



# Towards decarbonized specialty glass

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CORNING

# Sustainability at Corning

## Approach

At Corning, we take a long-term approach to sustainability, as we address key challenges of the moment and evolve to meet the needs of the future.

We think about our contributions in two categories:



### FOOTPRINT

The impact of the actions we take



### HANDPRINT

The impact of actions we enable others to take

## Highlights

### ENERGY STAR® Partner of the Year

For 11 consecutive years, by the U.S. Environmental Protection Agency (EPA)

### SBTi approved climate goals

Greenhouse gas (GHG) emissions reduction goals approved by the Science Based Targets initiative (SBTi)

### 4<sup>th</sup> for corporate solar energy usage

Ranked 4<sup>th</sup> within the U.S. manufacturing sector

## GHG emissions reduction goals

30%



**Reduce absolute Scope 1 & 2 emissions 30% by 2028 from a 2021 base year**

17.5%



**Reduce absolute Scope 3 emissions, covering purchased goods and services, capital goods, fuel- and energy-related activities, and upstream transportation and distribution 17.5% by 2028 from a 2021 base year**

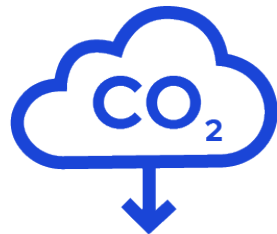
400%



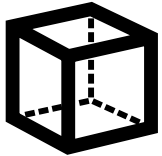
**Increase use of renewable energy by 400% by 2030 from a 2018 baseline**

