2025 SPRAYFOAM Convention & Expo
Daytona Beach, FL February 9-12

“Step Up” your Knowledge on Carbon Footprint of Building Enclosures

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Overview

This session will hopefully cover the mysterious and hidden world of Carbon, “Climate Change” and its potential impacts on the Design Community:

- Perception of Insulation Sustainability
- What is Coming down the “Chamber”
- What is an EPD
- Spray Foam Environmental Impact Resources
- Have We Made a Difference and How

Perception of Spray Foam

ARCHITECTS

These are the type of the people who are designing our buildings! “**Guardians of the Earth**”

Perception of Spray Foam

CONTRACTORS

These are the type of the people who are constructing our buildings! “Want to build stuff and make money”

Perception of Spray Foam

Spray Foam Games

Capitol

Districts

Perception of Spray Foam

Spray Foam Games

Spray Foam Slinger

Perception of Spray Foam

- "Green" Product
- Non-Combustible
- Vapor Permeable
- Acoustical Properties
- Easy Install
- "Non-Toxic"

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Perception of Spray Foam

- “Planet Killing” Product
- Combustible
- Vapor impermeable (2lb)
- No Acoustical Properties
- Complicated Install
- “Toxic”

What's Coming Down the “Chamber”

The New York Times

The California Wildfires Are the Latest Disaster Supercharged by Climate...

7 hours ago

Al Jazeera

Is climate change to blame for the California wildfires?

10 hours ago

Time Magazine

L.A. Fires Show the Reality of Living in a World with 1.5°C of Warming

1 day ago

The Tribune

Decoding California fires: ‘Devil’ Santa Ana winds, climate change, human-...

16 hours ago

Los Angeles Times

Intensifying climate ‘whiplash’ set the stage for devastating California fires

2 days ago

The New York Times

L.A. Fires Show Limits of America’s Efforts to Cope With Climate Change

1 day ago

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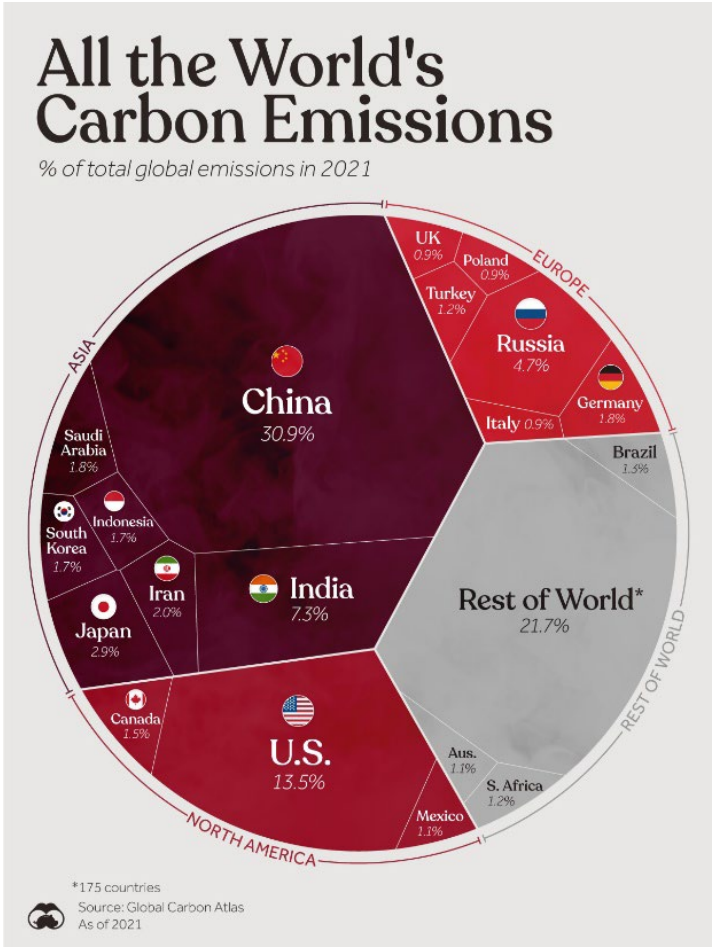
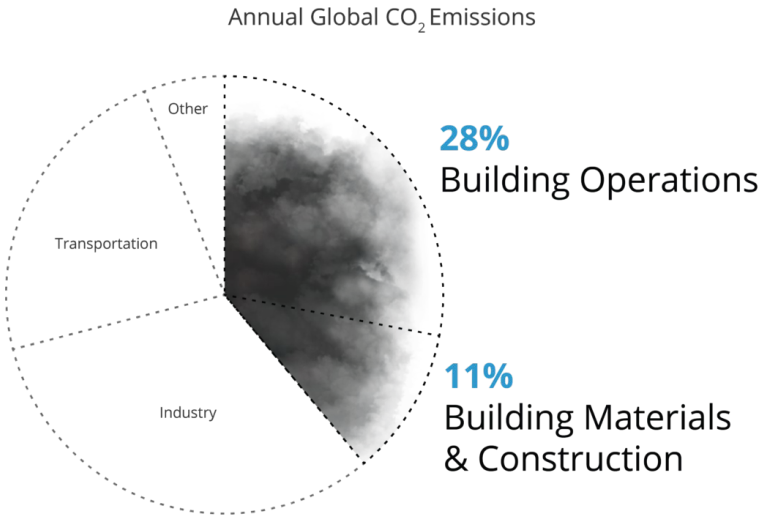
What's Coming Down the “Chamber”





Data Sources: Global ABC Global Status Report 2018, EIA

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What's Coming Down the “Chamber”

2030 Architectural Challenge

To have all New Buildings and Major Renovations would be ZERO Carbon by 2030. This is to meet the 1.5°C goal!

- 2030 Challenge
- 2030 Challenge for Planning
- 2030 Challenge for Embodied Carbon

*Over 1300 A/E have signed up for the 2030 challenge! 3.3 billion sq.ft. of project work was scheduled in 2019 alone.

What's Coming Down the “Chamber”

New Building Actions

Achieving zero emissions from new buildings will require energy efficient buildings that use no on-site fossil fuels and are 100% powered by on- and/or off-site renewable energy.

Energy Efficiency + **Electrification** + **Renewable Energy**

What's Coming Down the “Chamber”

Embodied Carbon Actions

Achieving zero embodied emissions will require adopting the principles of **reuse**, including renovating existing buildings, using recycled materials, and designing for deconstruction; **reduce**, including material optimization and the specification of low to zero carbon materials; and **sequester**, including the design of carbon sequestering sites and the use of carbon sequestering materials.

