Our Journey to Net Zero

Buzzi Unicem

HEAVY SIDE BUILDING MATERIALS: AN ATTRACTIVE PLACE TO BE

POPULATION GROWTH

9.8 billion estimated world's population by 2050, meaning about 2 billion more vs today.

MORE URBAN DEMAND

70% of population expected to live in cities by 2050 (vs 55% today), with clear impact on residential (new homes and more renovation) and urban infrastructure.

SUSTAINABILITY ON THE RISE

Consumer gradually more interested in sustainable products and low carbon construction. Tighter carbon regulation both in mature and emerging economies will favour circular economy models.

INNOVATION IN BUILDING CONSTRUCTION

More efficient construction solutions, both in residential and infrastructure, will be needed in order to preserve natural resources.

ALL CONSTRUCTION SEGMENTS ARE GOING TO CAPTURE THESE MEGATRENDS:

RESIDENTIAL
Strong demand, fueled by population growth and urbanization.

NON RESIDENTIAL
Climate policies to support private investments.

INFRASTRUCTURE
Relevant infrastructure package are going to be implemented in our key markets (EU Green Deal, IIJA,..).

CEMENT AND CONCRETE DEMAND IS LIKELY TO REMAIN FAVOURABLE OVER THE NEXT DECADE.

QUO VADIS CEMENT?

ROLE OF CEMENT AND CONCRETE

Concrete is the most used man-made material on our planet. Cement and concrete likely to remain irreplaceable materials that will play a significant role in solving the challenges of tomorrow

NET ZERO CONCRETE

Globally, cement industry contributes to ca. 6% of total man-made GHG emissions annually. The concrete decarbonization is very challenging for the sector and will require disruptive technology, like CCUS, which today are not fully available on industrial scale

KNOW-HOW IS KEY TO TACKLE THE TRANSITION

The complexity of technology and logistics will increase during the transition. Proficiency and expertise of the management in the concrete value chain will be determinant in understanding and identifying the best solutions

CRITICAL SIZE CAN MATTER

Not only raw materials; availability of efficient energy and CCU/S crucial production in the long run. Critical mass of a producer in a region helpful to access and connect to new infrastructure

PURSUING COST LEADERSHIP

Major changes in input costs (structure, weight).

New ROI models based on cost efficiency in production and distribution

RICHER COMMODITY

New energy intensive technologies and more demanding customer are changing the value of cement and concrete.

Possibly relative value versus substitutes (steel, wood, asphalt, etc.) to remain attractive.

BUZZI UNICEM TODAY: WELL POSITIONED TO CATCH FUTURE OPPORTUNITIES

Well balanced portfolio with exposure to mature markets as well as emerging
Strong market position in USA and Eurozone, enabling us to capture the local opportunities
Relevant exposure to Mexico and Brazil, countries with attractive prospects in population growth and urbanization

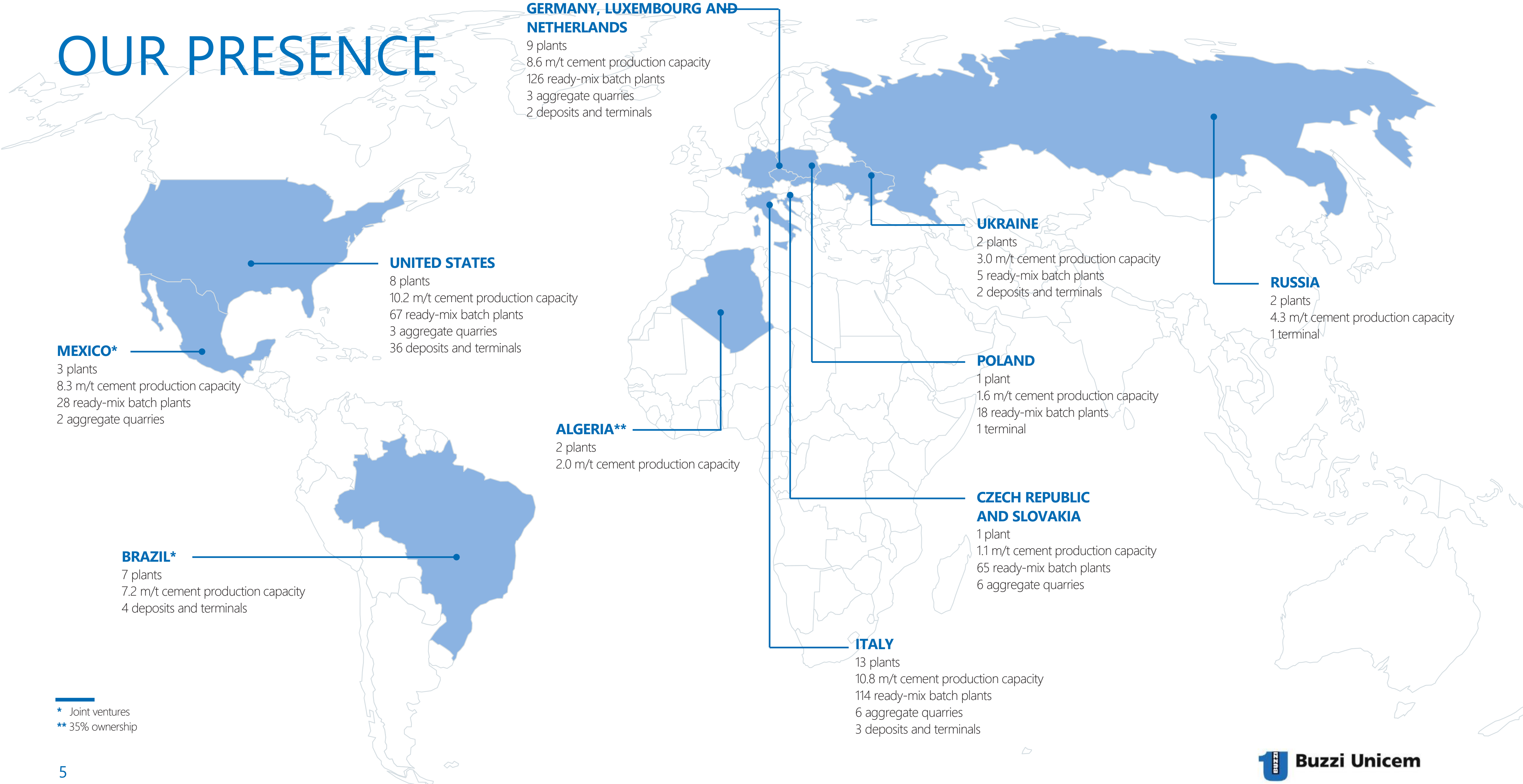
Above 40 mt of cement capacity available and 400 concrete plants (incl. JVs)

Strategy focused on long term and sustainable growth

Proven ability to deliver strong financial perfomance and free cash flows

Clear commitment to sustainability and value creation for all stakeholders

OUR PRESENCE



GERMANY, LUXEMBOURG AND NETHERLANDS
9 plants
8.6 m/t cement production capacity
126 ready-mix batch plants
3 aggregate quarries
2 deposits and terminals

UNITED STATES
8 plants
10.2 m/t cement production capacity
67 ready-mix batch plants
3 aggregate quarries
36 deposits and terminals

MEXICO*
3 plants
8.3 m/t cement production capacity
28 ready-mix batch plants
2 aggregate quarries

BRAZIL*
7 plants
7.2 m/t cement production capacity
4 deposits and terminals

ALGERIA**
2 plants
2.0 m/t cement production capacity

UKRAINE
2 plants
3.0 m/t cement production capacity
5 ready-mix batch plants
2 deposits and terminals

RUSSIA
2 plants
4.3 m/t cement production capacity
1 terminal

POLAND
1 plant
1.6 m/t cement production capacity
18 ready-mix batch plants
1 terminal

CZECH REPUBLIC AND SLOVAKIA
1 plant
1.1 m/t cement production capacity
65 ready-mix batch plants
6 aggregate quarries

ITALY
13 plants
10.8 m/t cement production capacity
114 ready-mix batch plants
6 aggregate quarries
3 deposits and terminals

* Joint ventures
** 35% ownership

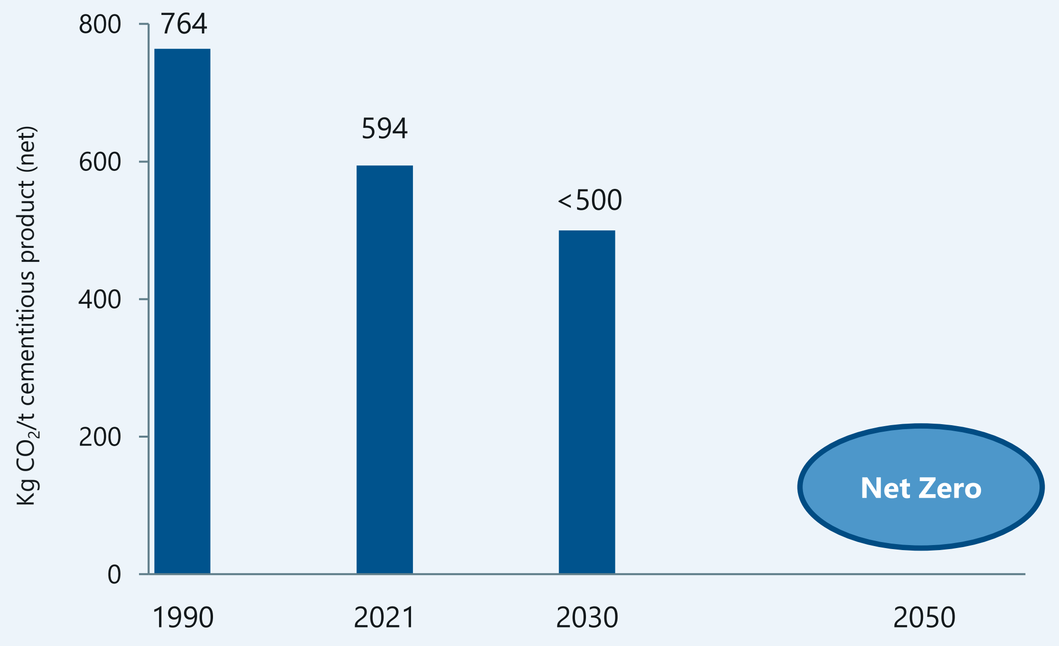
OUR JOURNEY TO NET ZERO

HOW TO GET THERE
Proven track record in CO_2 emissions reduction.
Already reduced by 17% CO2 emissions in 2021 vs 1990.

NEXT CHAPTER: NEW, SCIENCE BASED, REDUCTION TARGETS
Targeting to achieve CO_2 emissions (scope 1 net) below 500 kg per ton of cementitious material by 2030, meaning another 20% reduction vs 2021 level*.

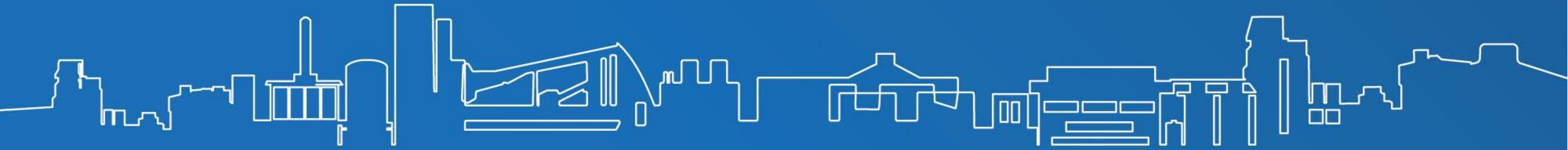
TCFD alignment
SBTi validation on-going

ROADMAP 2030 – 2050
Realistic path to turn ambition into reality



*scope including Brazil, excluding Russia

OUR JOURNEY TO NET ZERO



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MAIN ASSUMPTIONS

SCOPE

The roadmap has been developed considering all companies being part of the scope of consolidation excluding Russian ones due to the current uncertainty, and including BCPAR, our Brazilian joint venture. Production data concerns the grey clinker (standard and oil well) only and all cements/binders formulated with it.

MARKET PROJECTION

Up to 2030, the production scenario takes into account the market forecasts provided by individual countries. An increase between 5 and 10% is expected by 2030 and 2050 in comparison to 2021.

CCUS INFRASTRUCTURES

It is foreseen a successful cooperation of different actors to build and manage the CO_2 transport network; identify the storage or reuse sites (e.g. production of biofuels); obtain the acceptance by the public opinion; obtain adequate support by the government.

INSTITUTIONAL SUPPORT

Institutional support in permits and specific authorizations to facilitate the use of alternative fuels and the implementation of innovative technologies is expected.

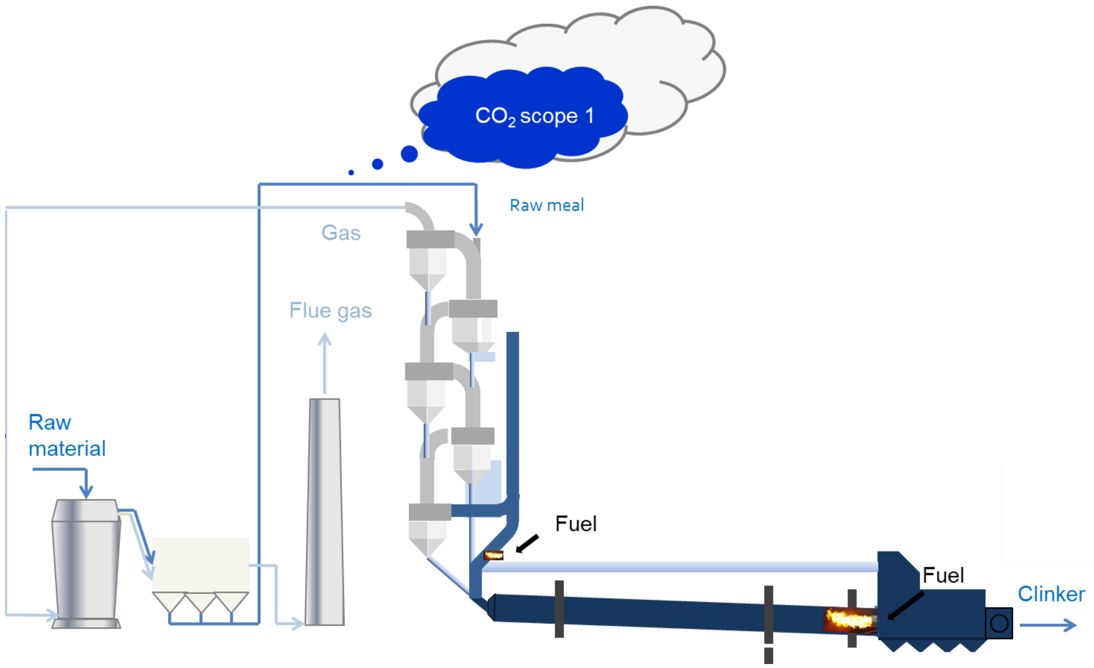
AVAILABILITY OF MATERIALS

It is assumed that clinker substitutes (slag, pozzolans, fly ash, etc.) remain available at competitive costs.

AVAILABILITY OF ELECTRICITY FROM RENEWABLE SOURCES

The roadmap considers decarbonization plans announced at national level for the electricity sector, which envisage the progressive use of renewable sources and for the residual share of production with fossil fuels the use of CO_2 capture and storage.

CO_2 EMISSIONS AND CEMENT PRODUCTION PROCESS

Direct emissions (scope 1)	Indirect emissions energy-related (scope 2)	Indirect emissions in the value chain (scope 3)
		

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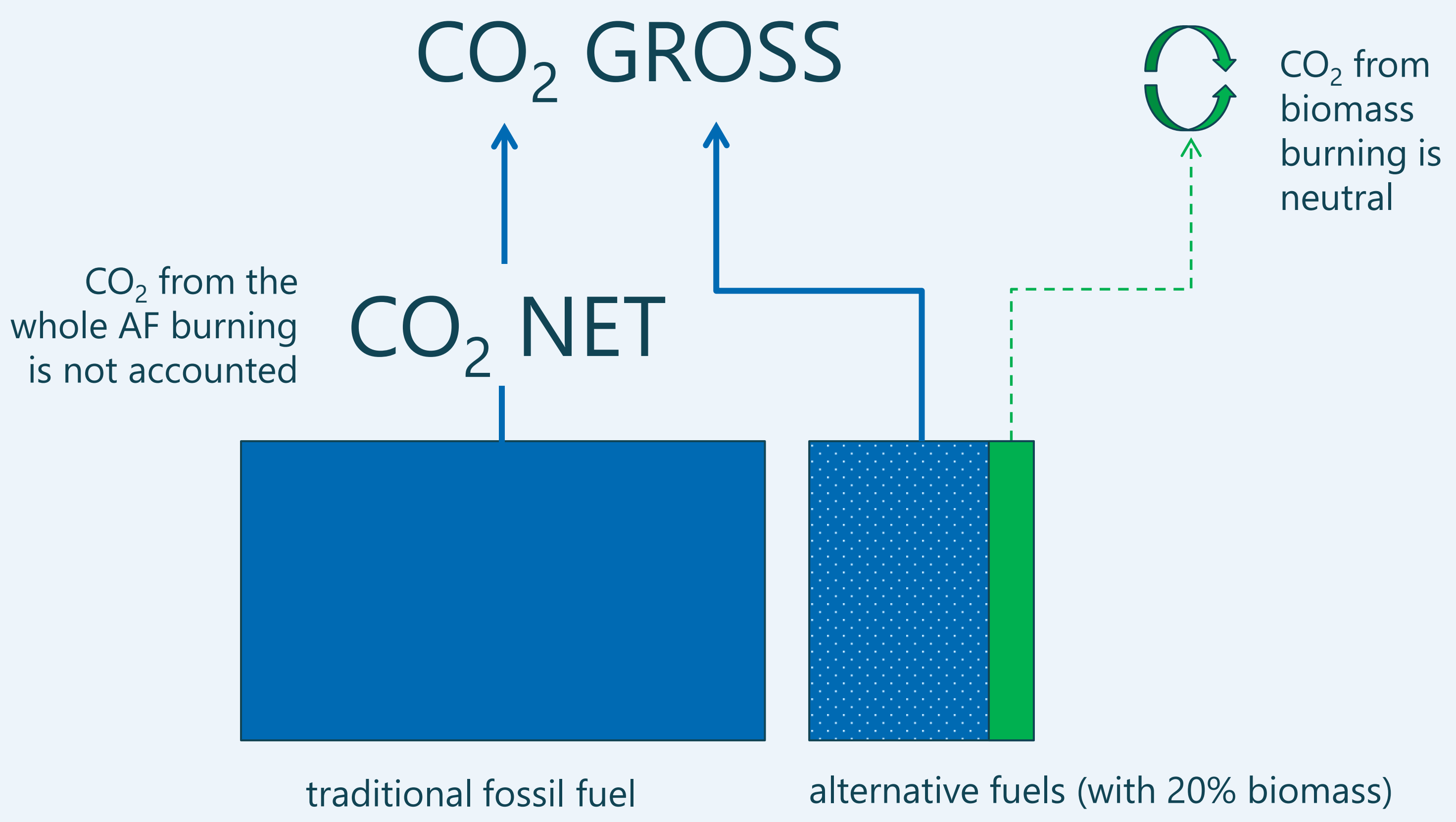
CO_2 EMISSIONS AND CEMENT PRODUCTION PROCESS

GROSS vs NET



CO_2 EMISSIONS - 2021
GROSS vs NET

20 566 t/000

GROSS

648 $KgCO_2$/t cem.ious prod.

GROSS

18 859 t/000

NET

594 $KgCO_2$/t cem.ious prod.

