Asphalt Plant Decarbonization - What Can Be Done Now!

BUILT TO CONNECT

Greg Renegar

Pennsylvania Asphalt Paving Association

January 2023

Fun Fact…

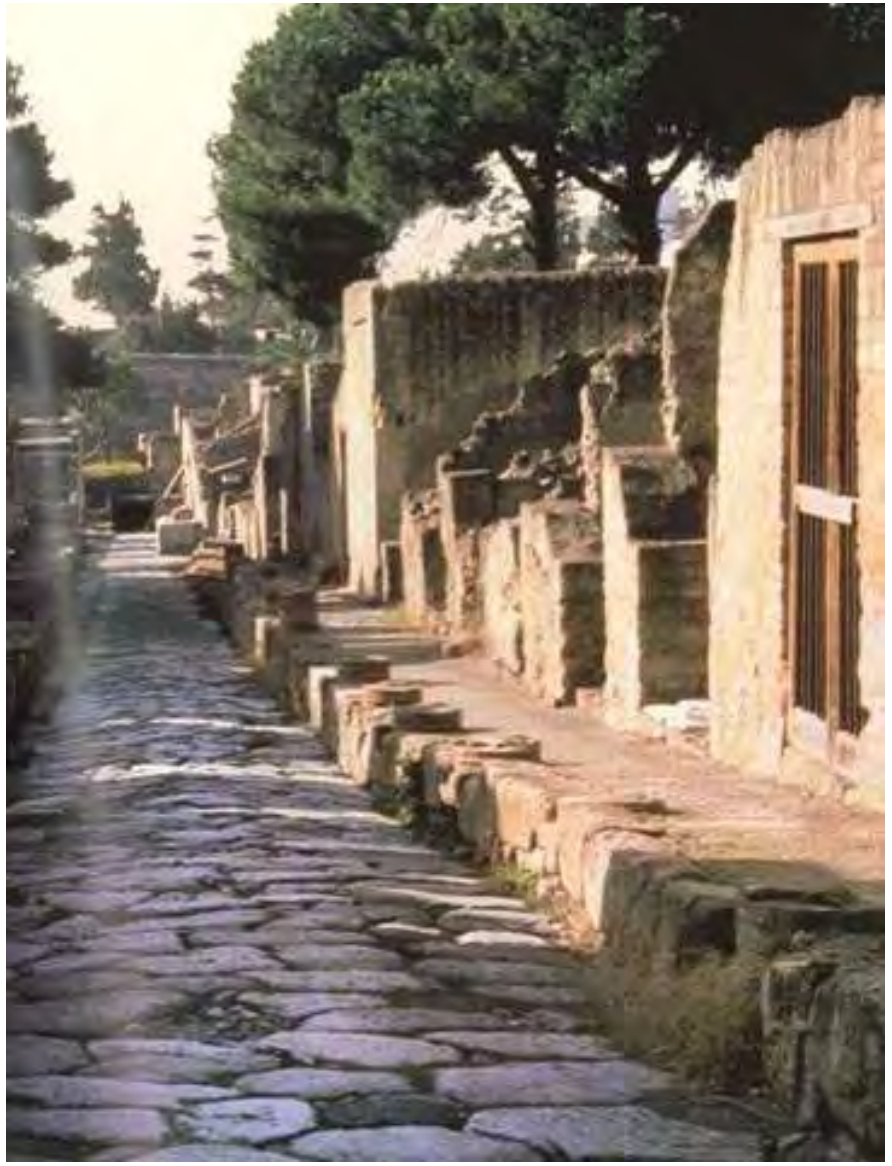
Where?

Why?

Roads are Important!

- 79% of Israel (9M) say traffic is the greatest cause of stress in everyday life…more than security
- As traffic increases roads must be great – long lasting and quickly renewable
- Great roads require great asphalt plants

Roman Roads – first good roads



- 50,000 miles (80,000 km) hard surfaced highway (250,000 miles in all)
- Known cambered surface facilitating drainage
- For conquest and administration…led to trade… migrations…diffusion of Christianity
- Appian way – 360 mi. First of 29 roads out of Rome. "All roads lead to Rome…"
- Being refurbished into a walking trail…first part can be seen in a McDonalds in Rome

Early roads

Now…

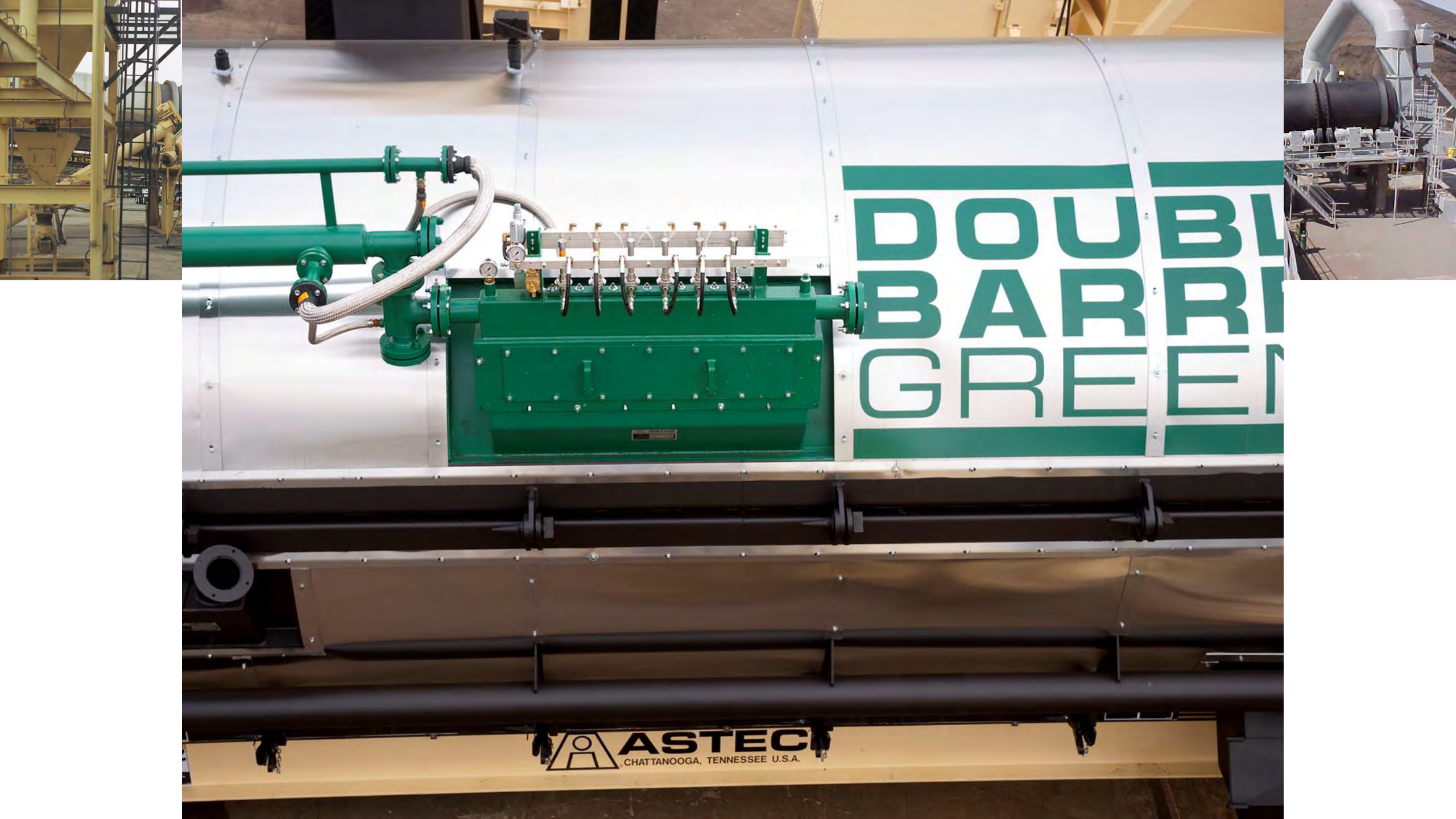
Paving then…

Paving now…

Early plant…sort of


PHOTO OF BOTHELL ROAD
TAKEN MAY 8. 1912
W&S SEATTLE, WASH.

