



CONGRESO Cemento & Concreto Verde 2050



11 AL **15** **2026**
MAYO



Santiago,
Chile

EL ROL DEL
CEMENTO &
CONCRETO
DE CARA
AL **CAMBIO**
CLIMÁTICO

Caso de Éxito de Alemania para el Mundo:
Como descarbonizar la industria del
Cemento a nivel nacional

Alejandro Espejel
Head of Sales—Alcemy

Agenda

1. Industria de Cemento en Alemania
2. Trayecto hacia la Descarbonización
3. El Papel de Alcemý
4. Otras Historias de Éxito
5. Conclusiones

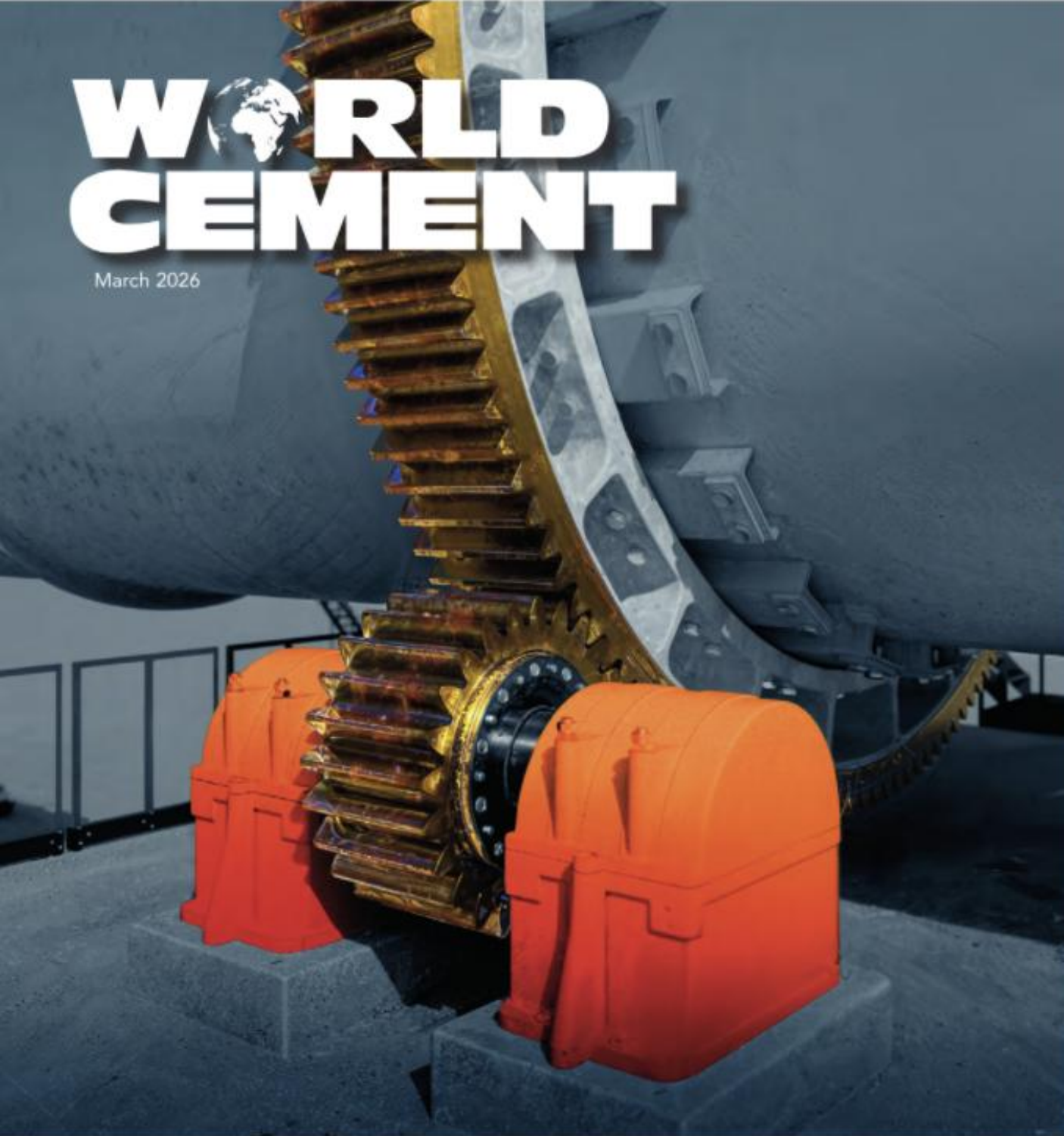
La industria del cemento en Alemania

- 17 Productores de Cemento
- 46 Plantas de Cemento:
 - 31 Plantas integradas
 - 15 Plantas de molienda/mezcla
- **Desde nuestra Fundación en 2018, Alcemy trabaja con 8 Productores (47%) en 16 plantas distintas (35%)**



WORLD CEMENT

March 2026



Germany's Clinker Cut Revolution

Christoph Müller, VDZ, examines how clinker-efficient cements, updated standards, and new carbon labelling are accelerating the shift towards climate-friendly cement in Germany.

In Germany, the clinker factor in cement was recently only 67% – a historically low value that underscores the industry's progress towards climate neutrality. This development is remarkable because the average clinker content in the product portfolio has been more or less constant for several years. The momentum in CEM I/C cements (ternary cements with a minimum clinker content of 50%) in particular has led to a more significant reduction in the clinker factor. The German concrete standard DIN 1045-2:2023, which is based on the European concrete standard EN 206, is likely to make a significant contribution to the greater market penetration of clinker-efficient cements. This standard defines new rules of application for clinker-efficient cements. These rules facilitate market access, in parallel with the path of building authority technical approvals. The latter have increased significantly in



Cement industry
Reliable & cost saving lubricants
Creating value all along your process



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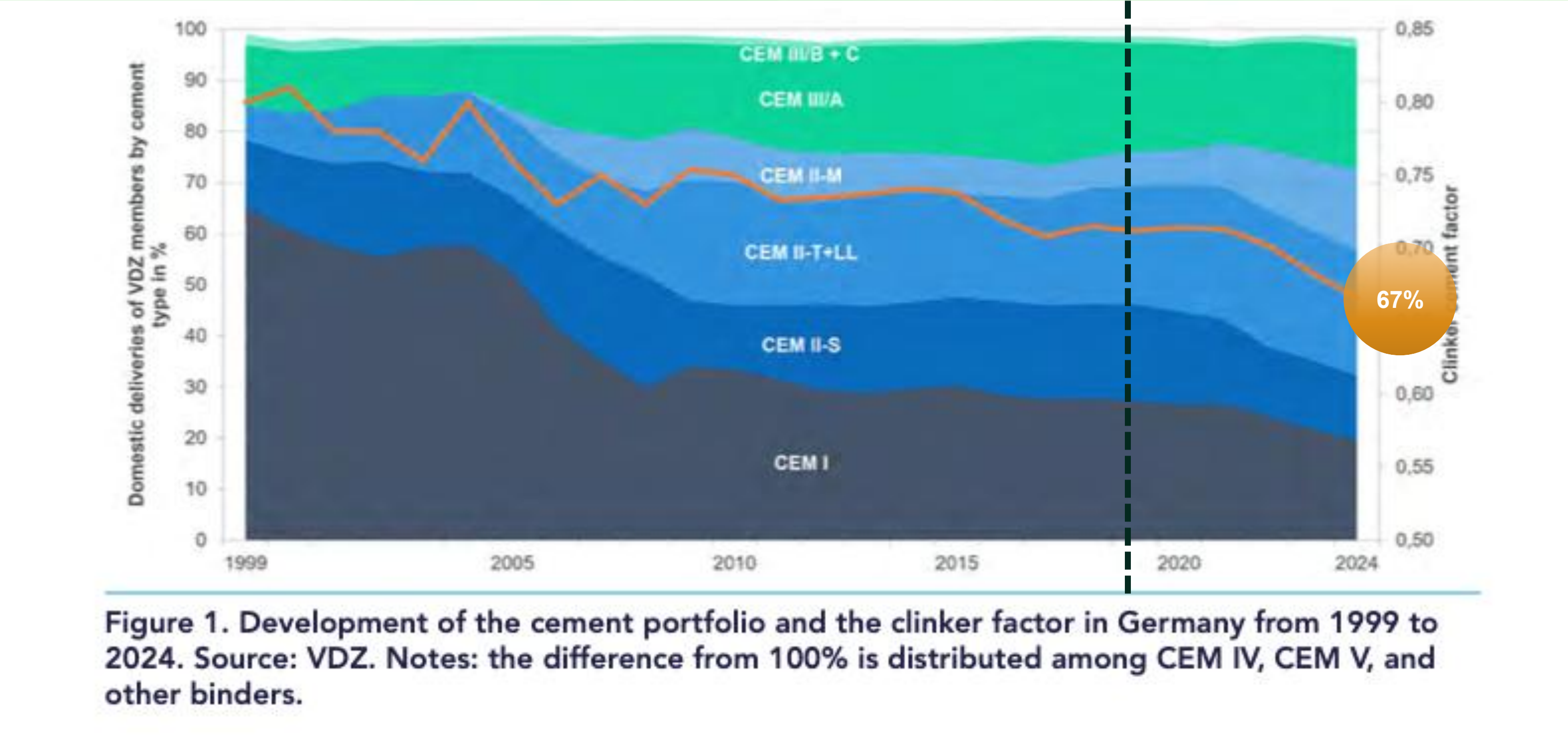
alcemy



