The corporation sources electricity from an existing installation to ensure continued operation after the system runs out of public support (public incentive schemes for renewable energy have an average duration of 10 to 20 years, while the lifetime of a system is several years longer). This sourcing approach can likewise be pursued through a corporate PPA or some sort of green tariff programme.

Path 3: The corporation sources electricity from an existing project already built with public support, claiming the related bundled certificates. This sourcing approach can be pursued through a utility's renewable energy premium product or certain types of PPAs. The additionality of such sourcing may not be as high as for paths 1 and 2.

Path 4: The corporation sources electricity through the purchase of unbundled EACs. Although this option has the advantage of offering flexibility, simplicity and lower operational risks, the low average prices of unbundled EACs cast doubt on the extent to which trading them will help to support existing or create new additional capacity.

Current market trends indicate that paths 3 and 4 are still the most common sourcing practices but that corporate willingness to pursue paths 1 and 2 is increasing. In order to reach the potential outlined at the beginning of this chapter, greater use of the more ambitious paths will be essential.

Shift

in corporate sourcing strategy towards more direct procurement models

Box 3.2. Corporate sourcing drivers

From the corporate surveys analysed for this report, the main drivers for corporate procurement can be grouped into four categories. Similarly, these drivers were also identified by RE100 in their latest Progress Report (RE100, 2018).

» **Environmental and sustainability drivers** were ranked as a top priority. These include responding to climate change concerns and managing environmental objectives. For companies that do not have a renewable electricity target, targets for reducing greenhouse gas emissions emerged as the key driver for procuring renewables.

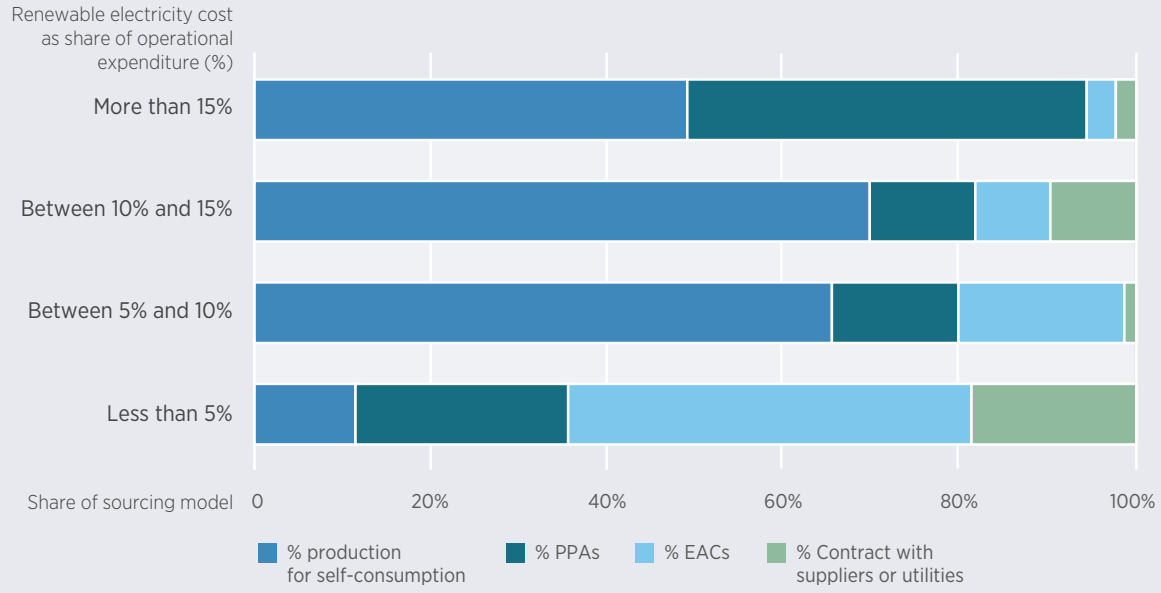
» **Corporate social responsibility and reputational drivers** were the second-highest priority. These relate to mitigating reputational risks, including answering to customers and shareholders who seek more sustainable operations from companies or, in the case of shareholders, more favourable public opinion.

» Classified third were **economic and financial drivers** such as reducing energy costs, positioning the company for better long-term price stability and hedging against potential price volatility. Economic and financial drivers will likely increase in importance as renewables become even more cost-competitive. This is particularly important for companies that have placed less emphasis in the past on environmental and sustainability priorities and that will be incentivised to turn to renewables for purely financial and economic reasons.

» For **energy management drivers**, ranked last, the main motivation is twofold. First, companies want to ensure the security of future energy supply. Second, they seek to diversify their energy supply as a hedge against volatility in global energy markets.

Survey results show that companies in which energy accounts for a small share of total operational costs (less than 5%), the use of unbundled EACs is the most common method of sourcing renewable electricity. In contrast, for companies in which energy represents a more significant share of operational expenditure (more than 15%), self-generation and PPAs are the preferred approaches. This is especially true in the Materials sector. A possible explanation is the fact that the procurement of EACs represents an actual cost to companies rather than a direct financial benefit. Conversely, generating renewable electricity for the company's own consumption or entering into a physical PPA allows companies to manage their energy supply and to a larger extent associated costs.

Figure 3.4. Renewable electricity sourcing by share of total corporate spending



3.3. Enabling frameworks: The policy perspective

In addition to a company's internal capacity and motivation to source renewables as outlined in the previous section, the possibility of implementing ambitious targets and strategies depends greatly on the markets in which the company operates, as well as the policy frameworks governing those markets. As with any form of renewable energy deployment, corporate sourcing of renewables can realise its full potential only when it has government backing through the establishment of long-term, stable and predictable policy frameworks. More importantly, the right policy framework can support sourcing models that trigger additional renewable energy generation. However, much of the strength and potential of corporate sourcing lies in the fact that relatively few and low-cost policy adjustments can provoke a quick market pick-up both in vertically integrated and liberalised energy markets.

For governments, the reasons for encouraging and facilitating corporate sourcing include the opportunity to attract additional investment in renewables, which in turn can support compliance with national and international climate objectives. In addition to meeting climate and energy targets, it can further support a government's broader socio-economic objectives, including job creation and economic growth. The latter has been the main driver for countries and governments using renewable energy and low electricity taxes to attract investments by large energy-intensive data-centres (Quartz, 2017).

While some governments have been quick to acknowledge the corporate sector's growing demand for renewable energy and the associated opportunities, findings from the 2017 IRENA corporate sourcing country survey indicate that a large majority of governments do not include or specifically address corporate sourcing of renewables in their energy strategies (IRENA, 2017). In many countries, policy-makers still lack systemic knowledge about how to integrate corporate players into renewable energy markets and at what level of participation.

The following paragraphs outline the types of policy and regulatory support that can unlock the potential of corporate sourcing to propel the energy transformation. Key examples of such policies and enabling frameworks are summarised in Table 3.1 and presented below in the form of recommendations. In addition to policies enabling voluntary sourcing of renewables, some countries have introduced renewable electricity compliance quotas for large electricity users however these will not be explored in this report.

Support a credible and transparent system for certification and tracking of renewable energy attributes.

Independently of the corporate sourcing model used, a credible claim of use of renewable electricity depends on the availability and effective tracking of EACs. An EAC scheme guarantees that a specific amount of energy having certain (renewable) attributes originates from a certain source. It further verifies exclusive ownership of those attributes by the customer making the claim – in this case the corporation. Many countries with established EACs markets have two trading schemes: one for compliance markets, where utilities and energy suppliers trade certificates to comply with quota obligations; and one for its voluntary market (IRENA, IEA, REN21, 2018). The latter is crucial for companies wanting to source renewable electricity. In markets without certificate tracking systems, it has been proven to be more difficult for corporations to substantiate their claims of renewable energy usage, which in turn discourages further corporate sourcing (Powers, 2016) (Bird et al., 2017).