Reuse **Reduce** **Sequester**

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What's Coming Down the “Chamber”

How can SPF help with Architecture 2030?

Embodied Carbon

Energy Efficiency

What's is a Life Cycle Assessment

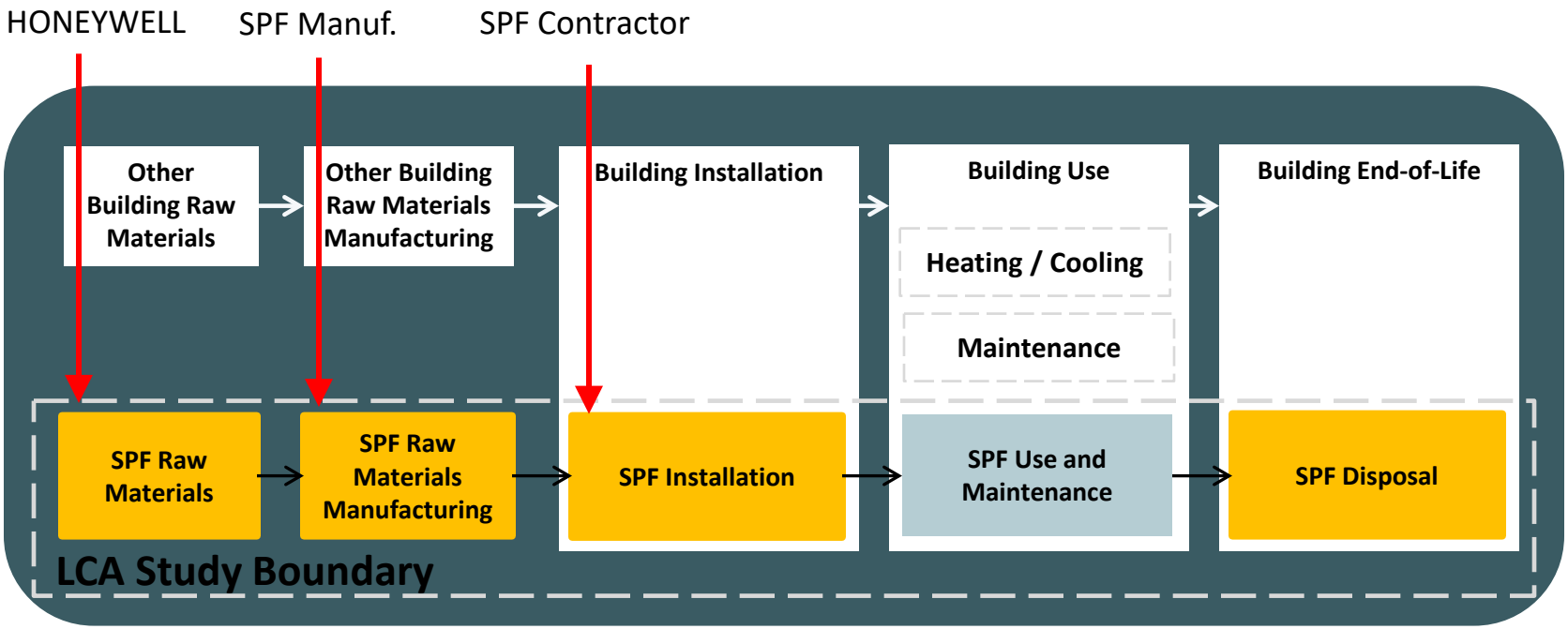
LCAs prevent a narrow outlook on environmental concerns (single-attribute evaluations) by:

- Utilizing a recognized global methodology that provides a holistic and balanced approach to product evaluation
- Compiling an inventory of all energy/material inputs and environmental releases
- Evaluating the potential impacts associated with all inputs and releases
- Interpreting the results to help customers make informed and technically sound decisions

2012- CPI – Life-Cycle Assessment (LCA) for Spray Polyurethane Foams, Duncan, Pavlvoich, Tian

What's is Included in SPF LCA

Inventory Analysis



2012- CPI – Life-Cycle Assessment (LCA) for Spray Polyurethane Foams, Duncan, Pavlvoich, Tian

Covers From Start To Finish

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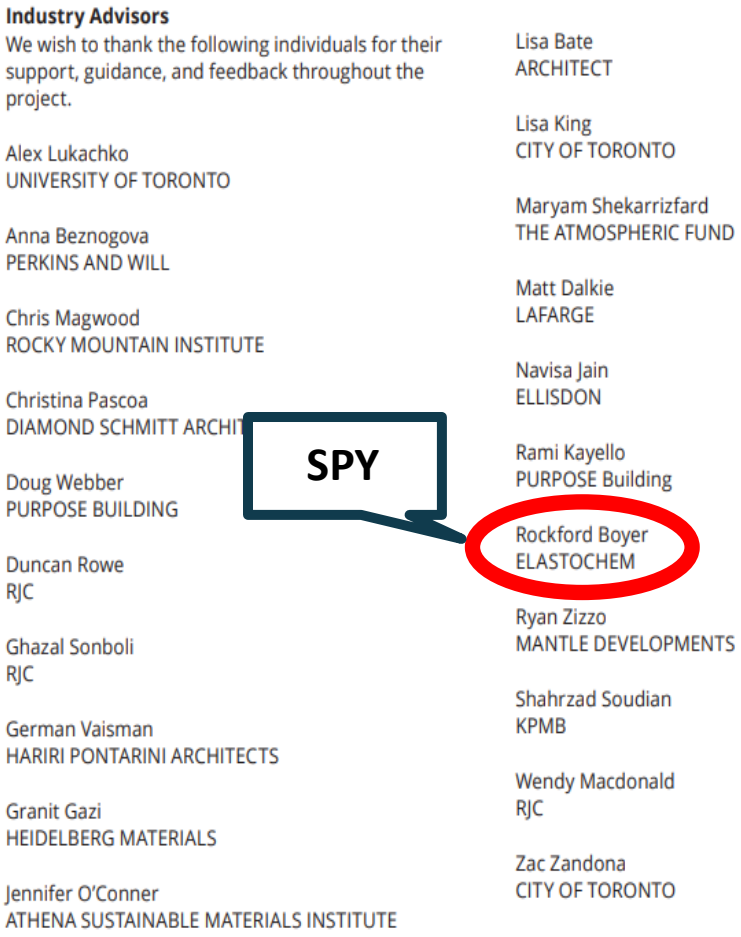
What's Coming Down the "Chamber"

