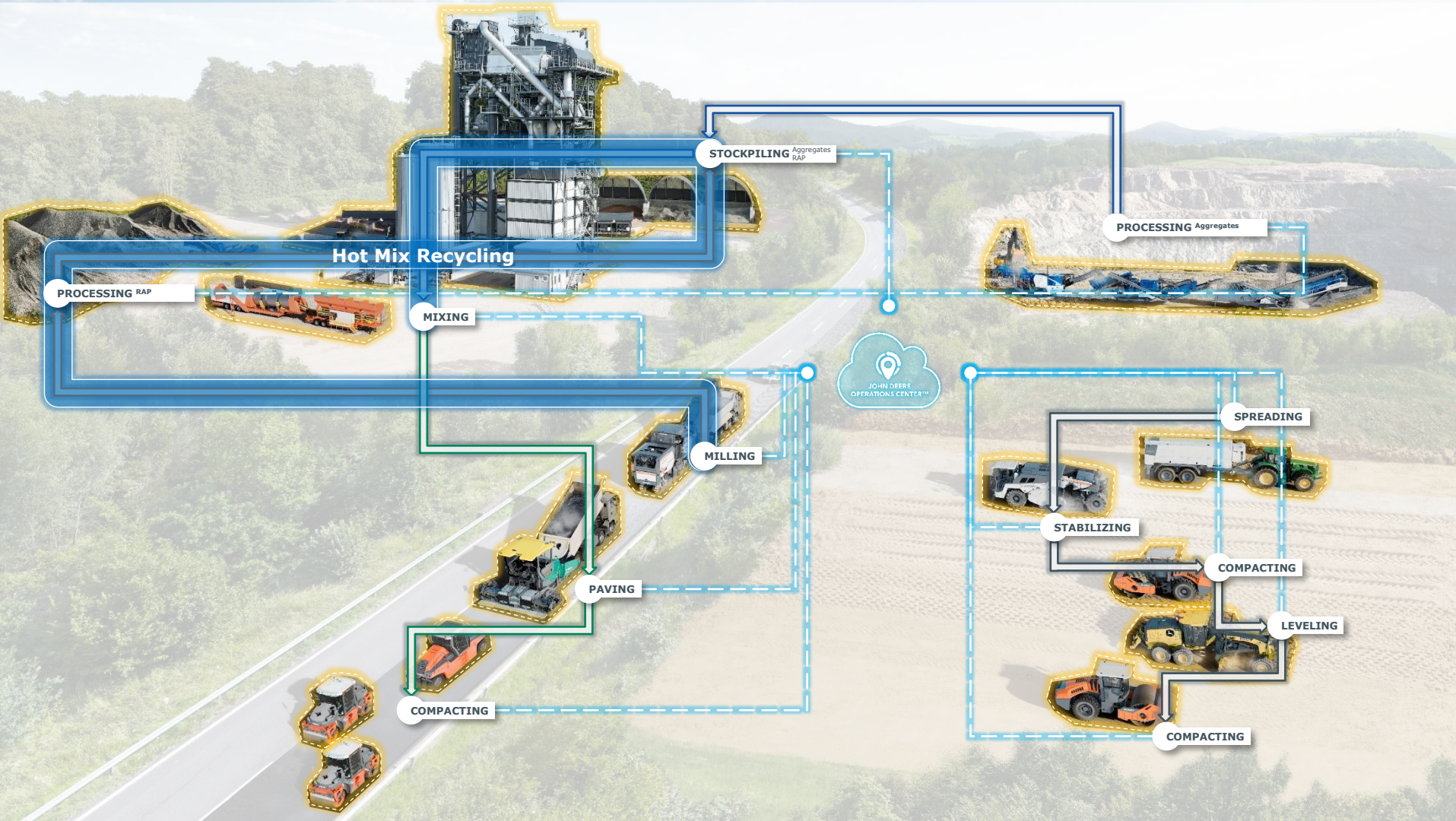




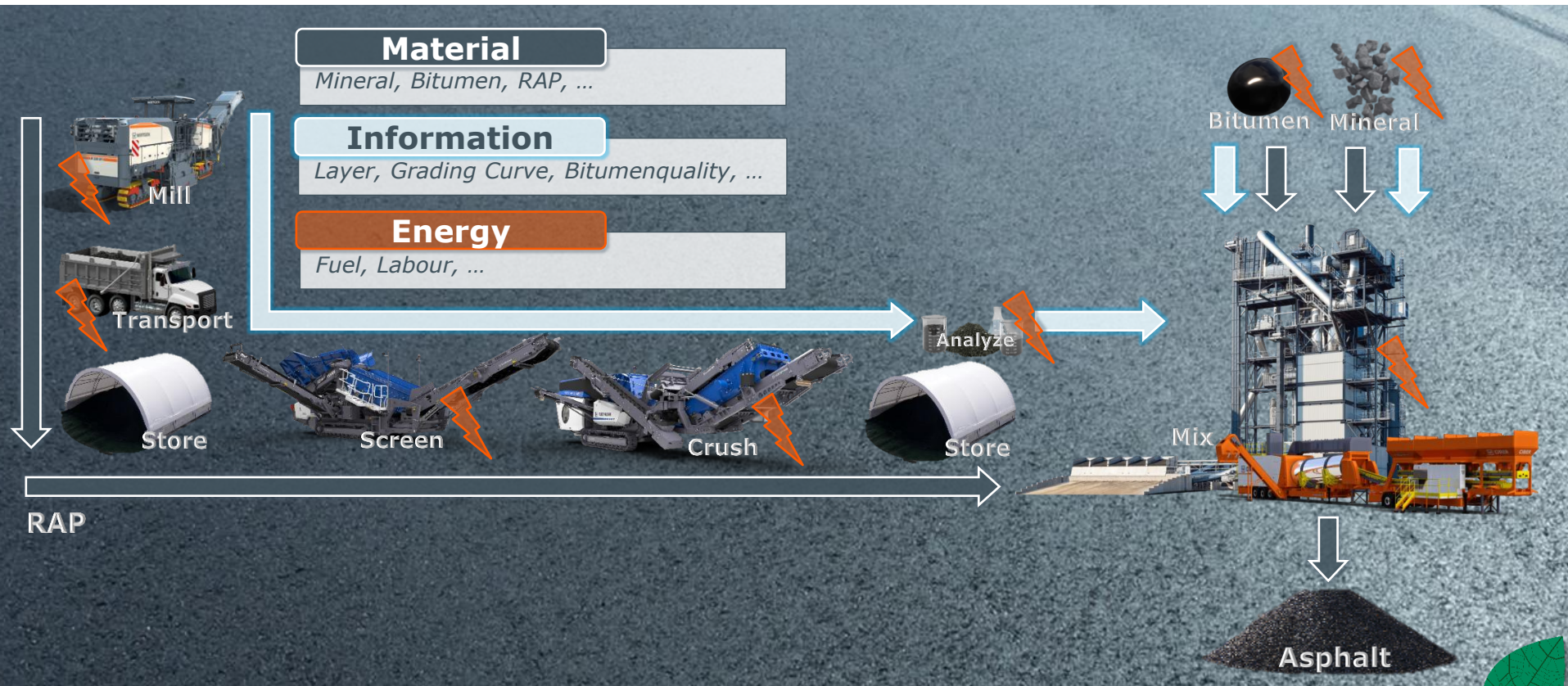
HOT MIX RECYCLING

Christian Bode





Hot Mix Recycling



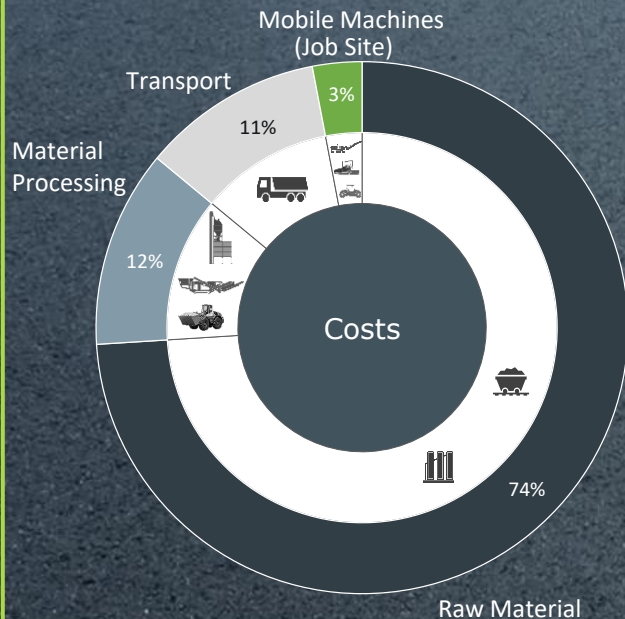
Baseline

Expenditure and Emissions Road Construction Project



WIRTGEN GROUP

Costs factors of conventional road rehabilitation

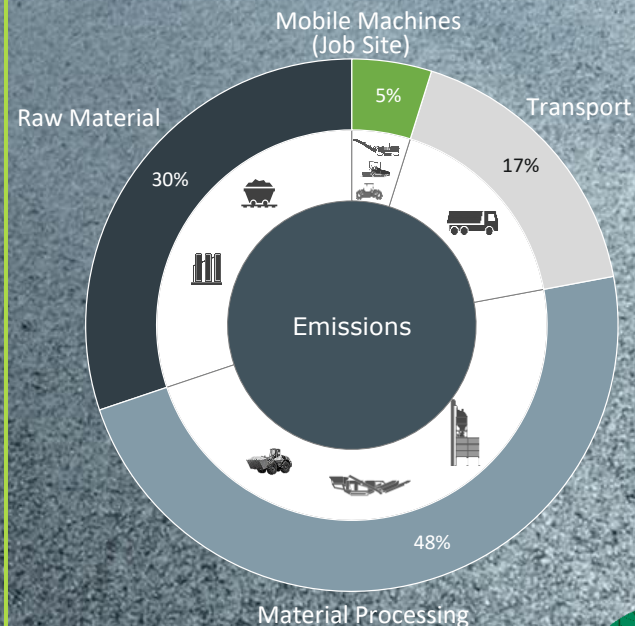


CO₂e intensive and expensive **raw materials**

