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Astec Sustainability

BUILT TO CONNECT

Greg Renegar

Reducing the Carbon Footprint
and the Plant of the Future

2024

Sustainability: Why Now?

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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

Our industry has come a long way…

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1912 › 2024 › The Plant of the Future

Innovation Example

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Looks similar – Both instantly recognizable as a Mustang

Not similar performance due to technology

Innovation Drivers

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ECONOMICS, MIX DESIGN, REGULATION, COMPETITION

CREATES NEED

AVAILABLE TECHNOLOGY

ADAPT, INNOVATE

New "recipe"

Asphalt Plant Carbon Footprint

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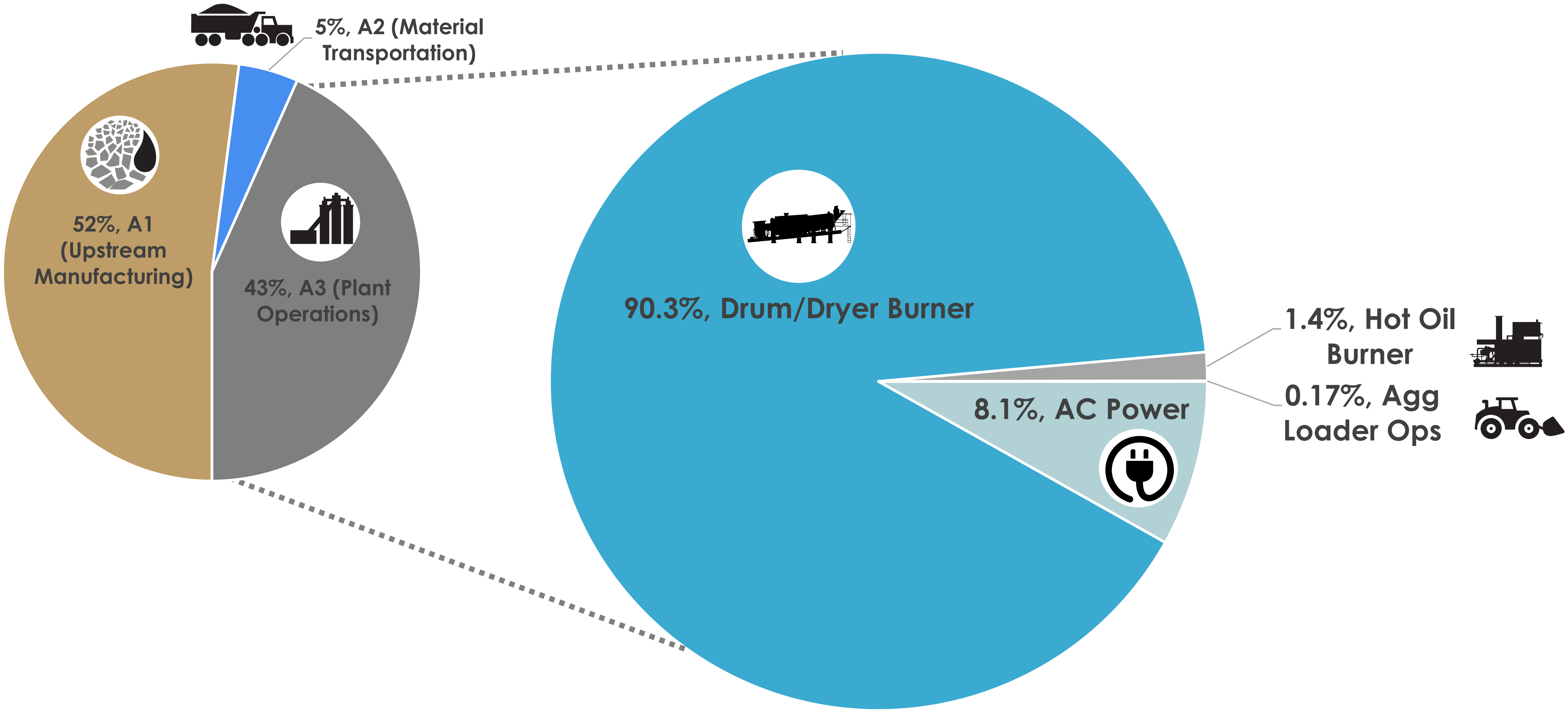


EPD Data from NAPA's 2022 "GHG Emissions Inventory for Asphalt Mix Production in the United States"
Plant Carbon Footprint data from Astec proprietary calculations. Third party verification in progress.

Just the facts

- 94% of roads are asphalt – importance of industry
- HMA/WMA requires energy
- Recycled Asphalt Pavement (RAP) is the USA's most recycled material – 22% average -opportunity
- Current plant technology can produce mix with 50% to 70% RAP - capability
- Many things can be done now to lower the energy requirements (component & operation efficiency)

Asphalt plant current technology

- Ultra-low NOx burner technology developed for California requirements – Regulation driven example