IRENA country survey indicates that a large majority of governments do not include corporate sourcing of renewables in their energy strategies

Box 3.3. Green electricity consumer labels

In a growing number of countries, environmental non-profit organisations have launched voluntary consumer labels for renewable energy as a way to strengthen transparency. These labels certify that a green energy product (e.g., unbundled EACs or utility green premium products) fulfils certain defined environmental and sustainability quality criteria as well as ensures that the energy is properly tracked and not double counted. While few labels certify additionality (see Box 3.2), some voluntary certificate programmes or labels dedicate a portion of revenue from the programme as "incremental funding" for new renewable energy projects.

Well-known examples of local energy consumer labels are Bra Miljöval in Sweden, Grüner Strom in Germany, NatureMade in Switzerland and Svanemærket/EU-Blomsten in Denmark. Other labels, such as EKOenergy from Europe and the American Green-e, are increasingly active on the international market (in particular in Asia and in Latin America).

The Greenhouse Gas Protocol recommends that, where possible, corporations purchase certified green electricity products. Many local and regional certification programmes already make this possible. However, in many parts of the world companies still lack access to these schemes. An added complexity is that companies with global operations must sustain their certification efforts across different programmes, making them more time-consuming and challenging. An international and recognised voluntary label, backed by governments, would facilitate corporate access, ensure environmental and sustainability requirements, and improve transparency around additionality.

Responsibility for issuing, tracking and verifying EACs should fall to an independent issuing body – generally a government agency or private actor, depending on the market. Tracking can be done using electronic systems or contracts. If contracts are used, the attribute transaction is detailed in a legally enforceable contract between the generator and end user. In this case, claims are based on the ownership of the attributes specified in the contract. Electronic EAC tracking systems can be preferable, to encourage robust markets, and may provide greater transparency and accountability if implemented properly. Certificates are tracked when transferred from generators to end-use customers and until they are retired or cancelled by an end-user making a claim (RE100, 2016). Often, tracking systems provide verification of the renewable generation data from the project owner to ensure accuracy. In general, the effectiveness of tradable EACs depends on some sort of parallel compliance market (e.g., for large developers/utilities) with adequate enforcement (IRENA, IEA, REN21, 2018).

As demonstrated in Chapter 2, the global diversity of EAC schemes provides options in various regions for companies looking to procure renewable energy. An area of concern, however, is a general lack of standardisation, eligibility and utilisation between EAC systems, particularly where multiple systems exist in a single jurisdiction. With multiple tracking systems, it becomes more challenging to ensure that double counting does not occur.

Consider an energy market structure that allows for direct trade between companies of all sizes and renewable energy developers – such as through PPAs.

At the end of 2017, most corporate PPAs were being signed in less-regulated markets, allowing for bilateral contracts directly between a large corporate buyer of electricity and a renewable energy developer. The global corporate PPA market will likely grow as more and more governments shift away from early support schemes including feed-in tariffs and administratively set premiums. Henceforth, developers will be looking for alternative off-takers – and having a PPA with a large creditworthy company presents an attractive alternative.

While allowing for third-party sales is a prerequisite for bilateral contracts between companies and developers, additional enabling frameworks may help stimulate corporate PPAs, including electricity retail rates, which closely track wholesale rates. This is particularly important for so-called virtual PPA transactions, where contracts and payments are determined on the basis of the market reference price and then settled between the corporate buyer and the developer.

Even though corporate PPAs thrive in less-regulated markets, there are still a number of examples of vertically integrated markets lacking the possibility of third-party sales but where corporate PPAs have been signed between large industrial or corporate players and the utility. In such cases, the utility must be willing to engage directly in this type of long-term transaction or be mandated to do so.

Most corporate PPA deals are large-scale and therefore built off site from a company's premises. This means that corporate PPAs benefit from open access or at least clearly defined transmission policies with priority access for renewables. In addition to priority access for renewables, some markets offer lower transmission fees for renewable generators (Heeter et al., 2016). Also, creating larger and more integrated electricity grids can provide a greater market from which companies can source, thus potentially lowering costs (Bird et al. 2017). This will also enable smaller companies to enter the PPA space and, coupled with providing easier access to available projects and less complex contractual arrangements, create additional market players.

A PPA in itself will not be enough for a company to make a credible renewable electricity claim, as companies must retain any attribute certificates associated with the electricity production to be sure that the same electricity is not claimed by someone else. The creation or strengthening of a robust EAC system can support this.

Work with utilities or electric suppliers to provide green corporate procurement options.

The restructuring of electricity markets, in which corporations are provided with access to alternative suppliers, allows for greater flexibility in procurement and more options for companies. Therefore, retail access and the tailoring of retail products to specific consumer demand is a key enabler for increased corporate procurement by all sizes of companies.

In some markets, utilities may be required to offer renewable energy options. Otherwise, the presence of green electricity programmes depends on the willingness of the utility to implement a programme – and the quality of such offerings can vary. To address quality concerns, policy-makers and regulators should support the use of established standards and consumer labels.

More complex utility offerings, such as long-term green tariffs, are often negotiated directly between large energy consumers and the utility. Because this may not be possible to the same extent for SMEs, utilities should make sure to tailor their offerings to smaller players as well. Regulators can play a role in ensuring that these offerings are fair and equitable. Key issues may relate to the ability of the corporate off-takers to retain some of the potential cost savings or the value of the hedge against future electricity price increases (WRI, 2014).

Already light policy adjustments can enable a rapid market pick-up of corporate sourcing of renewables

Empower companies to engage in direct investment for self-generation.

Encouraging direct investment for self-generation will play an important role in accelerating the energy transformation. Key policies that enable this development include clear and efficient interconnection and permitting practices, and, in the case of off site projects, the ability to transport electricity to the site where it is to be used.

Smaller scale self-generation, i.e., on site or close to the point of use, can be supported through net metering or net billing, which offers owners of renewable energy systems the possibility of "storing" electricity by feeding it into the grid at a rate of compensation. Conditions surrounding the rate of compensation of the exported electricity can have a significant impact on project economics (Zinaman et al., 2017). Well-designed net metering and net billing schemes may allow for significant cost savings for the company engaged in self-generation. In addition to the design of the policy scheme, the overall tariff structure and the presence of demand charges influence the economics of projects used for self-generation.

For off site projects, transporting electricity to the site of the end user can be a challenge. If electricity has to be transferred across utility service areas through its transmission and distribution system, grid transport charges may apply. These costs vary substantially across jurisdictions and may significantly affect the economics of off site projects. The ability to transport electricity may also be limited; it is more commonly available in liberalised markets.

In addition, interconnection costs and the time needed to connect the system to the grid can have a significant impact on project economics, and uncertainty about interconnection costs can be a hindrance to development. In some jurisdictions, policies have been devised to increase processing times, transparency and cost certainty for commercial-scale projects (Bird et al., 2018). Specifically, jurisdictions may have timeline requirements for utilities and pre-application reports designed to provide a better understanding of grid conditions, and hence of interconnection costs, at the site (Bird et al., 2018).

Source: Intel

Table 3.1. Overview of policy measures that support various corporate sourcing models

Corporate sourcing model	Policy measures	Examples of countries using these policies on a national or sub-national level
1 **Unbundled energy attribute certificates (EACs)**	• Support a system of EACs. • Provide transparent and credible system for renewable EACs and consider the development or use of an electronic system for tracking and trading. • Ensure that ownership of EACs under various sourcing models or other programmes is clear. • Support quality certification of EACs, e.g., consumer labels.	Guarantees of origin in Europe; renewable energy certificates in Australia, China, India, Mexico and United States
2 **Corporate power purchase agreements (PPAs)**	• Allow third-party sales directly between corporate buyers and independent power producers. • Offer clear and transparent grid-access rules and electricity transport arrangements that permit both on site and off site power purchase agreements. • Support a system of EACs.	Argentina, Brazil, Chile, Mexico, Netherlands, Norway, Sweden, United Kingdom and United States
3 **Renewable energy offerings from utilities or electric suppliers**	• Create market-based energy pricing/tariffs. • Encourage tailored long-term renewable energy contracts for large-scale corporations (e.g., green tariff programmes). • Facilitate mechanisms to increase retail competition which can result in a greater number of options for end-use customers (often at competitive prices). • Support a system of EACs.	Netherlands and United States
4 **Direct investment in production for self-consumption**	• Establish efficient interconnection and permitting practices. • Provide a clear and stable mechanism for on-site and off-site systems to feed excess electricity to the grid (e.g., a net metering scheme) – preferably with priority dispatch for renewable energy. Evaluate potential system size limitations. • Enable mechanism that allows for the transport of electricity from off site generation to the place of consumption. • Support a system of EACs.	China, India, Japan and United Kingdom

Fostering Corporate Sourcing of Renewables: Conclusions

Source: DHL Germany

Delivering the energy transformation will require fundamental shifts in policies, investments, planning, processes, attitudes and behaviours. Not only governments will need to take the lead in achieving this shift. Corporates can become an important driver in accelerating the energy transformation if they embrace a shared responsibility in decarbonising the economy. By shifting investments towards more direct sourcing models, companies could not just secure the cost of their power source and hedge against price escalation and price volatility, they could help advance necessary additional renewable energy deployment and enable associated socio-economic benefits such as gross domestic product growth, job creation and welfare gains.