NET

ROADMAP TO NET ZERO

CO_2 REDUCTION LEVERS

EFFICIENCY IN CONCRETE PRODUCTION AND DESIGN & CONSTRUCTION

EFFICIENCY IN ELECTRIC AND THERMAL ENERGY CONSUMPTION

CLINKER CONTENT IN CEMENTS

RECARBONATION

ALTERNATIVE FUELS WITH BIOMASS CONTENT

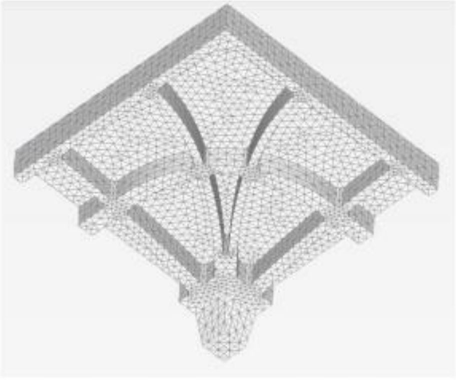
DECARBONIZATION OF ELECTRICITY

FOSSIL FUELS WITH LOWER EMISSION FACTOR

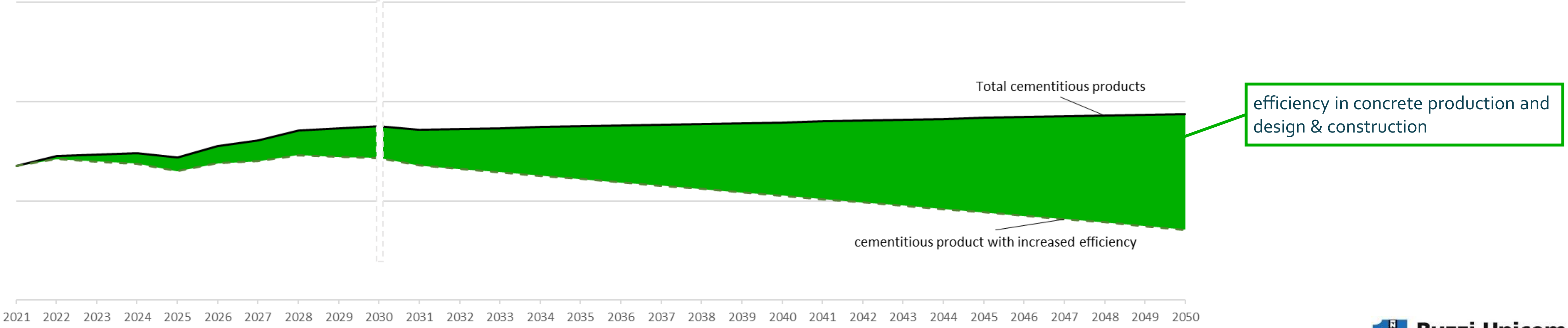
CARBON CAPTURE, (USAGE) AND STORAGE

EFFICIENCY IN CONCRETE PRODUCTION AND DESIGN & CONSTRUCTION

....according to the patent filed by the Nervi construction company, “if a continuous body were to be replaced by a filamentous structure, with the fibers arranged according to isostatic lines, [...] the behavior of this body, due to the given external forces, it is identical to that of the continuous body [...] obtaining a considerable economy of materials without modifying the play of internal forces”.



ig. 2 - Modello agli elementi finiti del solaio a nervature isostatiche utilizzato nel Lanificio Gatti progettato da Nervi



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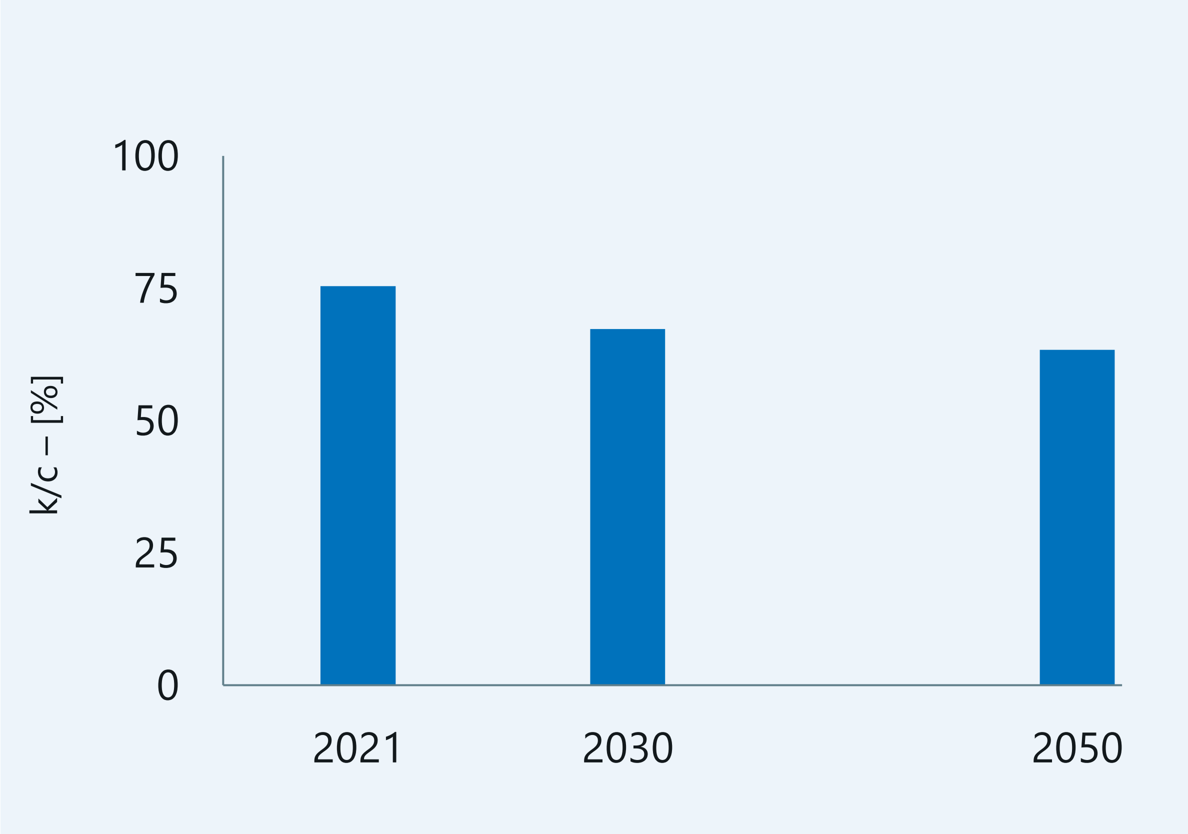
CLINKER CONTENT IN CEMENTS



75.4%

In 2021

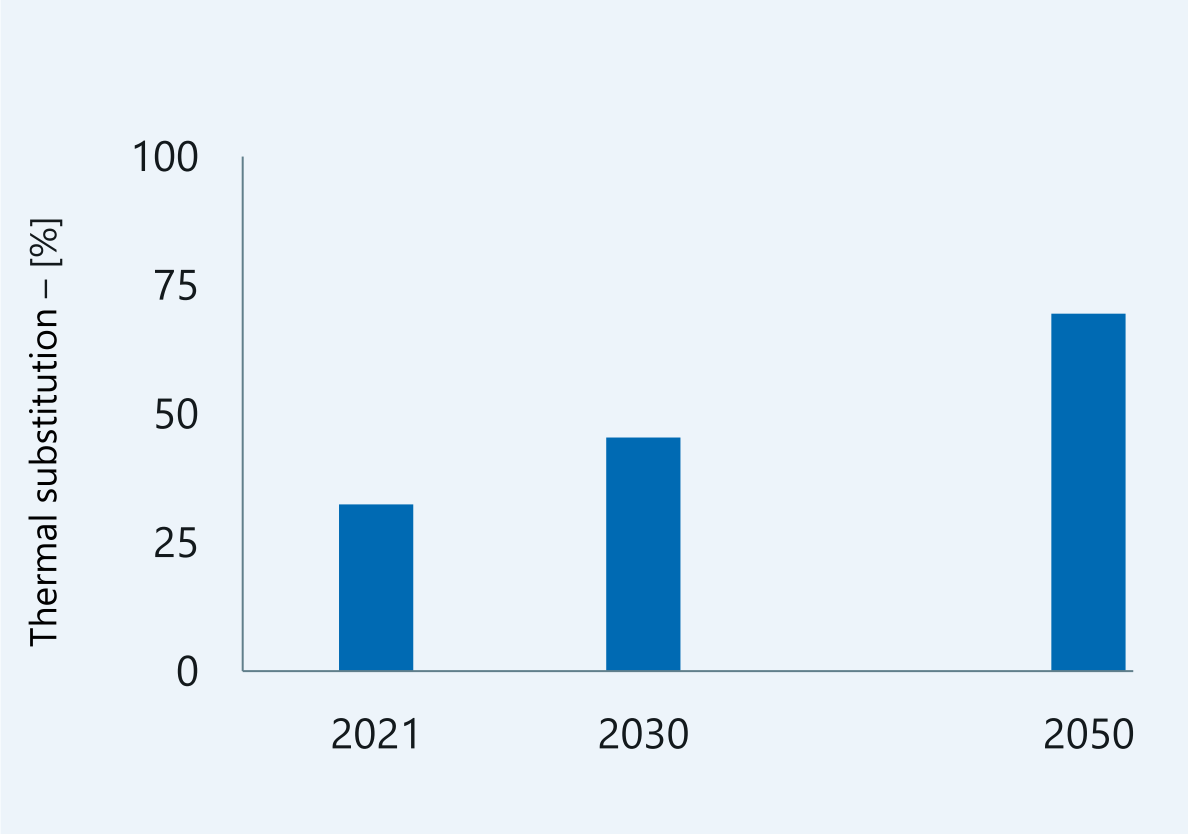
67.3%

In 2030

63.4%

In 2050

ALTERNATIVE FUELS WITH BIOMASS CONTENT



32.4%

In 2021

45.4%

In 2030

69.5%

In 2050

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FOSSIL FUELS WITH LOWER EMISSION FACTOR

The combustion of **methane** gas with the same energy supplied emits about half the CO_2 emitted by the combustion of coal or petcoke.

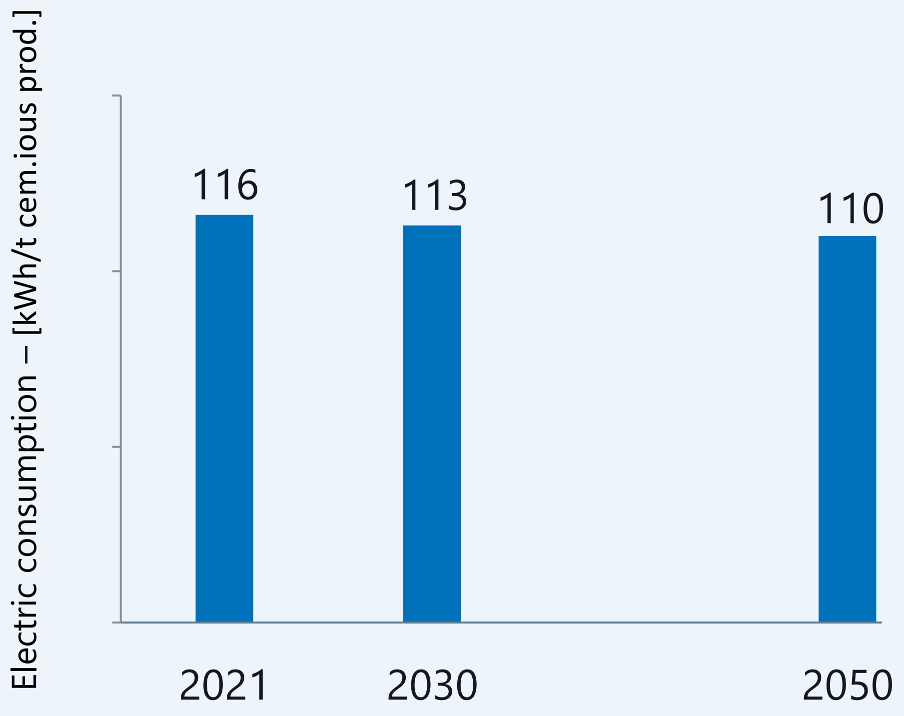
>45%

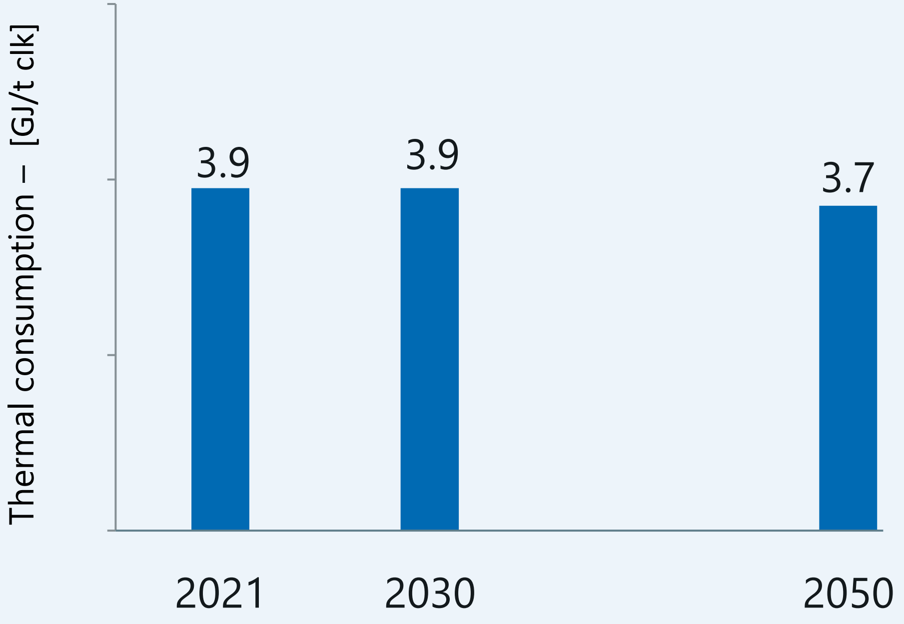
from 2030

Contribution of **methane**

to thermal energy from fossil fuels

EFFICIENCY IN ELECTRIC AND THERMAL ENERGY CONSUMPTIONS

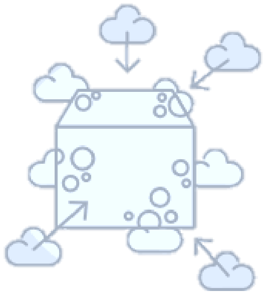




Additional electric and thermal consumptions requested by CCUS have not been taken into account

RECARBONATION

KEY FACTS



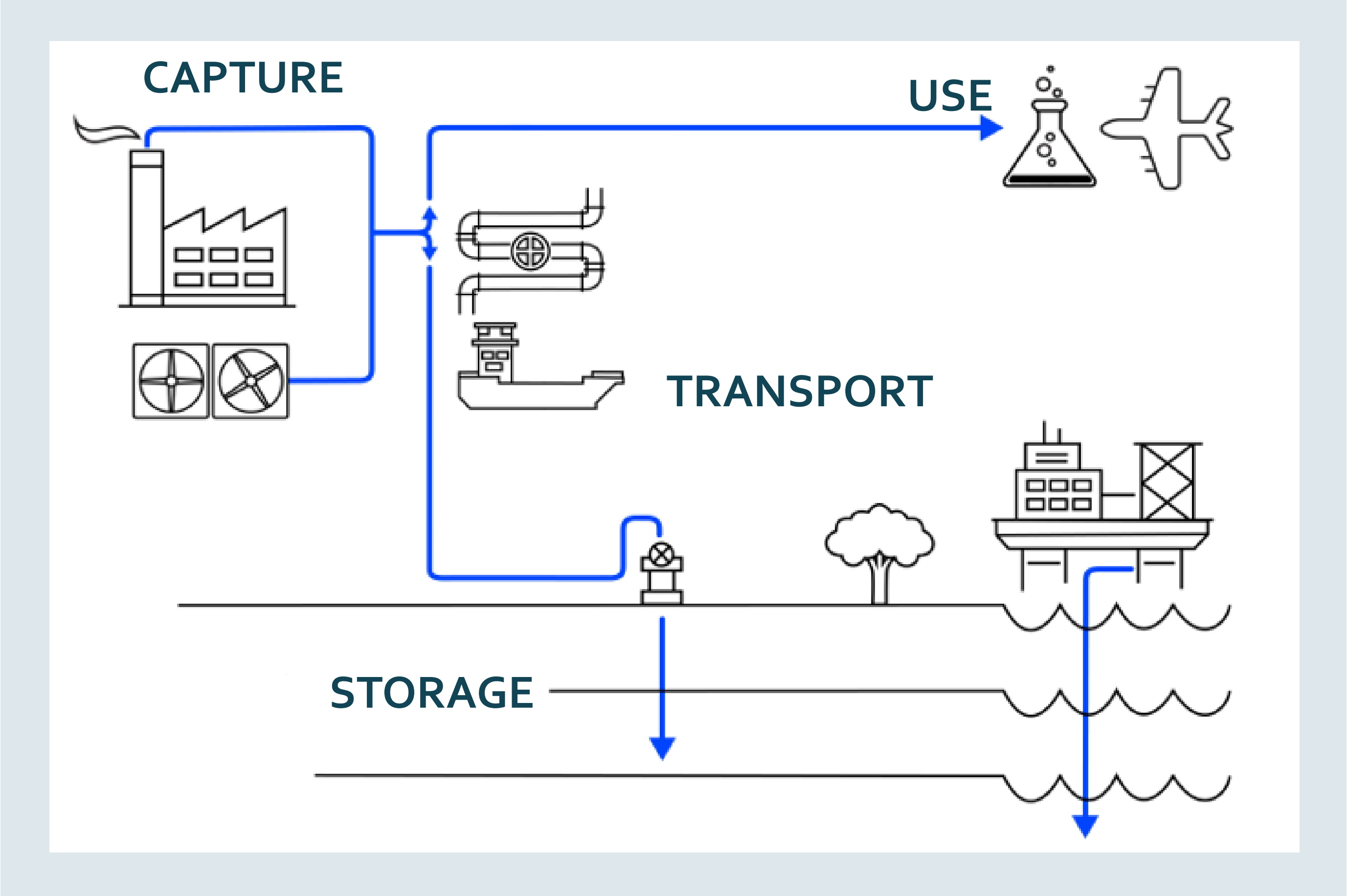
1. Concrete naturally absorbs CO_2 from the atmosphere throughout its lifetime.
2. Products, such as mortar and concrete blocks, carbonate rapidly. Reinforces concrete carbonates slowly – by design – to protect steel reinforcement from corrosion.
3. Improved demolition practices and innovative industrial carbonation techniques can enhance and accelerate carbonation CO_2 capture.

CARBONATION IS THE NATURALLY OCCURRING PROCESS IN WHICH CONCRETE ABSORBS CO_2, PERMANENTLY REMOVING CARBON FROM THE ATMOSPHERE.

CARBONATION OF CONCRETE IS A WELL-ESTABLISHED SCIENCE AND RECOGNIZED BY THE IPCC (INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE) AS AN IMPORTANT CARBON EMISSIONS SINK.

[Mt CO_2]	2021	2030	2050
Group	2.6	2.3	1.9

CARBON CAPTURE, (USAGE) AND STORAGE



1%

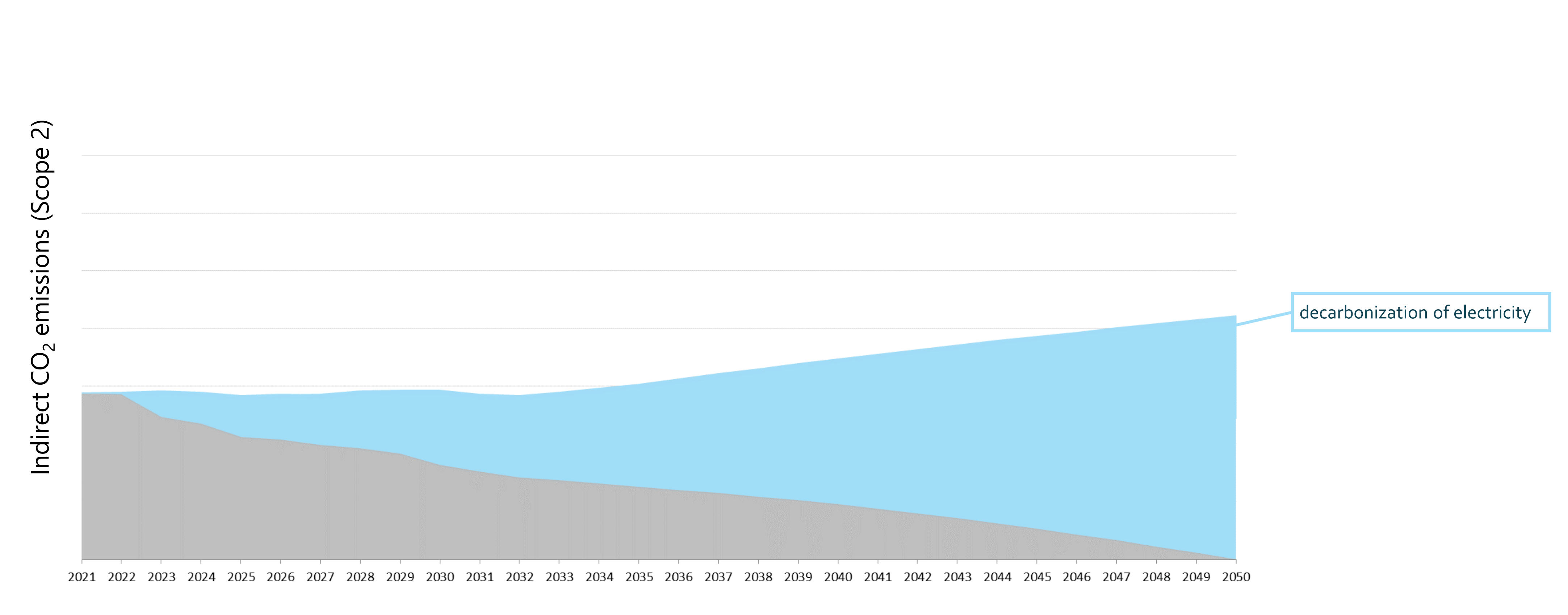
In 2030

48%

In 2050

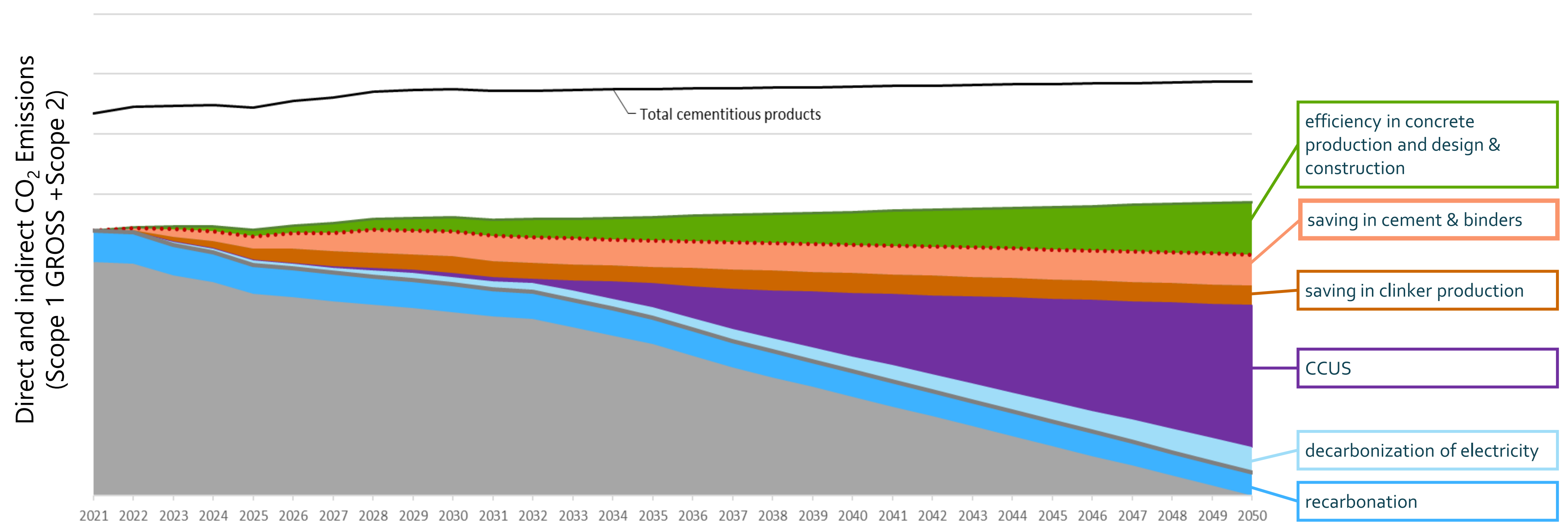
Additional CO_2 emissions due to the thermal energy requested by CCUS have not been taken into account

