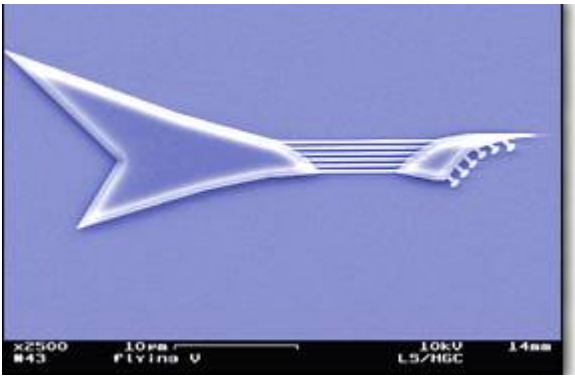
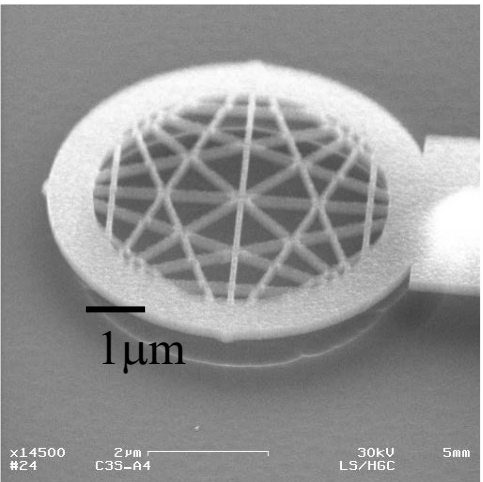
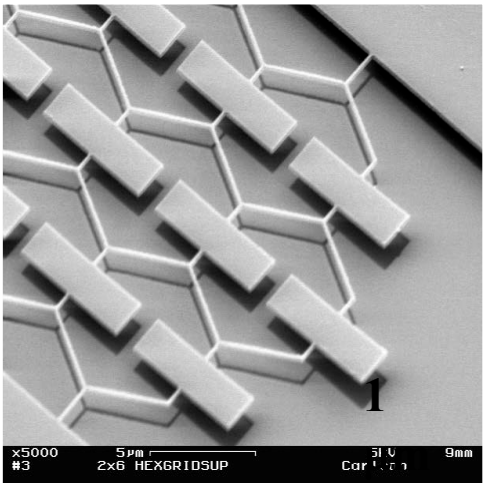
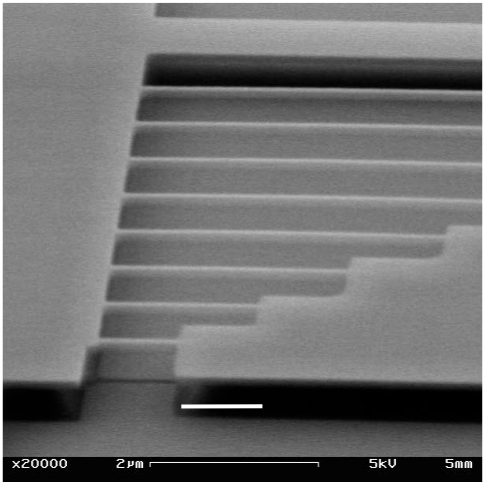
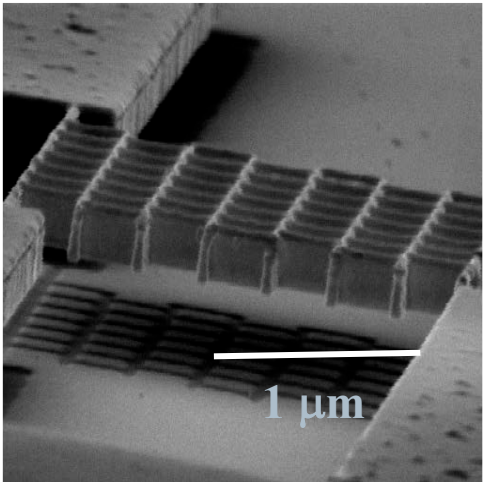


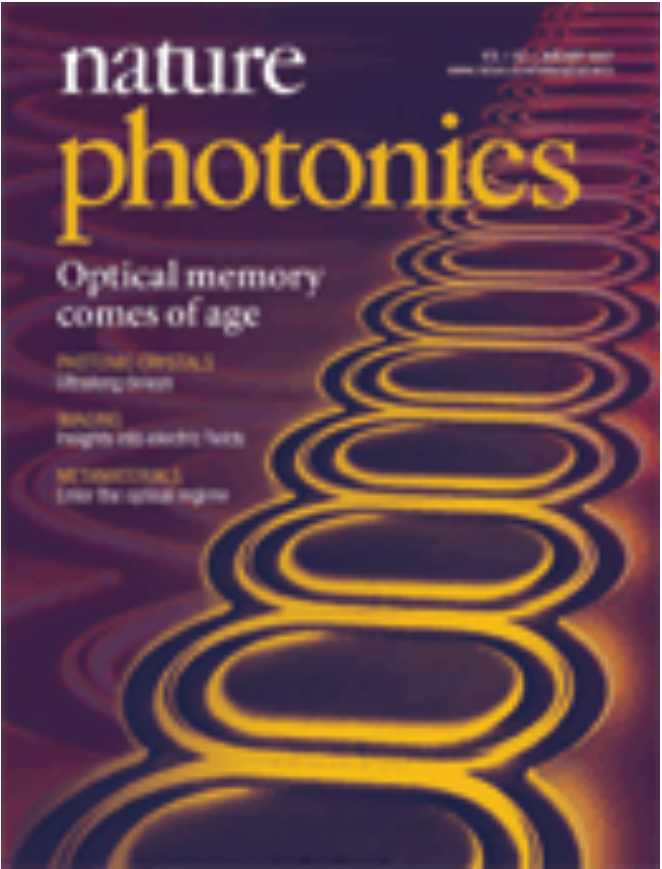
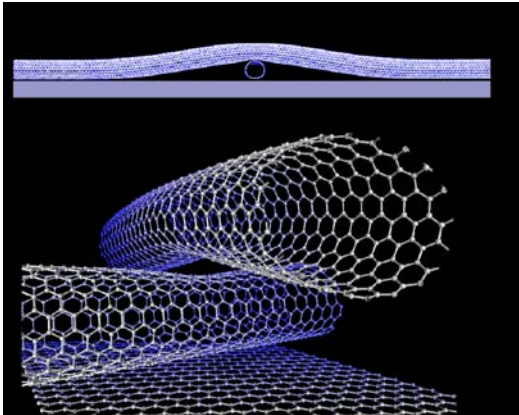
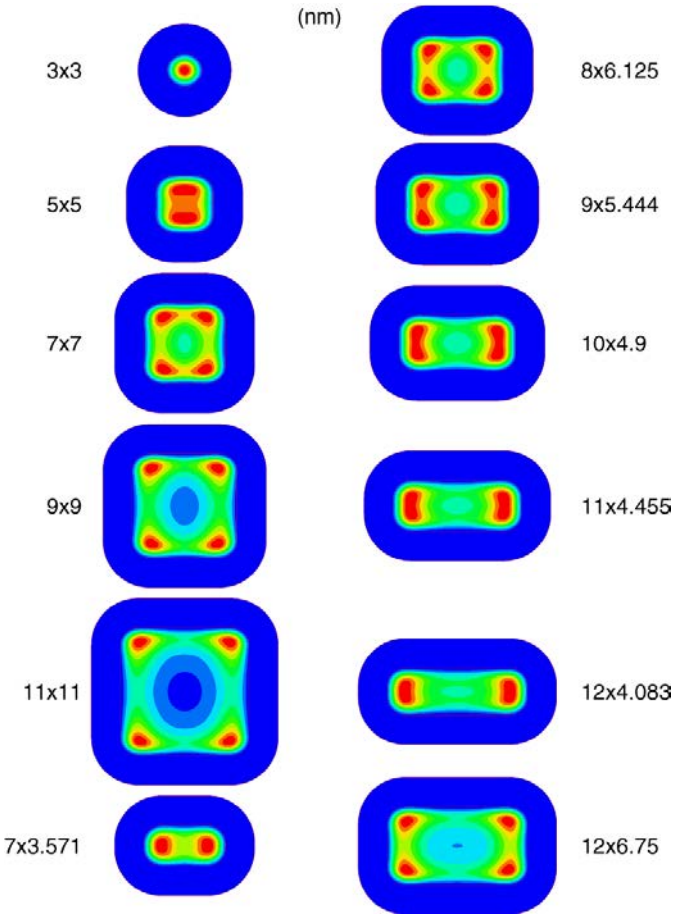
The Accelerating Energy Transition

