Shaping Tomorrow's Built Environment Today

Building Decarbonization Strategy Game

FACILITATOR'S GUIDE

Overview

The Building Decarbonization Strategy Game was developed by the ASHRAE Taskforce for Building Decarbonization as a fun, interactive group educational activity to learn about building industry drivers and best practices related to building decarbonization.

During the game, participants working individually (or in teams) first rank 10 building decarbonization market drivers for based on relative importance. Participants then rank 15 building decarbonization practices (related to project design, development, and construction) and 20 decarbonization measures (covering energy efficiency, facility management and renewable energy) based on relative impact.

Participant rankings are compared to rankings from a survey of over 50 ASHRAE Task Force for Building Decarbonization (TFBD) Executive Committee and Working Group members and the individual (or team) with the lowest score (i.e., smallest difference in importance and impact ranking) wins the game...and a prize!

Background

The Building Decarbonization Strategy Game was initially developed for a panel session at the 2023 ASHRAE Annual Meeting in Tampa, FL. It has been significantly refined since the first "playing" and has been facilitated at chapter meetings and industry events by four different members of the ASHRAE TFBD Executive Committee. The following facilitator's guidance is provided based on feedback from these initial sessions.

The game can be "played" in-person or virtually, in large or small group settings, competing either individually or in teams. When played individually, the game takes about 45 minutes to complete. When played in small groups, additional time is needed for the group to discuss - and agree on – their consensus ranking of each group of five industry drivers or practices. While either approach is educational, discussing the industry drivers and best practices with industry peers can be more engaging and informative. Facilitators can include supplemental presentation content before or after the game content, including background slides on building decarbonization or information on building decarbonization resources.

Introduction

At the beginning of the session, pass out one copy of the scoring sheet and the decarbonization practice definitions to each participant (included in Appendix C and D). Slide 2 is an overview of the game and slide 3 shows the two handouts. Slide 4 is the transition to the game.

IMPORTANT – DO NOT distribute copies of the slides to the game participants prior to the session as the presentation includes the answers for the game. The game objective is to guess the relative ranking of each driver or practice in each section, and they are reviewed after every participant (or team) has recorded their guesses on their scoring sheet.

Industry Driver Prioritization

Slide 5 lists the first set of five industry drivers. The participants (or teams) rank these environmental drivers from highest (1) to lowest (5) in terms of the **relative importance to the buildings industry as a whole**. The facilitator should mention that the ranking is not based on the relative importance to the participant, the participant's organization or to ASHRAE but instead to the buildings industry as a whole. Slide 6 shows how to record your (individual or team) ranking on the scoring sheet.

Slide 7 shows the relative importance of the drivers from the TFBD survey and their relative ranking based on importance. **It is important to mention that the TFBD survey results do not necessarily represent the "correct answers"** but instead provide a proxy indication of industry consensus. The survey results provide the basis for the Family Feud TV show's "survey says..." scoring approach. It is also good to mention that there is sometimes a relatively small difference in the relative importance rating (1-5 scale) between consecutively ranked drivers. **This strategy game is an educational exercise, and not the presentation of scientific research, and the survey results should be viewed from that perspective.**

Participants should complete the scoring sheet for the first set of drivers and compute their score, which is the absolute value of the difference between their ranking and the TFBD ranking. Slides 8 and 9 include the last set of industry drivers, which are organizational in nature.

Building Decarbonization Practices Prioritization

Slide 10 introduces the first set of building decarbonization practices which relate to Project Planning; Project Development; and Construction and Renovation. Slide 11 includes the five project planning practices which participants (or teams) rank from highest (1) to lowest (5) in terms of the **relative impact on building decarbonization efforts and outcomes**. The facilitator should mention that the ranking is not based on the relative impact of these practices on the participant's individual activities, but instead to current and future building decarbonization activities for the industry as a whole.

It is recommended that the facilitator talk through the definitions of the first five or ten practices, providing some examples or clarification. After the first couple of practice categories, detailed explanations won't be necessary and participants generally review the written definitions (on the slides or the definitions sheet) themselves or discuss them as a team. After each set of five practices, the participants record their ranking and the TFBD answers are shared.

Determining the Winner

After all 35 of the practices are ranked and the TFBD answers shared, slide 27 provides the participants with instructions on how to tally their score by adding up individual scores for the drivers and practices. The total should be an even number, if not there is a math error somewhere on the scoring sheet. The lowest score wins the game, which is generally in the 30 to 40 range. The facilitator can identify the winner by counting up from 0 until a participant (team) raises their hand. The maximum possible score is 108 and most ASHRAE participants score between 50 and 60. The game winner(s) should receive a prize. At the initial Tampa conference session, the winner received a Barbie Doll House scale split system heat pump made using a 3D printer.