DECARBONIZATION OF ELECTRICITY



ABSOLUTE EMISSIONS scope1 GROSS + scope2

BREAKDOWN BY LEVERS INCLUDING ELECTRICITY DECARBONIZATION



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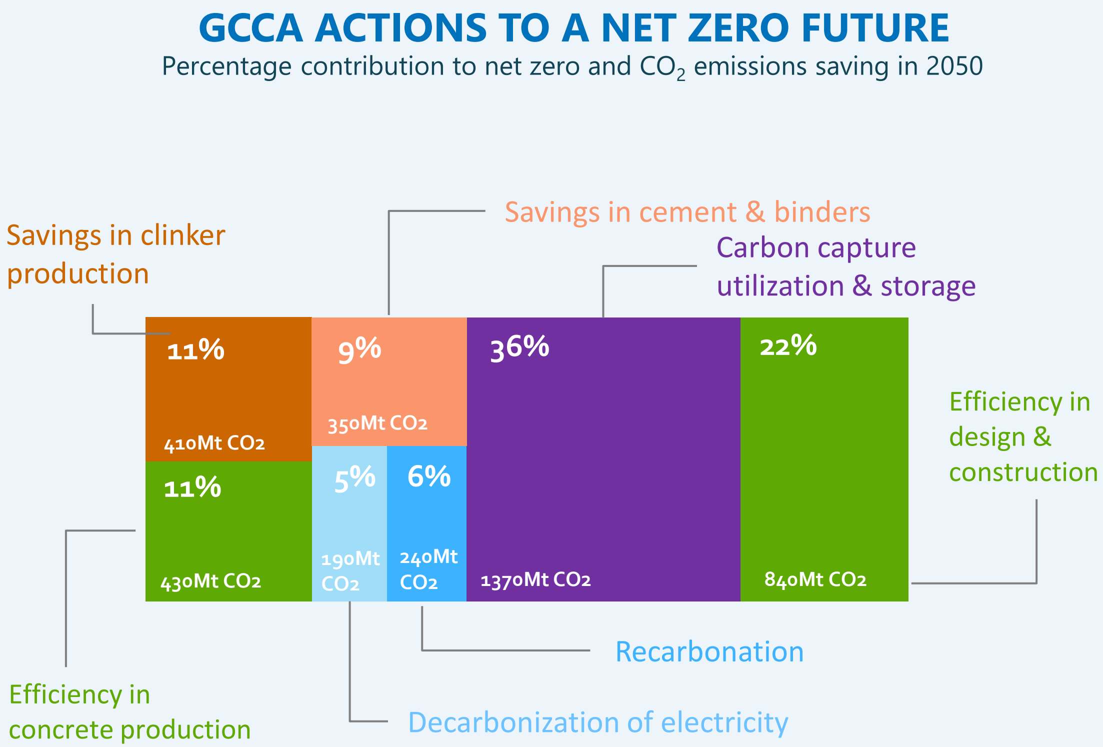
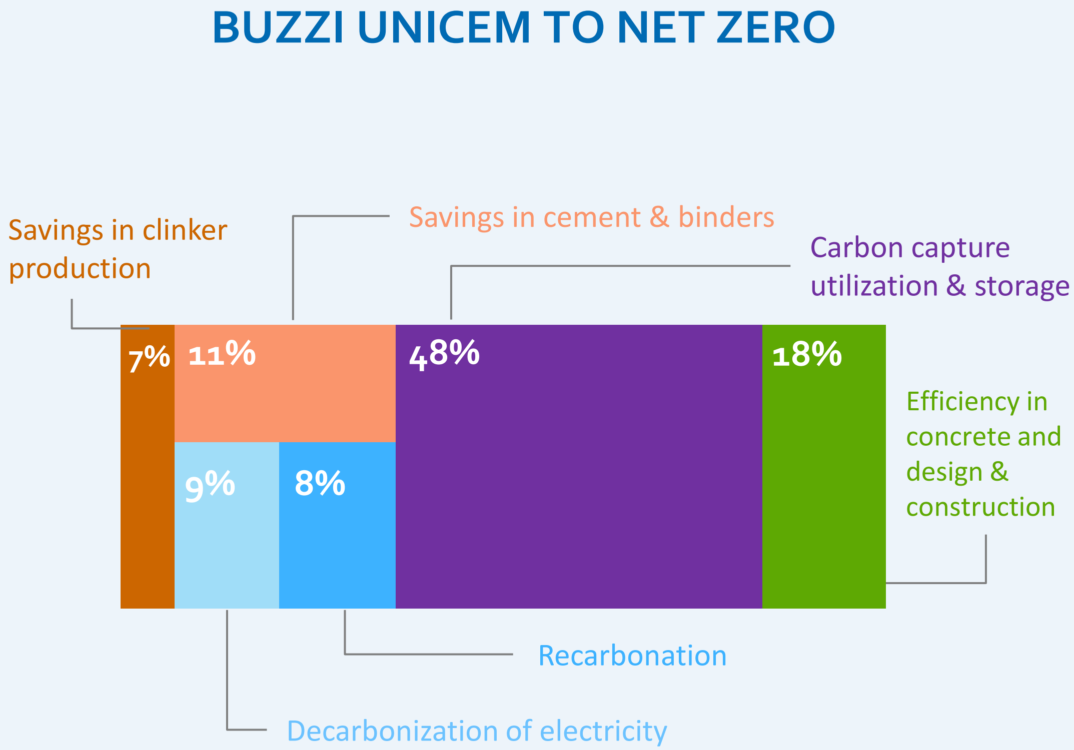
GCCA vs BU: 2050





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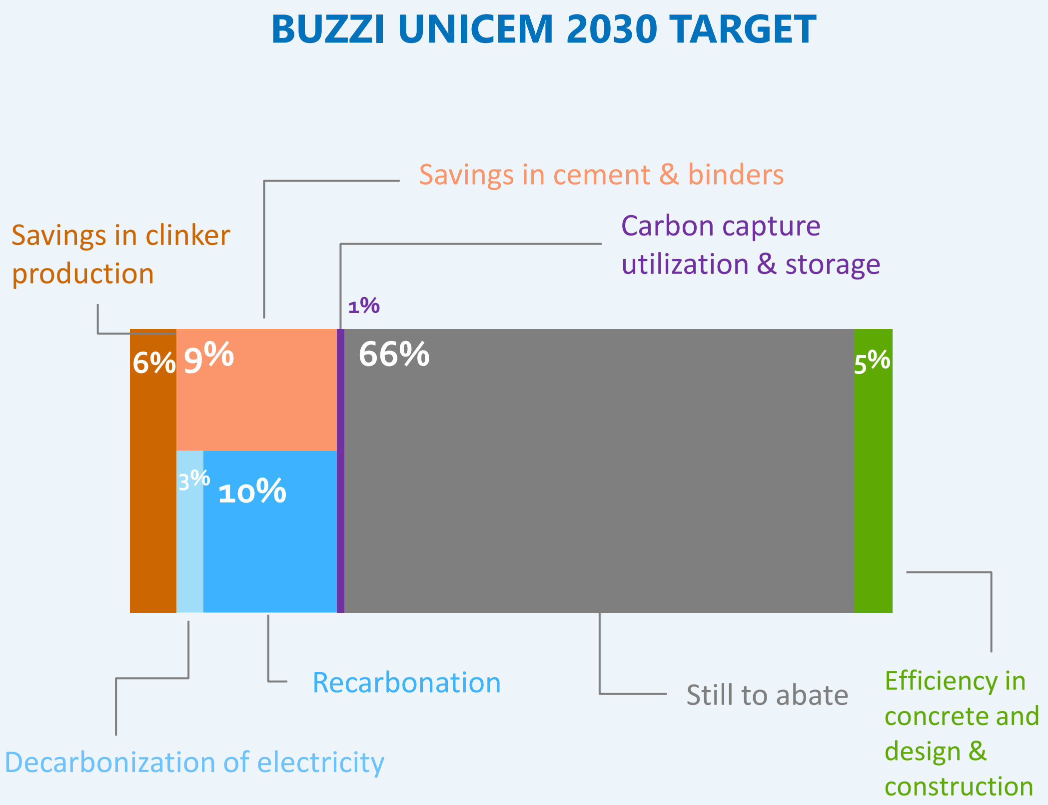
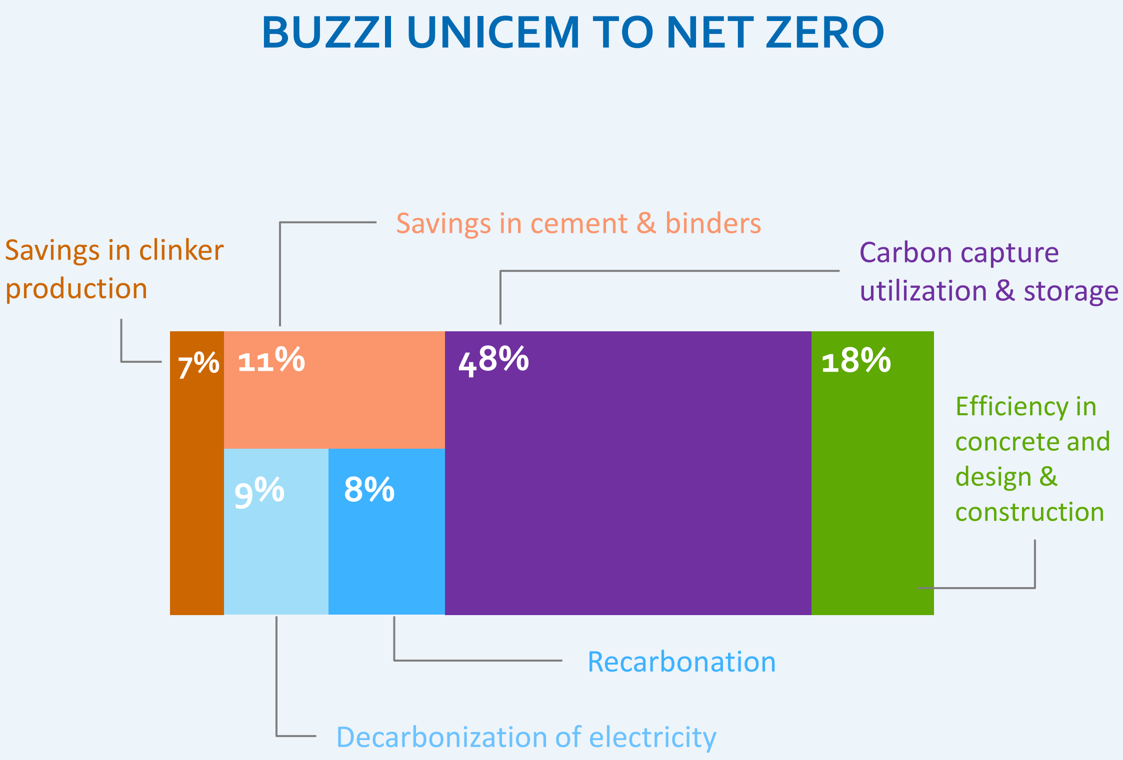
BU: 2030 vs 2050





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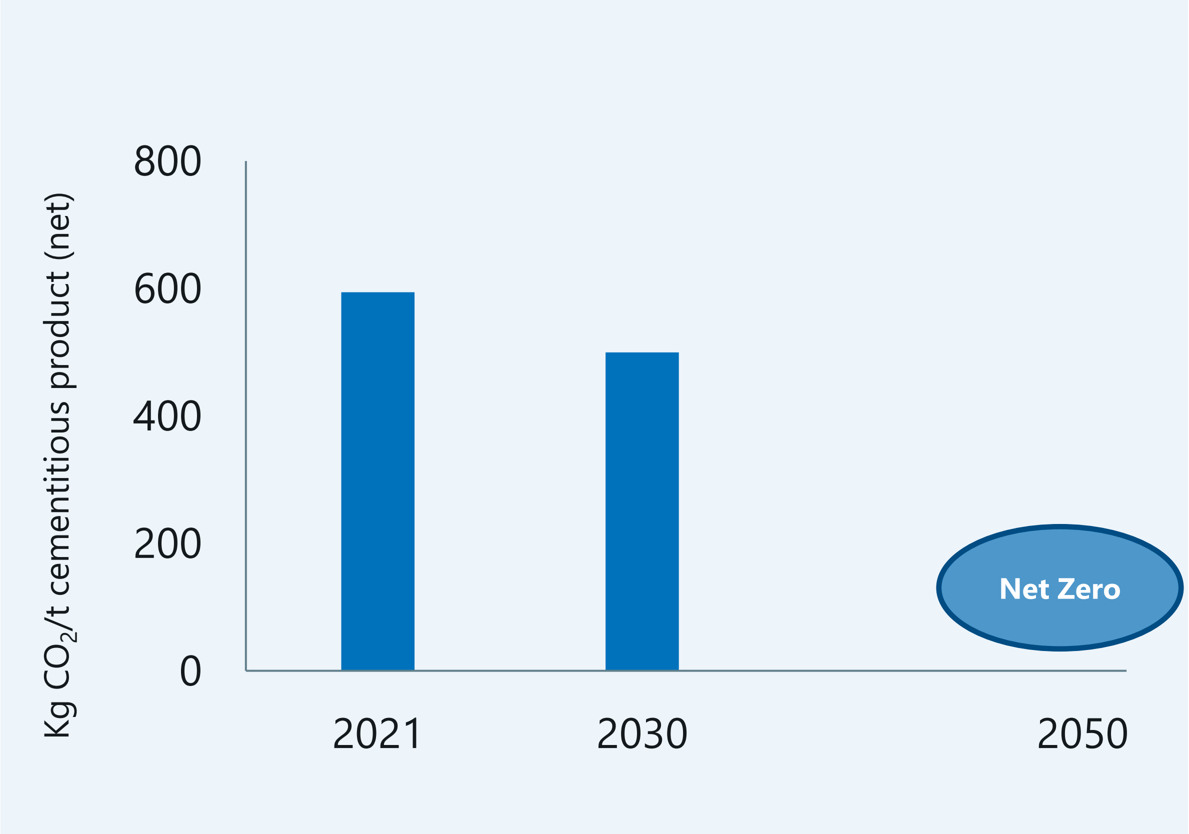
2030 TARGET

Specific emissions scope1 NET



594 **$KgCO_2$/t cem.ious prod.**

In 2021

<500 **$KgCO_2$/t cem.ious prod.**

In 2030

NET ZERO

In 2050

INITIATIVES BY GEOGRAPHIC AREA

CENTRAL AND EASTERN EUROPE - DYCKERHOFF

ROADMAP 2030 DYCKERHOFF

EXECUTIVE SUMMARY

PRODUCT INNOVATION – CEDUR AND ECO COMFORT

CEDUR and ECO-COMFORT (CEM II/C) crucial to reduce CO_2 emission in the construction.

Dyckerhoff 1st cement producer to receive technical greenlight for the production of CEM II/C in Germany.

AMBITIOUS CAPEX PROGRAM TO FUEL THE TRANSITION

Dyckerhoff is planning to invest ~256 million euros over the period, having more than 50 initiatives.

Significant focus on product mix.

CCU/S INSTALLATION AT INDUSTRIAL SCALE IN GERMANY

Initial capture at Deuna cement plant to start in 2027 (first pick of CO_2).

Scaled up to 0,28 mt CO_2 p.a. by 2030.

SCOPE 1 NET CO_2 EMISSIONS

Dyckerhoff countries to reduce CO_2 net emissions to <450 kg CO_2/t cementitious product.

Dyckerhoff ETS countries to perform even better: <400 kg CO_2/t cementitious product.

CEDUR AND ECO COMFORT: CO_2 EFFICIENT CEMENTS

<39%

CO_2 footprint in comparison to standard CEM I cements

-25%

Potential to reduce CO_2 intensity in comparison to the status quo of binder mixes

3

Cement plants in Germany producing CEM II/C cements

CEM II/C cements are the crucial approach to reduce the CO_2 emissions in construction. Dyckerhoff received as 1st cement producer in Germany the general technical approval for its CEM II/C cement.

CCU/S: GREEN ENERGY COOPERATION WITH TES&OGE IN DEUNA

DEUNA CEMENT PLANT (GERMANY) WILL PARTIALLY CAPTURE ITS CO_2 AND PARTICIPATE AT A CO_2 CIRCULAR ECONOMY INITIATIVE. CAPEX: 35-50 €M

CARBON CAPTURE AT CEMENT PLANT IN DEUNA (THURINGIA)

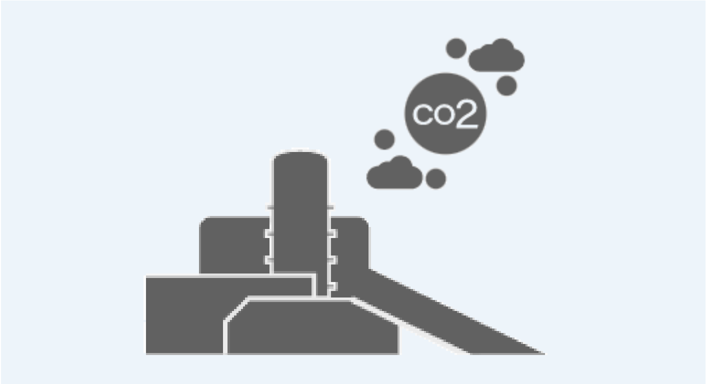
CO_2 emissions will be captured and transferred into liquid CO_2 at Deuna cement plant. Initial start in 2027, scaled up for approx. 280,000 tons CO_2 capture by 2030.

1,000 KM CO_2 TRANSPORT NETWORK

The CO_2 will be transported* to Wilhelmshaven. From there is will be exported by TES for a circular closed looped system or sequestration.

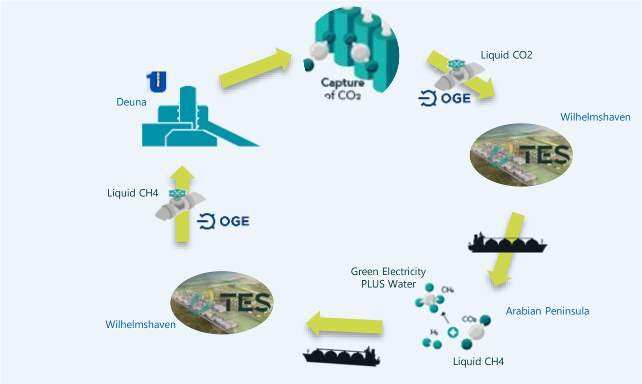
GREEN ENERGY HUB WILHELMSHAVEN

TES will import green methane which can be used in turn in industrial processes.



