# "GRÜNER WIRD'S NICHT" THEMA: GRÜNE ENERGIE

HEINRICH STEINS/BENNINGHOVEN/WIRTGEN GROUP/JOHN DEERE

# The WIRTGEN GROUP Concept

5 premium product brands

WIRTGEN GROUP

**5 product brands**

**2 business sectors**

**1 group of companies**

# Milestones in History

BENNINGHOVEN

**1909** — Company founded by Otto Benninghoven

**1944** — Gear wheels and gear boxes

**1952** — Entry into combustion technology

**1959** — First burners for asphalt mixing plants

**1966** — Plant components

**1986** — First asphalt mixing plant

**2009** — 100-year company jubilee

**2013** — Hot gas generator technology

**2014** — Integration into the WIRTGEN GROUP

WIRTGEN GROUP

**2016** — Groundbreaking New Factory

**2017** — Integration of the Wirtgen Group into John Deere

JOHN DEERE

**2018** — Start of Production New Factory

# SUSTAINABLE ROAD BUILDING

**> 19.000** asphalt plants

**> 1.3 Bn.** tons asphalt

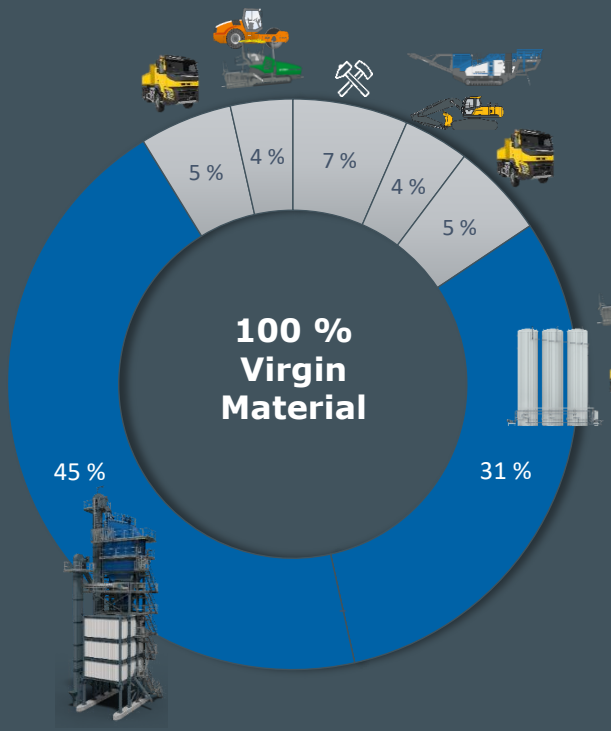
