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INTEGRATED PRODUCT APPROACH FROM CEMENT TO CONCRETE

CO2 – opportunity and challenge at the same time

Cement production has the highest carbon footprint per euro of sales. In addition, the price of CO2 is increasing rapidly in Europe and is already a determining economic factor. This trend will accelerate significantly as the free allocation of certificates expires by 2030. In the end, only those cement and concrete manufacturers who manage to decarbonize quickly and efficiently will remain competitive. The coming years will decide who will prevail in the market with innovative and low-CO2 portfolios.



Efforts of cement and concrete manufacturers

The greenhouse gas CO₂ is released when the limestone is burned into cement clinker through a chemical reaction. The path is clearly marked: over the next few years, cement manufacturers will gradually have to include more and more clinker-reduced products in their portfolios.

At the same time, this development means that concrete manufacturers have to deal more intensively with the handling of these clinker-reduced cements.

In the concrete application, these are much more complex than conventional cements due to the required precision and standard



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A decarbonized industry therefore means a joint effort for cement and concrete manufacturers, in which they have to work hand in hand to bring low-CO₂ products into mass use.

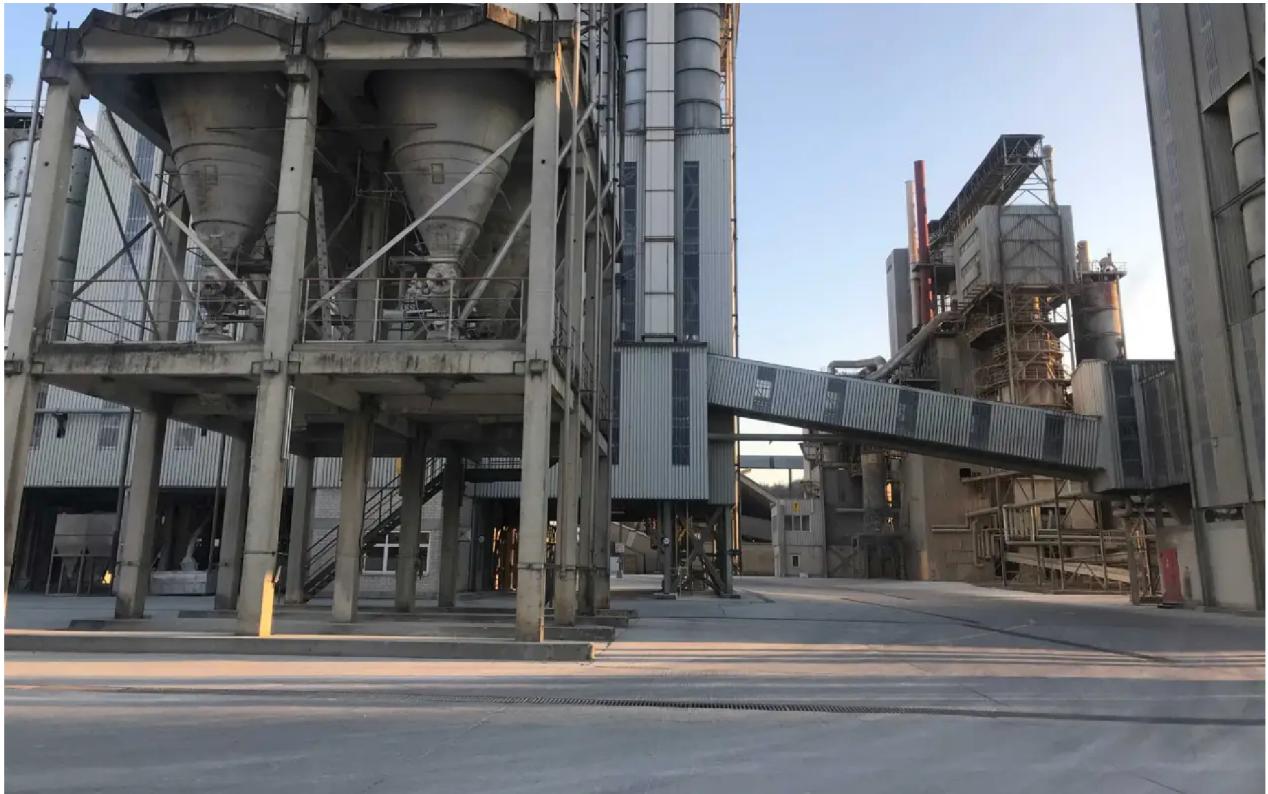
An integrated product approach made by alcemy

