
The Global Cooling Prize
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The Cooling Dilemma

Increasing access to cooling is a critical social need, but comes at an environmental cost we simply cannot afford

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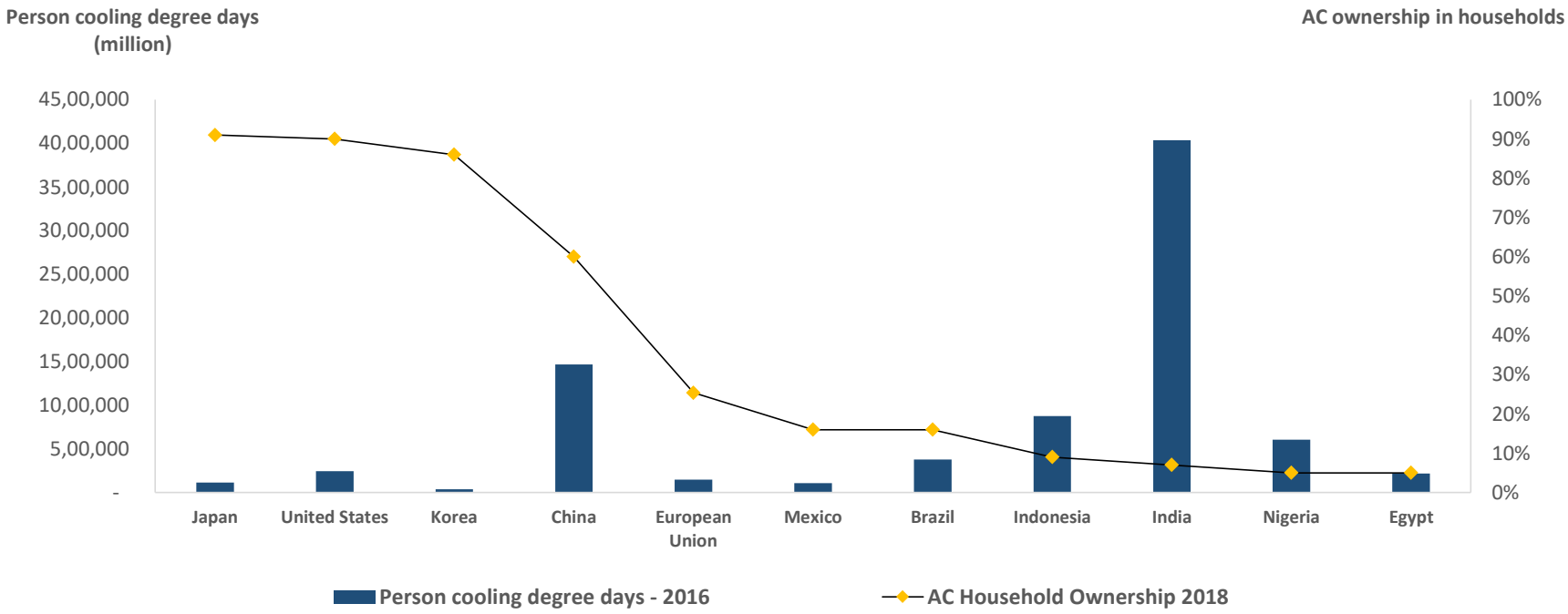
Cooling in the rearview mirror has not captured much attention… looking at the road ahead, it needs to be on everyone's agenda



Source: IEA Report: The Future of Cooling: Opportunities for Energy-efficient Air Conditioning (2018); United Nations, Department of Economic and Social Affairs, Population Division (2017); https://www.degreedays.net/

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In addition to today's unmet needs, major future demand accelerators are at work

POPULATION GROWTH
Population is growing by over 80 million people/year, with 97% of growth in developing countries

Cooling demand will increase ~4x by 2050

INCOME GROWTH
GDP growth for non-OECD countries will exceed 4.5% through 2025, making comfort economical for millions of new consumers

URBANIZATION
99% of population growth is occurring in urban environments, worsening heat island effects

A WARMING PLANET
Global average temperatures expected to rise over 2.0°C by 2100, making summers longer and hotter

Source: United Nations Sustainable Development Goals (2017), United Nations World Urbanization Prospects (2014), Population Reference Bureau World Population Data Sheet (2012), ExxonMobil Outlook for Energy (2018)

