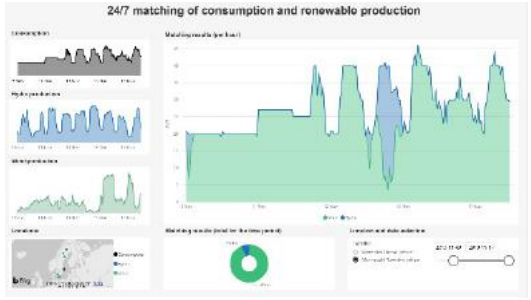
Decarbonizing the grid

Patrik Öhlund
Director Energy Markets EMEA

Our new DC’s in Sweden – world-class sustainability

Efficient cooling

Rainwater harvesting



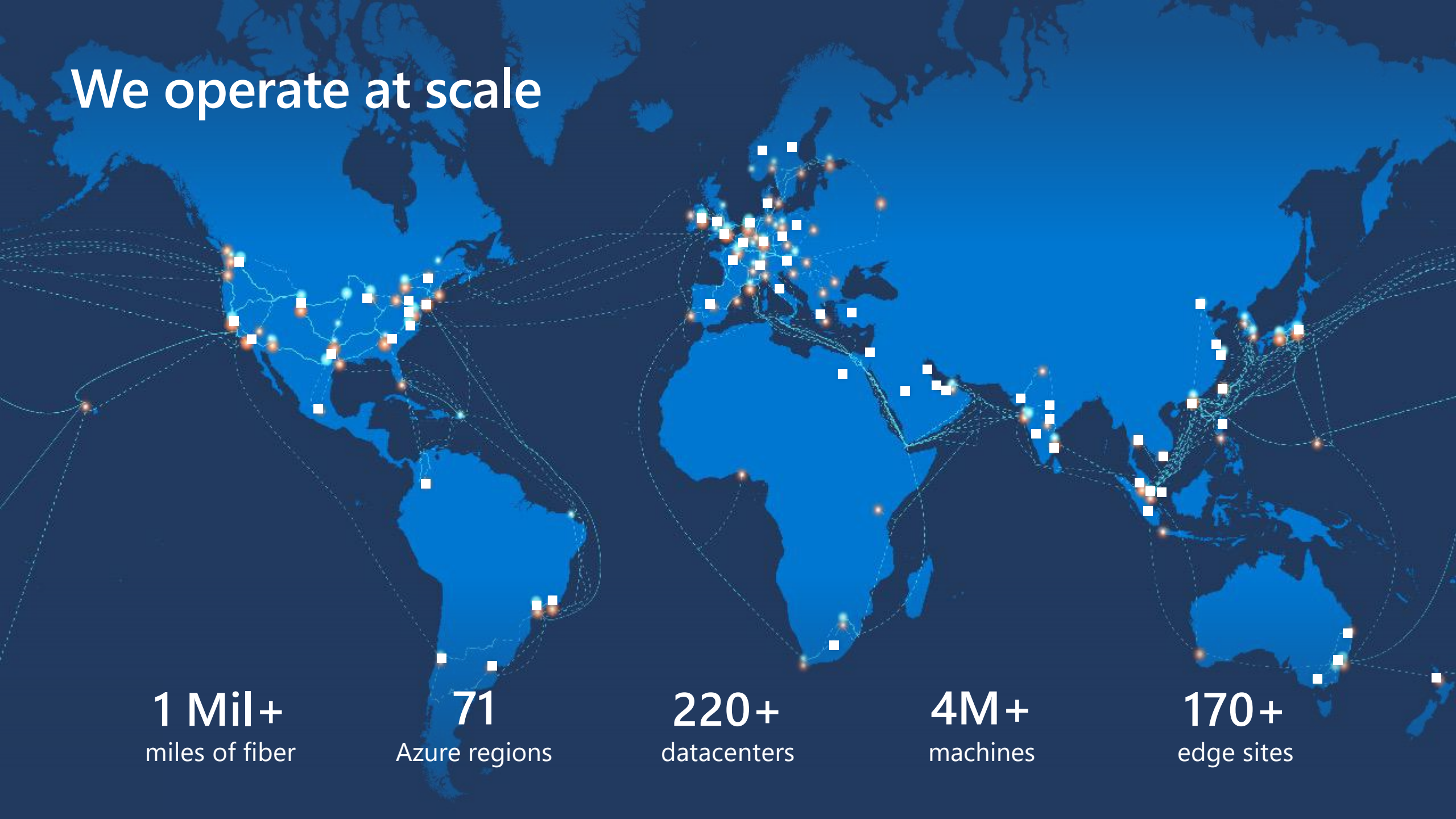
VATTENFALL

Microsoft Azure

24/7 renewable energy matching

Renewable fuel for backup power

We operate at scale



1 Mil+
miles of fiber

71
Azure regions