**> 50 Mio.** tons CO2

10 % RAP Usage / Fuel: Light Oil
38,5 kg CO2 / t Asphalt

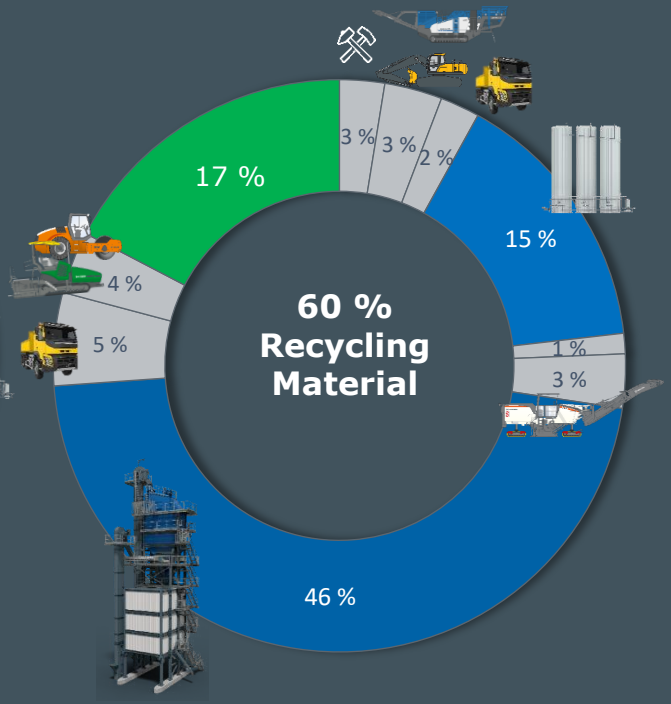
# Sustainability Goals

BENNINGHOVEN

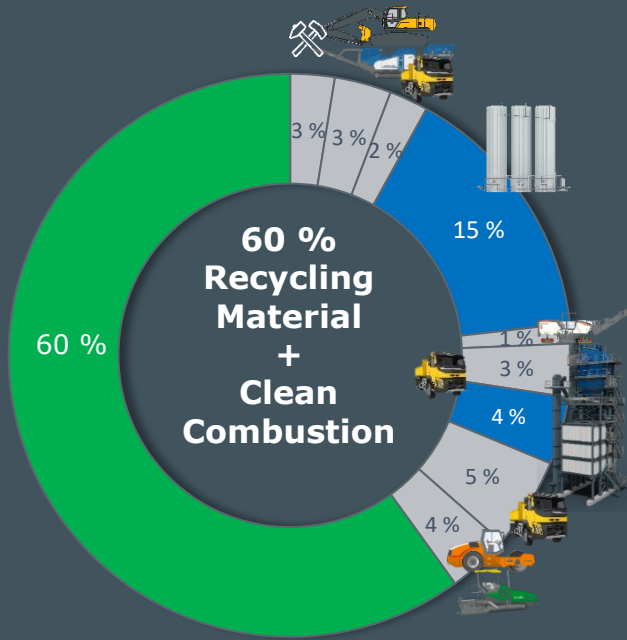
## INITIAL SITUATION




## RECLAIMED ASPHALT PAVEMENT




## FUTURE POWER SOURCES



# Technical solutions for CO2 reduction

## Overview [kg $CO_2$ / t Asphalt]

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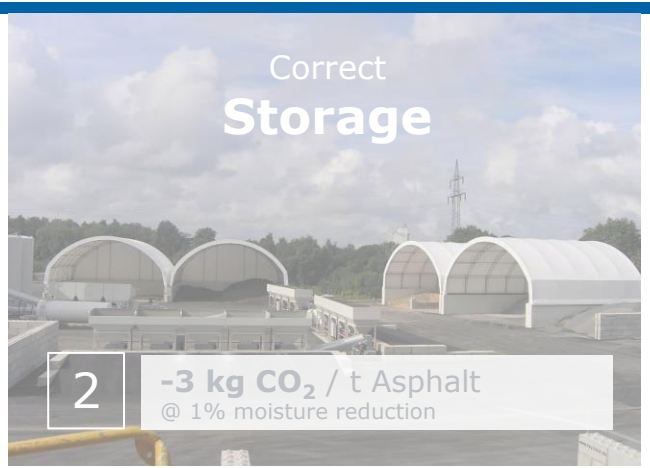




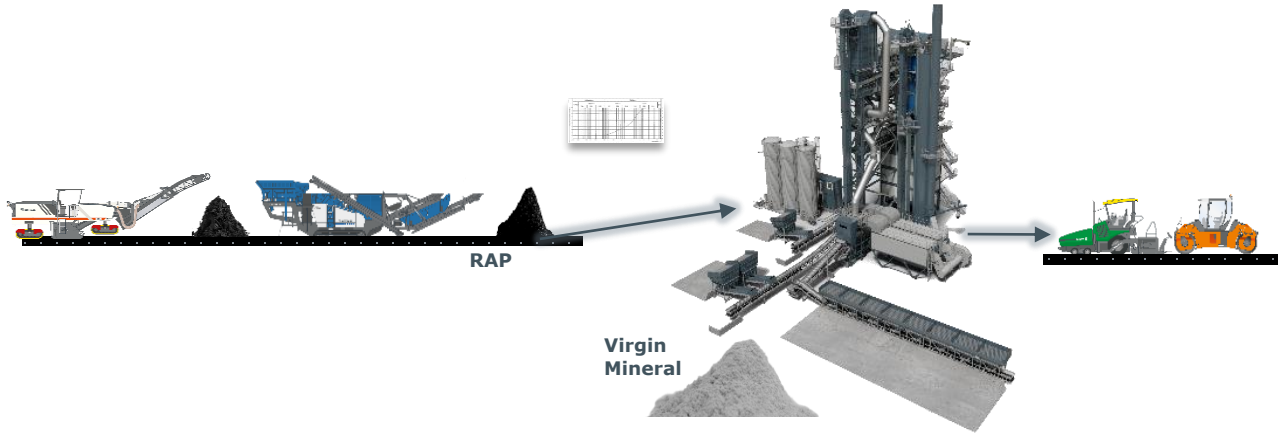


# Sustainable Road Building

## High recycling rates through Wirtgen Group production systems

BENNINGHOVEN

**WIRTGEN GROUP** delivers solutions for **all** global customer **requirements**






All solutions require an **optimized recycling management**, in it's entirety.
Milling > crushing/screening > mixing > paving > compacting has to be planned and **aligned** with the **customers** / **project requirements**