High energy required for **asphalt mixing**

Many **transports**

CO₂e factors of conventional road rehabilitation



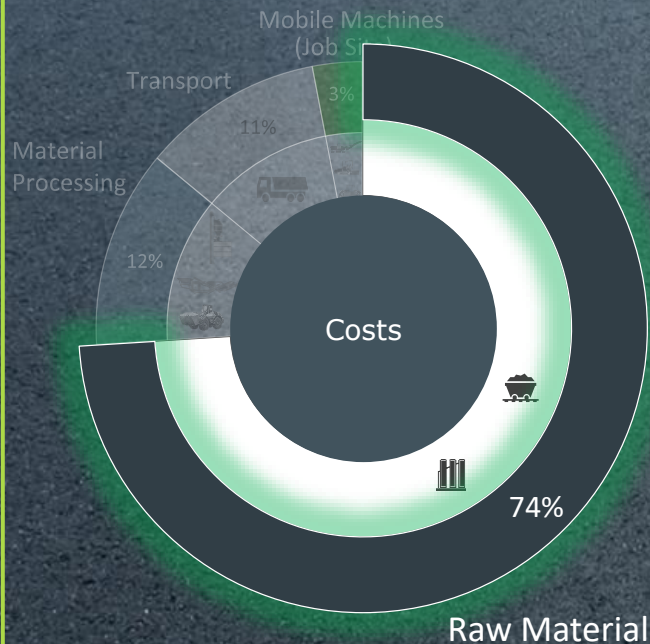
Baseline

Expenditure and Emissions Road Construction Project



WIRTGEN GROUP

Costs factors of conventional road rehabilitation

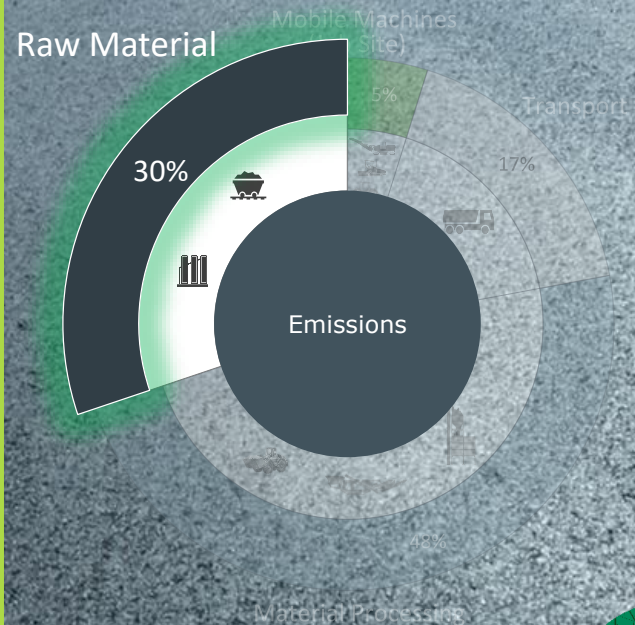


CO₂e intensive and expensive **raw materials**