Training and Education Needs

As a final activity, slide 28 shows a table of all 35 building decarbonization practices and the participants are asked to identify up to ten (10) priority practices that should be the focus of future ASHRAE training courses and educational resources. These ten practices can be indicated in the last column of the scoring sheet. Participants should then be encouraged to indicate their industry role at the bottom of the scoring sheet (participant names aren't necessary) so that ASHRAE can analyze the decarbonization training and education needs by industry role. Slide 29 shows high and medium priorities for ASHRAE training and education from 100's of participants in the initial pilot game board sessions.

After the game session, participants should turn in their completed scoring sheet but can keep the practice definitions as a reference. If they want to keep their scoring sheet, encourage then to take a picture of the sheet as a reference.

Please forward the completed scoring sheets (pdf or photos) to ASHRAE CEBD at decarb@ashrae.org so that the game results can be analyzed and used to inform future building decarbonization training, education and certification materials.

APPENDIX A - BUILDING DECARBONIZATION DRIVERS

The first part of the game asks participants to rank climate and organization-related drivers based on the relative importance within each category. A TFBD member survey is used to determine the "correct" ranking.

Environment-related Drivers

A. Reduce operational greenhouse gas emissions
B. Reduce embodied carbon in building materials and equipment
C. Reduce fossil fuel use in buildings
D. Increase use of zero carbon renewable energy
E. Increase facility resilience to climate change impacts

Organization-related Drivers

F. Maintain building occupant comfort, health and safety
G. Reduce building lifecycle costs
H. Increase building asset value
I. Maintain compliance with government regulations
J. Support sustainability goals and commitments

APPENDIX B - BUILDING DECARBONIZATION PRACTICES

PROJECT PLANNING AND DELIVERY

Project Planning Practices

1. Building Decarbonization Audit

   On-site technical assessment and project investment analysis of opportunities for building decarbonization improvements, including energy efficiency; beneficial electrification; building operations; and on-site renewable energy.

2. Policy & Regulation Review

   Evaluation of current and planned government policies and regulations that encourage building decarbonization, penalize poor building energy or emissions performance, or restrict building system replacements and improvements.

3. Financial Incentives Review

   Evaluation of utility and government financial incentives and rebates to support investment in building decarbonization measures for new construction, building renovation, retrofit and replacement projects.

4. Emission Reduction Roadmap

   Development of a short-term plan for implementing building decarbonization measures aligned with regulatory requirements, emission reduction targets and equipment replacement schedules.

5. Facility Capital Planning

   A short-term plan that identifies future capital projects and equipment purchases, a projected schedule for implementation, any implementation dependencies and options for financing the plan.

Project Development Practices

6. Integrated Project Delivery

   A new construction and building renovation design and delivery method that leverages the involvement of project participants and stakeholders through all phases of design, fabrication, construction, commissioning, and building operation.

7. Building Energy Modeling

   A computer simulation of a building used to estimate building heating, cooling and process loads on an hourly basis and determine predicted energy and indoor environmental performance based on building system and equipment selection.

8. Life-Cycle Cost Analysis

   A method for economic evaluation of the total costs and savings of alternative building and system designs for construction, renovation, and equipment replacements over the entire building life cycle.

9. Building Life-Cycle Emissions Assessment

   A method that quantifies the environmental impact of a building throughout its entire life cycle, including aspects such as energy and water use, greenhouse gas emissions, habitat destruction, resource depletion, and toxic emissions.

10. Building Information Management

    A process supported by various tools, technologies, processes, and policies involving the generation and management of digital representations of the physical and functional characteristics of facilities.

Building Construction & Renovation Practices

11. Building Material Reuse

    Reuse of existing construction elements and materials without reprocessing and the repurposing existing building structures for new uses (adaptive reuse).

12. Prefabrication & Modular Construction

    The manufacturing of building construction elements off-site and assembling them on-site, often through modular construction methods using standardized modules.

13. Low Carbon Building Materials

    Materials used in construction with a low carbon footprint in terms of greenhouse gas emissions generated during their manufacturing, transportation, installation, maintenance, and disposal.

14. Low GWP Refrigerants

    Refrigerants used in HVAC/R equipment with low relative global warming potential, such as natural refrigerants, hydrocarbons, hydrofluoroolefins (HFOs), and some hydrofluorocarbons (HFCs).

15. Construction Material Waste Reduction

    Diverting construction and demolition materials from disposal by using recycled products, practicing source reduction, preserving existing structures, salvaging construction structures, and reusing existing materials.

BUILDING SYSTEMS AND EQUIPMENT

Passive Efficiency Measures

16. Building Thermal Envelope

    The design and selection of materials for a building's physical barrier between the external environment and internal conditioned space to reduce energy consumption and improve building resiliency.

17. Building Fenestration

    Proper design, selection, and installation of windows and skylights to minimize heating, cooling, and lighting energy use while improving comfort for building occupants.