Source: OGE; Stefan Dinse via Shutterstock

* either by train through a JV of Rhenus & TES or by pipeline through a JV of OGE & TES.



Source: https://tes-h2.com/tes-h2-invests-in-german-green-energy-hub/

CCU/S: CATCH FOR CLIMATE

CI4C – CEMENT INNOVATION FOR CLIMATE WAS FOUNDED BY BUZZI UNICEM/DYCKERHOFF, HEIDELBERGCEMENT, SCHWENK ZEMENT AND VICAT.

DEMONSTRATION PLANT ON INDUSTRIAL SCALE IN MERGELSTETTEN

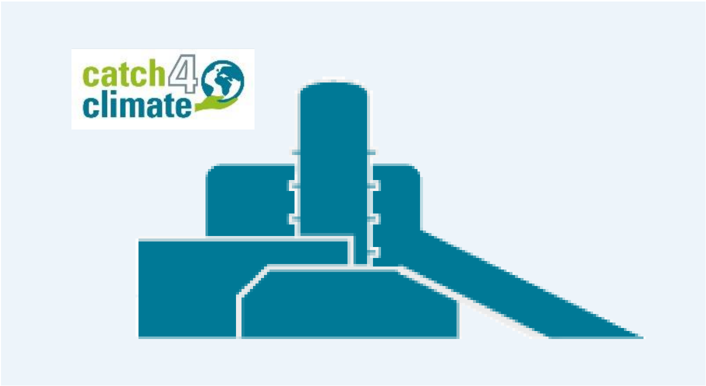
CI4C will build and operate a demonstration plant, where the oxyfuel (from oxygen and fuel) process will be applied. EPC contract with tkIS signed.

CAPTURE OF CO_2 BY OXYFUEL PROCESS

Pure oxygen is introduced into the cement kiln instead of air: No other components gets into the burning process. Highly concentrated CO_2 is created. ~100% of CO_2 can be captured.

REFUELS

The captured CO_2 is used to produce reFuels with the help of renewable electrical energy and turned into climate-neutral synthetic fuels such as kerosene for air traffic.



CAPEX REQUIREMENTS BY 2030

Dyckerhoff - Central and Eastern Europe

~ 256 m€

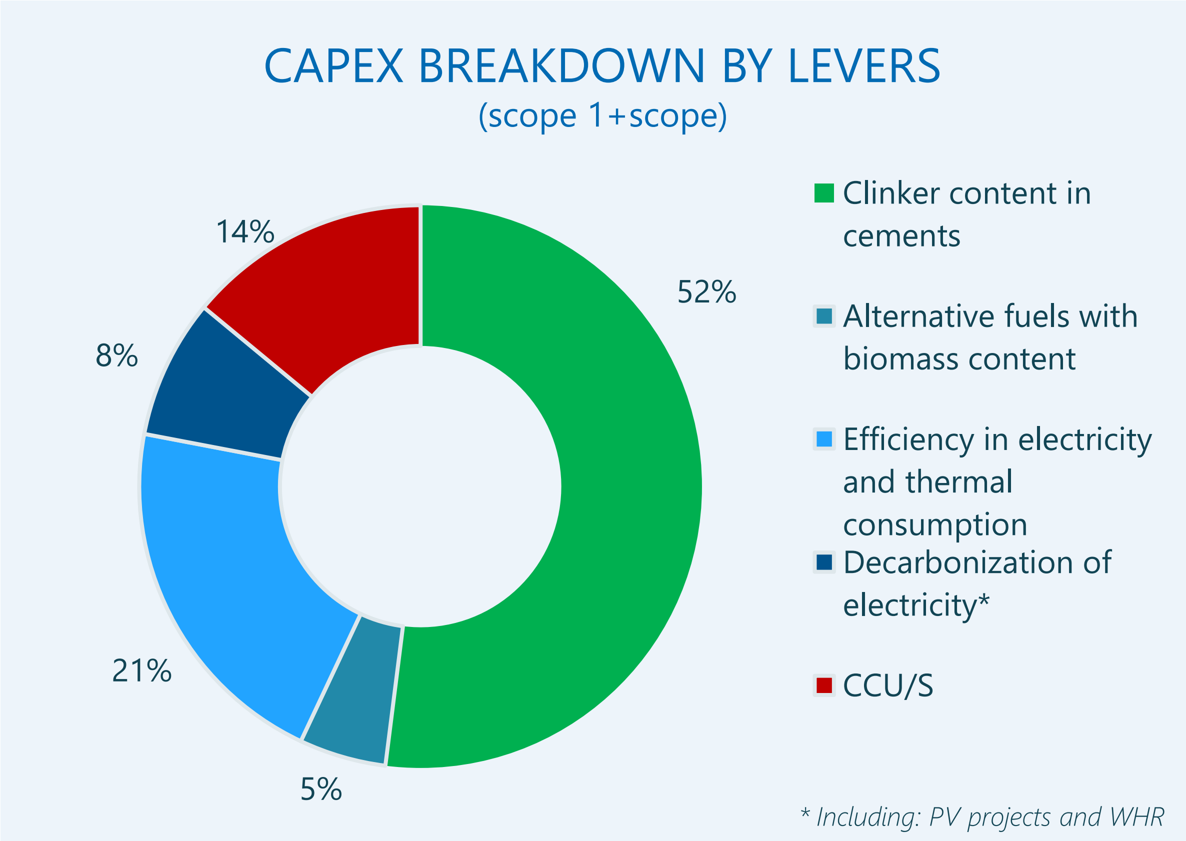
Additional capex in 2022-2030

>50

Projects in 5 countries and 12 plants

~ 134 m€

in product portfolio change



CO_2 EMISSIONS BY 2030

Dyckerhoff - Central and Eastern Europe*

Scope 1 Net CO_2 emissions

<450 kg CO_2/t. cem.ious

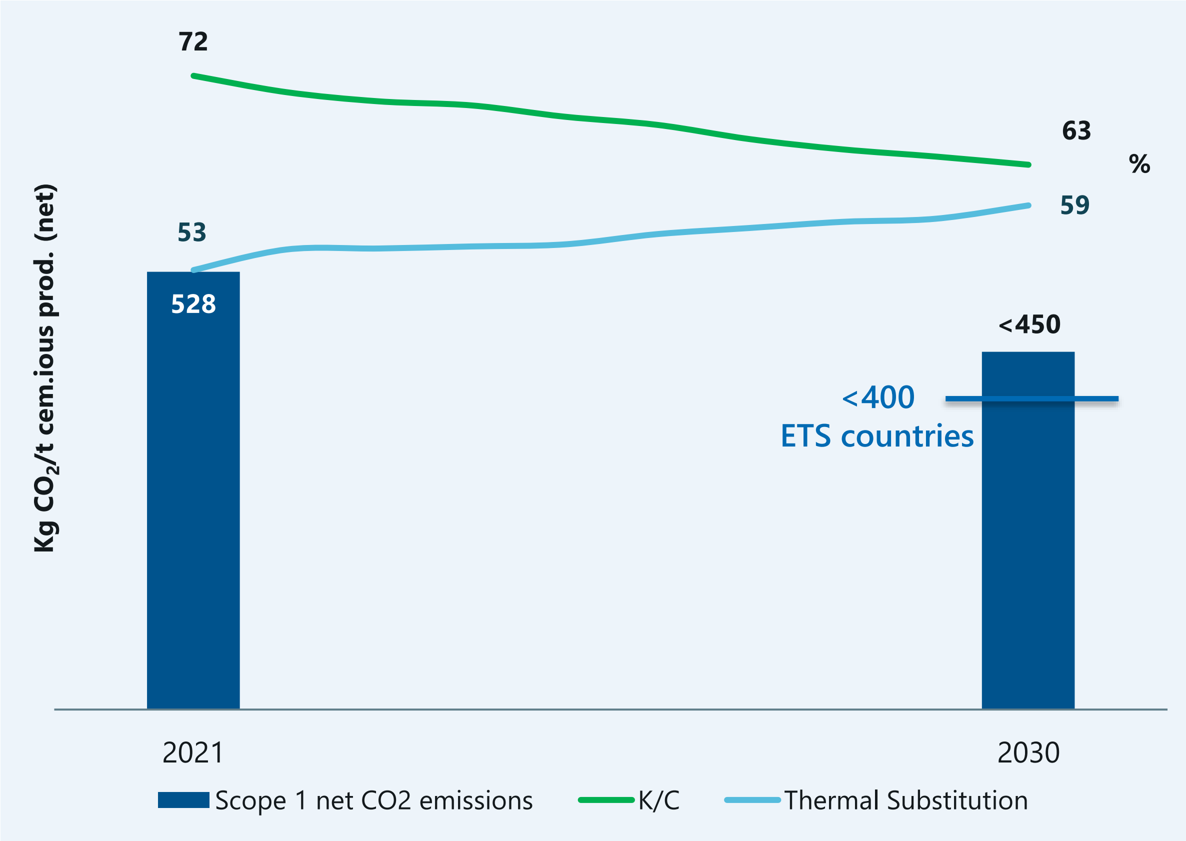
Clinker content in cements (K/C)

63% vs 72% in 2021

Alternative Fuels with biomass content (thermal substitution)

59% vs 53% in 2021

** Including: Germany, Luxembourg, Poland, Czech Rep., Ukraine. Excluding: Russia*



INITIATIVES BY GEOGRAPHIC AREA

UNITED STATES

Alamo Concrete Alamo Cement Buzzi Unicem USA Buzzi Unicem

ROADMAP 2030 USA

EXECUTIVE SUMMARY

ACCELERATED PATH FOR PLC TYPE 1L CONVERSION

Reducing K/C from 89% to 81%, substituting clinker with limestone (up to 15%) and other SCMs

Total transition in all plants to PLC Type 1L by the end of 2022*

ACCELERATED PATH FOR FUEL MIX CHANGES

By 2030:

- +50% alternative fuels utilization (from 20% in 2021 to 30% by 2030)
- Fossil fuels substitution with natural gas (up to 70%)

CAPITAL INTENSIVE EFFORT IN ORDER TO ACHIEVE TARGETS

Planning to invest ~272 m$ with more than 30 initiatives over the period
Significant effort on capex aiming to lower the clinker content as well as on investment in renewable energy production

OUTPERFORMING PCA TARGETS

Significant CO_2 emissions reduction thanks to the implementation of the commercial and capex initiatives planned.

By 2030, scope 1 net CO_2 emissions < 600 kg CO2/t cem.ious prod.

Excl. plants with oil well cement production

PLC Type 1L: CO_2 EFFICIENT CEMENTS

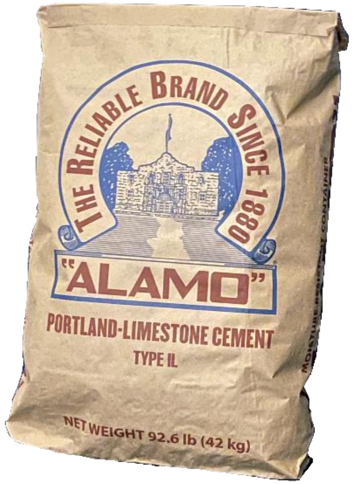
<12%

CO_2 footprint in comparison to standard Type I/II cements

Type 1L cement is the crucial approach to reduce the CO2 emissions in construction. As of May 31, 2022, 5 cement plants have fully converted production of Type I/II to Type 1L, another plant will fully convert by end of June, and the remaining 2 plants will fully convert by year-end.

8

Cement plants in USA producing Type 1L cement



PLC TYPE IL

ALTERNATIVE FUELS USAGE

Capital expenditure

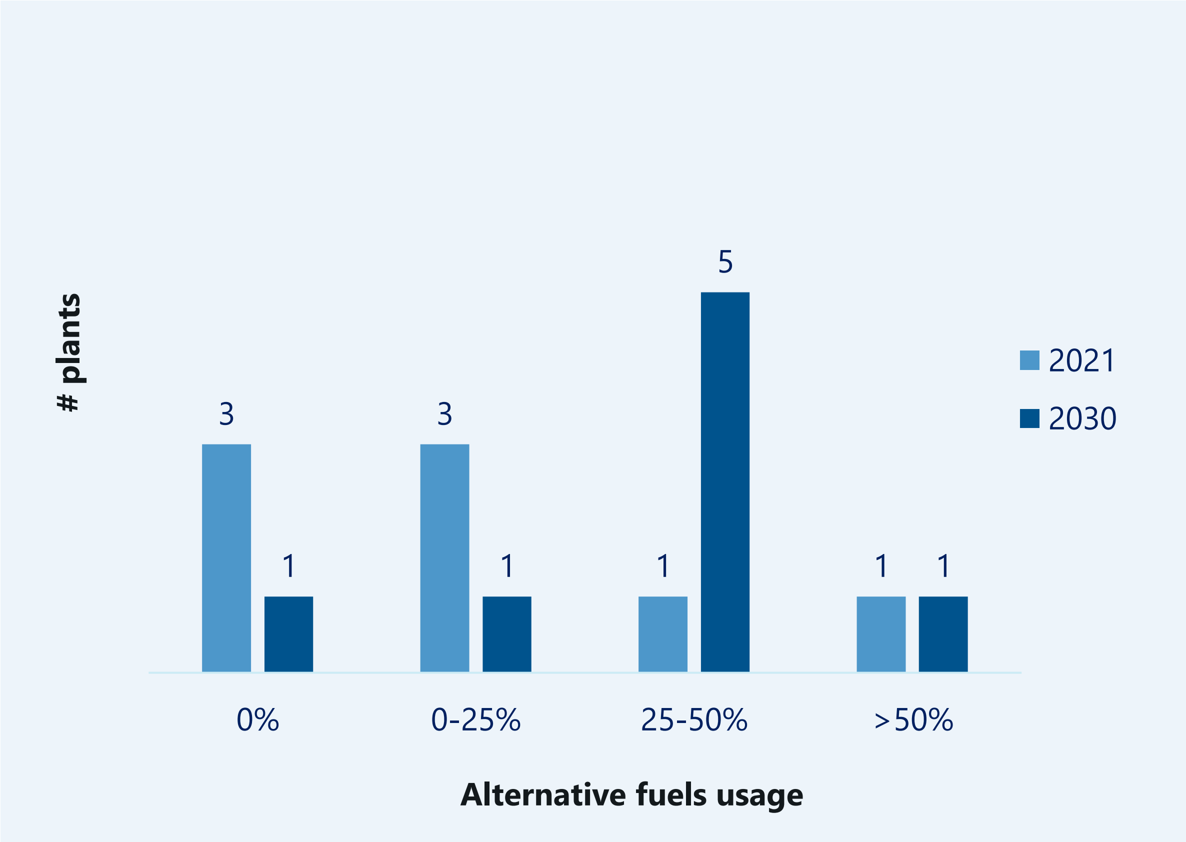
~ 52 m$

Thermal substitution

Up to 30%

Plants with alternative fuels usage by 2030

7 (out of 8)



NATURAL GAS CONVERSION PROJECTS

Capital expenditure

~ **53 m$**

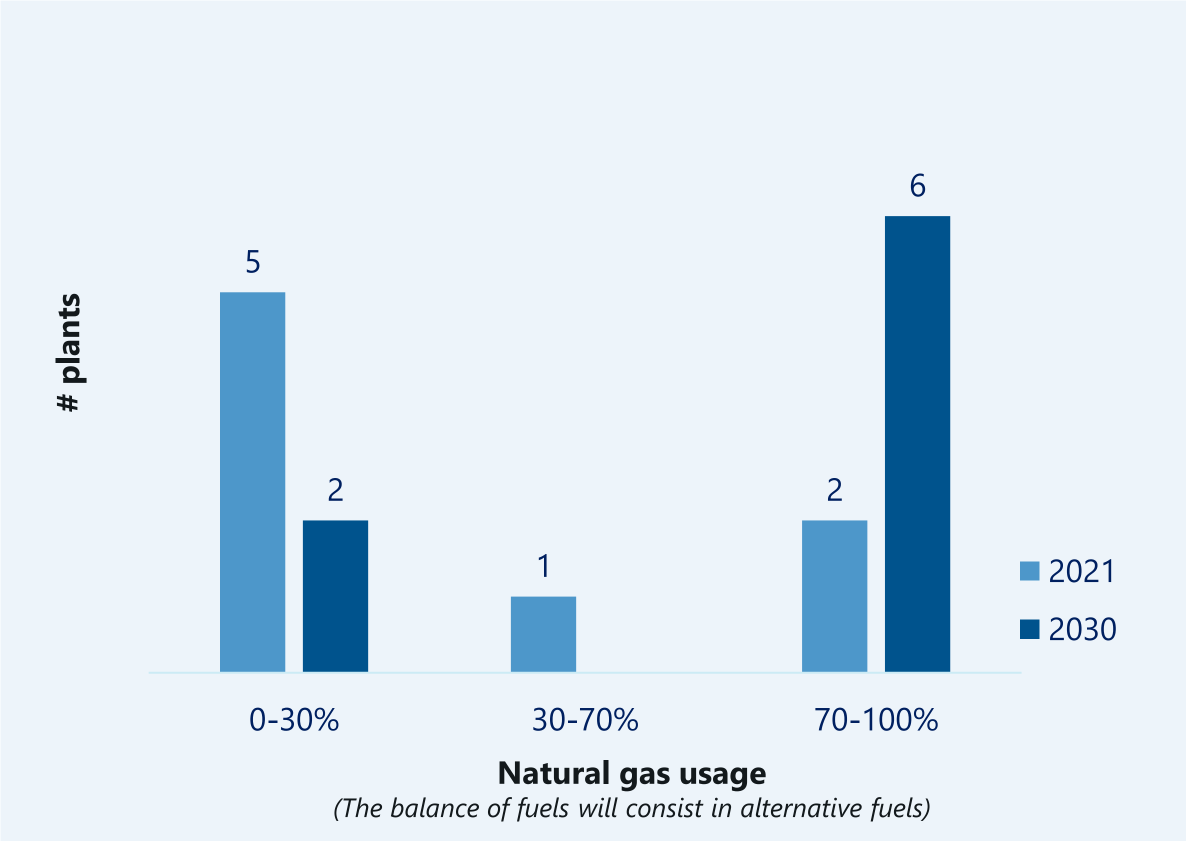
Fossil fuels* substitution with natural gas

Up to 70%

Plants with >70% of natural gas usage by 2030

6 (out of 8)

*mainly petcoke and coal



CAPEX REQUIREMENTS

~272 m$*

By 2030

>30

Initiatives in 8 plants

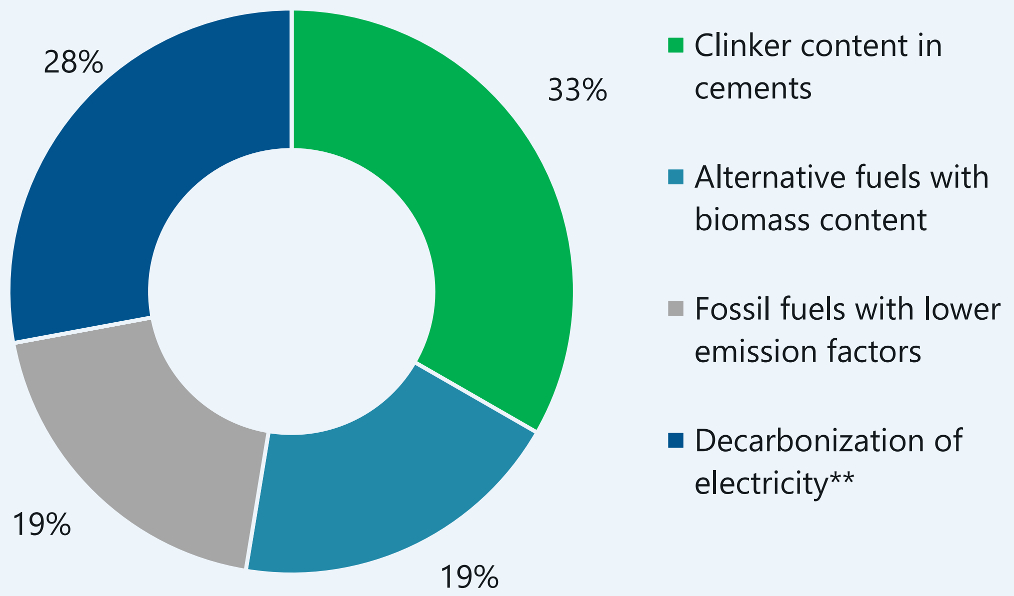
~69 m$

Photovoltaic and Wind Power Systems

*Not considering CCUS Pilot Test projects

CAPEX BREAKDOWN BY LEVERS

(scope 1+scope 2)



**Including: photovoltaic and wind mill projects

CO_2 EMISSIONS BY 2030

Scope 1 Net CO_2 emissions

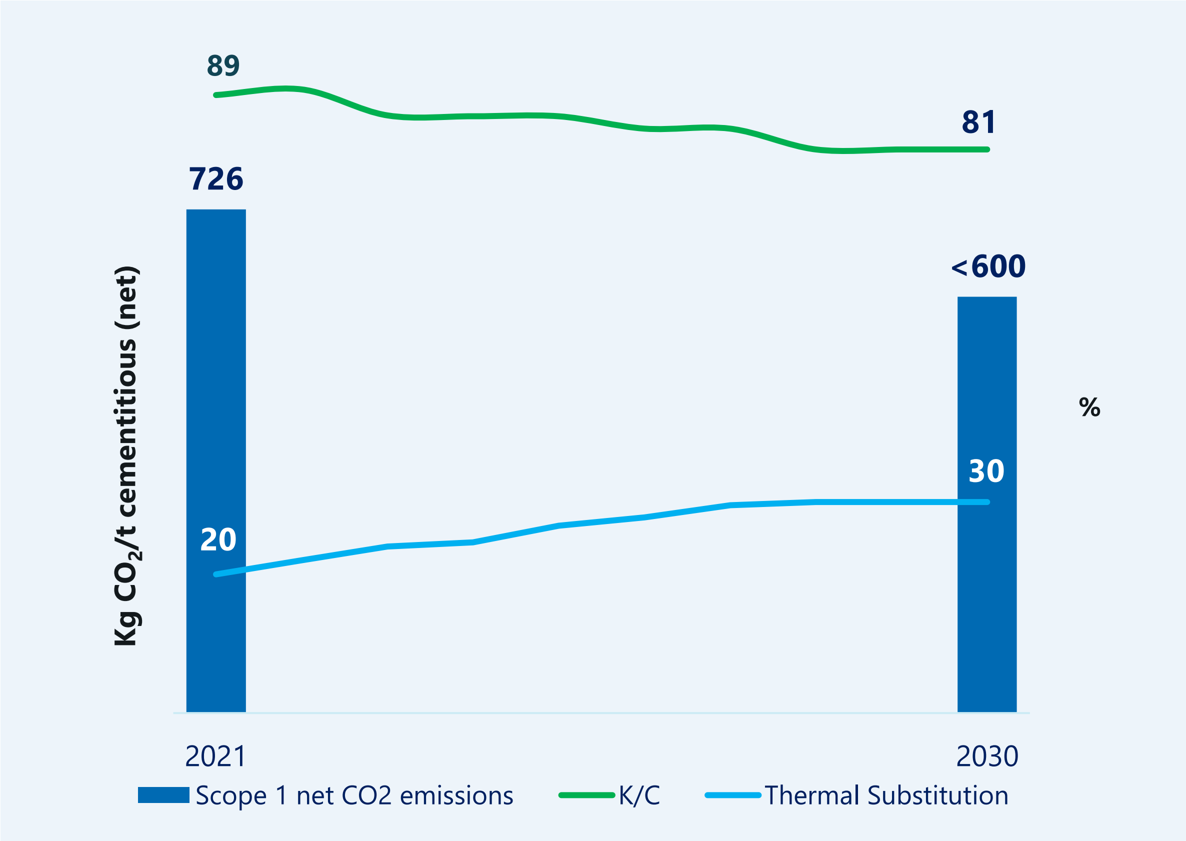
<600 kg CO_2/t. cem.ious prod.