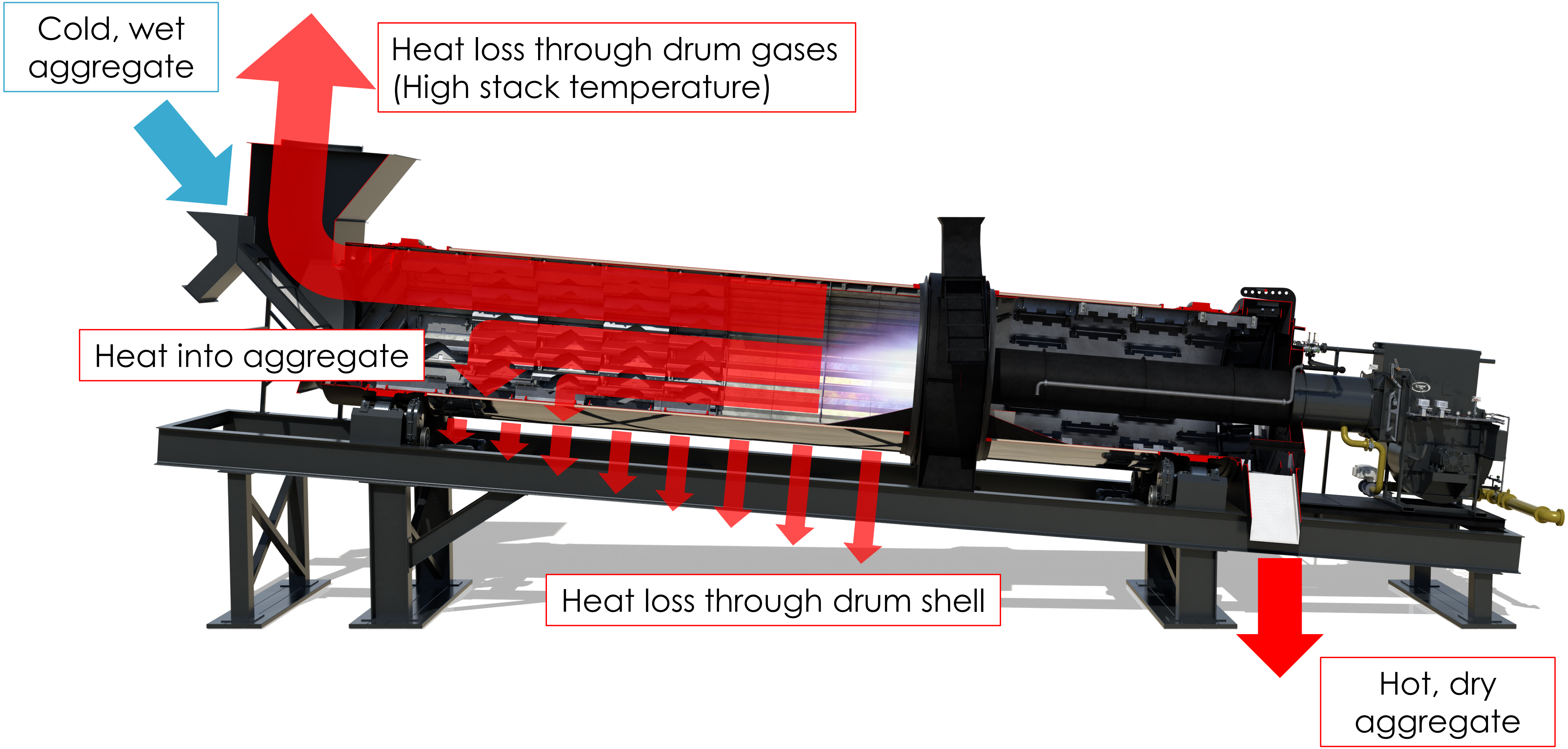
Existing Technology: Burners

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

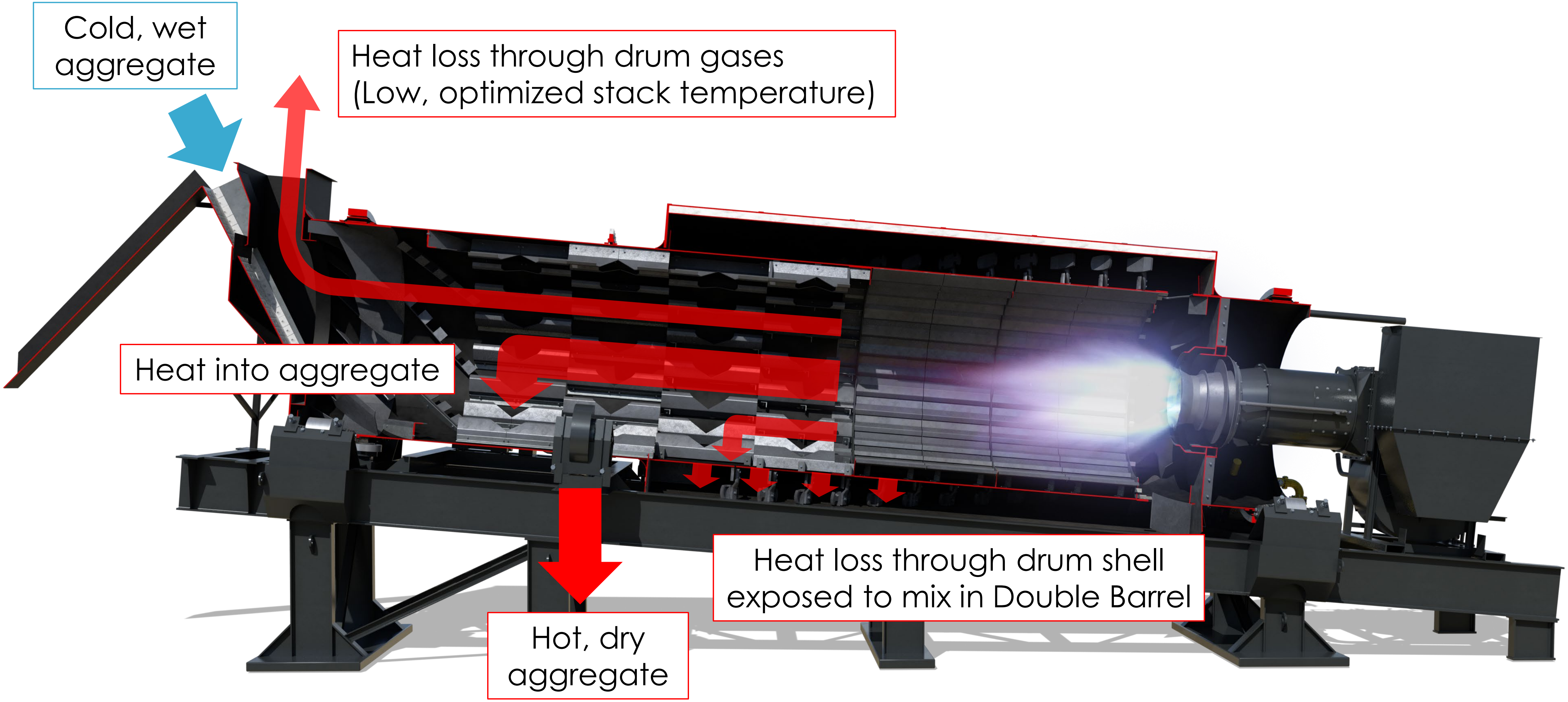
Astec has tested a hydrogen-enriched natural gas fuel train up to 30% hydrogen.
30% Hydrogen results in a 12% reduction in CO_2 with a slight increase in NOx.

