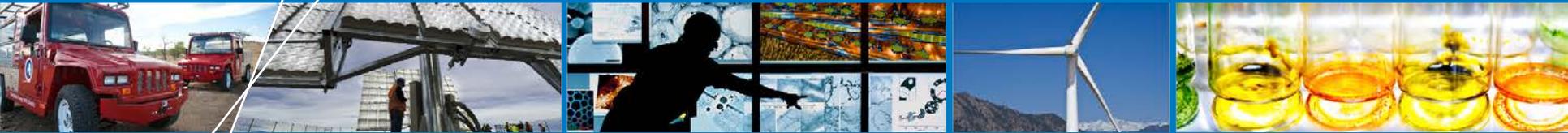


Renewable Electricity Use by the U.S. Information and Communication Technology (ICT) Industry



Presenters:

Jenny Heeter, NREL

Ryan Schuchard, BSR

July 28, 2015

Housekeeping

- Participants are joined in listen-only mode.
- Use the Q&A panel to ask questions during the webinar. We will hold all questions until after all speakers have presented.
- This webinar is being recorded. The slides will be posted to:
<http://apps3.eere.energy.gov/greenpower/events/archive.shtml>.

ICT Company Investments in RE are Increasing

Four announcements in June and July 2015 alone.



June 2015: Google to Build Green Data Center in Alabama



June 2015: Cisco Signs Solar Deal for San Jose Headquarters



July 2015: Facebook Powering New Texas Data Center with Wind



July 2015: Amazon Web Services to Purchase 208-MW of Wind in NC

Factors Considered

ICT sector a substantial consumer of electricity

- Growth in electricity use significantly impacted by recent energy efficiency/virtualization efforts

Deployment of ICT devices and services growing rapidly

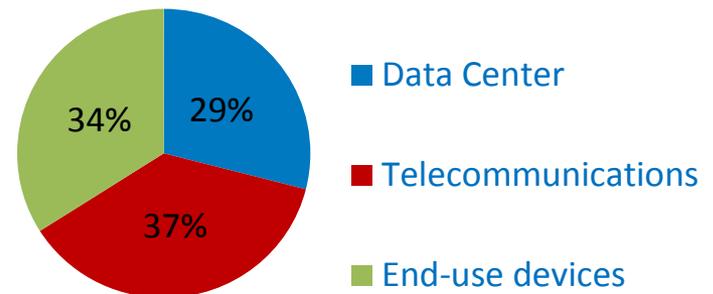
- Sector estimates and forecasts of electricity use become dated quickly; electricity use is a function of services as well as efficiency of devices and operations

Options for reducing impact of electricity use:

- Increase device and service-efficiency
- Power industry needs using clean/low carbon electricity

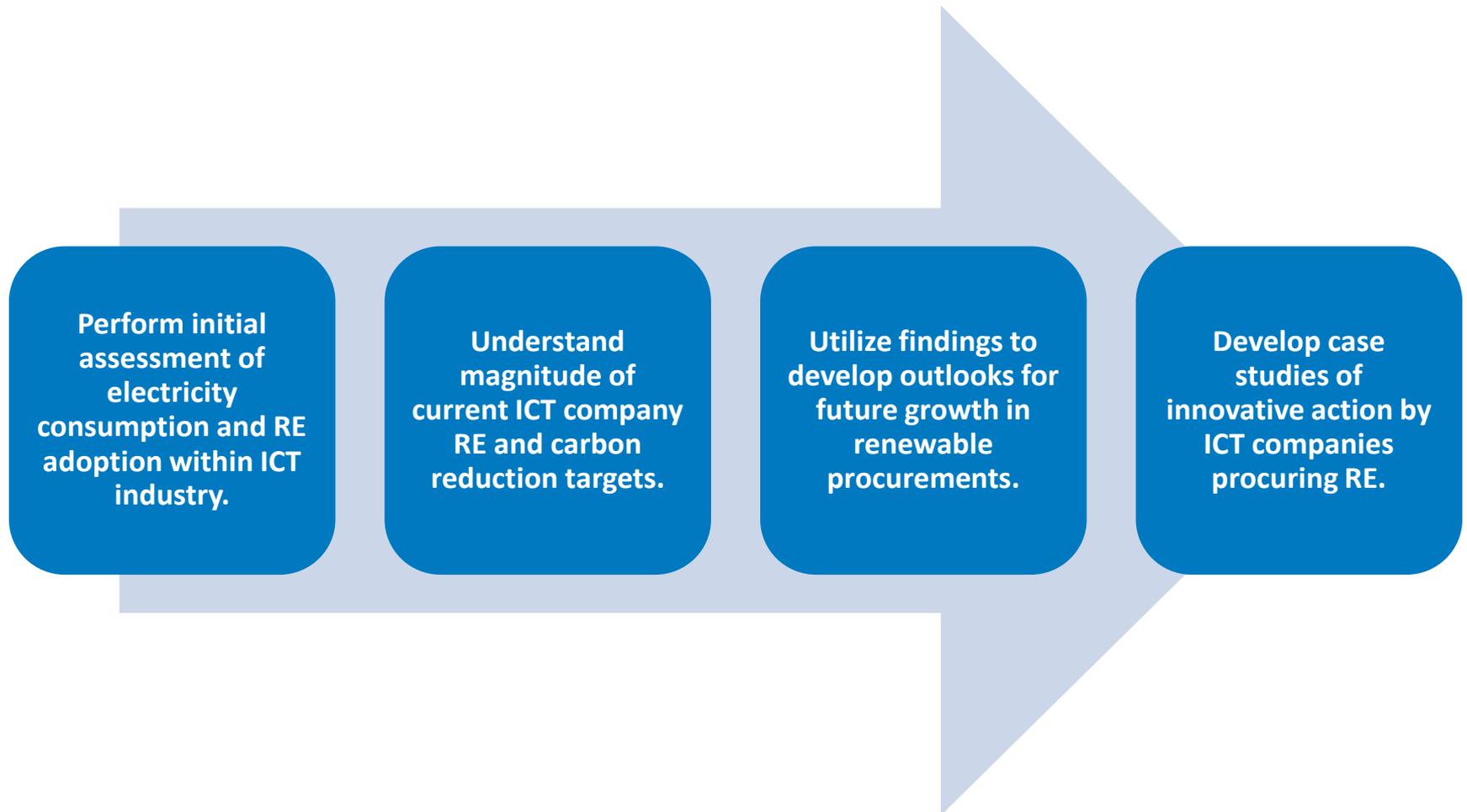
U.S. data centers: 91 million MWh in 2013 (NRDC 2014); representing 2.4% of total U.S. electricity demand.