**THE CHALLENGE: Reducing the massive amounts of greenhouse gases humans are putting into the atmosphere**

60B mton CO<sub>2</sub> eq

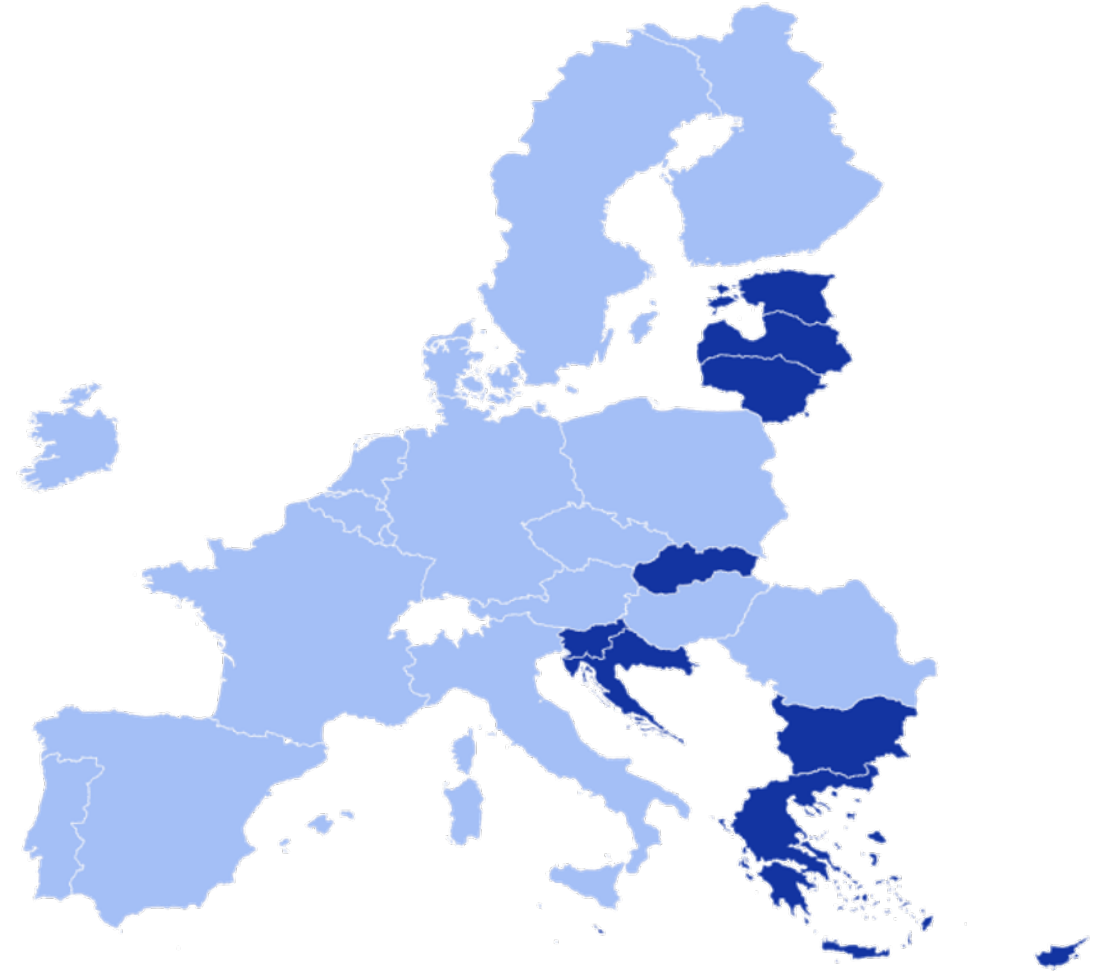


# What does 60B mton of CO<sub>2</sub> equivalent look like?



=

1 ton of CO<sub>2</sub> can fill a cube that's ~8m per side



# Tackling GHG reductions should be approached in two complementary ways



## carbon footprint

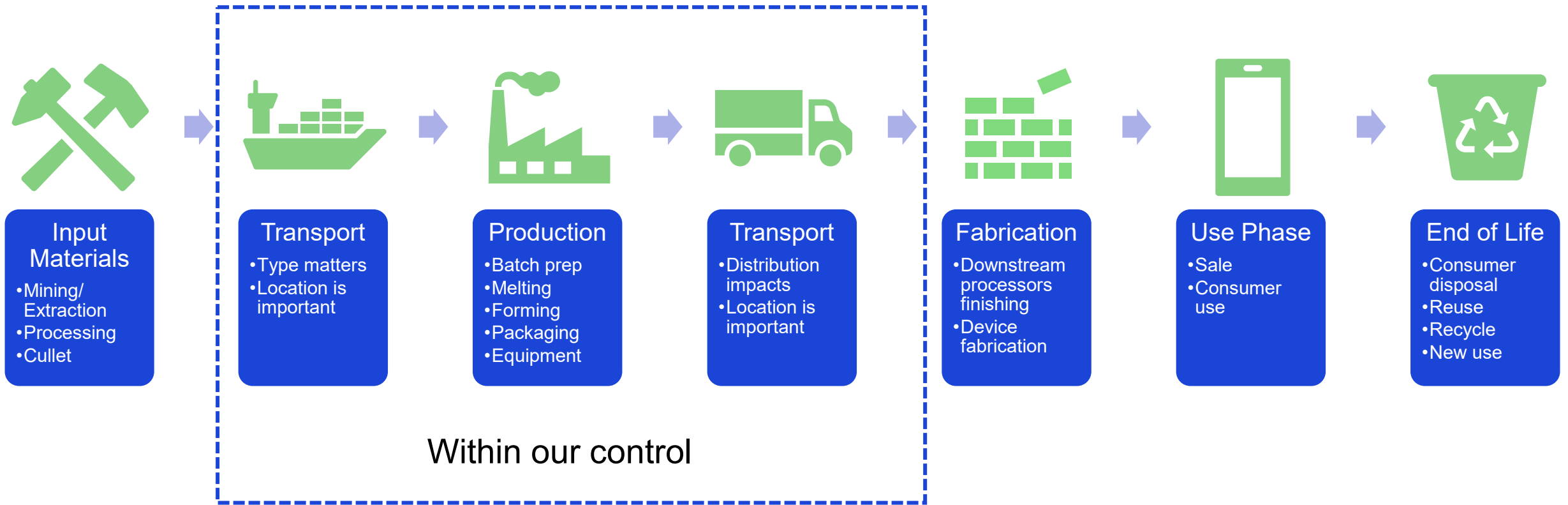
a measure of the amount of carbon dioxide and other carbon compounds emitted due to the activities by a person, group, etc.



## carbon handprint

a measure of the amount of greenhouse gas emission reductions that a person, group, product, services, etc., enables others to make