220+
datacenters

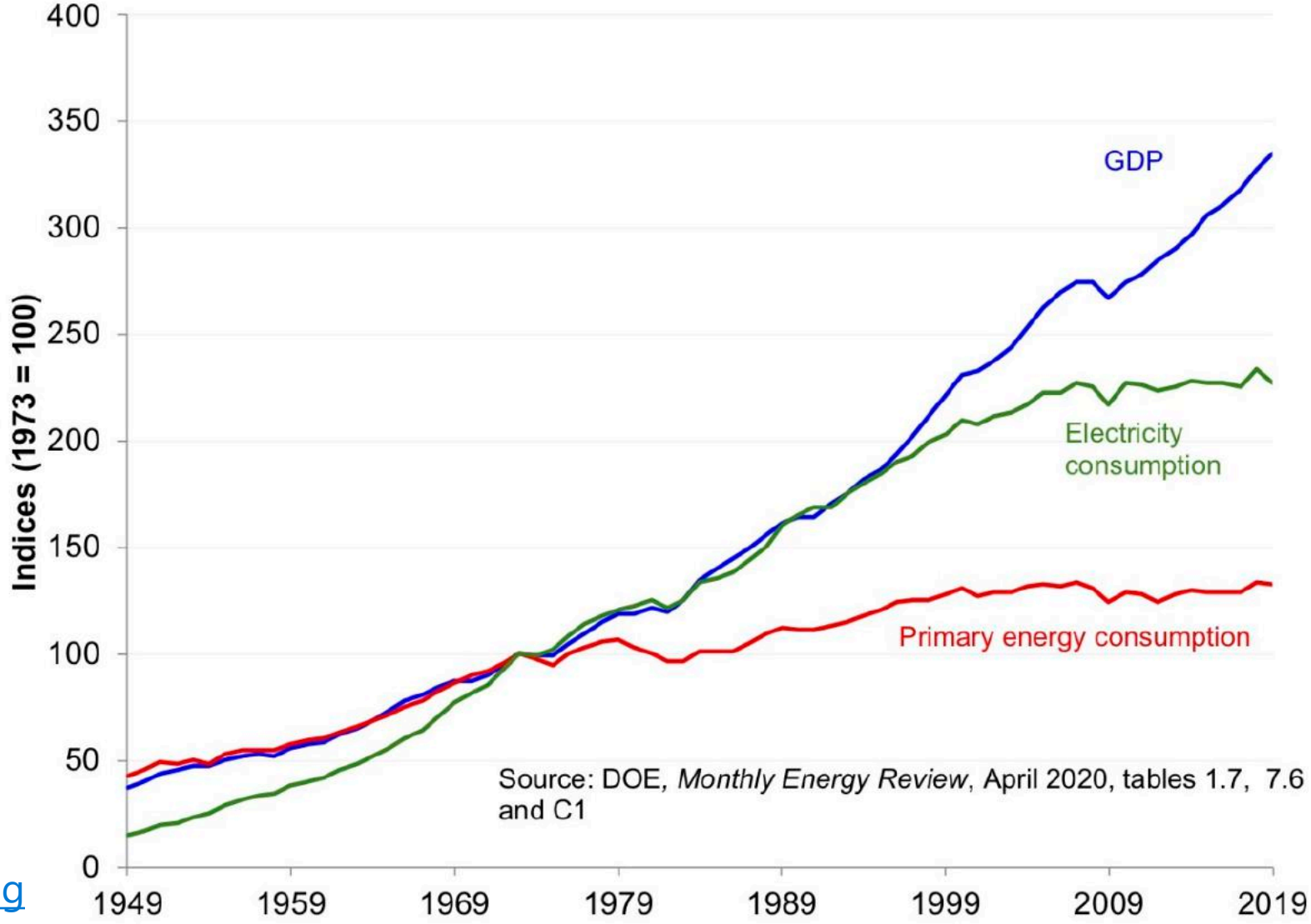
4M+
machines

170+
edge sites

Microsoft

Sustainability & the future of energy markets

Over the last century, economic growth has been tied to energy consumption, only recently have we seen a divergence



[Jonathan Koomey: Blog]

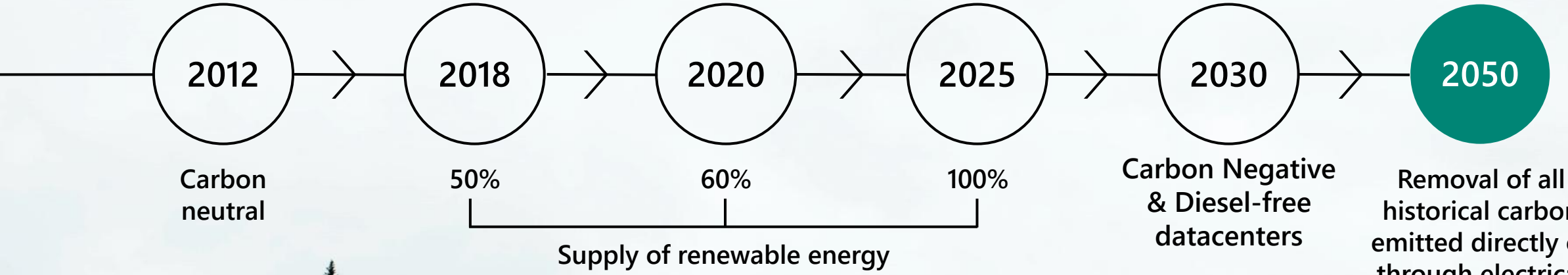
Technology has become an integral part of everyday life…