High energy required for **asphalt mixing**

Many **transports**

CO₂e factors of conventional road rehabilitation



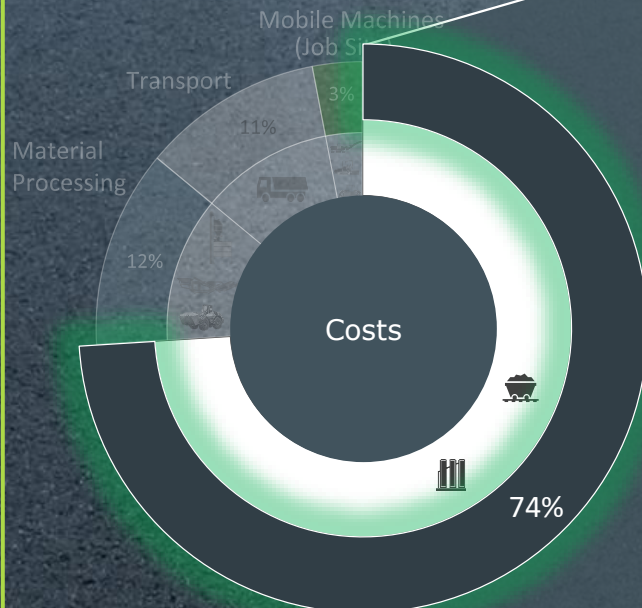
Motivation

Kosten und Emissionen von Straßenbauprojekten



WIRTGEN GROUP

Costs factors of conventional road rehabilitation



Raw Material



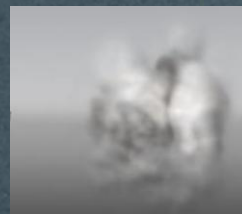
Mineral

25%



Bitumen

47%



Filler

2%

Motivation