Lidija Sekaric, Siemens

NEMS at Cornell – Craighead Lab



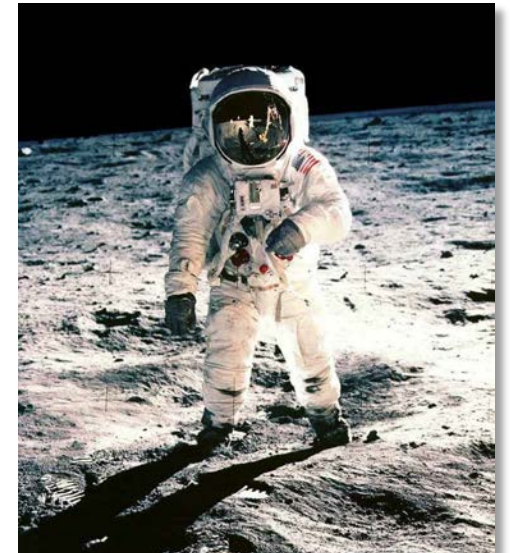
Exploratory nanostructures at IBM T. J. Watson



Next stop: US Department of Energy

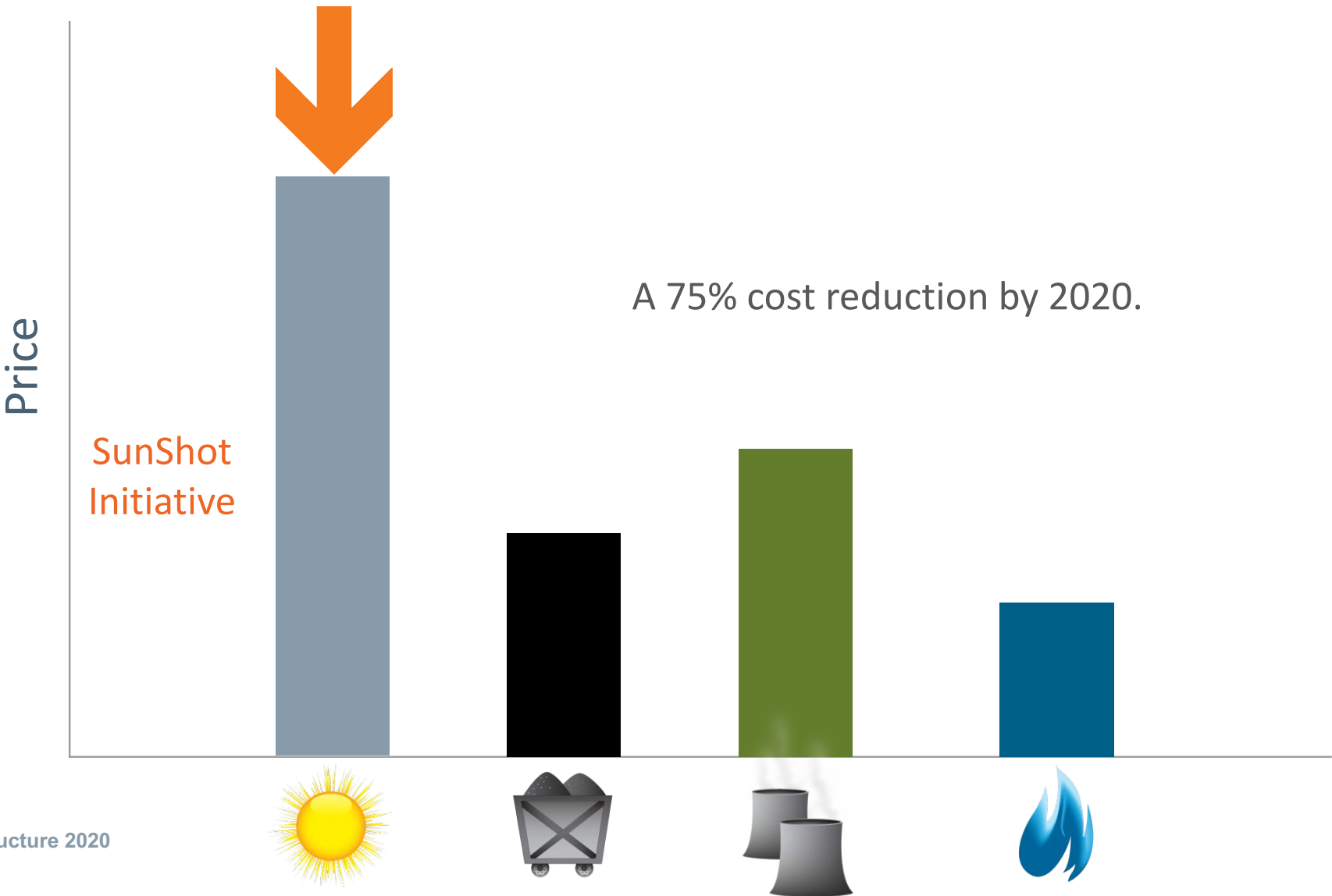


SIEMENS
Ingenuity for life



“We’re telling America’s scientists and engineers that if they assemble teams of the best minds in their fields, and focus on the hardest problems in clean energy, we’ll fund the Apollo projects of our time.”