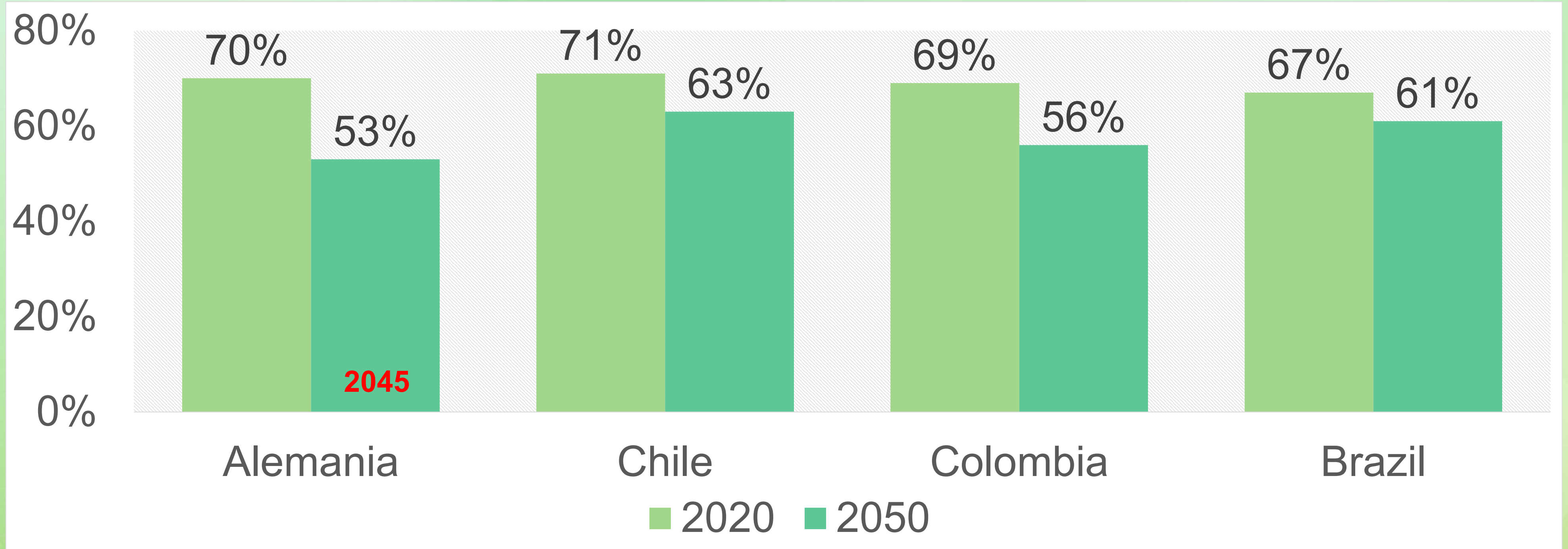
CONGRESO
Cemento & Concreto
Verde 2050

Reducción de Factor Clínter en Alemania 1990-2024

Alcemy
fundado en 2018



Alemania vs. LatAm



Fuentes: VDZ y FICEM

Factores Clave

- El factor clínker recientemente alcanzó un mínimo histórico de 67% en Alemania.
- Los Cementos tipo II/C con un contenido de clínker mínimo de 50% están tomando auge.
- El estándar de concreto alemán DIN 1045-2-2023 (equivalente al EN 206), y las aprobaciones técnicas de la autoridad de construcción, están contribuyendo al incremento de penetración de cementos eficientes en clínker. Este estándar define nuevas reglas de aplicación para este tipo de cementos.
- **El objetivo es alcanzar un factor clínker promedio de 53% para el año 2045.**

Desarrollo de nuevos tipos de Cemento

Los cementos eficientes en clínker se han producido y consumido en Alemania durante muchos años. Además de caliza, los principales materiales suplementarios han sido: escoria, puzolana y cenizas volantes. En el futuro, se espera que las arcillas calcinadas y los finos reciclados de concreto jueguen un papel más importante.

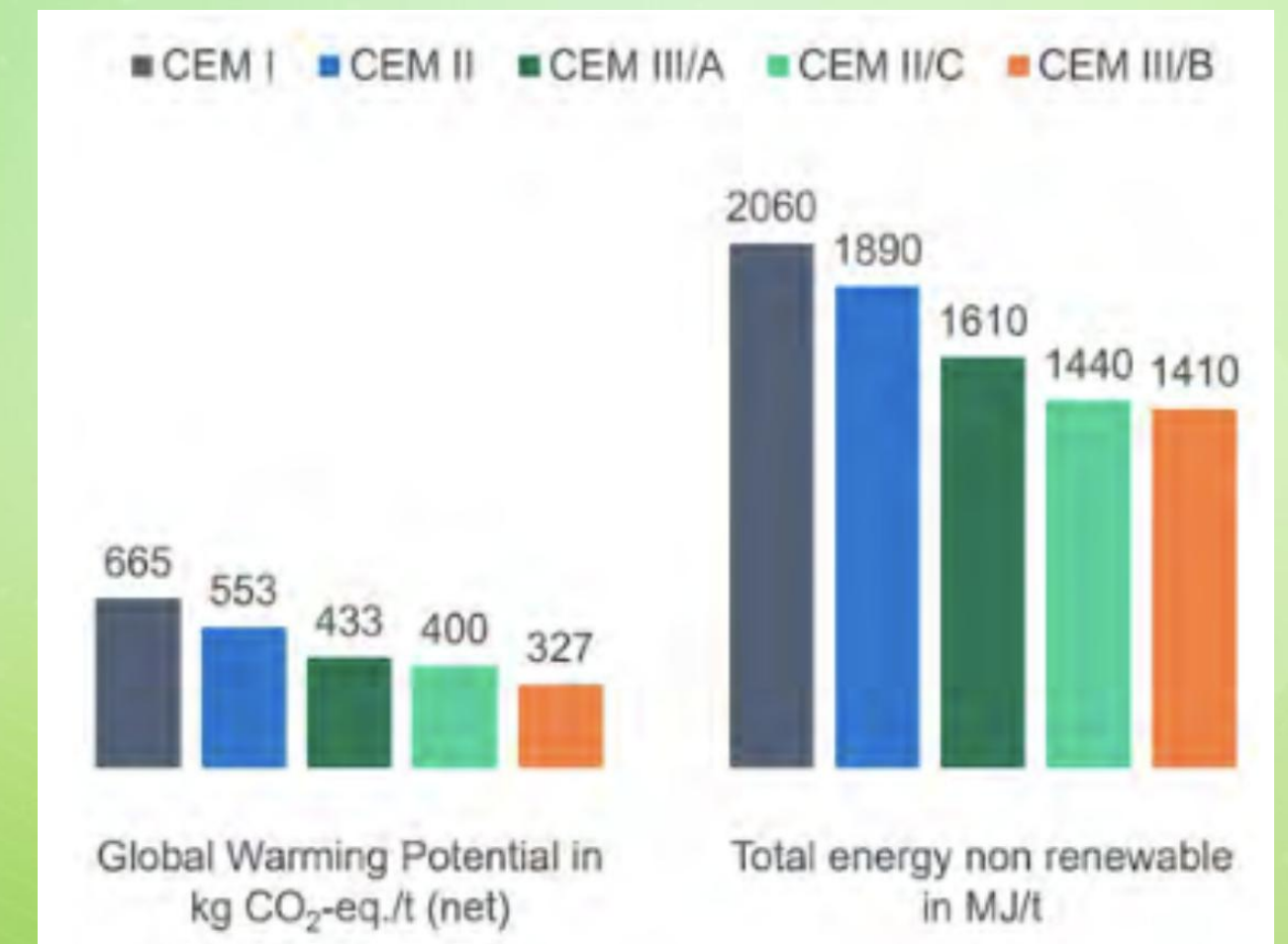
CEM I Porcentaje mínimo de clínker de 90%

CEM II/A Porcentaje mínimo de clínker de 80%

CEM II/B Porcentaje mínimo de clínker de 65%

CEM II/C-M Porcentaje mínimo de clínker de 50%

CEM VI Porcentaje mínimo de clínker de 35%



Etiqueta "Cement Carbon Class (CCC)"



CCC-Klassen für Zement		Anforderung (THG) CO ₂ Äqu / Tonne Zement
Klimafreundlich	D	400 ≤ THG < 500
	C	300 ≤ THG < 400
	B	200 ≤ THG < 300
	A	100 ≤ THG < 200
	Near Zero	< 100

Aplicación en Concreto

- Para productores de concreto y contratistas, la trabajabilidad y desarrollo de resistencias juega un papel central en el proceso constructivo.
- De acuerdo al estándar alemán de concreto DIN 1045-2, la composición del concreto debe tomar en cuenta la consistencia, densidad, resistencias, y durabilidad en torno a la aplicación.
- Cuando un tipo de cemento no esté permitido de acuerdo al estándar, es possible obtener una aprobación de adecuabilidad de la autoridad de construcción Alemana.