# Specialty glass value chain process flow steps



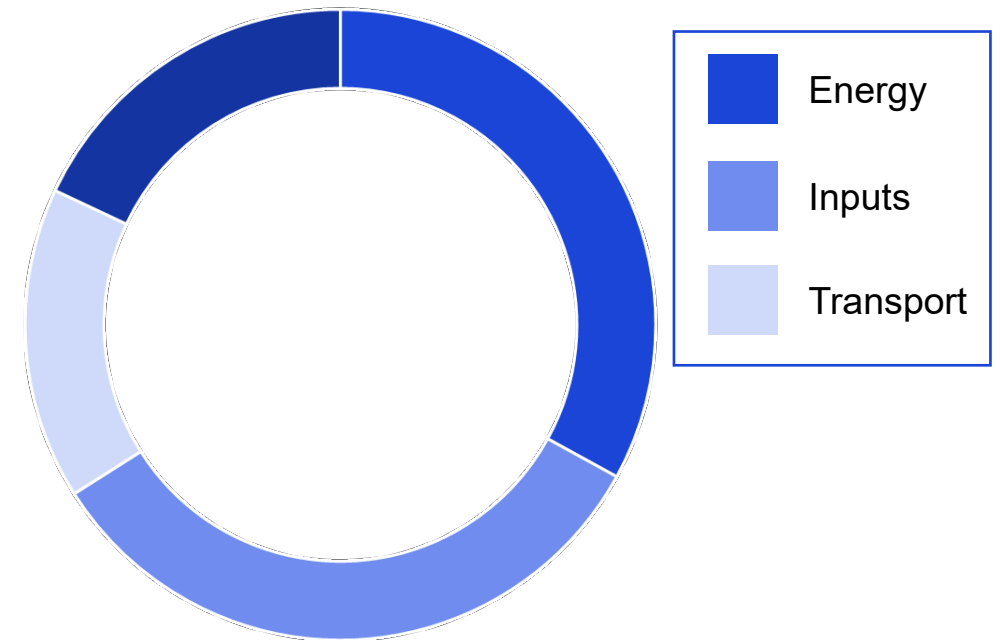
Within our control

← Collaboration to improve →

# Areas that comprise the majority of glass product embodied carbon

100  
million  
mton CO<sub>2</sub> eq

Transportation  
represents 5-25%  
of total emissions



Energy represents  
30-40% of total  
emissions

Goods purchased  
represents ~1/3 of  
total emissions



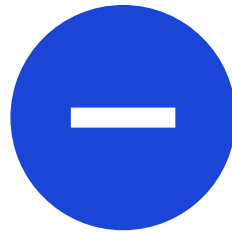
# Ways to tackle energy use from production

## Energy Choices



### Electrification

- Gas to electric
- Increased electric
- Low carbon electricity
- Electricity grid regional
- Nuclear



### No Carbon Fuels

- Green H<sub>2</sub>
- Green NH<sub>3</sub>
- Biofuels
- Hybridize

## Process Approaches



### Energy Efficiency

- Oxy-fuel firing
- Process control
- Batching technologies
- Less waste heat
- Process efficiency



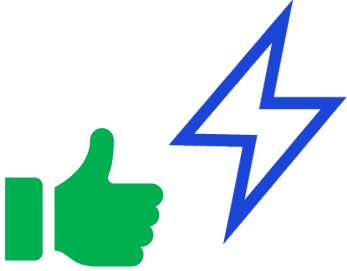
### Heat Recovery

- Heat to power
- Pre-heating
- Internal/external use
- Regeneration



# Practical reality of tackling production energy use

## Energy Choices



Electrification



No Carbon Fuels

## Process Approaches



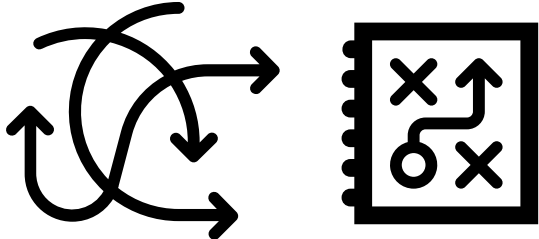
Energy Efficiency



Heat Recovery



Collaborate with industry groups to support the transition efforts.

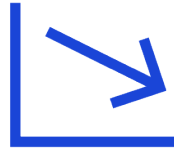


Reevaluate design, construction, process control, losses, and utilization.

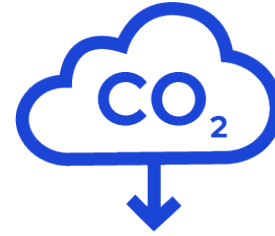
# There are 4 primary ways to reduce GHGs from input materials