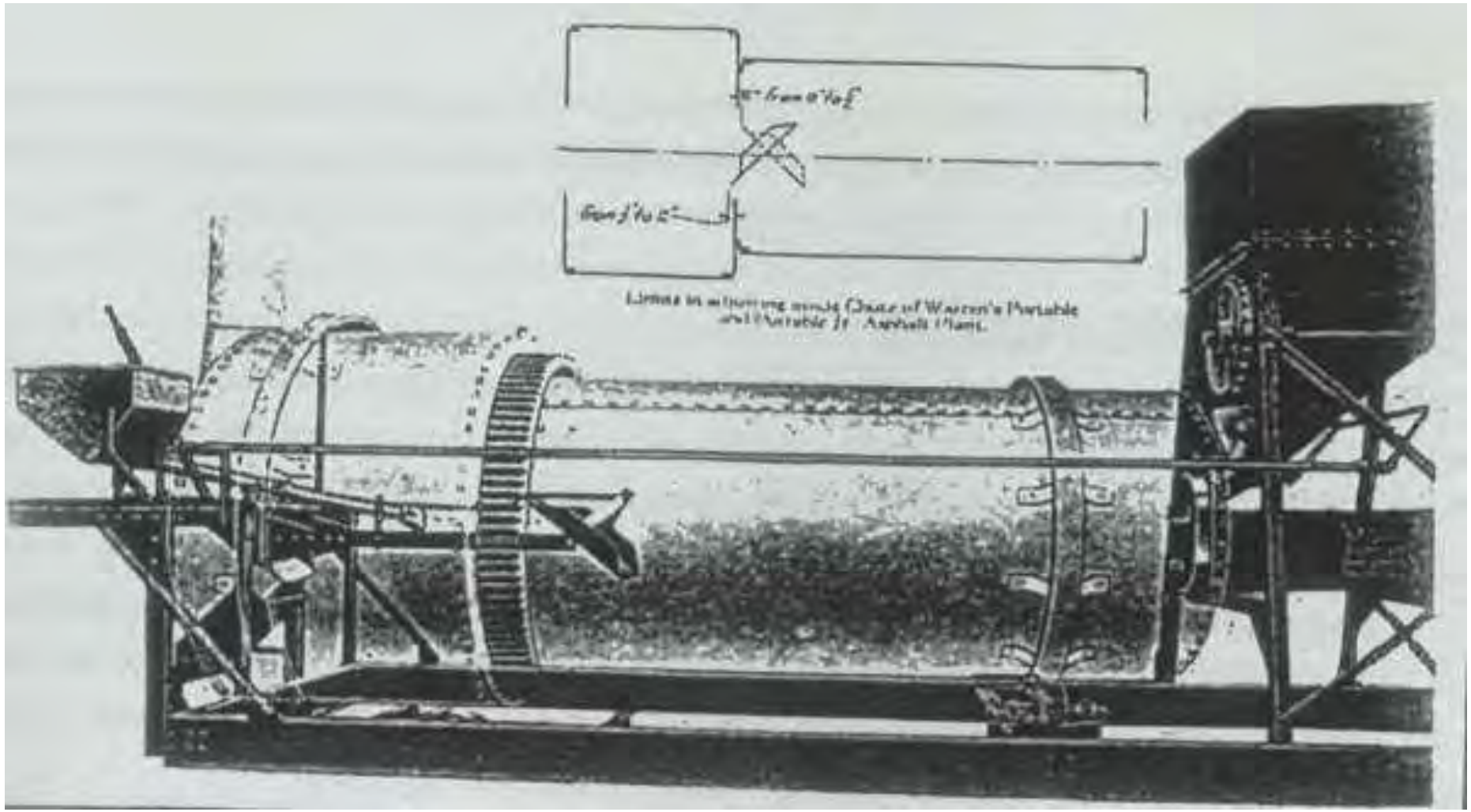

842214


DOUBL
BARR
GREEN
ASTEC
CHATTANOOGA, TENNESSEE U.S.A.

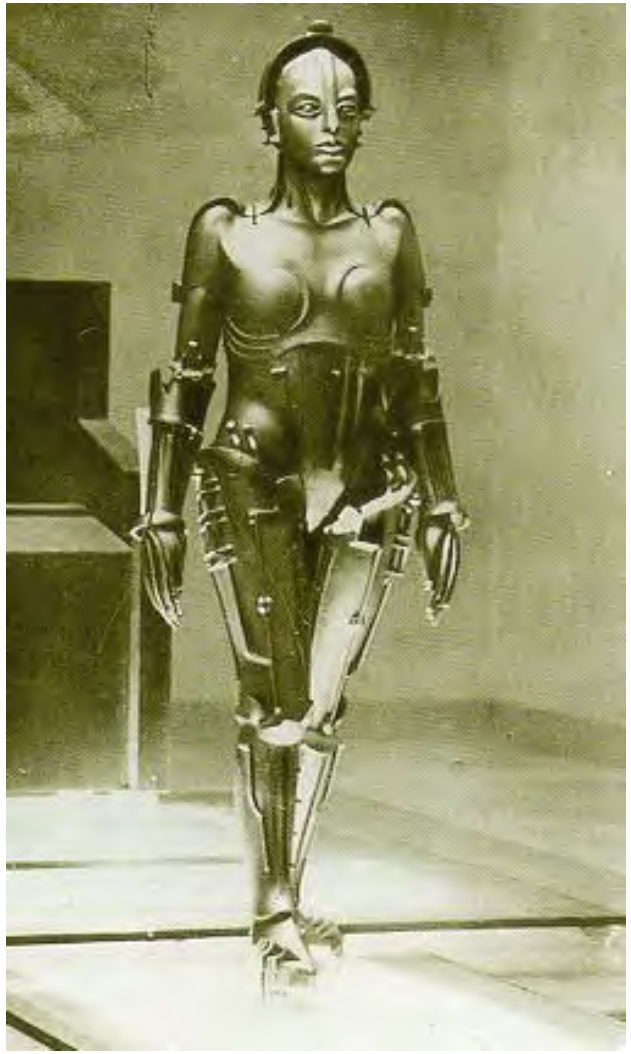
DB-X-HR

It’s not EVOLUTION.

Warren Brothers Portable



Plant “evolution” didn’t take this route



It's INNOVATION.

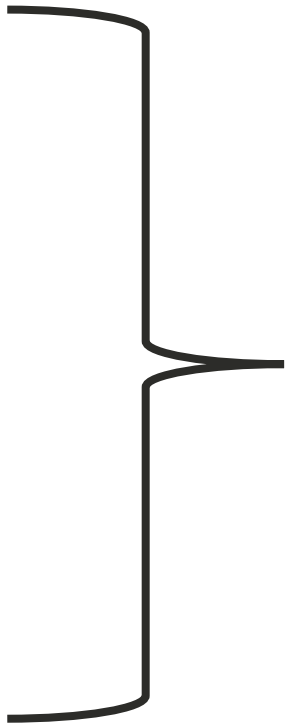
Traditional Innovation Drivers

MIX DEMAND, ECONOMICS, MIX DESIGN, REGULATION, COMPETITION

CREATES NEED

“AVAILABLE” TECHNOLOGY

ADAPT, INNOVATE



New “recipe”

Sustainability: Why Now?

The INFRASTRUCTURE INVESTMENT and JOBS ACT

FEDERAL BUY CLEAN INITIATIVE

INFLATION REDUCTION ACT

Large federal spending programs have outlined how certain funding pools may be accessed by using reduced-carbon products and solutions.

GSA

DEPARTMENT OF TRANSPORTATION · UNITED STATES OF AMERICA

Specific government agencies have outlined details of how products and solutions will be identified as reduced-carbon.