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

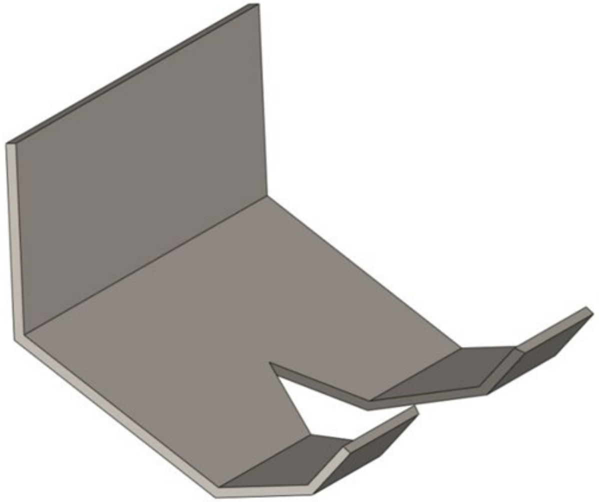
System Efficiency

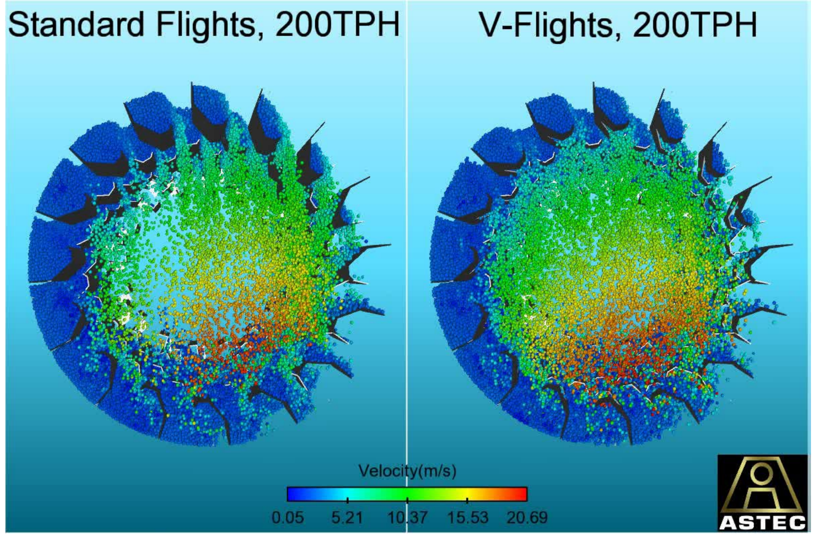


System Efficiency



V-Pack™ ~~Stack Temperature~~ Control
Carbon

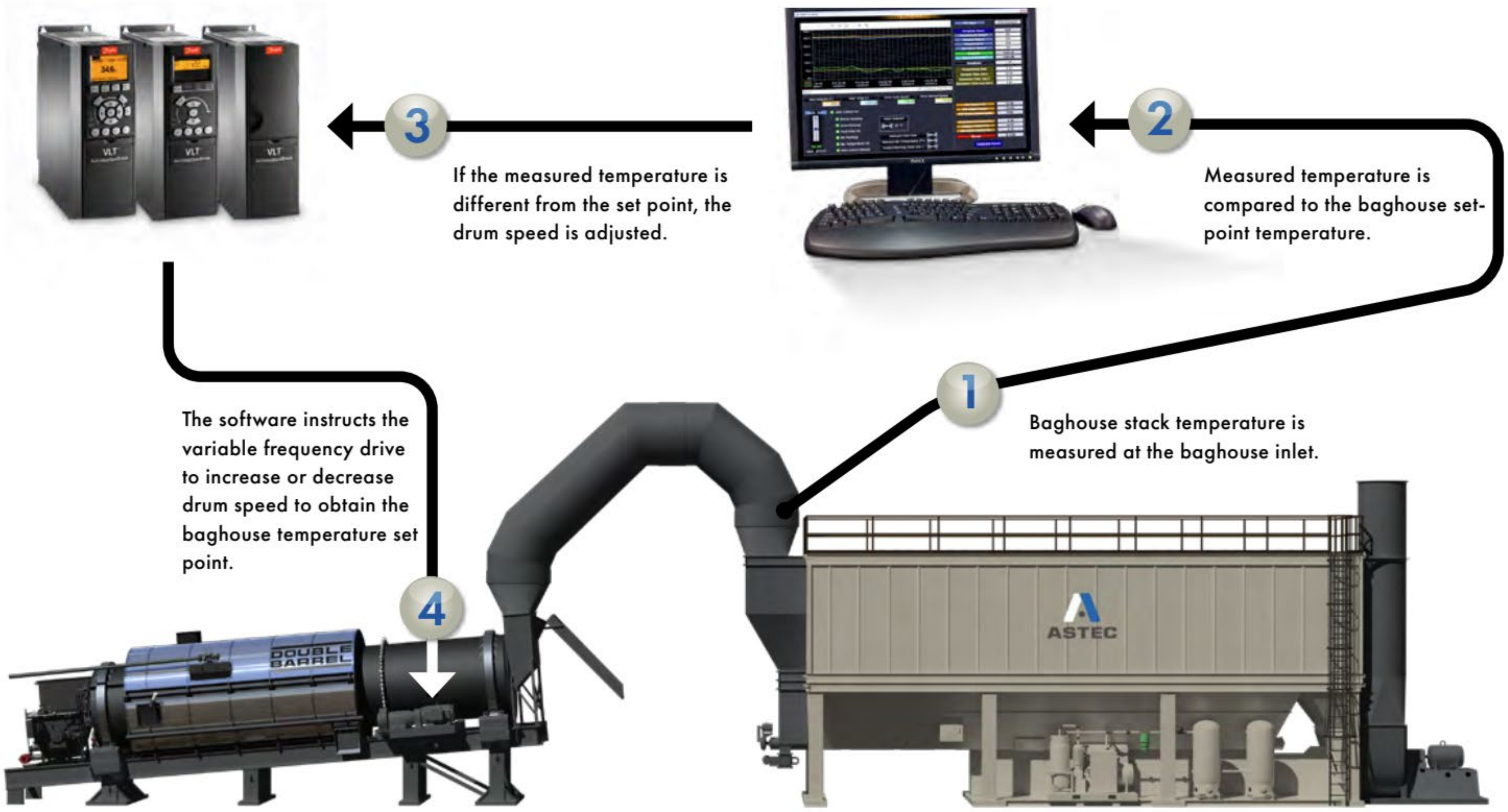




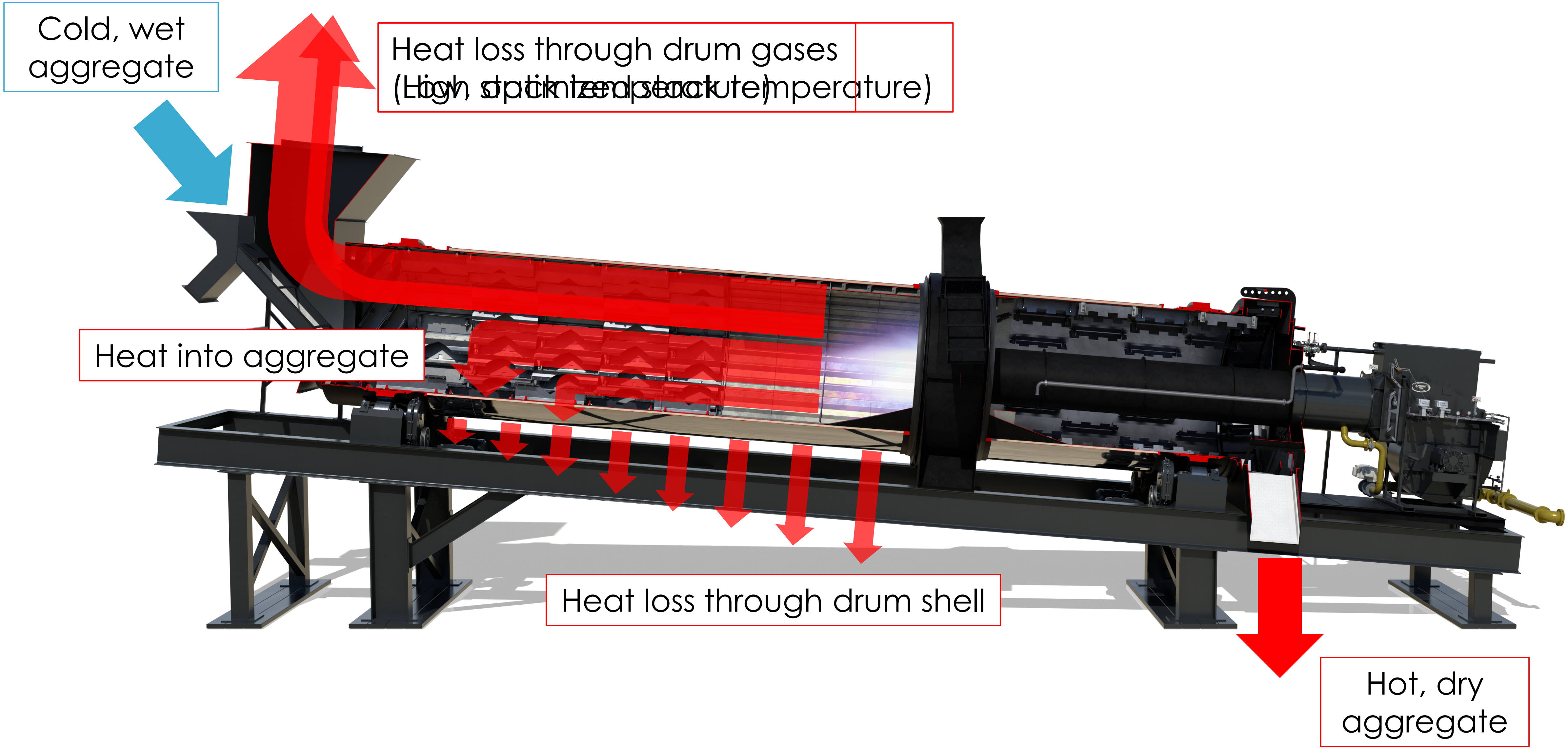
VFD plus Controls

The VFD changes the drum speed. Controls determines how much.

Existing Technology: V-PAC™