Production electrification & renewable energy



Reduce the amount of input material required



Use materials that have lower embodied carbon



Capture and store the CO<sub>2</sub> emitted

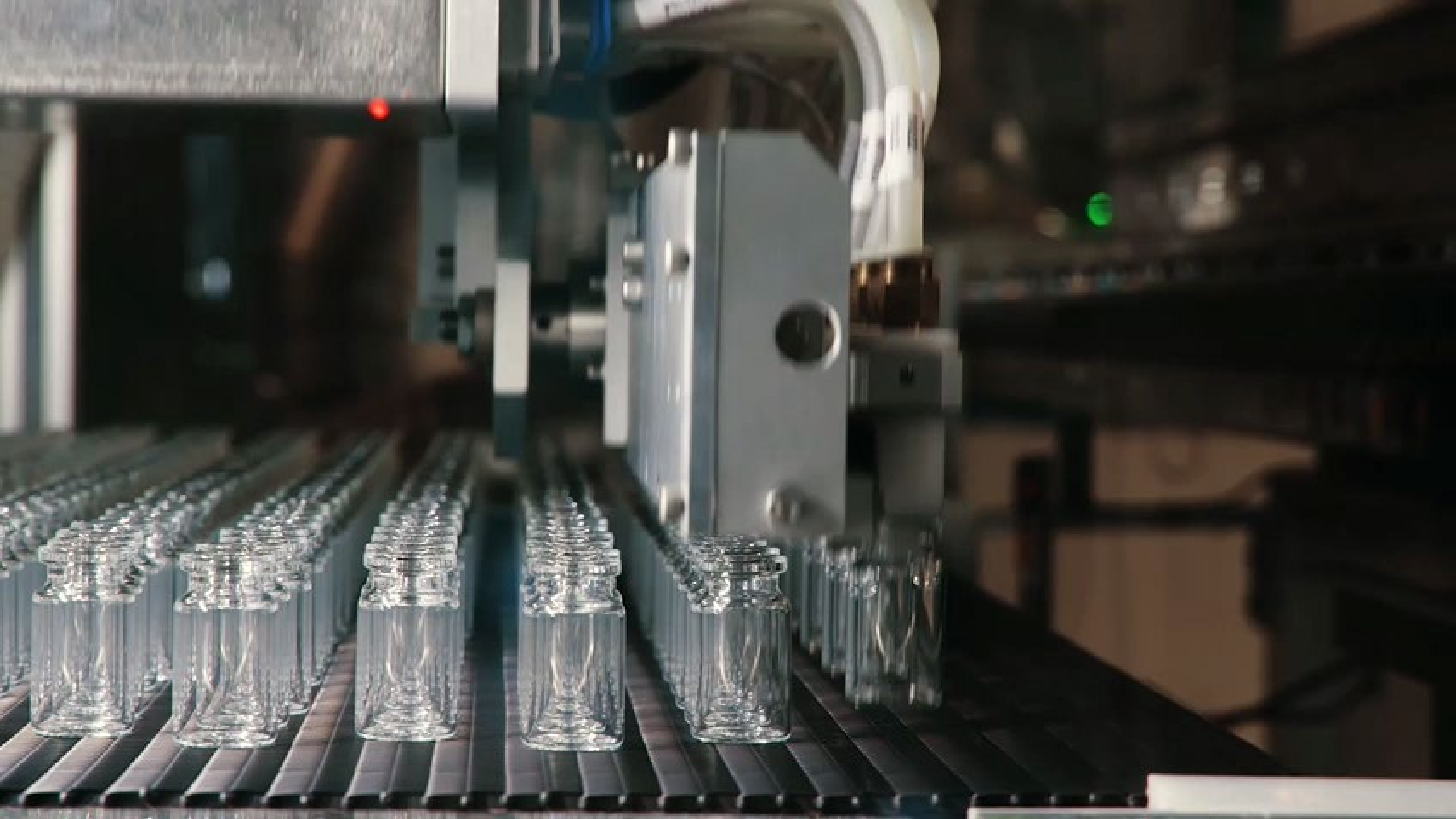


Recycling internal cullet is an industry standard approach with around ~20% being used.



Use recycled materials

10% of cullet used will reduce energy consumption by ~3% and will not release CO<sub>2</sub> upon 2<sup>nd</sup> melting.



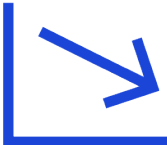




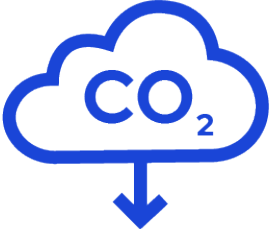
# Some approaches are 'easier' than others to implement



Production electrification & renewable energy



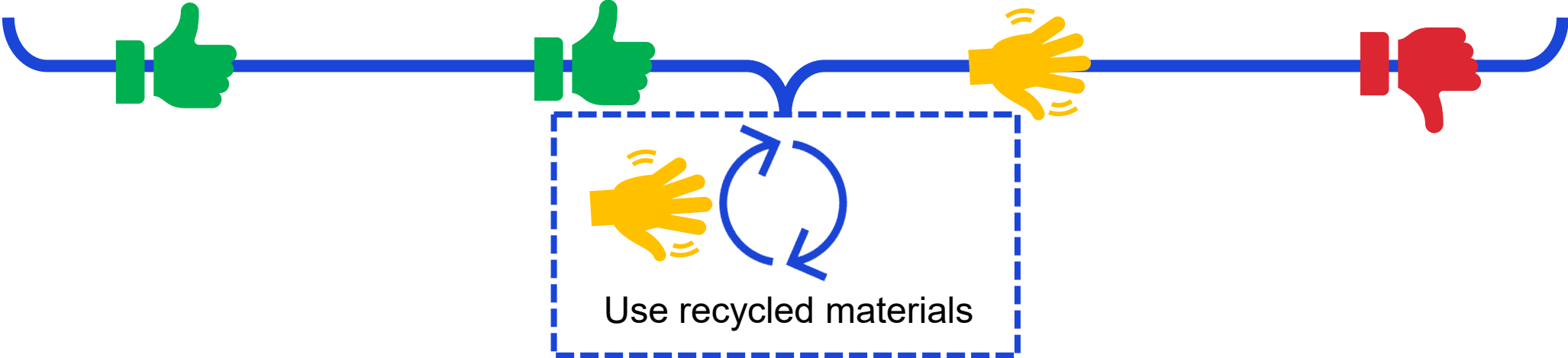
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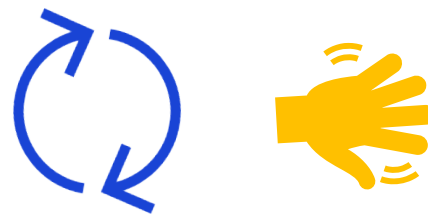