ICT Subsector Electricity Use Distribution (2012)



(Heddeghem et al. 2014)

NREL Report Characterizes State of RE



Miller, John, Bird, Lori, Heeter, Jenny, and Gorham, Bethany. *Renewable Electricity Use by the U.S. Information and Communication Technology (ICT) Industry*, 2015.

<http://www.nrel.gov/docs/fy15osti/64011.pdf>

Source Data

EPA's Green Power Partnership

- Electricity use/renewables directly reported
- Comparable data back to 2007 (within ICT and across other sectors)
- Growth in reported electricity use up from 0.5 million MWh (2007) to 7.7 million MWh
- U.S.-only data

CDP Worldwide

- Global audience
- Electricity use/renewables reported and derived
- Large share of ICT companies
- Difficulty distinguishing electricity use specific to U.S. operations



Corporate Renewable Energy Use

Significant growth in the number of companies reporting, driven by:

- Improved reporting frameworks
- Increased corporate transparency

Aggregated data for 113 ICT companies

- 59 million MWh of electricity use in 2014
- 8.3 million MWh of electricity use in 2014
- ICT sector 14% renewable in 2014

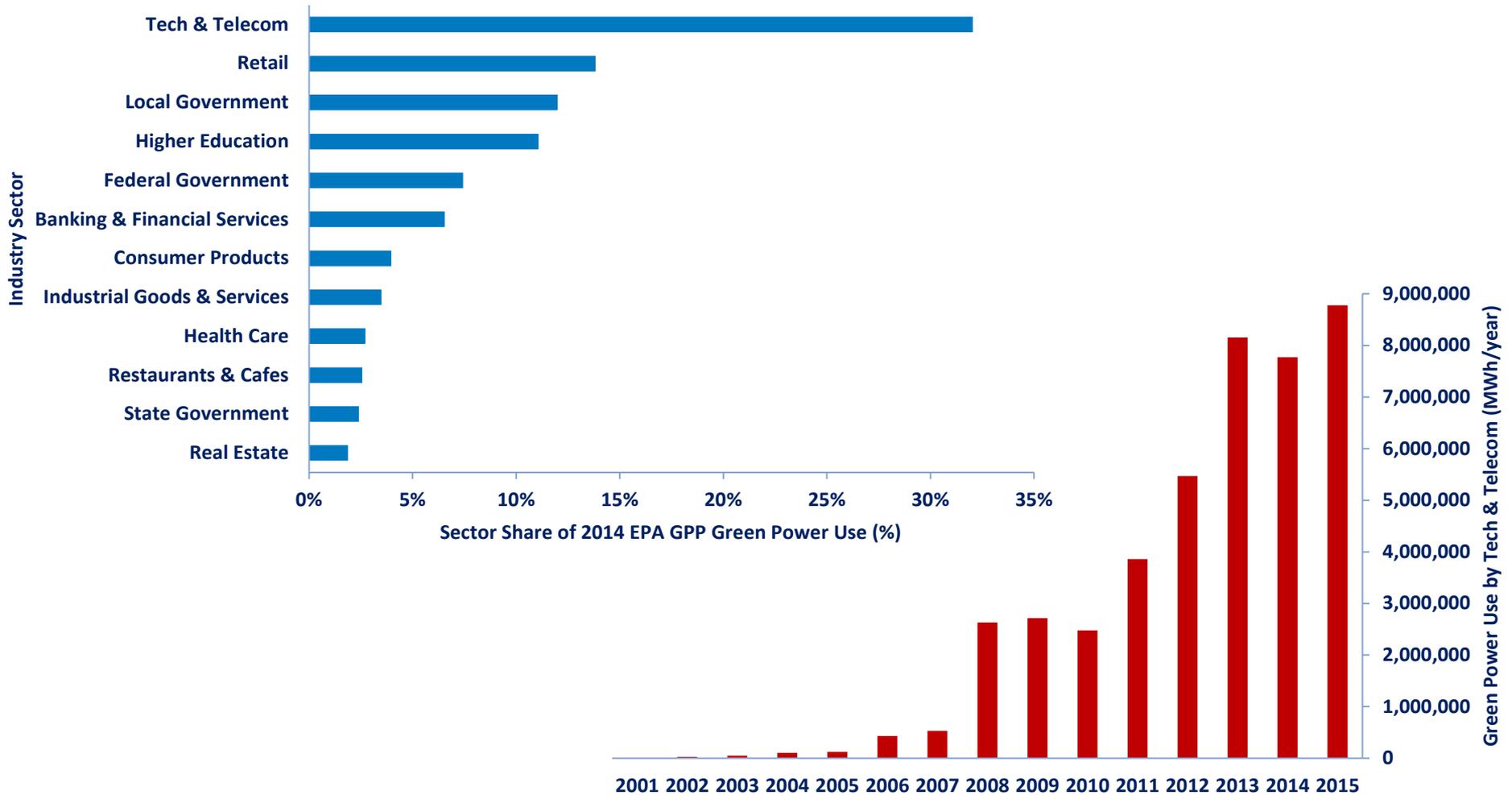
What we're missing:

- Non-reporters (especially co-los)
- Reporters without US-specific data
- Most recent announcements (typically signed PPAs for projects not yet built)

Company Name	Total Renewable Energy Use (MWh)	% Renewable Energy of Total Electricity Use
Intel Corporation	3,061,547	100%
Microsoft Corporation	1,363,235	50%
Google Inc.	879,153	38%
Apple Inc.	491,000	83%
Cisco	425,153	40%
Hewlett-Packard	280,560	14%
Dell Inc.	225,238	45%
Sprint	176,005	6%
Texas Instruments Incorporated	138,210	11%
EMC Corp	113,000	16%
International Business Machines	105,952	4%
Adobe Systems	98,697	234%
Yahoo Inc.	98,280	16%
Verizon Communications	89,000	1%
Sony Corporation of America	88,329	37%
SAP America	86,000	100%
Datapipe, Inc	75,190	100%
Applied Materials	75,000	34%
Motorola Mobility	62,260	100%
Advanced Micro Devices, Inc.	54,089	50%
Motorola Solutions	49,000	31%
Rackspace US Inc.	46,461	17%
Nokia Group	41,200	59%
1&1 Internet, Inc. / Kansas Data Center	22,000	100%
Workday	19,600	100%
Salesforce	15,187	18%
Pitney Bowes	13,043	13%
Freescale Semiconductor	12,996	3%
Lenovo	12,621	94%
Advantest	12,013	83%
TOTAL	8,230,019	

Sources: CDP; EPA-GPP

ICT Sector is Largest in EPA's Green Power Partnership



Procurement Methods

- **77% of ICT purchases in EPA GPP were of unbundled RECs.**
- **Increasing trend to long-term PPAs; REC ownership is still needed to make a renewable claim**
- **The Corporate Renewable Energy Buyers' Principles group, organized by World Wildlife Fund and World Resources Institute, is facilitating collaboration between signatories (including 14 ICT companies), utilities, energy suppliers, and regulators to increase the ability of corporations to buy renewable energy.**

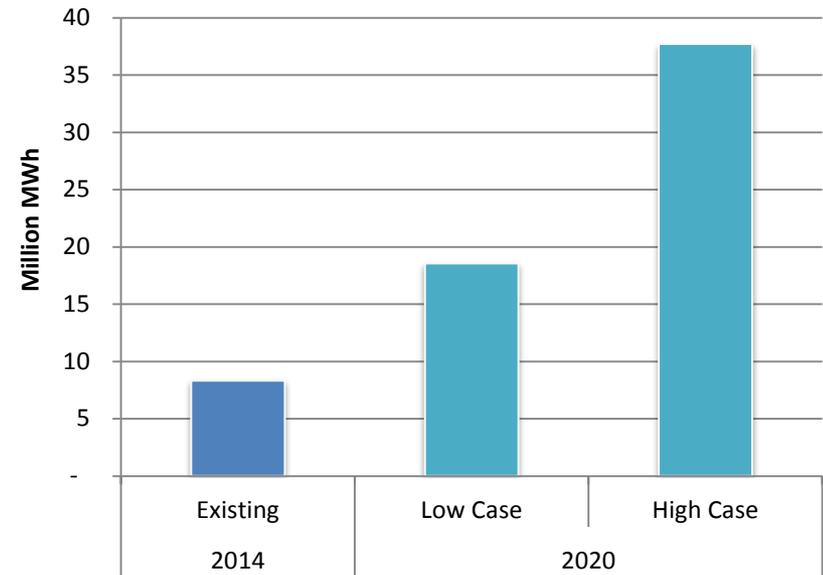
Company Commitments and Goals

	RE Goals	RE Goal Year	Carbon Reduction Goals	Carbon Reduction Goal Year
	100%	Long-Term	None Specified	None Specified
	100%	Long-Term	None Specified	None Specified
	25%	Annual Goal: 2013-2017	40%	FY17
	50%	2020	50%	2020
	8%	2015	10% per transaction in 2013	2013
	100%	Long-Term	None Specified	None Specified
	100%	Long-Term	Carbon Neutral	Ongoing
	None Specified	None Specified	Upcoming	Upcoming
	None Specified	None Specified	10% per chip in direct emissions	2020
	100%	2014	Carbon Neutral	2014
	100%	2026	None Specified	None Specified
	10%	2017	20%	2017
	Not Applicable	Not Applicable	40%	2050

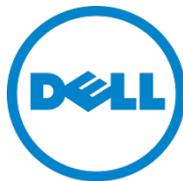
Projected Scenarios

- By 2020, this group of 113 companies could procure 18.5 million MWh to more than 37 million MWh of RE, representing 31% and 48% renewable electricity use, respectively
- Estimates take into account current % RE by company, and company RE targets
- Our estimates are limited by the amount of data available on ICT industry electricity consumption

Scenario	Annual growth in electricity consumption	Renewable electricity use in 2020	
		By companies purchasing renewables in 2014	By companies not purchasing renewables in 2014
High Case	4%	Greater of 50%, company target, or current renewable procurement	Greater of 25% or company target
Low Case	0%	Greater of 25%, company target, or current renewable procurement	Greater of 10%, or company target



Case Studies



Apple

- **678,000 MWh renewable energy procured or generated in 2014**
- **Achieved 92% of its 100% long-term goal to power all operation with renewables**
- **100% of Apple data centers are powered with 100% renewable energy**
- **Generates more renewable energy from on-site projects than any other company in ICT, reaching 148 MWh in 2014**