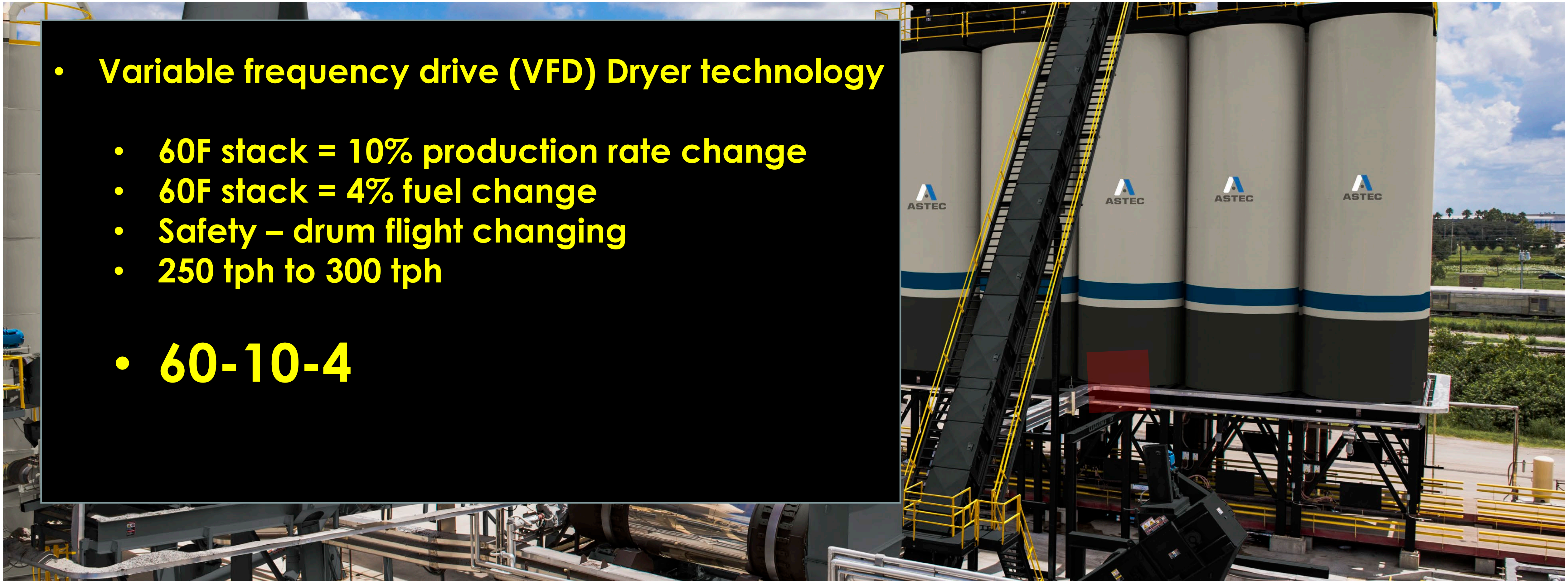


System Efficiency



Asphalt plant current technology

- Variable frequency drive (VFD) Dryer technology
  - 60F stack = 10% production rate change
  - 60F stack = 4% fuel change
  - Safety – drum flight changing
  - 250 tph to 300 tph
  - **60-10-4**



Fan Laws

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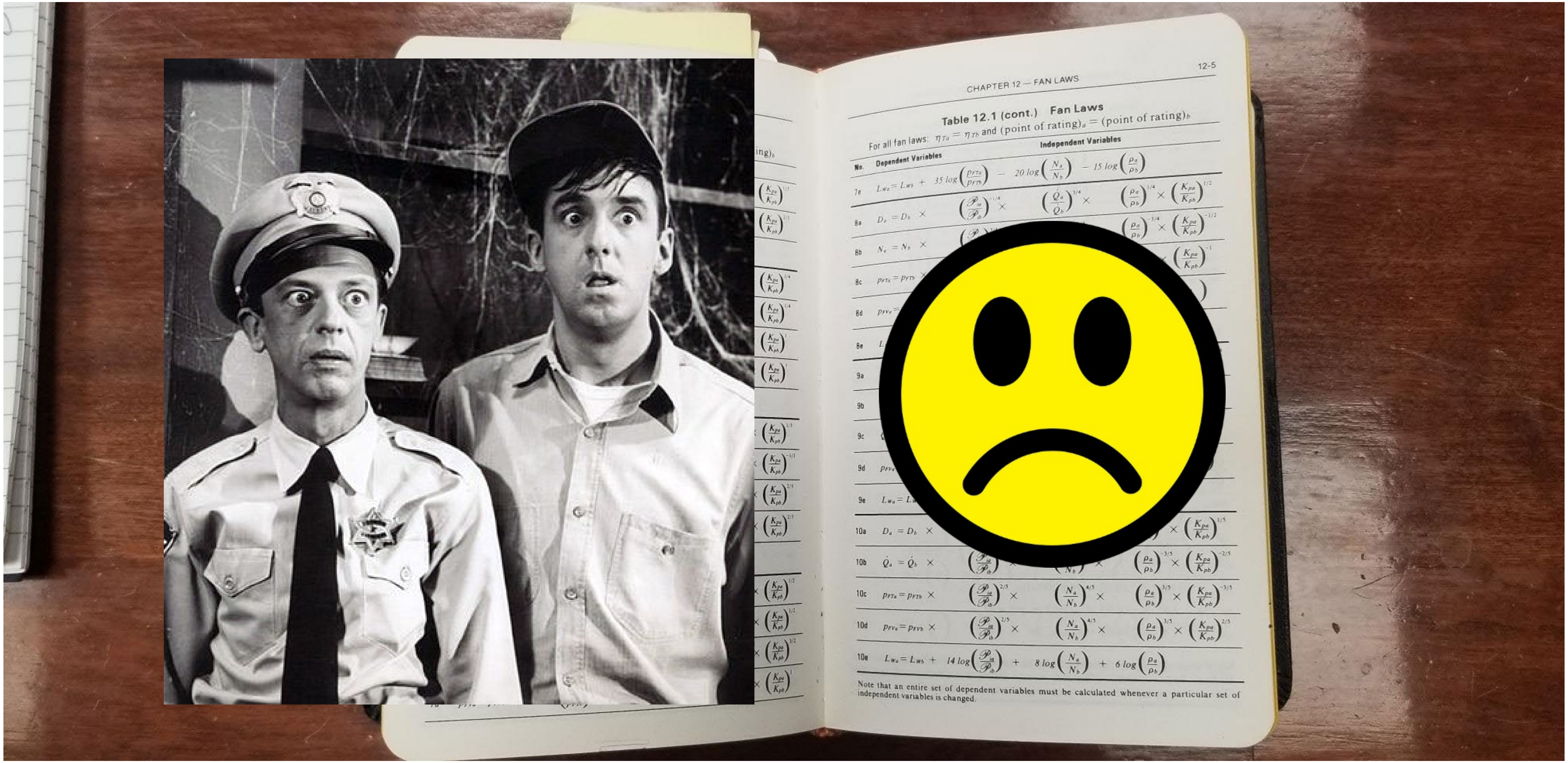
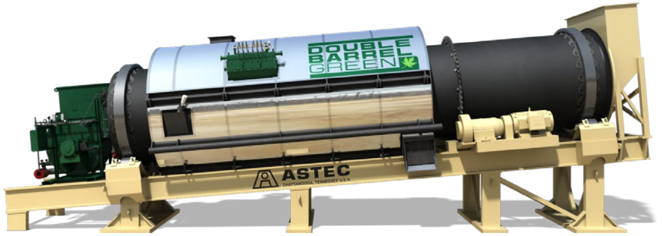