alcemy's product portfolio follows the value chain from the cradle in cement grinding and mixing to the processing of the concrete on the construction site. In this way, we support cement and concrete manufacturers alike in the challenges of this new age. Our intelligent quality monitoring and automation solution is based on the same approach in both products: data collected during production in the laboratory or via sensors in the factory or truck is sent to alcemy via interfaces.

alcemy's technology...

- monitors whether problems or deviations occur in production and draws the staff's attention to them.
- predicts quality parameters of the current production based on the data.
- gives factory personnel recommendations for settings to ensure optimal quality.

ALCEMY'S PRODUCTS



alcemy for cement: From reactive to proactive quality control with the help of machine learning.

Our AI software for intelligent quality control is the tool for producing cements of the highest quality. With this new approach, we support manufacturing companies in mastering increasingly complex cement recipes for a decarbonized future.

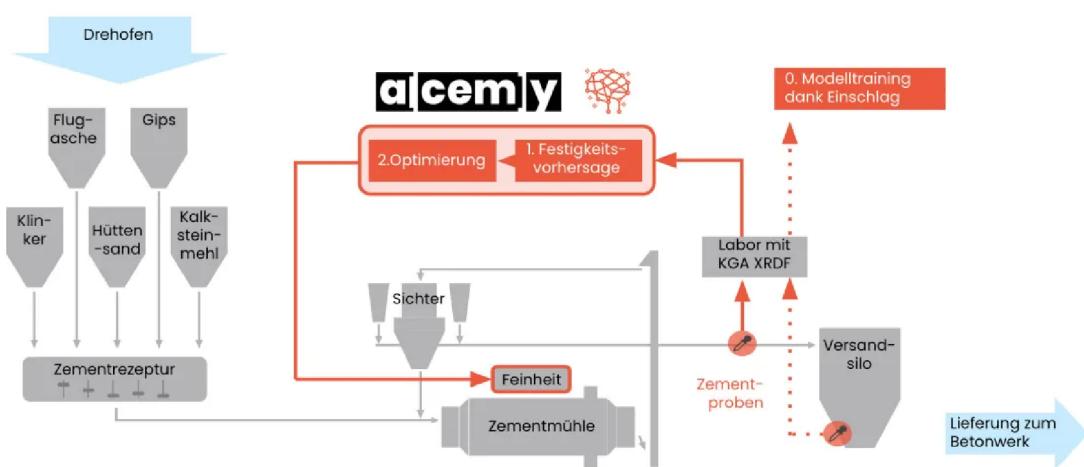
The challenge

In the final cement manufacturing step, the raw materials, including the clinker, are ground into cement. In addition to other parameters,

future strength of the cement currently being produced and the strength can only be controlled on the basis of the experience of the control room drivers and quality and production employees.

Our approach

Our technology enables a continuous analysis of the quality-relevant data from chemistry, mineralogy and grain size distribution. With our intelligent algorithms, target values for optimizing the current cement production are continuously passed on to the control center.