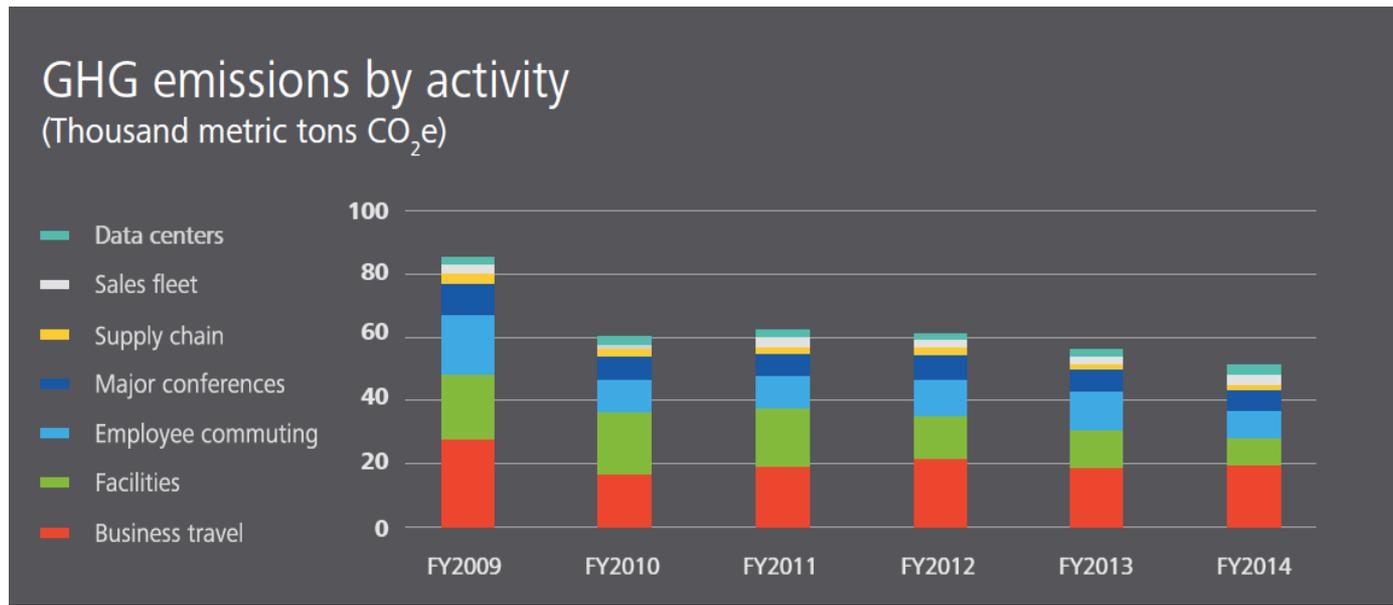


Apple Campus 2 – Cupertino, CA



Autodesk

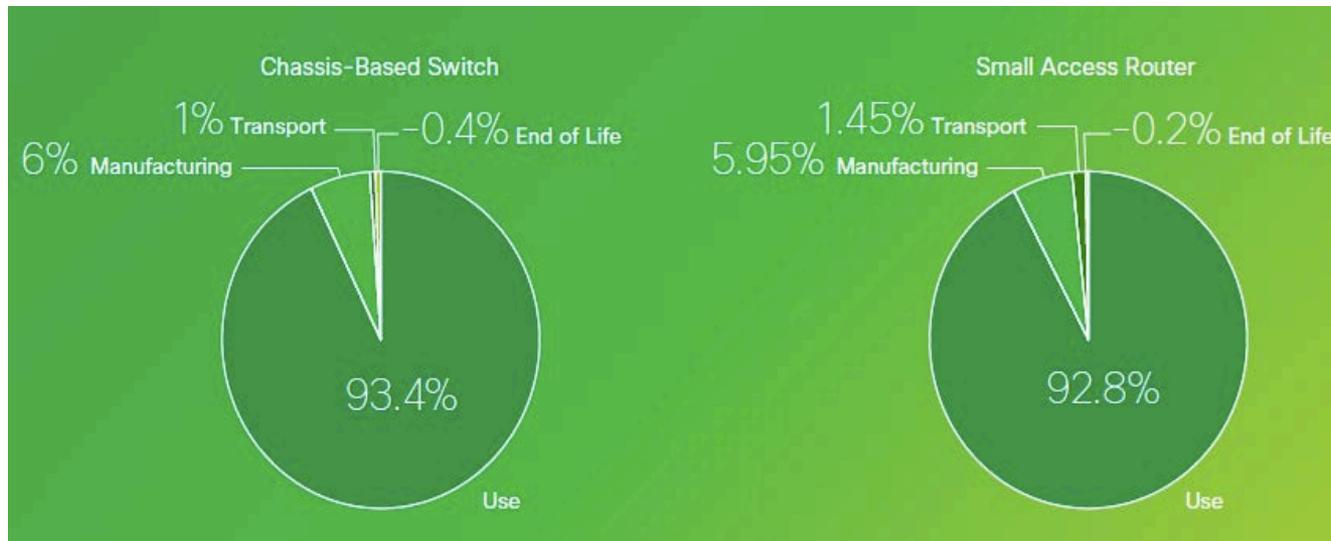
- 8,638 MWh renewable energy procured or generated in 2014
- Achieved 40% of its 100% long-term goal to power world-wide operations with renewable energy
- Corporate Finance Approach to Climate-Stabilizing Targets (C-FACT) – Open source GHG target setting methodology, which is the world's first science based approach to climate stabilization



Autodesk's GHG reduction progress using C-FACT since 2009

Cisco Systems

- 425,153 MWh renewable energy procured or generated in 2014
- Achieved 160% of its annual goal to power at least 25% of operations with renewable energy
- GHG reduction activities not only include, but TARGET Scope 3 emissions, which is the hardest category for ICT to track, measure, and dissect
- Recognized by CDP as the #1 ICT Climate Leader in voluntary reporting and #5 within Global 500