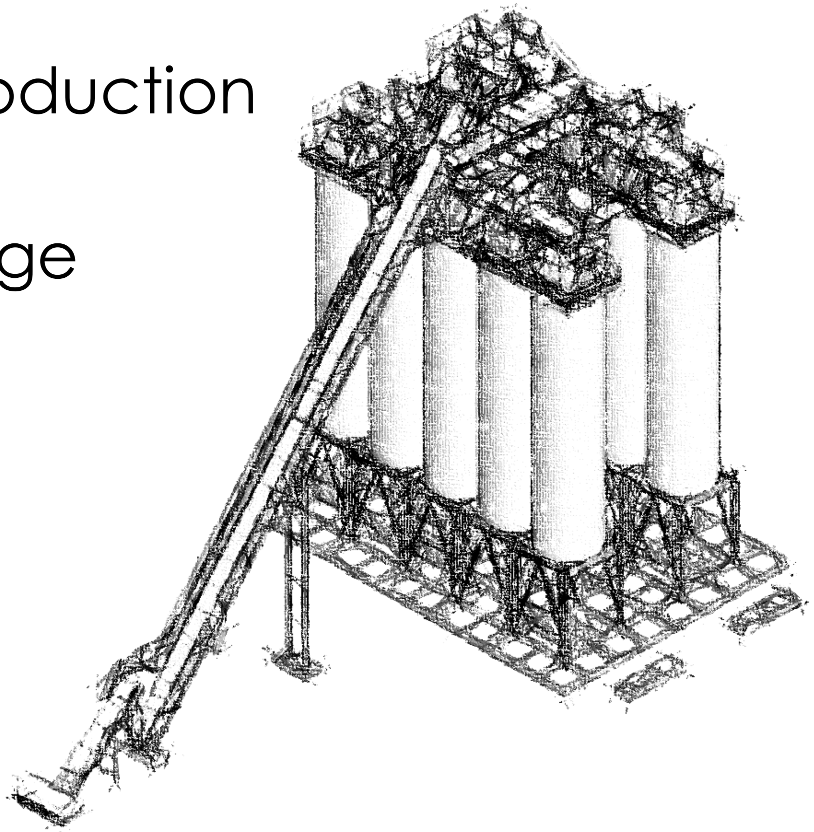
VFD – Variable Speed Drives
What are they good for?

- **Energy savings:**
  - Baghouse exhaust fan **(80% speed = 50% energy)**
  - Burner fan **(50% speed = 12.5% energy)**
  - Much less noise – less worker stress – happier neighbors



VFD – Variable Speed Drives
One more thing…

- **Wear:**
  - Drag Conveyor – enables balancing chain speed with production rate
  - Slats have a higher fill percentage at lower production
  - Less wear over time – about 40% less on average
  - **Less maintenance = less carbon**



What can be done NOW

- Go Electric
  - AC tanks
  - Hot oil heater
  - AC piping
  - Plant component heat
    - Drag slat conveyor
    - Silo cone heat
    - Traverse slat conveyors

Insulating Your Plant

- AC tank farm → Yes!
- AC piping → Yes!
- Pipe flanges → Yes!

Jacketed Asphalt Piping					
Asphalt Pipe Nominal Size	Hot-Oil Jacket Nominal Size	Loss Per Linear Foot BTU Per Hour		Loss Per Flange BTU Per Hour	
		Un-insulated Jacket	Insulated Jacket	Un-insulated	Insulated
3 inches	4 inches	1598	86	1890	120
4 inches	6 inches	2349	122	2600	134
5 inches	8 inches	3057	148	3240	178

Hot Oil Piping				
Pipe Diameter	Loss Per Linear Foot BTU Per Hour		Loss Per Flange BTU Per Hour	
	Un-insulated	Insulated	Un-insulated	Insulated
1-1/2 inches	676	47	1205	97
2 inches	846	54	1660	115
2-1/2 inches	1024	55	2155	125
3 inches	1243	72	2485	130

This will become more important as producers look to pick all the "low hanging fruit"

What about Electrification?

Where is the dryer?