President Obama
2011 State of the Union

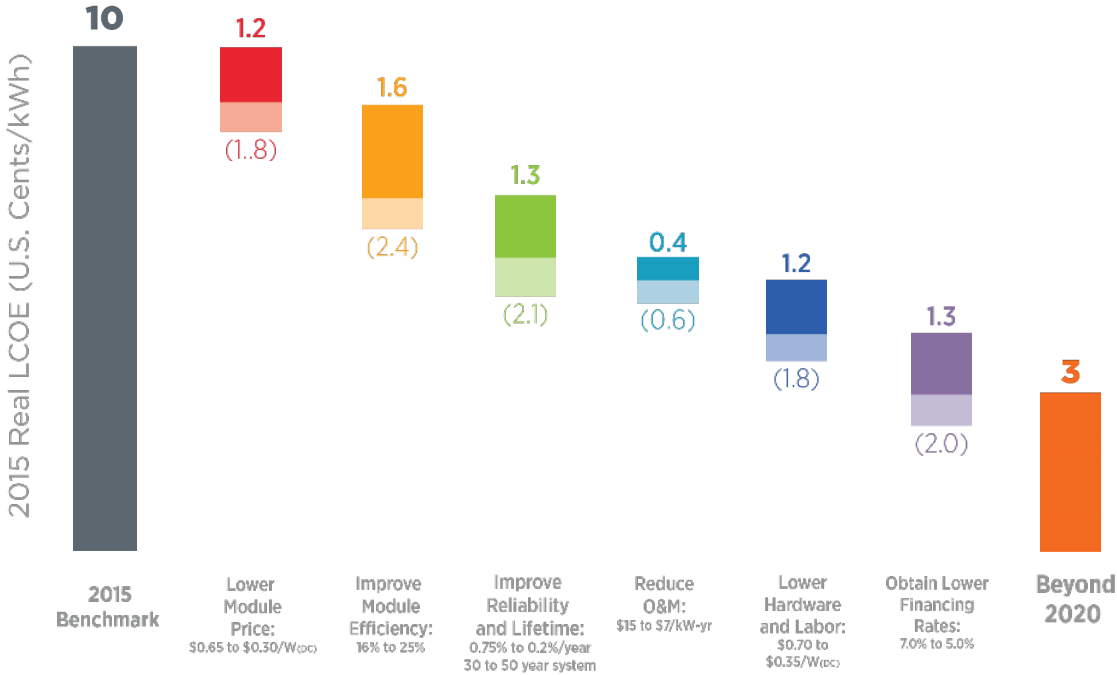




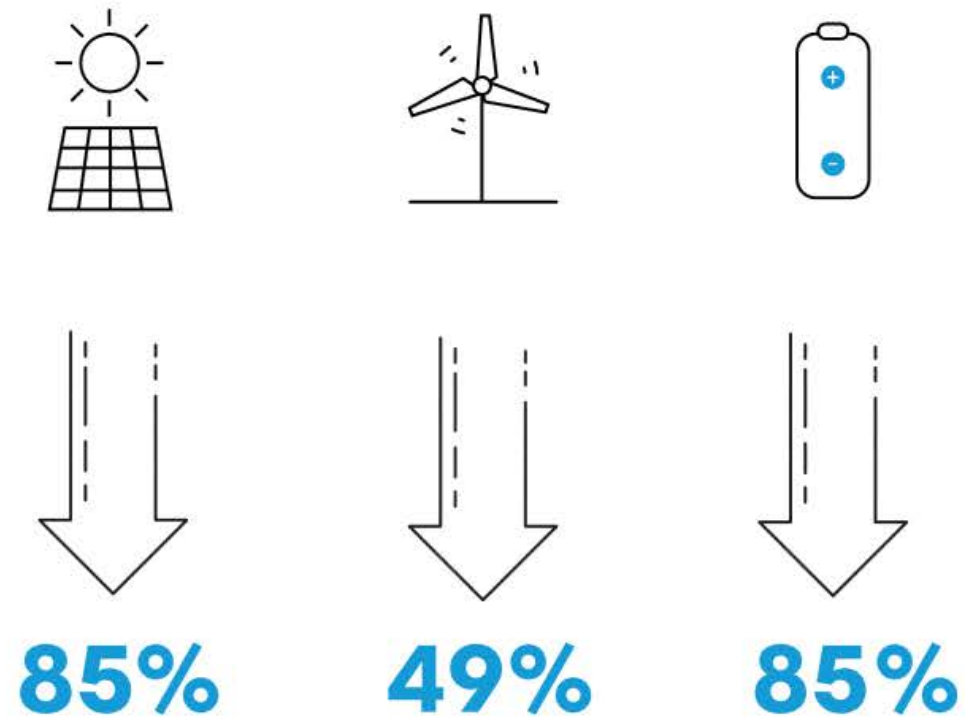
America Will Achieve its
SunShot

Forbes

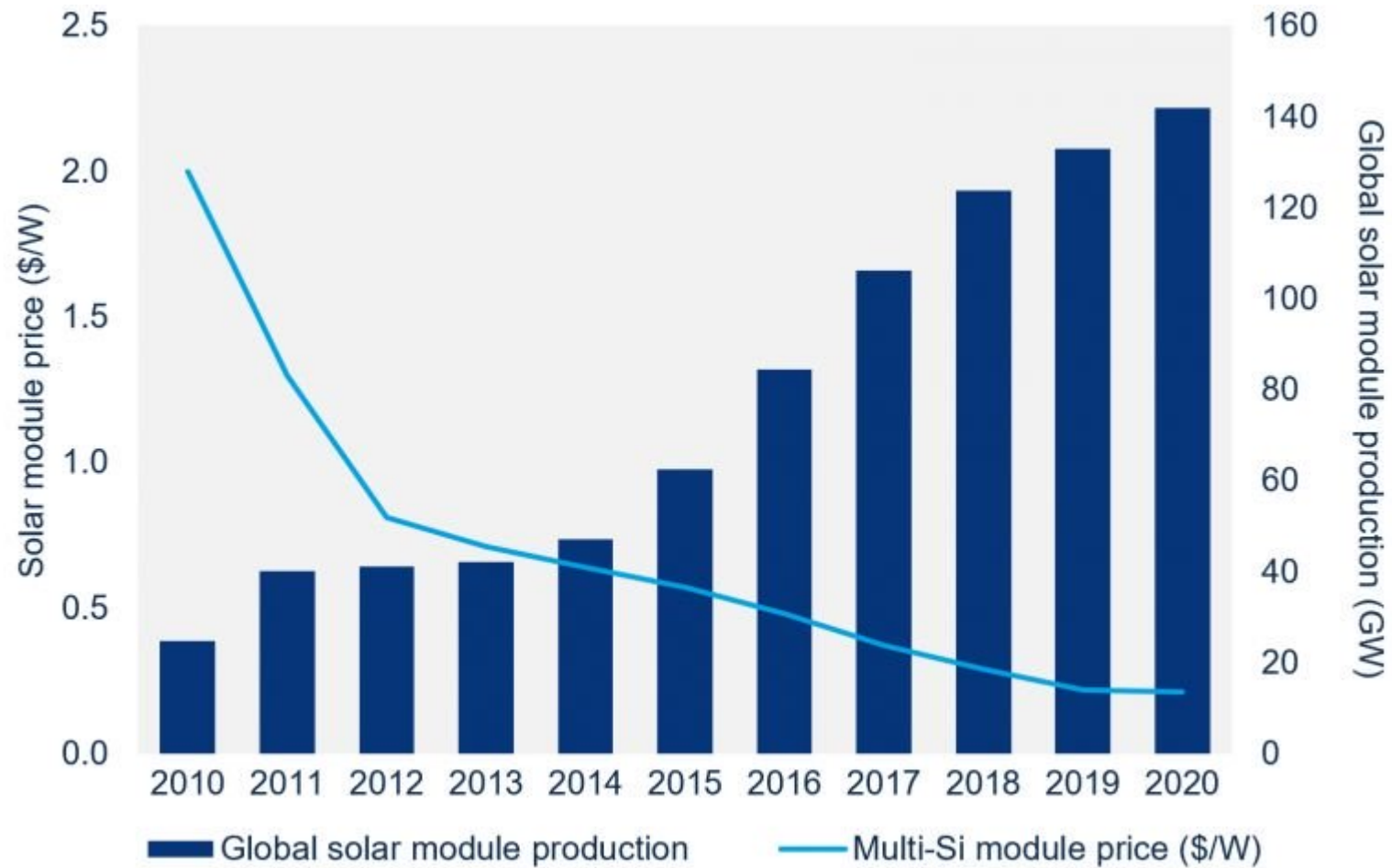
SunShot 2030



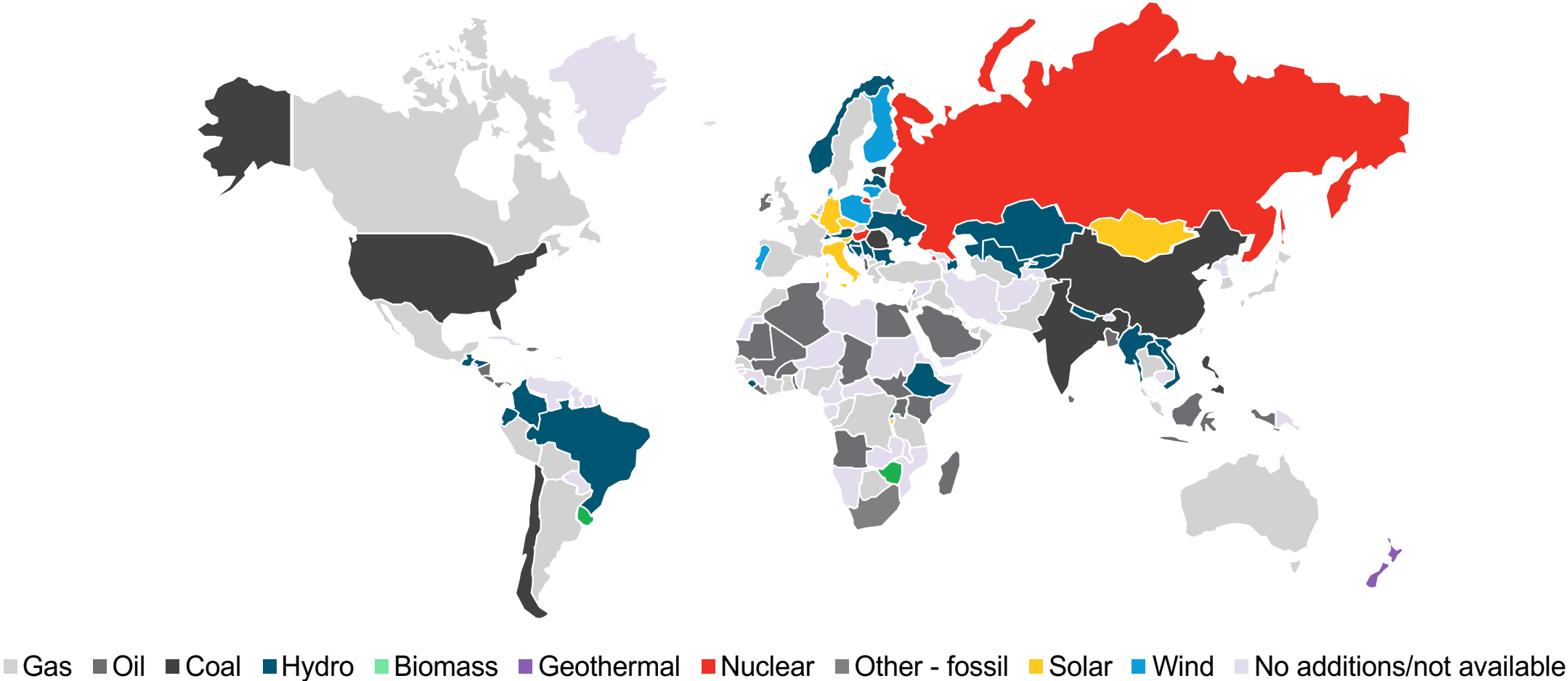
