Understanding the Technical Criteria for Winning the Challenge

February 20, 2019
Today’s Presenters

Ankit Kalanki
Associate, Rocky Mountain Institute

Yash Shukla
Technical Director, CEPT University

Elizabeth O’Grady
Senior Associate, Rocky Mountain Institute

Available to Answer Questions

Iain Campbell
Senior Fellow, Rocky Mountain Institute (Chairperson of the Technical Review Committee)

Radhika Lalit
Manager, Rocky Mountain Institute

Chad Gallinat
Senior Program Manager, Conservation X Labs

Hayes Zirnhelt
Consultant, Rocky Mountain Institute
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Housekeeping & Agenda

Housekeeping

• Webinar is being recorded
• Ask questions in the chat area by clicking on the question mark on the right side of your screen
• Future webinars will describe additional aspects of the Global Cooling Prize
  • March webinar will discuss testing protocol

Agenda

1. About the Global Cooling Prize
2. Prize Criteria
3. Evaluating the participating technologies
4. Next Steps
About the Global Cooling Prize
First-of-its-kind Innovation Challenge

- Aims to identify a residential cooling solution that has five times lower climate impact
- Provides a common platform to incumbents, start-ups, innovators, experts and research institutes working in air conditioning space to innovate and accelerate the transition to the next generation cooling technology

A Global Competition

- Attracts talent from across sectors and around the world to design a residential cooling solution that leapfrogs existing technologies

Focus on Commercialization and Mass Adoption

- Led by a global coalition of partners to drive the incubation, commercialization and ultimately mass adoption of the climate friendly residential cooling solution across the potential markets

Support from Leading National and International Institutions

- Supported by Mission Innovation and Government of India
Prize Timeline and Key Milestones

- **Prize Launch**
  - Nov 2018

- **Intent to Apply Deadline**
  - June 2019

- **Technical Application Deadline**
  - Aug 2019

- **Applications Evaluated**
  - July - Oct 2019

- **Announcement of Finalists**
  - Nov 2019

- **Prototype Development**
  - May - Sept 2020

- **Testing & Evaluation of Prototypes**
  - Nov 2019 - April 2020

- **Final Award Ceremony**
  - Nov 2020
Prize Criteria
Our Prize Criteria will ensure that the next generation room air conditioners can meet the challenging conditions across all markets.

### CLIMATE
One-fifth of the life-time climate impact (electricity and refrigerant) of the baseline AC unit.

### POWER
Consumes less than 700W from the grid at rated cooling capacity or during test period.

### SCALABILITY
Usable in existing homes, no “designed in” solution; less than 2x volumetric size of the baseline unit.

### WATER (if any is used)
Consumes an yearly average of 14 liters/day with daily maximum limit of 28 liters.

### AFFORDABILITY
At manufacturing scale of 100,000 units, costs no more than twice the cost of the baseline AC unit to consumers.

### EMISSIONS
Zero onsite emissions from any captive power or heat source.

### OPERATION
Designed to have 1.5 TR cooling capacity at standard outdoor conditions and Maintains below 27°C DBT and 60% RH indoors for the duration of test period.

### REFRIGERANTS (if any is used)
Zero ODP, lower toxicity, and compliance with safety standards.

### MATERIALS
Minimal usage of high embodied carbon or rare earth materials.
Defining the baseline AC unit for the competition

**Explanation**

- A 1.5 TR, fixed speed, EER 3.5 W/W room air conditioner (RAC) using an R410A refrigerant that...

- Operates in a typical apartment with a 90 square meter area in a composite climate like New Delhi, India over a full year temperature and humidity seasonal profile and...

- Consumes 2,969 kWh/year based on maintaining indoor conditions below 27°C DBT and 60% RH and...

- Has an installed cost of about US $546 to consumers (excluding any standard installation labor costs and taxes)

**Selection of the baseline**

- Most commonly-sold RAC in the Indian market in the year 2018 and also amongst the most popular units globally.

- Expected building type where the cooling technologies participating in this competition will be tested under real-world conditions.

- Installed cost of the most commonly-sold RAC sold in India by the market player with highest share
Primary Criteria for the Prize

**Climate Impact**: Solution must achieve at least 5X lower climate impact than the climate impact of the baseline AC unit

**What we mean by 5X**

- Responsible for one-fifth or 80% lower climate impact than the climate impact of baseline AC unit...
- Through a combination of 4-5x reduced grid electricity consumption and low GWP refrigerant (if any is used) considering...
- 80:20 weighting for electricity and refrigerant respectively, to arrive at the overall climate impact

**And why we think it’s achievable**

- Current best-in-class units are already ~2.5x more efficient and when combined with a low GWP refrigerant can have ~3.5x lower climate impact.
- Emerging technologies have shown potential in their prototype stages for lower energy consumption and increasing cost-effectiveness.

