

Cooling
for all
without
warming
the planet



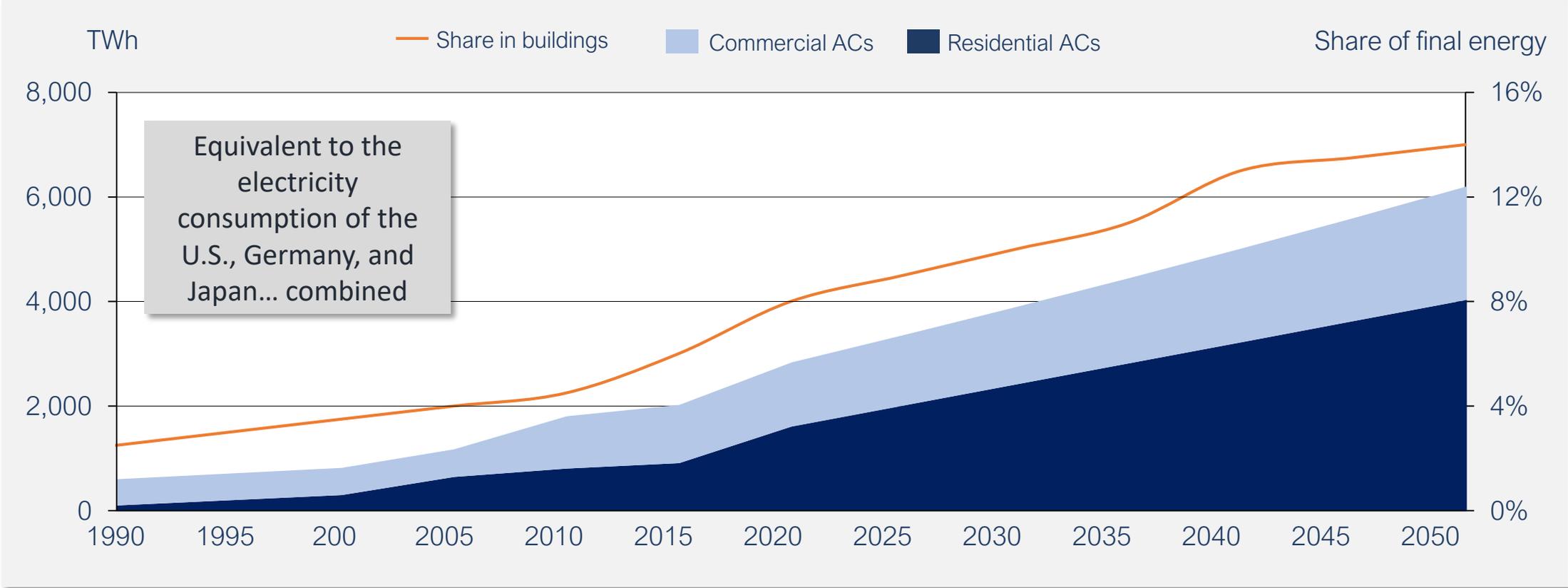
Global

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Prize

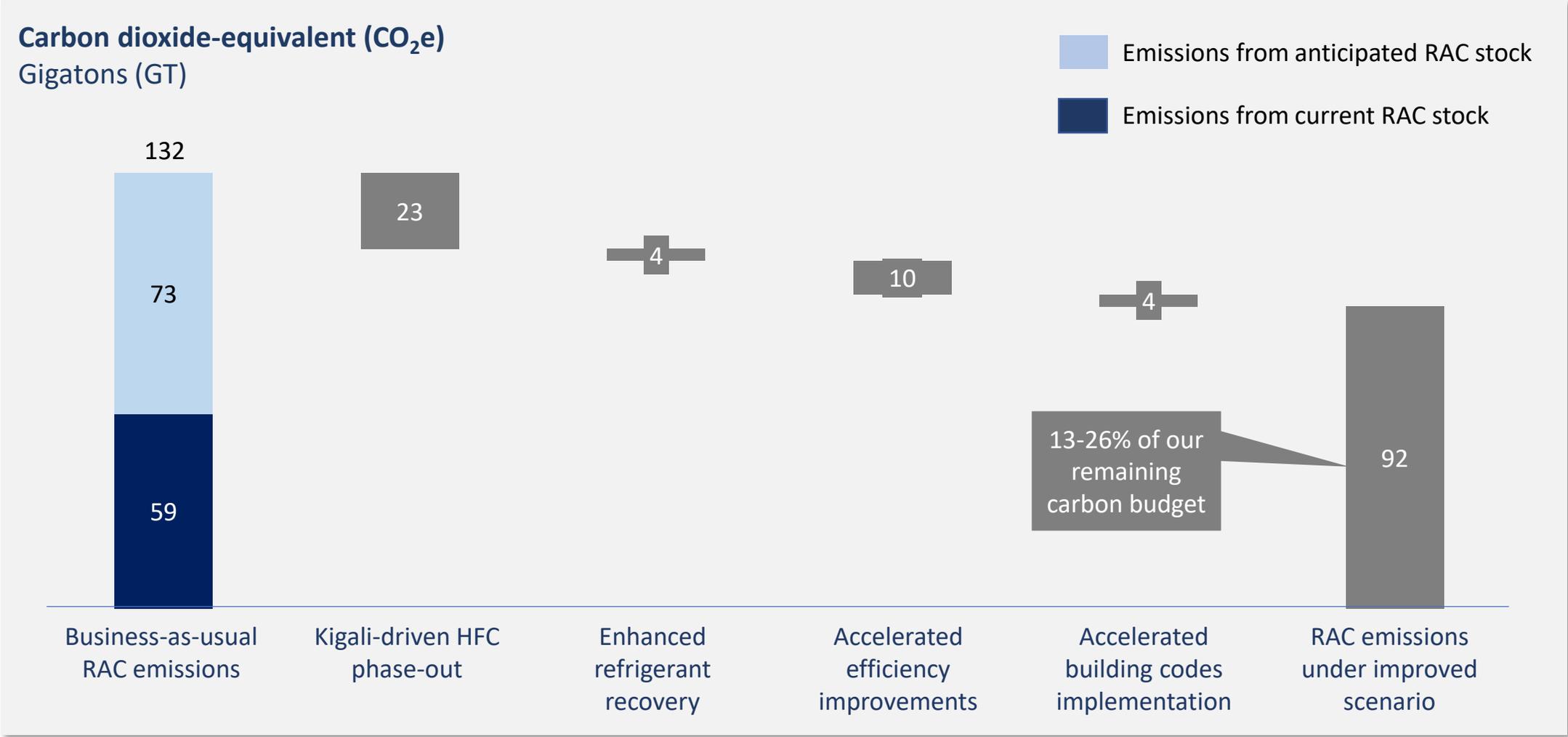
WORLD BANK CO3OL WORKSHOP, NOVEMBER 28, 2018

Residential AC's (RACs) will account for 8% of all energy use by 2050

Energy consumption associated with comfort cooling, 1990-2050

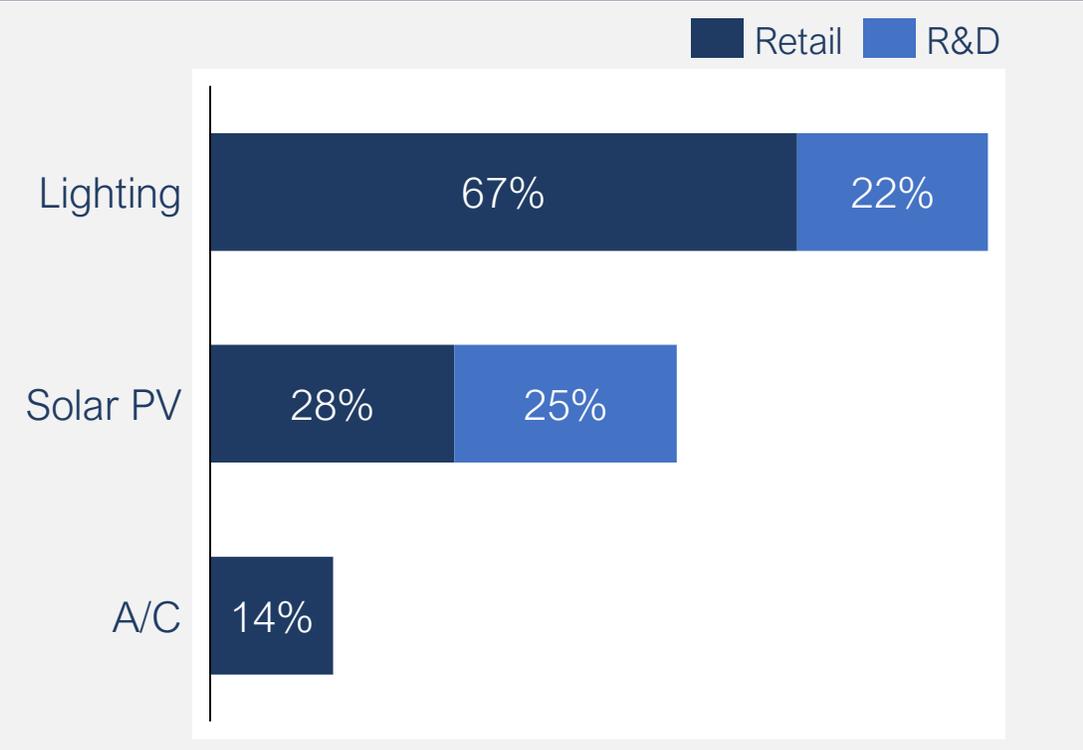


We are not moving far enough, fast enough, to mitigate the climate threat posed by growing demand for RACs



The globally consolidated AC industry has made limited progress on energy efficiency

Industry progress toward theoretical max efficiency



Consolidated industry

- Fewer than 500 AC companies worldwide
- 70% of global RAC production in China
- Two Chinese companies control over 35% of global RAC production

High barriers to entry

“The threat from a new entrant is causing a negligible impact to the present players because of heavy R&D and technical requirements needed to enter into the AC market”

– 2015-2020 Global AC Market Forecast, BIS Research

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

A 4-5x reduction in RAC energy consumption is achievable with technology available today

Potential reduction in RAC electricity use: Illustrative pathway for a vapor-compression-based technology
kWh/yr



Sources:

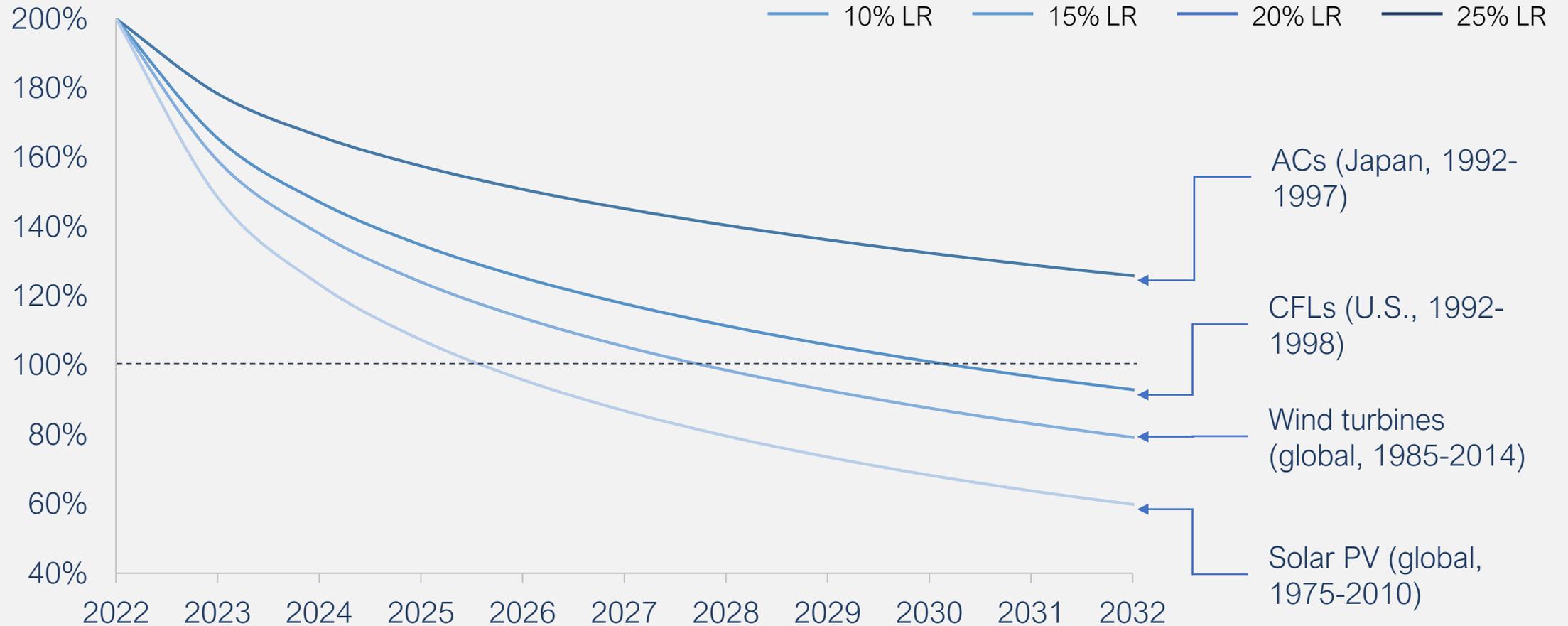
1 RMI Energy Modeling using data from BEOPT for US SEER 33 Mini Split (COP 5.4)

2 ORNL (2015) Alternative Refrigerant Evaluation for High-Ambient-Temperature Environments: R-22 and R-410A Alternatives for Mini-Split Air Conditioners