A decade in review: technology cost-declines since 2010



Drop in cost of solar enabled the installation growth

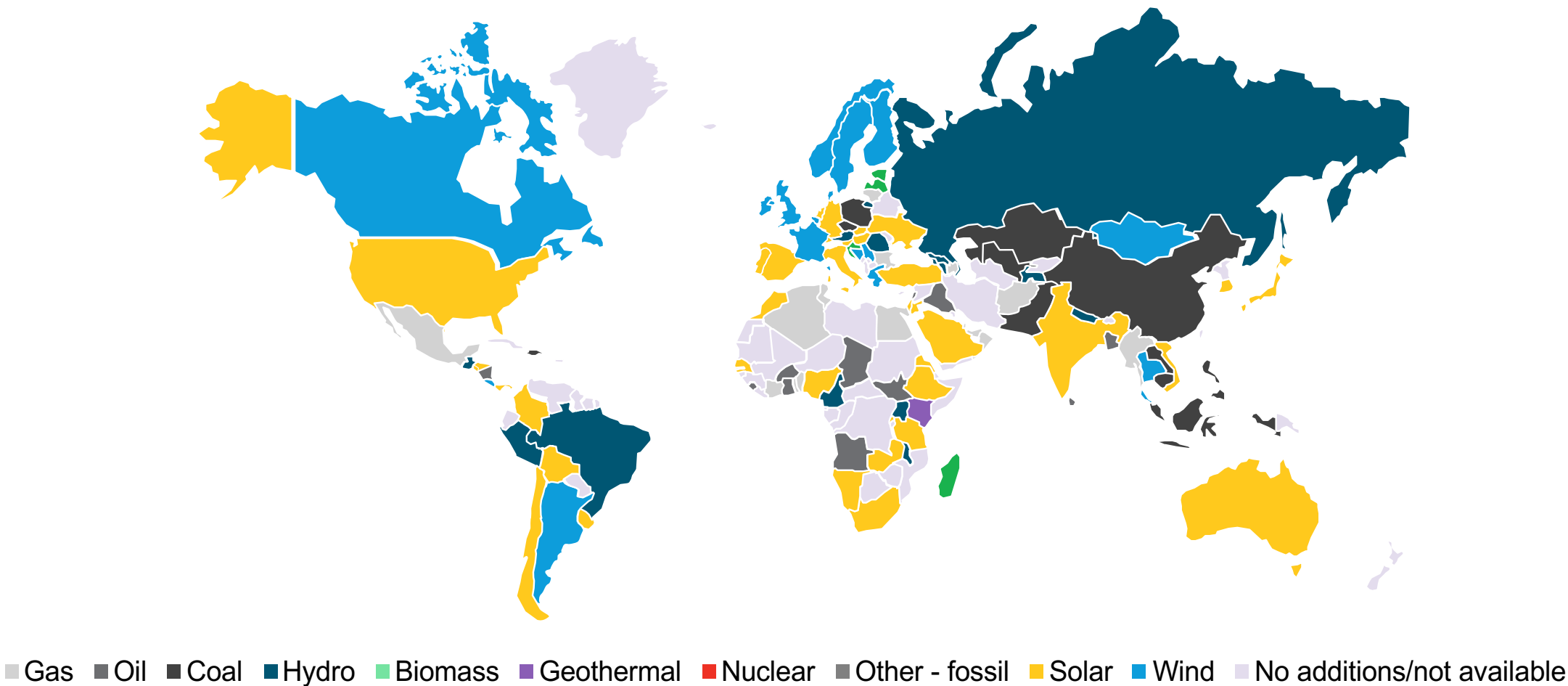


Most popular new power-generating technology installed in 2010



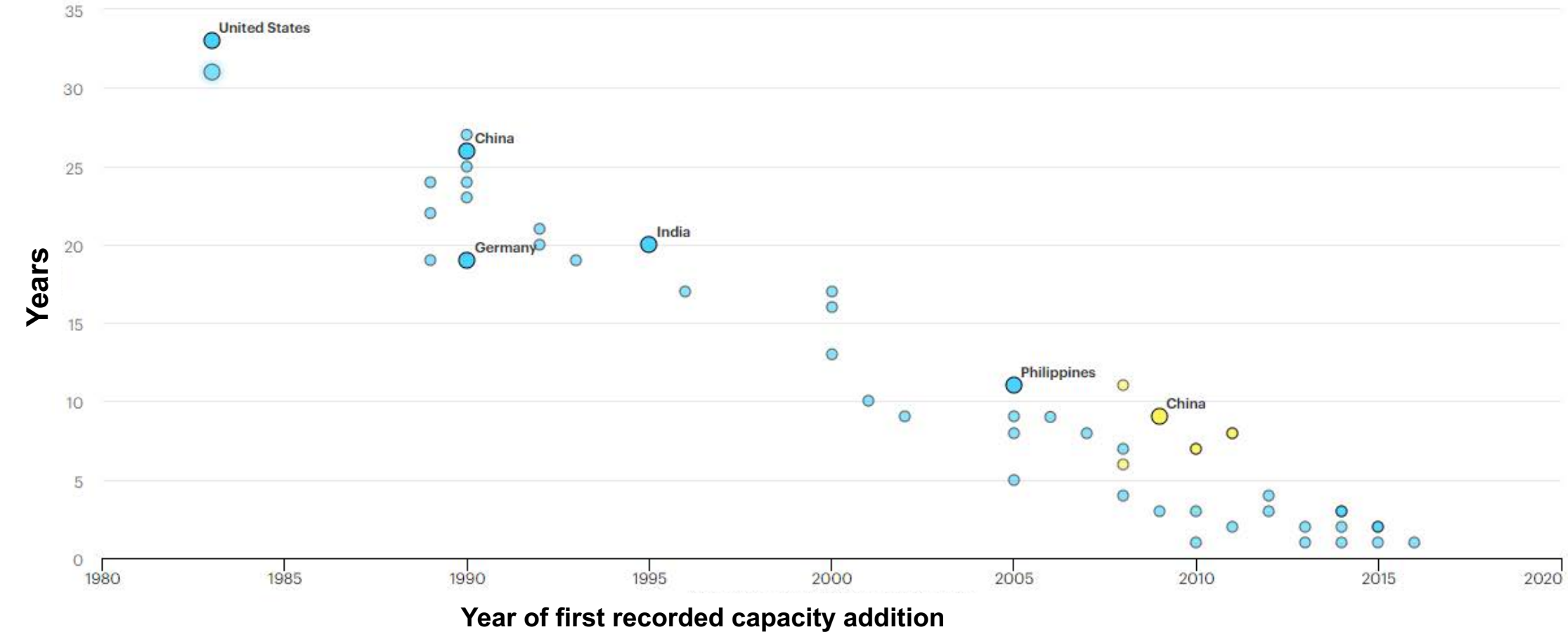
Source: BloombergNEF.