**How we will evaluate**

- Examining the grid electricity consumption calculations / measurements and comparing it to the baseline.
- Examining the refrigerant characteristics (if any is used) of your cooling solution.
- Points will be awarded ratably between 0 – 100 based on level of reduction achieved from the baseline i.e. 0 points for no reduction and 100 points for 100% reduction.

- Minimum 80 points will be required to compete in the competition
Example evaluation of the climate impact

Climate Impact: Solution must have 5x less climate impact than the baseline unit

Consider a proposed cooling solution that has:
ISEER 5.2 W/W (6.5 to 7.0 SEER) using 1336 kWh/yr and
R290 (Propane) refrigerant with a GWP of 3

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Baseline</th>
<th>Proposed Cooling Solution</th>
<th>% reduction achieved</th>
<th>Assigned Weight</th>
<th>Weighted Score</th>
<th>Total Achieved reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid Electricity Consumption</td>
<td>2969</td>
<td>1336</td>
<td>55%</td>
<td>80%</td>
<td>44%</td>
<td>64%</td>
</tr>
<tr>
<td>(kWh/yr)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Refrigerant GWP</td>
<td>2088</td>
<td>3</td>
<td>100%</td>
<td>20%</td>
<td>20%</td>
<td></td>
</tr>
</tbody>
</table>
Primary Criteria for the Prize

**Affordability**: Solution must cost the consumer no more than 2X the baseline AC unit cost at an assumed manufacturing scale of 100,000 units.

### What we mean by 2x
- Installed cost to consumers must be no more than two times the baseline cost where...
- Bill of materials will be assessed at a manufacturing scale of 100,000 units.
- And the baseline cost, taken as US $546 for reference, will be reassessed by the technical review committee during evaluation in the year 2018.

### And why we think it’s achievable
- RMI analysis shows that even at 2X price point, a 5X cooling solution brings significant savings over the life-cycle of operation.
- Innovative financing mechanisms by utilities and energy companies will further reduce the burden on consumer pockets.

### How we will evaluate
- Examining the bill of material of AC components and materials required for installation.
- Adding a fixed factor for typical margins and other costs excluding tax (to consumer) at 60% of total cost.
- Points will be awarded ratably between 0 (5x baseline cost) – 40 (zero cost) based on the level of cost achieved.
- Minimum 24 points will be required to compete in the competition.
Supplementary Criteria for the Prize

1. **Power Draw:** Solution should consume no more than 700 W of power from the grid.

**What we mean**
- Consume no more than 700 W of power from the grid at...
- Rated cooling capacity or any outdoor conditions during test period when...
- Determined over any 15-minute interval

**And why this is important**
- Reducing power demand is critical to avoid huge spending on new generation capacity and grid infrastructure.
- RMI analysis and literature review suggests that a 5X reduction in electricity could achieve about 60% reduction in power demand.

**How we will evaluate**
- Examining the maximum power draw calculations / measurements over a 15-minute interval.
- Verifying the veracity of the claim against the threshold of 700 W.
- Pass / fail criteria with failure leading to a likely disqualification.
Supplementary Criteria for the Prize

<table>
<thead>
<tr>
<th>Water: Solution should consume no more than 14 liters of water per day when averaged over a year with maximum limit of 28 liters per day</th>
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</table>

<table>
<thead>
<tr>
<th>What we mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Consume no more than an yearly average of 14 liters/day of water if…</td>
</tr>
<tr>
<td>• any is required for daily operation of the unit onsite and subject to…</td>
</tr>
<tr>
<td>• A maximum daily limit of 28 liters</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>And why this is important</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Need to ensure that the cooling solution does not consume large quantity of water, especially in regions where water scarcity is going to become a critical issue in the future</td>
</tr>
<tr>
<td>• Need to balance the energy-water nexus</td>
</tr>
<tr>
<td>• Not create a burden on consumer bills</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>How we will evaluate</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Examining the water usage calculations / measurements, if any is used</td>
</tr>
<tr>
<td>• Verifying the veracity of the claim against the average and maximum limits</td>
</tr>
<tr>
<td>• Pass / fail criteria with failure leading to a likely disqualification</td>
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</table>
### Supplementary Criteria for the Prize