Corporate sourcing of renewables has the potential to drive the energy transformation and increase the chances of achieving global climate targets.

Significantly accelerating corporate renewable electricity consumption by 2050 is an achievable goal, as demonstrated by the ambition and commitments of the more than 2 400 companies analysed in this report. Nearly a fifth of the companies that report renewable electricity consumption already source at least half of their electricity from renewable sources. Of these, 111 are already procuring between 85% and 100% of their electricity from renewable sources. However, to reach global climate targets, more companies will need to get on board. A large majority of the companies (70%) analysed still show levels of renewable electricity consumption below 25%. To achieve the energy transformation of 85% renewables in the power system, companies will have to take action now.

Companies can contribute to the needed scale-up in investment and provide capital needed to finance the energy transformation.

The energy transformation will require significant investments over a relatively short time. Renewable energy deployment must grow six-fold to meet the objectives of the Paris Agreement (IRENA, 2018a). Companies can help mobilise part of the additional investment stream of USD 22.3 trillion needed to fill the existing financing gap in renewables. In the power sector alone, companies could unlock significant investment by 2050, provided they accelerate renewable electricity commitments and shift towards more direct procurement models.

Corporate innovation in renewable energy sourcing needs to be encouraged and incentivised through enabling frameworks.

Corporate sourcing of renewable electricity takes place in over 70 countries. To stimulate further corporate innovation in sourcing, new relationships and closer partnerships must be developed between the private and public sectors. Governments will need to facilitate the opening of new sectors and markets, and promote innovation in renewable energy technology. Companies, too, will have to innovate in the process of adapting to an increasingly decarbonised global energy mix.

In recent years more and more companies have invested in innovative procurement as they have pursued their goals of environmental and corporate social responsibility in a manner compatible with their economic, financial and energy management goals. Today companies are turning increasingly to direct investments in on site and off site generation from renewable sources to supply their operations. As these trends pick up speed, the market will see more companies seeking to contribute to the building of new renewable energy projects instead of supporting projects that have already been commissioned. Utilities and governments will play a crucial role by establishing supportive enabling frameworks.

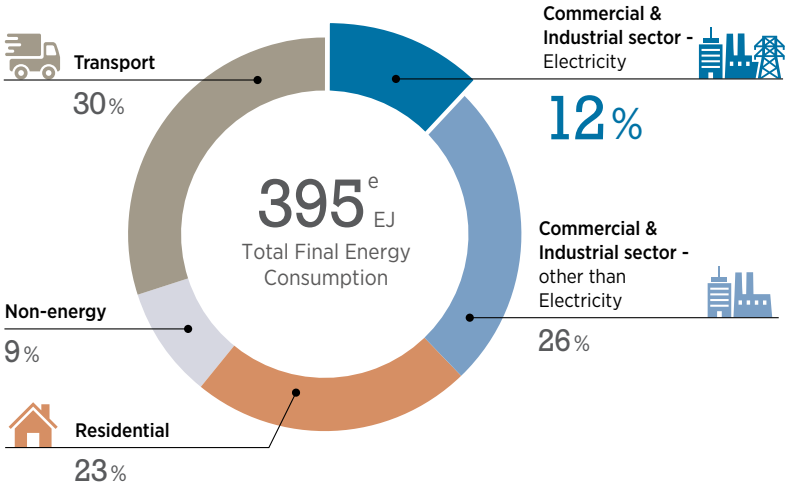
Corporate sourcing of renewables must grow beyond the power sector.

Corporate commitments to the use of renewable energy must not stop at electricity generation but focus on all end-uses such as transport, heating and cooling. Companies' carbon footprints extend well beyond their electricity consumption and their renewable energy efforts should reflect this.

The renewable energy potential that companies can unlock in other end-uses is vast (see Figure 4.1). This report covers only a fraction (12%) of that potential. More research will be required to fully understand and develop corporate sourcing of renewables in other areas. Companies are also uniquely positioned to create successful synergies between renewable energy and energy efficiency, leading by example into the decarbonisation age.

Through transparent reporting, companies can improve identifying barriers by sourcing model and by jurisdiction, thus enabling supportive policy-making and more effective regulatory frameworks for corporate sourcing of renewable energy in all end-uses.

Figure 4.1. Global total final energy consumption in 2016



Only through combined efforts and working hand in hand, the private and public sector will be able to develop the full corporate sourcing of renewables potential needed to accelerate the energy transformation.

Note: e = estimate

References

Acciona (2018), "ACCIONA will cover 100% of the electricity consumption of the National Mining Company of Chile with renewable energy", https://www.acciona.com/news/acciona-will-cover-100-electricity-consumption-national-mining-company-chile-renewable-energy/ (accessed 6 May 2018).

AIB (2017). AIB Annual Report 2016. *Association of Issuing Bodies*, AIB, https://www.aib-net.org/documents/103816/5954653/AIB+Annual+Report+2016/5883b6eb-449f-4d08-ef48-22699aa27532?version=1.0&download=true (accessed 23 April 2018).

AIB (2018), https://www.aib-net.org/aib_home (accessed 1 May 2018).

APX (2018), TIGRs Overview, https://apx.com/tigrs-overview/ (accessed 1 May 2018).

Australian Government Clean Energy Regulator (2018), Large scale generation certificates, http://www.cleanenergyregulator.gov.au/RET/Scheme-participants-and-industry/Power-stations/Large-scale-generation-certificates (accessed 5 May 2018).

Bird et al. (2002), Green Power Marketing Abroad: Recent Experience and Trends, National Renewable Energy Laboratory, https://www.nrel.gov/docs/fy02osti/32155.pdf (accessed 8 May 2018).

Bird, et al. (2018), *Review of Interconnection Practices and Costs in the Western States*, s.l.: National Renewable Energy Laboratory (NREL).

Bird, L. et al. (2017), *Policies for Enabling Corporate Sourcing of Renewable Energy Internationally: A 21st Century Power Partnership Report*, National Renewable Energy Laboratory, Golden, CO.

BNEF (2018), Corporations Purchased Record Amounts of Clean Power in 2017, Bloomberg New Energy Finance, https://about.bnef.com/blog/corporations-purchased-record-amounts-of-clean-power-in-2017/ (accessed 25 April 2018).

Bunge (2016), *2016 Global Sustainability Report*, https://www.bunge.com/sustainability2016/index.html (accessed 29 April 2018).

CDP (2017), "Picking up the pace", CDP, London, www.cdp.net/en/articles/companies/picking-up-the-pace-analysis (accessed 6 May 2018).

CEF-WWF (2016), *Corporate Renewable Energy Procurement: A Snapshot of Key Trends, Strategies and Practices in 2016*, Corporate Eco Forum and World Wildlife Fund, http://www.corporateecoforum.com/wp-content/uploads/2016/10/CEF-WWF-2016-Corporate-RE-Procurement_FINAL.pdf (accessed 6 May 2018).

Clean Energy Ministerial (2018), "Corporate sourcing of renewables", www.cleanenergyministerial.org/campaign-clean-energy-ministerial/corporate-sourcing-renewables (accessed 6 May 2018).