Exposure classes X = Valid area of application O = Not applicable for manufacturing according to DIN 1045-2:2023-08	No risk of corrosion/ risk of attack	Reinforcement corrosion										Concrete attack										Compatibility with prestressing steel
		Corrosion caused by carbonation				Corrosion caused by chlorides						Frost attack				Aggressive chemical environment			Wear			
						Other chlorides other than sea-water		Chlorides from seawater														
		X0	XC1	XC2	XC3	XC4	XD1	XD2	XD3	XS1	XS2	XS3	XF1	XF2	XF3	XF4	XA1	XA2	XA3	XM1	XM2	
CEM I CEM II/A (S, T, V, LL); CEM II/A-M (S, LL, T, V) CEM II/B (S, T, V); CEM II/B-M (S, T, V) CEM III/A ¹⁾ , CEM III/B ¹⁾ CEM V/A (S-V) ¹⁾ , CEM VI (S-V) ¹⁾	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
CEM II/A (P, Q); CEM II/B (P, Q) CEM II/A-M (S-Q, D-Q, P-Q, Q-V, Q-T, Q-LL) CEM II/B-M (S-Q, D-Q, P-Q, Q-V, Q-T) CEM VI (S-P)	X	X	X	X	X	X	X	X	X	X	X	O	X	O	X	X	X	X	X	X	X ²⁾	
CEM II/B-M (S-LL, V-LL, T-LL) ³⁾ CEM II/C-M (S-LL) ⁴⁾	X	X	X	X	X	X	X	X	X	X	X	O	O	O	X	X	X	X	X	X	X	
CEM II/B-M (S-LL; D-LL; P-LL; Q-LL; V-LL; T-LL) CEM VI (S-LL) ⁴⁾	X	X	X	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	
1) Special application rule in XF4 2) Cements containing P or Q are excluded as they have not yet been tested for this application. 3) The permissible limestone content of cements (S-LL), (V-LL) and (T-LL) is limited to 20 M.-%. Compliance with the maximum permissible limestone content must be declared by the cement manufacturer. 4) CEM II/C, CEM VI: Limestone content already limited to 20% in cement standard EN 197-5 5) Cements containing V only with fly ash with up to 5% loss on ignition																						

Figure 3. Rules for the use of selected cements in DIN 1045-2:2023-08.

El Producto: CEM X → Naturecem 65

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info@spenner-zement.de

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Products > cement >

naturecem® 65 Portland limestone granulated blast furnace cement PKH 32.5 N

Available in [Erwitte](#) and [Berlin](#) .

Products

naturecem 65 Portland limestone granulated blast furnace cement 32.5 N

Application/Properties

Ready-mixed concrete

Special notes

General building authority approval Z-3.16-2243 (Erwitte plant)
General building authority approval Z-3.16-2244 (Berlin plant)

Quality control

The cement is subject to in-house production control and external monitoring by VDZ Service GmbH.

Delivery forms Erwitte



Technical documentation Erwitte

Safety Data Sheet – DE

Product information – DE

Product certificate – DE

general building authority approval – DE

Declaration of Conformity – DE

Other cement products

Portland cements

Portland composite cements

Portland limestone slag cement

Blast furnace cements

Composite cements

Sales contact

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Belgium & Netherlands

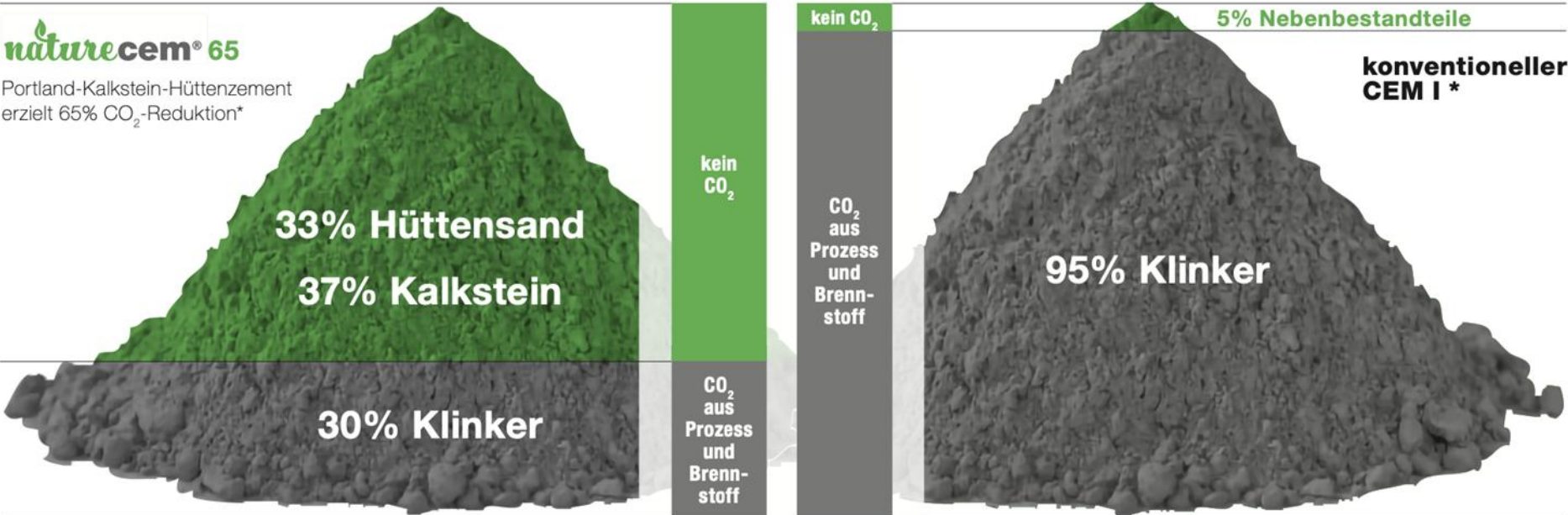
Phone: +31 6 5142 2806

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ventes@spenner-zement.de



* alle Angaben sind gemittelte Durchschnittswerte



Tabelle 2: Maximal zulässige Treibhausgasemissionen [kg CO₂-Äq. / m³ Beton]

CO ₂ -Klassen	C20/25	C25/30	C30/37	C35/45	C45/55	C50/60
Maximal zulässige Treibhausgasemissionen [netto kg CO ₂ -Äq. / m ³] ²						
Branchenreferenzwert	213	237	261	286	312	325
GWP-Wert für einen Durchschnittsbeton /3/ (informativ)	178	197	219	244	286	300
Level 1 (↓ ≥ 30%)	149	166	183	200	218	228
Level 2 (↓ ≥ 40%)	128	142	157	172	187	195
Level 3 (↓ ≥ 50%)	107	119	131	143	156	163
Level 4 (↓ ≥ 60%)	85	95	104	114	125	130

La Historia de CEM X → Naturecem 65

2012 - 2016 Investigación para el fundamento de CEM X (VDZ, TU Darmstadt, Spenner)

2018 Fundación de alcemy con una visión predictiva de la calidad CEM-CON-TRUCK para acompañar el desarrollo de CEM X del laboratorio hasta volverse un producto comercial

Fase I 2019 - 2020 CEM X Desarrollo y pruebas en **Cemento** (Spenner/VDZ/alcemy)

Fase II 2021 - 2022 CEM X Desarrollo y pruebas en **Concreto** (Spenner/MasterBuilderSolutions/alcemy)

2023 Pruebas de durabilidad acreditadas en laboratorio (VDZ)

2024, Abril Dos aprobaciones recibidas para la producción de Naturecem 65 en dos plantas de Spenner

A la fecha +5 proyectos insignia completados, +50 proyectos adicionales en desarrollo, cemento estándar en +25 recetas de concreto