Breakdown of GHG Emissions by Life-Cycle phase product categories

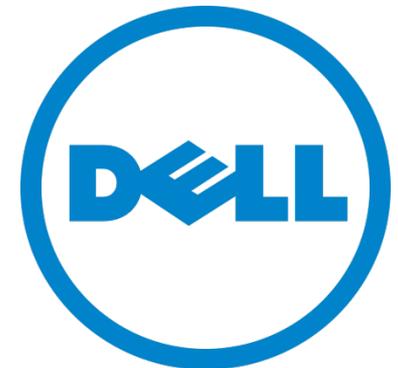
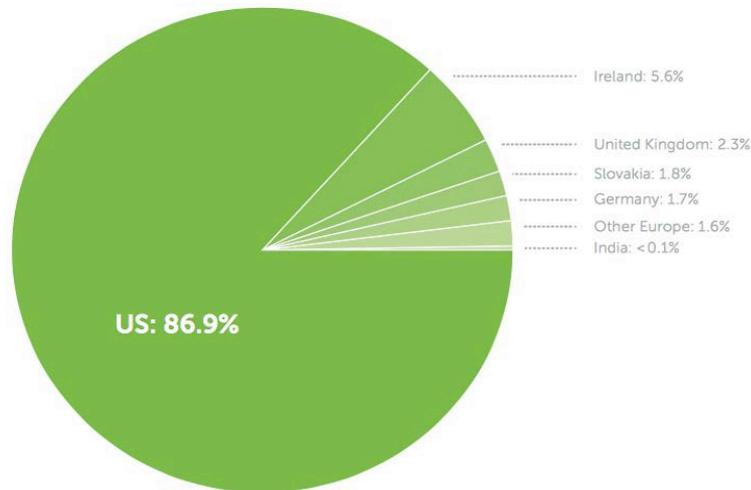


Dell

- 259.3 MWh renewable energy procured or generated in 2015
- In 2013, attributed 45% of total electricity use to renewable energy, which represents a 90% achievement towards Dell's 2020 goal
- Engages with supply chain partners to measure lifetime energy use of Dell products, and in 2013 achieved 60% compliance from its suppliers in a request for verified carbon emissions data

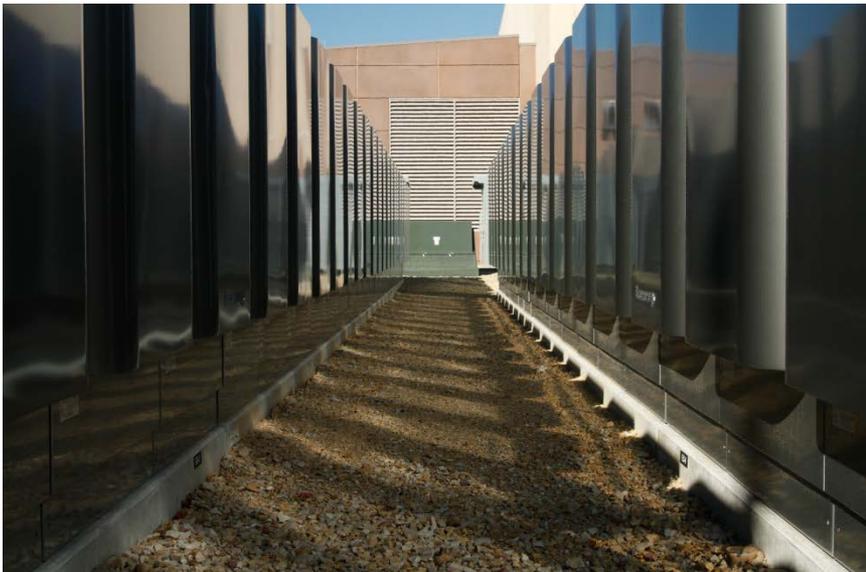
Dell renewable electricity FY15

Total purchased and generated: 259.3 million kWh



eBay

- 10,196 MWh renewable energy procured or generated in 2013
- Achieved a 90% increase in renewable energy use from 2012 to 2013
- In San Jose, CA eBay partnered with SolarCity on the city's largest commercial solar installation to date, which will offset 37 million pounds of carbon dioxide over the next three decades
- eBay's newest data center in Utah is the first commercial data center to be powered with 100% on-site fuel cell electricity generation



Facebook

- 822,000 MWh renewable energy procured or generated in 2013
- In addition to its long-term 100% RE commitment, Facebook sets short term targets, and is expected to reach its 2015 goal to power 25% of operation with RE.
- In 2013, achieved a power usage effectiveness of 1.09
- This month, announced plans for its newest data center in Fort Worth, Texas, which run off of 200 MW powered entirely by wind energy

