



Google

# Google's Search for Renewable Energy

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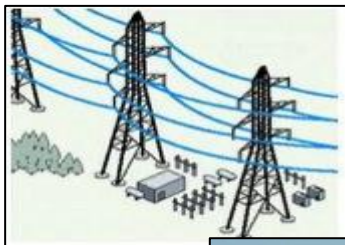
Marc Oman, E.U. Energy Lead, Global Infrastructure

# Why Energy Matters to Google

4.4 TWh ELECTRICITY CONSUMPTION

2.4m METRIC TONS CO<sub>2</sub>

## Data center energy supply



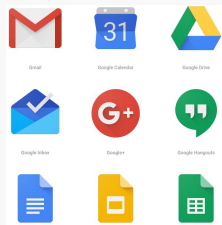
## Investments

- Over \$2.5B committed
- Financial returns
- Technology innovation

## Technology



# It All Runs in our Data Centers ...



## Search

- **100 billion+** searches on Google every month
- Found **60 trillion** web addresses
- Crawl over **20 billion** web pages a day

## Apps

- **1 billion+** active Gmail users
- **240 million+** Drive users
- **1 billion+** monthly active users of Google Maps
- **10 million+** teachers and students use Google Classroom

## YouTube

- **300 hours of video** are uploaded to YouTube every minute
- **400 hours of video** are shared on YouTube every minute
- Localized YouTube in **88 countries** in 76 languages, covering **95% of all internet traffic**

## Photos

- **100 million+** users
- **50 billion+** photos and videos uploaded
- **15 million+** animations and collages

## Cloud & Enterprise

- **1 million+** paid businesses use Google Apps for Work
- **60%** of Fortune 500
- **80%** of Dax 30
- **44%** FTSE100



# 15 Primary Data Center Sites on 4 Continents



## Americas

- Berkeley County, South Carolina
- Council Bluffs, Iowa
- Douglas County, Georgia
- Jackson County, Alabama
- Lenoir, North Carolina
- Mayes County, Oklahoma
- Montgomery County, Tennessee
- Quilicura, Chile
- The Dalles, Oregon

## Asia

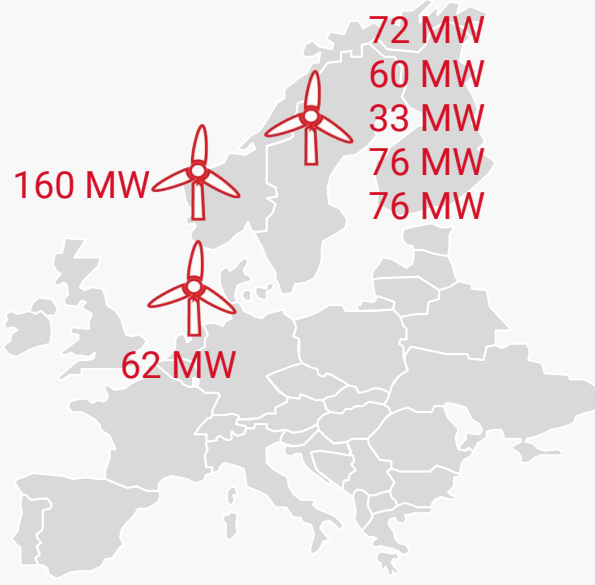
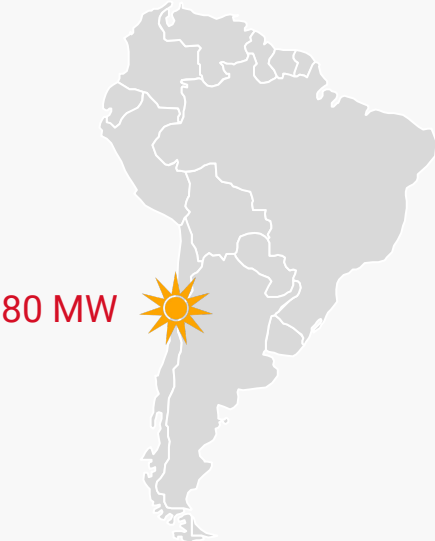
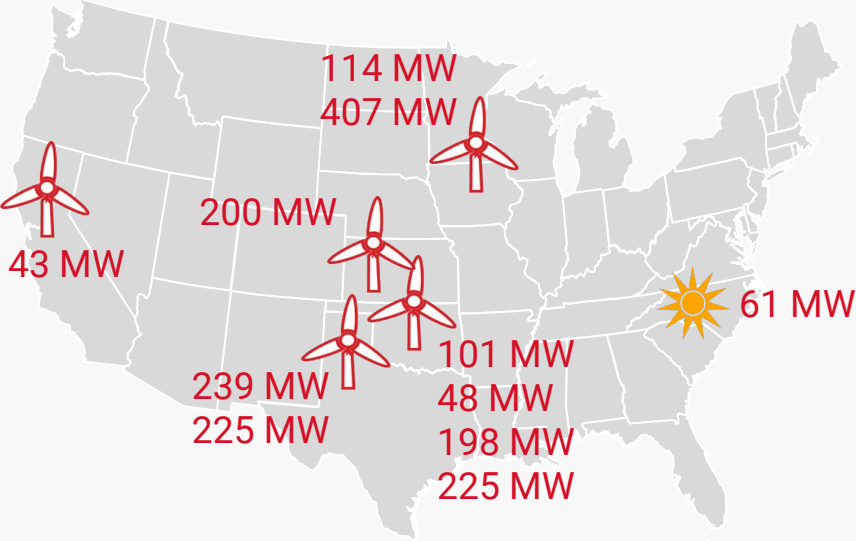
- Changhua County, Taiwan
- Singapore