Premade Wall/Roof Assemblies – Indicating Overall Carbon

- Developed by Building Science Firm/University/Government
- Catalog of 26 Wall/Roof Assemblies
- Catalog has various building components (i.e. Insulation)
- Will be marketed as a Tool to designers for sustainability
- Architects will use guide to choose assemblies with low carbon impact
- More assemblies will be developed in the coming months



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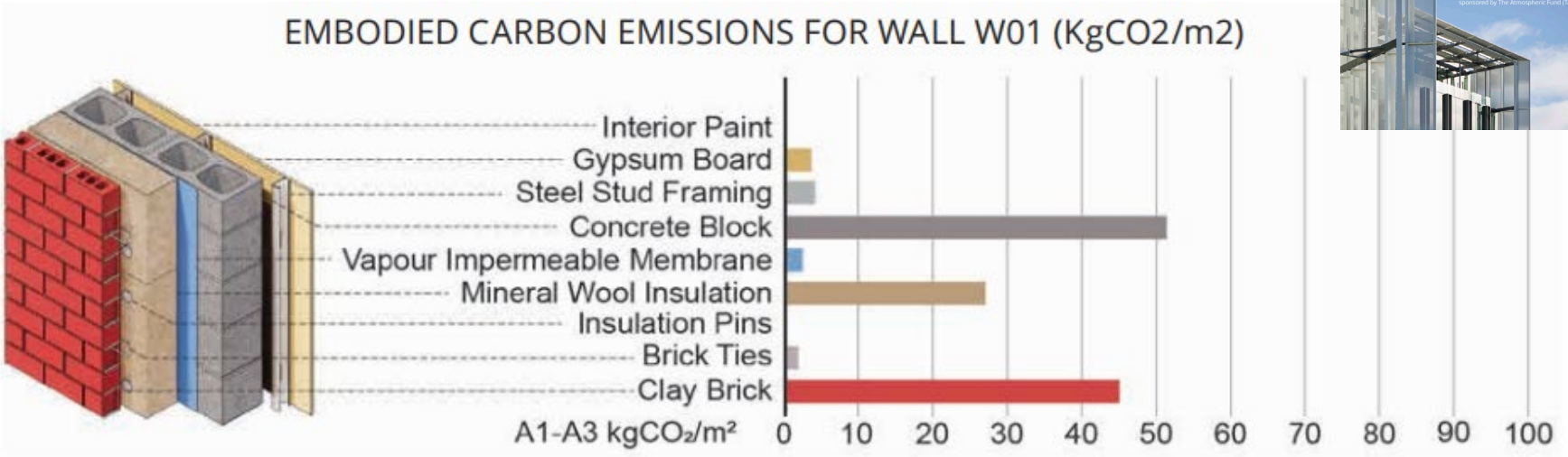

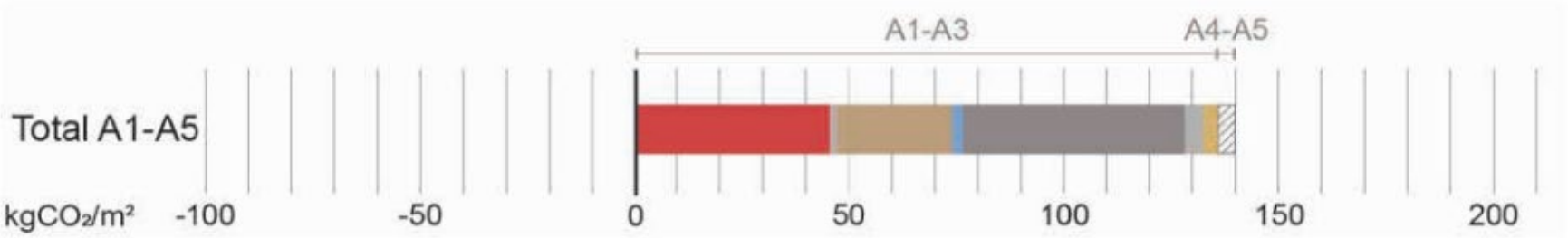

Considering the WHOLE WALL not Components Separately

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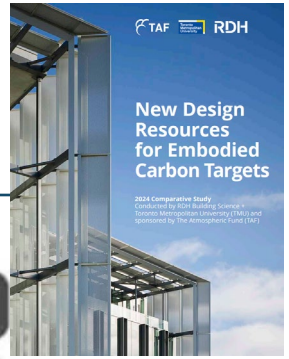
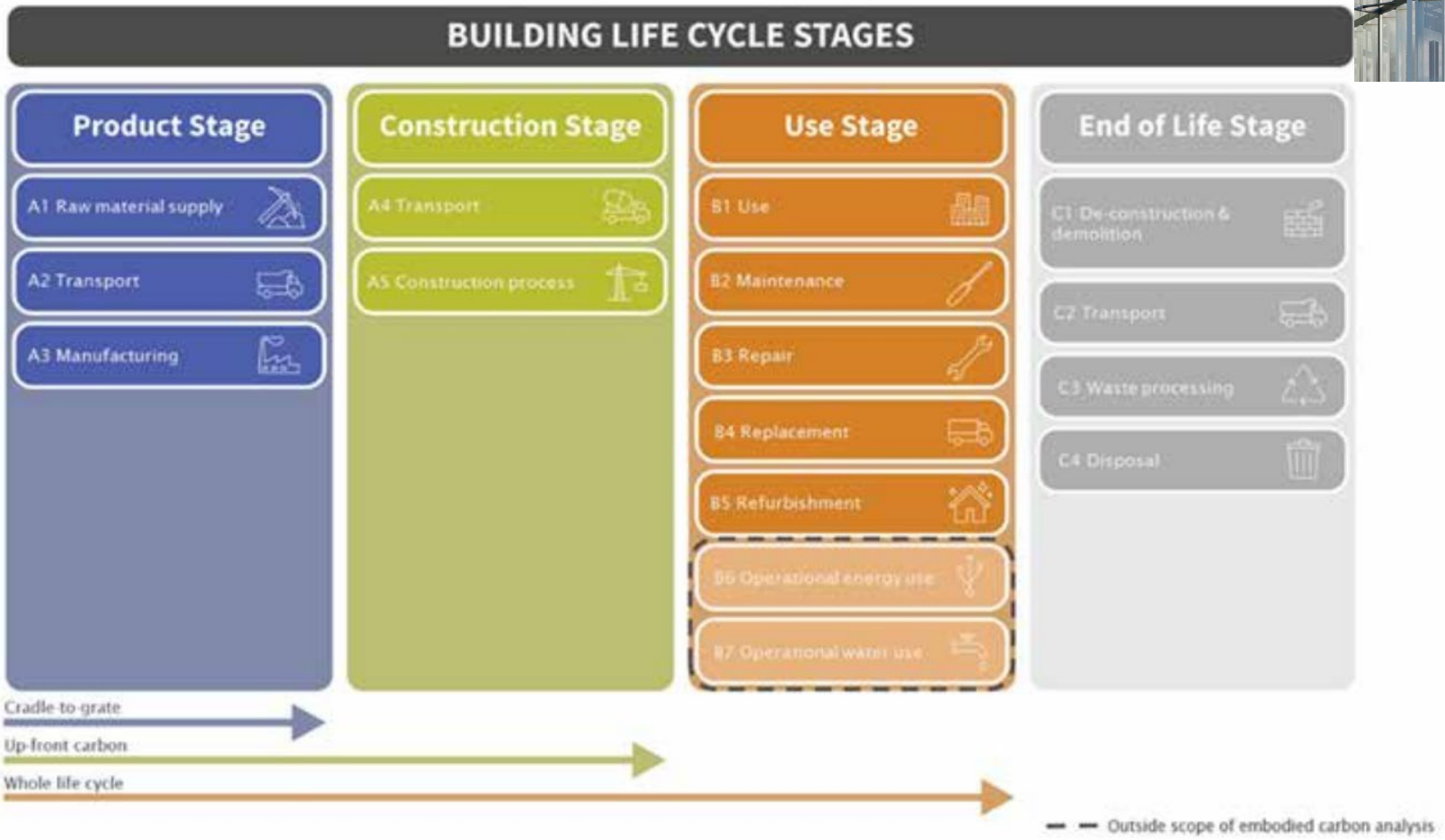
What's Coming Down the “Chamber”