Global avg. Recycling approx. 10%

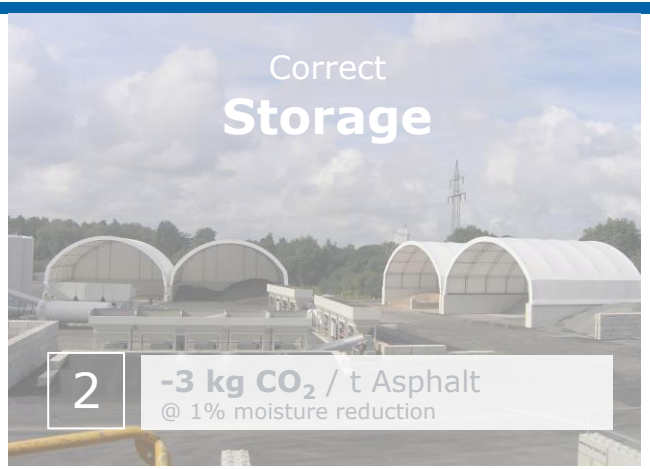
Target 30% **Saving 3.9 Mio. t CO2**
Target 50% **Saving 7.8 Mio. t CO2**

**More efficient** production **>** Gain **higher profits > Invest** in further **sustainable solutions**

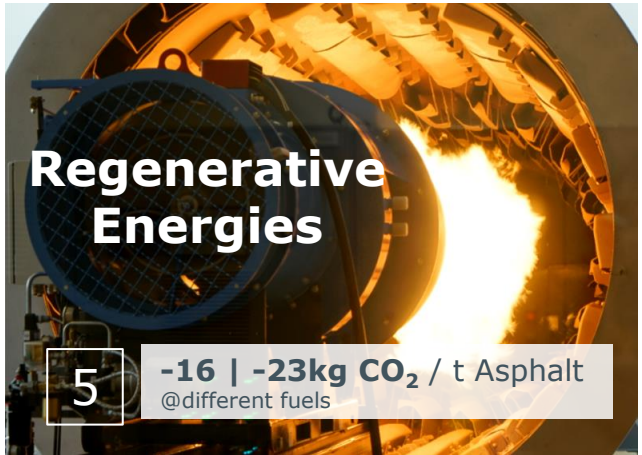
# Technical solutions for CO2 reduction

## Overview [kg $CO_2$ / t Asphalt]

BENNINGHOVEN




# Hydrogen Project
## Why Hydrogen as Fuel?

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- **No** greenhouse gas emissions
- Renewable energy if produced from green electricity
- **High** energy density: well suited as fuel for heat processes
- **No** use of agricultural land - no competition with food production
- 400 Billion € investment in $H_2$ sector expected by 2050
- Demand of 2,500 TWh/a for $H_2$ expected in Europe in 2050





*Source: www.auroraer.com/

# Hydrogen Project
## Characteristics of $H_2$

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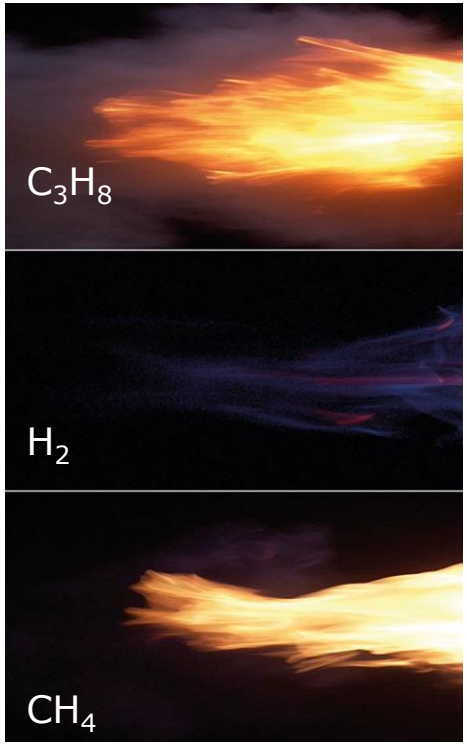
### Comparison $H_2$ – $CH_4$