## Europe

- Dublin, Ireland
- Eemshaven, Netherlands
- Hamina, Finland
- St Ghislain, Belgium

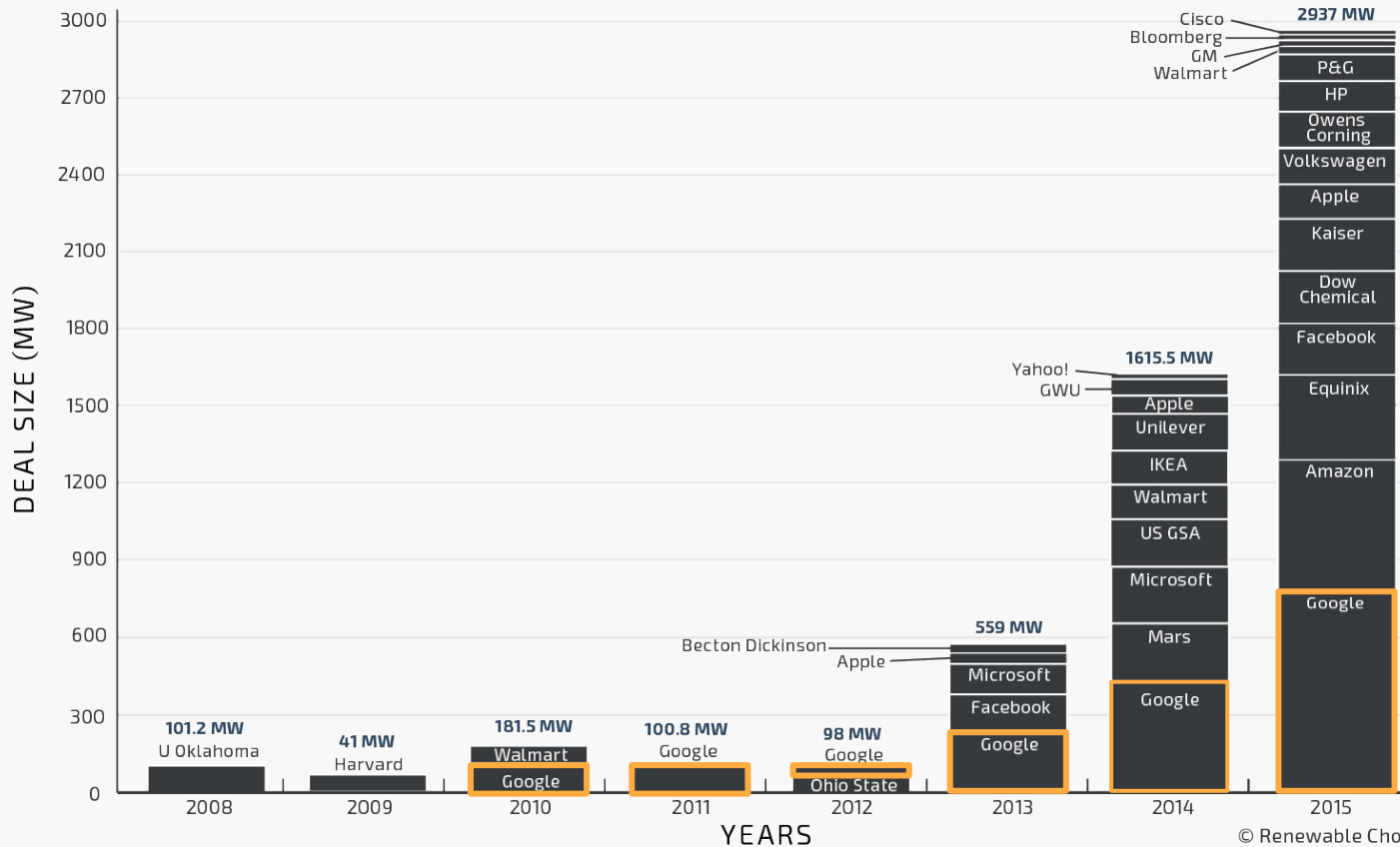
And growing with cloud requirements