3 Yun et al (2006) Comparison of Performance of a Residential Air-Conditioning System Using Microchannel and Fin and-Tube Heat Exchanger

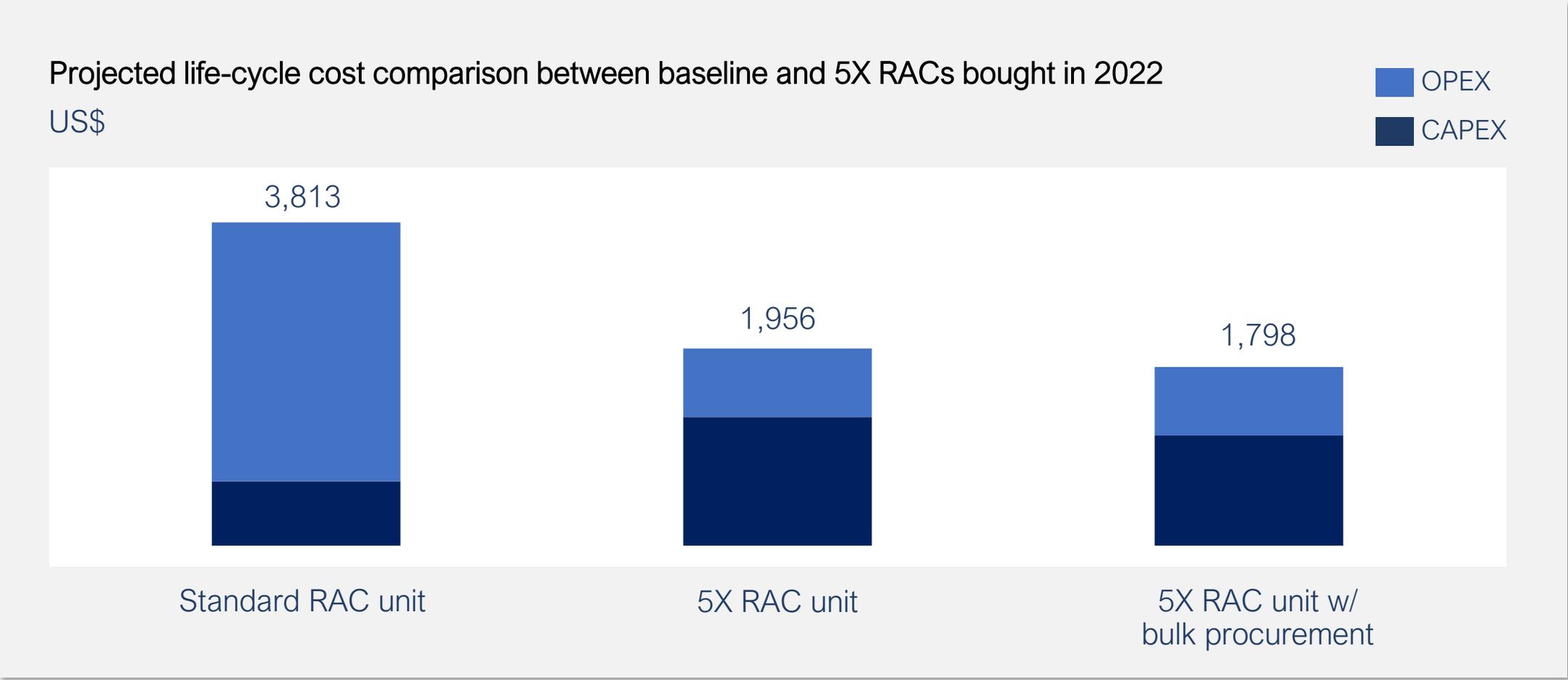
Experience with other technologies suggests that a super-efficient cooling solution could quickly achieve price parity