…datacenters are at the heart of the internet…

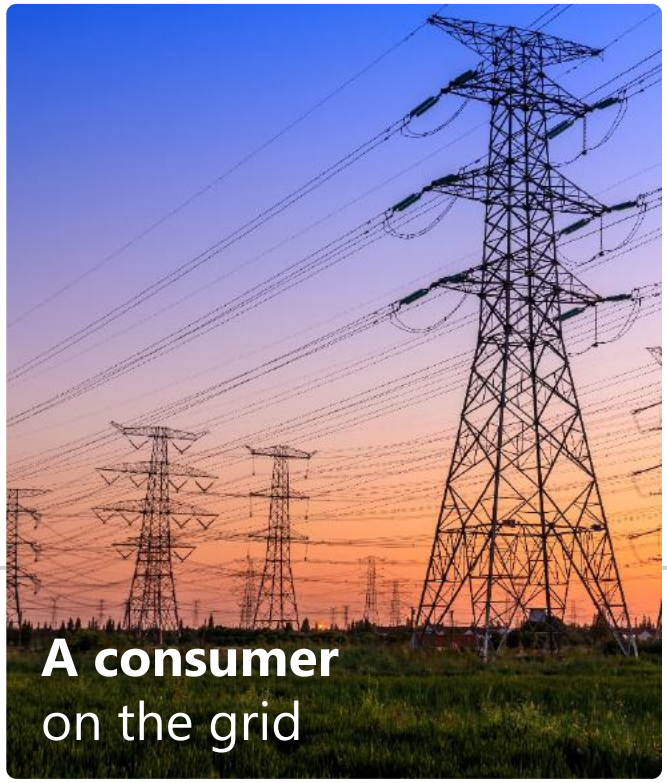
…and energy is the key input


To power customer innovation, Microsoft operates datacenters that are large energy consumers.
We are committed to innovating sustainable energy solutions

At Microsoft, we are committed to sustainability



Microsoft sees energy from three perspectives

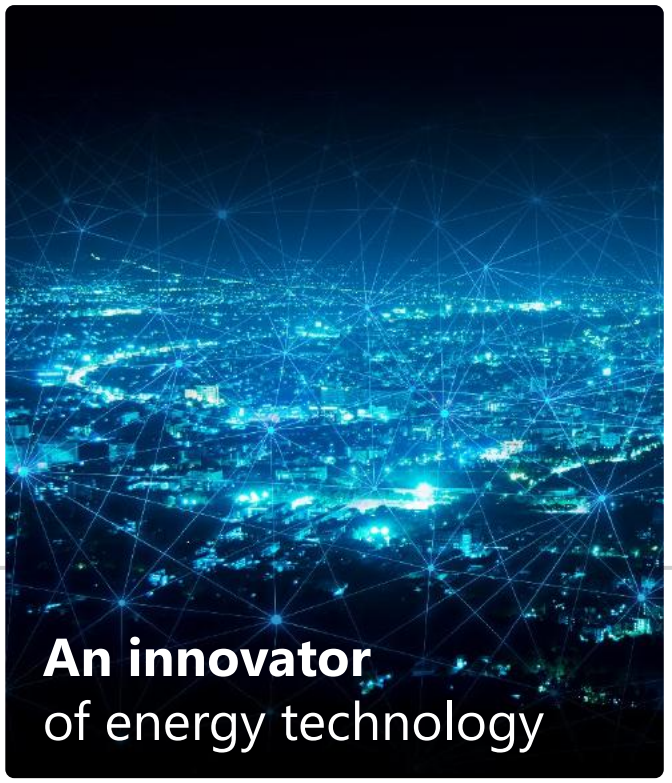


A consumer
on the grid

Large customer with **stable, high-value load** and high average load factor

A collaborator
in clean energy & grid

Dedicated to procuring **100% renewable energy,** investing in **grid infrastructure** and being a **backup provider**



An innovator
of energy technology

Improving **grid reliability** and enabling **environmental efficiencies**

Innovator: Power sustainability solutions

Smart Grid Pilot Program, **an Azure solution**, received the *Innovative Star of Energy Efficiency Award: Power Generation and Supply*. The technology helps Agder identify ways to operate the grid more efficiently through utilization of distributed energy resources, device controls and predictive forecasting.