Clinker content in cements (K/C)

81% vs 89% in 2021

Alternative fuels with biomass content (thermal substitution)

30% vs 20% in 2021



CARBON CAPTURE PILOT TEST PROJECTS

FACILITIES UNDER CONSIDERATION FOR IMPLEMENTING PILOT TESTS

- Maryneal, TX: closest to CO_2 sequestration site. 4th largest BU plant in USA
- Festus, MO: closest to CO_2 sequestration site. Largest BU plant in USA

TECHNOLOGIES UNDER EVALUATION FOR PILOT TESTING

- Solvent scrubbing
- Membrane separation
- Solvent-Sorbent Hybrid scrubbing

ESTIMATED PROJECT DEVELOPMENT COSTS AND CAPTURE RATE

- Maryneal, TX: 10-15 USDm (capture rate: 15 t CO_2/day)
- Festus, MO: 15-30 USDm (capture rate: 42 t CO_2/day)

PARTIAL FUNDING FROM US DEPARTMENT OF ENERGY

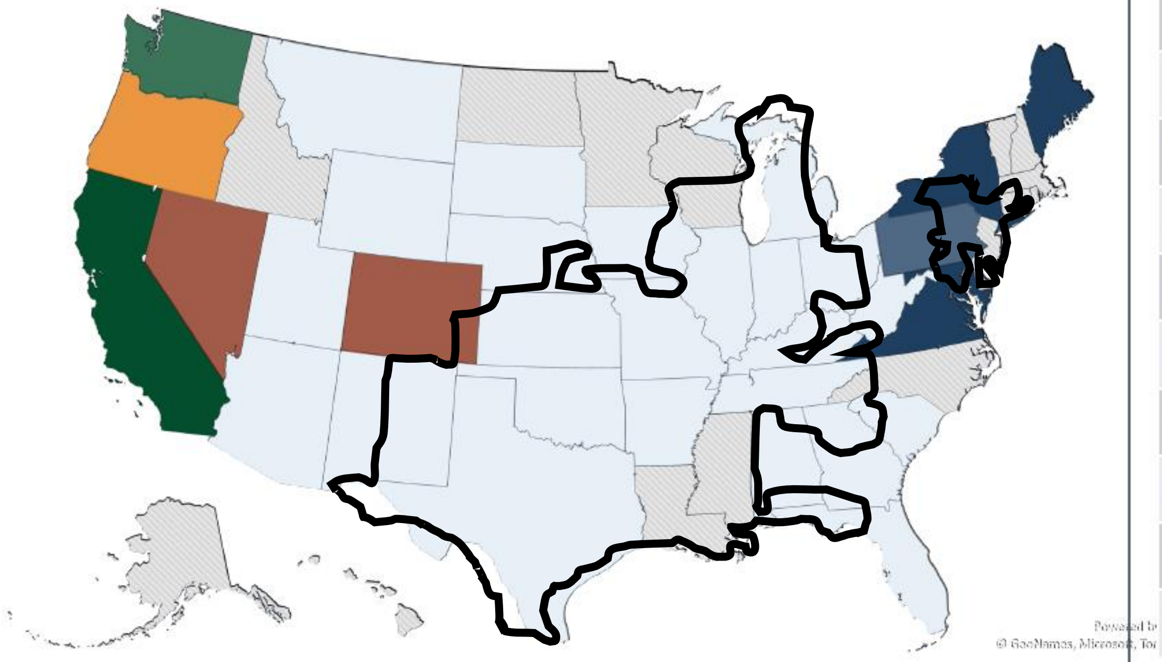
Planning to apply for partial funding from the US Department of Energy Grant Program

R&D grant could cover up to 80% of the pilot project cost

POLICY TRENDS

CARBON POLICY TRENDS OCCURRING ACROSS THE U.S.

Climate Action Plans and Emissions Trading Systems Active in PCA Member States*



- Climate Action Plan + WCI
- Climate Action Plan + WCI Pending
- Climate Action Plan + RGGI
- Climate Action Plan + RGGI Pending
- Climate Action Plan + Cap-and-Trade Pending
- Climate Action Plan Only
- None
- No PCA Members

State	Emissions Reduction Targets
Pennsylvania	No Targets
California	40% below 1990 by 2030**
Maryland	40% below 2006 by 2030
Oregon	75% below 1990 by 2050
Maine	80% below 1990 by 2050
New York	85% below 1990 by 2050**
Colorado	90% below 2004 by 2050
Nevada	Near-zero emissions by 2050
Washington	Net-zero by 2050
Virginia	Net- zero by 2045

* Picture-in-time as of February 28, 2022

** Currently developing Scoping Plan

INITIATIVES BY GEOGRAPHIC AREA

ITALY

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ROADMAP ITALY

EXECUTIVE SUMMARY

PRODUCT INNOVATION – C GREEN PUSH

C-Green cements are more sustainable and circular with up to 70% of recycled materials and lower clinker content

C-Green up to 60% of the volumes by 2030 (2x compared to 2021)

LOWER CLINKER CONTENT AND MORE FOSSIL FUELS SUBSTITUTION ARE KEY

- K/C from 77% to 65%
- 3x more alternative fuels utilization (from 17% to 48%)
- Fossil fuels substitution with natural gas (up to 30%)

AMBITIOUS CAPEX PROGRAM TO FUEL THE TRANSITION

Planning to invest ~170 million euros with more than 30 initiatives over the period

Significant focus on investment in renewables, aiming to both decarbonize electricity and to hedge power inflation

SCOPE 1 CO_2 EMISSIONS NET <500 Kg CO_2/ t. cem.ious prod.

Commercial and capex initiatives will lead to a significant reduction of CO_2 emissions

C-GREEN PUSH: PRODUCT PORTFOLIO DEPLOYMENT

CEM I:

- Stop of CEM I 42,5R by 2022, moving to CEM II/A-LL 42,5R
- Progressive introduction of CEM II/A-LL 52,5 from 2023)

CEM II:

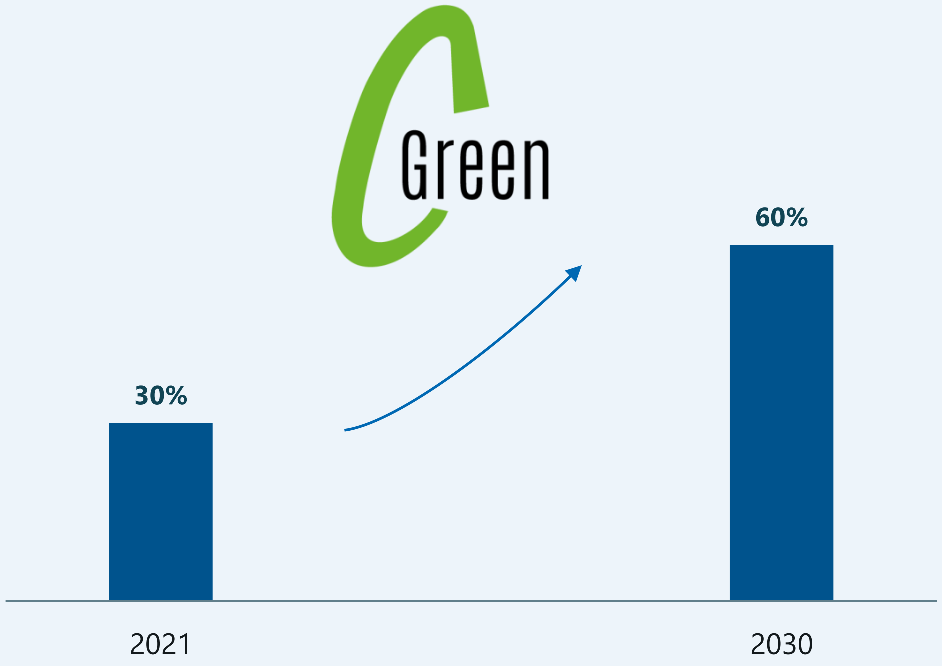
- 42.5 from II/A-LL to II/B-LL
- II/C-M with slag or natural puzzolan + limestone

CEM III:

- Short term volume increase
- Subs. of III/A with II/C-M by 2025/26

CEM IV & V:

- Substitution of fly ashes with natural puzzolan
- Introduction of CEM V/A (S-P)



C Green share on product mix

MAIN TECHNOLOGICAL ACTIONS TO REDUCE CO_2

LOWER CLINKER CEMENT

- New generation of admix developed with producers
- Incremental usage of SCM
- Composite cements by separate grinding

FOSSIL FUELS SUBSTITUTION

- RDF fuels new lines
- Introduction of biogenic dried sewage sludge
- Natural gas substitution (up to 30%)*

DECARBONATED AND MINERALIZING RAW MATERIALS

- Bypass dust washing to reduce Cl content recirculation and subsequent CO_2 recovery
- Usage of electric arch steel slag as supplementary raw meal material
- Fluorite usage to reduce burning T° and fuel consumption

OTHER TECHNOLOGICAL MEASURES

- DeCONOx installation to reduce CO/COT to support incremental usage of alternative fuels
- Scope 2 measures:
  - Photovoltaic systems
  - Waste Heat Recovery installation**

**subject to market conditions*
*** in selected plants*

CAPEX ALLOCATION TO CO_2 RELATED PROJECTS

~173m€

By 2030

>30

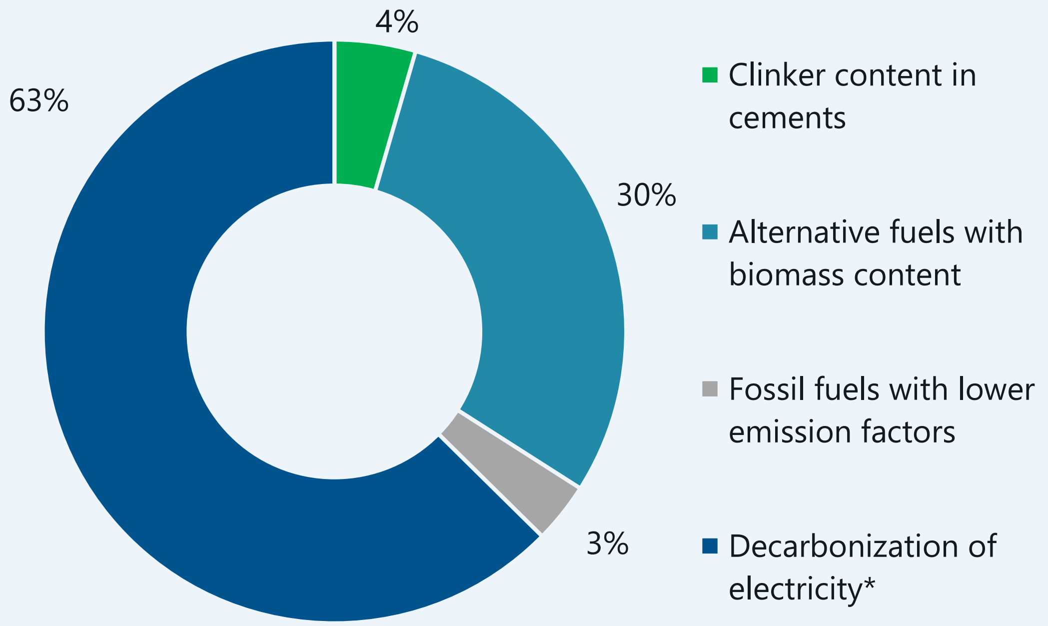
Initiatives in 9 plants

~62m€

Photovoltaic System

CAPEX BREAKDOWN BY LEVERS

(scope 1+ scope 2)



Including: PV projects and WHR

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PV PROJECTS SUMMARY:

«NATURALLY» HEDGING THE RISK

>29

Initiatives

~177 GWh

RES generation

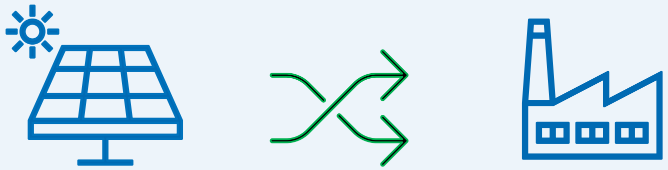
~573 GWh

2022 BGT consumption

~31%

RES coverage

OPTIONS TO IMPLEMENT THE RENEWABLE ELECTRICITY STRATEGY



- On site and near site generation
- Off- site PPA
- Grid incentives (auction at fixed price)
- Purchasing renewable certificates

CO_2 EMISSIONS BY 2030

Scope 1 Net CO_2 emissions

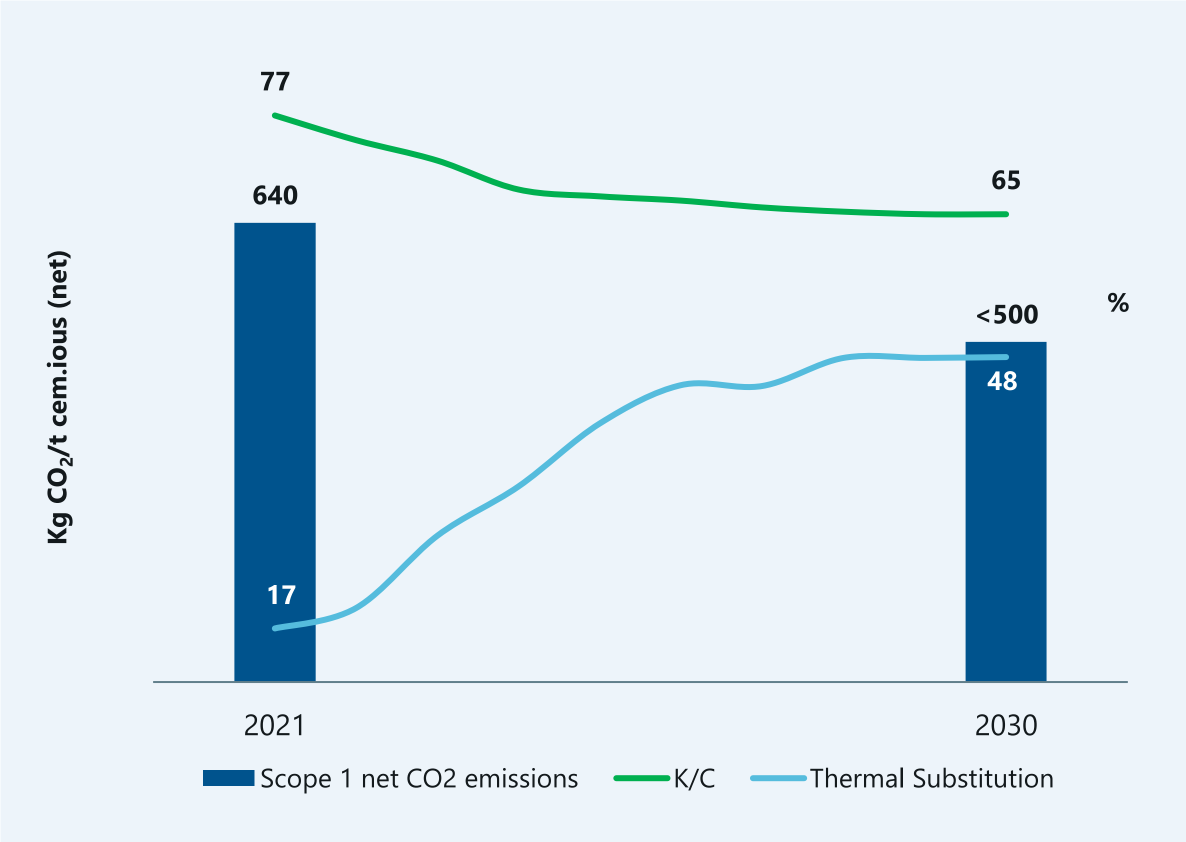
<500 kg CO_2/t. cem.ious

Clinker content in cements (K/C)

65% vs 77% in 2021

Alternative Fuels with biomass content (thermal substitution)

48% vs 17% in 2021



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INITIATIVES BY GEOGRAPHIC AREA

BRAZIL

CO_2 EMISSIONS BY 2030

Scope 1 Net CO_2 emissions

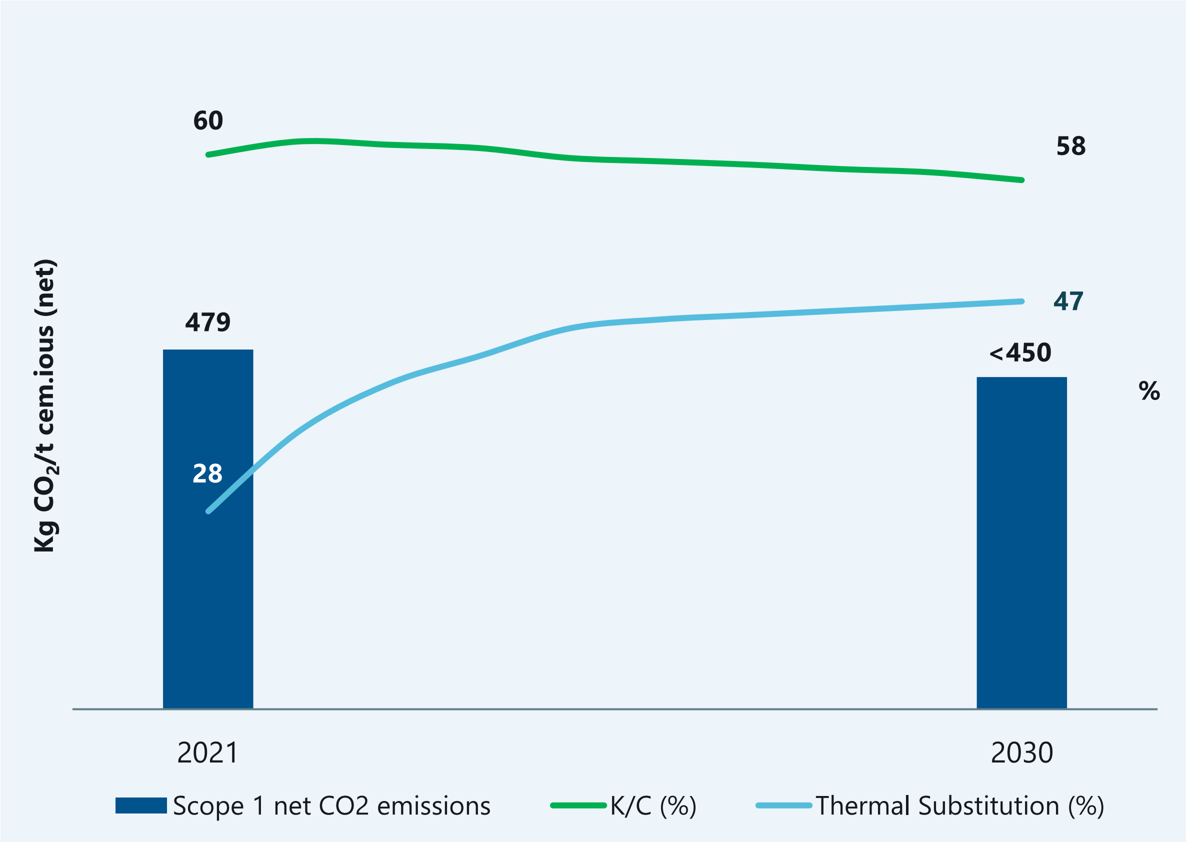
<450 kg CO_2/t. cem.ious

Clinker content in cements (K/C)