Projected super-efficient RAC costs vs. current market average at different learning rates¹



¹ The learning rate is the reduction in up-front cost resulting from a doubling in cumulative production volume
Source: IAEA, "Learning Curves and Technology Assessment", 2003; Bloomberg New Energy Finance

Super-efficient RACs could save consumers over \$1,800 in life-cycle costs, with a 3-4 year simple payback



The Global Cooling Prize is designed to raise the technology ceiling for RACs

Goal	5x	<p>Identify, award, and scale a breakthrough cooling solution that mitigates the climate risk from RAC growth. i.e., an RAC technology that:</p> <ul style="list-style-type: none">• Has 5x less climate impact (electricity and refrigerant) than today's standard (EER 3.5) units;• Operates within predefined constraints on refrigerant type and use, water, full-load power consumption, scalability and operational requirements• Is affordable and will cost no more than 2x the price of today's standard units to the consumer at assessed industrial scale
Approach		<p>Host a global competition to spur innovation by multiple actors:</p> <ul style="list-style-type: none">• Launch in November 2018 and run the competition for 2 years• Administer and test competing technologies in India• Secure demand via public and private sector advance market commitments (AMCs) and work with standards bodies on a step-change in minimum energy performance standards (MEPS)• Help winner(s) commercialize their technology by building a supportive ecosystem of industry experts, investors, and professional service firms
Prize	USD3M+	<p>Financial rewards to support prototype development and commercialization</p> <ul style="list-style-type: none">• At least USD2M as intermediate prizes to teams shortlisted based on their initial designs, in order to turn concepts into prototypes and enable them to compete for the final award• At least USD1M to incubate, commercialize, and support investment in the winning technology

Our Prize criteria will ensure the RAC works for developing countries, in challenging conditions

- Criteria used to determine final award
- Additional criteria used to shortlist finalists