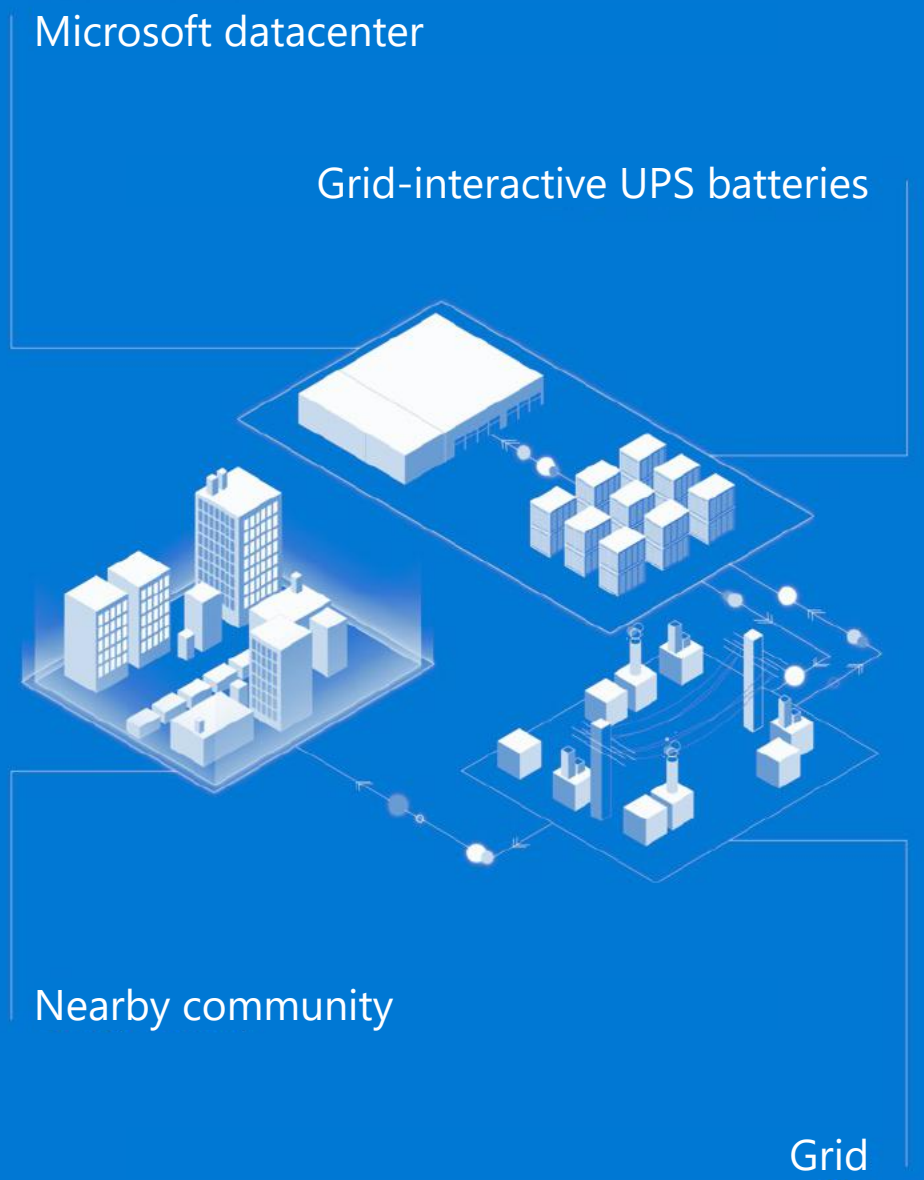
Ørsted operates 1,300 offshore wind turbines that provide power to 11.3 million people in Denmark. It is phasing out coal and will increase its capacity to 15 GW of renewable energy, enough to power 30 million people. Microsoft **advanced analytics** and **artificial intelligence** helps the company transform data from its turbines into insights for predictive maintenance that saves time and resources.

Ho Chi Minh City is saving more than 50 million cubic meters of water per year with **predictive loss analysis** powered by the **Microsoft Cloud**.

PWN uses **Azure IoT and AI analytics** to enable North Holland purification of over 25 billion liters of water through low-chemical, natural purification.