Kosten und Emissionen von Straßenbauprojekten



WIRTGEN GROUP

Costs factors of conventional road rehabilitation

Raw Material



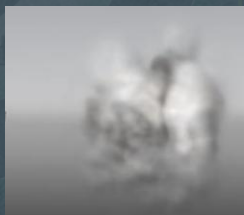
Mineral

4%



Bitumen

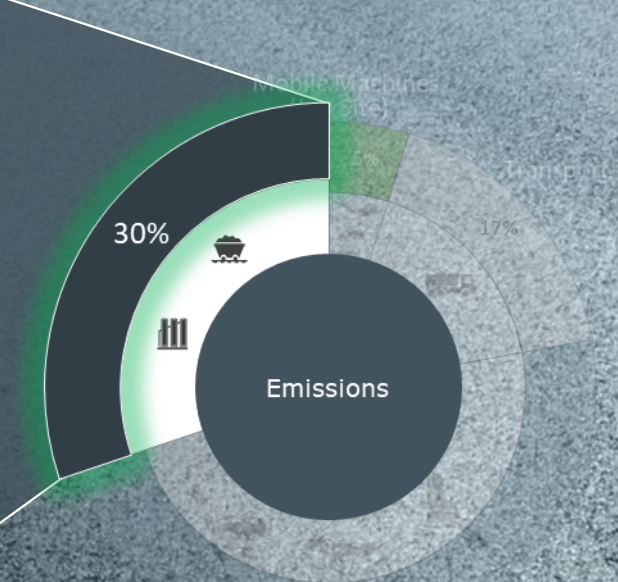
26%



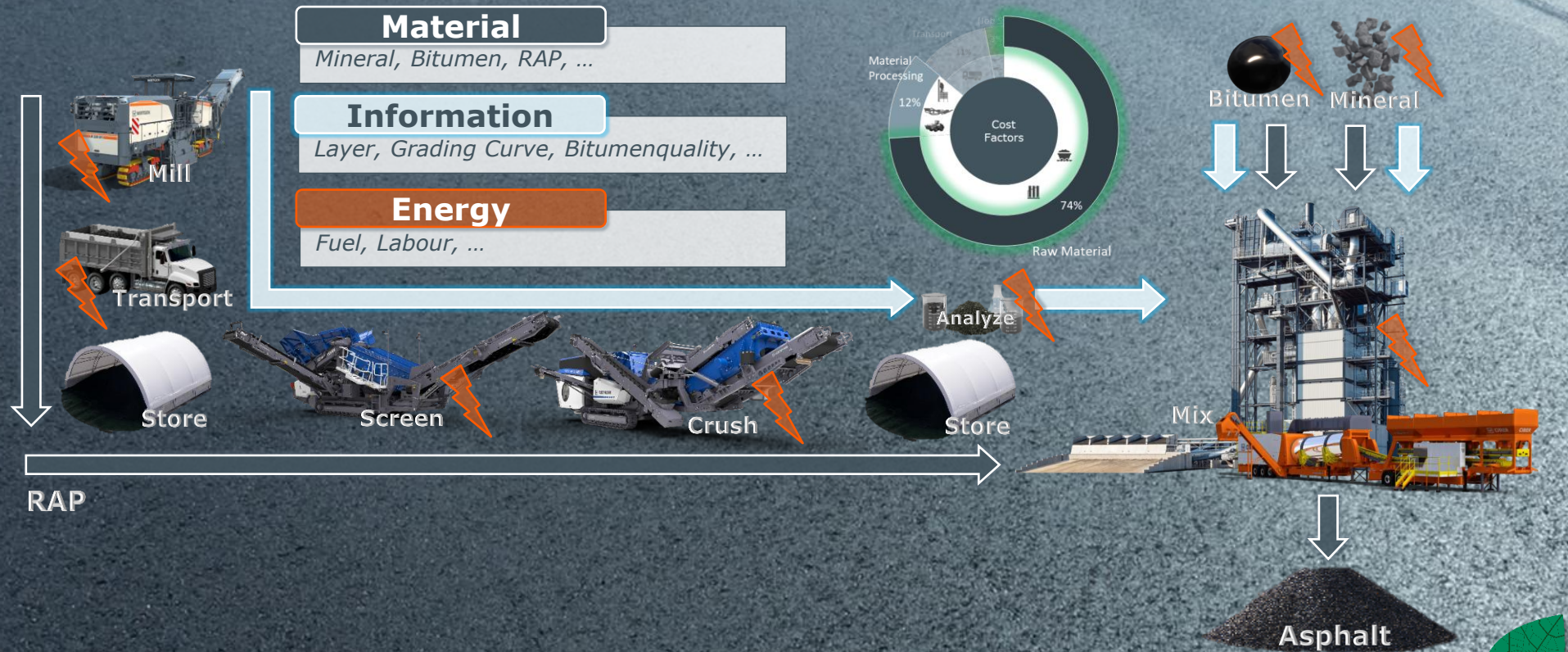
Filler

0%

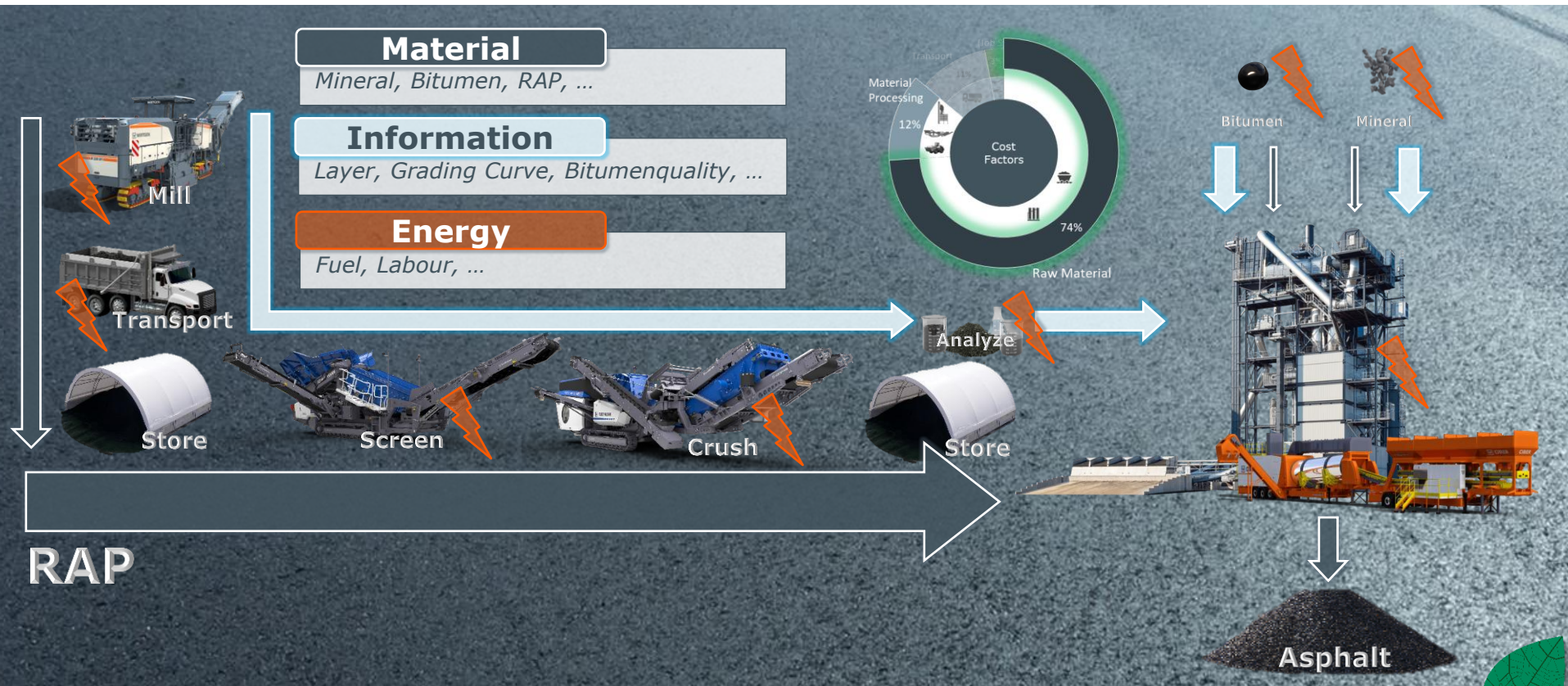
CO₂e factors of conventional road rehabilitation