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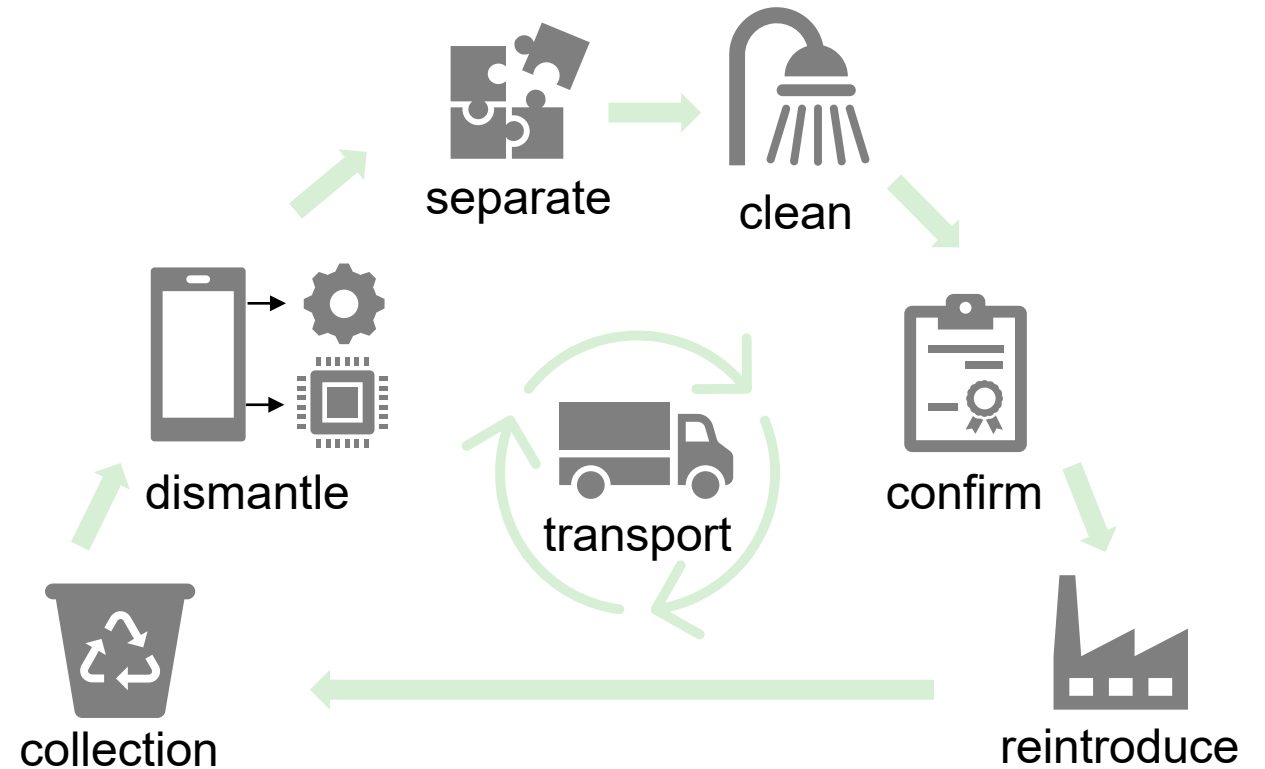




# Recycled Materials



## Example flat glass recycling schematic



References: Industrial Decarbonisation & Energy Efficiency Roadmaps to 2050, March 2015, UK Government Publications (<https://www.gov.uk/government/publications/industrial-decarbonisation-and-energy-efficiency-roadmaps-to-2050>)  
 2050 Flat Glass in Climate-Neutral Europe – Triggering a Virtuous Cycle of Decarbonization, 2020, Glass for Europe (<https://glassforeurope.com/wp-content/uploads/2020/01/flat-glass-climate-neutral-europe.pdf>)