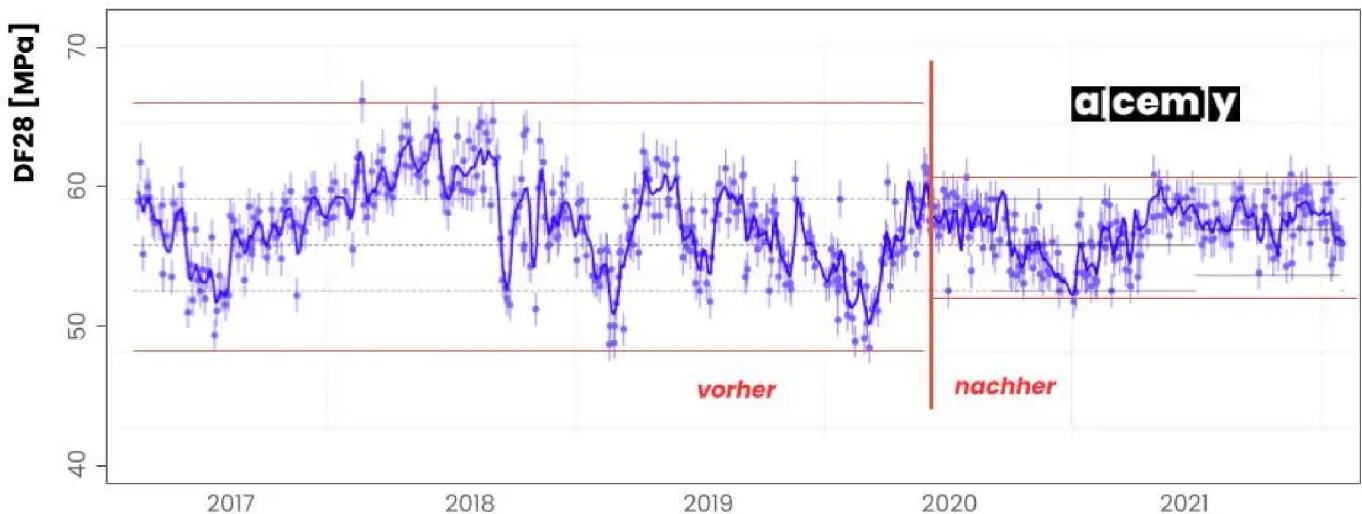


0. Model training thanks to impact: The alcemy model is trained based on values that already exist in the cement plant. In addition to the chemical and mineralogical properties, this also includes the results achieved, such as the strength after curing for one to 28 days.

homogeneous and qualitatively stable cement. Our models predict quality properties such as compressive strength and Blaine of the current grind or blend. This means that the fluctuations in resources are not only visible in the raw data, but also in the target values.

2. Optimization: However, it does not just remain with the pure strength prediction, but the technology uses the knowledge gained to create control specifications for the cement mill for the current production and to find optimal target values for fineness or the right recipe to achieve the desired target properties. These are then transmitted to the control room operator or imported directly into the process control system.

BENEFITS FOR OUR CUSTOMERS





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20% to 50% up to an average standard deviation of 1.5 MPa after six months and have thus become quality leaders in a very short time.