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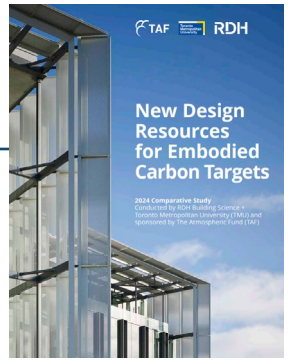
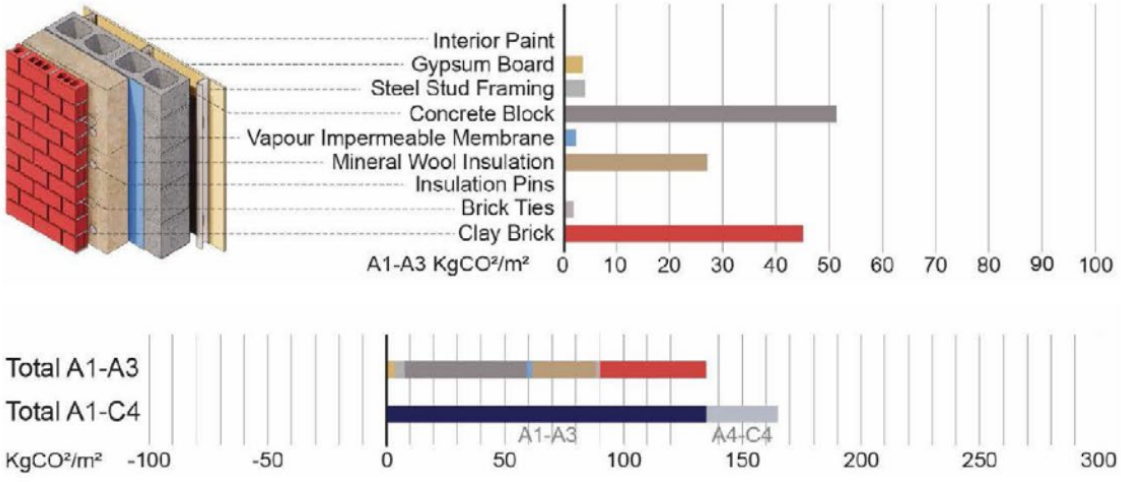


W01: Results Summary

Metrics	Results
Description	**Exterior Insulated CMU with Brick Veneer**
Effective R-value	RSI-4.6 m^2K/W | R-26 $ft^2 \cdot °F \cdot h/BTU$
Embodied Carbon per m^2 of Enclosure (A1-A3)	136.3 $kgCO_2/m^2$
Biogenic Carbon per m^2 of Enclosure	0 $kgCO_2/m^2$



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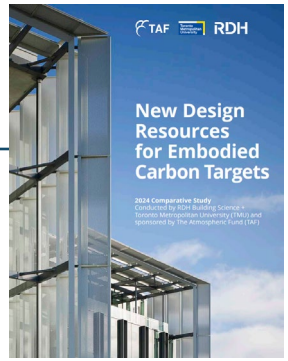
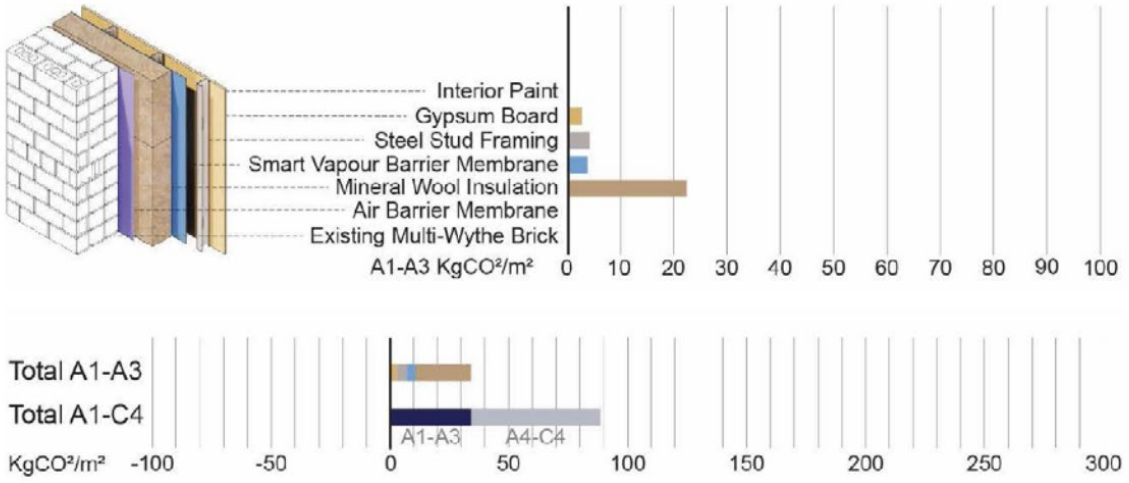