The Road Forward

energy

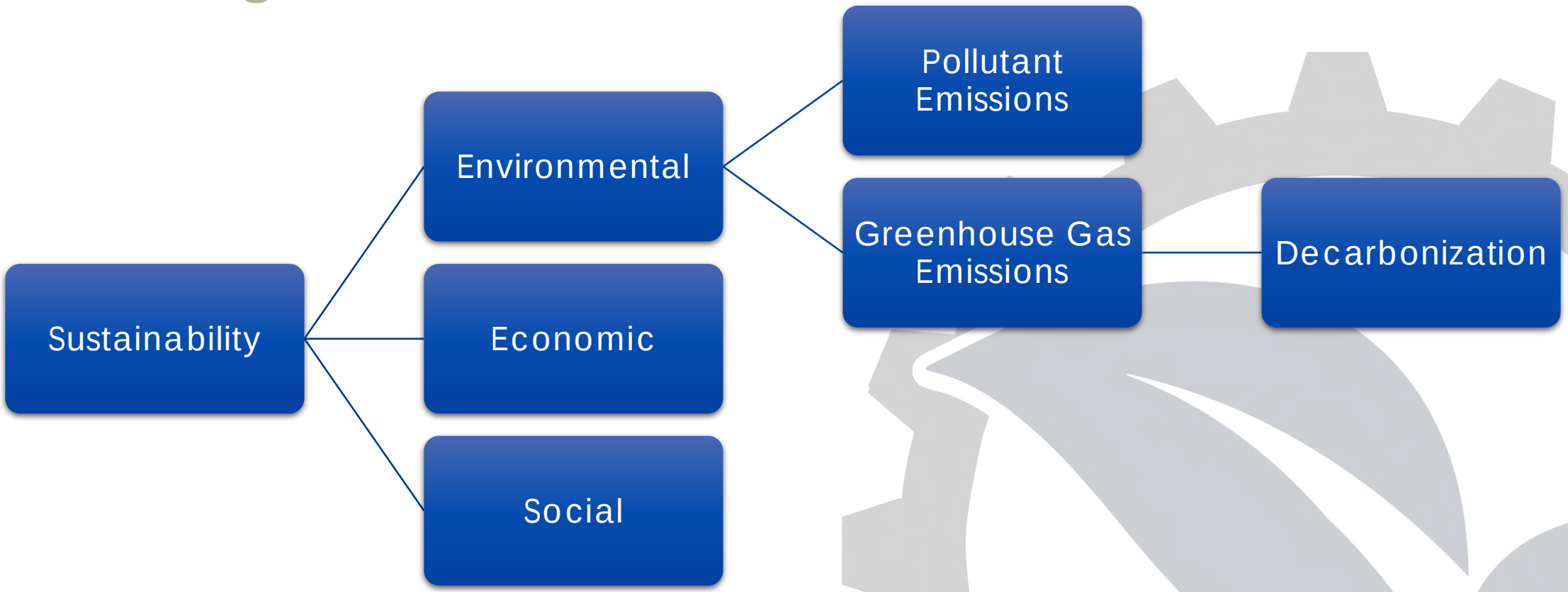
Industry organizations have outlined their goals and action plans to reduce the industry's carbon footprint.

THE GRASSHOPPER PROGRAM

Astec has created a program to reduce the carbon footprint of its products and solutions.

FUNDING → GOALS → REQUIREMENTS → INDUSTRY SOLUTIONS → PRODUCTS

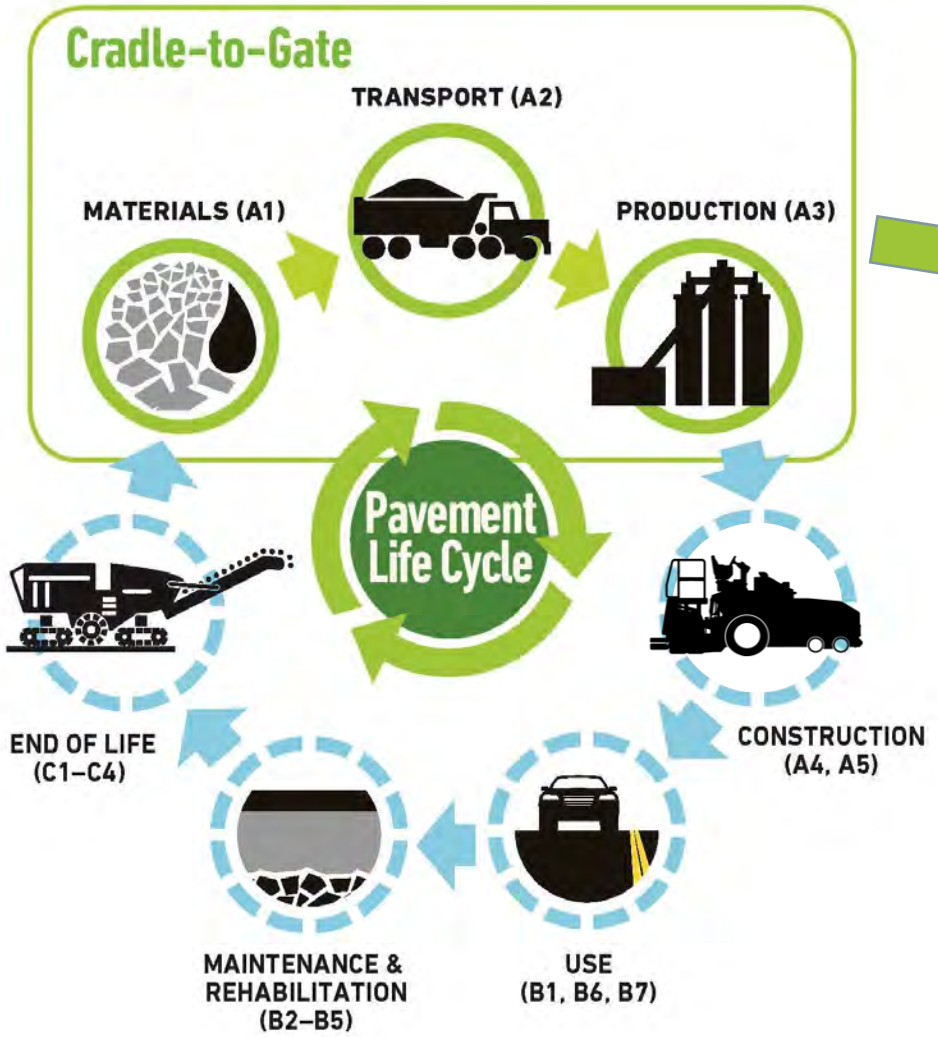
Defining our Terms



Sustainability: Finding a balance between the social, economic, and environmental needs of the present and the future.

Decarbonization: An environmental focus area of sustainability with a specific emphasis on reducing carbon emissions (especially CO_2).

Talking about Decarbonization



Environmental Product Declaration

EPD "Nutrition" Label

Your Building Product

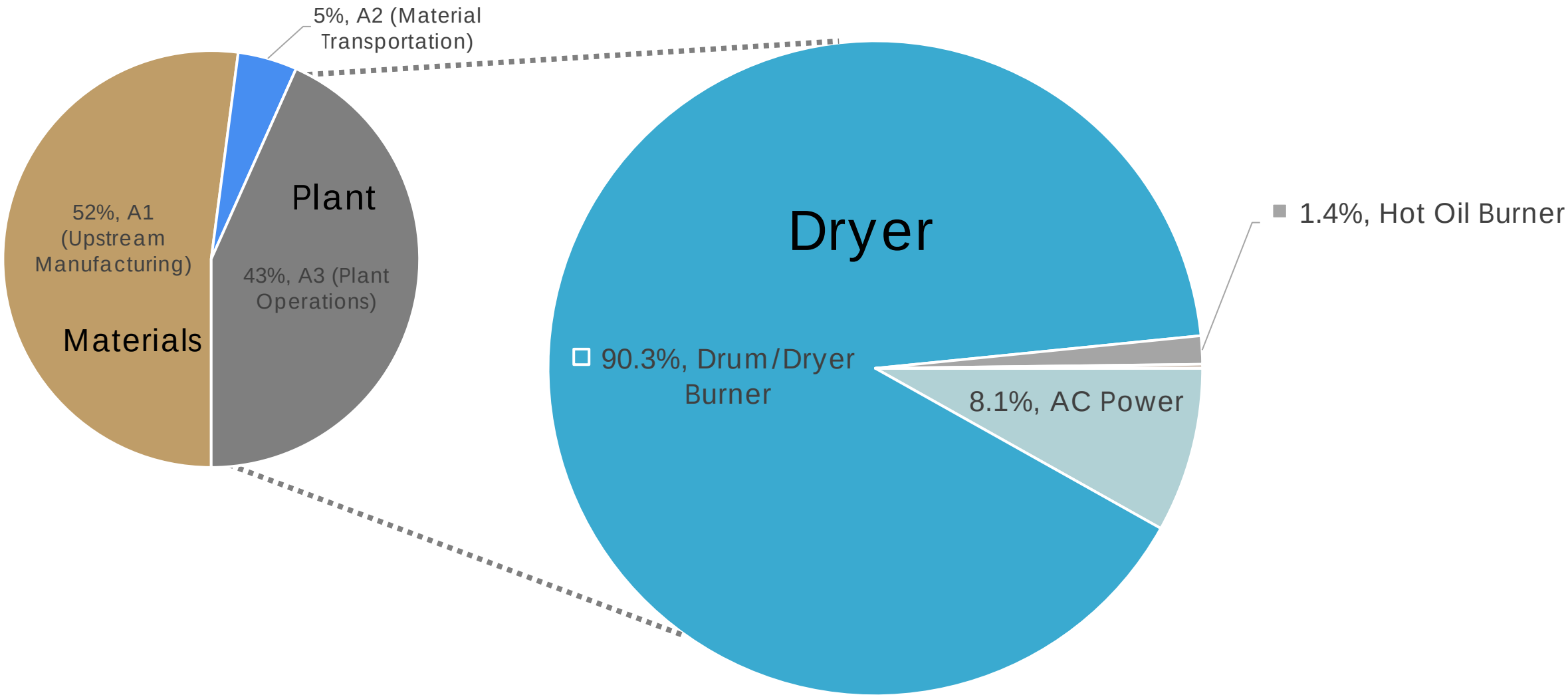
Amount per Unit

LCA IMACT MEASURES	TOTAL
Primary Energy (MJ)	12.4
Global Warming Potential (kg CO^2 eq)	0.96
Ozone Depletion (kg CFC- 11 eq)	1.80E-08
Acidification Potential (mol H^+ eq)	0.03
Eutrophication Potential (kg N^- eq)	6.43E-04
Photo-Oxidant Creation Potential (kg O3 eq)	0.121