Comision Reguladora de Energia (2018), Certificados de Energia Limpia, https://www.gob.mx/cre/acciones-y-programas/certificados-de-energias-limpias-51673.

Energiedienst (2016), Burghof Lorrach relies on NaturEnergie Gold, https://www.energiedienst.de/presse/nachricht/news/807-burghof-loerrach-setzt-auf-naturenergie-gold/ (accessed 5 May 2018).

Egypt Independent (2017), "KarmSolar, Dakahlia Group sign US$23 million solar power agreement", www.egyptindependent.com/karmsolar-dakahlia-group-sign-us23-million-solar-power-agreement/ (accessed 6 May 2018).

EKOenergy (2018), Licensed Sellers, http://www.ekoenergy.org/buying-ekoenergy/licensees/, (accessed 30 April 2018).

Frankfurt School (2012), Case Study: The Thai Energy Efficiency Revolving Fund, http://fs-unep-centre.org/sites/default/files/publications/fs-unepthaieerffinal2012_0.pdf (accessed 1 May 2018).

Green-e (2018), *Commercial Renewable Electricity Products* (database), www.green-e.org/certified-resources (accessed 6 May 2018).

GreenPower (2018a), Business case studies, www.greenpower.gov.au/Business/Case-Studies/ (accessed 6 May 2018).

GreenPower (2018b), GreenPower costs, www.greenpower.gov.au/Business/Costs/ (accessed 6 May 2018).

Groupe ADP (2017), Aeroports de Paris Management Report 2016 Financial Year, https://www.parisaeroport.fr/docs/default-source/groupe-fichiers/finance/actionnaires-individuels/assemblee-generale/2017/4-1-management-report-for-the-a%C3%A9roports-de-paris-group-2016-financial-year.pdf?sfvrsn=44e01cbd_0 (accessed 10 May 2018).

Heeter, J. et al. (2016), *Wheeling and Banking Strategies for Optimal Renewable Energy Deployment: International Experiences*, National Renewable Energy Laboratory, www.nrel.gov/docs/fy16osti/65660.pdf (accessed 22 April 2018).

IAMGOLD (2017), "IAMGOLD partners with EREN Renewable Energy and AEMP to develop solar power capacity for Essakane Mine", http://s1.q4cdn.com/766430901/files/doc_news/2017/03/NR-12-17-Essakane-signs-partnership-for-solar-power_FINAL.pdf (accessed 6 May 2018).

I-REC International (2018), Authorized issuance countries, http://www.internationalrec.org/assets/doc_4007.pdf (accessed 1 May 2018).

Illovo Sugar Africa (2018), https://www.illovosugarafrica.com/About-Us/Group-Overview, (accessed 2 May 2018).

International REC Standard (2018), http://www.internationalrec.org/.

IRENA and CPI (2018), *Global Landscape of Renewable Energy Finance*, http://www.irena.org/-/media/Files/IRENA/Agency/Publication/2018/Jan/IRENA_Global_landscape_RE_finance_2018.pdf (accessed 30 April 2018).

IRENA and IEA (2017), Executive Summary/Chapter [1/4]] of Perspectives for the energy transition – investment needs for a low-carbon energy system ©OECD/IEA and IRENA 2017, http://www.irena.org/publications/2017/Mar/Perspectives-for-the-energy-transition-Investment-needs-for-a-low-carbon-energy-system (accessed 30 April 2018).

IRENA, IEA, REN21 (2018), *Renewable Energy Policies in a Time of Transition*, http://irena.org/-/media/Files/IRENA/Agency/Publication/2018/Apr/IRENA_IEA_REN21_Policies_2018.pdf (accessed 28 April 2018).

IRENA (2017), *IRENA Corporate Sourcing of Renewables Country Survey*, IRENA, Abu Dhabi.

IRENA (2018a), *Global Energy Transformation: A roadmap to 2050*, http://www.irena.org/-/media/Files/IRENA/Agency/Publication/2018/Apr/IRENA_Report_GET_2018.pdf (accessed 29 April 2018).

IRENA (2018b), *Renewable Power Generation Costs in 2017*, http://www.irena.org/-/media/Files/IRENA/Agency/Publication/2018/Jan/IRENA_2017_Power_Costs_2018.pdf (accessed 29 April 2018).

Jansen et al. (2016), The Disclosure of Guarantees of Origin: Interactions with the 2030 Climate and Energy Framework, CEPS Special Report, https://www.ceps.eu/system/files/Guarantees%20of%20Origin%20CEPS%20Special%20Report.pdf (accessed 10 May 2018).

Japan for Sustainability (2013), "Japanese railway company to build a mega solar power plant in rail yard", www.japanfs.org/en/news/archives/news_id032818.html (accessed 6 May 2018).

LEDinside (2011), LG to invest $7 billion in green business, LEDinside, https://www.ledinside.com/news/2011/9/lg_20110927 (accessed 8 May 2018).

Ohorongo Cement (2017), "Ohorongo goes solar on world environment day", www.ohorongo-cement.com/cms_documents/ohorongo-goes-solar-on-world-enviroment-day-74c1181a5c.pdf (accessed 6 May 2018).

O'Shaughnessy, E. et al. (2017), *Status and Trends in the U.S. Voluntary Green Power Market (2016 Data)*, National Renewable Energy Laboratory, Golden, CO.

Powers, J. (2016), *Global Green Power: How International Markets Are Changing Clean Energy*, s.l.: s.n. Unpublished.

Prateek, S. (2018), After January slump, non-solar REC trading spikes in Feb 2018. *Mercom India*, https://mercomindia.com/non-solar-rec-trading-spikes-february-2018/ (accessed 2 May 2018).

PwC (2017), *Optimising Energy Procurement via Corporate PPAs*, PwC, www.pwc.com.au/publications/pdf/optimising-energy-corporate-ppas-nov17.pdf (accessed 6 May 2018).

Quartz (2017), *A new tax law is making Sweden very attractive to the world's biggest tech companies*, https://qz.com/957750/sweden-cuts-data-centers-electricity-tax-rate-by-97-and-tech-companies-fb-amzn-are-loving-it/ (accessed 29 April 2018).

RECS International, 2018. Renewables Good Practice (ReGP) Guidance Document, http://www.recs.org/news/recs-international-releases-the-renewables-good-practice (accessed 30 April 2018).

REN21 (2017), Renewables 2017 Global Status Report, http://www.ren21.net/wp-content/uploads/2017/06/17-8399_GSR_2017_Full_Report_0621_Opt.pdf (accessed 25 April 2018).

RES (2018), "Murra Warra Wind Farm Stage One reaches financial close, construction to commence", Renewable Energy Systems, www.murrawarra-windfarm.com/media/2578895/MWWF-financial-close-release-FINAL-FOR-RELEASE-V114318.pdf (accessed 25 April 2018).

RE-Source (2018), RE-Source European platform for corporate renewable energy sourcing, http://resource-platform.eu/about/ (accessed 3 May 2018).

Reve (2018), Vestas to extend wind farm in Argentina with 50 MW. Wind Energy and Electric Vehicle Review, https://www.evwind.es/2018/01/01/vestas-to-extend-wind-farm-in-argentina-with-50-mw/62266 (accessed 2 May 2018).

RE100 (2016), *Making credible renewable electricity claims*, http://www.recs.org/documents/re100-technical-briefing--making-credible-renewable-electricity-usage-claims (accessed 30 April 2018).

RE100 (2018), *Approaching a Tipping Point: How Corporate Users Are Redefining Global Electricity Markets*, The Climate Group and CDP, http://media.virbcdn.com/files/97/8b2d4ee2c961f080-RE100ProgressandInsightsReport2018.pdf (accessed 6 May 2018).

Richard, C. (2017), "Google buys 536MW from US wind farms", *Wind Power Monthly*, www.windpowermonthly.com/article/1451791/google-buys-536mw-us-wind-farms (accessed 6 May 2018).

RMI (Rocky Mountain Institute) (2018), *Corporate Renewable Deals 2013-2018 YTD*, http://businessrenewables.org/corporate-transactions/, (accessed 17 April 2018).