Most popular new power-generating technology installed in 2019



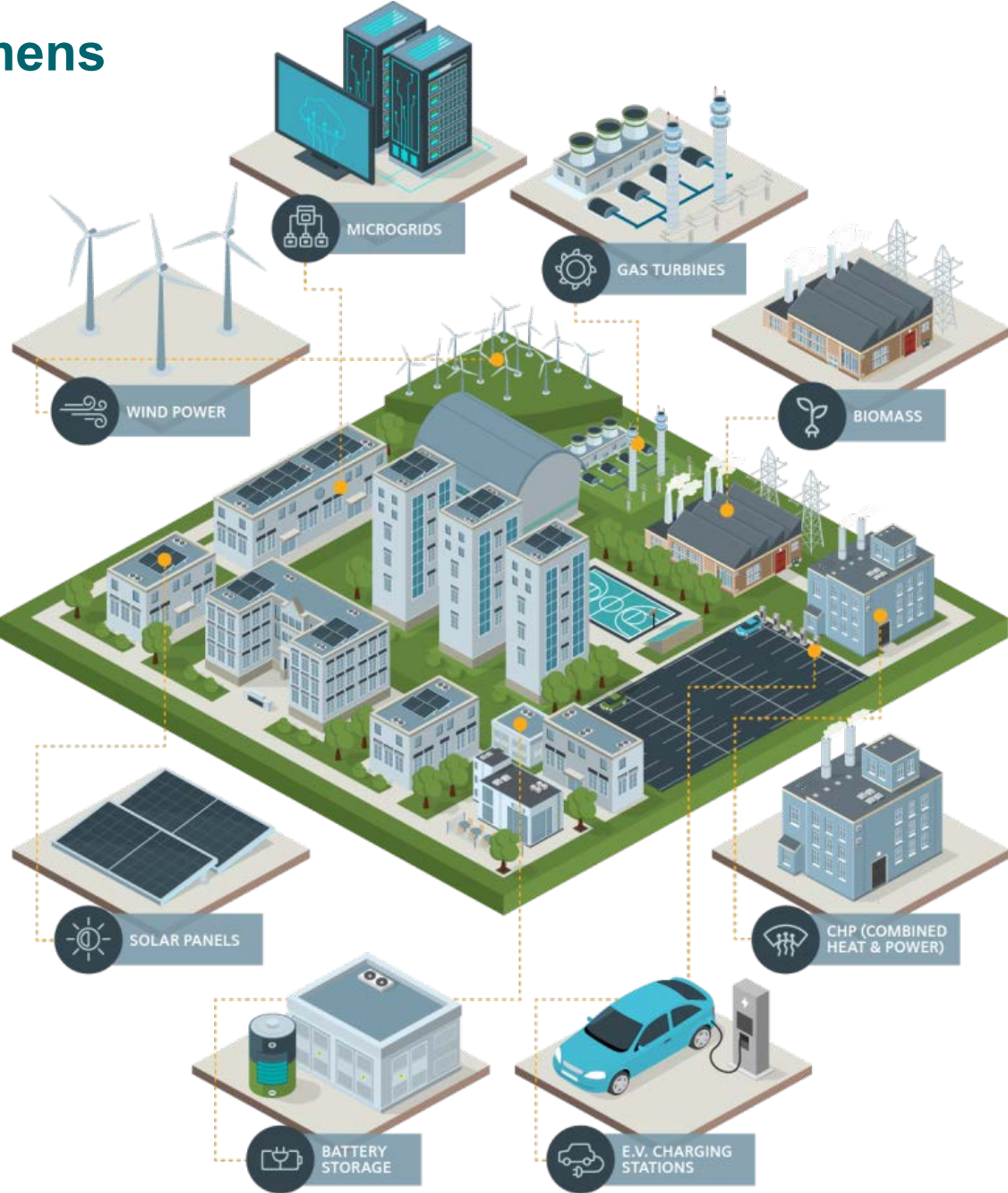
Two-thirds of new global power generation capacity came from solar and wind in 2019

Years to material level of deployment for solar PV and EVs



Germany took ~20 years to meet 1% of national electricity demand from solar PV (2008)
Philippines took ~10 years to reach the same milestone (2015).

Distributed Energy at Siemens



Blue Lake Rancheria low-carbon microgrid



Challenge	Solution
<p>Diverse renewable energy sources –</p> <ul style="list-style-type: none">• Solar PV• Battery storage system• Biomass fuel cell• Bioiesel generators <p>GOALS: energy efficiency, cost savings and emission goals</p>	<p>Siemens microgrid software for managing numerous energy sources and balancing with energy loads</p>
<p>Operations need to be automated to allow limited staff to manage the system in event of a grid outage to ensure energy security for the on-site emergency shelter</p>	<p>Microgrid defined sequence of operations programmed to coordinate with the local utility</p>