# 19 PPAs and 2.5+ GW contracted since 2010



\* Our 9 new deals

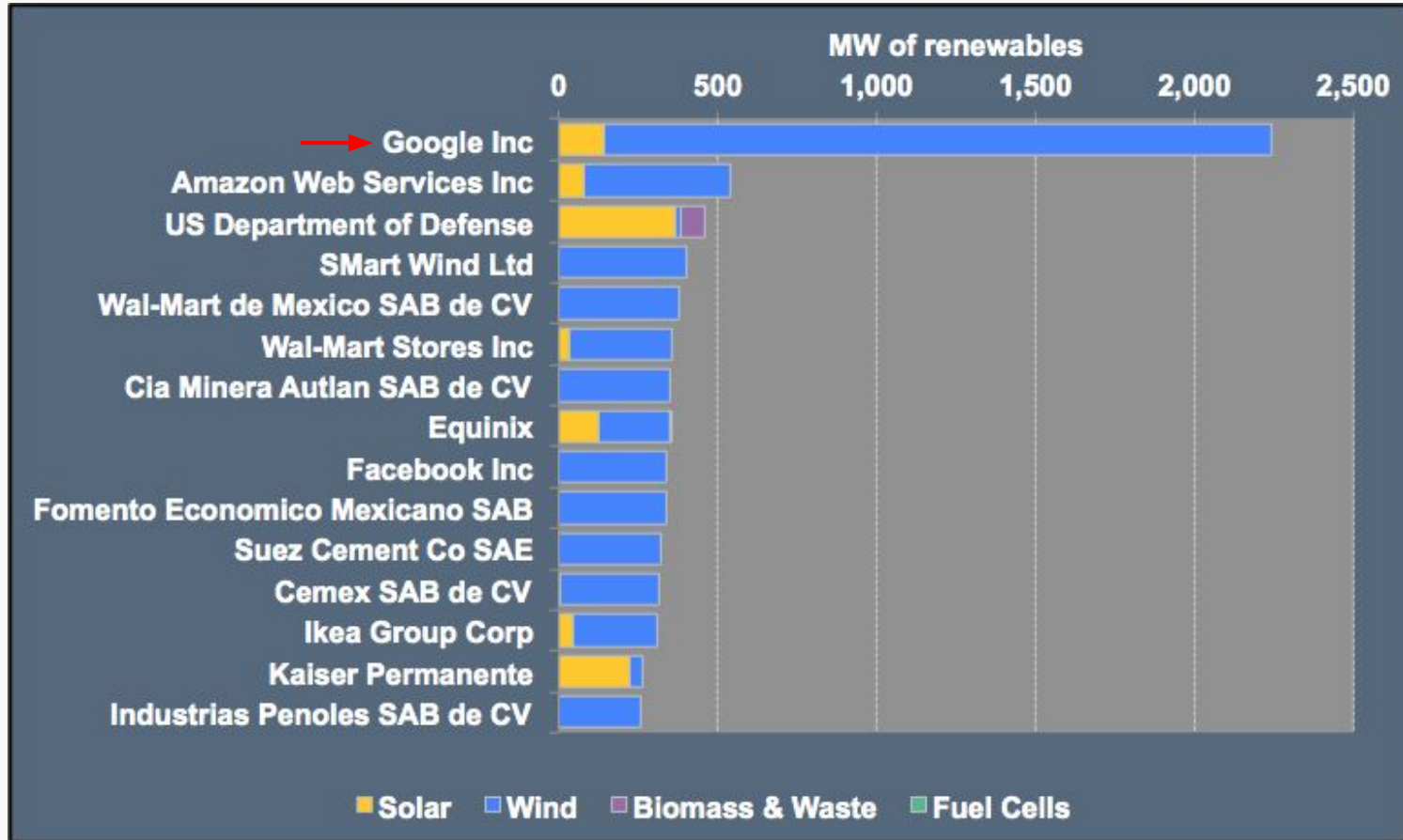
# Led by Google, Corporate Purchasers are Gaining Momentum