Sotos, M. (2015), *GHG Protocol Scope 2 Guidance: An Amendment to the GHG Protocol Corporate Standard*, World Resources Institute, Washington, DC.

Telstra (2017), "Telstra led consortium supports major renewable energy project in regional Victoria", www.murrawarra-windfarm.com/media/2550892/Telstra-Energy-PPA-RES-Macq-19Dec-4pm-2-.pdf (accessed 6 May 2018).

The Guardian (2017), Dutch electric trains become 100% powered by wind energy, https://www.theguardian.com/world/2017/jan/10/dutch-trains-100-percent-wind-powered-ns (accessed 1 May 2018).

The International Aluminium Institute (2018), *World Aluminium* (database), www.world-aluminium.org/statistics/primary-aluminium-smelting-power-consumption/ - histogram (accessed 6 May 2018).

The Local (2017), "Why Ikea is buying a wind farm… in Canada", www.thelocal.se/20170127/why-swedens-ikea-is-buying-a-wind-farm-in-canada (accessed 6 May 2018).

Tongaat Hulett (2017), Integrated Annual Report, http://www.tongaat.co.za/imc/annual_reports/ar_2017/downloads/annual-report-2017.pdf (accessed 30 April 2018).

Toshiba (2016), "Toshiba wins order to supply autonomous hydrogen energy supply system to JR East", www.toshiba.co.jp/about/press/2016_03/pr2403.html (accessed 6 May 2018).

United States Environmental Protection Agency (2018), Renewable Energy Certificates, https://www.epa.gov/greenpower/renewable-energy-certificates-recs.

Vale (2013), Vale invests in the sustainable generation of its own energy, http://www.vale.com/EN/aboutvale/news/Pages/vale-investe-na-geracao-de-energia-propria-de-forma-sustentavel.aspx (accessed 30 April 2018).

Ward, A. (2017), Norsk Hydro in 'biggest' deal to secure wind farm energy. *Financial Times*, https://www.ft.com/content/6483f562-c3bd-11e7-a1d2-6786f39ef675 (accessed 29 April 2018).

WBCSD (2015), *Overcome Barriers to Renewable Energy Procurement*, World Business Council for Sustainable Development, available at www.wbcsd.org/Projects/Education/Resources/Overcome-Barriers-to-Renewable-Energy-Procurement (accessed 6 May 2018).

WBCSD (2018a), *Innovation in Power Purchase Agreement Structures*, World Business Council for Sustainable Development, available at www.wbcsd.org/Clusters/Climate-Energy/REscale/Resources/Innovation-in-Power-Purchase-Agreement-Structures (accessed 22 April 2018).

WBCSD (2018b), *Power Purchase Agreements en Argentina [Power Purchase Agreements in Argentina]*, World Business Council for Sustainable Development, available at www.wbcsd.org/Clusters/Climate-Energy/REscale/Resources/Power-Purchase-Agreements-en-Argentina (accessed 6 May 2018).

WRI (World Resources Institute) (2014), *Above and Beyond: Green Tariff Design for Traditional Utilities: Working Paper*, s.l.: s.n.

zaRECs (2018). South African Voluntary REC Market, available at http://www.zarecs.co.za/ (accessed 6 May 2018).

Zinaman, O. et al. (2017), *Grid Connected Distributed Generation: Compensation Mechanism Basics*, Colden, Colorado: National Renewable Energy Laboratory (NREL).

Annex 1. Report Methodology

To compile this report, data voluntarily reported by 2 410 companies were analysed. These companies collectively disclosed nearly 2 500 terawatt-hours (TWh) of annual electricity consumption. The distribution of these companies across sectors is presented in Table A1.1. The sample reflects corporate renewable electricity sourcing practices across a broad geographic and sectoral range, with the goal of identifying practices within the corporate sector. All companies analysed have a renewable electricity consumption or production target and/or must be sourcing renewable electricity. The sample is composed of companies from the following groups:

- **CDP respondents:** Companies in the CDP database whose core business is not the generation or provision of energy to the market and that reported via the CDP climate change questionnaire in 2016 and/or 2017. CDP respondents further include RE100 members disclosing data to CDP as part of their annual progress reporting exercise. Companies reporting data may include multiply subsidiaries of the same holding company.
- **International Renewable Energy Agency (IRENA) survey respondents:** Companies that answered the IRENA corporate survey.

Table A1.1 Distribution of companies analysed in this report

Sector	Description of sectors	Number of companies	Electricity annual consumption (TWh)
Industrial	Sub-sectors include aerospace, building products, construction and engineering, electrical equipment, industrial conglomerates, machinery, trading companies and distributors and commercial services and supplies	531	222
Consumer Discretionary	Sub-sectors include auto components, automobiles, household durables, textiles, apparel and luxury goods, hotels, restaurants and leisure, diversified consumer services and specialty retail	380	262
Financial	Sub-sectors include commercial banks, diversified financial services, consumer finance, capital markets and insurance	342	50
Materials	Sub-sectors include chemicals, construction material, containers and packaging, metals and mining, paper and forest products	330	1 247
Information Technology (IT)	Sub-sectors include software and services, IT services, electronic equipment and instruments, semiconductors and semiconductor equipment	270	186
Consumer Staples	Sub-sectors include food and staples retailing, beverages, food products and household products	221	284
Healthcare	Sub-sectors include healthcare equipment and supplies, healthcare providers and services, healthcare technology and pharmaceuticals	134	40
Real Estate	Sub-sectors include real estate and office service providers	130	30
Telecommunications Services	Sub-sectors include diversified telecommunications services and wireless telecommunications services	72	142
	Total	**2 410**	**2 463**

Note: Sector classifications for this report are drawn from the Global Industry Classification Standard (GICS®). For a description of the industries covered in each sector, please refer to the definition of GICS sectors in MSCI (2016).

Annex 1. Report Methodology (continued)

Classifications

In terms of sector and industry classification, this report relies on the Global Industry Classification Standard (GICS) for the overall classification and GRI Industry Classification for sub-sectors. For a description of the industries covered in each sector, please refer to the definition of GICS sectors (MSCI, 2016).

The classification of corporate procurement methods used in this report are shown in Table A1.2.

For the purpose of this report, other forms of renewable electricity consumption than mentioned in table A1.2 were not considered (i.e. contracts with suppliers not supported by EACs, etc.). In the absence of a standardised classification system for corporate procurement, data presented in this report may differ from data presented elsewhere (i.e. annual sustainability reports, etc.).

Input data

Input data are the raw data points used for the report. They are largely derived from the CDP and IRENA survey respondents (see further explanation at the beginning of the methodology). Input data are the primary contribution for the development of the "Index".

Both CDP's disclosure programme and the IRENA survey include a provision for companies to mark their response as "public" or "private". Responses marked as "private" have been used only in aggregated form to maintain the privacy of these companies' disclosed information.

Unless otherwise indicated, the proposed indicators were developed using data disclosed by companies in 2016 and 2017. Usually, the data corresponds to activity that took place throughout the report period (e.g., financial year) most recently concluded before the disclosure date.

Data quality control and procedures

In order to ensure data quality, thorough quality checks were conducted:

Consistency checks were used for every company that submitted information for this report to verify that each data point aligns with other information and data that the company reported.

Internal consistency checks were made to remove data points that have been misreported ex ante. Criteria used included comparing total reported electricity consumption and Scope 2 emissions, low carbon energy consumption and associated emission factors, etc. Any data points identified as outliers were investigated in detail by thoroughly reviewing key data points across the companies' responses.

External consistency checks were also conducted by retrieving information from other data sources and trying to reconcile the companies' disclosed energy data with those reported elsewhere.