Your Product's Ingredients: Listed Here

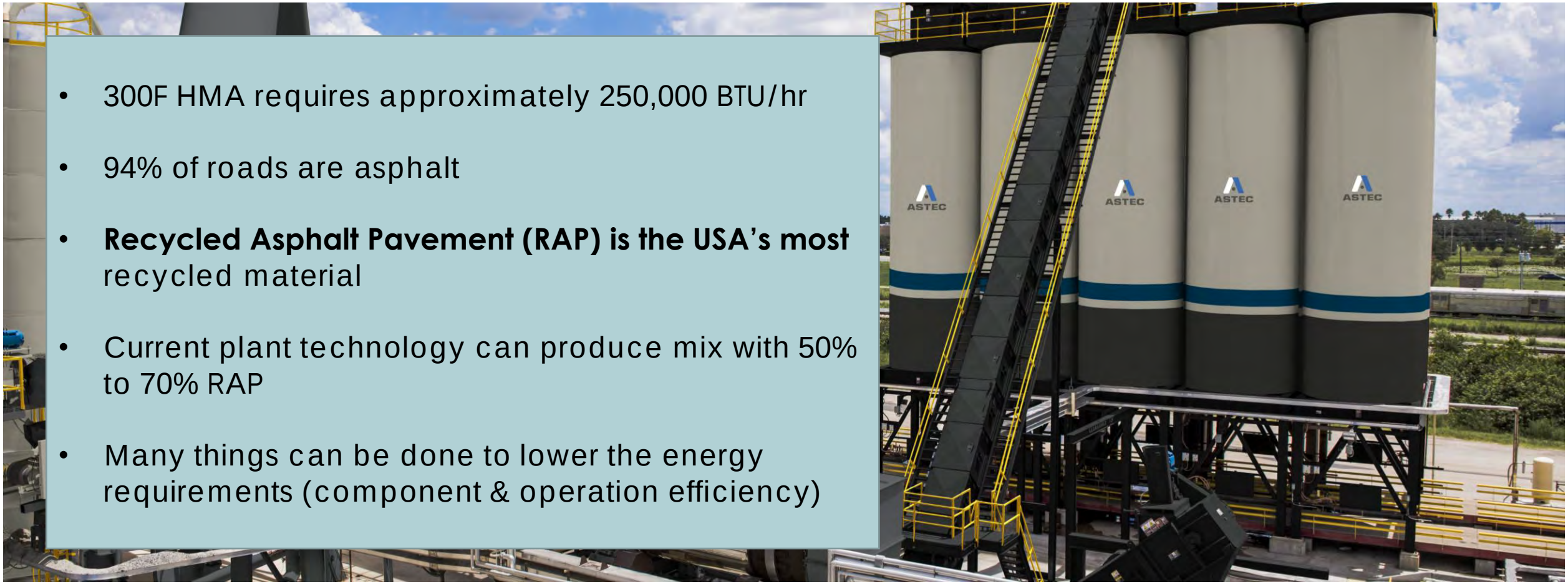
https://westcoastclimateforum.com/cfpt/concrete/strategy1

Asphalt Plant Carbon Footprint



EPD Data from NAPA's 2022 "GHG Emissions Inventory for Asphalt Mix Production in the United States"
Plant Carbon Footprint data from Astec proprietary calculations. Third party verification in progress.

Just the facts



- 300F HMA requires approximately 250,000 BTU/hr
- 94% of roads are asphalt
- **Recycled Asphalt Pavement (RAP) is the USA's most** recycled material
- Current plant technology can produce mix with 50% to 70% RAP
- Many things can be done to lower the energy requirements (component & operation efficiency)

Asphalt plant current technology

- Ultra-low NOx burner technology developed for California requirements
- High efficiency drying system – low heat loss
- Astec V-Pac technology – further reduces heat loss
- Fugitive hydrocarbon emission control
  - Hydrocarbon capture system for entire plant
  - Fiber bed smoke collection system
  - AC tank condensers
  - AC tank activated charcoal fume collectors

Existing Technology: Burners

Switching from Waste Oil to Natural Gas can lead to a 29%* reduction in carbon emissions.

Astec's burner technology can meet the most stringent pollutant emissions requirements.

WHISPER JET®

- Total-Air Burner
- Oil, Natural Gas, or Propane compatible
- 200 to 600 TPH nominal aggregate drying capacity
- Patented castellated nose, ring, and nozzle

The Whisper Jet burner delivers unmatched reliability and hassle-free maintenance.

PHOENIX® TALON II™

- Total-Air Burner
- Oil, Natural Gas, or Propane compatible
- 200 to 600 TPH nominal aggregate drying capacity
- Lean burn premix

The Phoenix Talon II burner sets the standard for power and efficiency, while maintaining very low emissions.

*Based on Astec internal calculations. Third party verification in progress.

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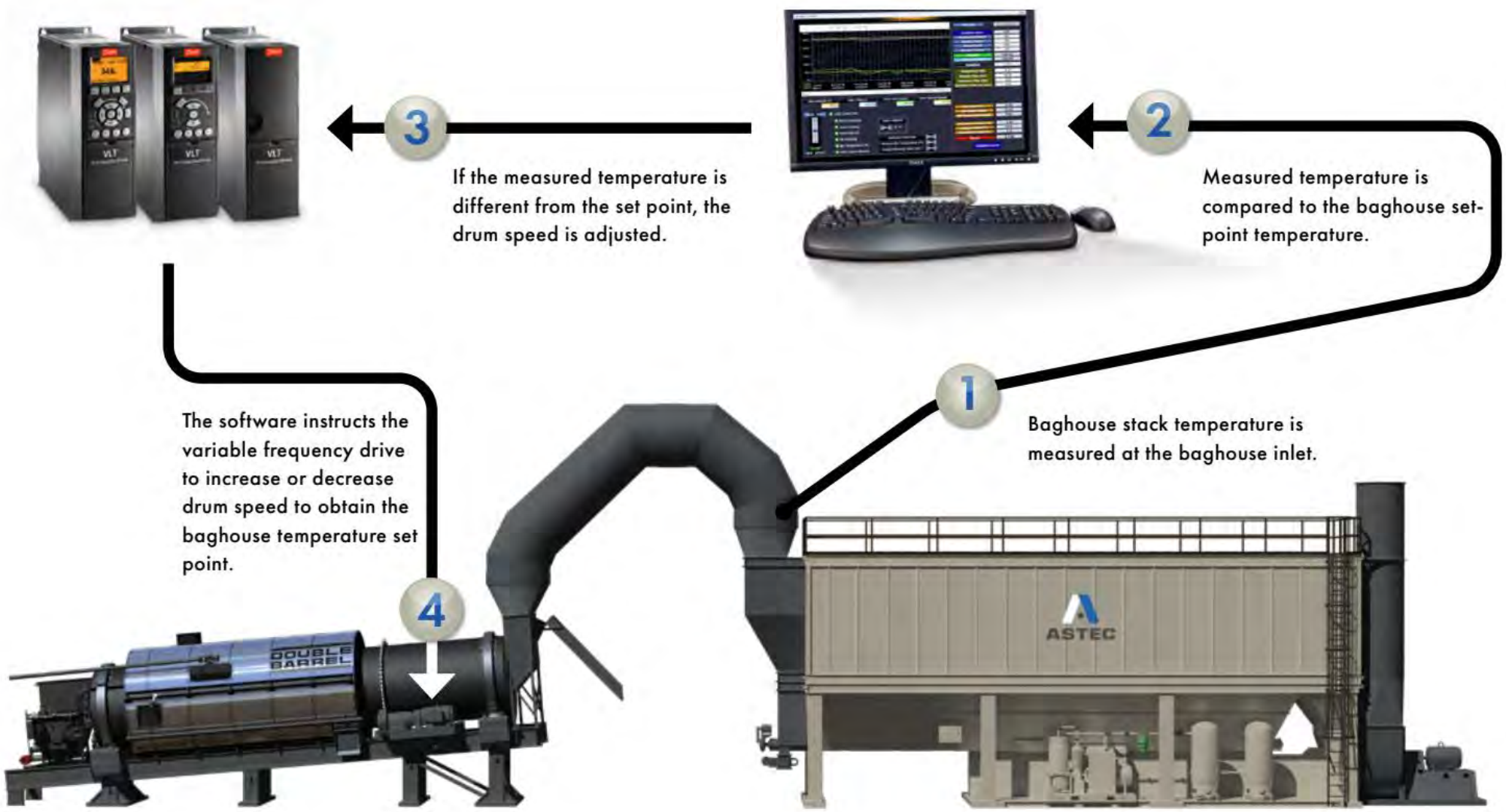
Existing Technology: V-PAC