58% vs 60% in 2021

Alternative Fuels with biomass content (thermal substitution)

47% vs 28% in 2021



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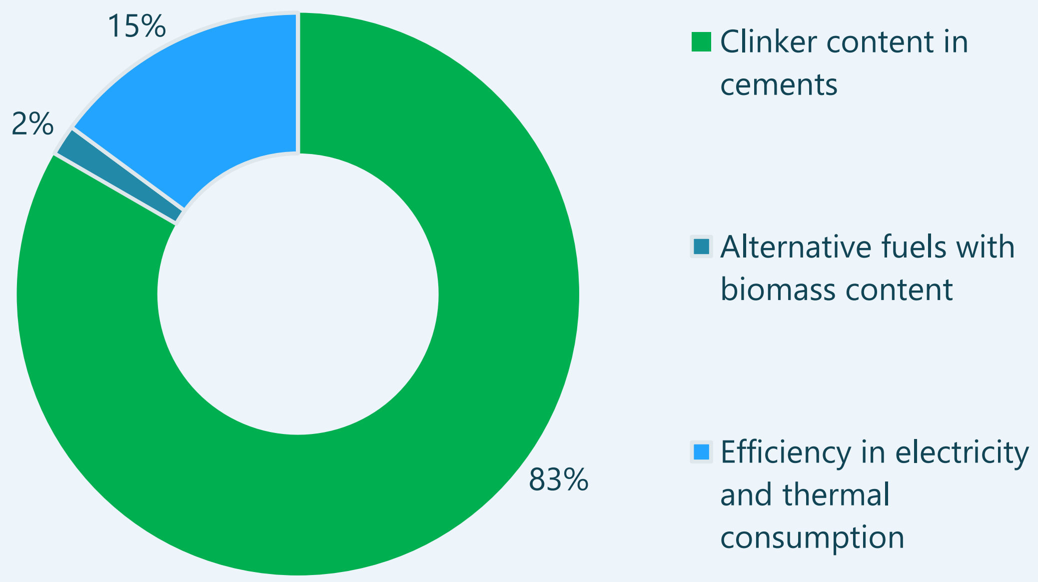
CAPEX REQUIREMENTS

~ 72 m€

By 2030

CAPEX BREAKDOWN BY LEVERS
(scope 1+scope 2 initiatives)



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INNOVATIVE TECHNOLOGIES TO ACCELERATE DECARBONIZATION

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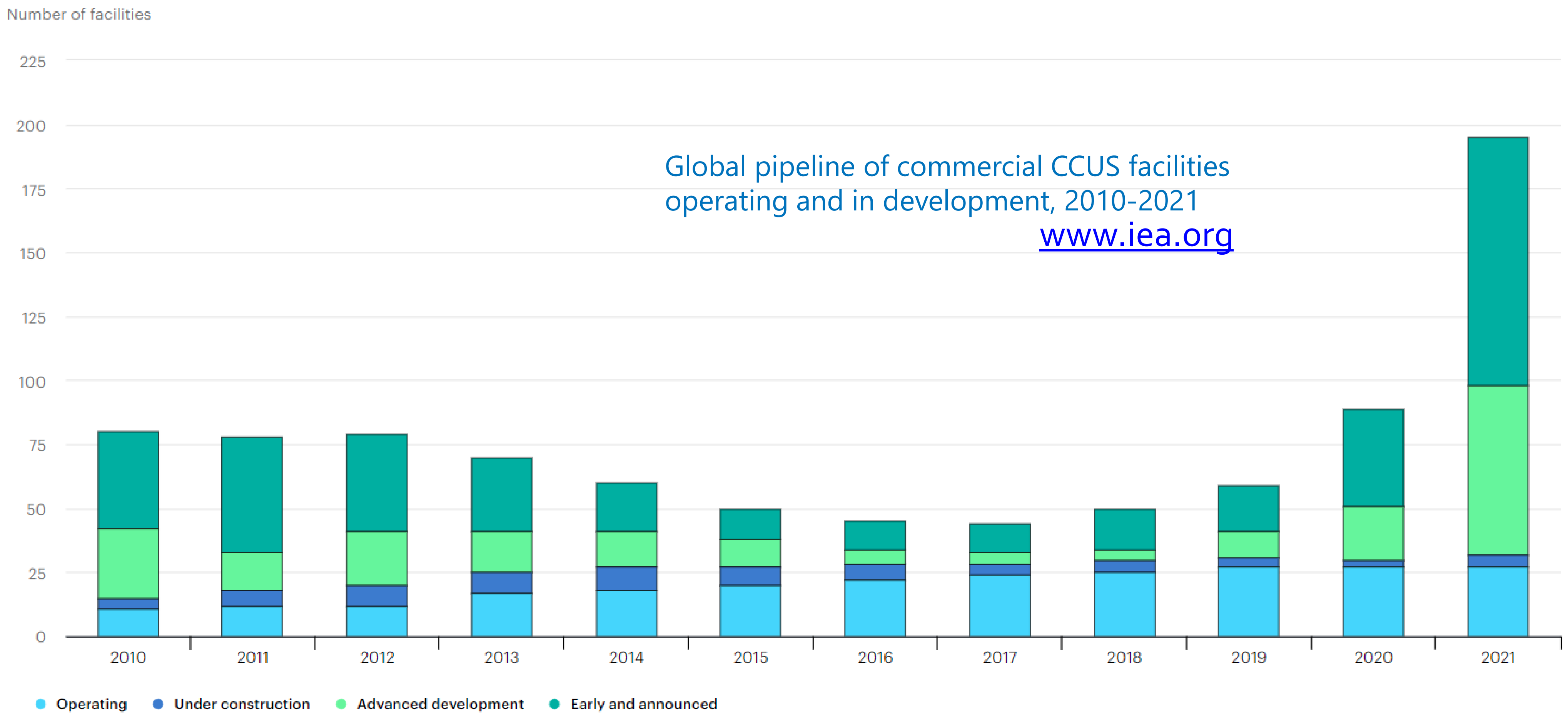
CCUS FACILITIES DEVELOPMENT



Global pipeline of commercial CCUS facilities operating and in development, 2010-2021
www.iea.org

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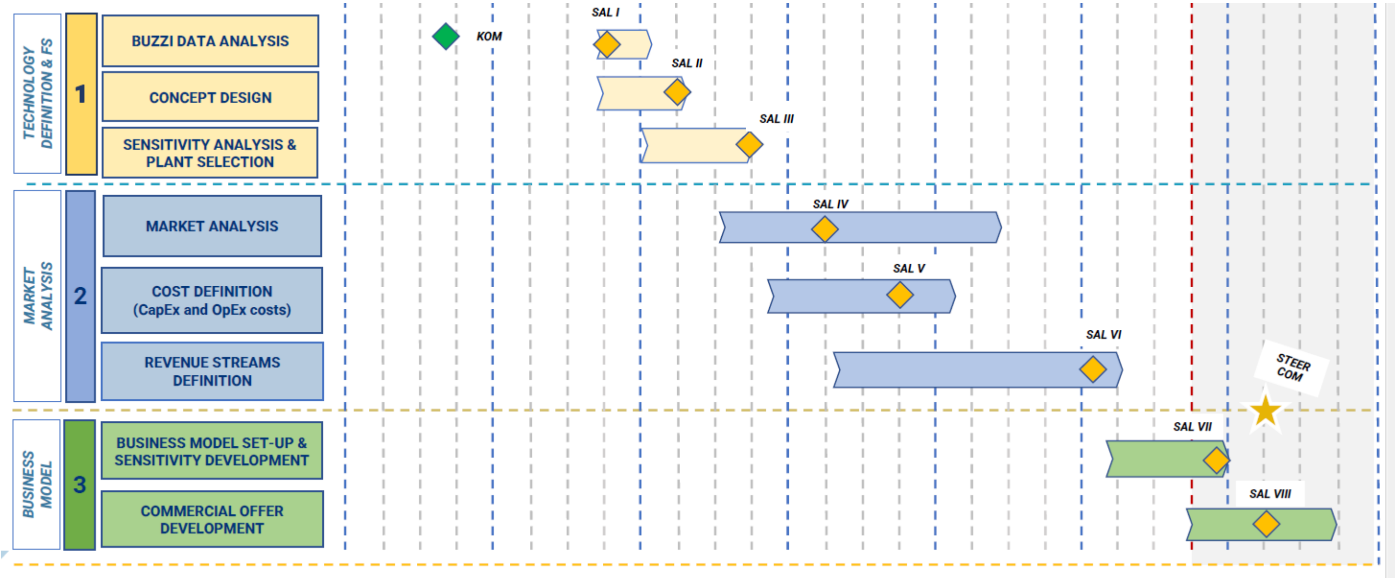
BUZZI UNICEM - ITALGAS FEASIBILITY STUDY

BUZZI UNICEM – ITALGAS: FEASIBILITY STUDY

- **Memorandum of Understanding** signed in December 2021
- **Scope of work**: Development of a feasibility study on the implementation of Power to Gas plants in combination with Carbon Capture Systems at Buzzi Unicem production plants
- **Target:** Italgas economic offer for the realization of the system assessed in the feasibility study at Buzzi Unicem production plants, in case of concrete opportunities for both parties in terms of feasibility and sustainability
- **Scientific advisor:** Politecnico di Torino
- **Project timeline:** Dec. 2021 – June 2022

- Main project steps:
  1. Technology definition
  2. Market analysis
  3. Business model development



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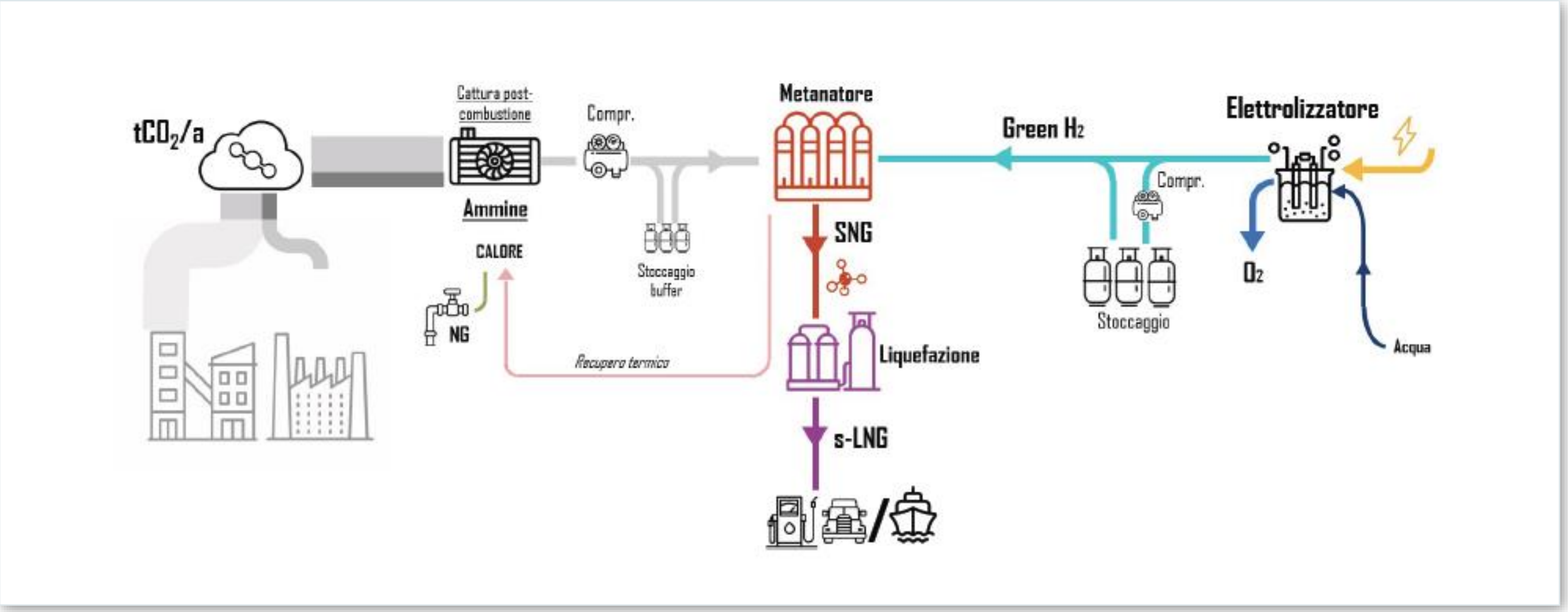
BUZZI UNICEM – ITALGAS: POWER TO GAS TECHNOLOGY



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DEUNA PLANT:
STUDY ON PARTIAL CO_2 CAPTURE

STUDY ON PARTIAL CO_2 CAPTURE DEUNA PLANT

CURRENT SITUATION AND BACKGROUND

Dyckerhoff is working with strong partners to decarbonize the Deuna plant

- **TES (Tree Energy Solutions)** offering a full solution to decarbonize the energy and process related emissions
  - Setting up the LNG, green gas, CO_2 terminal in Wilhelmshaven "AvantHy"
  - Building the CO_2 network in Germany together with its partner OGE
- **OGE (Open Grid Europe)**
  operating the largest gas transmission network in Germany
  - 12.000 km pipelines for gas
  - 30 compressor stations (1.000 MW_{total}), 111 GW peak load and 654 TWh gas transported in 2020
  - 17 border crossings and 1.009 exit points

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CURRENT SITUATION AND BACKGROUND

TES offer TES

- TES is setting up a complete value chain which includes the terminal in **Wilhelmshaven** near the Jade bay at northern seashore. This terminal will be connected to the gas-, CO_2-, and hydrogen pipeline network as well as the railway network.
- Together with **Rhenus**, TES offers to pick up CO_2 by train in 2026, latest 1st quarter of 2027
- In a first step, CCS is offered
- In a second step, the captured CO_2 will be used for CCU in a closed loop
    - Transport to the Middle East as a feedstock is foreseen.
    - The CO_2 will be used to produce "green CH4" out of "green H2" using the high solar energy potential in this region
    - Methane (CH$_4$) will return to Europe with the same ships.

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STUDY ON PARTIAL CO_2 CAPTURE DEUNA PLANT

WHAT IS IN FAVOR OF DEUNA?

Deuna plant has the most promising preconditions for a (partial, post combustion) CO_2 capture unit

- High raw material reserves, good permission situation, high acceptance in the region
- Good space situation for the big footprint of a CPU
- Comparable high CO_2 content in the stack (own stack for the clinker cooler air vent)
- Powerful energy supply acc. to the plant history
- Large train station and rail lines
- **Existing LOI** with a partner who will be able to pick up CO_2 in near future
- Good geological preconditions also for CCS close to the plant, if it will be politically feasible

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STUDY ON PARTIAL CO_2 CAPTURE DEUNA PLANT

SCOPE OF THE PROJECT

The project target is to do a comprehensive feasibility study, cost calculation and timetable considering:

- Existing process figures
- Define the optimal reduction rate taking a potential future expansion into account
- Integration of only one or both kilns?
- Cost estimation for Capex and Opex

From today point of view, a **post-combustion CO_2 capture** system will be chosen among the industrial readily available capture technology, i.e. **Amine based** or **Cryogenic** Techn.

First CO_2 delivered by train expected in 2026, latest 1st quarter of 2027
followed by potential full CO_2 capture and transport by pipeline to Wilhelmshaven

CI4C:
OXYFUEL CO_2 CAPTURE TECHNOLOGY

CI4C – ''PURE OXYFUEL"

"OXYFUEL" def.: combustion of fuel by replacing air (ca. 21% O_2 + 79% inert components: N_2, Ar) with pure oxygen as oxidizer

- **CI4C** - **C**ement **I**nnovation **F**or **C**limate: J.V. of four partners
- The **catch4climate project** is intended to create the conditions for the large-scale use of CO_2 capture technologies in cement plants
- First application of so-called "Pure Oxyfuel" technology in the cement production process
- Significant improvement in CO2 capture potential from flue gas expected at much lower electricity costs
- The long-term goal is to establish a process for complete and cost-efficient capture of CO2 emissions from a cement plant.
- Technology provider is TKIS (Polysius)

The EPC contract with TKIS was recently signed.

Joint Venture: HEIDELBERGCEMENT, Dyckerhoff, CI4C, VICAT, SCHWENK

Project: catch4climate

CI4C – ''PURE OXYFUEL"

PILOT PLANT (450 TPD) IN MERGELSTETTEN (SCHWENK Cement Plant, South Germany)

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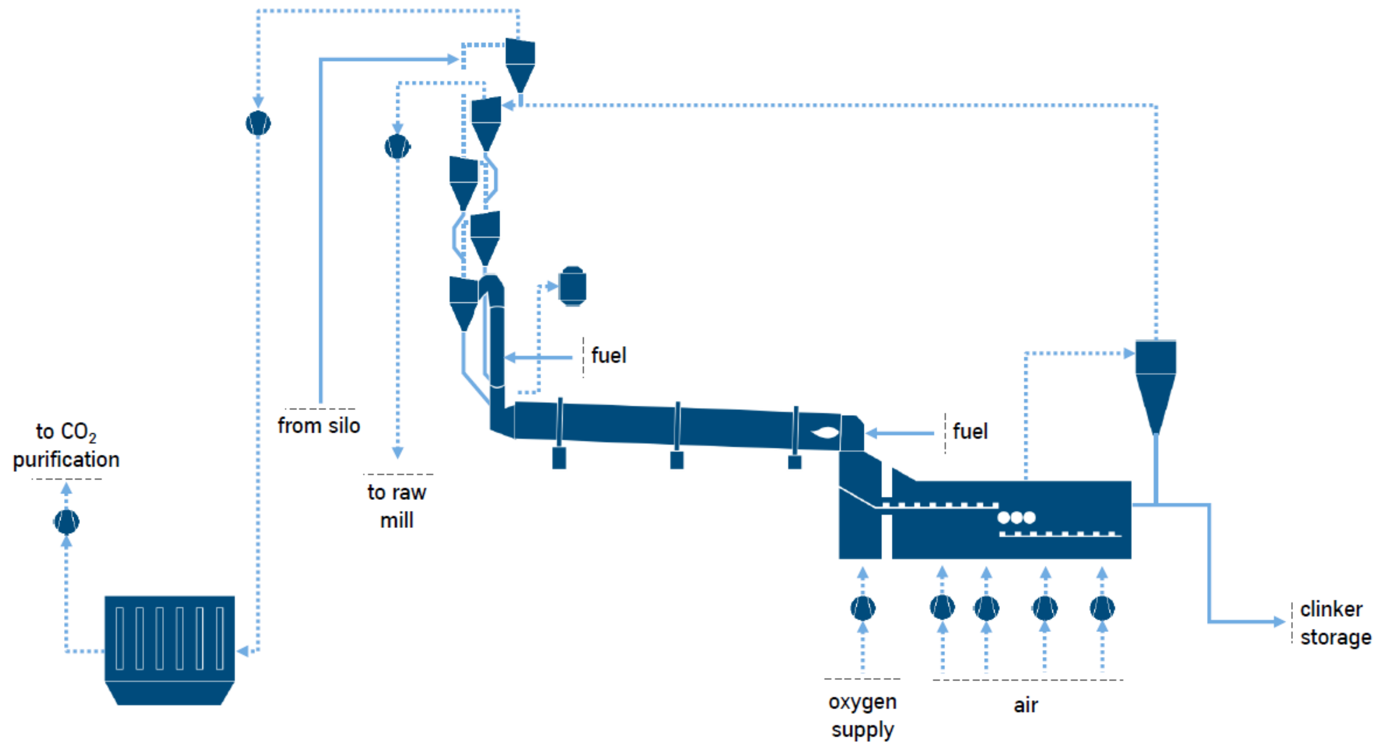
CI4C – "PURE OXYFUEL" vs 1st gen. Oxyfuel

OPPORTUNITY (according to TKIS)