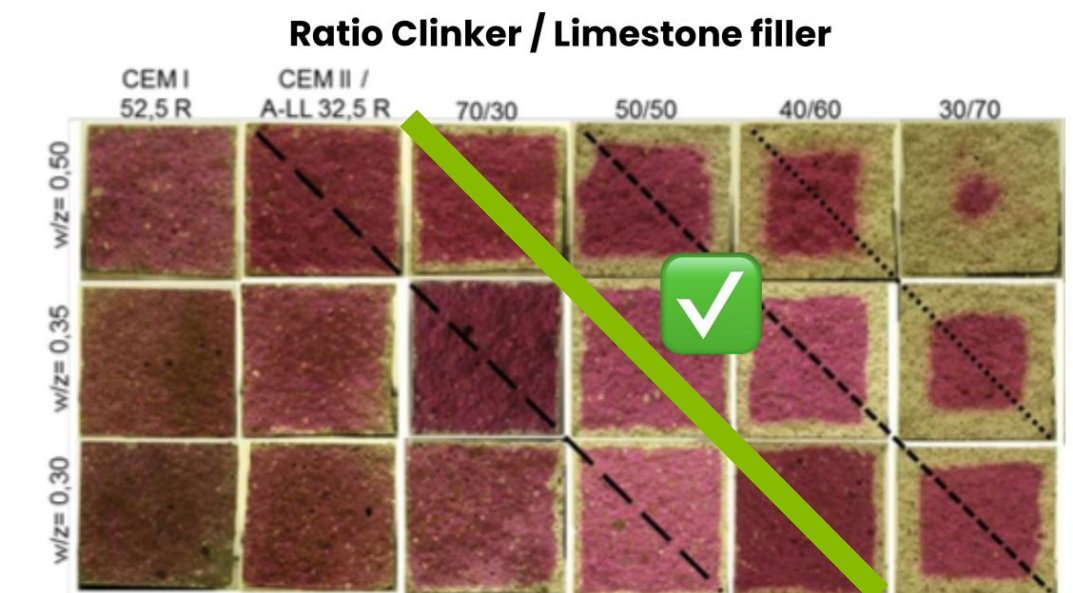


Cement and Concrete Composites
Volume 89, May 2018, Pages 107-119



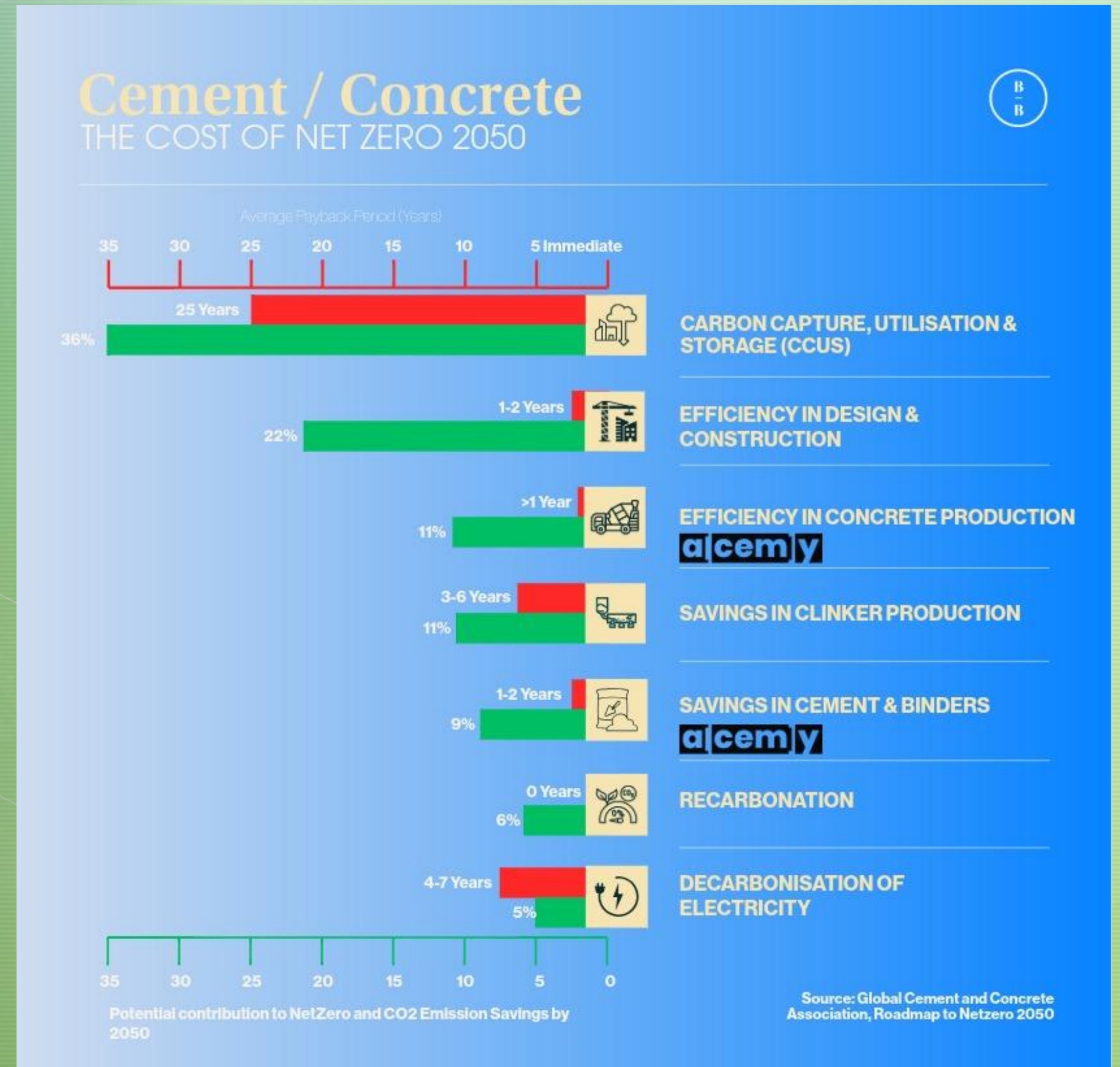
Concretes made of efficient multi-composite cements with slag and limestone

Tilo Proske ^a, Moien Rezvani ^a, Sebastian Palm ^b, Christoph Müller ^b, Carl-Alexander Graubner ^a

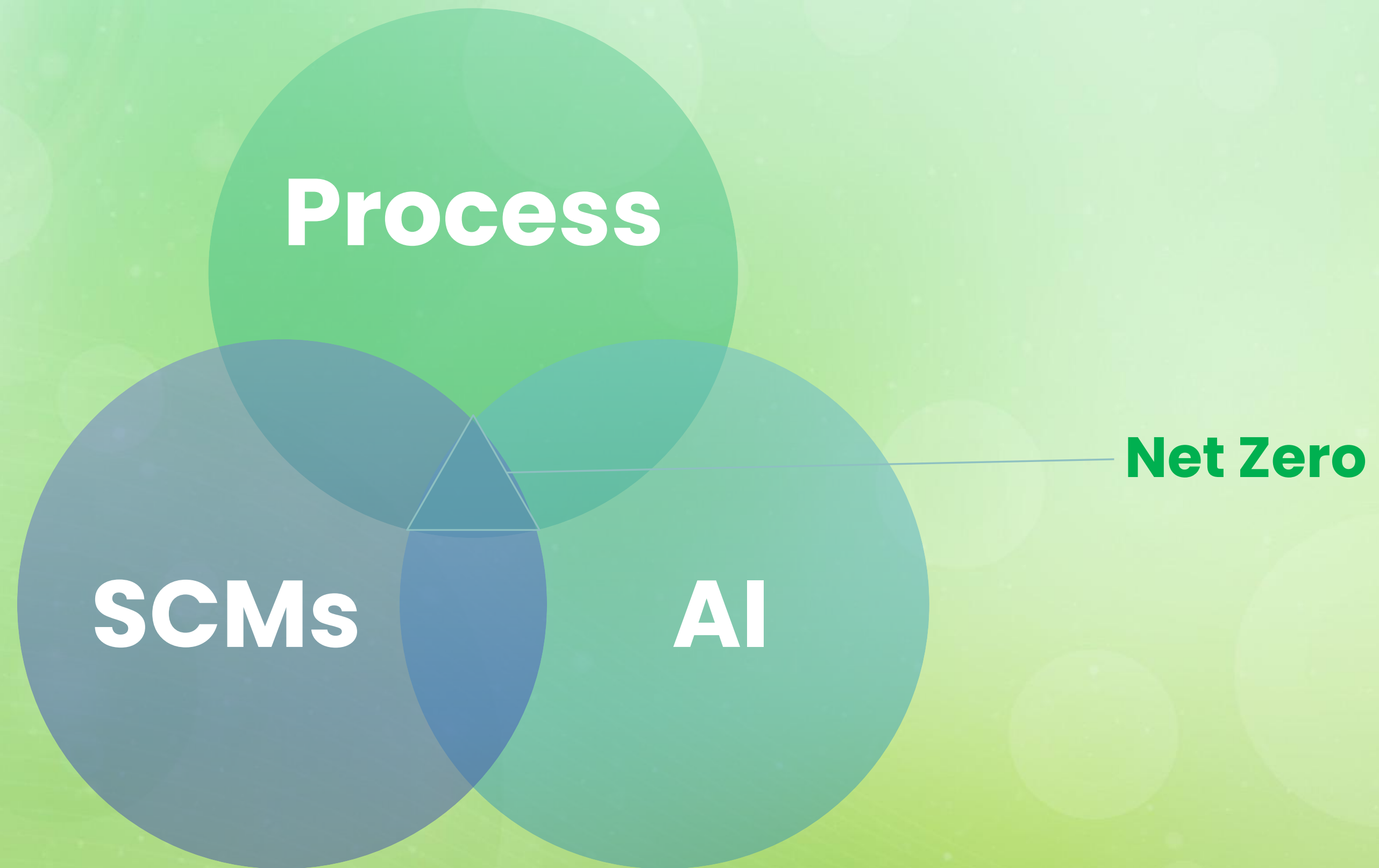


Funciona en el laboratorio, pero no en la vida real!