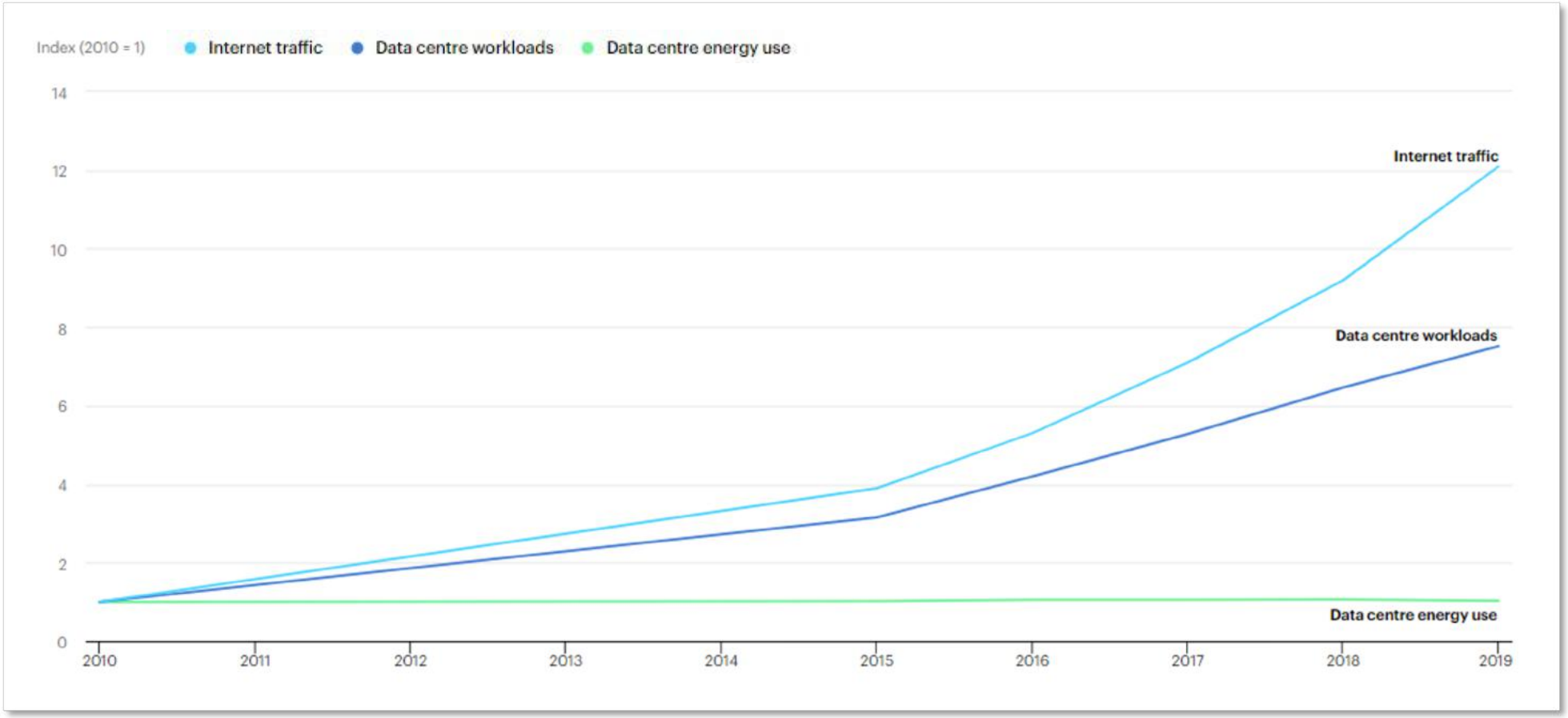
Collaborator: Improve reliability and resiliency

- Supporting investments in transmission, distribution, and interconnection facilities
- Developing storage, grid-interactive UPS, hydrogen fuel cells and other clean backup power solutions
- Augmenting local power deficiencies
- Supporting the “grid of the future” with IoT, AI analytics, and compute technology



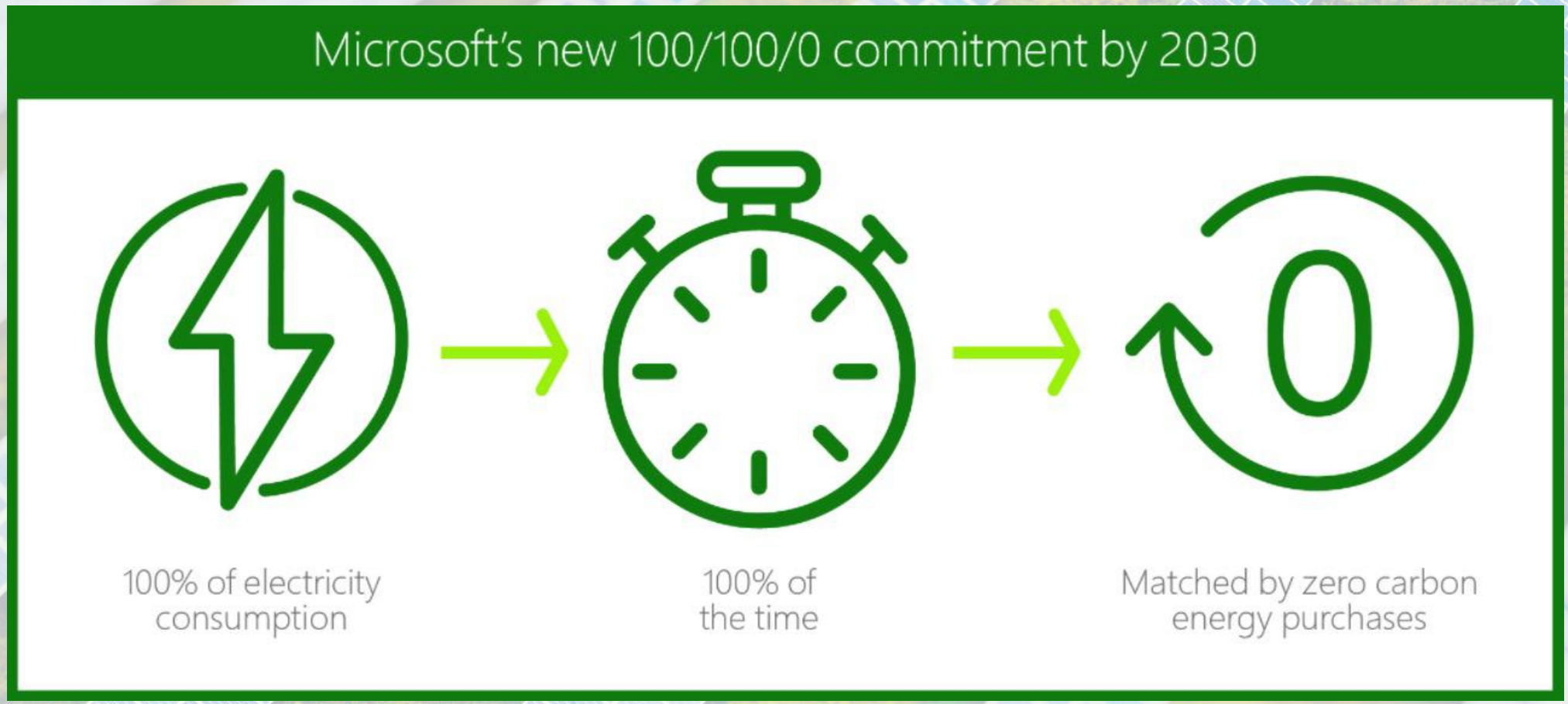
Consumer: Cloud Efficiency Over Last Decade