7 days

Duration of available on-site power independent from the utility

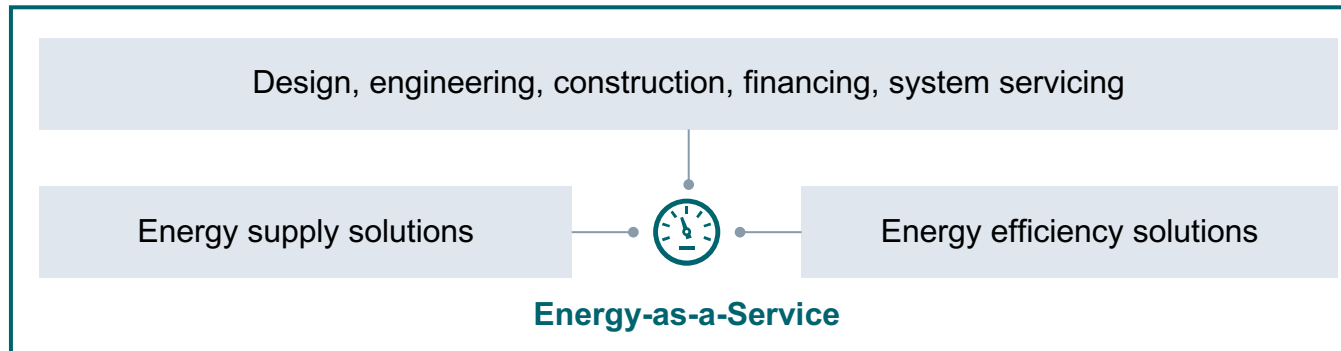


New business models enable the transition

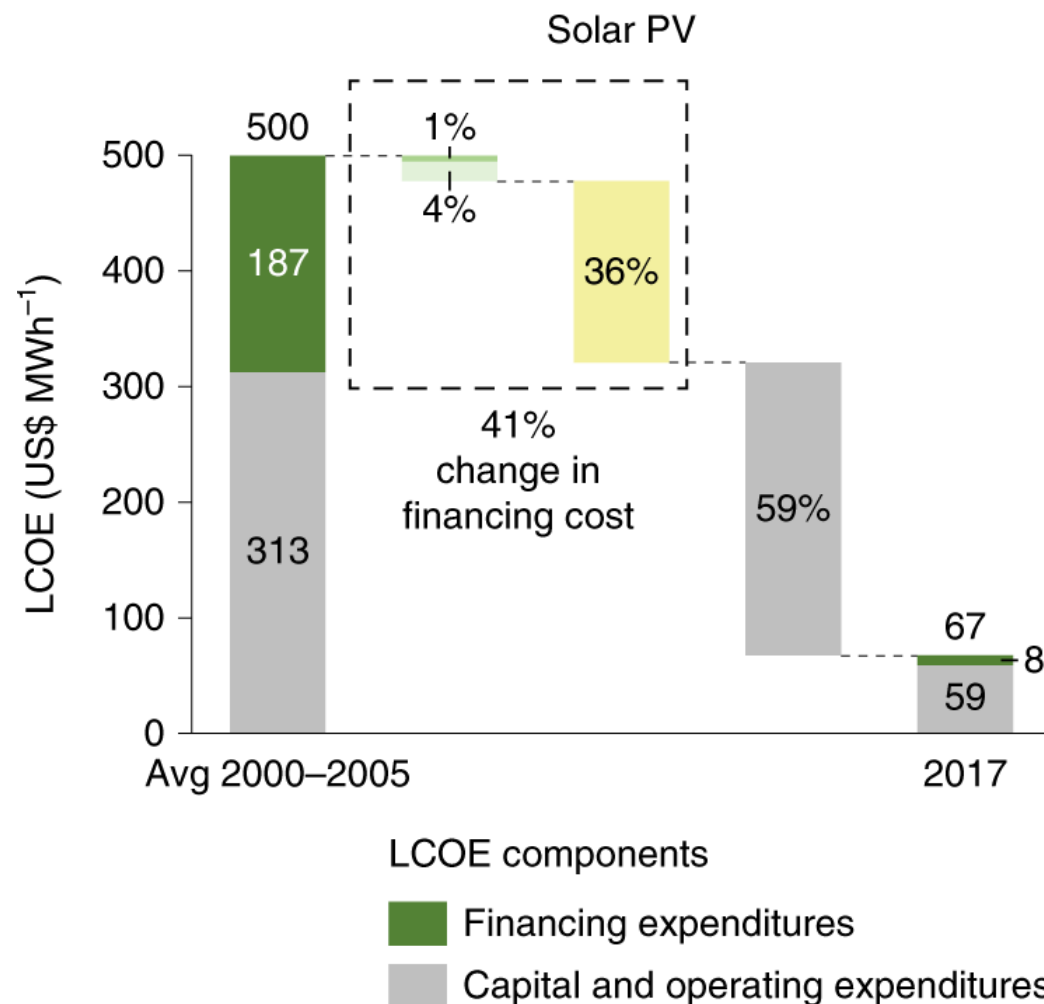
(A science story detour)

*“The ‘**as-a-service**’ model is the delivery of a product or a combination of products, with no up-front capital by the customer and guarantees from the provider to meet defined key performance metrics for an ongoing fee.”*

- Bloomberg New Energy Finance

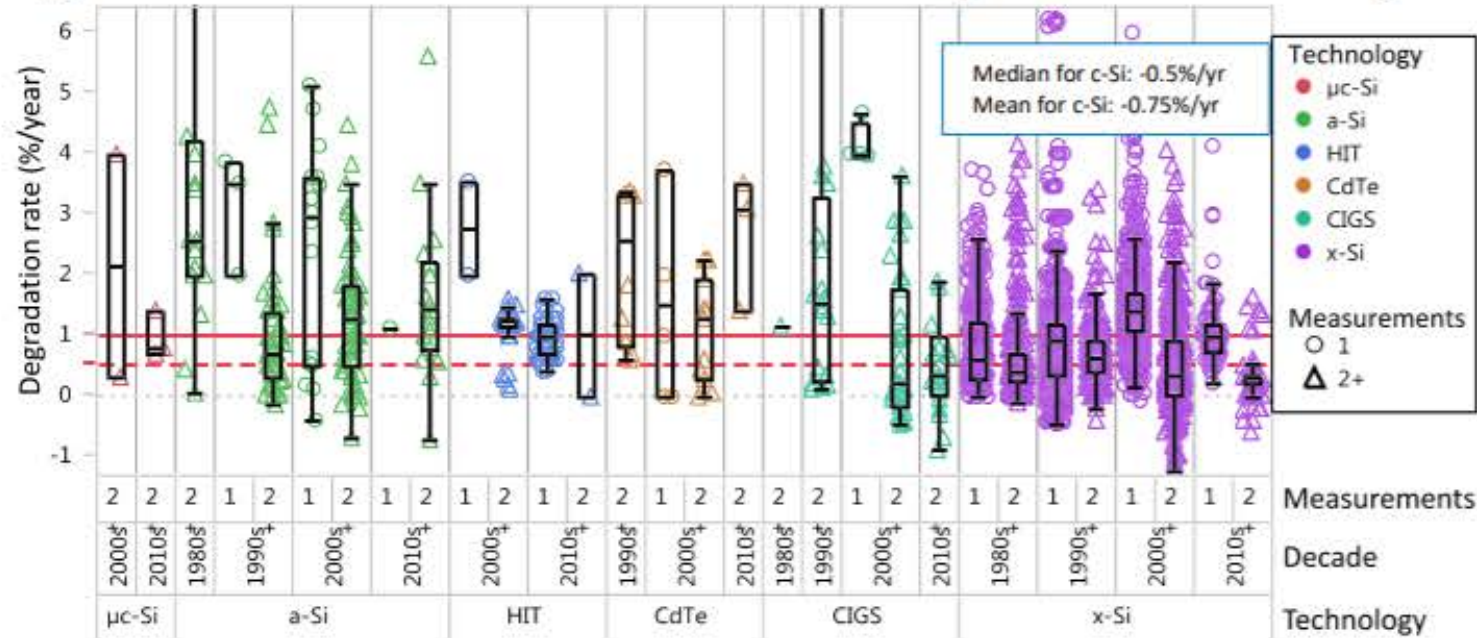


Lower risk and financing costs enabled RE expansion (Still a science story detour)