- Smaller structure (lower CAPEX and OPEX)
- Smaller gas volume in pre-heater
- Higher CO_2 concentration in the raw gas
- Clinker cooler waste air can be used for raw milling process



- No recirculation
- No tertiary air duct
- No CO_2 in the cooler
- No gas-gas heat exchanger
- No condenser
- No additional auxiliaries

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VERNASCA PLANT:
CLEANKER PROJECT CA-LOOPING TECHNOLOGY

THE CLEANKER PROJECT

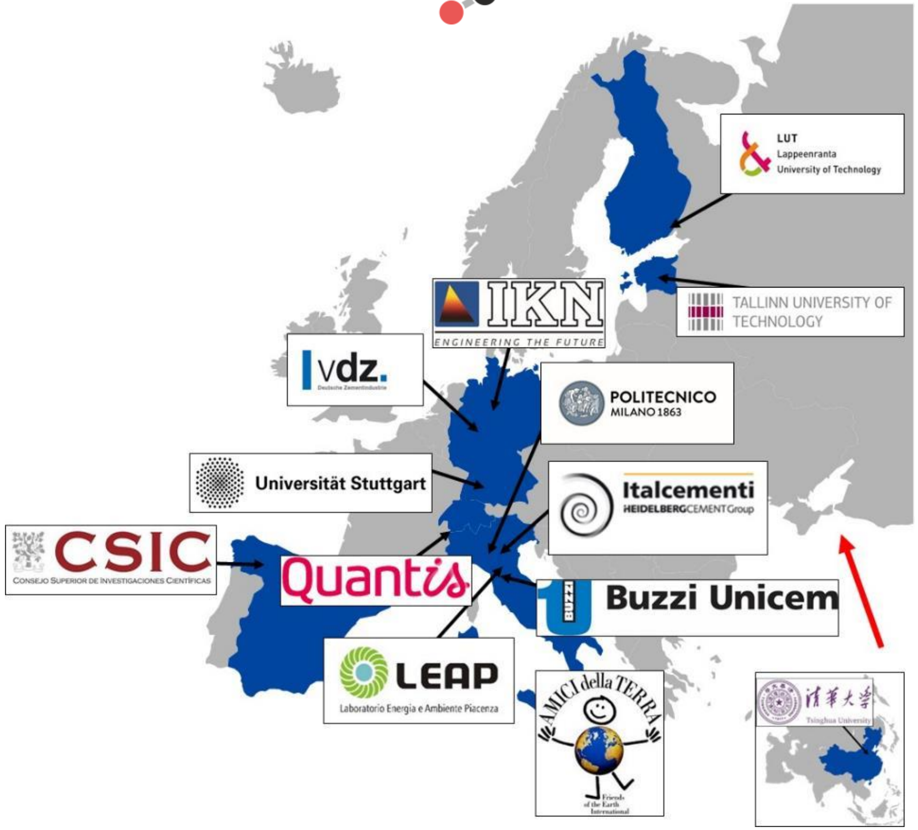
CLEAN clinKER by calcium looping for low-CO_2 cement

CLEANKER

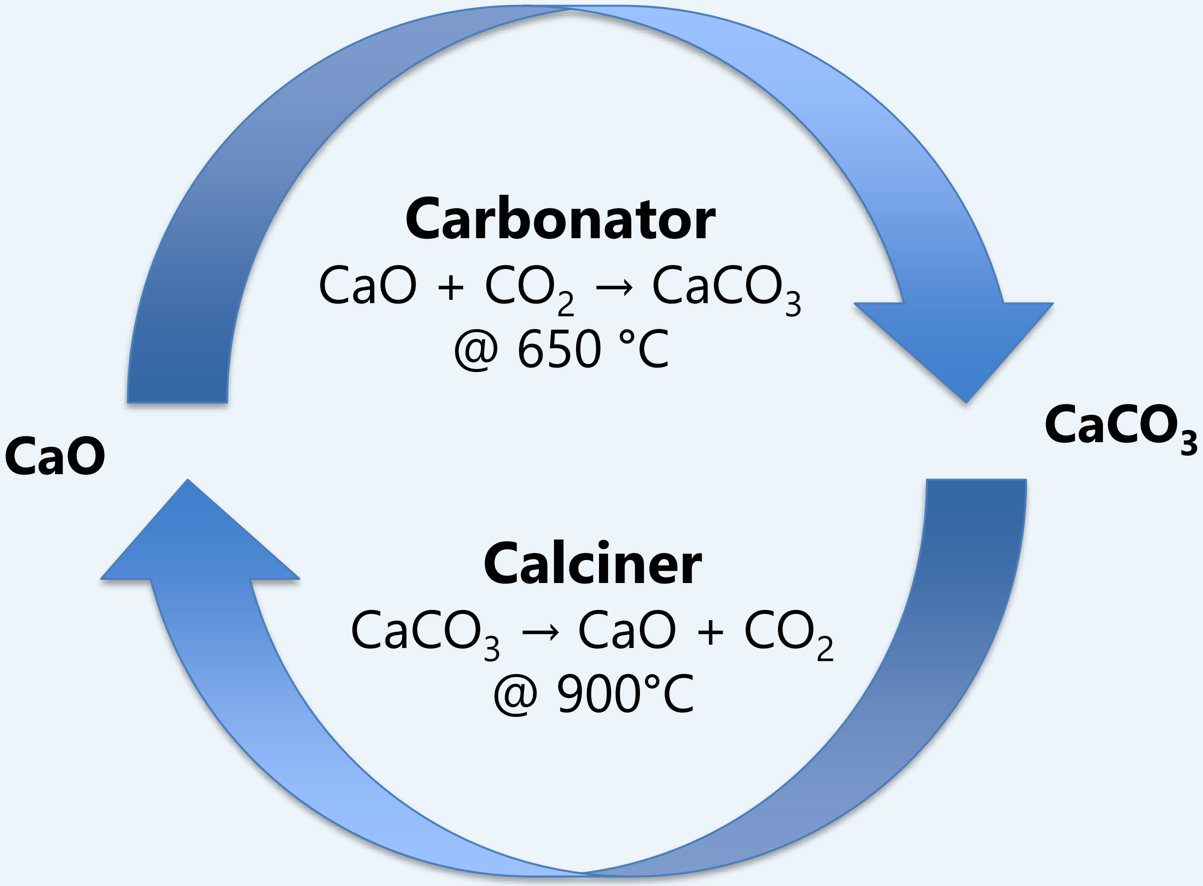
- Ultimate objective: **advancing the integrated Calcium-Looping (CaL) process** for **CO_2 capture in cement plants**

- Primary targets:
  - **Demonstrate the integrated CaL process at TRL 7**, in a new demo system connected to the operating cement burning line of **Vernasca** cement plant
  - **Demonstrate the technical-economic feasibility** of the integrated CaL process in **retrofitted large scale cement plants** through process modelling and scale-up study.

- Starting date: October 1st 2017
- Duration: 4 years + 1.5 years extension (Covid-related delays)
- End date: March 31st 2023
- Partner: 13 from 5 EU member states + Switzerland and China



CALCIUM LOOPING WORKING PRINCIPLE



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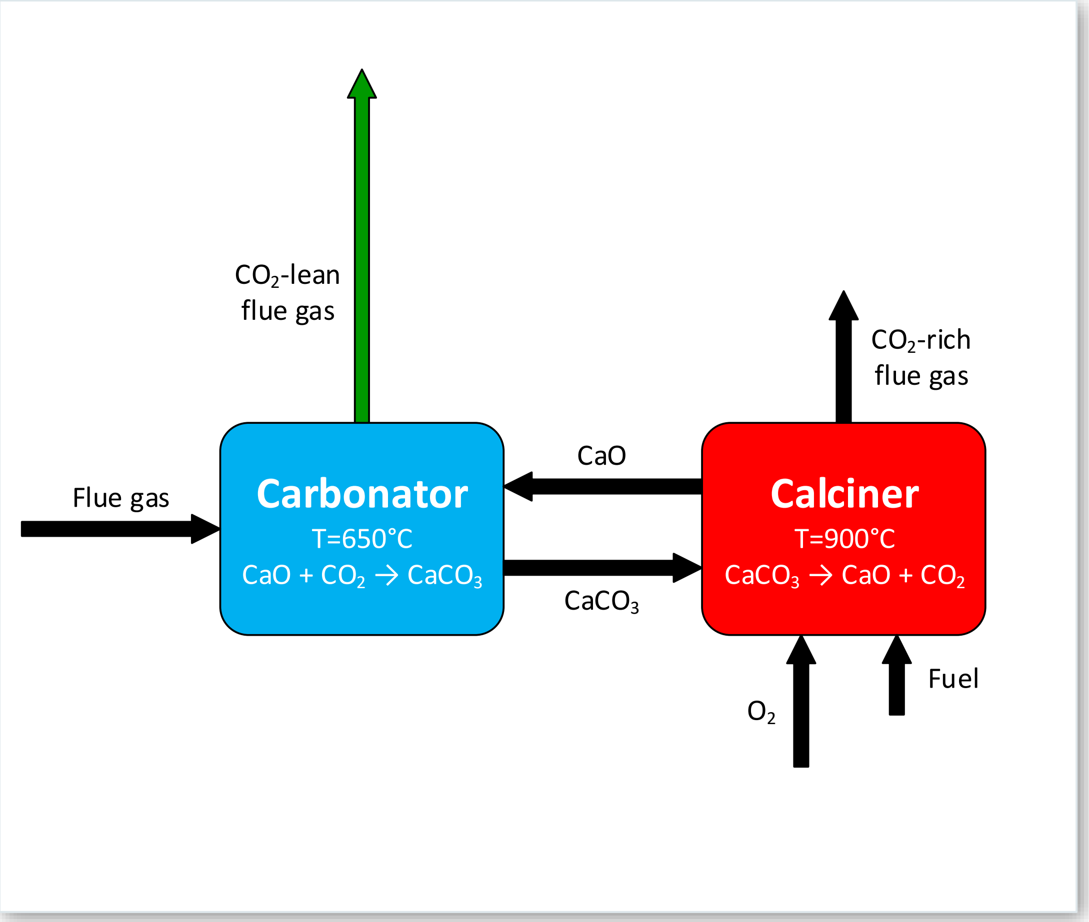
CALCIUM LOOPING WORKING PRINCIPLE



- Flue gases enter the **Carbonator** together with **CaO**, which acts as a **selective CO_2 sorbent**
  Carbonation reaction:
  $CaO + CO_2 \rightarrow CaCO_3$ @ 600 – 650 °C

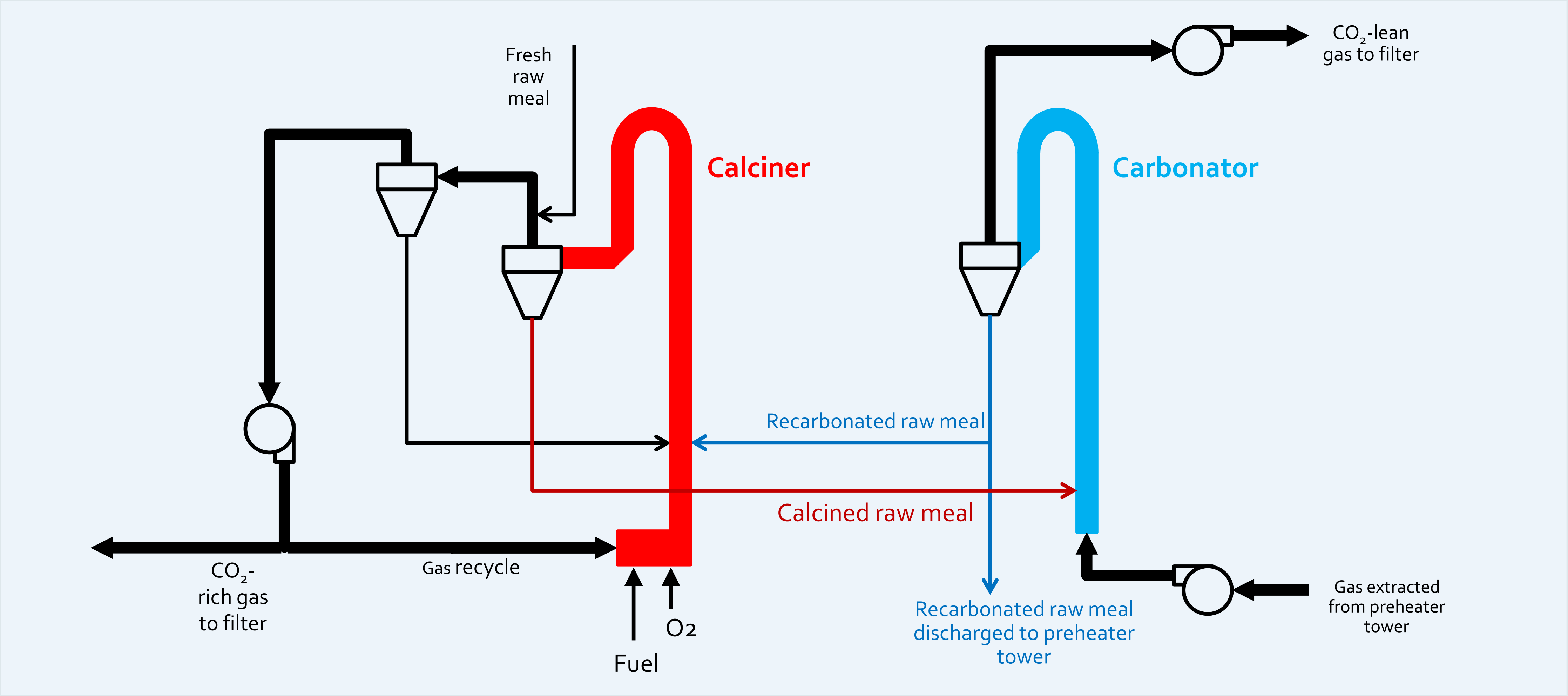
- **CO_2 is removed** from the flue gases and bonded into **$CaCO_3$**

- The **CaO** is produced in the **Calciner**, where the opposite reaction takes place and the captured CO_2 is released
  Calcination reaction:
  $CaCO_3 \rightarrow CaO + CO_2$ @ 900°C

- **Heat** is provided by **Oxy-fuel combustion**
  → **Combustion gas is very rich in CO_2** (no N_2 dilution)

- Continuous **$CaCO_3$ make-up** and **CaO purge** are needed to counteract CaO **deactivation as a CO_2 sorbent**

CALCIUM LOOPING – VERNASCA PILOT PLANT



THE EXPERIMENTAL CAMPAIGNS

- **9 experimental campaigns** foreseen:
  - **5 short tests**: one week each, non-continuous operation, test of several operating points
  - **4 long tests**: one week of continuous operation each

→ The aim of the short tests is to identify the most attractive operating conditions for the longer test runs

4 weeks of short tests have been carried out

- Test of **air-fired calcination** at first, then **oxyfuel calcination**
- Evaluation of the **impact of the main governing parameters**:
  - Flow rate of fresh raw meal to the calciner
  - Flow rate of recarbonated raw meal recycled to the calciner
  - Gas flow rate at carbonator inlet
  - Calciner outlet temperature
  - Temperature of calcined raw meal entering the carbonator
- Main results to assess the performance of the system:
  - **Loss On Ignition (LOI)** of samples from calciner and carbonator outlet
  - **Gas composition (CO_2, O_2)** at calciner outlet, carbonator inlet and outlet

CONCLUSIONS AND NEXT STEPS

- The pilot produced consistent data showing that CO_2 capture actually takes place in the Calcium Looping system
- Oxyfuel calcination has been tested and managed for a significant number of hours

- The data obtained in the short tests carried out in the last weeks are currently being analyzed, with the following main targets:

  → To assess the impact of the governing parameters on the overall performance of the system

  → To define the most interesting operating windows to be verified in the long tests

  → To simulate the performance of a full-scale Calcium Looping system

CO_2 CAPTURE - KPI

KEY PERFORMANCE INDICATORS FOR CO_2 CAPTURE

- The KPIs listed below are calculated for any new process () by comparison with a reference process (), i.e. the state-of-the-art clinker production process

- **SPECCA**: Specific Primary Energy Consumption per CO_2 Avoided
  - Both thermal energy and electricity are expressed as primary energy,
  - Equivalent CO_2 emissions are considered, i.e. the sum of direct and indirect (electricity production) emissions,

- **CCA**: Cost of CO_2 Avoided
  - It is calculated starting from the difference in clinker production cost

CO_2 CAPTURE TECHNOLOGIES COMPARISON

		Chemical absorption	Oxyfuel	Integrated Calcium Looping	Pressure Swing Adsorption
Additional thermal consumption		1’000 – 3’000	0	2’100 – 2’400	0
Additional electricity consumption		30 – 120	150 – 200	40 – 60	300 – 450
SPECCA		3.7 – 7	1.6 – 2.2	3.1 – 4.4	3.2 – 5
CCA		55 – 80	40 – 60	50 – 70	40 – 70

Steps considered in the table above:

- CO_2 capture
- CO_2 conditioning to meet specifications for pipeline/ship transport are considered

Steps not considered:

- CO_2 transport
- CO_2 utilization and/or storage

FINANCING NET ZERO

FINANCIAL ROADMAP AGENDA

ORGANIC GROWTH TO REMAIN POSITIVE

Demand to remain lively and prices trend to reflect the value appreciation along the value chain.

PROTECTING MARGINS THROUGH COST LEADERSHIP

Cost management along the value chain as key to provide competitive advantage.

Focusing on core business and flexibility to reach optimization in each region

RE-BALANCING THE CAPEX PORTFOLIO FOR THE TRANSITION

~750 million euros expected by 2030 to be allocated for transition projects.

~70-80 million euros p.a. allocated to CO_2 specific capex

STRONG FOCUS ON ROIC

Right mix in fast payback and strategic long term projects to drive capex selection and to preserve cash generation

FINANCING THE TRANSITION, WHILE PRESERVING FINANCIAL SOUNDNESS

Funding approach as a balanced mix of solid cash flows and working capital management, as well as external funding (debt or public subsidies)

Retaining sound investment grade profile.

MOVING TO THE NEXT PHASE, PRESERVING OUR AMBITIONS

Reducing CO_2 emissions will be a capital intensive effort but this will not change our ambitions to allocate cash to growth and shareholders

INDUSTRY LEADING PERFOMANCE THROUGH THE CYCLE

Net Sales

Solid growth fueled by sound demand, driven by residential, infrastructure needs and non-residential recovery.
CAGR (2010-2021): +2.2%

EBITDA

Over proportional growth to Net Sales, with EBITDA which has more than doubled compared to 2010

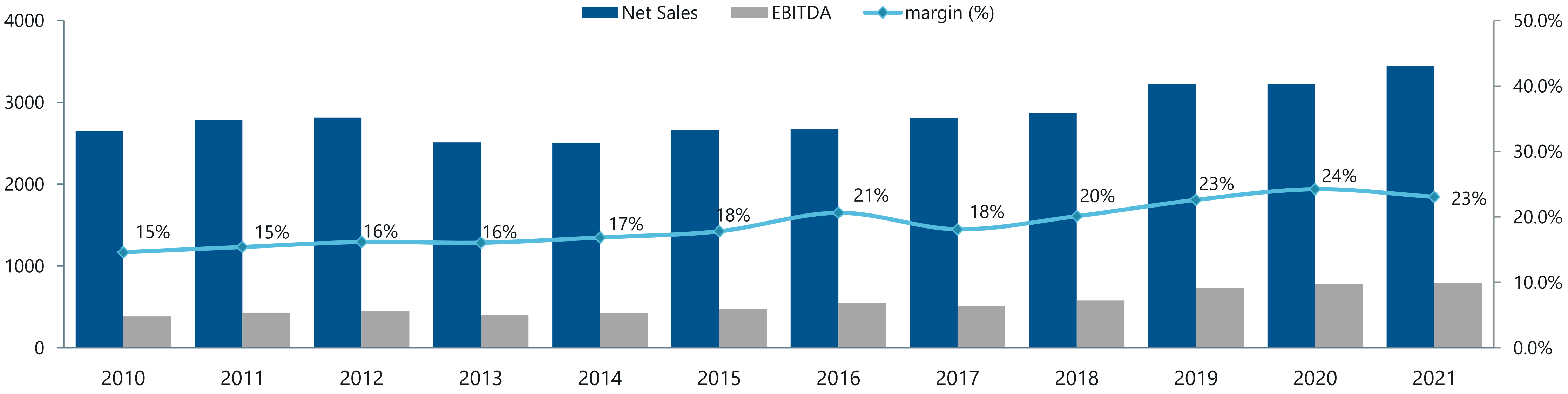
CAGR (2010-2021): +6.2%

EBITDA Margin %

Leading performance driven by cost efficiency and synergies

+800 bps vs 2010.