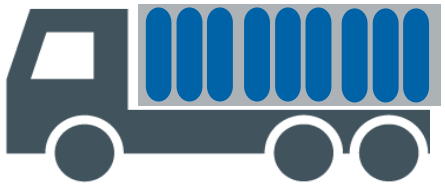
| Characteristics | Unit | $H_2$ | $CH_4$ |
|---|---|---|---|
| Lower calorific value | kWh/kg | 33 | 13,9 |
| Density (15 °C, 1 bar) | kg/m³ | 0,09 | 0,72 |
| Ignition limits in air | Vol.-% | 4 - 75 | 5 - 15 |
| Minimum ignition energy | mWs | 0,02 | 0,29 |
| Flame velocity in air | cm/s | 265 | 43 |
| Flame temperature in air | °C | 2130 | 1970 |
| Flame temperature in $O_2$ | °C | 3080 | 2860 |

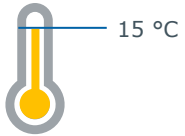
### Flame comparison

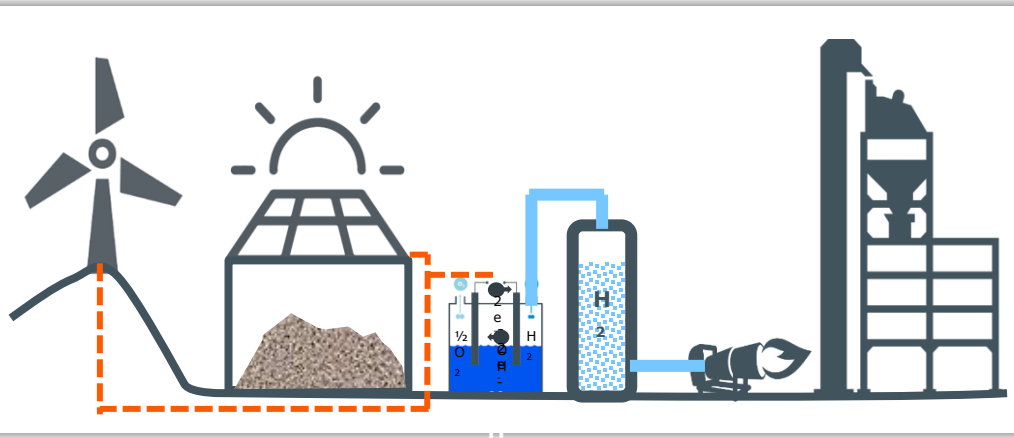


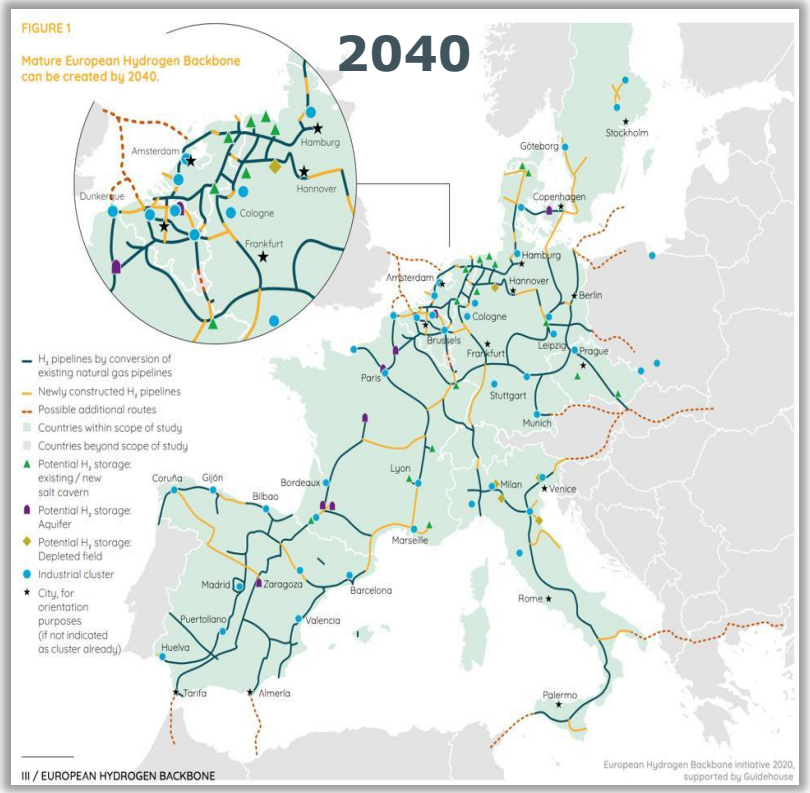
# Hydrogen
## Transport

**Container Trailer**
500 bar
corresponds to 1000 kg
**Mixing capacity***
**456 t**






* Bei ΔT=160K u. 4% Materialfeuchte

Quelle: SHELL WASSERSTOFF-STUDIE ENERGIE DER ZUKUNFT? Nachhaltige Mobilität durch Brennstoffzelle und $H^2$

Quelle: HyARC 2017; SHELL

# Hydrogen Burner Development

## Pre-Study

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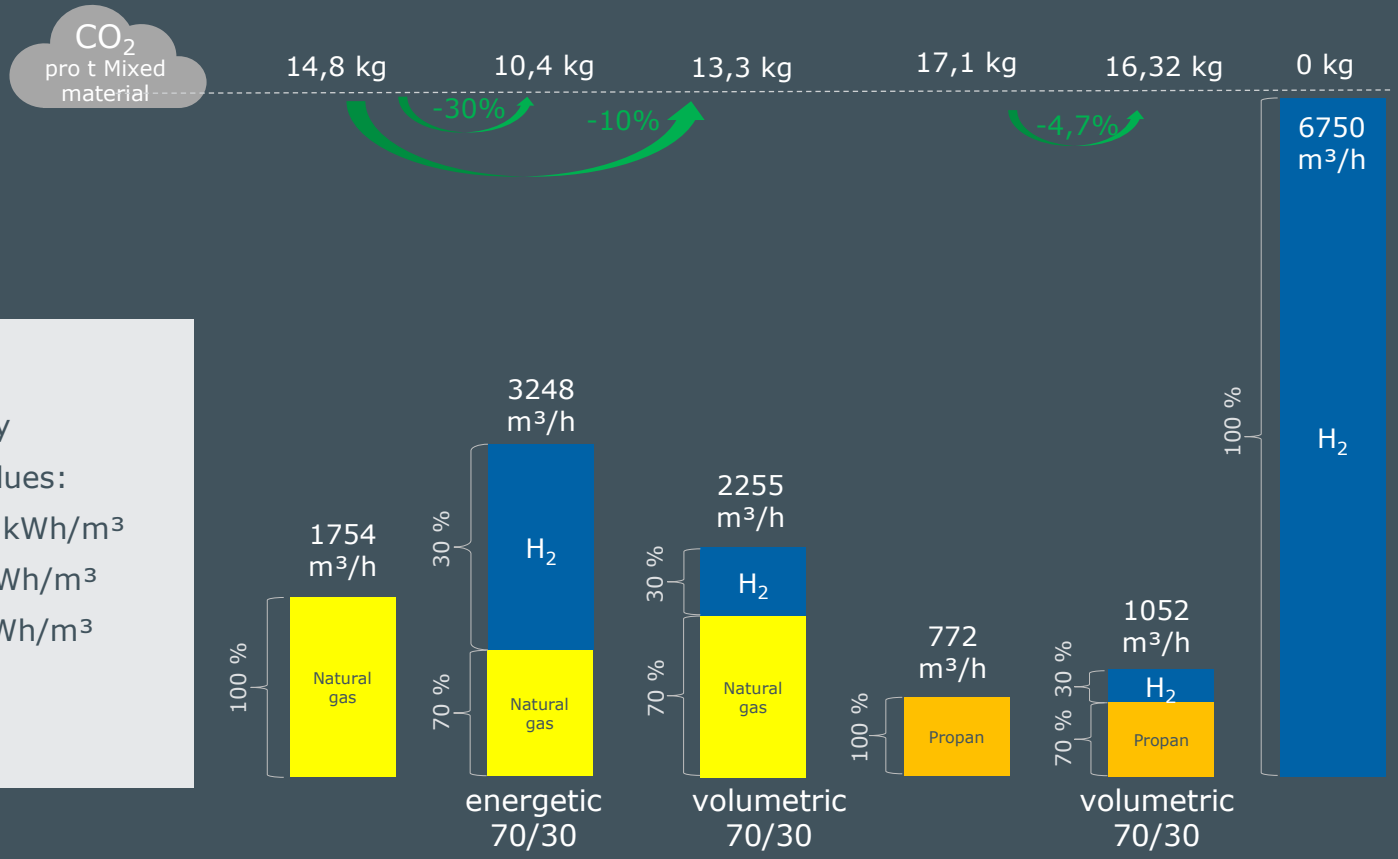