El Rol de Alcemy



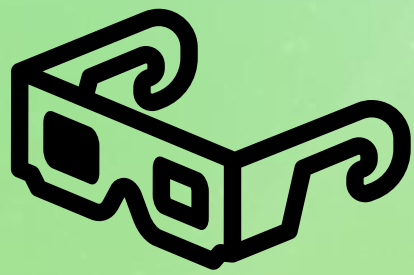
Tecnologías que están convergiendo



La importancia de la Inteligencia Artificial

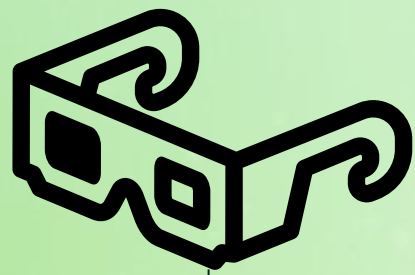
Punto Ciego #1

Resistencia a la
Compresión



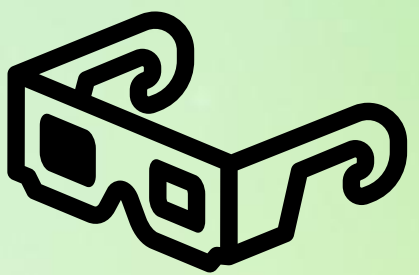
Punto Ciego #2

Consistencia en Tránsito
Adición de Agua



Punto Ciego #3

Trazabilidad entre
Cemento y Concreto



Alcemy en números

Fundado en **2018** en Berlin, Alemania

50+ Colaboradores

40+ Plantas de Cemento, y
100+ Plantas de Concreto usando nuestra solución

<1 Año Retorno de Inversión

100% Renovaciones hasta la fecha. Nuestros clientes incluyen:



CONGRESO
Cemento & Concreto
Verde 2050

Optimizado por

alcemy



alcemy for Cemento

alchemy for Cement



Cement Mills
(Production Samples)

Blaine
Sieves Residue
PSD
XRF
XRF

+50 Measurements
every
1-4 hours

1. Compressive Strength Predictions in Real-time



alchemy

010101001010

1 day

010101001010

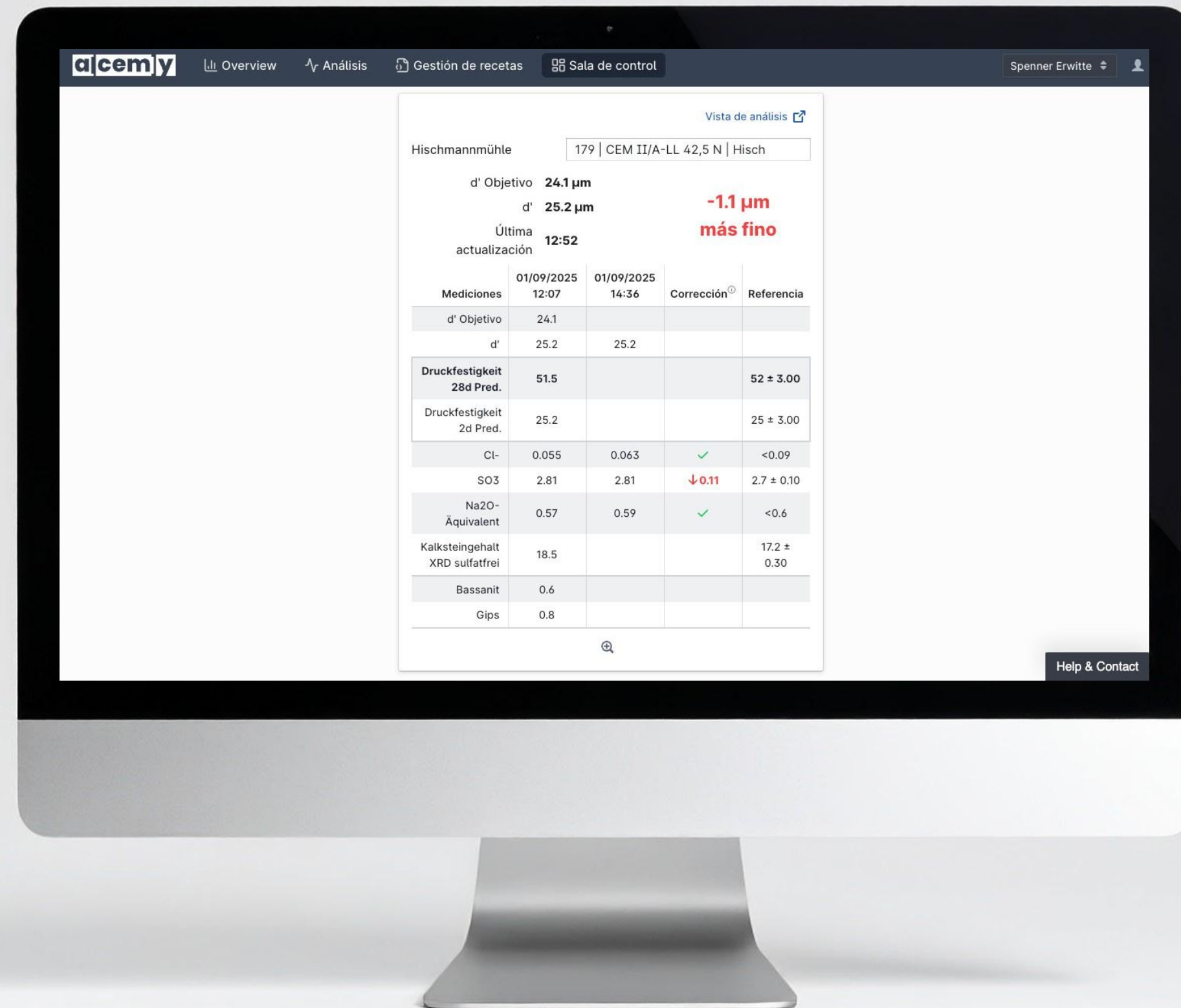
2 days

010011001011

28 days

2. Optimal Fineness/Recipe Setpoint to reach Quality Target

alcemy

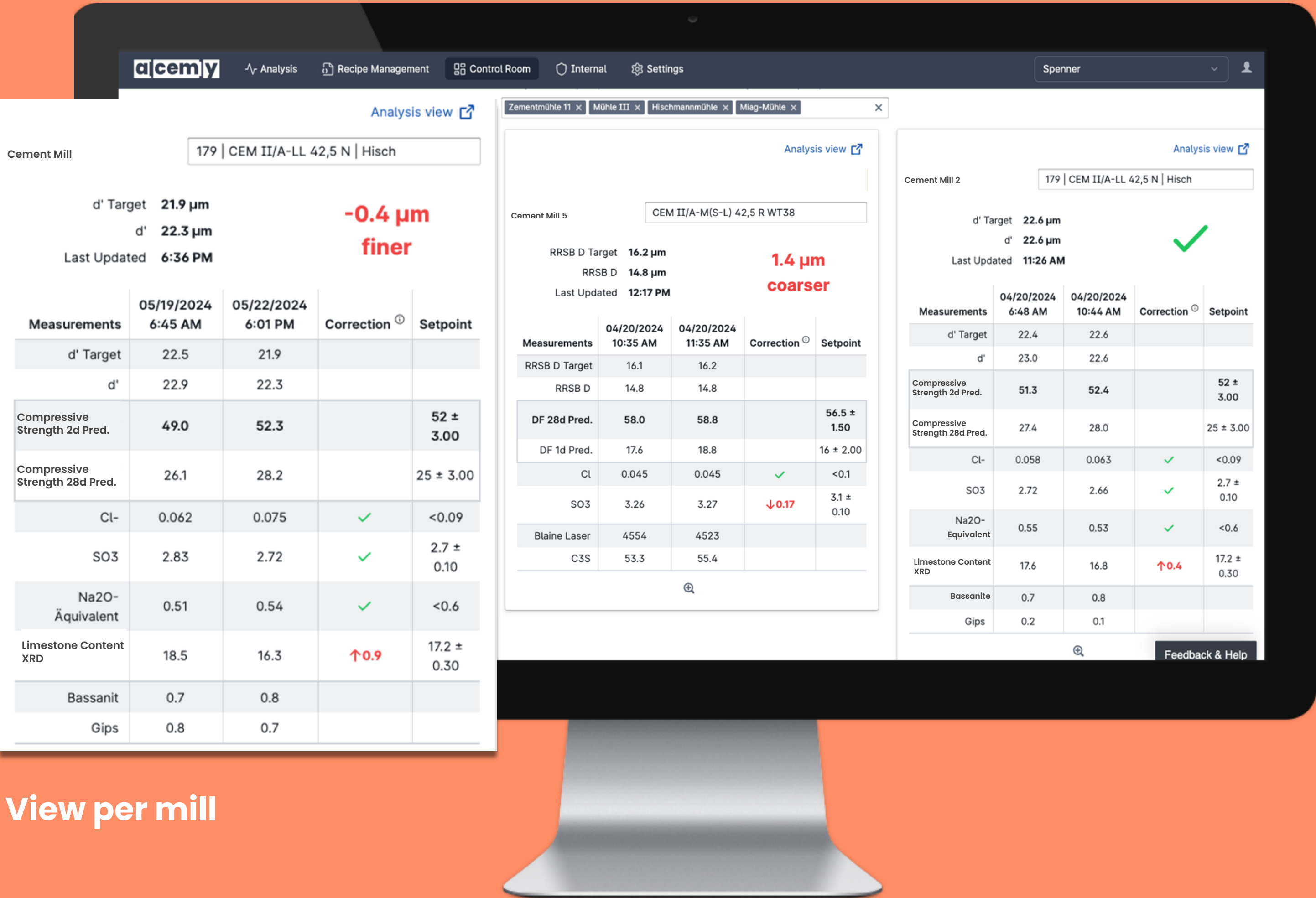


alcemy's
**predictive quality
optimization**
software
revolutionizes how
accurately
cement and
concrete can be
produced.