35% quality improvements (hrs) across all cement families



ø €400,000 in cost savings by reducing the clinker factor and grinding energy



ø 15,000 tons less CO2 emissions per customer



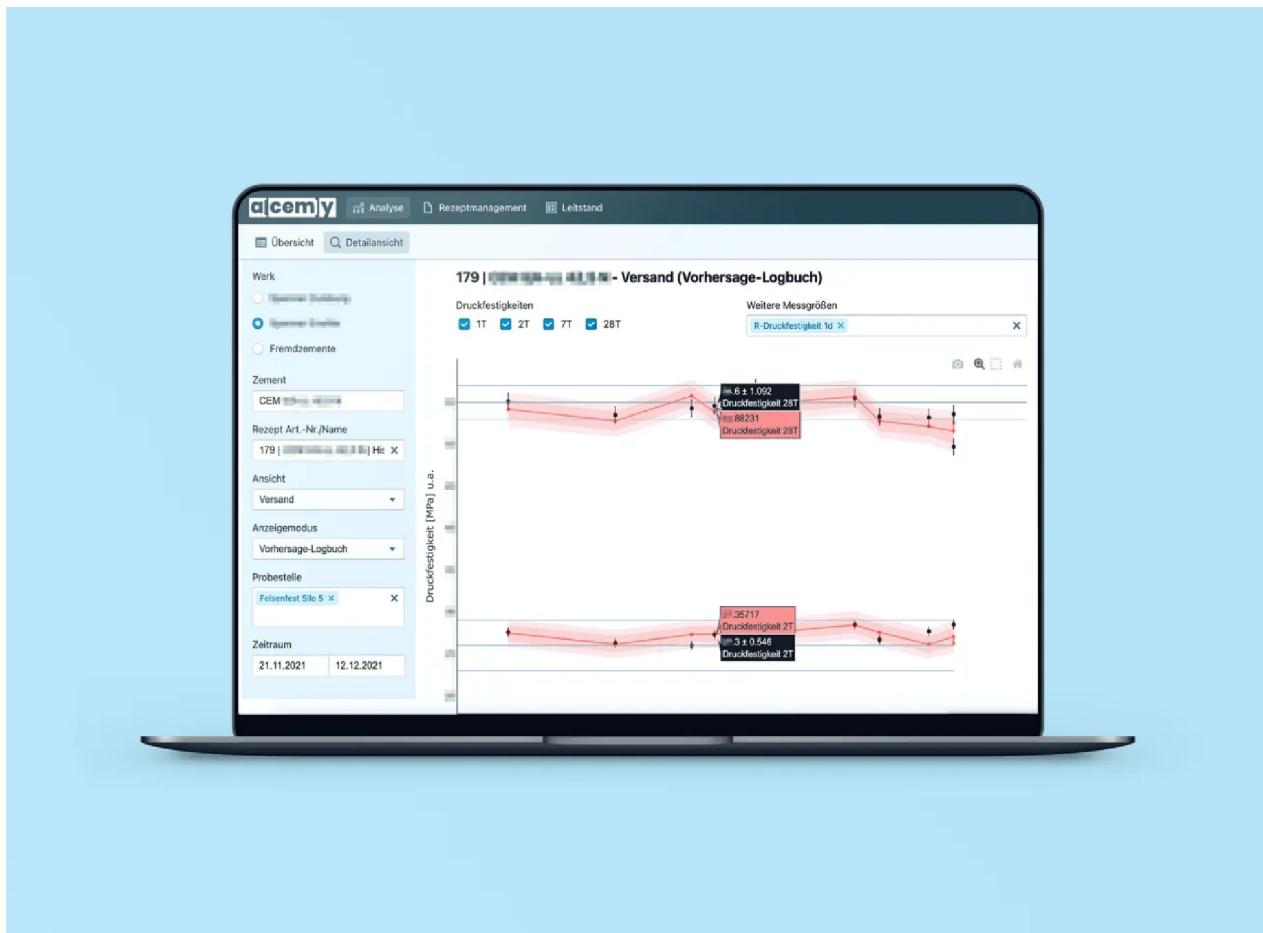
OUR APPLICATION IN DETAIL

Zementmühle 11		8204 23.12.2021 16:06	
d' Soll 10.0 µm		-0.4 µm feiner	
d' 10.4 µm			
Messwerte	15:25	16:15	Vorgabe Sollwert
d' Soll	10.0		
d'	10.4	10.4	
Druckfestigkeit 2d Vorh.	47.0		48 ± 3.0
Cl-	0.017	0.018	✓ <0.09
SO3	6.41	6.47	✓ 6.5 ± 0.10
C3S	53.3	52.8	
Calcit	0.220	0.300	
Bassanit	2.180	2.100	
Gips	0.510	0.420	
Letzte Rezeptänderung: 23.12.2021			

Hirschmannmühle		329 07.02.2022 16:46	
d' Soll 17.8 µm		-0.9 µm feiner	
d' 18.7 µm			
Messwerte	11:29	16:06	Vorgabe Sollwert
d' Soll	17.6	17.8	
d'	18.2	18.7	
Druckfestigkeit 2d Vorh.	33.6	32.3	33 ± 3.0
Cl-	0.064	0.035	✓ <0.09
SO3	2.85	2.96	↓ 0.16 2.8 ± 0.10
Kalksteingehalt XRD sulfatfrei	5.660	2.980	↑ 1.020 4 ± 0.300
C3S	58.2	58.0	
Bassanit	0.620	0.680	
Gips	0.490	0.470	
Letzte Rezeptänderung: 07.02.2022			

All information on cement control at a glance.