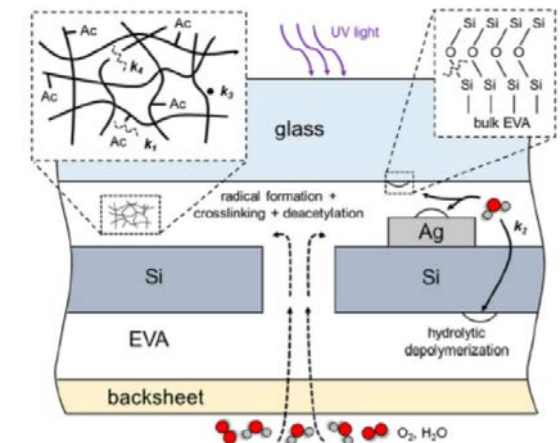


Science de-risks technology for widespread use: solar PV

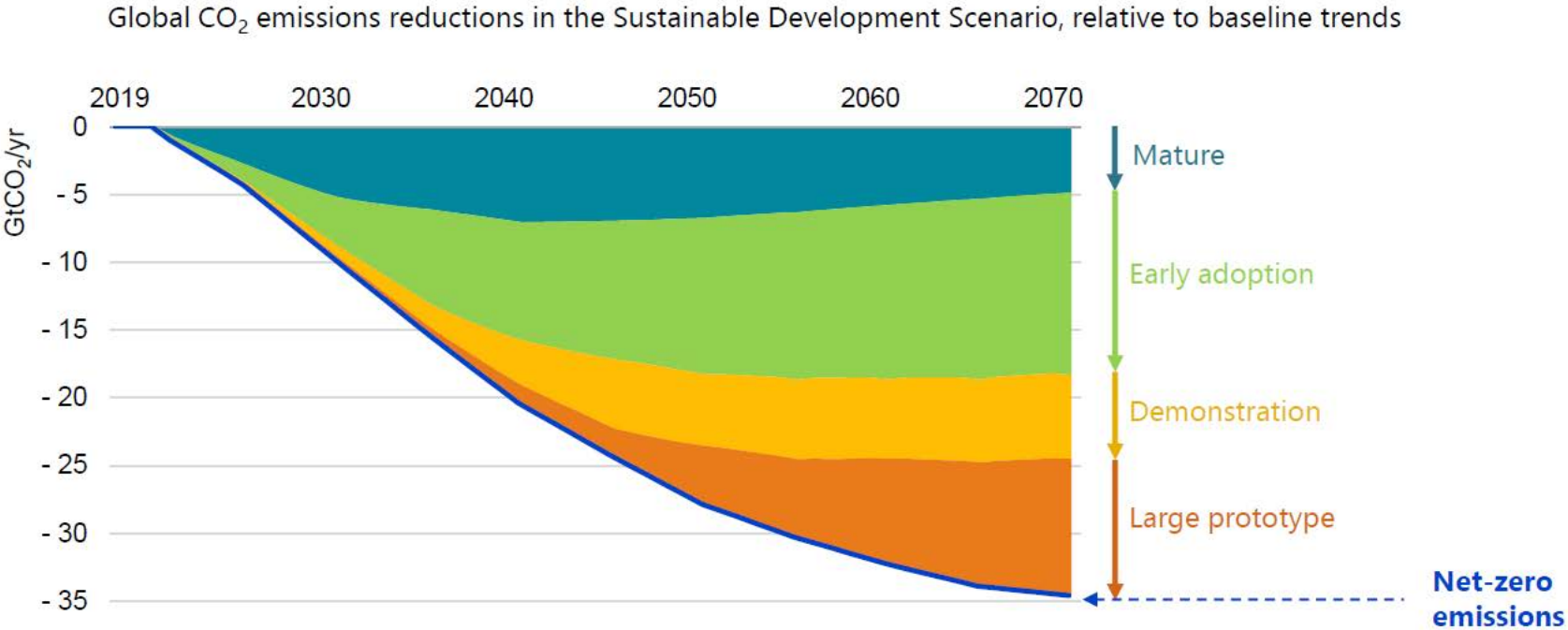
Degradation rates and failure modes vary across technologies