Control Room Operator View

Latest predictions, steering recommendations and important measurements at a glance.

This way, **your production is always on target**

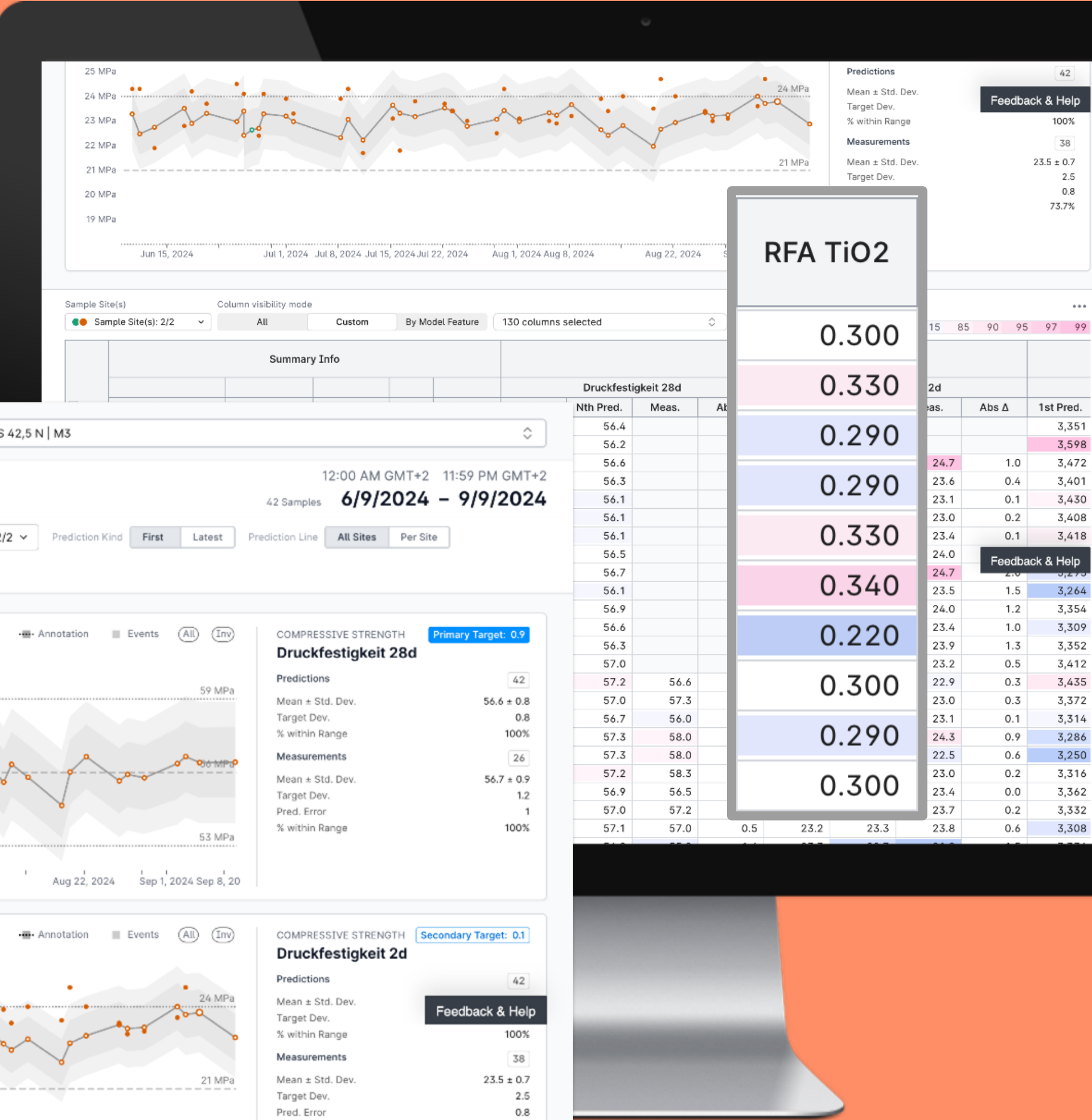
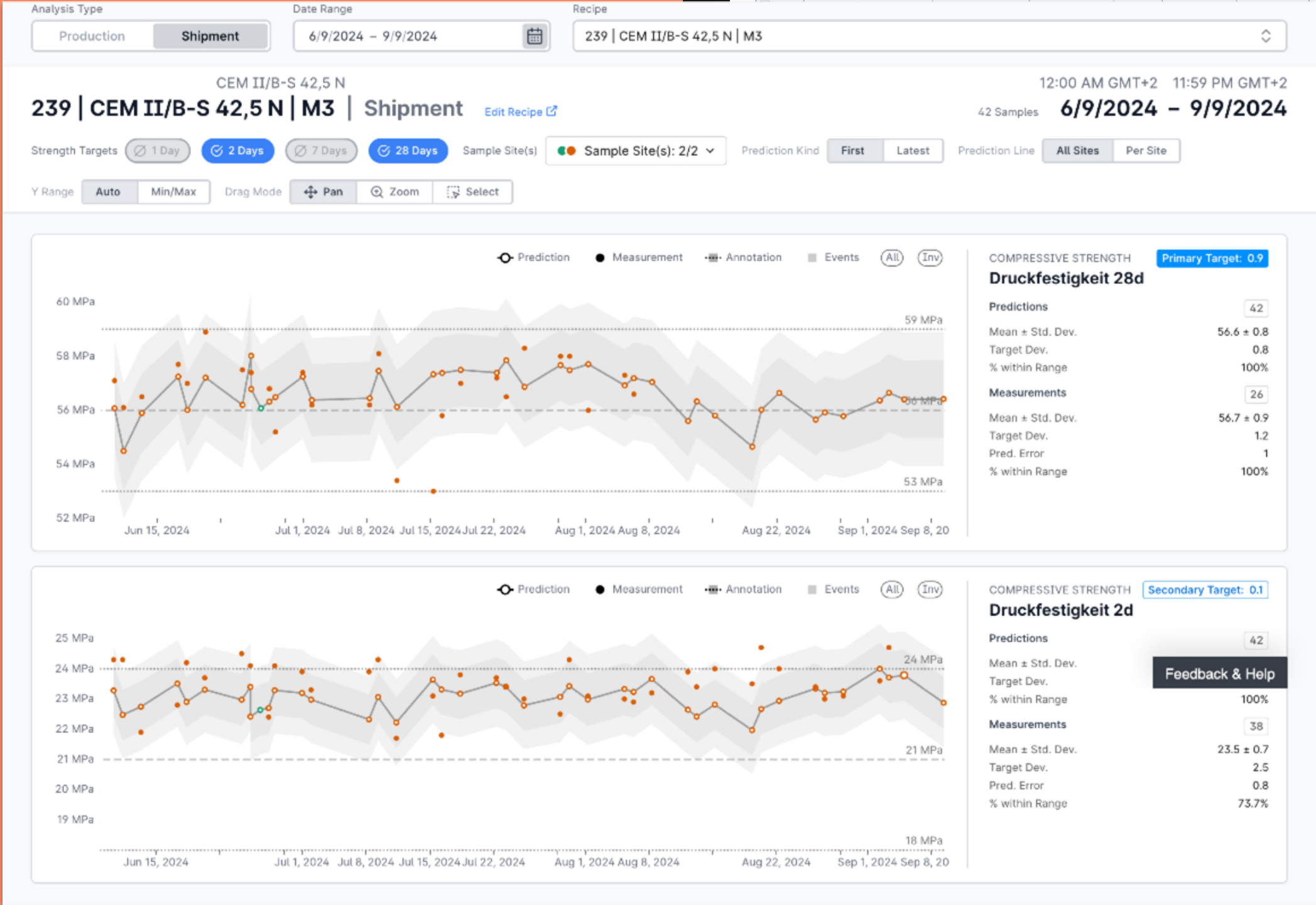


View per mill

Analysis View

Precise strength predictions, deep insights, and correlation identification.