W14: Results Summary

Metrics	Results
Description	**Existing Masonry with Interior Mineral Wool Insulation**
Effective R-value	RSI-4.2 m^2K/W | R-24.0 $ft^2 \cdot °F \cdot h/BTU$
Embodied Carbon per m^2 of Enclosure (A1-A3)	33.7 $kgCO_2/m^2$
Biogenic Carbon per m^2 of Enclosure	0 $kgCO_2/m^2$



Considering the WHOLE WALL not Components Separately

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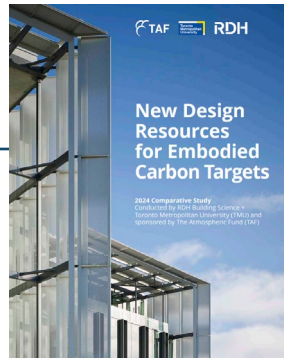
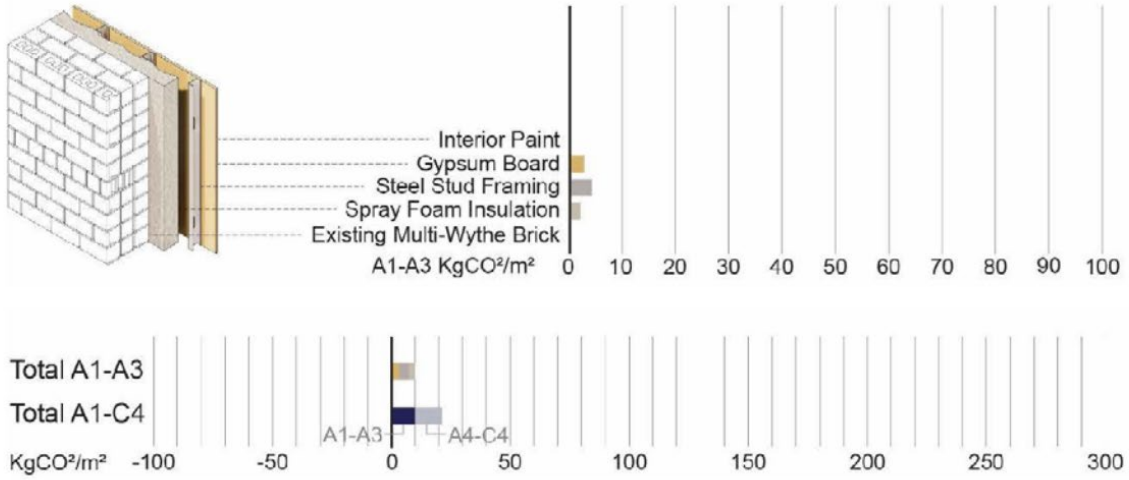


W15: Results Summary

Metrics	Results
Description	**Existing Masonry with Interior Spray Foam Insulation**
Effective R-value	RSI-4.7 m^2K/W | R-26.8 $ft^2 \cdot °F \cdot h/BTU$
Embodied Carbon per m^2 of Enclosure (A1-A3)	9.8 $kgCO_2/m^2$
Biogenic Carbon per m^2 of Enclosure	0 $kgCO_2/m^2$



Considering the WHOLE WALL not Components Separately

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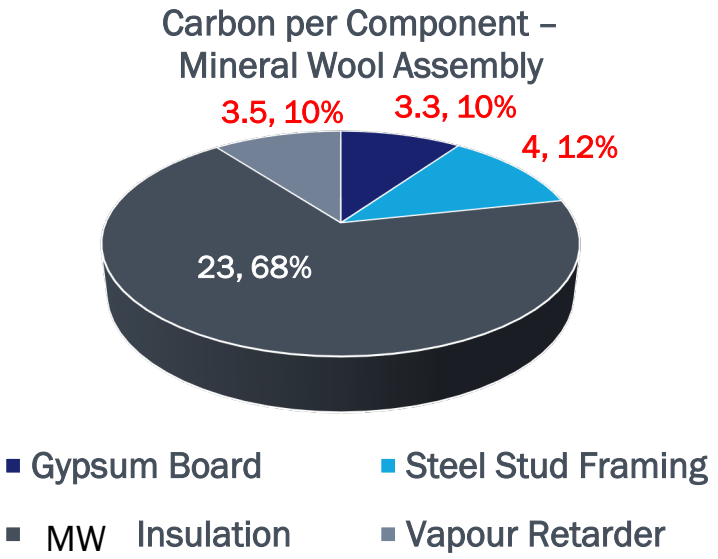
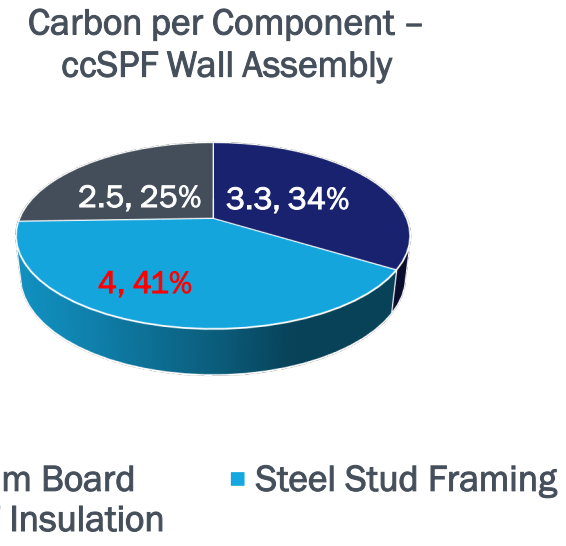
What's Coming Down the "Chamber"

Mineral Wool Assembly – 33.7 kg CO_2 /m²



ccSPF Assembly – 9.8 kg CO_2 /m²



ccSPF Assembly: Less Materials
71% Reduction in Embodied Carbon

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EPD – Environment Product Declaration

What is an EPD?