Table A1.2 Classification of renewable electricity sourcing models

Sourcing model	Including
1 Unbundled energy attribute certificates (EACs)	Includes different types of contractual tracking instruments that represent information about the origin of the energy generated, most commonly guarantees of origin and renewable energy certificates.
2 Power purchase agreements (PPAs)	Includes both on site and off site agreements between a company and an independent power producer or between a company and the utility. Considered PPAs supported by EACs as well as PPAs where electricity attribute certificates do not exist or are not required for a usage claim.
3 Renewable energy offerings from utilities or electric suppliers	Includes both short term renewable energy premium products and longer term contractual arrangements between the utility and a corporation and supported by EACs.
4 Production for self-consumption	Includes both on site and off site systems that the corporate entity owns to produce renewable electricity for self-consumption. This category also includes on site solar PVs leasing contracts and off-grid systems..

Annex 1. Report Methodology (continued)

Index data

The report is composed of two data sets. Market data which provides an overview of renewables sourcing trends within the corporate sector, and company data recognising corporate efforts in sourcing renewables in the focus sectors analysed.

Total renewable electricity consumption (corporate sourcing/consumption of renewable electricity at the global level and per industry/sector)

Percentage of electricity consumption from renewable sources (average percentage of corporate consumption of renewable electricity at the global level and per industry/sector)

Total renewable electricity production (volume of production of renewable electricity over a two-year period at the global level and per industry/sector)

Renewable electricity production as a percentage of total electricity consumption (on site and off site) (production of renewable electricity as a percentage of total electricity consumption at the global level and per industry/sector)

Number of companies reporting renewable electricity targets (adoption of renewable electricity targets in the corporate sector – both renewable electricity production targets and renewable electricity consumption targets – per industry/sector)

Number of corporate renewable electricity targets per level of ambition (adoption of renewable electricity targets in the corporate sector and the level of ambition of these targets)

Percentage of renewable electricity procurement methods (companies' methods of consuming and purchasing renewable energy at the global level per industry/sector and by size).

Top 25 corporate consumers of renewable electricity by sector (procured and self-generated, at the global level, by volume and share of total electricity consumption)

Top 25 corporate producers (prosumers) of renewable electricity (prosumers/producers, at the global level, by volume and share of total electricity consumption).

Data limitations

Most of the 2 410 companies reporting data (>98%) are large publicly listed private-sector companies with more than 250 employees and a revenue of over USD 200 million yearly. Only a small fraction of non-listed privately owned or state-owned companies have reported to CDP or participated in the IRENA survey.

While companies disclose detailed information with regard to volume, share and procurement models used, limited data have been reported with regard to sourcing location and renewable energy technologies used. In the report, graphs and figures only display data from companies that consented to public disclosure.

The sample of 2 410 companies is not necessarily representative to the Commercial & Industrial sector as such. Considering these companies' efforts in reporting extensive data on their climate and energy efforts, it has been assumed that companies actively procuring renewable electricity are more likely to be in the sample. All estimates and extrapolation of data have been made with this aspect in mind.

Annex 2. Company Data

1. Corporate renewable electricity consumption index (excluding companies in the Materials sector)

Company information				Renewable electricity consumption (annual)		Renewable electricity consumption by sourcing model				Renewable electricity targets		
No.	Company	Sector	Country HQ	Renewable electricity consumption (MWh)	Share of Electricity from RE (%)	Production for self-consumption (incl. off-grid)	PPAs	Unbundled EACs	Green procure-ment from utilities	RE target?	Target year	Level of ambition
1	Microsoft Corporation	Information Technology	United States	4,793,774	99%	1,084	796,802	3,995,888	-	Yes	2016	
2	Intel Corporation	Information Technology	United States	4,303,000	79%	50,000	-	4,253,000	-	Yes	2020	90%
3	Volkswagen AG	Consumer Discretionary	Germany	4,032,919	33%	303,165	3,729,754	-	-	No		
4	Deutsche Bahn AG	Industrial	Germany	3,438,553	33%	62,126	-	3,376,427	-	Yes	2020	45%
5	Alphabet, Inc.	Information Technology	United States of America	2,824,021	45%	6,108	2,811,805	-	-	Yes	2017	100%
6	Wal-Mart Stores, Inc.	Consumer Staples	United States of America	2,358,702	8%	2,692	2,072,109	283,901	-	Yes	no target year	100%
7	BT Group	Telecom-munication Services	United Kingdom of Great Britain and Northern Ireland	2,271,087	89%	21	-	-	2,271,066	Yes	2020	100%
8	Telefonica	Telecom-munication Services	Spain	2,228,426	36%	10,036	-	874,873	1,343,517	Yes	2030	100%
9	EQUINIX, INC.	Real Estate	United States of America	2,077,301	56%	-	113,272	714,812	1,249,217	Yes	no target year	100%
10	Apple Inc.	Information Technology	United States of America	1,478,000	102%	350,500	601,000	468,400	53,000	Yes	no target year	100%
11	Unilever plc	Consumer Staples	United Kingdom	1,423,464	46%	147,511	715,182	413,599	147,172	Yes	2020	100%
12	Bank of America	Financial	United States of America	1,369,243	64%	292		1,368,659	-	Yes	2020	100%
13	Cisco Systems, Inc.	Information Technology	United States of America	1,311,425	80%	1,710	-	1,282,681	25,324	Yes	2017	25%
14	East Japan Railway Company	Industrial	Japan	1,310,000	26%	1,310,000	-	-	-	No		
15	Wal Mart de Mexico	Consumer Staples	Mexico	1,276,711	58%	-	1,276,711	-	-	No		
16	Kohl's Cor-poration	Consumer Discretionary	USA	1,242,666	100%	-	-	1,242,666	-	No		
17	BMW AG	Consumer Discretionary	Germany	1,234,710	42%	90,924	-	1,143,786	-	Yes	2020	100%
18	Tesco	Consumer Staples	United Kingdom of Great Britain and Northern Ireland	1,210,000	24%	-	-	1,210,000	-	Yes	2030	100%
19	H&M Hennes & Mauritz AB	Consumer Discretionary	Sweden	1,147,998	83%	-	-	1,147,998	-	Yes	2035	100%
20	Sandvik AB	Industrial	Sweden	1,104,005	76%	-	-	1,104,005	-	No		
21	Honda Motor Company	Consumer Discretionary	Japan	1,047,000	15%	153,000	-	-	894,000	No		
22	Deutsche Post AG	Industrial	Germany	1,013,000	62%	-	-	1,013,000	-	No		
23	Siemens AG	Industrial	Germany	971,230	39%	-	971,230	-	-	No		
24	Hewlett-Packard	Information Technology	United States of America	914,440	27%	8,000	305,000	420,823	180,617	No		
25	Deutsche Telekom AG	Telecom-munication Services	Germany	906,196	13%	3,063	-	878,741	24,393	No		

Annex 2. Company Data (continued)