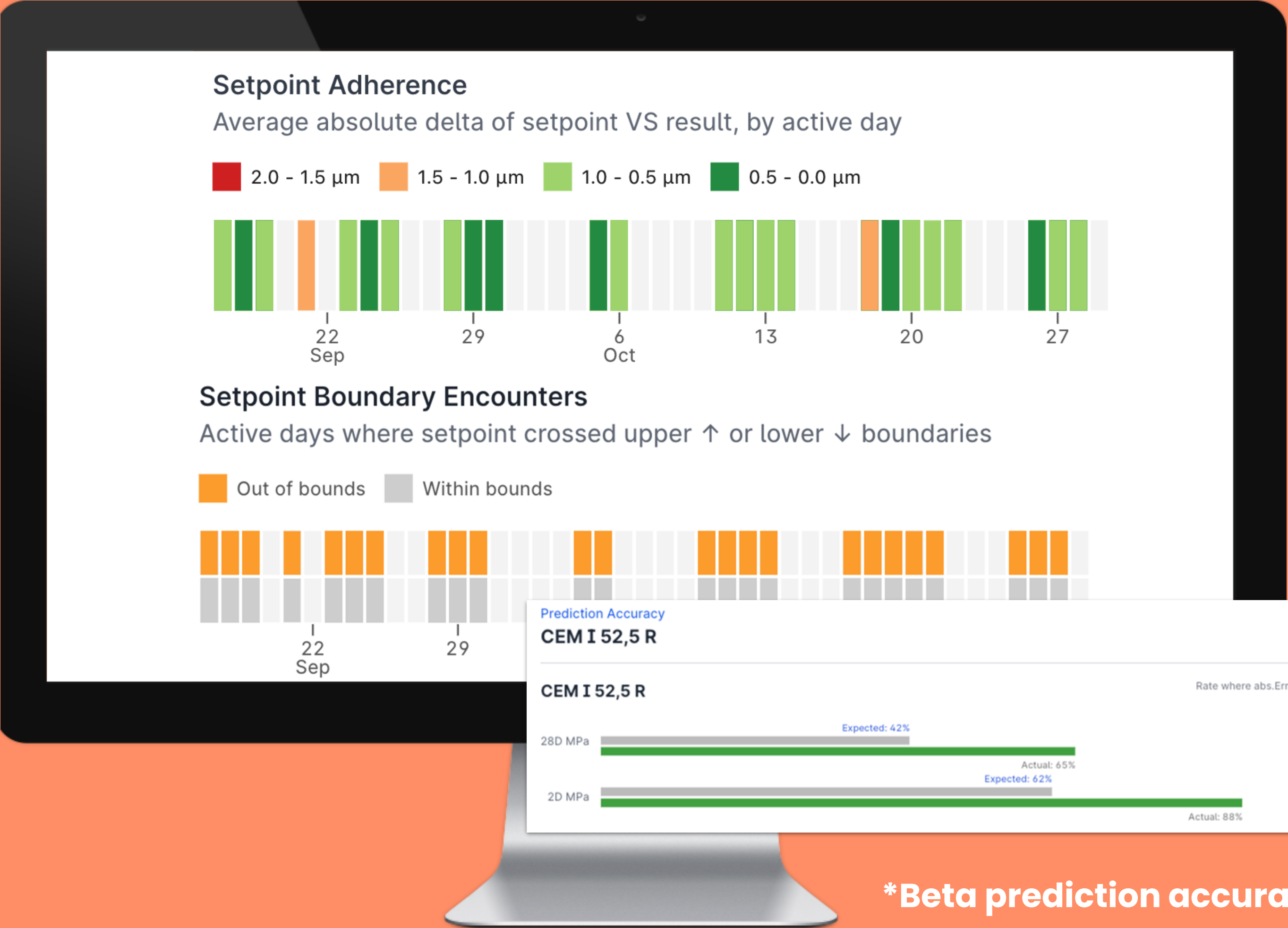
Understand your cements like never before



Steering Adherence View

Monitoring how the recommendations are followed.

Maximize the value from the software



*Beta prediction accuracy

Historias de Éxito:

Molins^o

CEMTECH 2025

Molins[®]

+60%

alternative fuels in SVH cement plant.

1

5 stages- preheater tower & high efficiency kiln with vertical raw mill.

2

Cement Ball mills and 5 types of Portland cement.

Sant Vicenç dels Horts (Barcelona)

Our factory at a glance



Success story Barcelona - implementation

DATA

Daily Composite / Shipment

- Chemistry (XRF)
- Mineralogy (XRD)
- Particle size distribution (PSD)
- **Compressive Strength**

Production

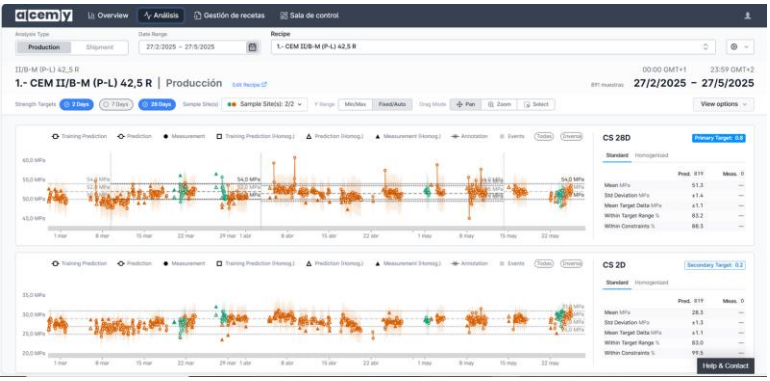
- Chemistry (XRF)
- Mineralogy (XRD)
- Particle size distribution (PSD)