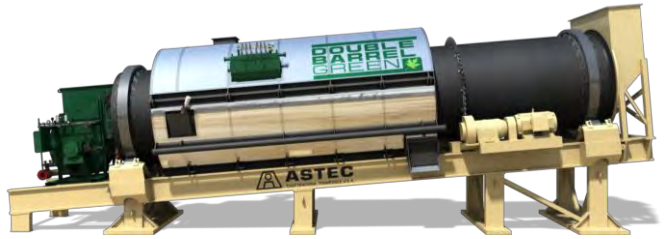


VFD – Variable Speed Drives
What are they good for?

- Process control:
  - Drum – control energy loss (hot gases out the stack)
  - 60F change in stack temperature is a 4% change in fuel

- Energy savings:
  - Baghouse exhaust fan (80% speed = 50% energy)
  - Burner fan

- Drag conveyor
  - Reduce maintenance



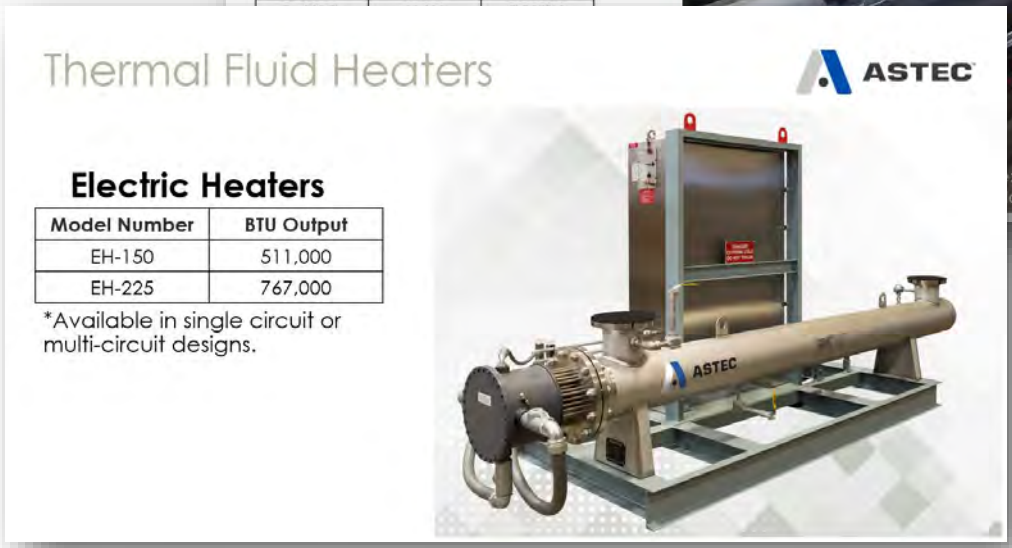
What can be done NOW

- Go Electric
  - AC tanks
  - Hot oil heater
  - AC piping
  - Plant component heat
    - Drum
    - Drag slat conveyor
    - Silo cone heat
    - Traverse slat conveyors
- Insulate everything that gets hot - almost
- Utilize Silos to keep plant running efficiently
- Use as much RAP as possible – do it the right way
- CCPR (Cold Central Plant Recycling) – no heat req'd
- WMA (warm mix asphalt)

What about Electrification?

A 400 TPH plant with a 100 MM BTU burner is equivalent to 39,300 hp. Additionally, the grid is not green…yet.

However: Some regions do have a green grid, so it can be beneficial to electrify plant subsystems.



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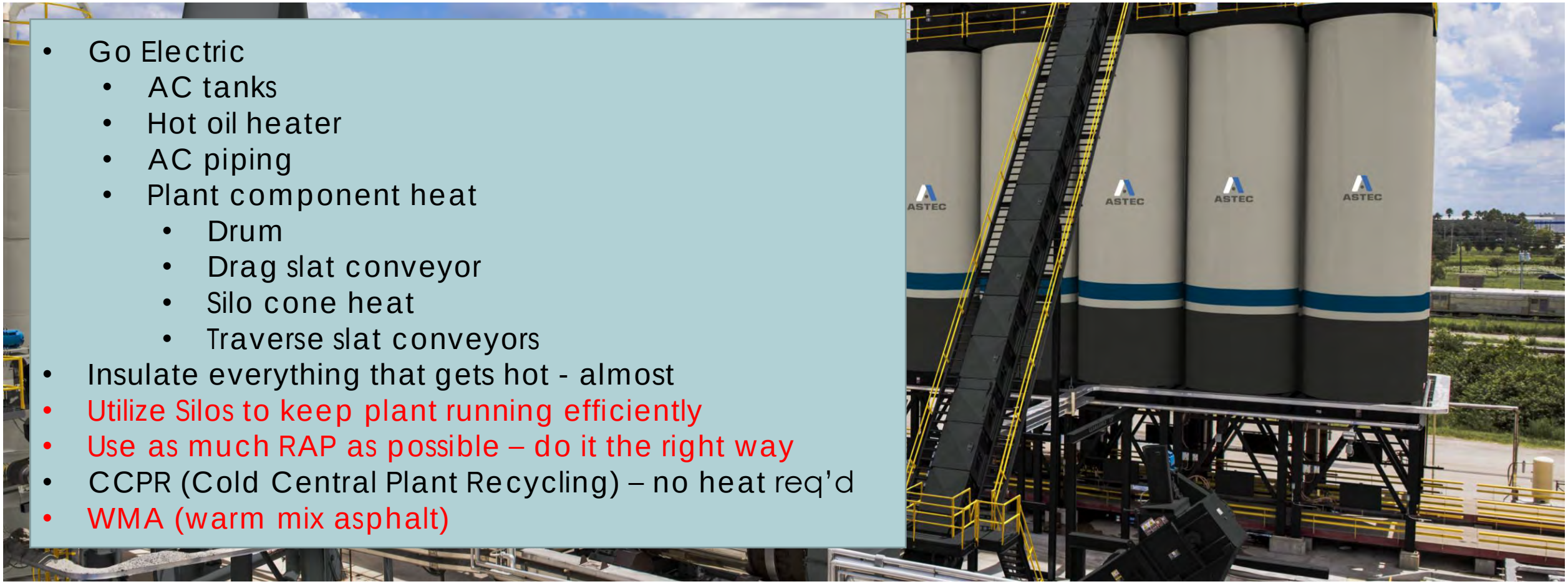