18. Building Shading

    The use of natural habitat or artificial devices to control the amount of sunlight entering a building, reducing its cooling requirements, and improving natural lighting quality.

19. Building Surface Reflectivity

    The ability of a building's surface to reflect sunlight and heat, reducing heat flow from the roof into the occupied space and improving comfort and safety in buildings without air conditioning.

20. Natural Ventilation and Thermal Management

    The process of using natural forces of wind and thermal buoyancy to deliver fresh air into buildings to improve indoor environmental quality and reduce energy consumption.

Active Efficiency Measures

21. High Performance HVAC Equipment

    Heating, ventilating, and air-conditioning systems designed to provide increased user thermal comfort, improved indoor environmental quality, and result in considerable energy, emissions, and operational cost savings.

22. Beneficial Electrification

    Replacing fossil-fuel systems for space heating, water heating and cooking with highly efficient, cost-effective electric alternatives that reduce greenhouse gas emissions and minimize cost and reliability impacts on the electric grid.

23. Building Management and Control Systems

    Computer-based systems installed to control and monitor a building's electrical and mechanical systems and equipment, such as HVAC, lighting, energy management, fire safety, and security systems.

24. Lighting and Plug-load Management

    Strategies and devices for automatic switching and dimming of general indoor and outdoor lighting and the control of plug loads such as computer monitors, task lighting, coffeemakers, and vending machines to reduce energy consumption.

25. Water Conservation

    Reduction in water resources through the installation of high efficiency fixtures, elimination of leaks, water conserving cooling towers, smart irrigation systems, and other actions throughout the life of a building.

Building Operations and Management Practices

26. Indoor Air Quality Management

    Designing and operating building systems to provide a comfortable, safe, and healthy environment that reduces common pollutants both within and around buildings.

27. Refrigerant Management

    The proper handling of high global warming potential refrigerants in HVAC/R equipment to control leakages and ensure their recovery, recycling, and destruction at the end of life.

28. Integrated Facility Management

    The use of advanced technology, systems, and processes to optimize the operations and maintenance of buildings while enhancing sustainability, productivity, and tenant experiences.

29. Building Retro-commissioning

    A systematic process applied to existing buildings that have never been properly commissioned to ensure that their systems can be operated and maintained according to the owner's needs and functional requirements.

30. Building Education and Training

    Providing people who occupy, maintain, and operate buildings with the information, tools and strategies needed to optimize the performance of the building's systems and protect the health and comfort of the building's occupants.

Distributed Energy Resource Measures

31. On-site Renewable Energy

    Generating renewable energy on-site (solar, wind, hydro, biofuels) where the power is used.

32. Energy Storage

    Use of technologies (thermal energy storage, battery electric storage) to store energy for later use powering electrical systems and devices or providing building heating and cooling.

33. Managed Electric Vehicle Charging

    An adaptive method of electric vehicle charging to mitigate impacts on the electrical grid and minimize costs by controlling the time and power of charging.

34. Demand Flexibility

    The capability for demand-side building loads to change their electricity consumption patterns by shaping, shedding, and shifting energy use on a short-term basis based on time-of-use energy pricing or utility requests.

35. Off-site Renewable Energy

    The procurement of zero carbon electricity from off-site renewable energy projects or through renewable energy certificates, generally when sufficient on-site renewable generation is impractical.

APPENDIX C – STRATEGY GAME SCORING SHEET

Building Decarbonization Strategy Game	**Your Ranking (1-5)**	**TFBD Ranking (1-5)**	**Your Score = absolute value of | your ranking minus TFBD ranking |**	**Priority Topics for ASHRAE Education (select up to 10)**
Climate-related Building Decarbonization Drivers				
A. Reduce operational greenhouse gas emissions				
B. Reduce embodied carbon in building materials and equipment				
C. Reduce fossil fuel use in buildings				
D. Increase use of zero carbon renewable energy				
E. Increase facility resilience to climate change impacts				
Organization-related Building Decarbonization Drivers				
F. Maintain building occupant comfort, health and safety				
G. Reduce building lifecycle costs				
H. Increase building asset value				
I. Maintain compliance with government regulations				
J. Support sustainability goals and commitments				
Project Planning Practices				
1. Building Decarbonization Audit				
2. Policy & Regulation Review				
3. Financial Incentives Review				
4. Emission Reduction Roadmap				
5. Facility Capital Planning				
Project Development Practices				
6. Integrated Project Delivery				
7. Building Energy Modeling				
8. Life-Cycle Cost Analysis				
9. Building Life-Cycle Emissions Assessment				
10. Building Information Management				
Building Construction and Renovation Practices				
11. Building Material Reuse				
12. Prefabrication & Modular Construction				
13. Low Carbon Building Materials				
14. Low GWP Refrigerants				
15. Construction Material Waste Reduction				
Passive Efficiency Measures				
16. Building Thermal Envelope				
17. Building Fenestration				
18. Building Shading				
19. Building Surface Reflectivity				
20. Natural Ventilation and Thermal Management				
Active Efficiency Measures				
21. High Performance HVAC Equipment				
22. Beneficial Electrification				
23. Building Management and Control Systems				
24. Lighting and Plug-load Management				
25. Water Conservation				
Building Operations and Management Practices				
26. Indoor Air Quality Management				
27. Refrigerant Management				
28. Integrated Facility Management				
29. Building Retro-commissioning				
30. Building Education and Training				
Distributed Energy Resource Measures				
31. On-site Renewable Energy				
32. Energy Storage				
33. Managed Electric Vehicle Charging				
34. Demand Flexibility				
35. Off-site Renewable Energy				
Total Score (108 points maximum - lowest score wins)				