2. Corporate renewable electricity consumption index, Materials sector

Company information				Renewable electricity consumption		Renewable electricity consumption by sourcing model				Renewable electricity targets		
No.	Company	Sector	Country HQ	Renewable electricity consumption (MWh)	Share of Electricity from RE (%)	Production for self-consumption (incl. off-grid)	PPAs	Unbundled EACs	Green procure-ment from utilities	RE target?	Target year	Level of ambition
1	Rio Tinto	Materials	United Kingdom of Great Britain and Northern Ireland	28,900,000	47%	25,800,000	3,000,000	-	-	No		
2	United Co RUSAL PLC	Materials	Russian Federation	28,608,578	42%	245,050	28,363,528	-	-	Yes	2025	95%
3	South32	Materials	Australia	17,707,553	81%	9,575,103	8,132,450	-	-	No		
4	Norsk Hydro	Materials	Norway	11,332,000	39%	11,332,000	-	-	-	No		
5	Vale	Materials	Brazil	9,597,675	56%	2,794,807	5,829,417	-	-	No		
6	AkzoNobel	Materials	Netherlands	5,456,000	62%	-	4,965,000	-	-	Yes	2050	100%
7	Anglo Ameri-can	Materials	United Kingdom of Great Britain and Northern Ireland	4,700,678	29%	2,660,592	-	2,034,016	-	No		
8	Stora Enso Oyj	Materials	Finland	4,394,131	34%	3,986,411	407,720	-	-	No		
9	UPM-Ky-mmene Corporation	Materials	Finland	3,700,000	25%	3,700,000	-	-	-	Yes	2016	69%
10	Glencore plc	Materials	Switzerland	3,155,117	11%	3,155,117	-	-	-	Yes	2016	6%
11	WestRock Company	Materials	United States of America	3,116,097	30%	3,116,097	-	-	-	No		
12	ArcelorMittal	Materials	Luxembourg	2,954,480	6%	1,477,240	-	-	-	No		
13	Holmen	Materials	Sweden	2,674,400	68%	1,796,000	-	-	878,400	Yes	2020	50%
14	Mondi PLC	Materials	United Kingdom of Great Britain and Northern Ireland	2,641,000	38%	2,641,000	-	-	-	No		
15	FIBRIA Celu-lose S/A	Materials	Brazil	2,482,963	85%	2,482,963	-	-	-	No		
16	China Steel Corporation	Materials	Taiwan	2,069,521	42%	770	-	-	1,500	No		
17	Empresas CMPC	Materials	Chile	2,004,000	100%	2,004,000	-	-	-	Yes	2020	80%
18	Sappi	Materials	South Africa	1,941,447	31%	1,941,447	-	-	-	No		
19	Teck Resources Limited	Materials	Canada	1,850,823	39%	1,801,047	49,776	-	-	Yes	2030	100%
20	thyssenk-rupp AG	Materials	Germany	1,820,100	22%	100	-	-	-	No		
21	Billerud-Korsnäs	Materials	Sweden	1,469,071	48%	1,414,725	-	38,926	-	Yes	2020	100%
22	Klabin S/A	Materials	Brazil	1,401,895	46%	1,401,895	-	-	-	No		
23	Braskem S/A	Materials	Brazil	1,329,772	20%	-	-	-	-	No		
24	Smurfit Kappa Group PLC	Materials	Ireland	1,092,000	23%	1,092,000	-	-	-	No		
25	Resolute Forest Products Inc.	Materials	Canada	1,086,814	9%	1,086,814	-	-	-	No		

Annex 2. Company Data (continued)

3. Corporate renewable electricity consumption index, Financial sector

Company information				Renewable electricity consumption		Renewable electricity consumption by sourcing model				Renewable electricity targets		
No.	Company	Sector	Country HQ	Renewable electricity consumption (MWh)	Share of Electricity from RE (%)	Production for self-consumption (incl. off-grid)	PPAs	Unbundled EACs	Green procure-ment from utilities	RE target?	Target year	Level of ambition
1	Bank of America	Financial	United States of America	1,369,243	64%	292	-	1,368,659	-	Yes	2020	100%
2	TD Bank Group	Financial	Canada	574,198	100%	-	-	571,931	-	Yes	2016	100%
3	Barclays	Financial	United Kingdom of Great Britain and Northern Ireland	469,421	62%	-	-	-	469,421	No		
4	Itausa Investimentos Itau S.A.	Financial	Brazil	457,808	30%	26,280	431,528	-	-	Yes	2020	96%
5	Banco Santander	Financial	Spain	448,157	41%	-	-	-	448,157	No		
6	Goldman Sachs Group Inc.	Financial	United States of America	440,901	90%	-	-	440,901	-	Yes	2020	100%
7	Itaú Unibanco Holding S.A.	Financial	Brazil	431,528	68%	-	431,528	-	-	Yes	2020	96%
8	Credit Agricole	Financial	France	412,765	100%	-	-	-	-	Yes	2016	100%
9	UniCredit	Financial	Italy	394,712	70%	231	-	394,481	-	No		
10	Intesa San-paolo S.p.A	Financial	Italy	355,361	76%	1,050	-	349,973	4,338	Yes	2022	81%
11	BNY Mellon	Financial	United States of America	323,998	100%	110	-	323,888	-	Yes	2017	100%
12	HSBC Hold-ings plc	Financial	United Kingdom of Great Britain and Northern Ireland	318,706	29%	160	89,990	216,107	12,449	Yes	2030	100%
13	UBS	Financial	Switzerland	272,483	52%	278	-	-	272,205	Yes	2020	100%
14	BNP Paribas	Financial	France	257,583	24%	1,694	-	253,871	-	No		
15	Allianz SE	Financial	Germany	245,317	45%	17	-	-	245,283	No		
16	ING Group	Financial	Netherlands	215,456	83%	24	9,020	191,109	15,279	Yes	2020	100%
17	JPMorgan Chase & Co.	Financial	United States of America	214,474	11%	2,237	-	210,000	-	Yes	2020	100%
18	MetLife, Inc.	Financial	United States of America	204,588	85%	-	-	204,588	-	No		
19	State Street Corporation	Financial	United States of America	187,795	75%	-	-	187,795	-	No		
20	Commerz-bank AG	Financial	Germany	187,495	88%	-	-	187,495	-	Yes	2019	100%
21	Citigroup Inc.	Financial	United States of America	179,469	12%	70	74,573	104,826	-	Yes	2020	100%
22	Remgro	Financial	South Africa	171,219	30%	171,219	-	-	-	No		
23	CaixaBank	Financial	Spain	170,605	99%	-	-	170,605	-	Yes	2040	100%
24	American Express	Financial	United States of America	150,000	59%	566	-	150,000	-	Yes	2040	100%
25	Credit Suisse	Financial	Switzerland	147,274	32%	1570	-	145,704	-	No		

Annex 2. Company Data (continued)

4. Corporate renewable electricity consumption index, Information Technology sector

Company information				Renewable electricity consumption		Renewable electricity consumption by sourcing model				Renewable electricity targets		
No.	Company	Sector	Country HQ	Renewable electricity consumption (MWh)	Share of Electricity from RE (%)	Production for self-consumption (incl. off-grid)	PPAs	Unbundled EACs	Green procure-ment from utilities	RE target?	Target year	Level of ambition
1	Microsoft Corporation	Information Technology	United States of America	4,793,774	99%	542	796,802	3,995,888	-	Yes	2016	100%
2	Intel Corporation	Information Technology	United States of America	4,303,000	79%	50,000	-	4,253,000	-	Yes	2020	90%
3	Alphabet, Inc.	Information Technology	United States of America	2,824,021	45%	6,108	2,811,805	-	-	Yes	2017	100%
4	Apple Inc.	Information Technology	United States of America	1,478,000	102%	350,500	601,000	468,400	53,000	Yes	no target year	100%
5	Cisco Systems, Inc.	Information Technology	United States of America	1,311,425	80%	1,710	-	1,282,681	25,324	Yes	2017	25%
6	Hewlett-Packard	Information Technology	United States of America	914,440	27%	8,000	305,000	420,823	180,617	No		
7	Hewlett Packard Enterprise Company	Information Technology	United States of America	798,466	27%	2,000	265,130	531,336	-	Yes	2025	100%
8	International Business Machines (IBM)	Information Technology	United States of America	722,180	20%	-	47,626	1,337	672,288	Yes	2020	20%
9	SAP SE	Information Technology	Germany	440,147	124%	147	-	440,000	-	Yes	2014	100%
10	STMicro-electronics International NV	Information Technology	Switzerland	375,699	18%	1,974	-	371,751	-	Yes	2020	30%
11	Ericsson	Information Technology	Sweden	351,040	46%	-	-	351,040	-	No		
12	Dell Technologies	Information Technology	United States of America	293,176	24%	287	-	76,923	215,966	Yes	2020	50%
13	Dell Inc.	Information Technology	United States of America	267,954	41%	172	-	-	267,782	Yes	2020	50%
14	Altaba Inc.	Information Technology	United States of America	251,951	43%	1,095	101,921	-	147,840	No		
15	Nokia Group	Information Technology	Finland	212,515	21%	-	-	212,515	-	Yes	2016	15%
16	eBay Inc.	Information Technology	United States of America	175,792	47%	275	-	175,242	-	Yes	2025	100%
17	Samsung Electronics	Information Technology	Republic of Korea	170,810	1%	16,000	-	80,000	58,000	No		
18	Infosys Limited	Information Technology	India	118,903	45%	17,572	101,331	-	-	Yes	2020	100%
19	Fujitsu Ltd.	Information Technology	Japan	116,700	6%	700	-	24,000	92,000	Yes	2018	6%
20	FUJIFILM Holdings Corporation	Information Technology	Japan	101,812	6%	18,777	-	-	83,035	No		
21	salesforce.com	Information Technology	United States of America	93,302	25%	-	-	93,302	-	Yes	no target year	100%
22	MasterCard Incorporated	Information Technology	United States of America	89,812	58%	-	-	86,467	3,345	No		
23	Cap Gemini	Information Technology	France	77,877	20%	300	-	78,177	-	No		
24	Wipro	Information Technology	India	76,466	19%	-	76,466	-	-	Yes	2020	36%
25	LG Innotek	Information Technology	Republic of Korea	64,631	4%	64,631	-	-	-	No		