**Onsite Emissions:** Solution should have zero onsite emissions from any fossil fuel based captive power source or heat source

#### What we mean
- Does not use any combustion sources onsite when...
- such energy source is required to generate a heating medium or electricity for operation of the unit

#### And why this is important
- Including distributed combustion sources possesses potential safety concerns for residential applications
- Undermines the impact of increasing penetration of renewables in the electricity grid and the corresponding reduction in grid emissions intensity

#### How we will evaluate
- Examining the cooling technology principle and drawings to identify use of combustion sources.
- Verifying the veracity of the claim against the requirement
- Pass / fail criteria with failure leading to a likely disqualification
Supplementary Criteria for the Prize

**Refrigerant compliance**: Solution should use a refrigerant that has a zero ozone depleting potential (ODP), lower toxicity and complies with international standards on refrigerant safety.

<table>
<thead>
<tr>
<th>What we mean</th>
<th>And why this is important</th>
<th>How we will evaluate</th>
</tr>
</thead>
<tbody>
<tr>
<td>- If any refrigerant is used, it should have…</td>
<td>- Develop synergy with international agreements and standards to ensure environmental safety</td>
<td>- Examining the refrigerant characteristics (if any is used) of your cooling solution</td>
</tr>
<tr>
<td>- Zero ODP,</td>
<td>- Should not pose risk to the health and safety of the occupants from its operation</td>
<td>- Verifying the veracity of the claim against the requirement</td>
</tr>
<tr>
<td>- lower toxicity (class A) according to ISO 817,</td>
<td>- Reducing the warming impact from refrigerants that are potent greenhouse gases</td>
<td>- Pass / fail criteria with failure leading to a likely disqualification</td>
</tr>
<tr>
<td>- comply with ISO 5149 or IEC 60335-2-40 or any local standard (if stricter)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Charge quantity not materially different from baseline unit¹</td>
<td></td>
<td></td>
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</tbody>
</table>

¹ A 1.5 ton air conditioner unit has a typical R410A charge quantity of 1.65 kg.
## Supplementary Criteria for the Prize

### Scalability: Solution should be usable in existing homes, rather than requiring a "designed in" engineering solution

<table>
<thead>
<tr>
<th>What we mean</th>
<th>And why this is important</th>
<th>How we will evaluate</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Does not have a total volumetric size of more than 0.42 cubic meters(^1) which includes…</td>
<td>• Should be able to scale in same market conditions as conventional vapor compression based units</td>
<td>• Examining the technical drawings of your cooling solution to determine the volumetric size.</td>
</tr>
<tr>
<td>• Size of the cooling unit, any external component and any integrated renewable energy source such that…</td>
<td>• Should be easy to install in existing buildings as well as new buildings</td>
<td>• Verifying the veracity of the claim against the threshold of 0.42 cubic meters</td>
</tr>
<tr>
<td>• Installation does not need any major structural, electrical or plumbing upgrades</td>
<td></td>
<td>• Pass / fail criteria with failure leading to a likely disqualification</td>
</tr>
</tbody>
</table>

\(^1\) The baseline AC unit has the volumetric size of indoor and outdoor unit as 0.075 and 0.135 cubic meters.
Supplementary Criteria for the Prize

**Materials:** Solution should be developed with regard to minimal usage of rare earth materials and embodied carbon.

### What we mean
- Should carefully consider the quantity and type of materials used for producing the components of the cooling solution.

### And why this is important
- A solution might not be sustainable if it uses materials having high embodied carbon or are rare earth.
- Mitigate the risk of unintended consequences in the future by use of such materials.

### How we will evaluate
- Examining the bill of materials of your cooling solution.
- Conducting a life cycle impact assessment study if needed.
- Verifying the veracity of the claim against the requirement.
- Pass / fail criteria with failure leading to a likely disqualification.
Supplementary Criteria for the Prize

**Operation:** Solution should be designed to have 1.5 TR cooling capacity at standard outdoor conditions and maintain below 27°C DBT and 60% RH indoors for the duration of test period.

**What we mean**
- Ability to meet a cooling load (sensible + latent) of 1.5 TR at outdoor conditions of 35°C DBT and 24°C WBT.
- Maintain the indoor conditions below 27°C DBT and 60% RH under varying outdoor weather conditions of test and simulated markets.

**And why this is important**
- Humidity and temperature control are key to human comfort and productivity.
- Improper humidity levels can result in mold growth in buildings.
- These conditions are increasingly used as standards for indoor set-points to optimize energy use and thus allows to scale in other markets.