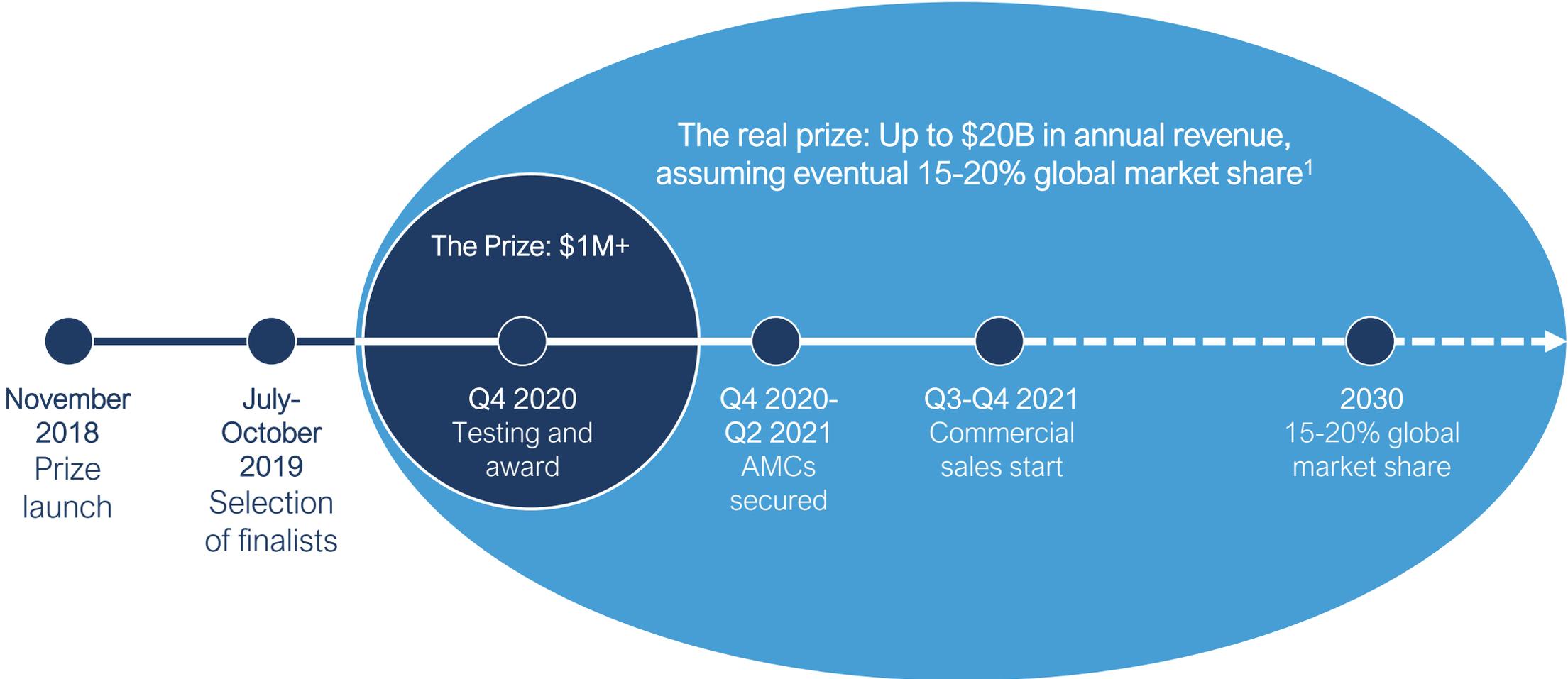
Weighting for final evaluation: Climate criteria: 71.5%, affordability criteria: 28.5%

CLIMATE One-fifth of the life-time climate impact (electricity and refrigerant) of the baseline unit ¹		AFFORDABILITY At assessed industrial scale, will cost less than 2x cost of the baseline unit to consumers	
REFRIGERANTS IF USED Zero ODP, lower toxicity (Class A) and compliance with international safety standards		EMISSIONS Zero onsite emissions from any captive energy or power source	
POWER Consumes less than 700W at rated cooling capacity		OPERATION Maintains at or below 27°C DBT and 60% RH for the duration of the test period	
WATER Consumes less than 14 liters per day for onsite use		SCALABILITY Usable in existing homes, no “designed in” solution; <2x volumetric size of baseline unit	

¹ The baseline unit represents the most common RAC product sold in India and is in accordance with the BEE defined ISEER rating for a 3 star AC in 2018. It is equivalent to EER 3.5 of a 5 star AC in 2016-17.

** The prize supplementary criteria are under review for finalization which will be completed within 60 days of the launch and the indicated prize supplementary criteria are to be considered as directional guidance until full ratification has been secured.