Carbon from Extraction

Carbon from Landfill & Life

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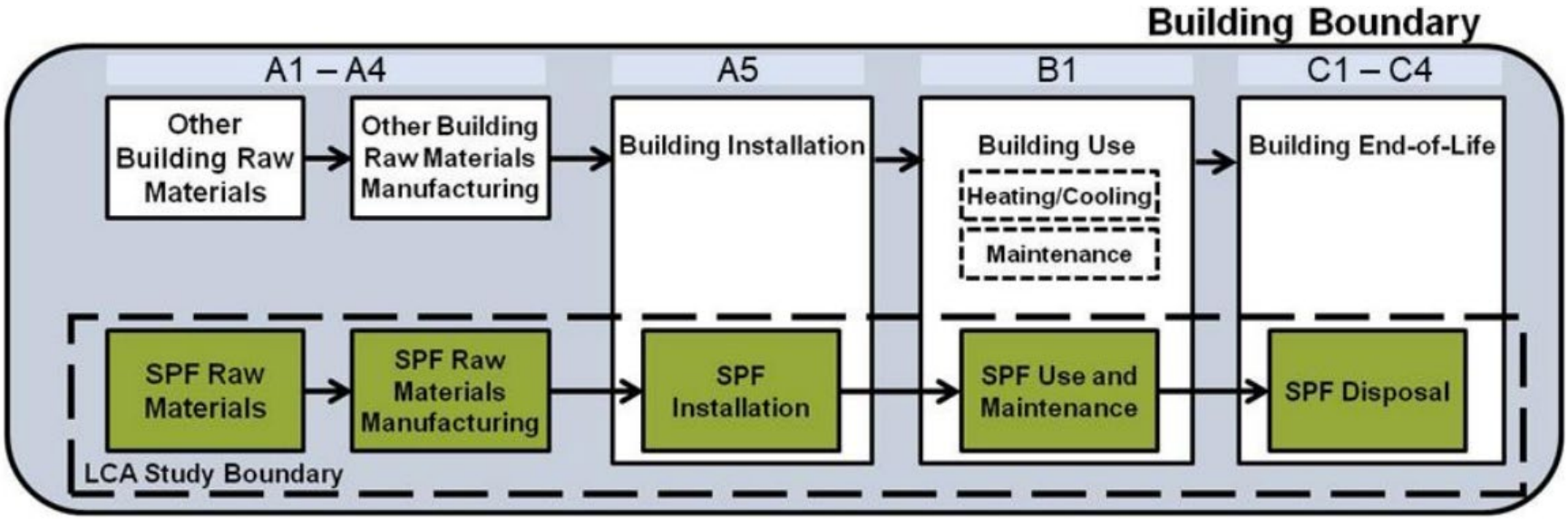
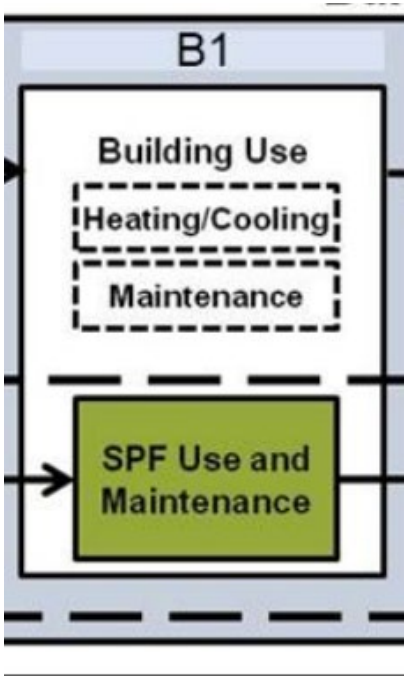
EPD – Environment Product Declaration



EPD – Environment Product Declaration

Energy Efficiency



Insulation is one of the only passive products that saves carbon over the life of the building (i.e. saving energy from heating and cooling)!

Focus on LCA or EPD For Building Not EMBODIED CARBON

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EPD – Environment Product Declaration

ccSPF – Industry Average

Table 12. North American Impact Assessment Results

TRACI v2.1	A1	A2	A3	A4	A5	B1	C2	C4
GWP 100 [kg CO_2 eq]	2.17E+00	6.01E-02	1.28E-01	6.52E-02	2.74E-01	3.33E-03	1.04E-03	1.62E-02
ODP [kg CFC-11 eq]	1.27E-08	1.50E-16	1.20E-12	1.66E-16	3.94E-12	0.00E+00	2.64E-18	6.69E-16
AP [kg SO_2 eq]	3.27E-03	6.54E-04	3.51E-04	2.74E-04	1.18E-03	0.00E+00	4.42E-06	7.24E-05
EP [kg N eq]	3.57E-04	3.27E-05	2.05E-05	2.51E-05	1.03E-04	0.00E+00	4.03E-07	3.11E-06
POCP [kg O_3 eq]	6.07E-02	1.29E-02	7.04E-03	6.31E-03	4.00E-02	1.86E-03	1.02E-04	2.53E-03
ADP_{fossil} [MJ, LHV]	4.89E+01	7.67E-01	1.50E+00	8.55E-01	4.13E+00	0.00E+00	1.36E-02	2.05E-01

ocSPF – Industry Average

Table 11. North American Impact Assessment Results

TRACI v2.1	A1	A2	A3	A4	A5	B1	C2	C4
GWP 100 [kg CO_2 eq]	9.91E-01	1.75E-02	4.29E-02	2.68E-02	1.22E-01	0.00E+00	4.66E-04	6.27E-03
ODP [kg CFC-11 eq]	2.42E-14	4.36E-17	5.40E-13	6.81E-17	1.77E-12	0.00E+00	1.19E-18	3.01E-16
AP [kg SO_2 eq]	1.17E-03	2.12E-04	9.41E-05	1.11E-04	5.30E-04	0.00E+00	1.99E-06	3.25E-05
EP [kg N eq]	1.37E-04	9.92E-06	5.04E-06	1.02E-05	4.60E-05	0.00E+00	1.81E-07	1.40E-06
POCP [kg O_3 eq]	2.42E-02	4.10E-03	1.44E-03	2.54E-03	1.76E-02	0.00E+00	4.57E-05	5.82E-04
ADP_{fossil} [MJ, LHV]	2.19E+01	2.22E-01	5.04E-01	3.51E-01	1.86E+00	0.00E+00	6.12E-03	9.23E-02

Spray Foam Environmental Impact Resources

Elastochem/HONEYWELL/RDH are going to develop 10 wall assemblies with total carbon creation which incorporate various types of insulation and building components. These assemblies will be similar to the guide that was created by TAF/TMU/RDH. These assemblies were developed to demonstrate the low "embodied carbon" compared to other types of insulation types.