Annex 2. Company Data (continued)

5. Corporate renewable electricity production for self-consumption index

Company information				Renewable electricity consumption		Renewable electricity consumption by sourcing model				Renewable electricity targets		
No.	Company	Sector	Country HQ	Renewable electricity consumption (MWh)	Share of Electricity from RE (%)	Production for self-consumption (incl. off-grid)	PPAs	Unbundled EACs	Green procure-ment from utilities	RE target?	Target year	Level of ambition
1	Volkswagen AG	Consumer Discretionary	Germany	4,032,919	33%	303,165	3,729,754			No		
2	Deutsche Bahn AG	Industrial	Germany	3,438,553	33%	62,126	-	3,376,427	-	Yes	2020	45%
3	Apple Inc.	Information Technology	United States of America	1,478,000	102%	350,500	601,000	468,400	53,000	Yes	no target year	100%
4	East Japan Railway Company	Industrial	Japan	1,310,000	26%	1,310,000	-	-	-	No		
5	IKEA	Consumer Discretionary	Sweden	704,256	23%	704,256	-	-	-	Yes	2020	100%
6	Illovo Sugar Ltd	Consumer Staples	South Africa	454,087	57%	454,087	-	-	-	No		
7	Bunge	Consumer Staples	United States of America	436,545	16%	436,545	-	-	-	No		
8	Tongaat Hulett Ltd	Consumer Staples	South Africa	407,660	63%	407,660	-	-	-	No		
9	S Group	Consumer Discretionary	Finland	401,326	33%	401,326	-	-	-	Yes	2016	50%
10	Cargill	Consumer Staples	United States of America	389,170	3%	389,170	-	-	-	No		
11	General Motors Company	Consumer Discretionary	United States of America	292,536	3%	292,536	-	-	-	Yes	2050	100%
12	RCL Foods Ltd	Consumer Staples	South Africa	239,684	33%	239,684	-	-	-	No		
13	Kuehne + Nagel Inter-national AG	Industrial	Switzerland	217,482	31%	111,721	43,615	62,146	-	Yes	2020	10%
14	Furukawa Electric Co., Ltd.	Industrial	Japan	200,072	15%	95,007	-	105,065	-	Yes	2017	15%
15	Remgro	Financial	South Africa	171,219	30%	171,219	-	-	-	No		
16	Charoen Pokphand Foods PCL	Consumer Staples	Thailand	169,353	12%	169,353	-	-	-	No		
17	Reckitt Benckiser	Consumer Staples	United Kingdom of Great Britain and Northern Ireland	164,732	39%	164,732	-	-	-	Yes	2030	100%
18	Golden Agri-Resources	Consumer Staples	Singapore	152,174	89%	152,174	-	-	-	No		
19	Wilmar International Limited	Consumer Staples	Singapore	121,244	11%	121,244	-	-	-	No		
20	PT Musim Mas	Consumer Staples	Singapore	120,947	21%	120,947	-	-	-	No		
21	TEKFEN HOLDING A.S.	Industrial	Turkey	97,969	52%	97,969	-	-	-	No		
22	Costco Wholesale Corporation	Consumer Staples	United States of America	62,516	2%	62,516	-	-	-	No		
23	China Mobile	Telecom-munication Services	China	60,282	0.3%	60,282	-	-	-	No		
24	Bharat Forge	Consumer Discretionary	India	60,000	18%	60,000	-	-	-	No		
25	Seven & I Holdings Co., Ltd.	Consumer Staples	Japan	58,014	1%	58,014	-	-	-	No		

Annex 3. Options for Corporate Sourcing of Renewable Electricity, by Country

Country	Energy Attribute Certificates (EACs)	Corporate Power Purchase Agreements (PPAs)	Renewable Energy Offerings from Utilities or Electric Suppliers	Production for self-consumption	Third Party Sales	Net Metering
Algeria		●		●		
Argentina		●		●	●	●
Australia	●	●	●	●	●	●
Austria	●	●	●	●	●	
Bahrain						●
Belgium	●	●	●	●	●	●
Brazil	●	●		●	●	●
Bulgaria	●		●	●		
Burkina Faso		●		●		
Canada	●	●	●	●	●	●
Chile	●	●		●		●
China	●			●	●	●
Colombia	●			●	●	●
Croatia	●					
Cyprus	●			●		●
Czech Republic	●		●	●	●	
Denmark	●	●	●	●	●	●
Dominican Republic				●	●	●
Egypt		●		●	●	●
Eritrea		●		●		
Estonia	●		●			
Fiji				●		
Finland	●	●	●	●	●	
France	●	●	●	●	●	
Germany	●	●	●	●	●	
Ghana		●		●	●	●
Greece	●		●	●	●	●
Guatemala	●			●	●	●
Honduras	●			●		●
Hungary	●		●	●		
Iceland	●	●	●	●		
India	●	●	●	●	●	●
Indonesia				●	●	
Ireland	●	●	●	●		
Israel	●			●		●
Italy [i]	●	●	●	●	●	●
Japan	●		●	●	●	●
Jordan	●	●		●		●
Kazakhstan				●	●	
Kenya		●		●		●
Latvia	●		●			●

Annex 3. Options for Corporate Sourcing of Renewable Electricity, by Country (continued)

Country	Energy Attribute Certificates (EACs)	Corporate Power Purchase Agreements (PPAs)	Renewable Energy Offerings from Utilities or Electric Suppliers	Production for self-consumption	Third Party Sales	Net Metering
Lithuania	●		●	●		●
Luxembourg	●		●			
Malaysia	●			●		
Malta	●			●		
Mexico	●	●	●	●	●	●
Morocco		●	●	●	●	●
Namibia		●		●		
Netherlands	●	●	●	●	●	●
New Zealand		●		●		●
Norway	●	●	●	●	●	
Pakistan				●		●
Panama		●		●	●	●
Philippines	●			●	●	●
Poland	●		●	●	●	
Portugal	●	●	●	●		
Republic of Korea	●		●	●	●	●
Romania	●				●	
Saudi Arabia	●					
Singapore	●		●	●		●
Slovakia	●		●			
Slovenia	●		●			●
South Africa	●		●	●	●	
South Sudan			●		●	
Spain	●		●	●	●	
Sweden	●	●	●	●	●	
Switzerland	●			●	●	
Thailand	●	●	●	●	●	
Turkey	●					
Uganda	●			●		
United Arab Emirates	●	●	●	●		
United Kingdom	●	●	●	●	●	
United Republic of Tanzania				●		●
United States of America	●	●	●	●	●	●
Vietnam	●					●

[i] Italy has retired the trading of green certificates as of 2016, but still has a Guarantees of Origin system in place.

Note: The table indicates countries where corporate sourcing takes place through different procurement options (either through power purchase agreements, utility green procurement programmes, the purchase of unbundled renewable energy attribute certificates and/or direct investments in production for self-consumption). The table further highlights countries where third party sales and net metering schemes have been put in place.

Disclaimer: The country names shown in this table do not imply any official endorsement or acceptance by IRENA. The term "country" as used in this material also refers, as appropriate, to territories or areas.

IRENA
International Renewable Energy Agency

Corporate Sourcing of Renewables:

Market and Industry Trends

See the full report:

www.irena.org/publications

IRENA Headquarters

Masdar City
P.O. Box 236, Abu Dhabi
United Arab Emirates

www.irena.org