With alcemy you can see the current sample values as well as the dynamic control specifications at a glance and are always informed about the production status. Based on the analysis values of the production samples, the associated forecasts are presented. Clear



X-ray view of the cement qualities.

Our analysis view enables detailed analyzes of the current production data and the chemical and mineralogical readings. In addition to all measured values, it also visualizes the associated forecasts for shipping and production samples.

The tabular processing of the samples enables deep insights into the strength of the influencing factors on the strength of the cement. In this way, outliers can be recognized directly and questions can be



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Manage recipes and connect them with the findings from the analyses.

The cement recipes and target values can be stored and managed for each cement. All settings for control areas, strength targets and constraints can be adjusted centrally.





alcemy for concrete: Real-time monitoring and quality control for ready-mixed concrete using machine learning.

Our technology uses the data in the ready-mixed concrete plant and truck mixer, continuously predicts the quality properties of the concrete in real time and translates these into KW target values for the plant. This means that complaints on the construction site and inefficiencies in the factory are a thing of the past.

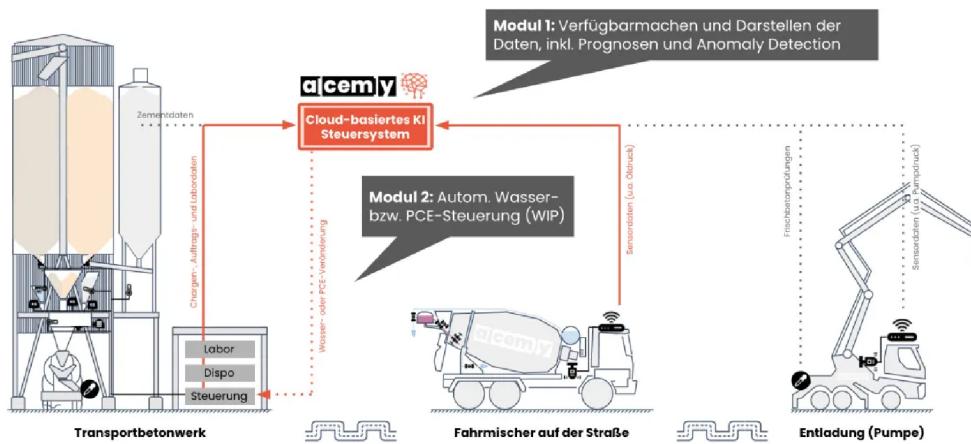
The challenge

At the moment, quality control in the ready-mixed concrete plant is still largely based on the instinct and many years of experience of the employees. The tools for quality control, such as slump tests or consistency comparison curves, are still mostly created manually and are therefore very time-consuming.

Our approach

Our AI-supported software, which runs in the cloud and collects data

more efficient.



The alcemy concrete product consists of two modules:

The **monitoring module** uses data generated during production and travel to the construction site and uses this to continuously forecast the expected quality properties of

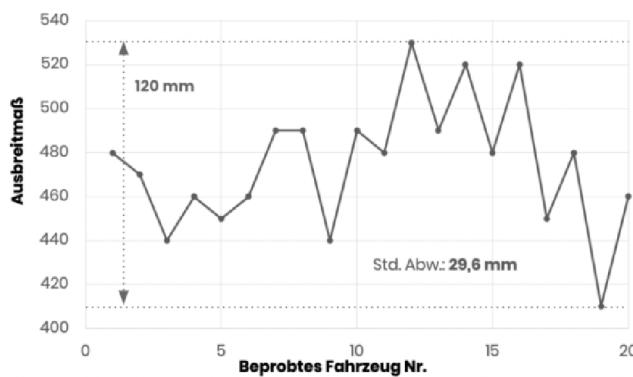
the concrete. This is possible because the algorithms are trained with historical data for each plant. The constant forecasts can be viewed by employees from production and quality assurance at any time and create a completely new level of transparency and information.