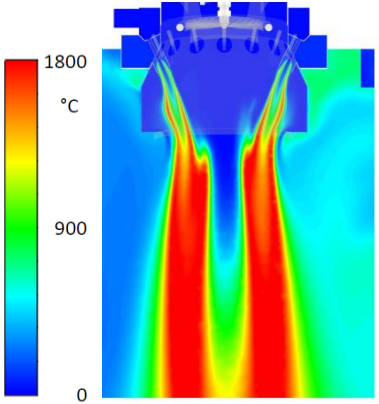

**Boundary condition:**

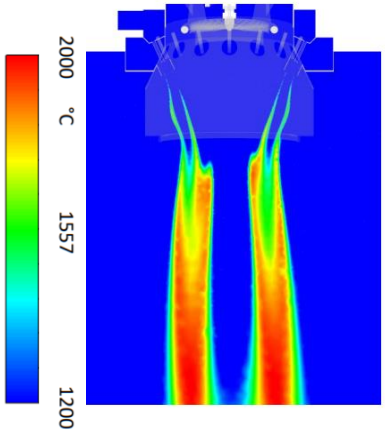
- 20 MW burner capacity
- Volumetric calorific values:
  - Natural gas 11,4 kWh/m³
  - Hydrogen 2,97 kWh/m³
  - Propane 25,89 kWh/m³
- New drying system necessary for $H_2$