# Transportation is an attainable opportunity



- Due to supply constraints and port shutdowns, value chain partners have chosen air travel
- Even a small amount of air travel can have a massive impact on your overall carbon footprint
- Anticipate progress in the lower-carbon transportation space
- Choices are critical

1 icon represents limited long-term opportunity  
 2 icons represents large long-term opportunity  
 3 icons represents greatest long-term opportunity

	BATTERY/ELECTRIC	HYDROGEN	SUSTAINABLE LIQUID FUELS
Light Duty Vehicles (49%)*		—	TBD
Medium, Short-Haul Heavy Trucks & Buses (~14%)			
Long-Haul Heavy Trucks (~7%)			
Off-road (10%)			
Rail (2%)			
Maritime (3%)			
Aviation (11%)			
Pipelines (4%)		TBD	TBD
<b>Additional Opportunities</b>	<ul style="list-style-type: none"> <li>• Stationary battery use</li> <li>• Grid support (managed EV charging)</li> </ul>	<ul style="list-style-type: none"> <li>• Heavy industries</li> <li>• Grid support</li> <li>• Feedstock for chemicals and fuels</li> </ul>	<ul style="list-style-type: none"> <li>• Decarbonize plastics/chemicals</li> <li>• Bio-products</li> </ul>
<b>RD&amp;D Priorities</b>	<ul style="list-style-type: none"> <li>• National battery strategy</li> <li>• Charging infrastructure</li> <li>• Grid integration</li> <li>• Battery recycling</li> </ul>	<ul style="list-style-type: none"> <li>• Electrolyzer costs</li> <li>• Fuel cell durability and cost</li> <li>• Clean hydrogen infrastructure</li> </ul>	<ul style="list-style-type: none"> <li>• Multiple cost-effective drop-in sustainable fuels</li> <li>• Reduce ethanol carbon intensity</li> <li>• Bioenergy scale-up</li> </ul>

\* All emissions shares are for 2019

† Includes hydrogen for ammonia and methanol



# Specialty glass value chain decarbonization “to do list”

- Electrify everything you can
- Use low carbon electricity everywhere
- Improve energy efficiency
- Reduce excess process heat losses
- Replace carbon-based fuels with non-carbon alternatives
- Capture GHGs from furnaces
- Use low-carbon input materials
- Switch to recycled input materials as much as possible
- Transport materials by low- or no- carbon modes
- Redesign capital equipment to reduce embodied carbon (lifetime, materials, etc.)

# Practical examples of increasing our carbon handprint



## carbon footprint

a measure of the amount of carbon dioxide and other carbon compounds emitted due to the activities by a person, group, etc.



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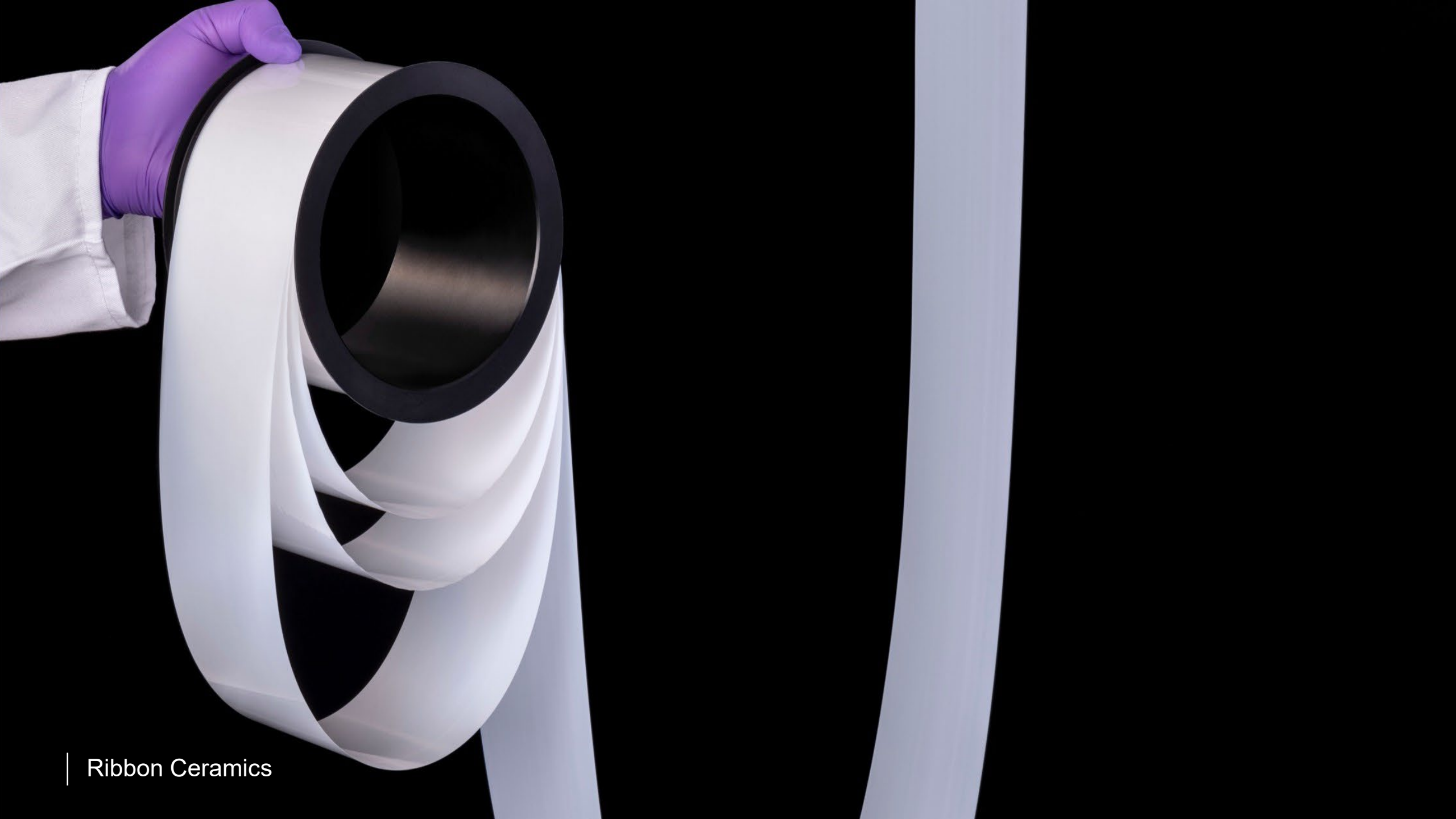