The **control module** is responsible for the recipe control.

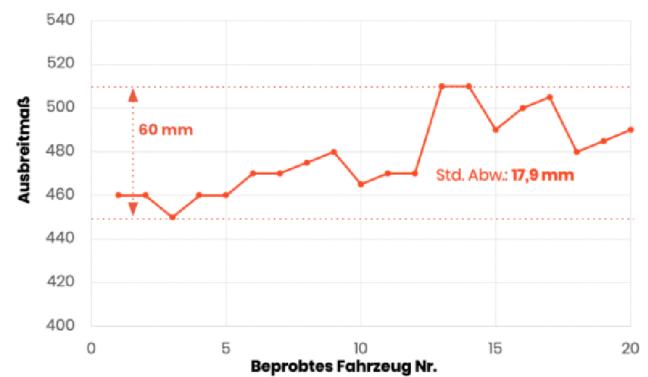
Forecasts are used to identify deviations in advance and to transmit them to the plant quickly and easily. For example, concrete that is otherwise too stiff can be prevented from the outset by adding more water. Our software calculates supporting KW target values for the active power and water addition and continuously transmits them to the mixing

BENEFITS FOR OUR CUSTOMERS

Status Quo



Gesteuert via alcemy



96 %
d. Chargen

benötigten manuellen Eingriff des
Mischmeisters

0 %
d. Chargen

benötigten manuellen Eingriff des
Mischmeisters

During our three-month series of tests, the water balance was manually intervened in 96% of all batches. With the help of alcemy technology, manual intervention was no longer necessary. In addition, the fluctuations in the slump have been reduced by up to 50%.



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Material cost reduction



Reduction of quality fluctuations by up to 40%



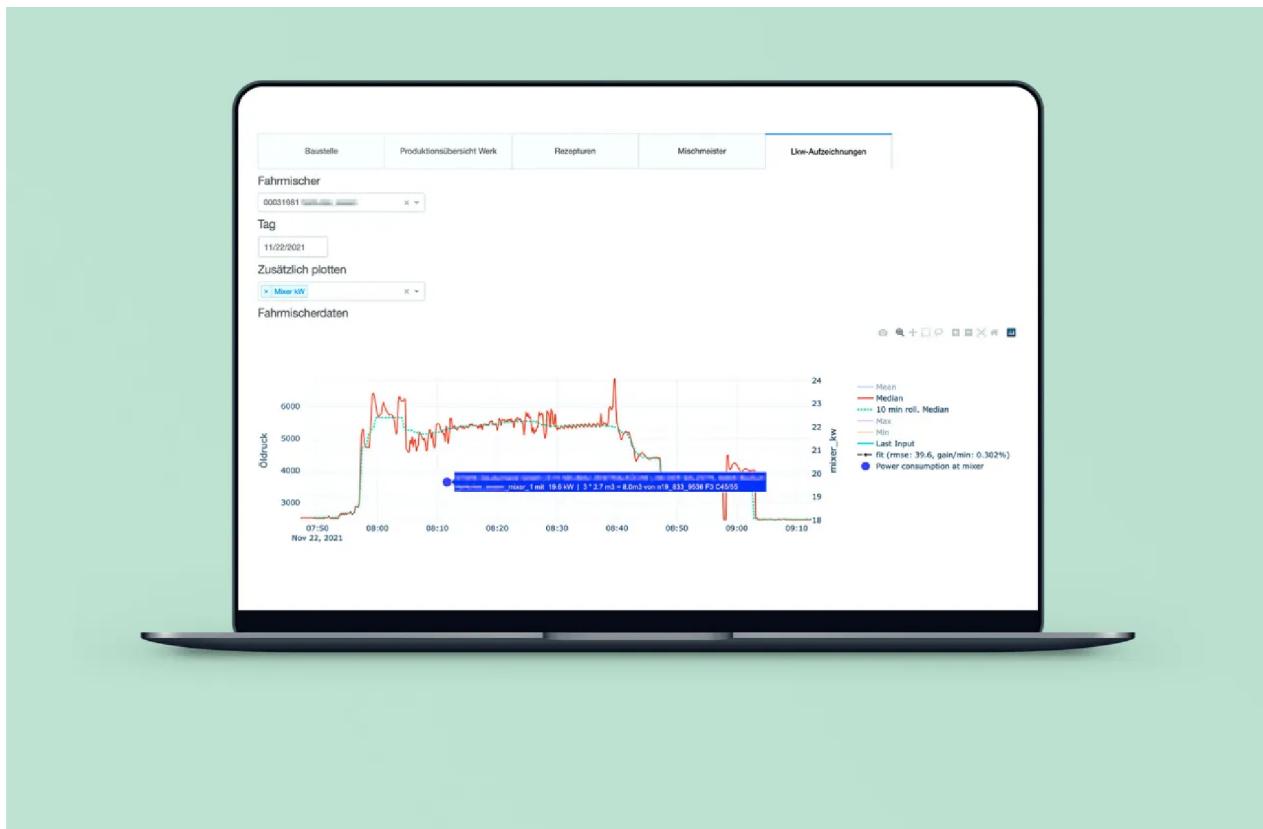
80% less manual intervention regarding sand moisture