400 TPH (**100 MM BTU/hr burner**) =__HP ?

39 HP ?
390 ?
3900 ?

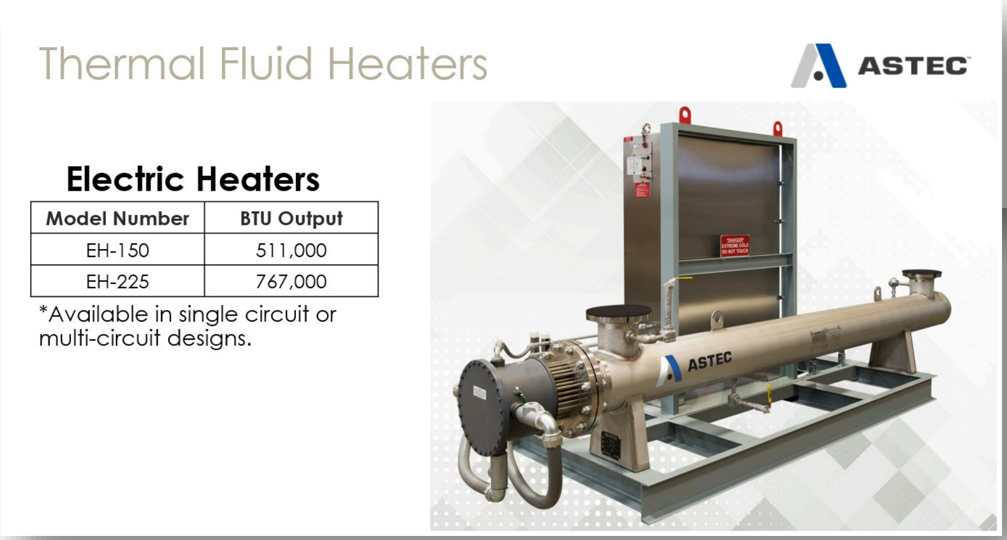
39,300 HP

We aren't there yet

Model	Volume (Gal.)	Heating
TAV-10D	10,000	HOT OIL
TAV-15D	15,000	HOT OIL
TAV-20D	20,000	HOT OIL
TAV-25D	25,000	HOT OIL
TAV-30D	30,000	HOT OIL
TAV-40D*	40,000	HOT OIL
TAV-45D*	45,000	
TAV-50D*	50,000	
TAV-10DEL	10,000	
TAV-15DEL	15,000	
TAV-20DEL	20,000	
TAV-25DEL	25,000	
TAV-30DEL	30,000	
TAV-40DEL*	40,000	
TAV-45DEL*	45,000	
TAV-50DEL*	50,000	

*Shipping constraints, consul

Model	Volume (Gal.)	Heating
TA-10D	10,000	HOT OIL
TA-15D	15,000	HOT OIL
TA-20D	20,000	HOT OIL
TA-25D	25,000	HOT OIL
TA-30D	30,000	HOT OIL
TA-40D*	40,000	HOT OIL
TA-45D*	45,000	HOT OIL
TA-50D*	50,000	HOT OIL
TA-10DEL	10,000	ELECTRIC



Electric Heaters

Model Number	BTU Output
EH-150	511,000
EH-225	767,000

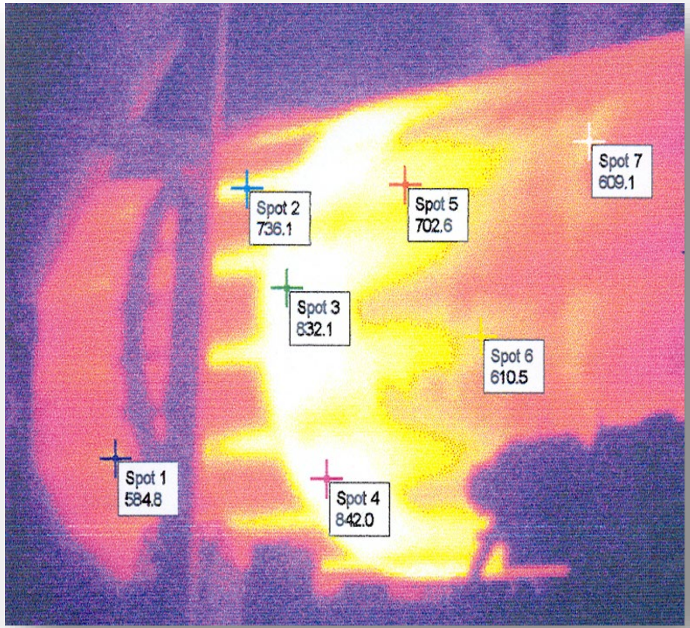
*Available in single circuit or multi-circuit designs.

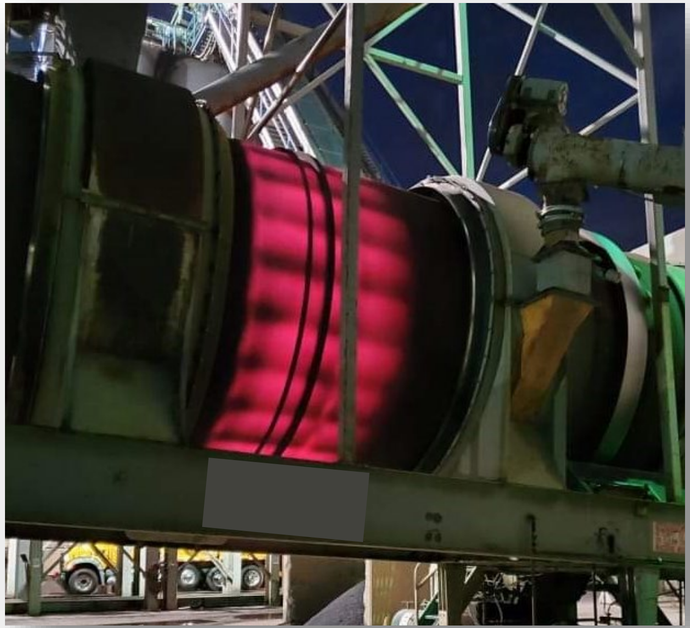
What can be done NOW ?

- Insulate everything that gets hot - almost

Insulating Your Plant

- Dryer drum → Insulate?
- Duct work → Worth the effort?
- Baghouse → Lots of surface area





What can be done NOW

- Utilize storage silos to keep plant running efficiently
  - Minimize waste
  - Maximize quality
  - Manage end of day stop - starts

Plant Efficiency – Operations

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- Plants that start and stop more than 3 times per shift use up to **20 - 35%*** more fuel

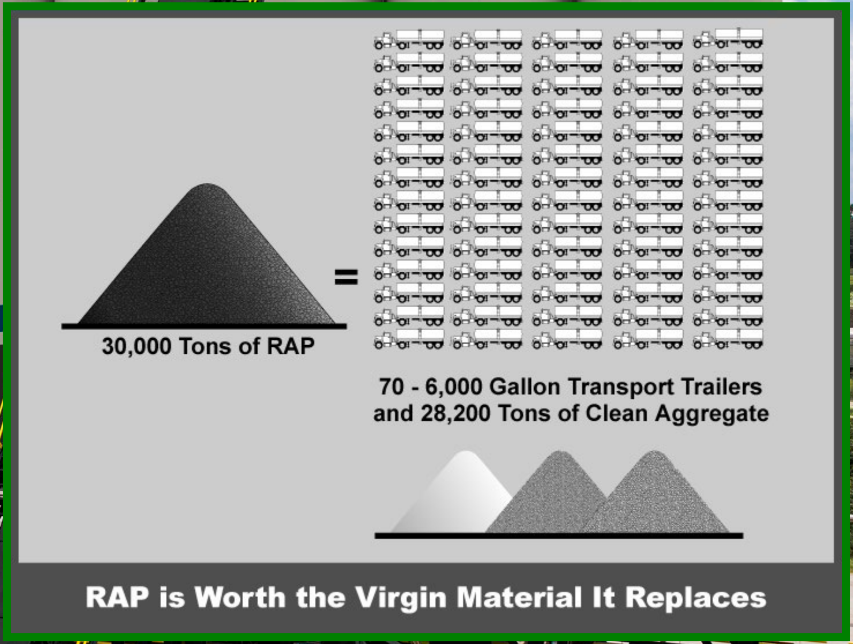
The solution: Storage silos.