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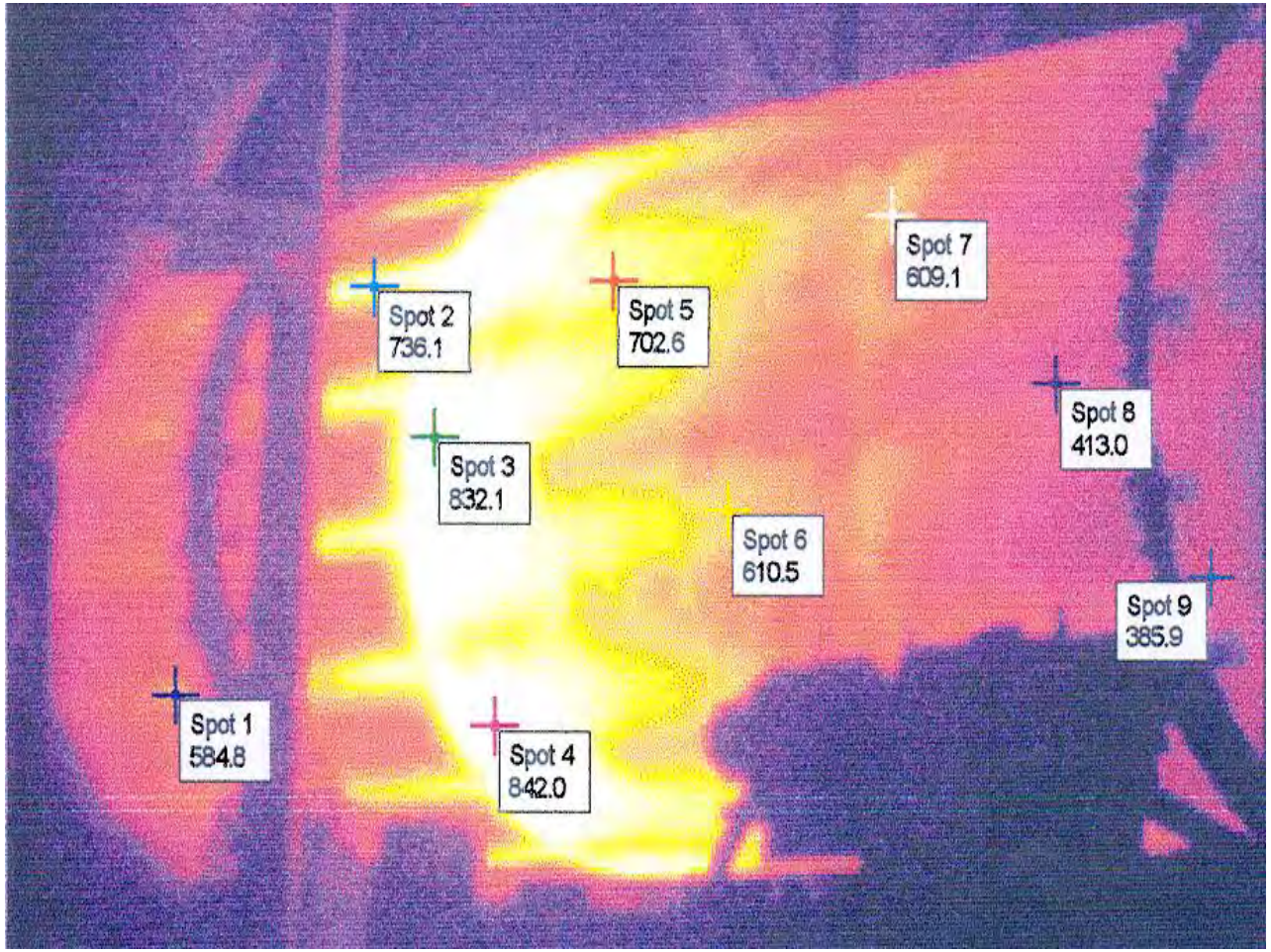
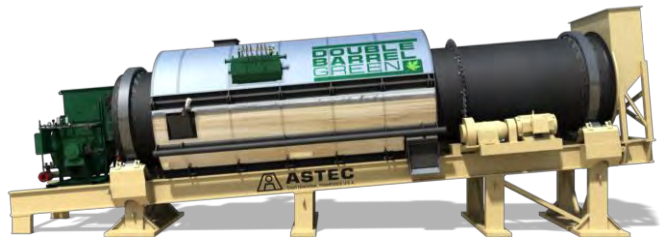
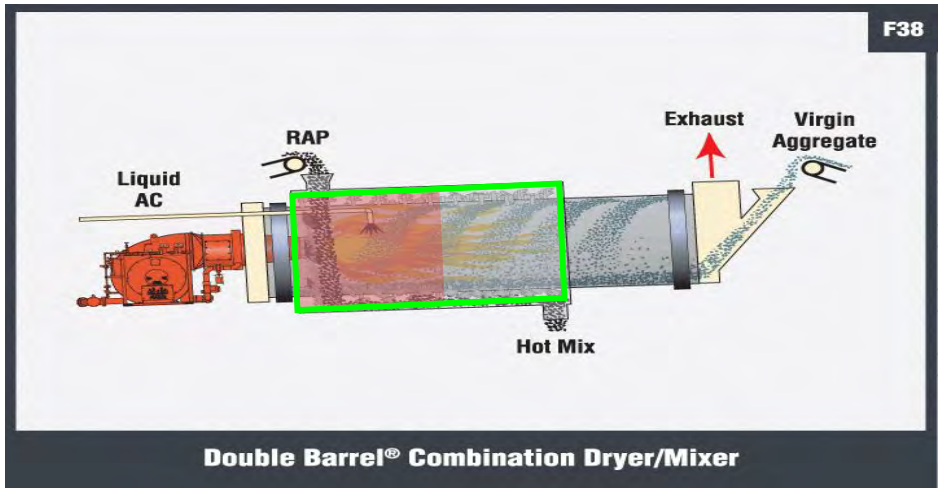
Thermal image of an aggregate dryer



Insulate or not?





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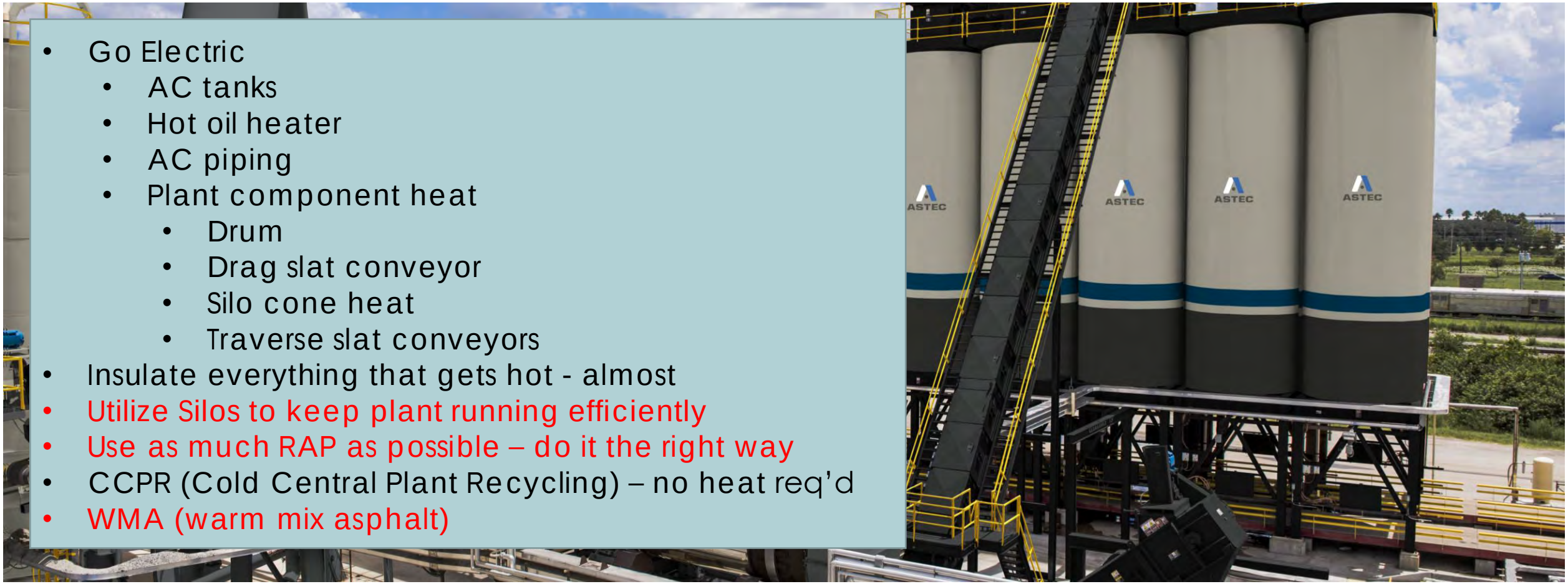

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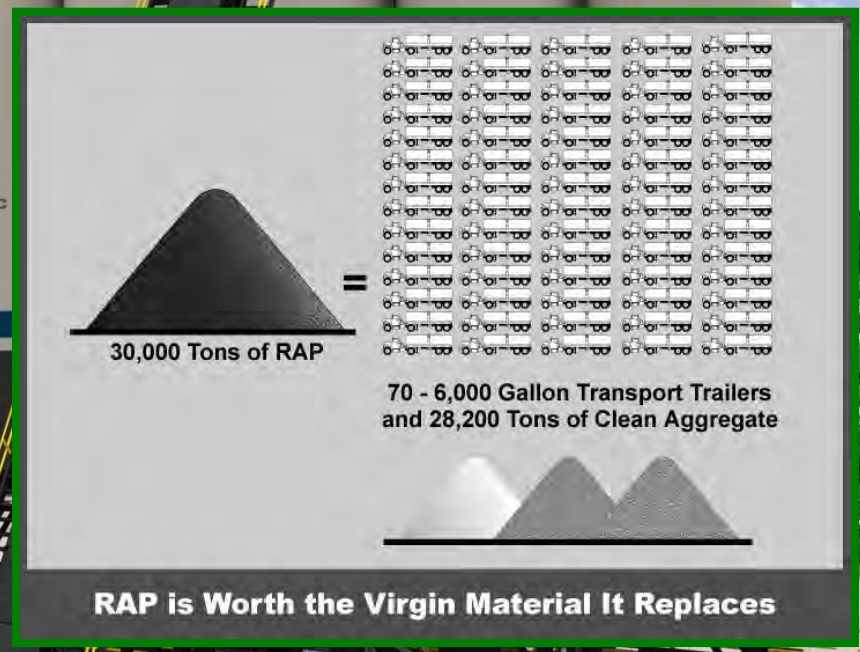