Canada – 4 Wall Assemblies
USA – 6 Wall Assemblies

Spray Foam Environmental Impact Resources

Carbon Footprints of Commercial and Residentail Walls in Canada and United States of America

Canada

Type	Cladding	Exterior Insulation	Membrane	Exterior Sheathing	Structure	Interior Insulation	Me
Commercial	N/A	N/A	N/A	N/A	Existing Masonry	Wrapsulate ocSPF	Sn
Commercial	Aluminum Panel	Wrapsulate ocSPF	N/A	Exterior Gypsum	Steel Stud	Extreme ccSPF	N/
Residential	Brick	Extreme ccSPF	N/A	OSB	Wood Stud	ocSPF (0.5lb)	VR
Residential	Wood Cladding	N/A	Air Barrier	OSB	Wood Stud	ccSPF	N/

USA

Type	Cladding	Exterior Insulation	Membrane	Exterior Sheathing	Structure	Interior Insulation	Me
Commercial	Brick	ccSPF	N/A	N/A	Concrete Block	N/A	N/
Commercial	Aluminum Panel	ccSPF	N/A	Exterior Gypsum	Steel Stud	Fiberglass	N/
Commercial	Aluminum Panel	Rockwool	Membrane	Exterior Gypsum	Steel Stud	ccSPF	N/
Residential	Vinyl	XPS	Membrane	OSB	Wood Stud	ccSPF	N/
Residential	Brick	Rockwool	Membrane	OSB	Wood Truss	ccSPF	N/
Residential Passive	Wood Panel	ccSPF	N/A	Exterior Sheathing	Wood Truss	ccSPF	N/

Dynamic Environment – Research Continues

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What Differences Have We Made to Date

MAKING A DIFFERENCE WITH SOLSTICE® HFO

The use of Honeywell Solstice® products is helping avoid the eventual release of the equivalent of more than **395 million** metric tons of carbon dioxide into the atmosphere*, comparable to:

Carbon sequestered by **461M** acres of U.S. forests in one year

Taking **94 million** gasoline-powered passenger vehicles off the road for one year

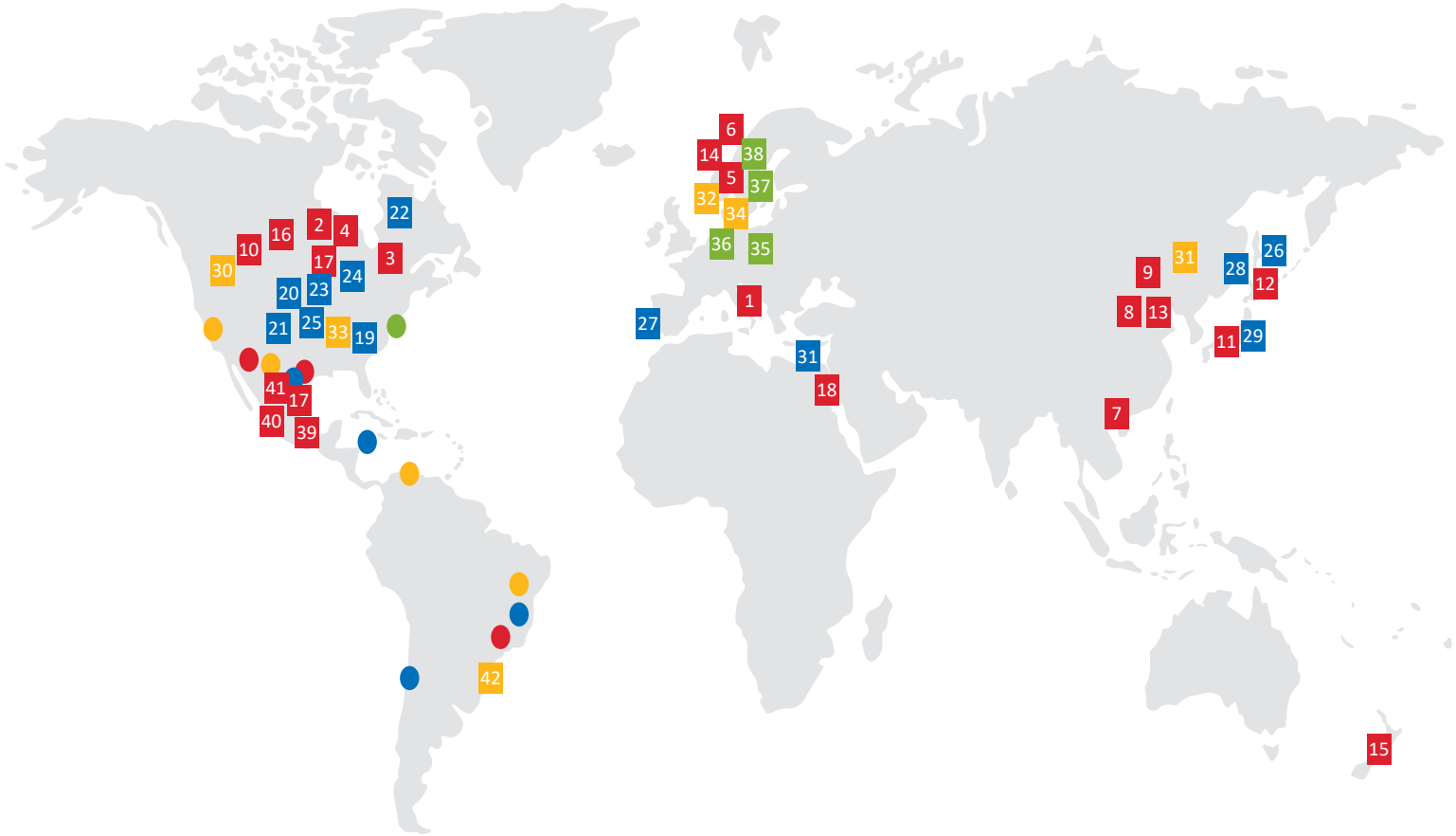
Solstice Replaced Gen 3 HFC Blowing agents with A GWP of 1300

Electricity use of **78 million** homes for one year

*Calculations are based on actual sales of Solstice products (in lbs.) from Jan 2010 through Dec 2023 and utilize the EPA GHG equivalency calculator for conversion.

Is It Just in North America ?