Hot Mix Recycling

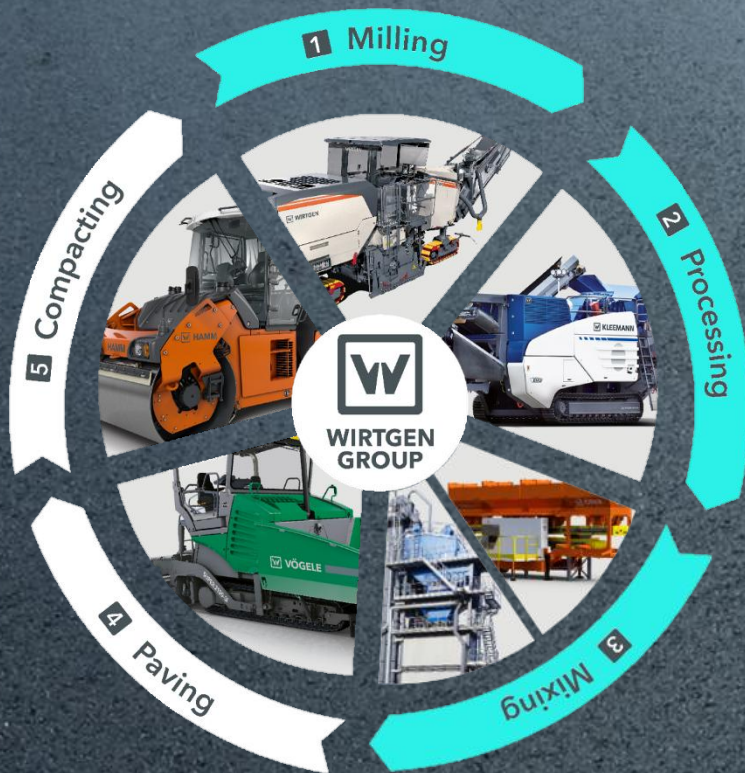


Hot Mix Recycling



Hot Mix Recycling

More than machine Technology



Hot Mix Recycling Team



WIRTGEN



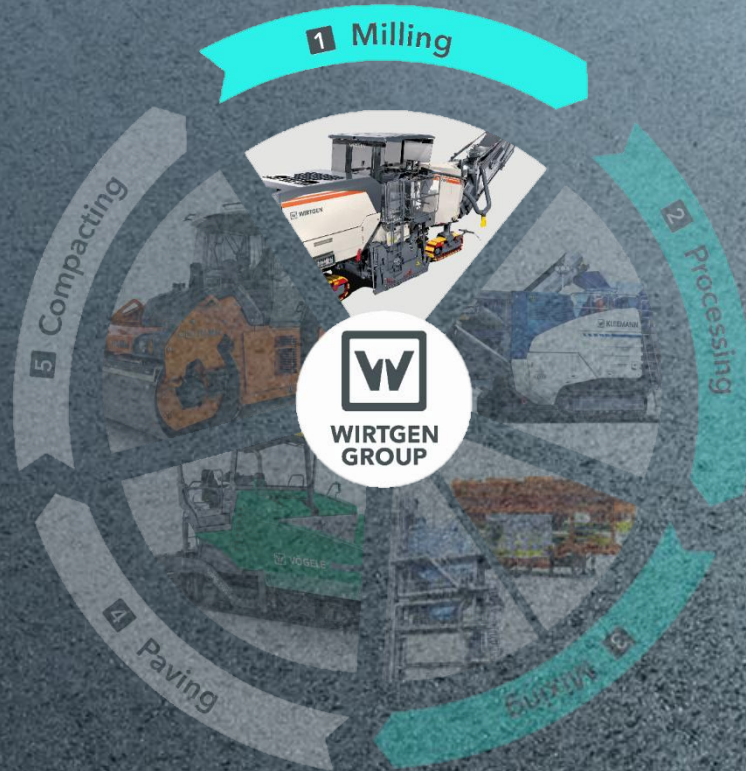
KLEEMANN



BENNINGHOVEN



CIBER



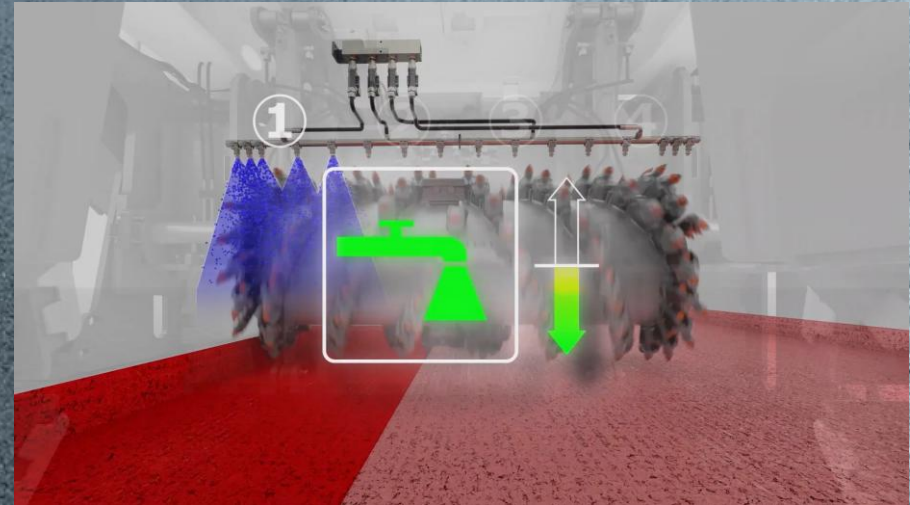
Milling layer by layer

- Milling layer by layer on suitable sites
- Produce clean RAP out of **Top-, Binder-, Base layer** to keep high quality material
- To reuse these in highest RAP rates
- Core samples help with the decision



Water Management

- To reduce water consumption and keep moisture content in the RAP on a low level
- Automatic water flow addition depending on RAP flow during milling and section control on spray bar for overlaps