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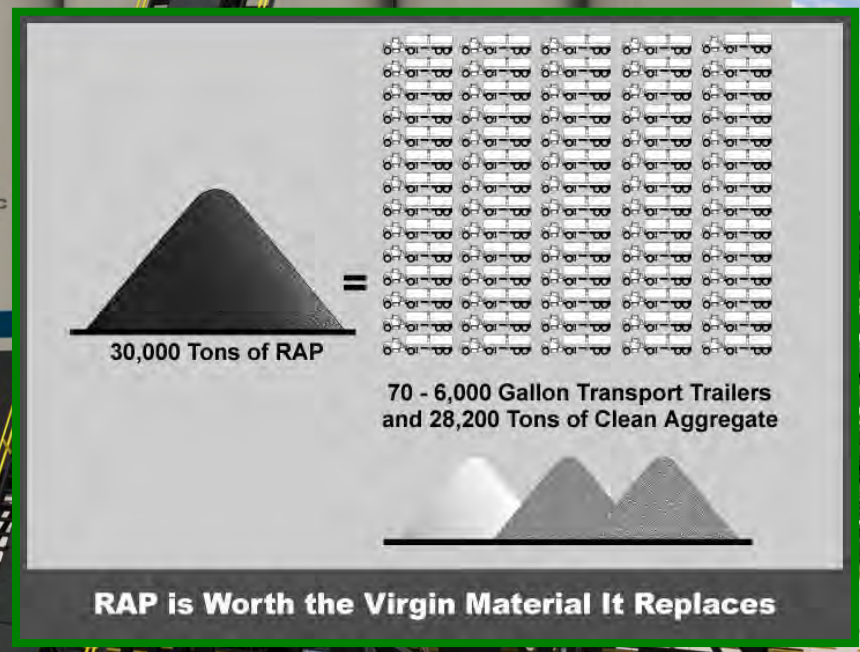

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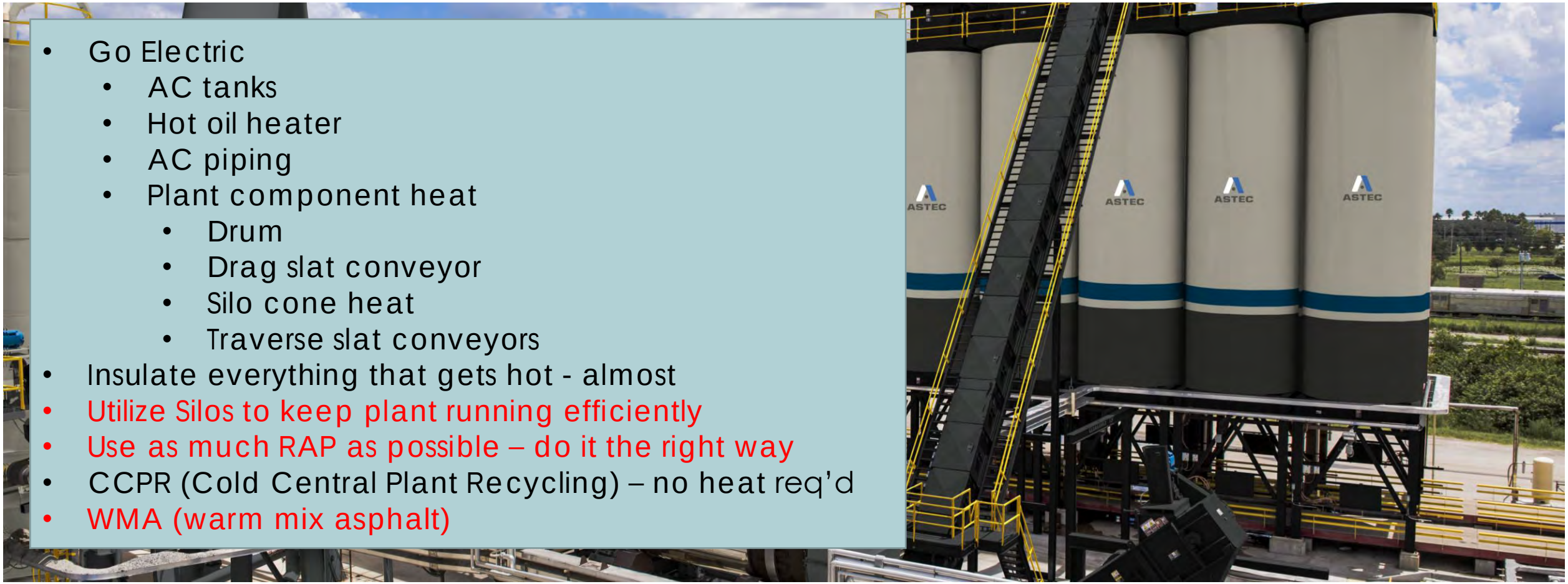

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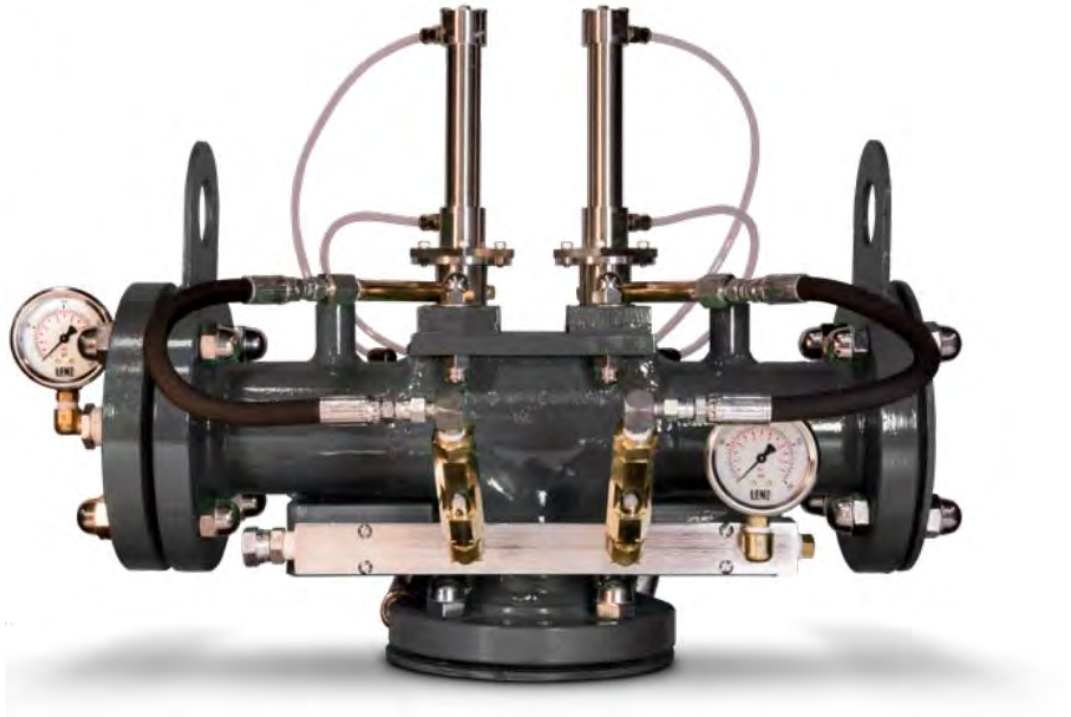
Existing Technology: Warm Mix

Foamed asphalt has a reduced viscosity, serving as a compaction aid and allowing the mix to be produced at lower temperatures.

A 50° F reduction in mix production temperature can result in a fuel savings of 11%*.



*Based on Astec internal calculations. Third party verification in progress.

Who is in charge?

50F lower mix temperature = 11% less fuel

Pick a WMA technology and sell it

Existing Technology: Operations

Good stockpile management practices can have an oversized effect on plant efficiency.

A 2% reduction in moisture can reduce the burner energy requirement by 21%*.

*Based on Astec internal calculations. Third party verification in progress.