Raising the revenue level



reduction in complaints



Seamless quality monitoring from production to handover.

Oil pressure, water addition and drum performance can be easily monitored by our comprehensive remote support of the truck mixer. In this way, the plant is informed at all times about changes while the truck mixer is in motion and can track all changes in real time until the material is handed over to the customer. This enables seamless quality assurance from production to delivery





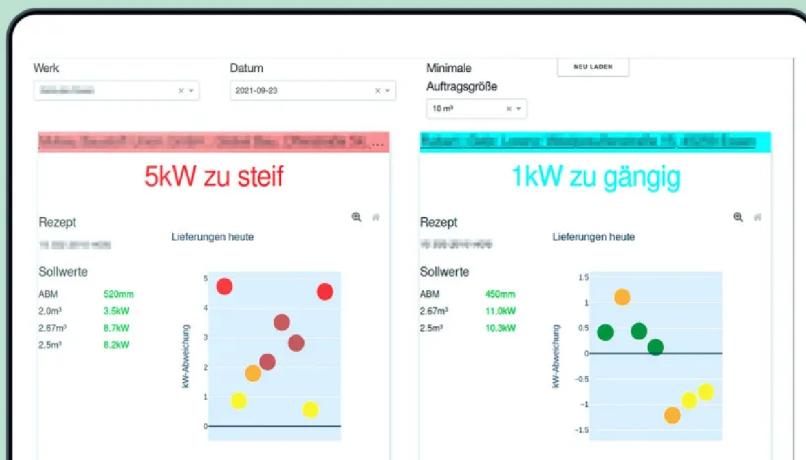
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Every construction site at a glance.

Thanks to the real-time display, measured values and predicted concrete properties can be viewed transparently – and clearly for all truck mixers that are currently on the road. Alcemy supports you in completing values that are usually difficult to measure with

detailed forecasts. Outliers in the values are highlighted in real





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Parallel optimization of batches.

The seamless monitoring of the truck mixers that have already started enables a parallel optimization of the ready-mixed concrete for the next batches in the plant. With the help of reliable data from the truck mixer and the plant, alcemy can be used to make predictions about the required target values for the next batch. This guarantees optimal quality when it is handed over to the customer.



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**Discover our products.**

Book a demo and make an appointment. We look forward to meeting you.

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