Workloads increased 8x and traffic 12x ...yet datacenter energy use remained constant



IEA, *Data Centres and Data Transmission Networks*, June 2020

We recently announced our 100/100/0 commitment



100/100/0 can accelerate complete grid decarbonization by illuminating when and where we rely upon carbon-based resources

when

100/100/0 requires our load and carbon-free energy production to be matched at all times. By contrast, our 2025 goal focuses on annual totals of electricity consumption and renewable energy production.

where

Additionally, we will match our consumption and purchases within the same grid systems. Our 2025 goal did this on a global basis.

Collaborator: as we work towards 100/100/0, we are developing solutions that help others decarbonize

With our partner Vattenfall, we developed the first commercially available 24/7 hourly energy-matching solution.

Microsoft is a flagship customer of FlexiDAO's 24/7 solution, which will enable Eneco customers including Microsoft to have 24/7 energy-matching tools at scale.

MSFT-Vattenfall pilot: 24/7 renewable energy

1 Hourly GOs

2 CO2 stamping

3 Scalable products

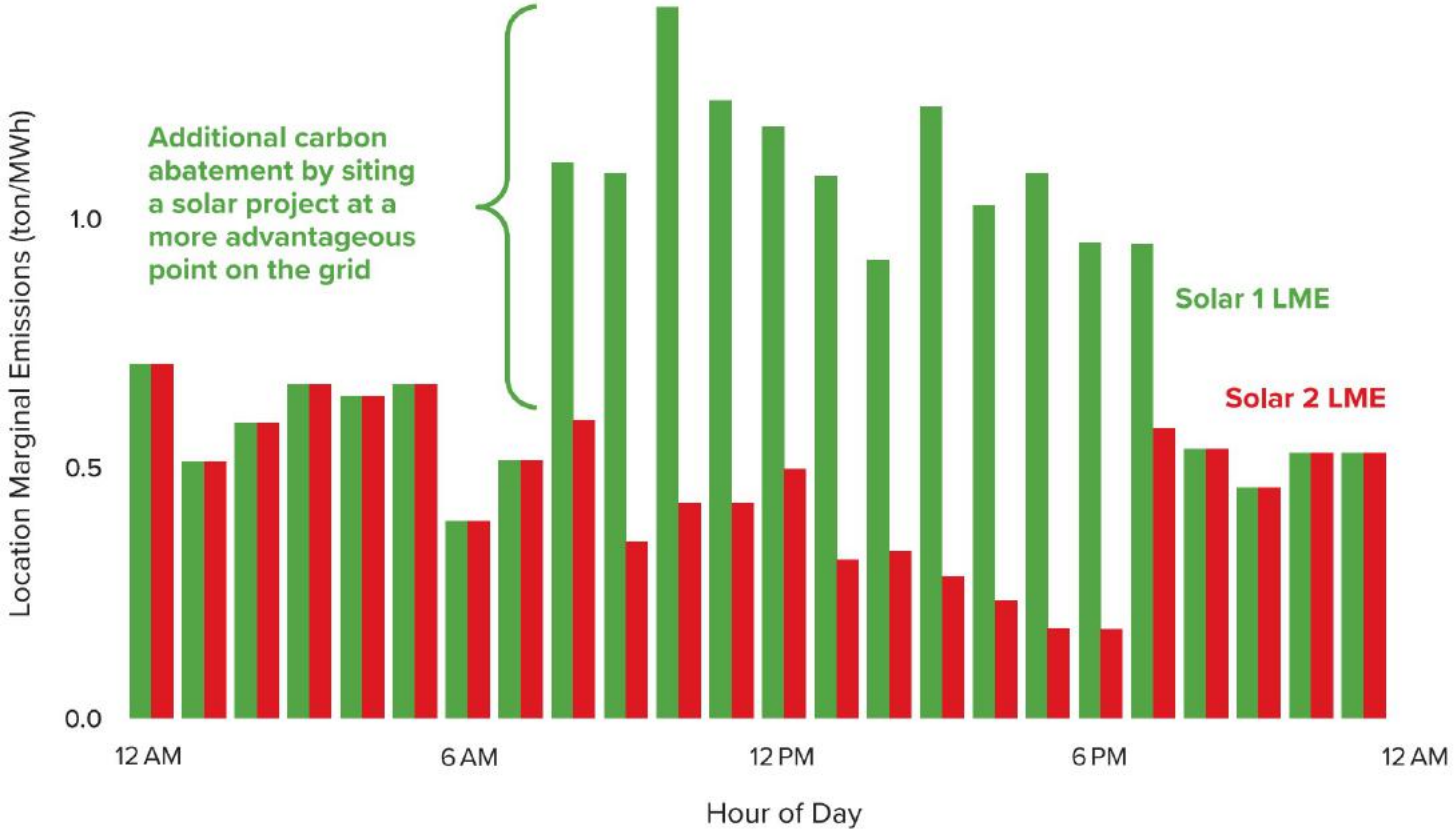
Collaborator: Locational marginal emissions, a force multiplier