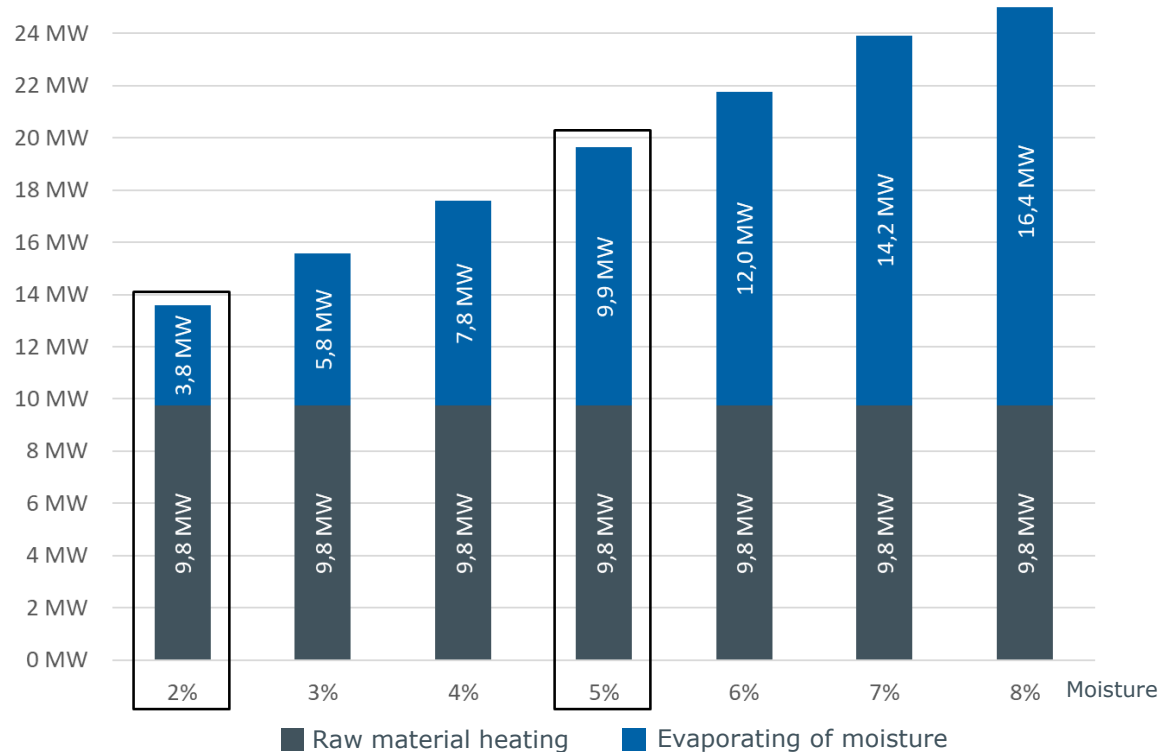
- 1 % MORE moisture $\triangleq$ 1 l MORE oil per 1 t of asphalt
- Approx. – 2,2 kg CO₂ per 1 % moisture per 1 t asphalt

Example:

- Annual production of 100,000 t
- 100,000 l MORE heating oil
- AND
- ~220 t MORE CO₂



Energy consumption for Asphalt production of 240t/h



Hot RAP addition

Moisture 2% 8%



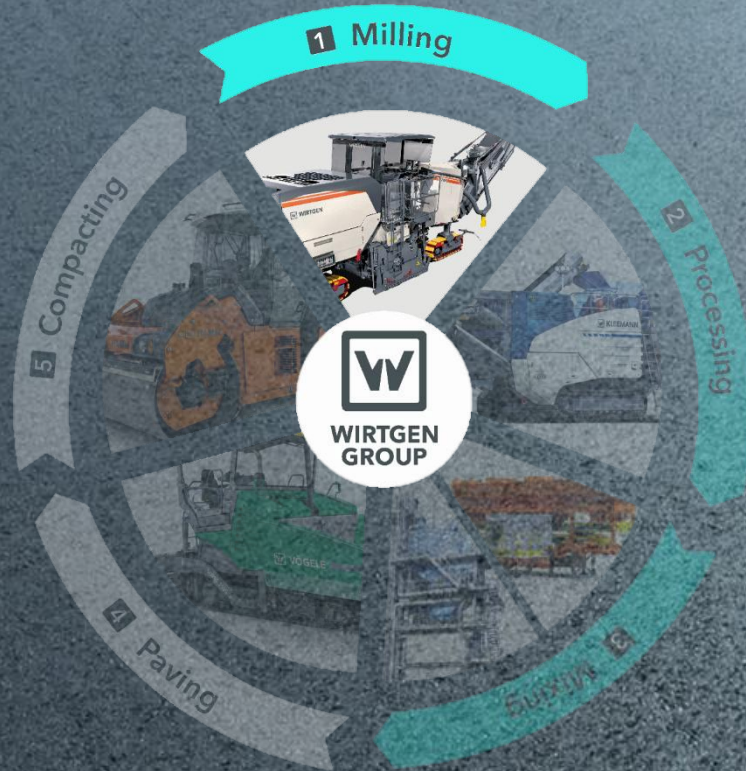
Performance 180 t/h 90 t/h

Cold RAP addition

Moisture 2% 8%



Addition 50% 20%





Processing

Do



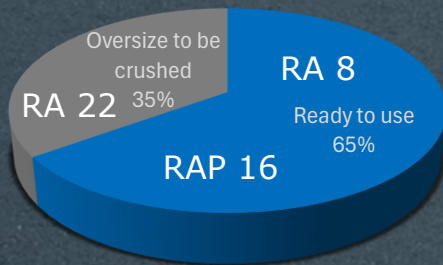
- Use of gentle processing methods
- Keep original grading curve

Don't

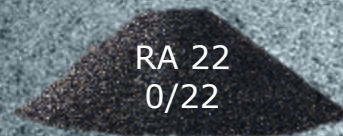
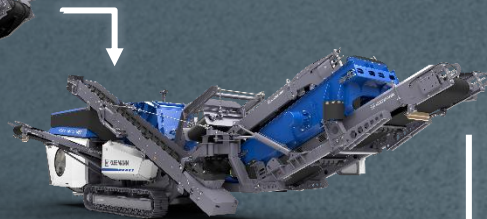


- Crushing stones produces fines
- Fines limiting RAP Addition

Typical Size Distribution – Milled Asphalt



Screening | Crushing





Kosten Aufbereitung pro Tonne RC
 All In Feed 100% $\times Z \text{ €/t}$ = $Z \text{ €/t}$
 Brechkosten „Z“ für jede Tonne RC



Kosten Aufbereitung pro Tonne RC
 $<32\text{mm}$ $65\% \times 1/3 \times Z \text{ €/t}$ = $0,2 \times Z \text{ €/t}$
 Überkorn $35\% \times (1/3+1) \times Z \text{ €/t}$ = $0,5 \times Z \text{ €/t}$
 $\underline{\hspace{1cm}}$
 $0,7 \times Z \text{ €/t}$

The Cost of the Operation of a Screen is 1/3 of the Cost of the operation of a Crusher.

So if 65% of the usable particle sizes are screened out beforehand, only 35% of the milled material is fed through the crusher.