Operate your continuous plant…continuously!

When compared to theoretical steady-state operation. Percentages from NAPA Publication QIP-132.

What can be done NOW

- Use as much RAP as possible – do it the right way
  - “Best practice” if below 25% RAP
  - Fractionate if above 25% RAP
  - Equipment – training – mix design

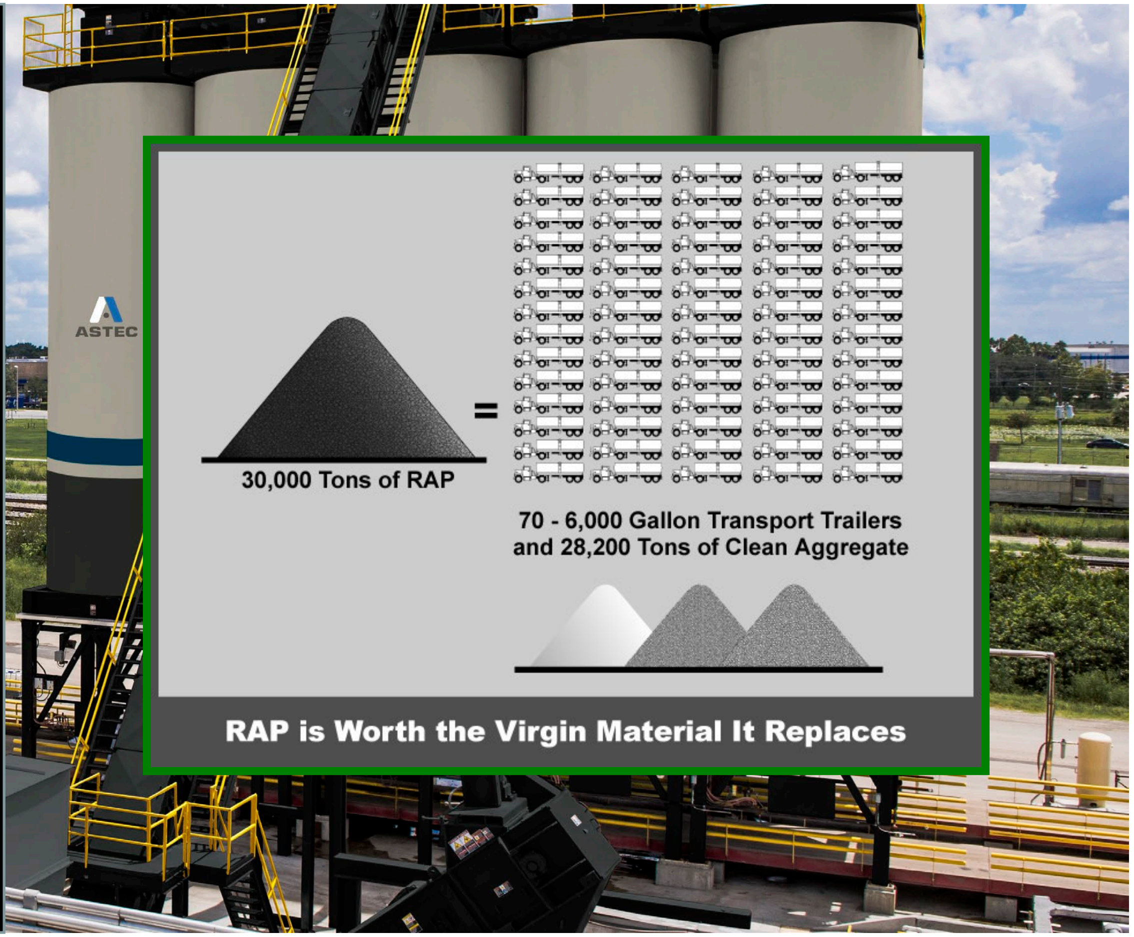


Excess RAP is an Urban Issue

Even with aggressive recycling excess RAP is a growing situation in urban areas

What can be done NOW

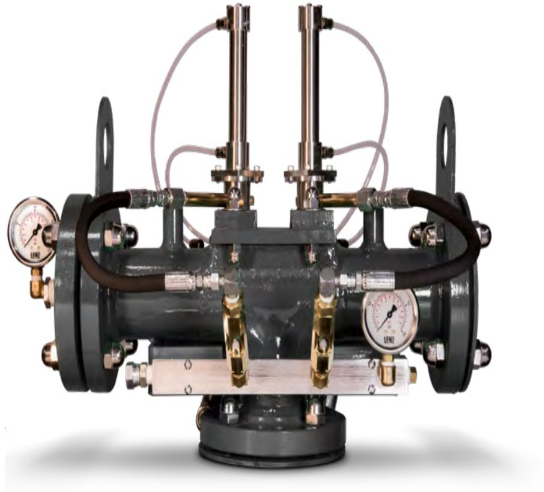
- CCPR (Cold Central Plant Recycling) – no heat req'd
  - What is it?
    - 97% RAP Product
    - Water added as compaction aid
    - 2% AC
    - 1% cement
    - RAP + AC spot welds + water = CCPR
  - What is it good for?
    - Base
    - Binder
    - Rock base substitute



What can be done NOW

- WMA (warm mix asphalt)
- Just do it – yes you can!
- Yes you will….sooner or later…

Who is in charge?



50F lower mix temperature = 11% less fuel

Many see more!