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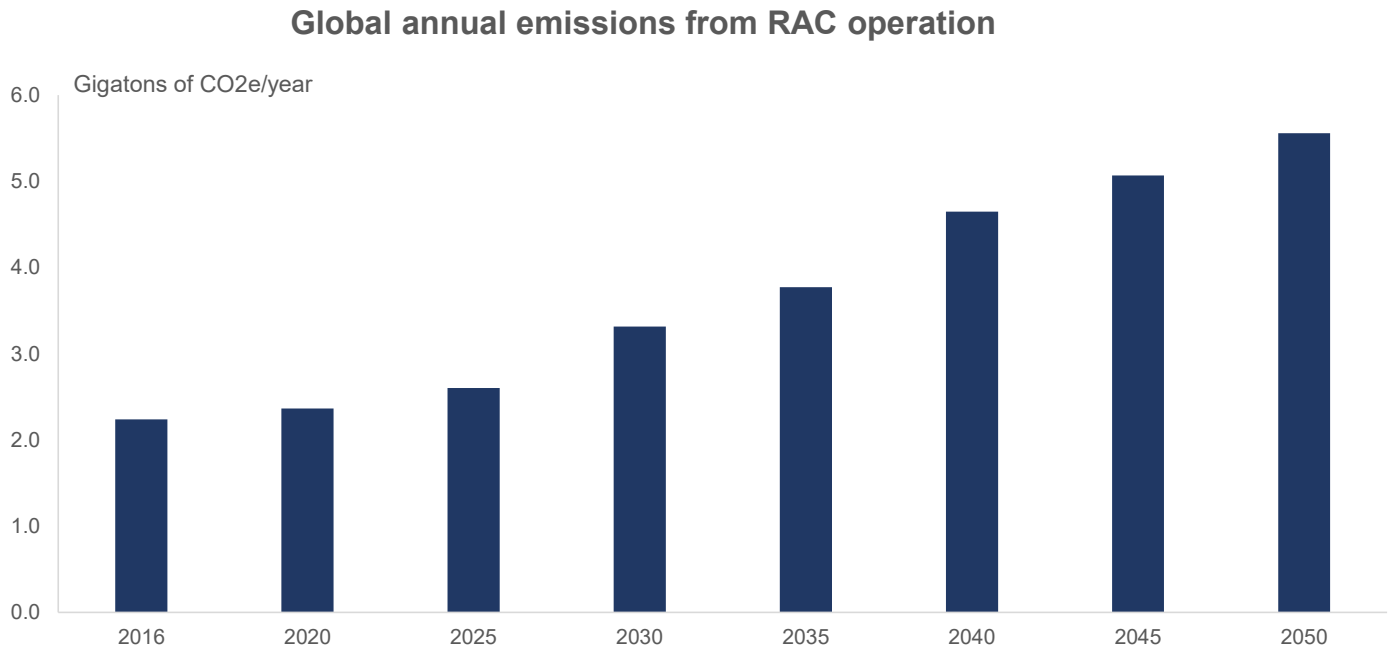
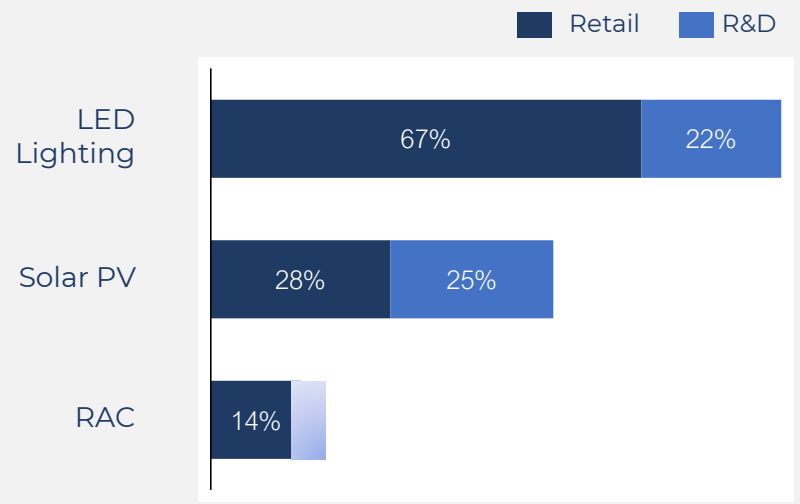
Even projecting trends in buildings codes, equipment efficiency and grid emissions intensities – annual cooling emissions will almost triple by 2050



RS - Reference Scenario, or the business-as-usual RAC growth scenario, where the current adopted or committed policies and government commitments will move forward as per established timelines.

The efficiency opportunity in RAC

Industry progress toward theoretical max efficiency



Consolidated industry

- RAC segment is subject to a massive market failure - the focus on lowest upfront cost…and industry responds to market signals
- Fewer than 500 AC companies worldwide

Market Analysis

- Mass market innovation has largely focused on first cost and meeting near term market requirements — not transformational efficiency
- Emerging & innovative technologies are unable to achieve scale

Source: Greentech Media, “Sunpower Again Holds Record for World’s Most Efficient Rooftop Solar Panel”, 2017; PHYS, “White LEDs with Super-High Luminous Efficacy Could Satisfy All General Lighting Needs”, 2010; Fujitsu, 2017; CLASP, “AC Challenge Program for India”, 2017; LBNL, “Addressing Air Conditioner Energy Efficiency Lost in Translation to Strengthen Policy”, 2018

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A prize to spur the development of climate-friendly and affordable cooling

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Key takeaways and learnings

- *Testing of prototypes under different conditions allowed us to understand what's missing*

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Our learnings from the Prize

- **Only 2/3rd of the true performance of winning technologies is captured by testing standards** → current standards measure performance associated with maintaining temperature; little consideration to humidity

- **We will need updated testing standards and protocols to capture the other 1/3rd** → by simulating close to real-world conditions to reflect units operating at lower aggregate capacity levels with much higher latent loads (humidity), it is possible to realize full technology potential

- **Manufacturers need clear market and policy signals** → although manufacturers are committed to bring these technologies to market, they would need a more clear and complete target to design to and a level field on which they can then compete

- **Performance rating systems need to keep up with technology** → highest performing technologies should be the benchmark and used as reference to derive performance rating ladders that can truly differentiate performance – Today's performance ladders are akin to a 20-year-old guidebook which is a disservice to consumers and leaves an excessively large range of performance in the top rating category

- **We need to flip the relationship between MEPS and performance ladders** – Today we build ladders from the floor of MEPS, but our ladders should have their top rung aligned to the best technology and should ultimately lift MEPS providing safeguards for consumers and better information to inform their purchase decisions

- **Replicate technology innovation across adjacent sectors** → many performance attributes of the winning technologies are applicable to cooling solutions more generally, this will help with the broader net-zero cooling goal

Impact of scaling 5X lower climate ACs by bringing them to market as early as 2025 in line with manufacturer's commitment

68+ GT

CO_2eq emissions avoided through 2050

0.5°C

Global warming mitigation by 2100

Avoid over **2,000 GW** of new generation capacity globally

Avoid up to **5,400 TWh** of electricity generation, equivalent to electricity consumption of US, Japan, and Germany today

Thank You

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