EURm



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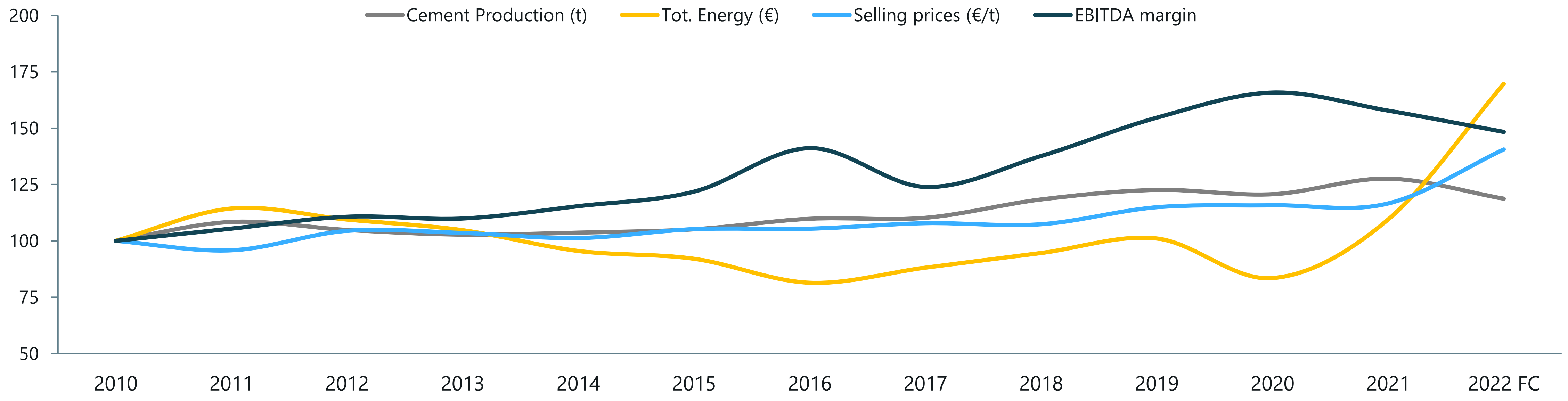
TRANSITION PRICE AND COST TRENDS

During the last decade, we have been able to pass through the higher costs on selling prices, protecting our margins

In 2022, margins are trending down impacted by significant energy inflation (+50/60% at a group level) but selling prices are following.

Over time, targeting to protect margins through better prices sensitivity and costs savings



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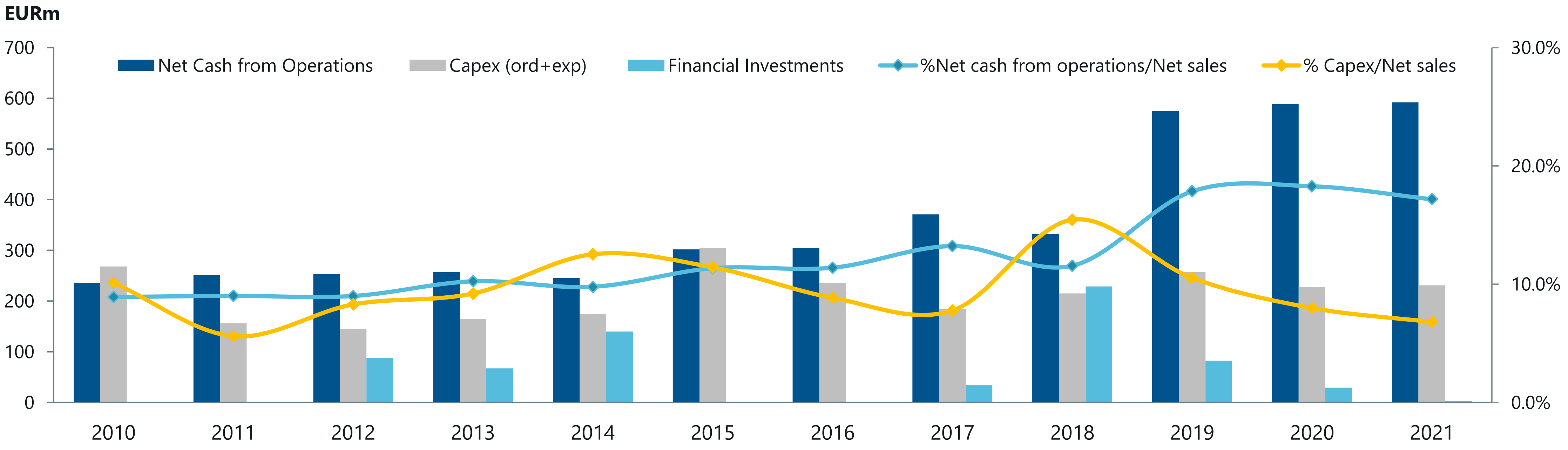
STRONG CASH GENERATION AND VALUE CREATIVE CAPITAL ALLOCATION

Over the last 10 years, we have invested 3.2 billion euros in our industrial assets, thereof ca. 700 million euros in special projects dedicated to installed capacity expansion and ca.700 million euros in equity investments

In the same period, we have invested ca. 700 million euros in equity investments, in order to enter in new countries (Brazil, 2018) and to strenghten our position in existing markets (Germany and Italy)

From 2010, we have generated strong cash flows from operations (ca. 4.3 billion euros) with a CAGR equal to +8%



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CAPEX REQUIREMENTS BY 2030

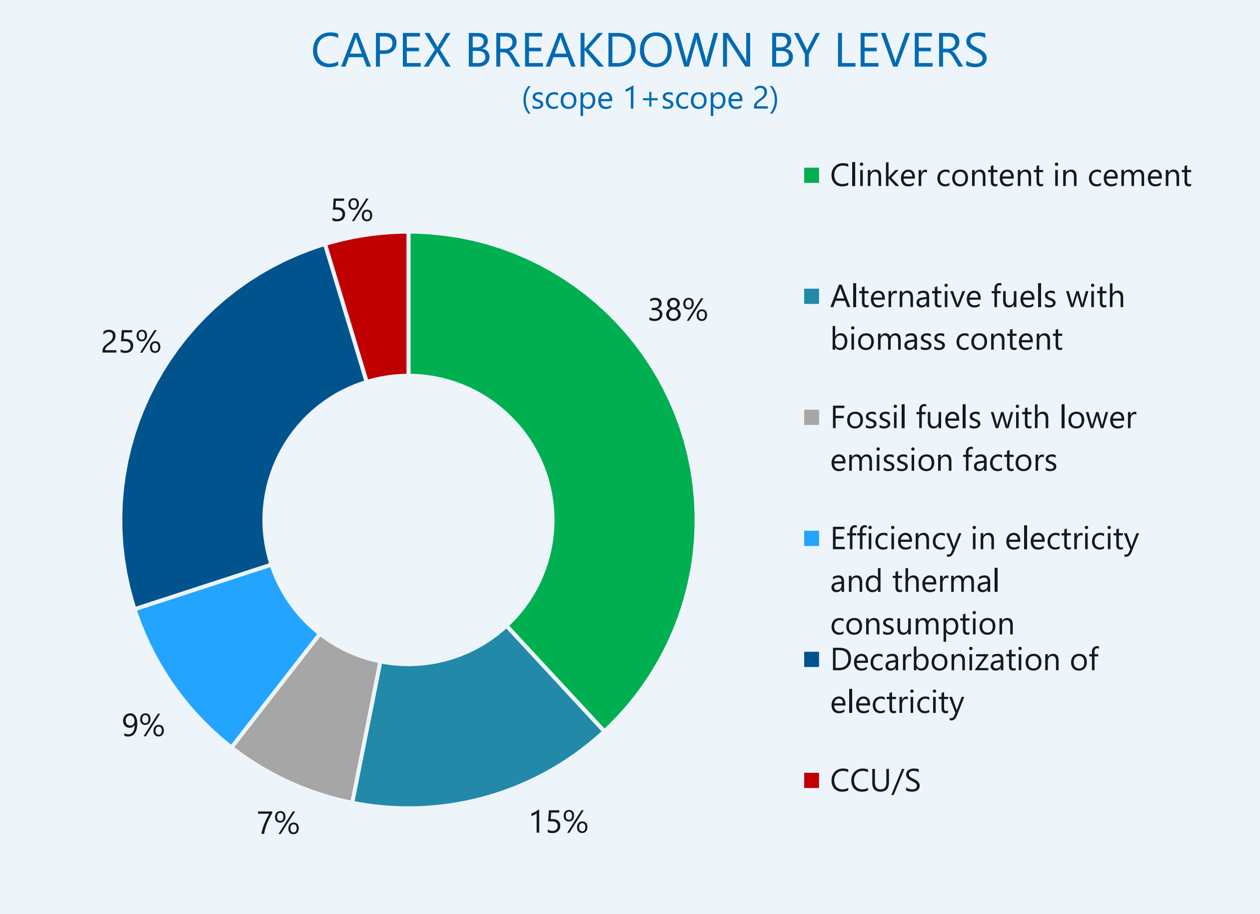
Expected capex requirements for 2030 target:

750 million euros

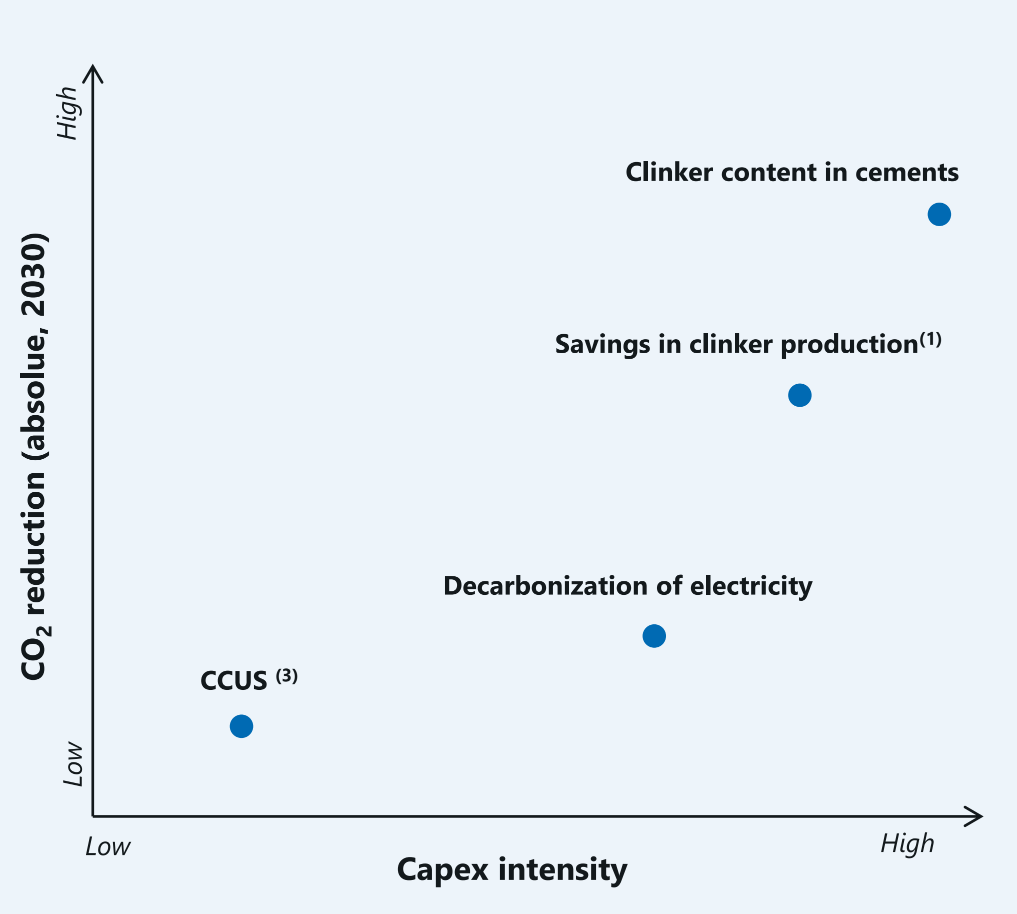
This plan leads to CO_2 specific capex per year equal to 20-30% of the annual avg capex spending

Maintaining ~8% of capex* to net sales ratio over the period

**excluding financial investments*



CAPEX REQUIREMENTS BY 2030



	Payback Duration[2]
Clinker content in cements	< 5 years
Alternative fuels with biomass content	< 5 years
Fossil fuels with lower emission factors	5-15 years
Efficiency in electric and thermal energy consumptions	5-15 years
Decarbonization of electricity	5-15 years
CCU/S [3]	< 5 years

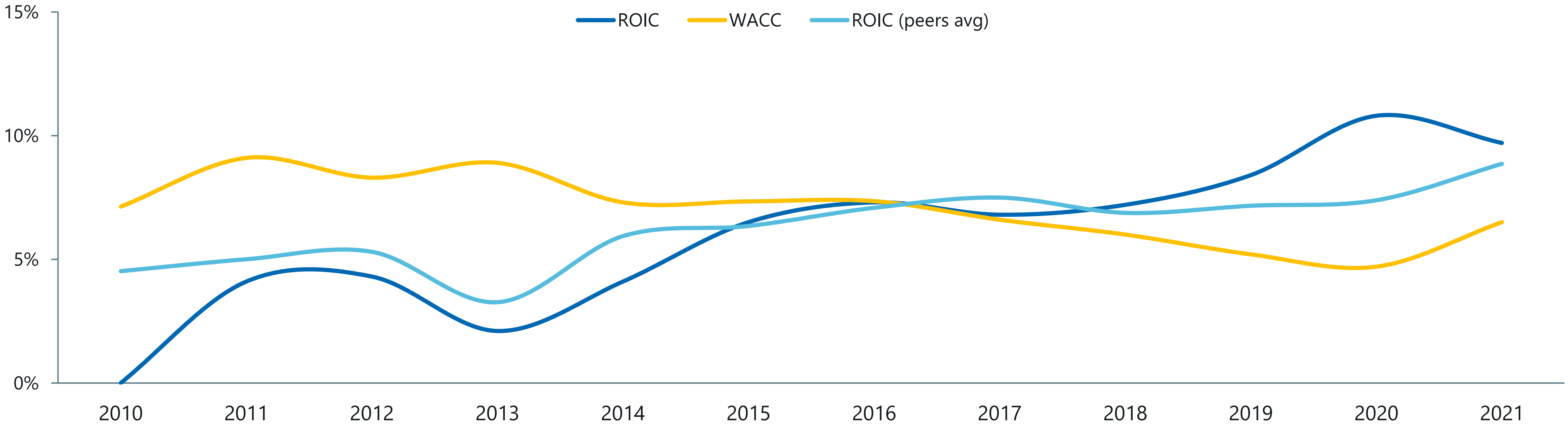
[1] *Including: Alternative fuels with biomass content, fossil fuels with lower emission factors and efficiency in electric and thermal energy consumption*

[2] *General assumption; not considering opex*

[3] *Only referring to a specific CCUS installation*

DRIVING VALUE THROUGH CAPITAL EFFICIENCY

ROIC improvement driven by growth in profitability, cost savings and efficient capital allocation



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STRONG BALANCE SHEET, PRESERVING INVESTMENT CAPACITY FOR GROWTH

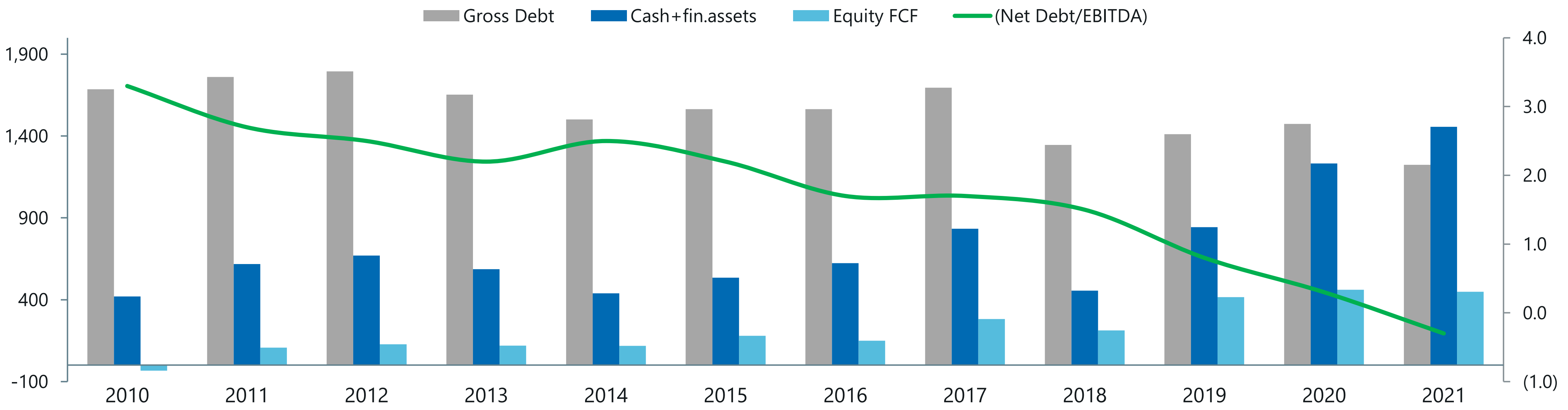
We have a solid track record of consistent deleveraging over the last decade, while continuing to create value

Net cash position achieved at the end of 2021.

Strongest balance sheet in the industry

Committed to maintain Investment grade metrics, preserving our capacity to create value for the company and shareholders, while financing the Net Zero transition

EURm



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STRONG CASH GENERATION AND VALUE CREATIVE CAPITAL ALLOCATION

Strengthened Equity FCF, selective CAPEX, reducing interests through deleveraging

CAGR >12%

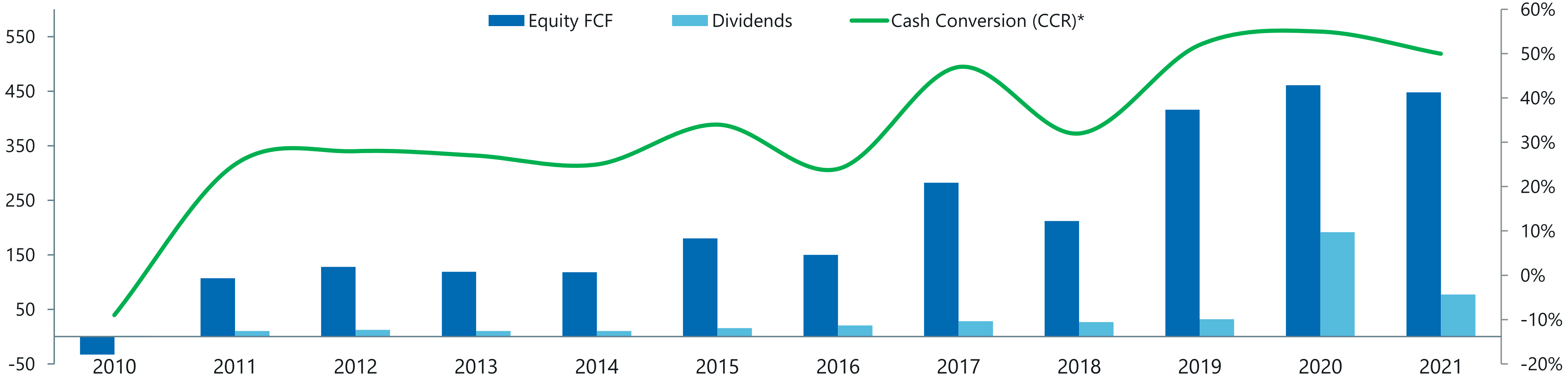
Over the last decade, we have returned to shareholders >650 million euros through dividends and buybacks**

~ 30% cash return to shareholders

Leading Cash Conversion in the sector (avg ~50%) over the period

*CCR: Equity FCF/(EBITDA+Income from associates)
** including 2022 Buyback

EURm



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DISCIPLINED AND BALANCED FINANCIAL APPROACH

WITHIN THE COMPANY....

- Margins protection, through organic gowth, adequate pricing and efficient cost management
- Selective decisions on Capex (~8% to Net Sales)
- Maintaining positive avg ROIC vs WACC spread
- Maintaining investment grade metrics (Net debt/EBITDA ratio of 1.5 x – 2.0 x)
- Focus on cash generation and allocating exceeding cash to M&A and shareholders

...AND EXTERNAL FUNDING

- Funding plan with access to fixed income markets and loan markets as well as private placements focusing on maturity profiles, flexibility and cost of funding.
- Proactively looking for public subsidies for developing new technologies
- ESG targets and metrics will be integrated in our financial documentations.

DISCLAIMER

THIS REPORT CONTAINS COMMITMENTS AND FORWARD-LOOKING STATEMENTS BASED ON ASSUMPTIONS AND ESTIMATES. EVEN IF THE COMPANY BELIEVES THAT THEY ARE REALISTIC AND FORMULATED WITH PRUDENTIAL CRITERIA, FACTORS EXTERNAL TO ITS WILL COULD LIMIT THEIR CONSISTENCY (OR PRECISION, OR EXTENT), CAUSING EVEN SIGNIFICANT DEVIATIONS FROM EXPECTATIONS. THE COMPANY WILL UPDATE ITS COMMITMENTS AND FORWARD-LOOKING STATEMENTS ACCORDING TO THE ACTUAL PERFORMANCE AND WILL GIVE AN ACCOUNT OF THE REASONS FOR ANY DEVIATIONS.