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<sup>1</sup> Source: RMI dataset for US only.

# At 2.2+ GW, Google is Largest Non-Utility Renewable Buyer in the World



# But integration of Renewables is not easy

## Goals

**Additionality** : bring  
*new* RE capacity online

**Location** : in the same  
grid network as our data  
center

**Bundled products** :  
Google buys power and  
RECs (or GOOs)

**Acceptable cost**

## Constraints

**Regulatory policies:**  
corporate PPAs not  
always possible

**Wind variability** and  
associated balancing  
costs

**Financial risks**  
associated with  
long-term, fixed-price

**Renewable LCOE**  
going down but so has  
conventional power



# Striving to ensure new data centers are 100% renewable powered from day 1

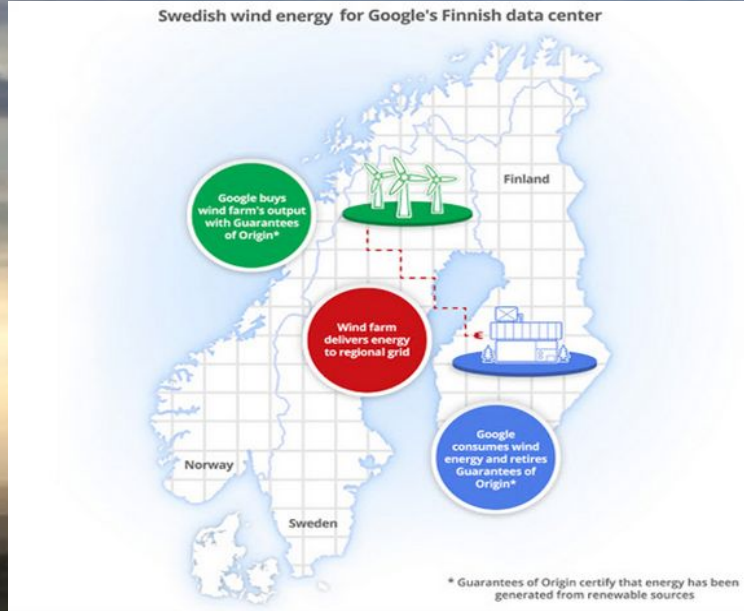


**Widows Creek (AL-USA)**  
**Partnership with TVA**  
**(Tennessee Valley Authority)**



**Eemshaven (Netherlands)**  
**Partnership with Eneco**

# Case study 1 : Google Nordics Power Purchase Agreements



6 PPAs, >500 MW contracted  
10 Years fixed price (typically)  
2 projects in operation since 2015  
1 being commissioned  
3 to come on line in 2017 and 2018

Working with developers directly : OX2,  
Eolus, Zephyr, Rabbalshede  
Owners : institutions (Allianz) , utilities  
(EWZ), funds (Ardian)



Balancing party + Supply activity

# Case study 2: Netherlands Google-Eneco Partnership

Sept 2014 : Google 600 M€ Data Center investment

Nov 2014 : Signature of PPA

End 2015 : Wind farm operational

Location: Delfzijl Harbour

Capacity: 62.7 MW (19 x 3.3 MW)

Expected volume 185 GWh/year

10 year PPA

Power + Guarantees of Origin (GoO)

Service contract.



## Parting thoughts

- ✓ We'll continue to do more and diversify our portfolio
- ✓ Utilities coming to the game
- ✓ Persistence : PPA Agreements, Green Tariffs
- ✓ Think bold, not afraid to disrupt
- ✓ Closer industry collaboration : a new way forward ?
- ✓ Aim for new heights : Migration to Cloud





Google

Thank You

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