Boost solving data structure & integrity

alcemy

Machine Learning models to accurately predict compressive strength

User-friendly interface



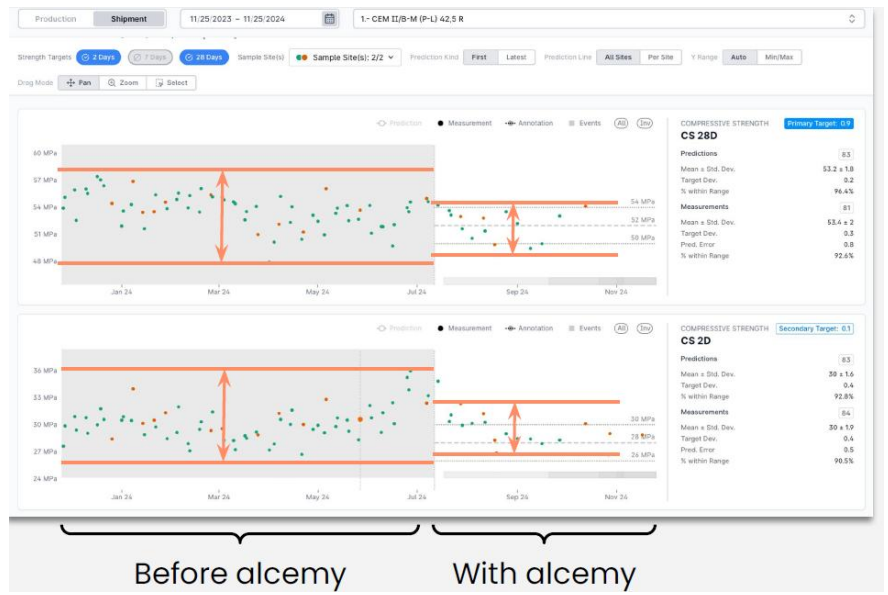
OUTPUT

Set-points for process control in closed loop



% clinker is manually adjusted

RESULTS



Success story Barcelona – results YTD

-11 %

target variability

-1.6 %

clinker factor reduction

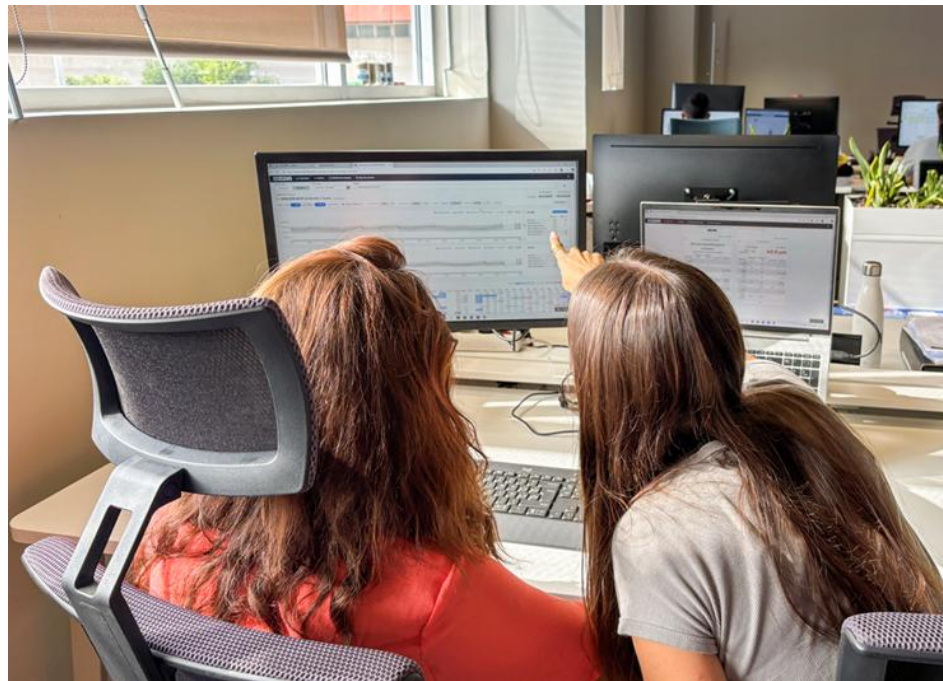
-12 kg CO₂

per ton cement

+480k€

equivalent carbon permits

Global expansion with Molins



Corporate framework agreement

Commitment, standard terms and predictability for scaling



Ongoing implementations

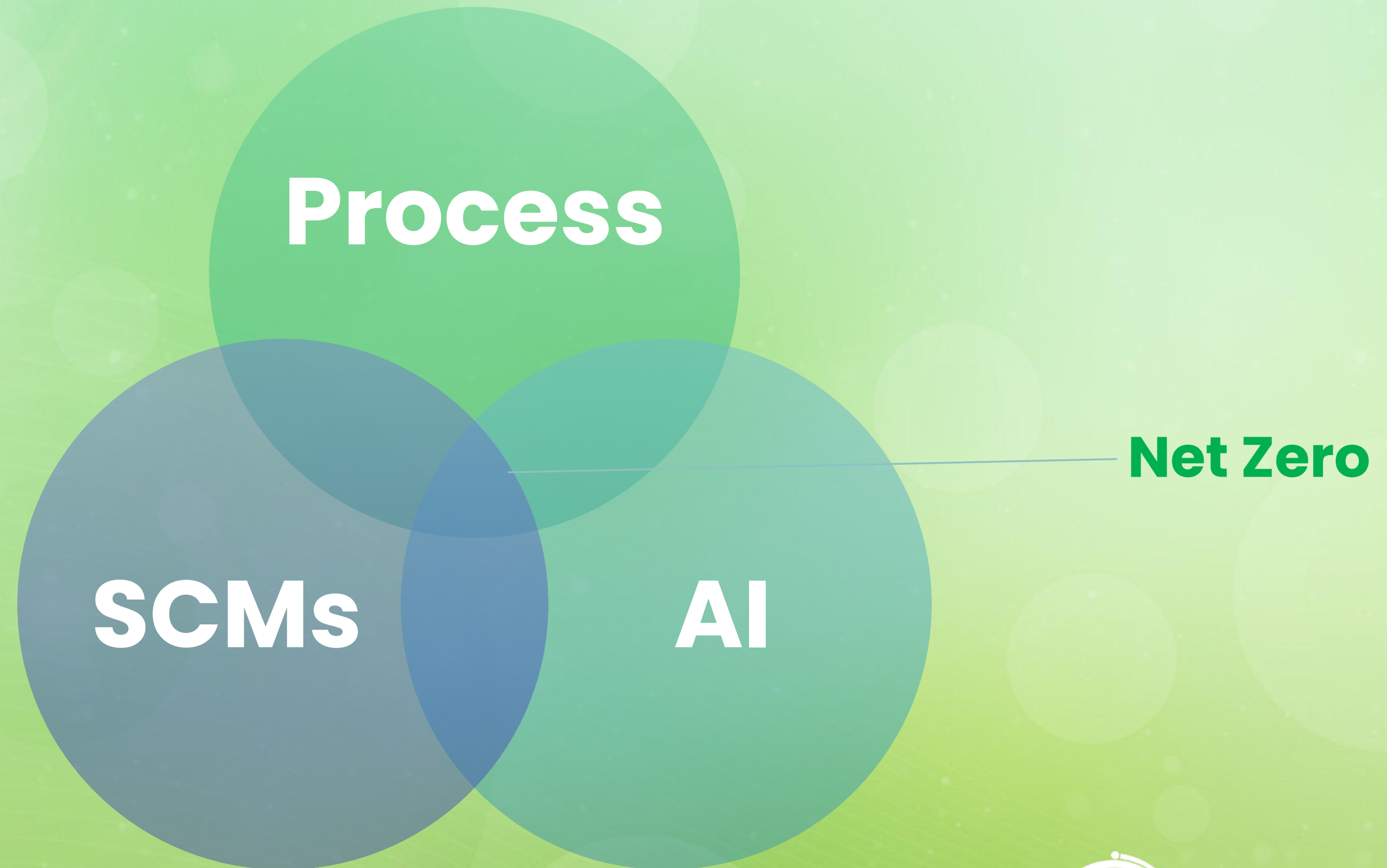
Moctezuma (Mexico)
Alion (Colombia)



Partnership mission statement

Accelerate decarbonization in the construction industry and boost Molins' digital transformation

Conclusión: La Inteligencia Artificial ya es Factor Clave en la Decabornización



Nuevo Partnership:



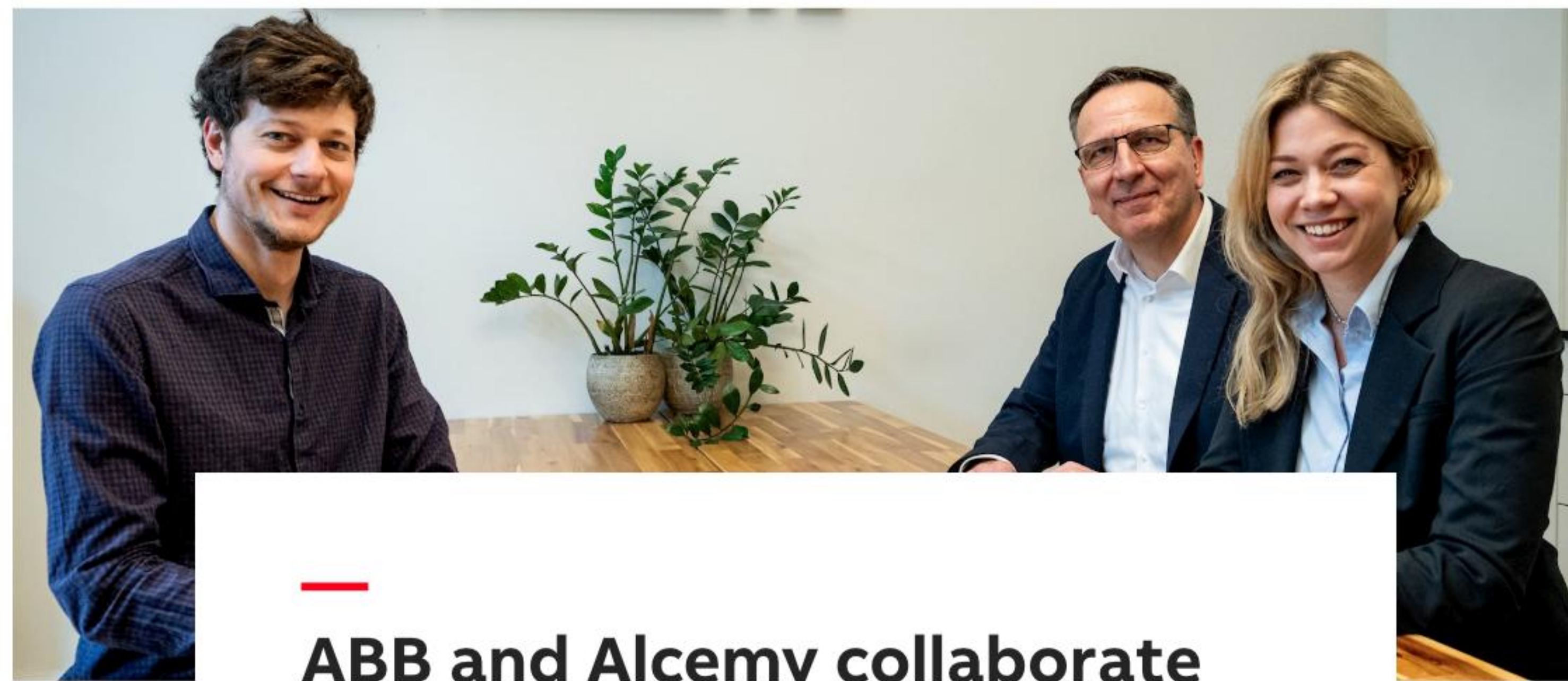
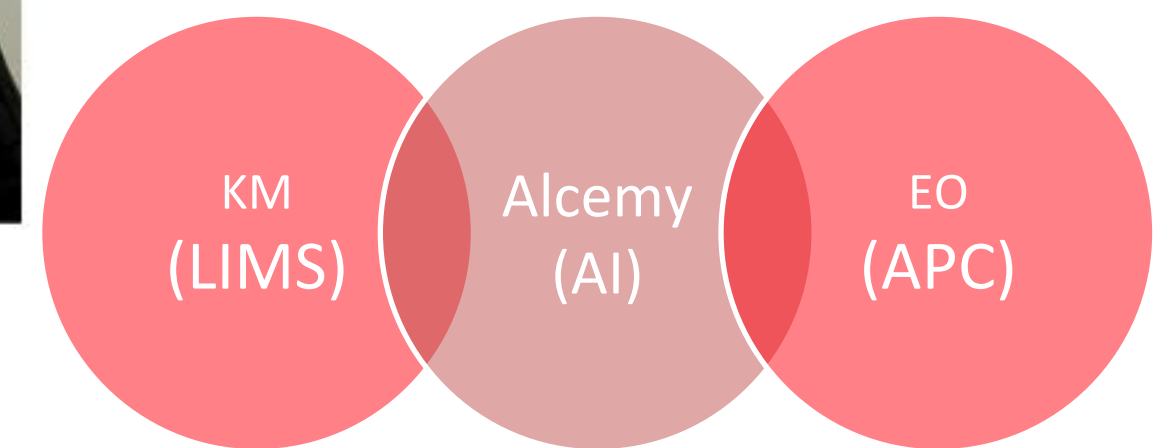


ABB and Alcemy collaborate to bring AI-driven quality control to cement production

Press release | Berlin, Germany | 2026-04-29

- Joint initiative aims to improve cement and concrete quality while supporting carbon reduction targets
- Supports the implementation of AI and digital technologies in the cement industry, aligning with future segment transformation efforts
- Collaboration combines ABB automation expertise with Alcemy's AI and ML-based quality prediction technology



Read more: [ABB and Alcemy collaborate to bring AI-driven quality control to cement production](#)



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Verde 2050

EL ROL DEL
CEMENTO &
CONCRETO
DE CARA
AL CAMBIO
CLIMÁTICO

Muchas Gracias por su Atención

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