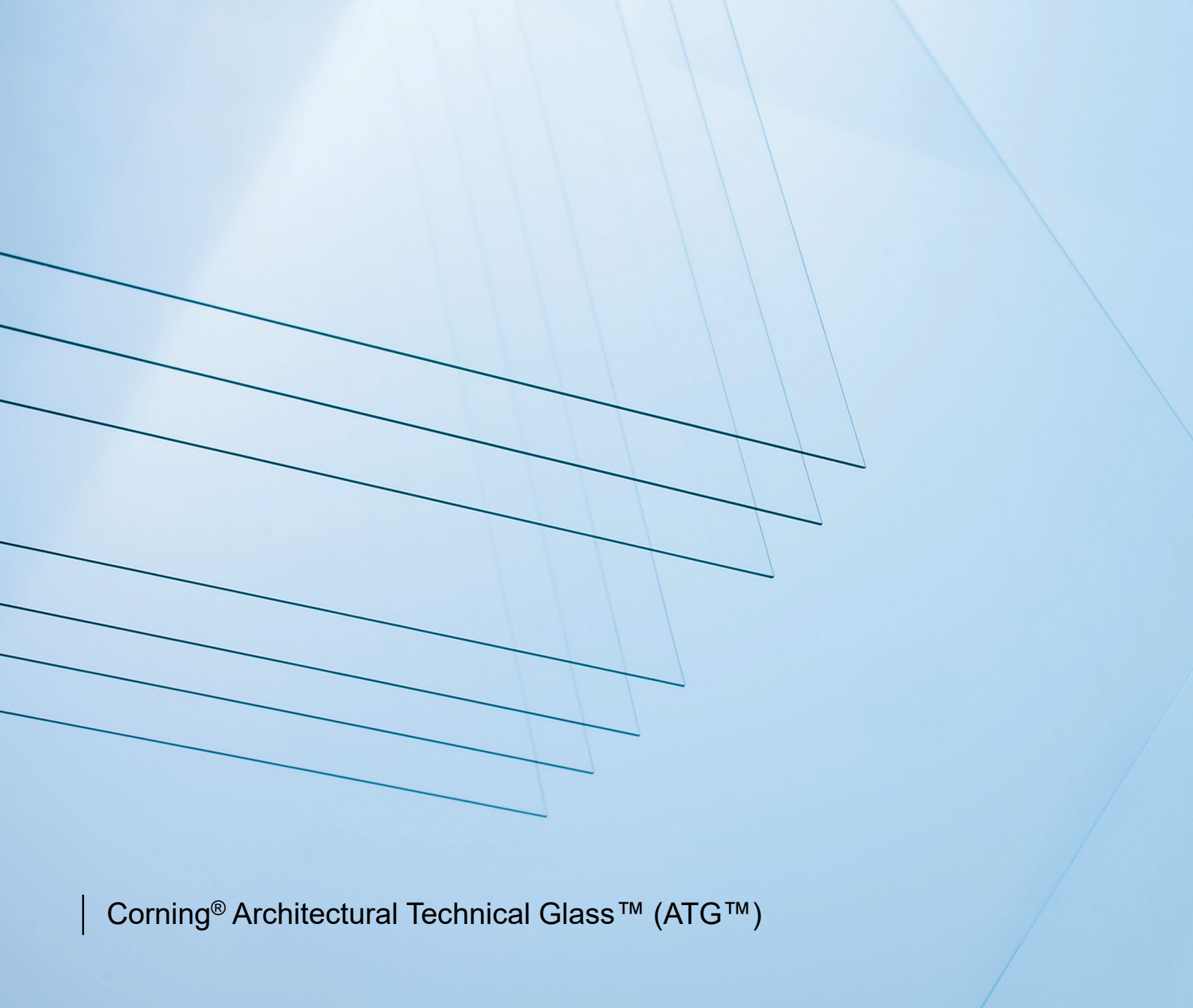


| Cellular Ceramic Substrates



| Ribbon Ceramics

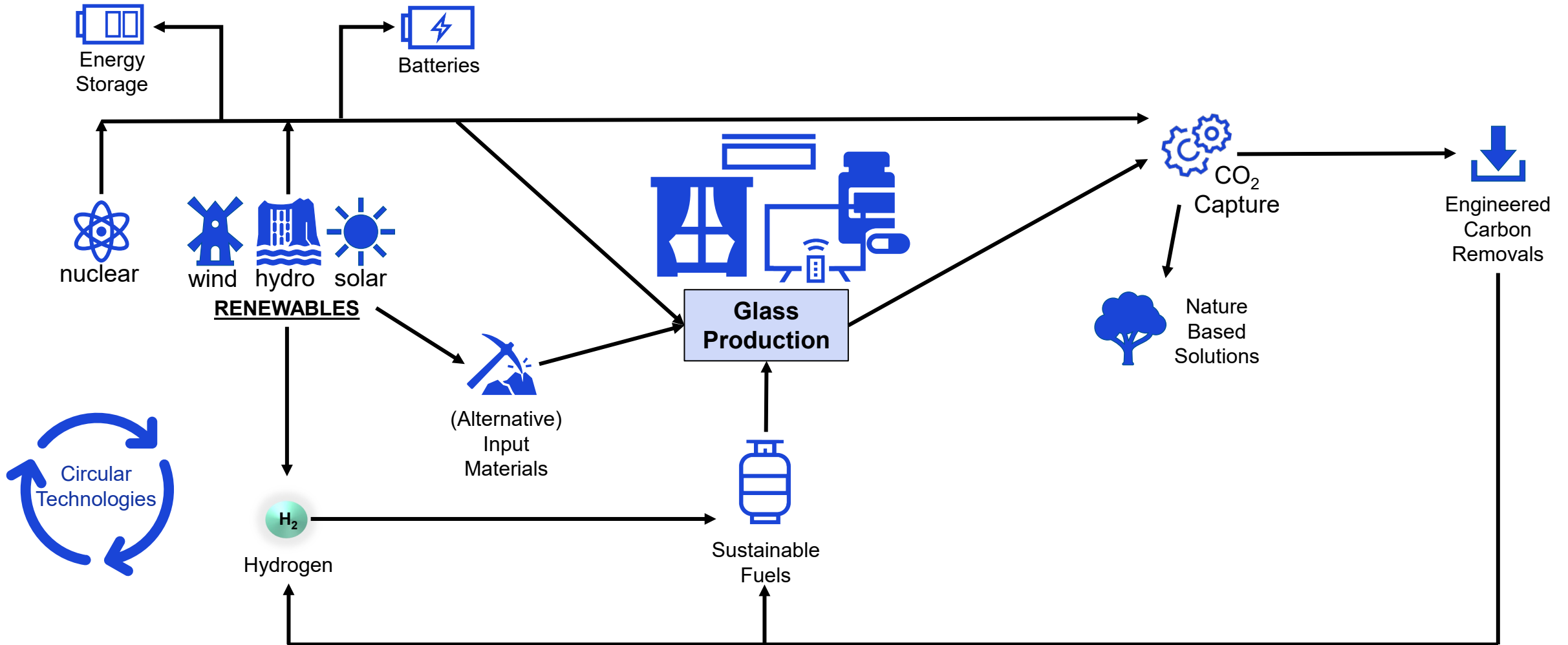




| Corning® Architectural Technical Glass™ (ATG™)



# A collaborative network of technologies is essential to decarbonize





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