Pick a WMA technology and sell it

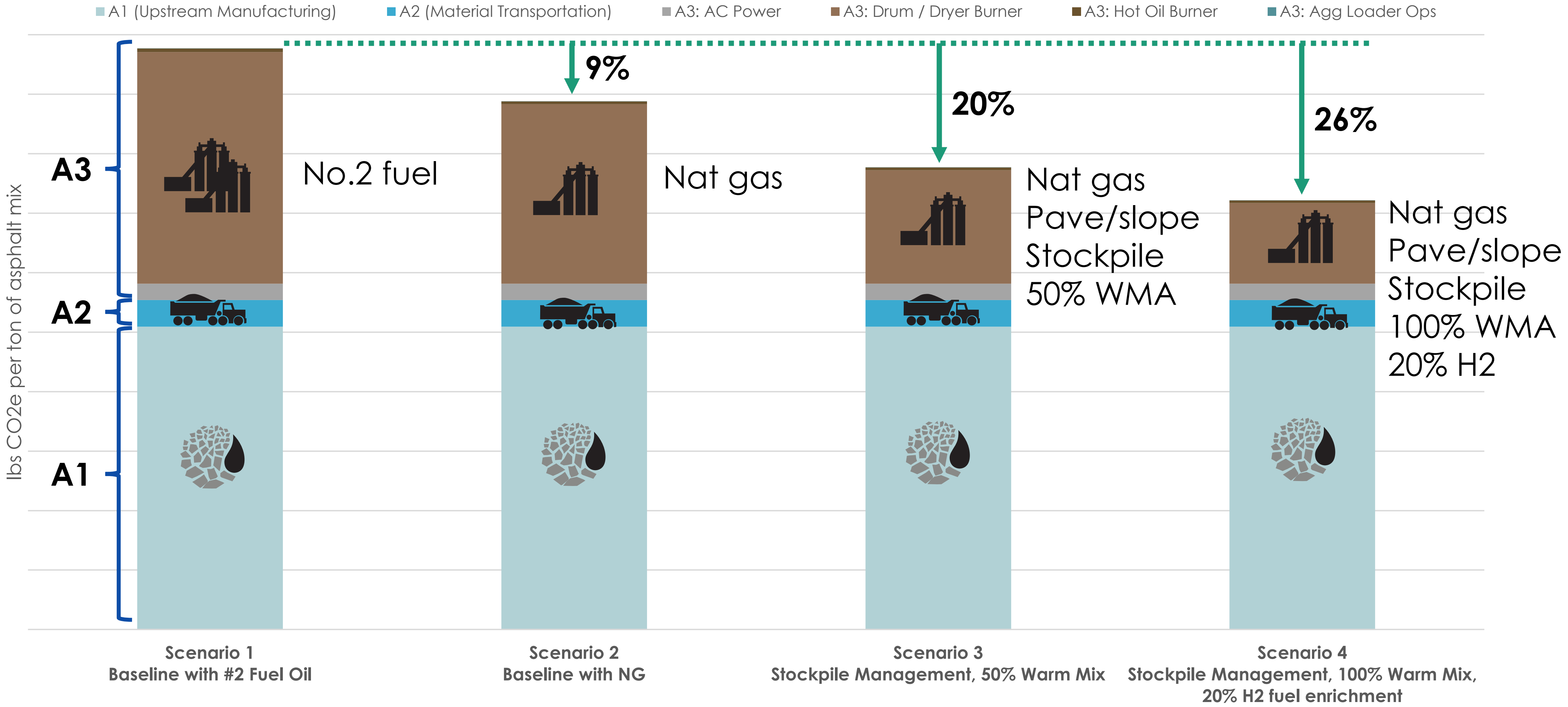
Existing Technology: Operations

Good stockpile management practices can have an oversized effect on **plant output** and mix cost.

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

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

How things add up

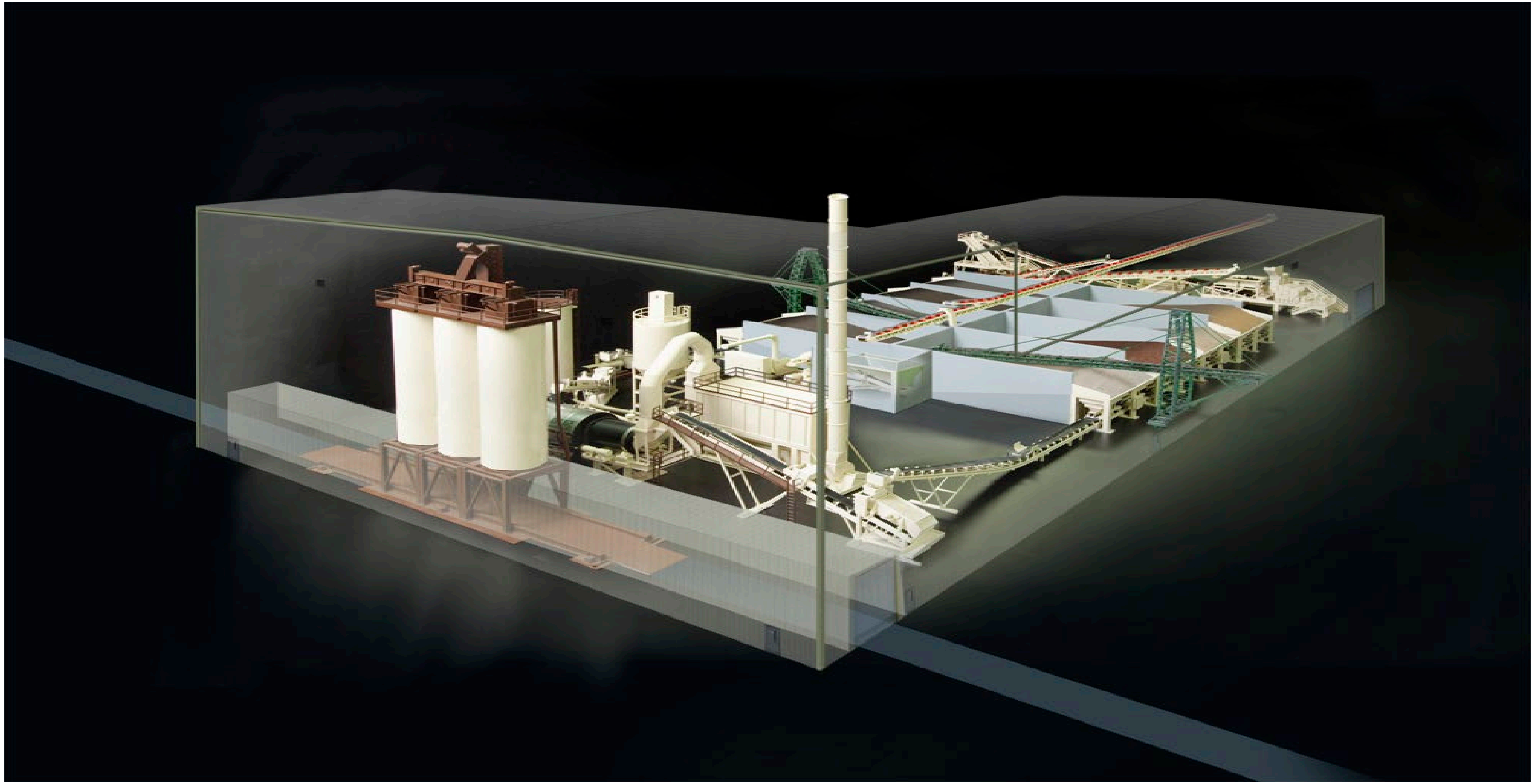


**Stockpile Management = 2% Moisture Reduction*

***Warm Mix = 75° F Temperature Reduction*

No change to A1, A2, A3: AC Power, A3: Outbound Trucking, or A3: Agg Loader Ops

Covered indoor facilities



Astec Asphalt Plant - France

Covered indoor facility, France, 2013

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Welcome to the future – Covered everything!

Sydney, Australia

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
- Mostly electric plant components
- Covered or partially covered facilities

Less Impact… Better Neighbor.

What will the future look like?

- Condition monitoring systems (CMS) anticipate **maintenance**
- Realtime process and **energy** use monitoring with visual KPI
- Operator Assist technologies to **minimize material/energy waste**
- Easy to operate well

Connecting Equipment with Action Takers and Decision Makers

Enhanced Control… Better Operation

We can safely predict…

ABOUT ASTEC

- Based in Chattanooga, TN USA and founded in 1972
- Unique vision to bring state-of-the-art technology to traditionally low-tech industries
- Built on the legacy of putting customer service first.
- Market-leading brands have become a global leader in the manufacture of equipment from Rock to Road.

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