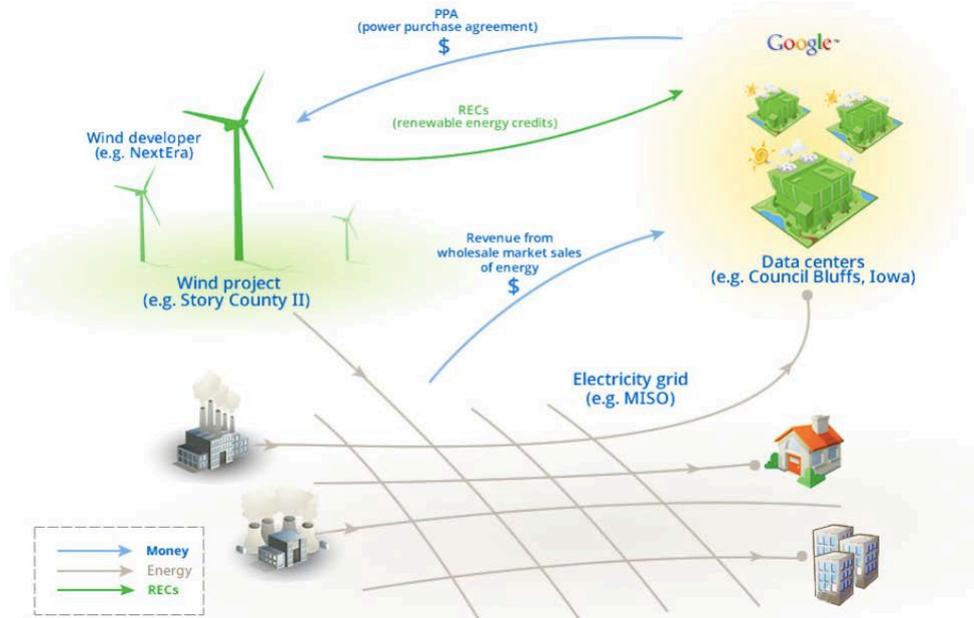


Facebook's Fort Worth data center expected to go live in 2016

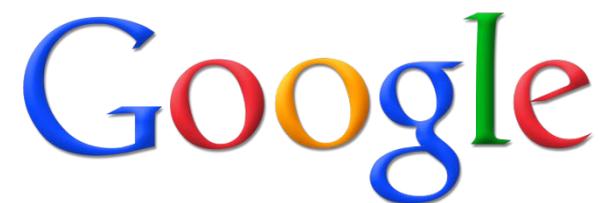
facebook®

Google

- 879,153 MWh of renewable energy procured or generated in 2013
- Achieved 38% of its long-term 100% goal, to power all operations with renewable energy
- Google has an internal subsidiary called 'Google Energy', specifically focused on growing its \$1.5 Billion renewables investment portfolio through strategic PPA's, On-site projects, and innovative financing partnerships



Google Power Purchase Agreement's energy and money flows

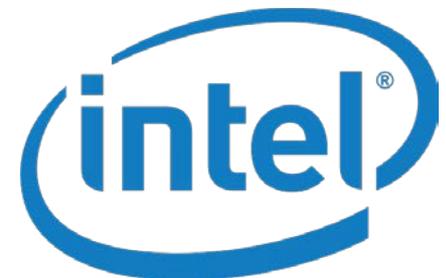


Intel

- In 2013, Intel procured 3,061,547 MWh of renewable energy to serve all of its electricity needs, which satisfies Intel goal to power 100% of operations with renewable energy
- One of the earliest ICT adopters of environmental reporting, voluntarily measuring, monitoring, and reporting its footprint since 1994
- Single largest purchaser of Renewable Energy Credits (RECs) in the United States



Intel ranked #1 since 2008 by GPP as the top user of renewable energy



Microsoft

- 1,363,235 MWh of renewable energy procured or generated in 2013
- Achieved using 62% renewable energy resources to power its operations, which shows impressive progress towards its 100% long-term goal
- In 2012, Microsoft made a Carbon Neutral Commitment, which is a tax model that holds internal business units accountable for attributable emissions



Microsoft set carbon fee in consultation with the office of the CFO based on the average price of RE and carbon offset projects globally



Microsoft

Summary/Conclusions

- The ICT sector is a significant user of electricity, with data centers representing about 2% of total electricity consumption.
- The ICT sector has been a leading user of RE in recent years.
- Looking forward, impact of electricity use will depend on efficiency of operations and RE use.
- No comprehensive assessment of RE purchasing by ICT, but data from 113 companies show purchasing of 8.3 million MWh in 2014 (14% RE).
- By 2020, this group of 113 companies could procure 18.5 million MWh to more than 37 million MWh of renewable electricity, representing 31% and 48% renewable electricity use, respectively.
- Our estimates are limited by the amount of data available on ICT industry electricity consumption.

Thank you!

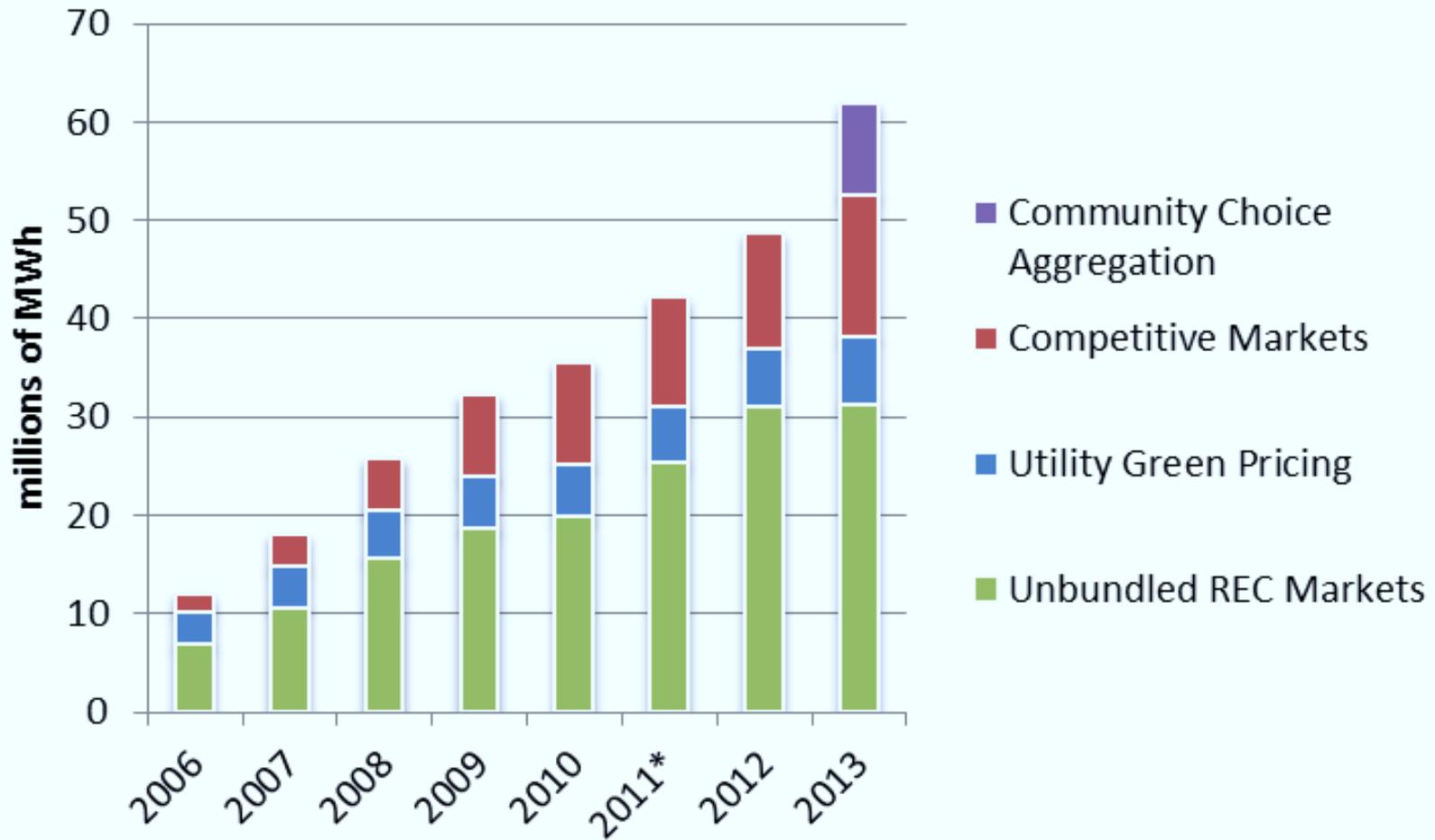
Contact information:

Jenny Heeter

303-275-4366

jenny.heeter@nrel.gov

Voluntary Market Comparison



Trends and Opportunities for Renewables in the Information and Communications Technology Sector

July 2015



BSR[®]

The Business of a Better World

Global Nonprofit Business Network

BSR is a global nonprofit organization that works with our network of more than 250 member companies to build a just and sustainable world. From our offices in Asia, Europe, and North America, we develop sustainable business strategies and solutions through consulting, research, and cross-sector collaboration.



How BSR Works

We develop sustainable business strategies and solutions through membership, advisory services, collaboration, and research with our global network of more than 250 member companies.



Membership



Advisory
Services



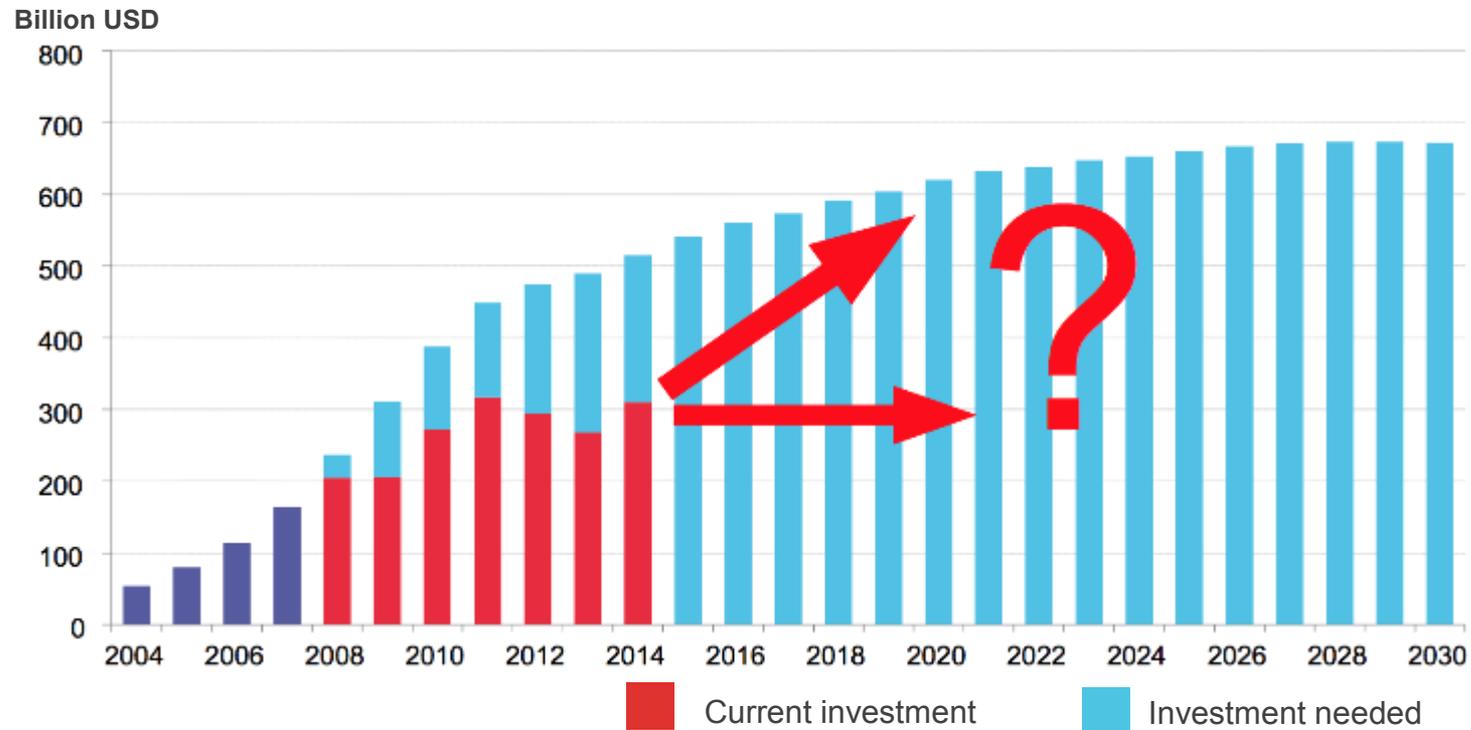
Collaboration



Research

- **Insights** gained from our research and collaborative partnerships enhance our consulting work
- **Our real-world experience** working closely with member companies informs our research
- **Our cross-sector efforts** build on our extensive network of members and stakeholders