Please circle your industry role:

Consulting Engineer - Contractor - Manufacturer/Rep - Educator/Student - Architect - Design/Build - Sales Engineer - Facilty Operations - Utility - Other _____

APPENDIX D – BUILDING DECARBONIZATION PRACTICE DEFINITIONS SHEET

	Building Decarbonization Strategy Game Definitions
Project Planning Practices	1. **Building Decarbonization Audit** – On-site technical assessment and project investment analysis of opportunities for building decarbonization improvements, including energy efficiency; beneficial electrification; building operations; and on-site renewable energy
	2. **Policy & Regulation Review** – Evaluation of current and planned government policies and regulations that encourage building decarbonization, penalize poor building energy or emissions performance, or restrict building system replacements and improvements.
	3. **Financial Incentives Review** – Evaluation of utility and government financial incentives and rebates to support investment in building decarbonization measures for new construction, building renovation, retrofit and replacement projects.
	4. **Emission Reduction Roadmap** – Development of a short-term plan for implementing building decarbonization measures aligned with regulatory requirements, emission reduction targets and equipment replacement schedules.
	5. **Facility Capital Planning** – A short-term plan that identifies future capital projects and equipment purchases, a projected schedule for implementation, any implementation dependencies and options for financing the plan.
Project Development Practices	6. **Integrated Project Delivery** – A new construction and building renovation design and delivery method that leverages the involvement of project participants and stakeholders through all phases of design, fabrication, construction, commissioning, and building operation.
	7. **Building Energy Modeling** – A computer simulation of a building used to estimate building heating, cooling and process loads on an hourly basis and determine predicted energy and indoor environmental performance based on building system and equipment selection.
	8. **Life-Cycle Cost Analysis** – A method for economic evaluation of the total costs and savings of alternative building and system designs for construction, renovation, and equipment replacements over the entire building life cycle.
	9. **Building Life-Cycle Emissions Assessment** – A method that quantifies the environmental impact of a building throughout its entire life cycle, including aspects such as energy and water use, greenhouse gas emissions, habitat destruction, resource depletion, and toxic emissions.
	10. **Building Information Management** – A process supported by various tools, technologies, processes, and policies involving the generation and management of digital representations of the physical and functional characteristics of facilities.
Building Construction & Renovation Practices	11. **Building Material Reuse** – Reuse of existing construction elements and materials without reprocessing and the repurposing existing building structures for new uses (adaptive reuse).
	12. **Prefabrication & Modular Construction** – The manufacturing of building construction elements off-site and assembling them on-site, often through modular construction methods using standardized modules.
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	15. **Construction Material Waste Reduction** – Diverting construction and demolition materials from disposal by using recycled products, practicing source reduction, preserving existing structures, salvaging construction structures, and reusing existing materials.
Passive Efficiency Measures	16. **Building Thermal Envelope** – The design and selection of materials for a building's physical barrier between the external environment and internal conditioned space to reduce energy consumption and improve building resiliency.
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	22. **Beneficial Electrification** – Replacing fossil-fuel systems for space heating, water heating and cooking with highly efficient, cost-effective electric alternatives that reduce greenhouse gas emissions and minimize cost and reliability impacts on the electric grid.
	23. **Building Management and Control Systems** – Computer-based systems installed to control and monitor a building's electrical and mechanical systems and equipment, such as HVAC, lighting, energy management, fire safety, and security systems.
	24. **Lighting and Plug-load Management** – Strategies and devices for automatic switching and dimming of general indoor and outdoor lighting and the control of plug loads such as computer monitors, task lighting, coffeemakers, and vending machines to reduce energy consumption.
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Building Operations & Management Practices	26. **Indoor Air Quality Management** – Designing and operating building systems to provide a comfortable, safe, and healthy environment that reduces common pollutants both within and around buildings.
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	29. **Building Retro-commissioning** – A systematic process applied to existing buildings that have never been properly commissioned to ensure that their systems can be operated and maintained according to the owner's needs and functional requirements.
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