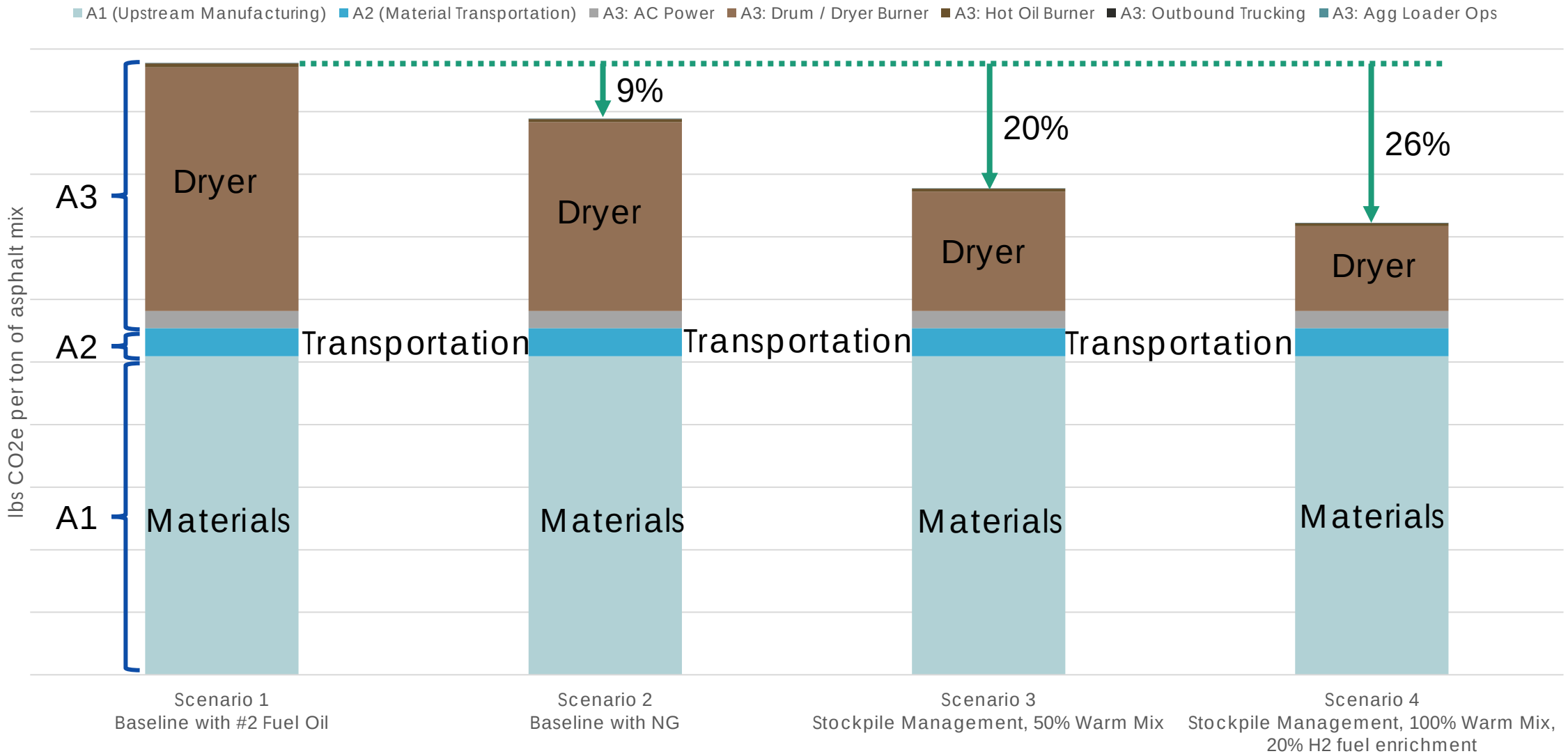
Future Technology: Burners

100% Natural Gas

70% Natural Gas, 30% Hydrogen

Astec has tested a hydrogen-enriched natural gas fuel train up to 30% hydrogen.
30% Hydrogen results in a 12% reduction in CO_2 with a slight increase in NOx.

Decarbonization Scenarios



**Stockpile Management = 2% Moisture Reduction*
***Warm Mix = 75° F Temperature Reduction*
No change to A1, A2, A3: AC Power, A3: Outbound Trucking, or A3: Agg Loader Ops

What might the future look like?

- Barely audible, if at all, to neighbors
- No odors or visible hydrocarbon emissions
- More fuel efficient & less greenhouse gas emissions
- Plant layout optimized for emissions reductions
- Better capacity utilization
- Mostly electric plant components
- Covered facilities

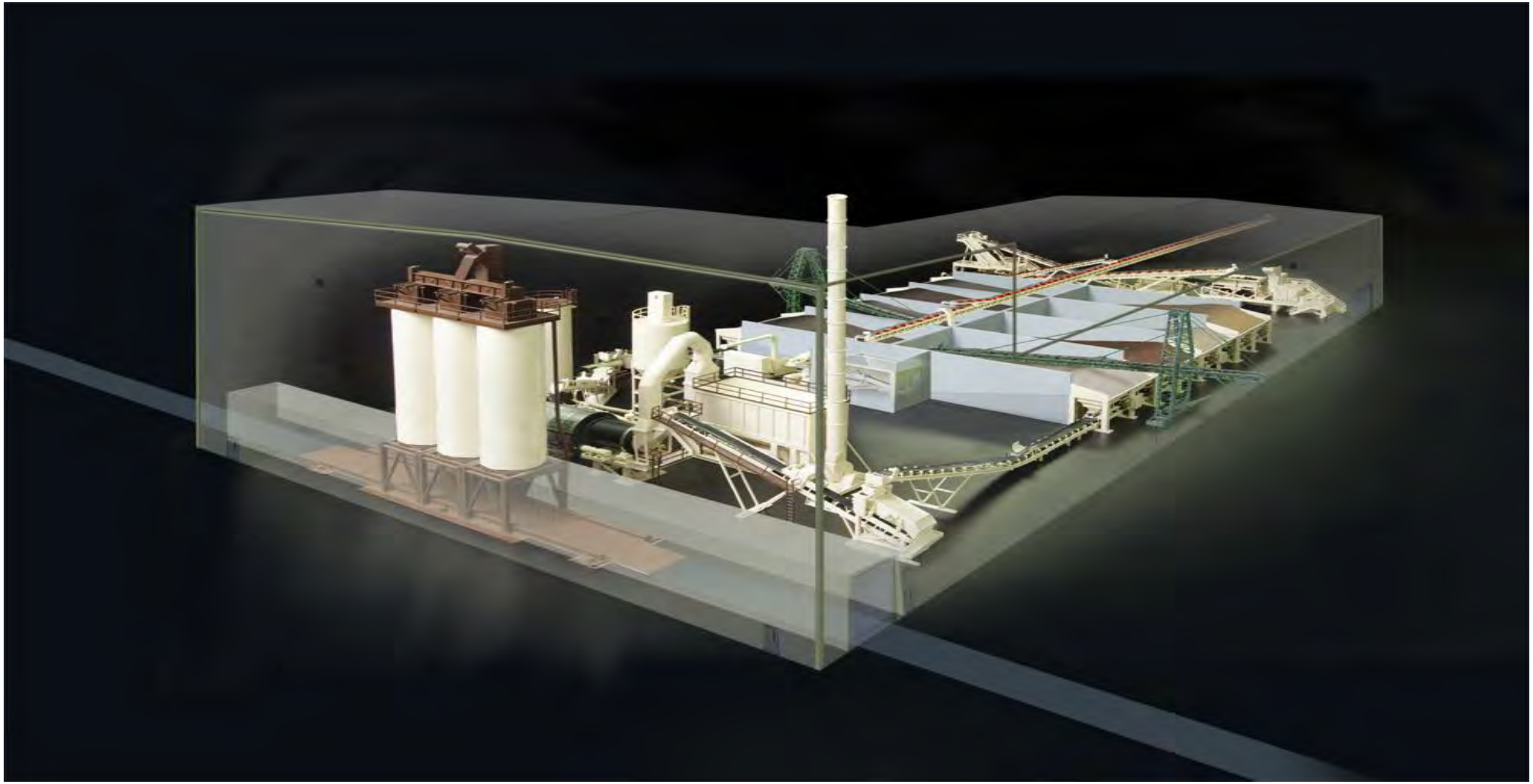
Less Impact... Better Neighbor.

Certainty: Increased Expectation of Sustainability

We have come a long way…

Warren Brothers, 1912 → Asphalt Inc, 2019 → The Plant of the Future

Covered indoor facilities



Certainty: Increased RAP: NORM rather than EXCEPTION

Covered indoor facility, France, 2013


05/17/2013

Covered indoor facility, France, 2013

Interface to Outdoor Storage (Storage Bins)


Looking down the road...

We can safely predict…

What we do know:

- Increasing expectations of sustainability
- Increasing RAP usage

Questions?

BUILT TO **CONNECT**