Much More Investment in Renewables is Needed to Stabilize Climate Change at 2°C



Current levels of investment in renewables are well below those needed to avoid a 2°C global warming

Sources:

- Bloomberg New Energy Finance (2015). Global Trends in Renewable Energy Investment 2015 and Bloomberg New Energy Finance Summit 2015
- IRENA (2014). REmap 2030 – A Renewable Energy Roadmap

The ICT Sector is Critical in the Race To Accelerate Renewables Deployment



Expansion



Leverage



Leadership

- ICT plays a major role in new energy load—ICT sector **energy use is expected to double** from 2002-2020
- One of **few large sources of relative energy growth** in mature economies
- Data centers **expanding in all states** and internationally
- **Siting and building choices** set impacts in motion for decades
- **Contract negotiation** for services define roles and incentives for renewables co-investment over life of agreement
- “Shopping” for sites is opportunity to influence **policymakers**
- As **significant power users**, ICT companies are uniquely credible as advocates for policy change
- ICT company reach is significant – **others are watching**

The ICT Sector is Leading the Way to Advancing Corporate Renewables PPAs

	2012	2013	2015					
								
MW	~1	100	139	153	130	43	208	112
Source	Solar ¹	Wind	Wind ²	Wind	Solar	Wind	Wind	Wind
Dur. (yrs)	-	20	-	20	25	20	-	12
Location	UT	TX	IA	CA	CA	CA	NC	TX
Partners	-	Vestas	MidAmerican, Siemens	NextEra	First Solar	NextEra	Iberdrola	SunEdison

1 Onsite rooftop

2 Done in partnership with utility

15+ ICT Companies Have Committed to 100% Renewables as of July 2015



The Data Center Ecosystem is Ripe for Co-Investment in Renewables



1

Technology companies use in-house data centers

- Cloud providers
- Retailers, banks, etc.

2

Large data centers can use 100x energy of office building (80-100 MW)

Data centers are the fastest growing part of the ICT sector's carbon footprint

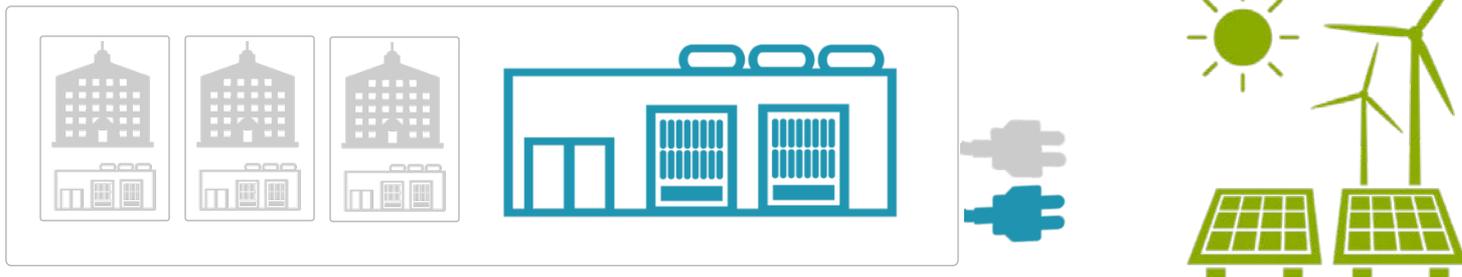
3

Professional data center operators provide added industrial data center services for flexibility & security

- “Co-location” providers

Question: How can companies in the data center value chain collaborate to expand renewables?

- Group purchasing among **shared co-lo tenants**?
- Co-investment with **data center peers** in regional hubs?
- Creation of green tariff style **renewables offered by co-los**?
- Collective **negotiation with utilities**?
- **Demonstrate to policymakers** that internet companies are “shopping” for states and cities that promote renewables?
- Education to wider corporate **users of data centers** about value chain energy opportunities?



Future of Internet Power



Future of Internet Power

An internet powered by 100% renewables



Collaboration and co-investment
for renewables among major players
in the ICT value chain



Capability for renewables
procurement among data center
siting and procurement teams



Call to action for policymakers and stakeholders to
assist with addressing barriers that stand in the way

Future of Internet Power

An internet powered by 100% renewables

Near Term Aim

- **20 ICT companies have 100% renewables goal by 2016**
- This represents a doubling from 10 in one year
- The count as of late July is 15 companies, including 4 from the FoIP membership

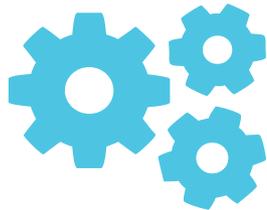
Medium Term Aim¹

- **100 ICT companies get more than half (50%) of their energy from renewables by 2020**
- In 2014, the average renewables mix for the top ~100 ICT companies is approximately 14%
- The “business as usual” trend line for 2020 is only 31%

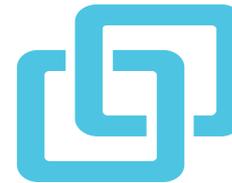
¹ Building on analysis from: Miller, Bird, Heeter, and Gorham (2015). Renewable Electricity Use by the U.S. Information and Communication Technology (ICT) Industry. NREL.

Future of Internet Power

2015-16 Activities



Supplier (Co-lo) Best Practices Framework



Analysis of Co-Investment Opportunities



Siting & Procurement Negotiator Guide



Targeted Education and Advocacy

BSR is a global nonprofit organization that works with its network of more than 250 member companies to build a just and sustainable world. From its offices in Asia, Europe, and North America, BSR develops sustainable business strategies and solutions through consulting, research, and cross-sector collaboration.

More Information:

Ryan Schuchard, Associate Director, BSR
San Francisco
rschuchard@bsr.org



BSR[®]

The Business of a Better World

www.bsr.org



QUESTIONS

Presentation files will be posted at
<http://apps3.eere.energy.gov/greenpower/events/archive.shtml>