**How we will evaluate**
- Examining the operational performance of your cooling solution by testing in laboratory and real-world apartments.
- Verifying the veracity of the claim against the requirement - an unmet hours allowance of 3.4% of test period in addition to any non-performance by baseline AC unit.
- Pass / fail criteria with failure leading to a likely disqualification.
Evaluation of the participating technologies
Technology evaluation will occur across three stages in this competition:

1. **Application Review & Screening**
   - Applicants will submit design documents detailing how they meet technical criteria.
   - Initial assessment of solution cost (at manufacturing scale) will be completed alongside.
   - Score will be given based on achievement of climate impact and affordability criteria.
   - Up to 10 finalists will be selected for interim award and testing.

2. **Lab & Field Testing**
   - A combination of lab and real world testing will allow further filtering and evaluation of each cooling solution based on performance against the prize criteria.

3. **Final Assessment**
   - Results from field and lab testing will be used to update the score of competing solutions in order of performance on technical criteria.
   - The winner will be selected based on updated score on the climate impact and affordability criteria.

Global Cooling Prize
Phase 1 of the Global Cooling Prize is underway…

• REGISTER AND COMPLETE PROFILE
  ✓ Register at www.globalcoolingprize.org/apply for applying to the Prize
  ✓ Stay informed about application deadlines, get useful resources and participate in forums

• SUBMIT PARTICIPANT “INTENT TO APPLY” FORM– June 30, 2019
  ✓ Complete a simple online form to showcase your intent to participate
  ✓ What we ask is a few simple questions to know:
    ➢ your team
    ➢ your innovative cooling technology
    ➢ your understanding of the Prize Criteria

• SUBMIT DETAILED TECHNICAL APPLICATION FORM– August 31, 2019
  ✓ Comprehensive information about the innovative cooling technology along with a detailed schematic, design calculations, technical drawings, showcasing the achievement of the Prize Criteria
Phase 2: Field and lab testing will be conducted in parallel for all shortlisted technologies

- Selection of ~10 most promising technologies
- Application Evaluation
  - Prototype 1
  - Prototype 2
- ISEER testing
  - Exception to ISEER testing made for alternative technologies
- Field testing (up to 60 days)
- Lab simulated full-year testing (up to 12 days)
- Final evaluation: Testing results combined with final cost assessment
- Screen out solutions with ISEER <7
Phase 3: Final evaluation of the prototypes and selection of winner

- After consideration of the full suite of test results Technical Review Committee will provide an updated score to the top 10 cooling solutions following the same scoring methodology and provide a rank to each solution.

- Supervisory Board ratifies the recommendations after ensuring the winning participant(s) fully meet the intent of the Prize’s technical criteria.

- Announcement of the final winner at a day-long international award ceremony with Mission Innovation, as well as participating country ministerial and funder presence.
Next Steps with Global Cooling Prize
Global Cooling Prize will continue for a period of two years

<table>
<thead>
<tr>
<th>Date</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>November 12, 2018</td>
<td>Participant portal launched and Intent to Apply form opened</td>
</tr>
<tr>
<td>June 30, 2019</td>
<td>Deadline to submit Participant “Intent to Apply”</td>
</tr>
<tr>
<td>August 31, 2019</td>
<td>Deadline to submit Detailed Technical Application</td>
</tr>
<tr>
<td>July – October, 2019</td>
<td>Evaluation of Technical Applications and Selection of Finalists</td>
</tr>
<tr>
<td>November, 2019</td>
<td>Announcement of top 10 finalists and Interim Awards</td>
</tr>
<tr>
<td>November, 2019 - April, 2020</td>
<td>Prototype development phase</td>
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<tr>
<td>May – September, 2020</td>
<td>Prototype testing in India</td>
</tr>
<tr>
<td>October - November, 2020</td>
<td>Final Evaluation, Presentations and Award Ceremony</td>
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Thank you!

• Please feel free to send in your questions by clicking on the question mark icon now

• Also, please check out the FAQ page on our website for answers to commonly asked questions: https://globalcoolingprize.org/prize-details/faq/
Next Webinars

1. Understanding the Technical Criteria for Winning the Challenge
   • Feb 22, 2019, 6:30 – 8:00 am GMT

2. Testing Protocols
   • March 25, 2019 at 4:00PM GMT (noon US EDT)
   • March 26, 2019 at 9:00AM GMT (2:30 pm IST)

3. Intellectual Property
   • Date and Time TBD
Initiated by

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Visit us: www.globalcoolingprize.org
Contact us at: info@globalcoolingprize.org