The Prize award would represent just one milestone on the path to a global transformation for RAC technology

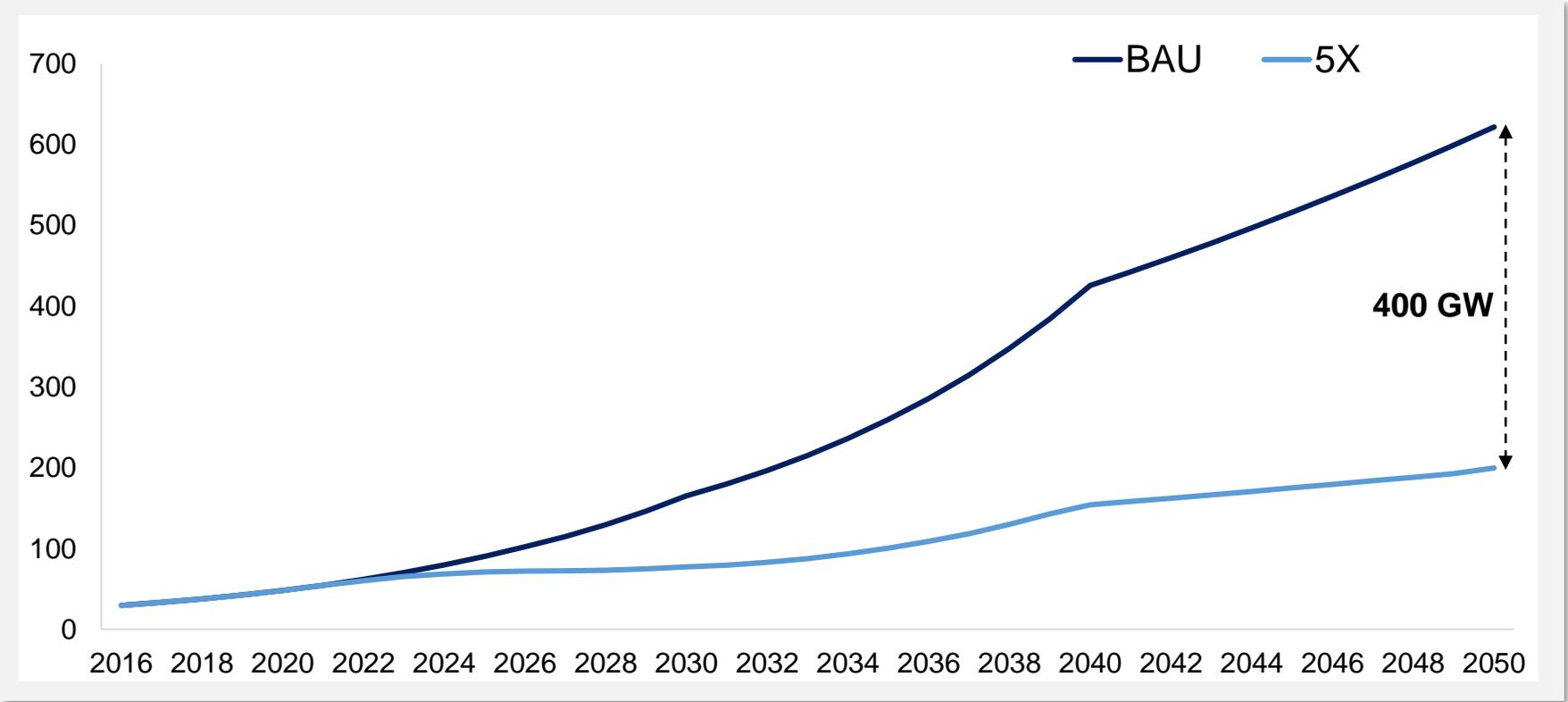


¹ Equivalent to current market share of the current largest players

Super-efficient RACs could help India obviate the need for about 400 GW of generation capacity through 2050