"Directing clean energy deployment to the highest-value renewable projects has the potential to *double the carbon impact*."

—REsurety

Figure 1: Large Differences in LME Between Seemingly Interchangeable Solar Projects

LME of Two Solar Projects in Texas Across an Example Day



Notes: Figure shows hourly LMEs for two solar facilities on June 13, 2018. Both facilities are located in ERCOT's Far West, on either side of a binding transmission constraint.

MSFT-REsurety pilot: CO2↓ matters most

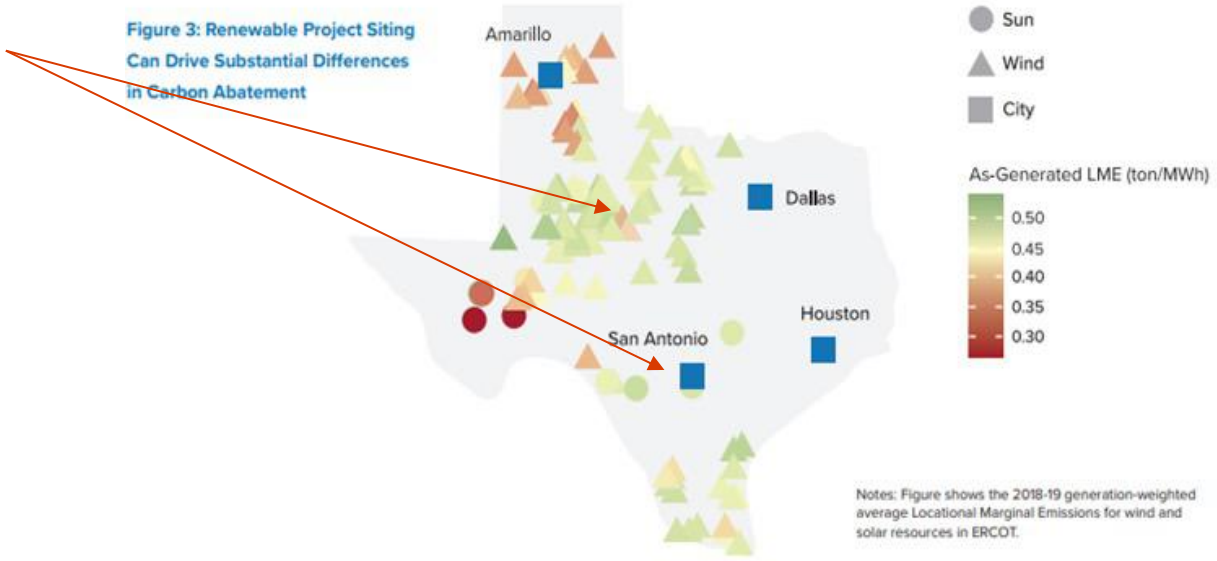
Net CO2 math improves Scope 2

For a load in San Antonio, and a wind farm in Central Texas…

Scenario	100% RE annual or hourly	100% RE annual	100% RE hourly
RE Accounting Methodology	GHG Acc Protocol: Market-based	Locational marginal emissions	Locational marginal emissions
CO2 methodology	Asset-specific, annual	Marginal, nodal, hourly	Marginal, nodal, hourly
Net CO2 position (Metric Tonnes)	0	152,000	86,000