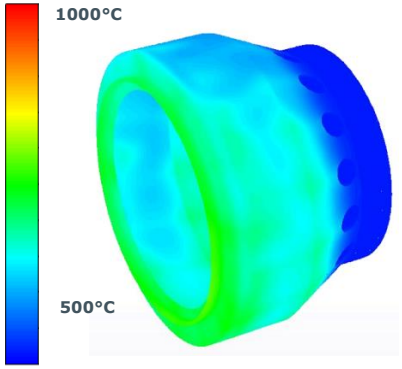
# Hydrogen Burner Development

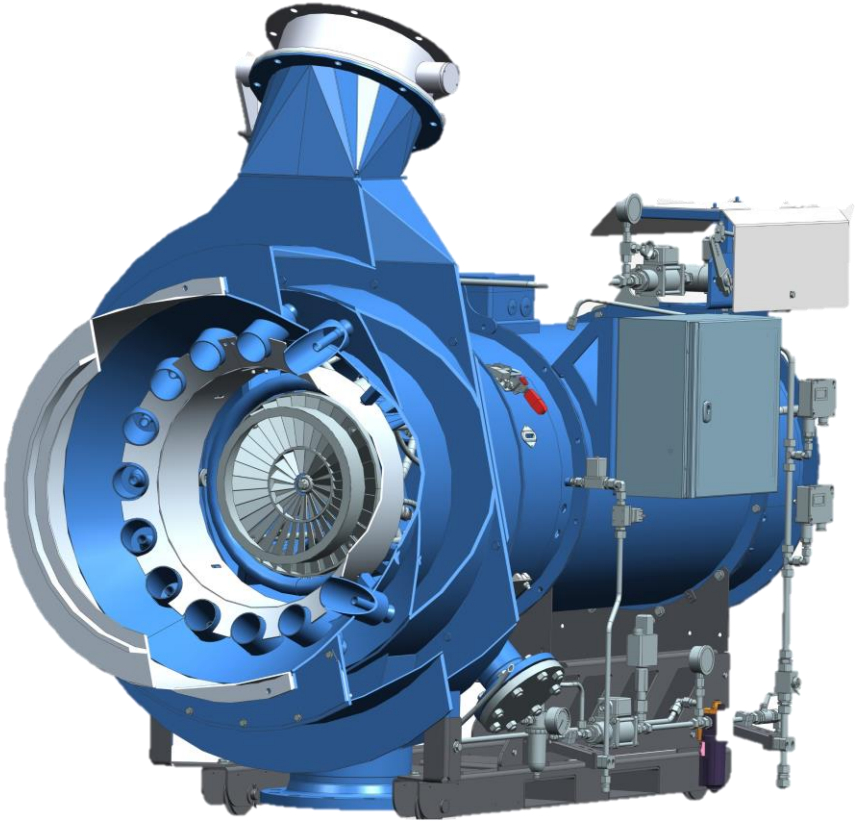
## Numerical Study & Design Phase

WIRTGEN GROUP



# EVOJET Multi fuel burner

## New Burner Control System

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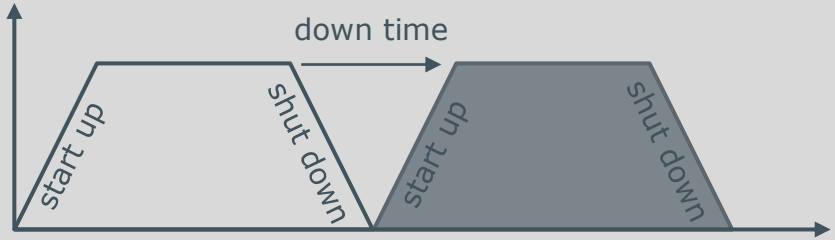
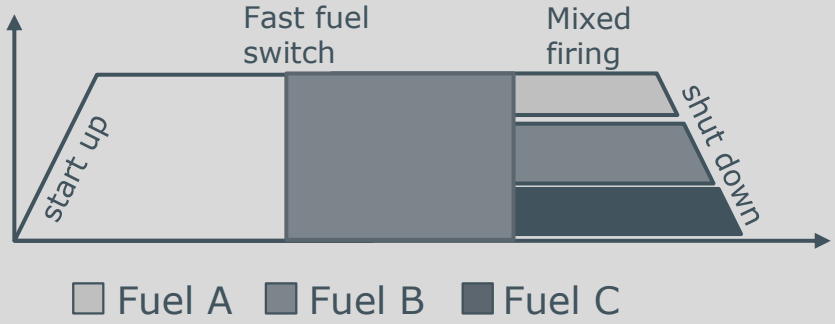
### Status Quo




### New



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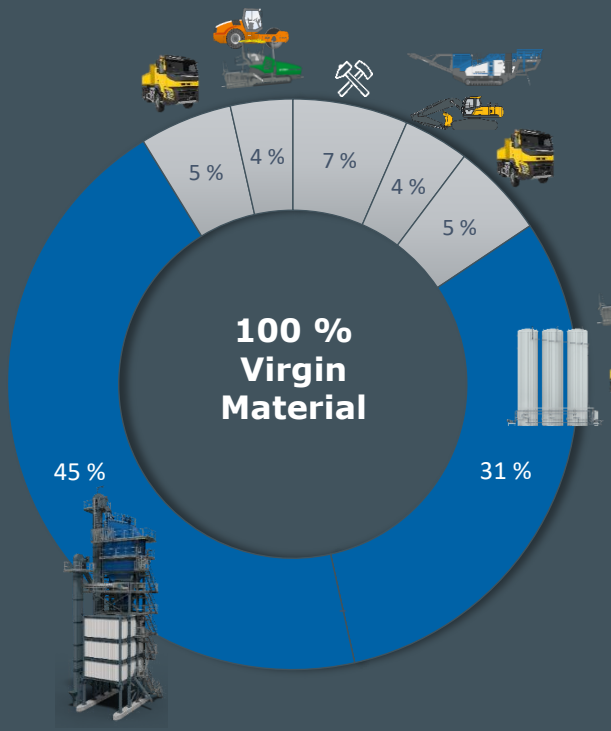