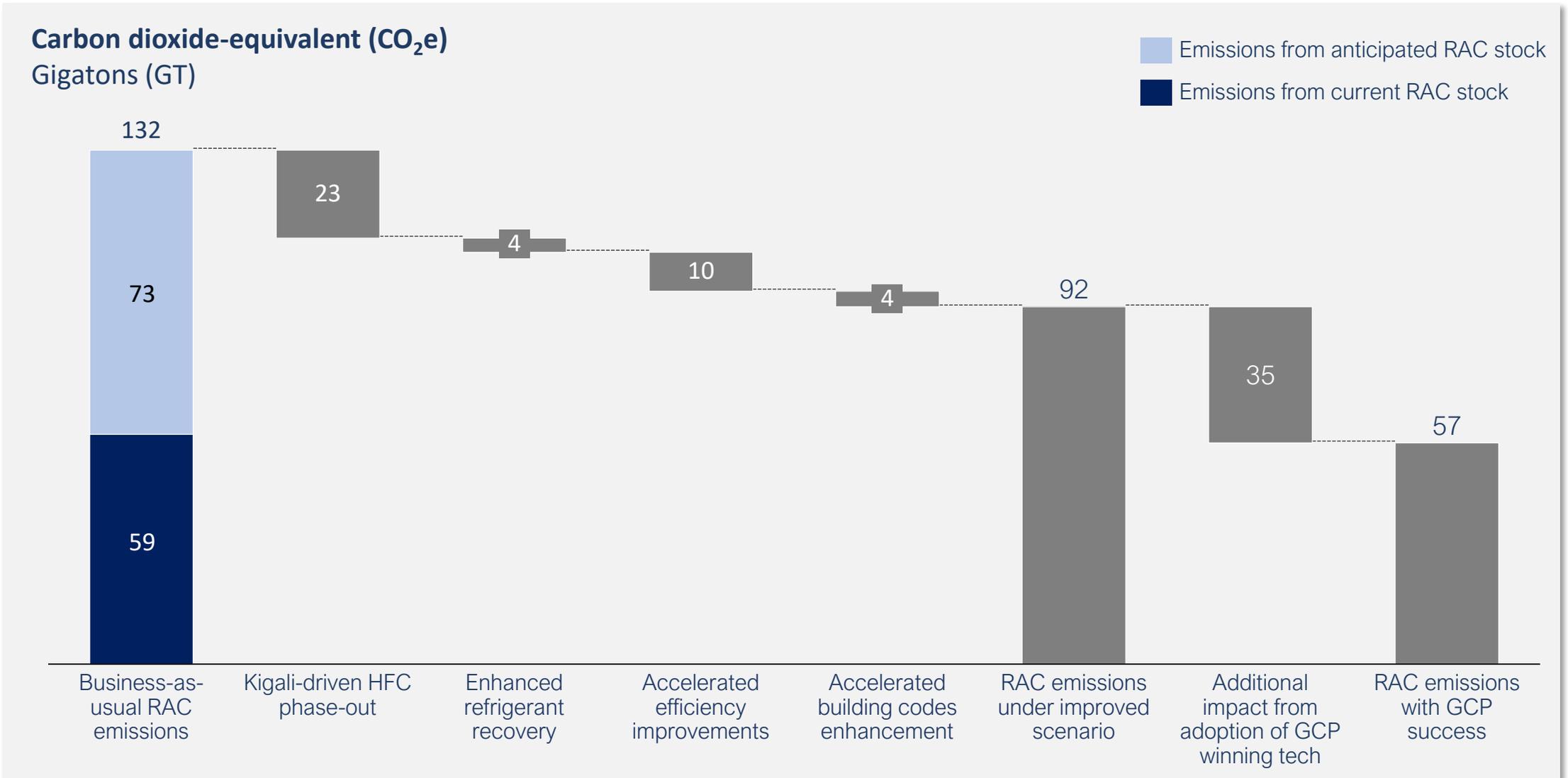
Potential avoided peak power demand, India, 2016-2020

GW



Key Assumptions: Peak Coincidence Factor 0.5. Baseline EER of 3.1. 5x EER of 14.

Success with the Global Cooling Prize will help keep our Paris climate aspirations within reach



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