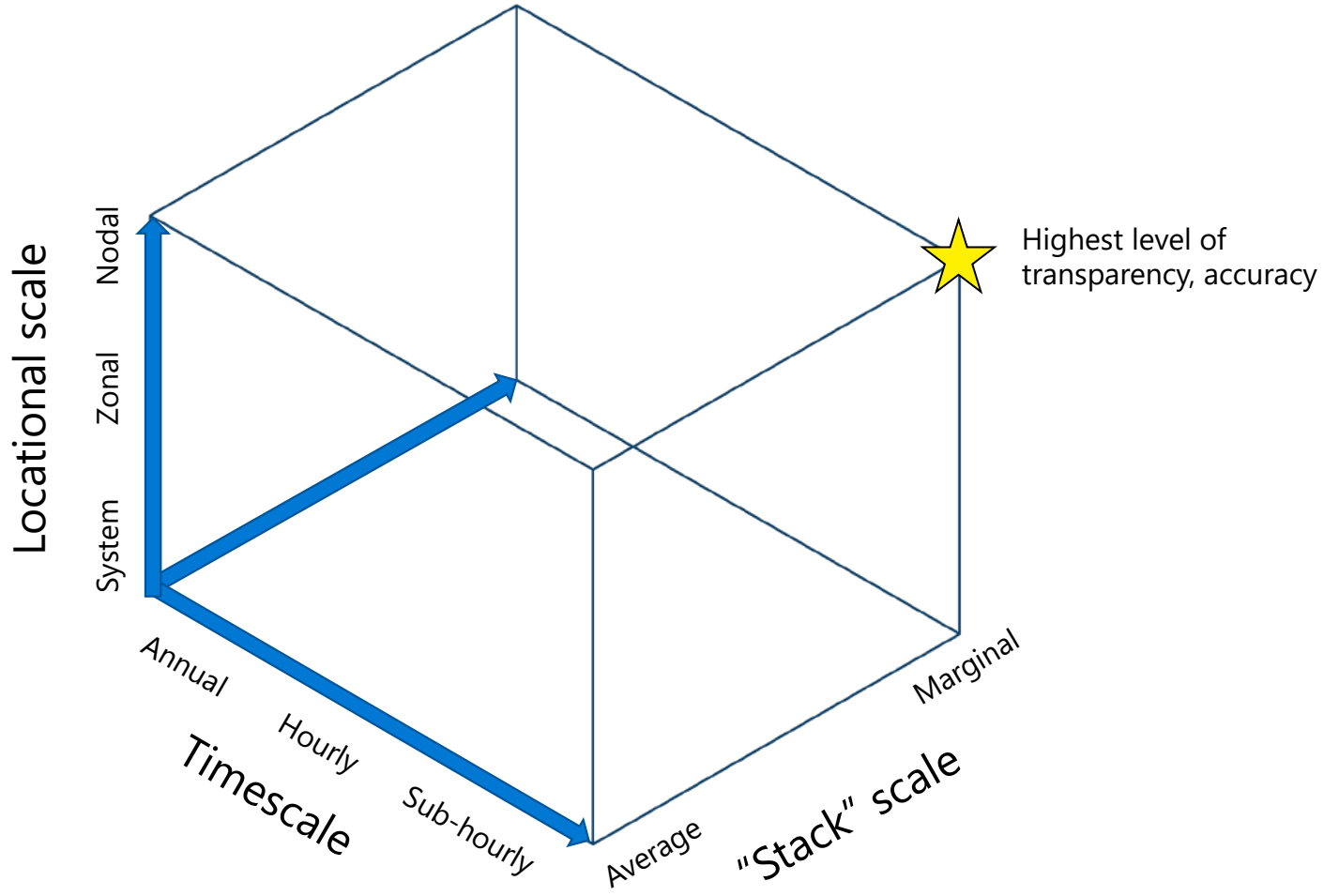
Source: Microsoft analysis

Data tools form 'CO2 reduction heatmaps'

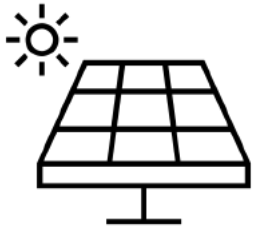


Source: REsurety and The Brattle Group, "Locational Marginal Emissions"

We need more granular carbon data



Parallel innovations need to come together



24/7 RE = new GOs, attributes

FLEXIDAO

EnergyTag

ENERGINET

M-RETS

certiQ

enosi

SBTs = new CO2 metrics/offtake

pjm

WattTime

REsurety

electricityMap

TCR

3 big takeaways

1. **Clean energy purchasing is helpful, but no substitute for policy**
   - *Corporate PPAs >100GWs globally, concentrated in the USA*
   - *1,000s of firms feature RE purchasing and/or science-based targets*
   - *Power market design, utility practices, etc. should amplify this progress*

2. **New data tools improve corporate/policy efforts to decarbonize**
   - *Clean MWhs = means to an end, e.g. CO2↓*
   - *Not all clean MWhs create the same outcomes in CO2↓*
   - *New data tools can link clean MWhs to CO2 outcomes*

3. **TSOs/utilities are essential to better CO2↓ scoreboards**
   - *RE is largely built where convenient/possible, not where necessary*
   - *Purchasing 100% clean energy ≠ consuming 100% carbon-free energy*
   - *Better CO2↓ metrics matter for power industry innovation/infrastructure*


Thank you!