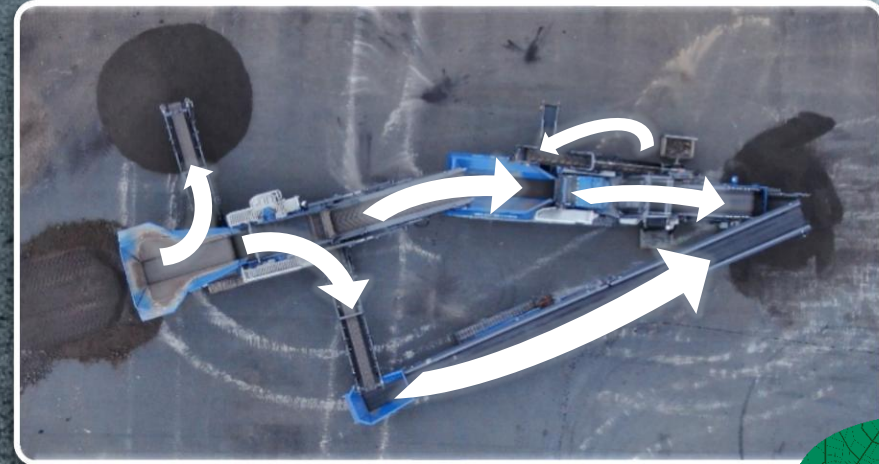
This reduces the processing costs by **30%**.

Processing Homogeneity – Accumulated piles

- Homogeneity is important for a stable asphalt production
- Try to feed the processing set-up with a mix of layers

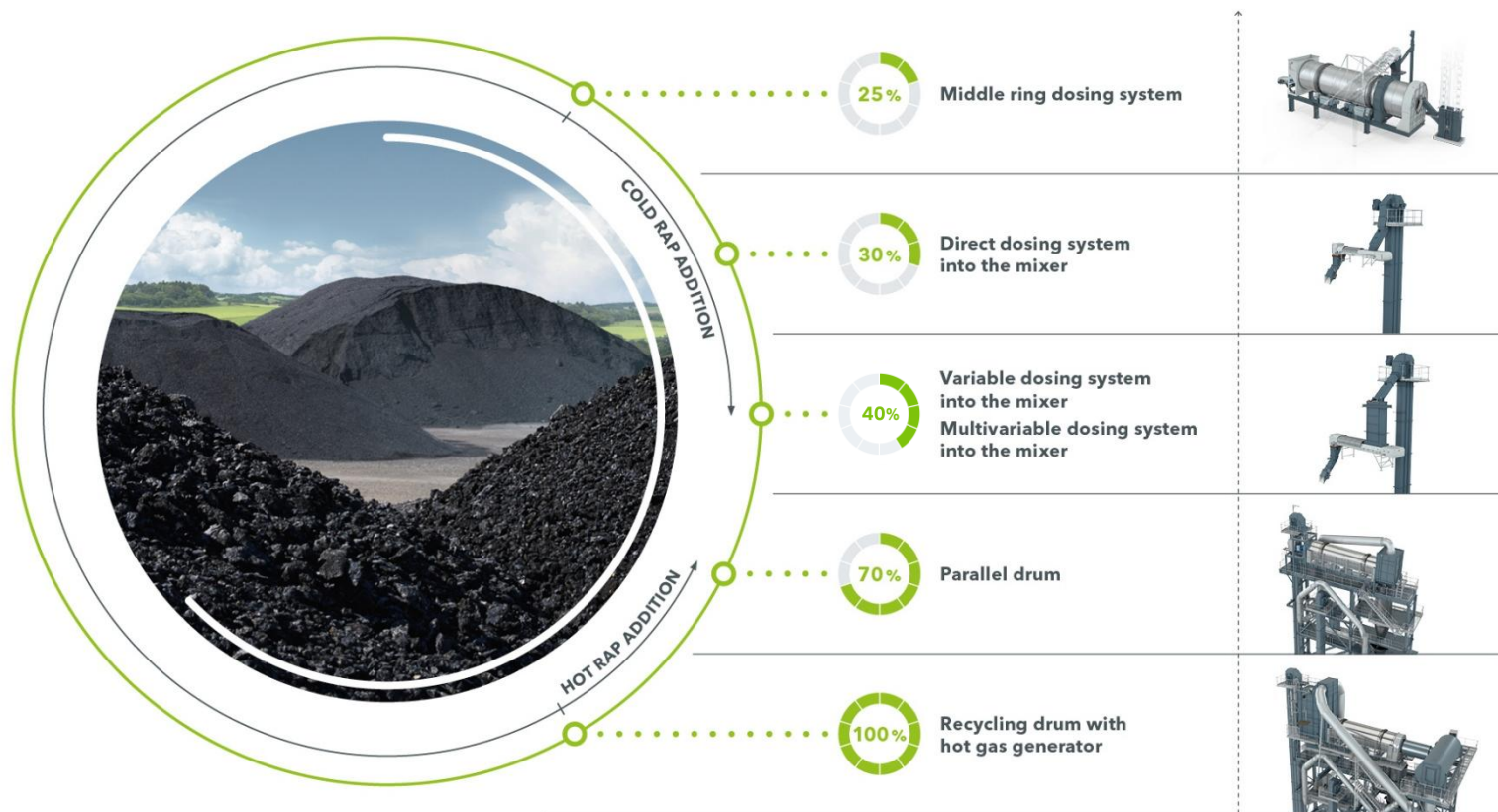


- Material flow inside processing set up helps to homogenize
- Regular Sampling is mandatory









Thermal stress on Bitumen

Hot RAP Addition

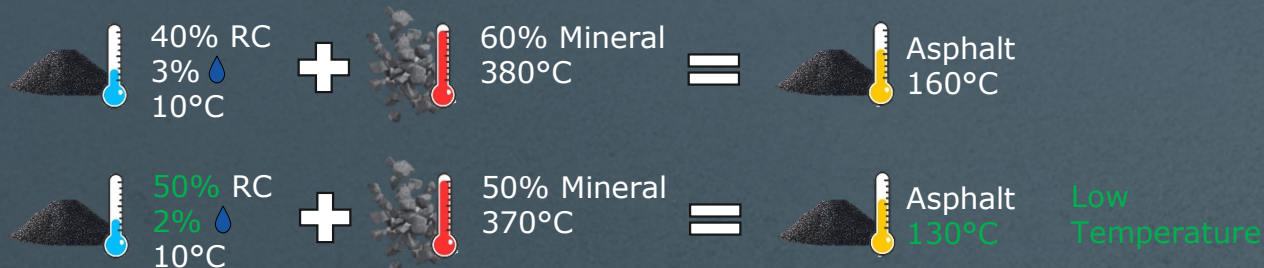
Counter Flow Drum with hot gas generator