Adoption of Low GWP Foam Blowing Agents Accelerating Worldwide :
Appliance (Domestic and Commercial) Spray Panel XPS



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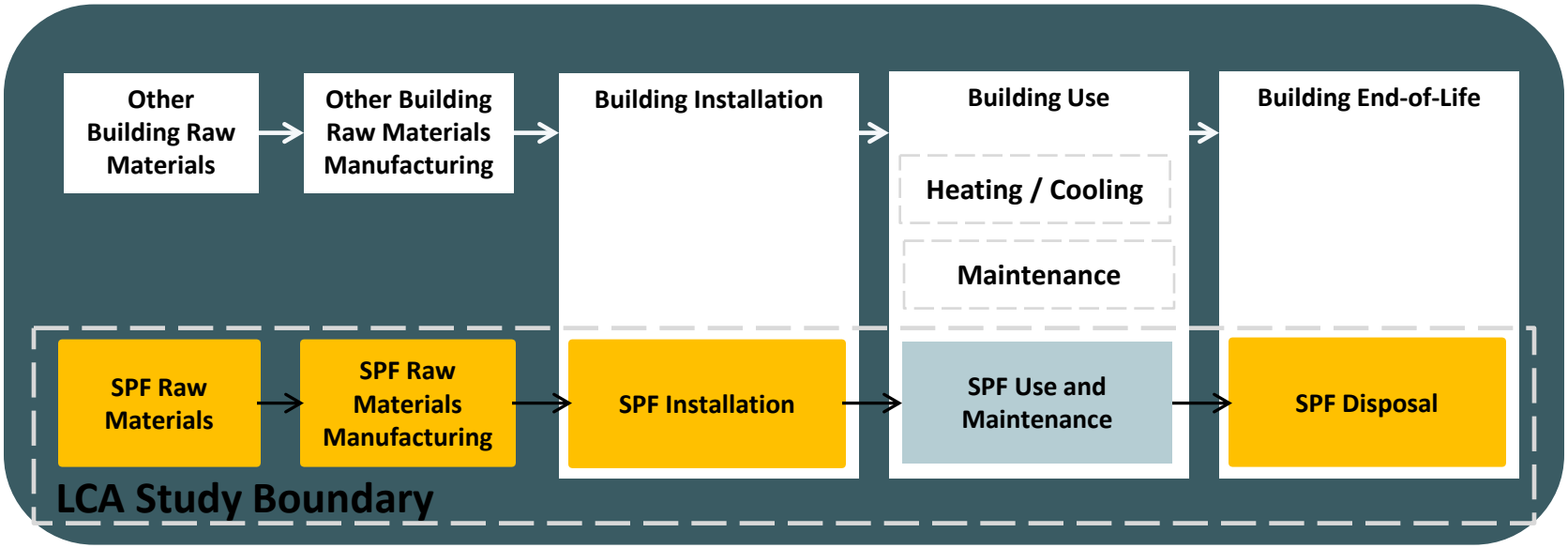
How Do We Improve Our Environmental Footprint?

Inventory Analysis



2012- CPI – Life-Cycle Assessment (LCA) for Spray Polyurethane Foams, Duncan, Pavlvoich, Tian

By Looking At Each Part of the LCA

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How is the Carbon Number Lowered

OUR JOURNEY TO CARBON NEUTRALITY

Decarbonization Strategy	Example
Energy Efficiency	Honeywell looks for opportunities to upgrade and make existing equipment more energy efficient through the replacement of assets such as compressors and pumps with newer, more efficient designs. We also take advantage of opportunities to capture waste energy through the installation of boiler economizers and upgraded heat exchangers.
Renewable Energy	Honeywell has entered into an agreement to invest in a utility scale solar project in Louisiana that is expected to reduce its Scope 2 footprint by approximately 80,000 metric tons per year. In addition, Honeywell is closing several waste beds in Syracuse, New York using solar panels that will generate renewable energy for the local community.
Fuel Switching	As hydrogen becomes available near our large manufacturing plants, Honeywell will pursue opportunities to replace natural gas with hydrogen for boilers and other industrial equipment.
Electrification	Honeywell currently uses natural gas-fired boilers for comfort heating and the generation of process steam at many of our manufacturing plants. We are developing a plan to replace several of these boilers with electric boilers and/or heat pumps between now and 2035. Honeywell has also deployed a program to electrify its vehicle fleet by 2035.
Carbon Capture	Honeywell is identifying opportunities at our sites to deploy our Advanced Solvent Carbon Capture process that removes CO_2 from flue gas so it can be utilized or stored instead of entering the environment.
Process Emissions	Honeywell continues to develop and deploy technology aimed toward reducing process emissions at its manufacturing facilities. For example, Honeywell's Rebellion cameras can detect emissions in real-time, allowing for fast response and resolution.
Market-Based Instruments (Credible Offsets & Renewable Fuels)	Honeywell will invest in renewable fuels such as sustainable aviation fuel (SAF) and renewable natural gas. If needed to achieve carbon neutrality, Honeywell will also invest in credible carbon offsets. Credible carbon offsets will come from projects that are technology-based, metered, and permanently store captured carbon.

Honeywell | 2024 IMPACT REPORT | 16

https://www.honeywell.com/us/en/company/impact-report, pg 16

Does It Work?..... Yes

PLANET

REDUCING GHG EMISSIONS

Honeywell reports on its global GHG emissions pursuant to The Greenhouse Gas Protocol and publicly reports through CDP, a U.K.-based organization that supports companies' and cities' environmental disclosures, as well as various regulatory agencies.

We have received third-party limited assurance per ISO 14064-3 of our Scope 1 and Scope 2 GHG emissions annually since 2011.

Greenhouse Gas Data

	2019	2020	2021	2022	2023
Scope 1, Metric Tons CO_2e	1,384,849	1,384,849	1,324,742	1,059,105	690,042
Scope 2, Metric Tons CO_2e	951,982	860,579	693,288	697,090	665,877
Total	2,336,831	2,248,306	2,018,031	1,756,196	1,355,919
GHG Intensity, Metric Tons CO_2e/$M Revenue	63.4	68.9	58.7	49.5	37.0

The GHG intensity metrics are the sum of our Scope 1 and location-based Scope 2 emissions in metric tons of carbon dioxide equivalent divided by revenue in million U.S. dollars. Variations in data reported can occur due to timing of reporting and updates to methodologies as newer reporting protocols and emission factors are adopted.

As a part of our commitment to reduce GHG emissions, Honeywell has been implementing solar projects to reduce dependency on conventional power sources. Examples of in-progress and recently completed solar projects include:

- Investment in a utility scale solar facility in Louisiana that is expected to reduce our GHG footprint by approximately 80,000 metric tons per year.
- Installation of solar panels over an existing waste bed slated for closure instead of the traditional method of installing an impermeable cap over the waste bed.
- Installation of a rooftop solar system at our factory in Trieste, Italy that produces approximately 500,000 kilowatt hours per year.

https://www.honeywell.com/us/en/company/impact-report, pg 17

Conclusion

- Environmental perception of SPF is low
- Promote the environmental benefits of SPF
- Use SPF as other control layers
- Develop case studies base on sustainability
- Join green organizations
- Continue developing green literature
- Production/RD need to understand the “green” requirements
- Industry as a whole is working to reduce SPF Environmental Footprint

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THANK YOU

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