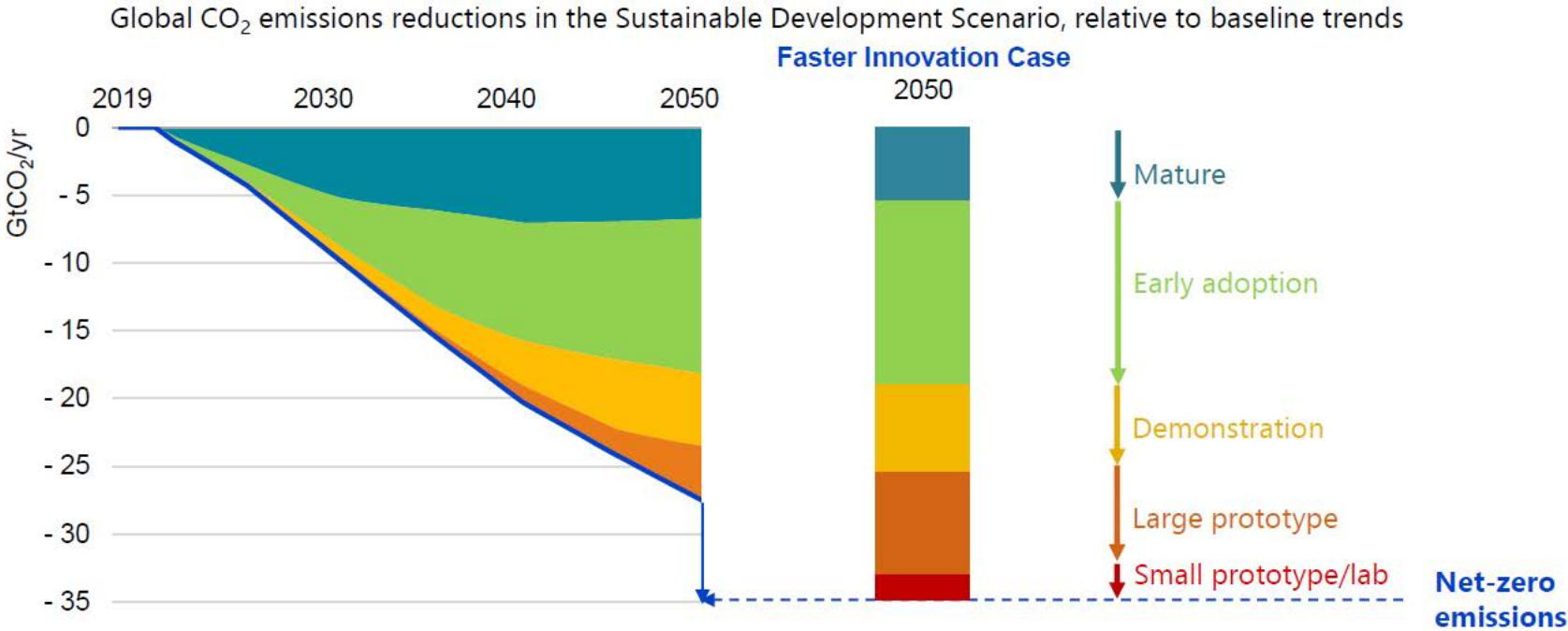
Degradation in EVA encapsulants



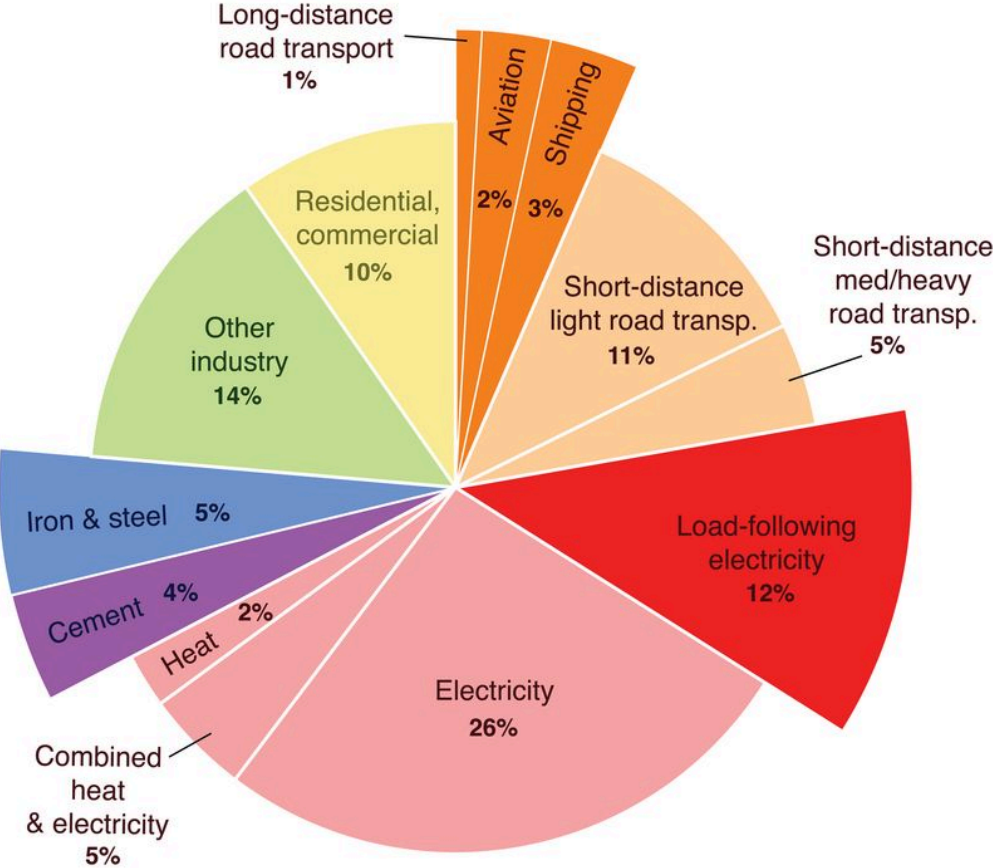
The role of innovation



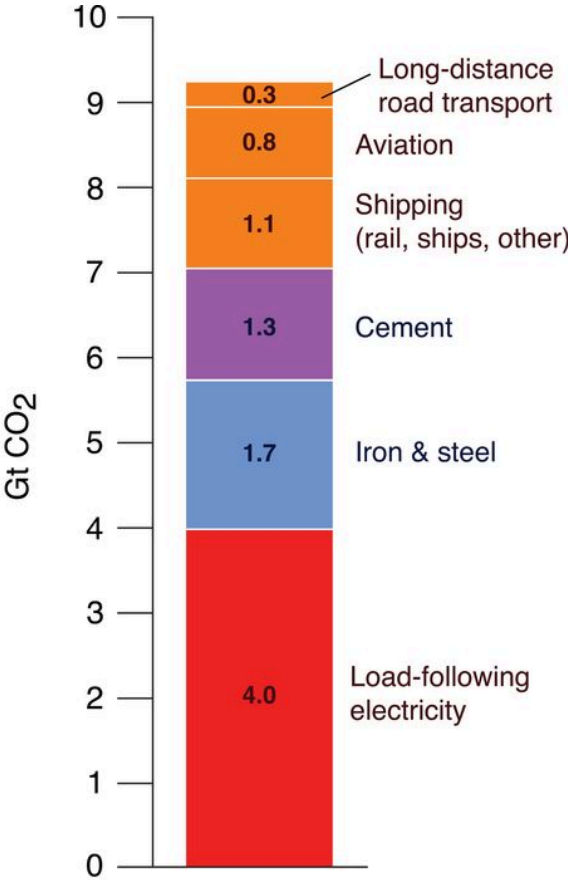
The role of innovation



Difficult to eliminate emissions



A Global fossil fuel & industry emissions, 2014 (33.9 Gt CO₂)



B Difficult-to-eliminate emissions, 2014 (9.2 Gt CO₂)

Steven J. Davis et al. Science 2018;360:eaas9793




Megatrends that are
shaping our world

Climate change

At the UN Climate Conference in Paris in 2015, almost all nations of the world agreed to limit anthropogenic global warming to under 2° C.

The past decade was the hottest on record. Global warming has accelerated in the past five years; they are the five hottest years since record-keeping began.




Megatrends that are
shaping our world

Globalization

In the time span of 20 years, global export volume has more than quadrupled.

Source: Statista, 2019

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The background image is a composite of a city at night and digital technology. A cityscape, possibly San Francisco with Mount Diablo in the background, is shown with its lights reflecting on water. Overlaid on this are various digital elements: glowing orange and yellow light trails that curve through the scene, suggesting motion or data flow; a network of white lines connecting nodes, resembling a data or communication network; a glowing lightbulb icon in a square frame; a small line graph in a square frame; and several floating binary code strings (0s and 1s).

Megatrends that are
shaping our world

Urbanization

By 2050, nearly 68 percent of the world population will live in cities; today it's 55 percent.

The population of cities worldwide is growing at a rate of about 50 million people per year. Accordingly, investments in urban infrastructure are booming.

Source: United Nations, World Urbanization Prospects. The 2018 Revision, New York, published 2017

Megatrends that are
shaping our world

Demographic change

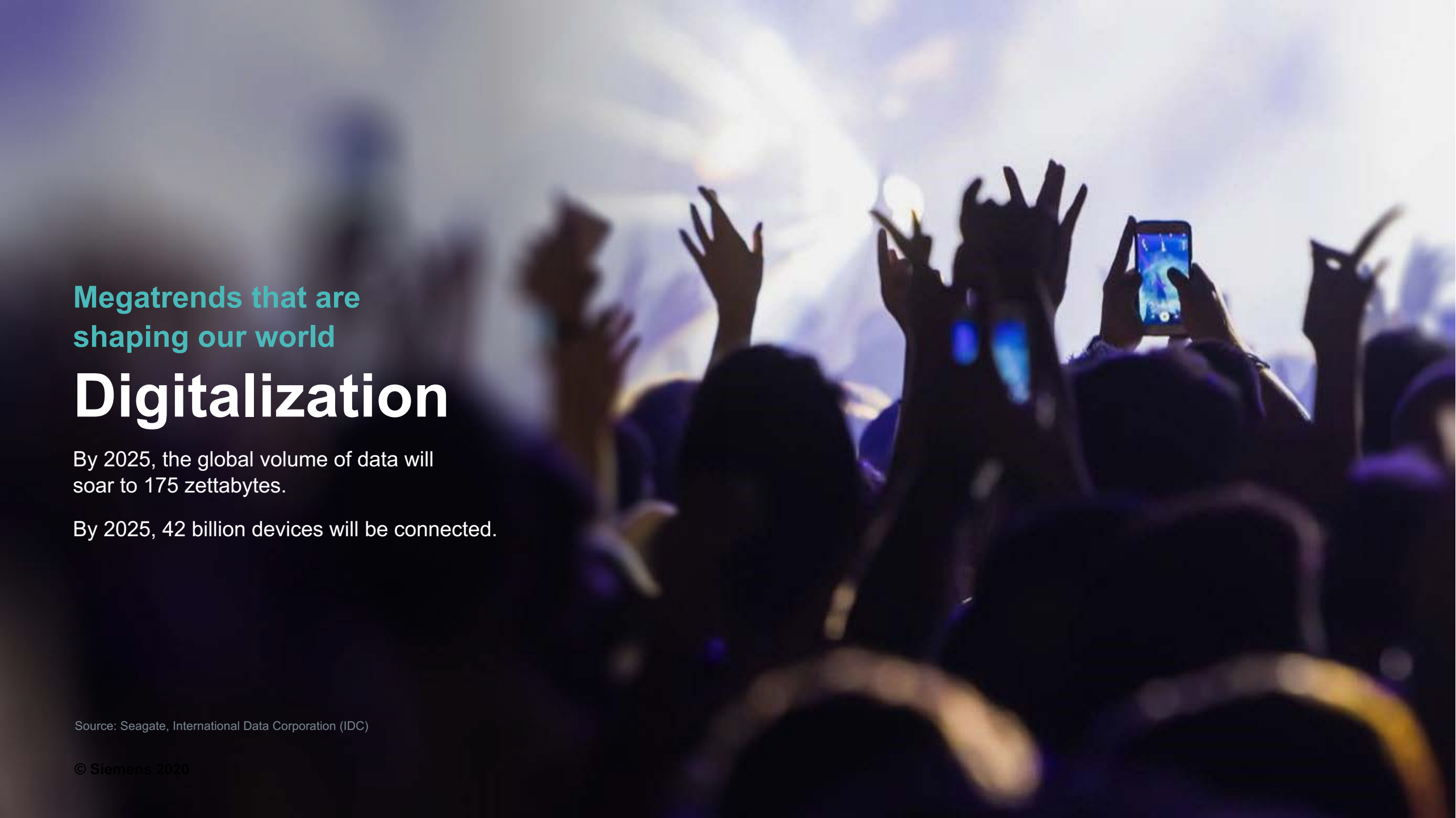
By 2050, the world population will grow from
7.7 billion today to 9.7 billion.

The average life expectancy will be 77 years
in 2050; today it's 73 years.

Source: United Nations, World Population Prospects 2019.

© Siemens 2020





Megatrends that are
shaping our world

Digitalization

By 2025, the global volume of data will
soar to 175 zettabytes.

By 2025, 42 billion devices will be connected.

Source: Seagate, International Data Corporation (IDC)

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Thank you!



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