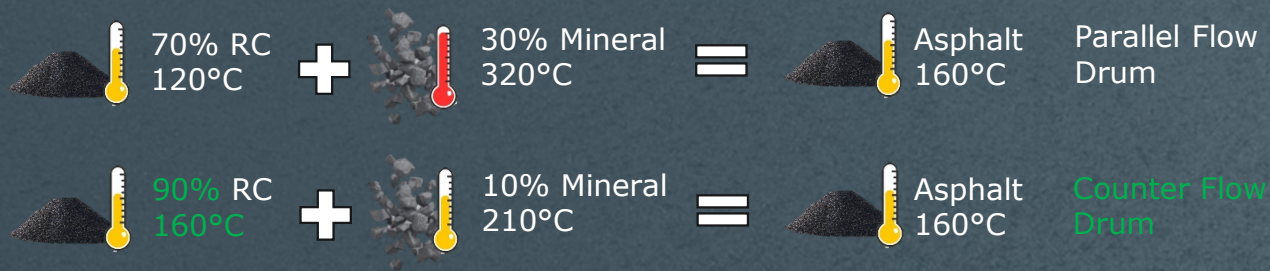
Mixing

Temperature inside Mixer

Cold RAP Addition

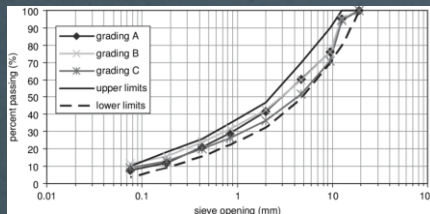


Hot RAP Addition



*Temperatures at drum outlet

Asphalt Specification



Grain Sizes
Bitumen Content
Bitumen Quality

Compare

Mixing Recipe

RAP



30%

Mineral



67%

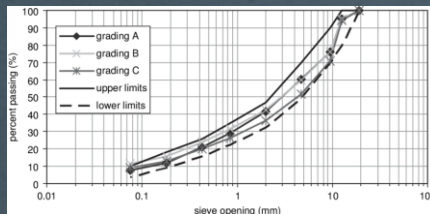


Bitumen



3%

Asphalt Specification



Grain Sizes
Bitumen Content
Bitumen Quality

Compare

Mixing Recipe

RAP



80%



Mineral



19%



Bitumen



1%



Rejuvenator



0,3%

Benninghoven Recipe Generator

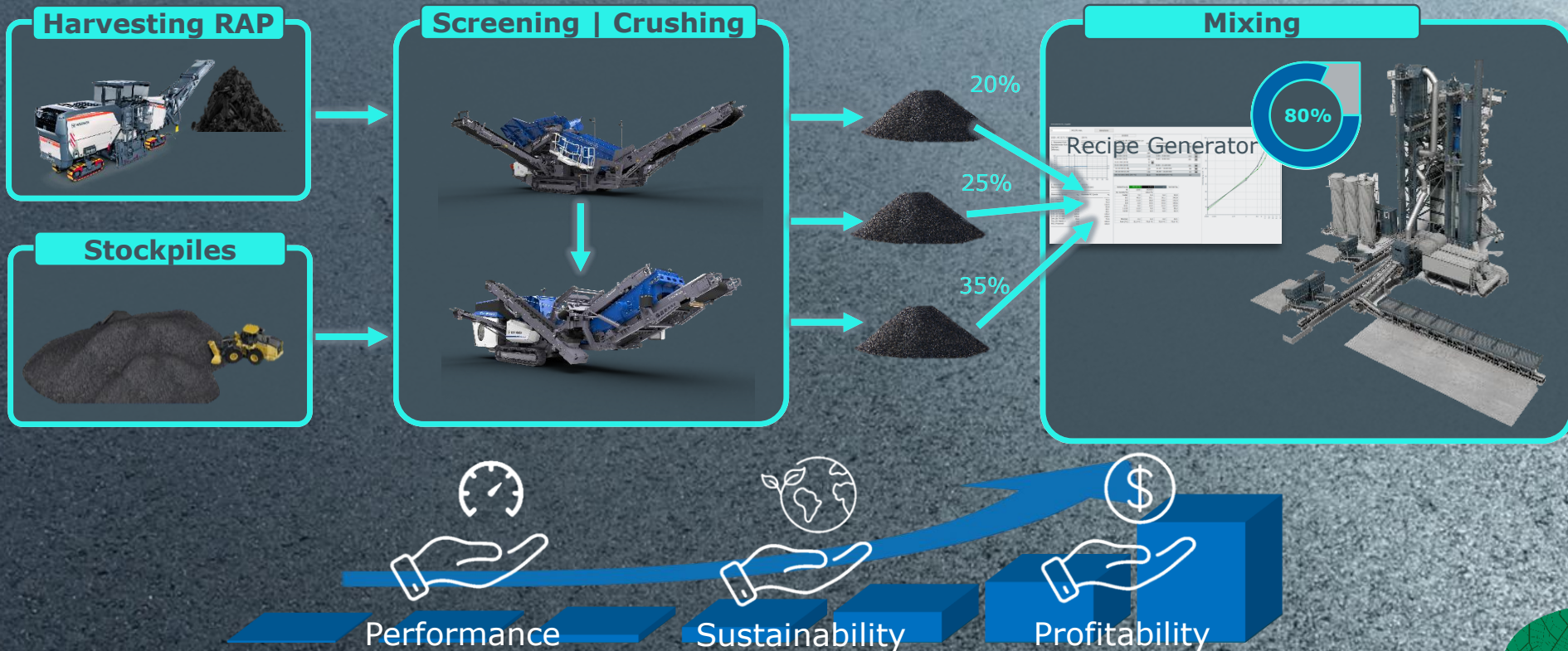






Production System Solution

Hot Mix Recycling



An aerial photograph showing a calm, deep blue lake on the left and a winding asphalt road on the right. The road is bordered by a dense, lush green forest. A single white car is visible on the road, moving away from the viewer. The sky is not visible, but the water reflects the surrounding environment.

THANK YOU

Contact:
christian.bode@benninghoven.com