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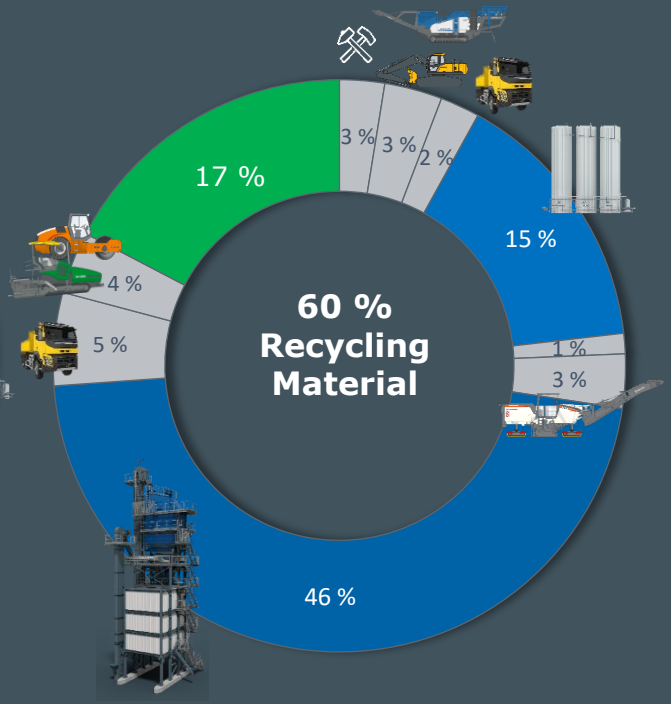


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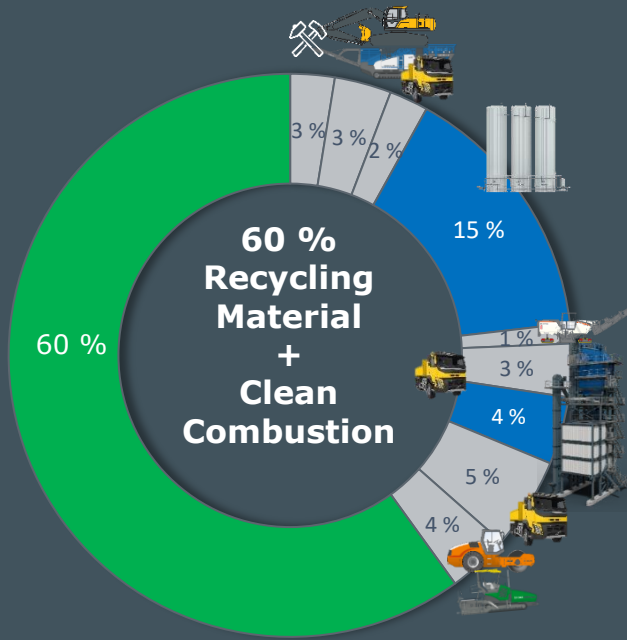
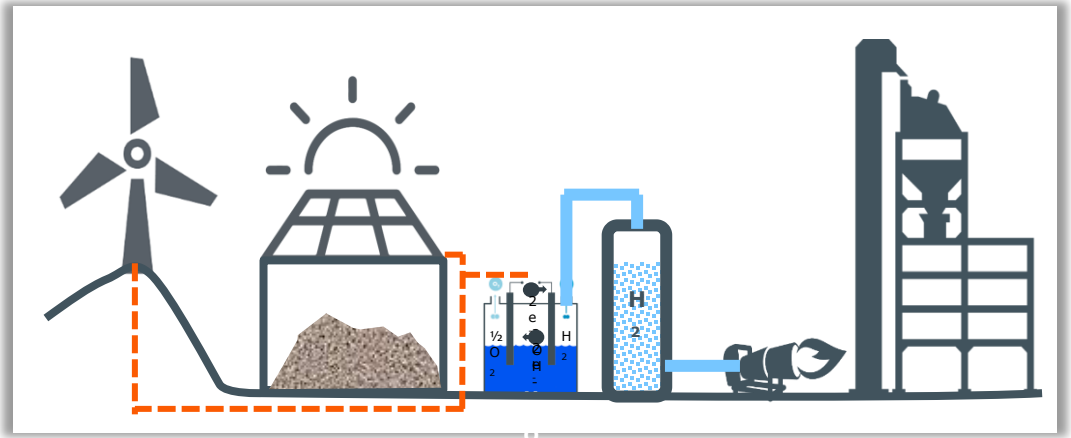


# Hydrogen

Opportunities:
- Windenergy
- Solarenergy
- Electrolysis
- Road Construction




# THANK YOU!