ADVANCED CARBON SEQUESTRATION

8. Carbon Capture FORUM
15.03.2024
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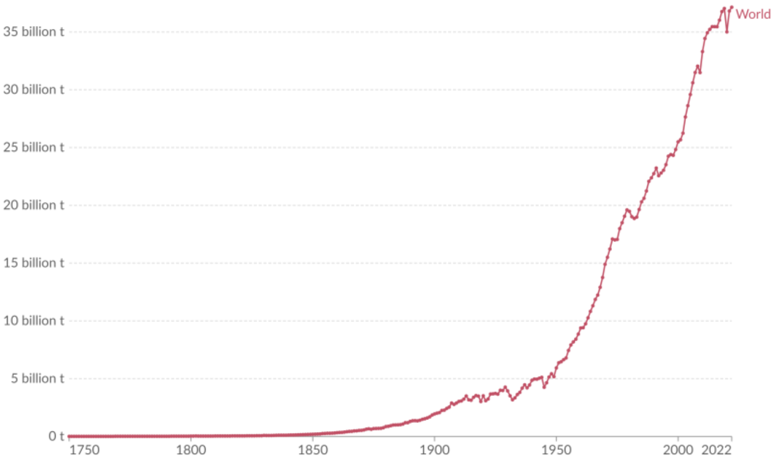
Co-Founder & CEO

sequestra

Annual CO_2 emissions

Carbon dioxide (CO_2) emissions from fossil fuels and industry[1]. Land-use change is not included.

Our World in Data



Data source: Global Carbon Budget (2023)

1. **Fossil emissions**: Fossil emissions measure the quantity of carbon dioxide (CO_2) emitted from the burning of fossil fuels, and directly from industrial processes such as cement and steel production. Fossil CO_2 includes emissions from coal, oil, gas, flaring, cement, steel, and other industrial processes. Fossil emissions do not include land use change, deforestation, soils, or vegetation.

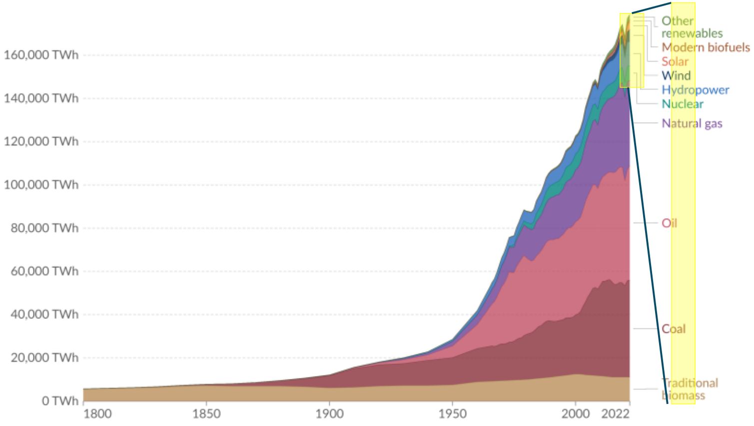
Table SPM.2 | Estimates of historical carbon dioxide (CO_2) emissions and remaining carbon budgets. Estimated remaining carbon budgets are calculated from the beginning of 2020 and extend until global net zero CO_2 emissions are reached. They refer to CO_2 emissions, while accounting for the global warming effect of non-CO_2 emissions. Global warming in this table refers to human-induced global surface temperature increase, which excludes the impact of natural variability on global temperatures in individual years.
{Table 3.1, 5.5.1, 5.5.2, Box 5.2, Table 5.1, Table 5.7, Table 5.8, Table TS.3}

Global Warming Between 1850–1900 and 2010–2019 (°C)		Historical Cumulative CO_2 Emissions from 1850 to 2019 ($GtCO_2$)					
1.07 (0.8–1.3; likely range)		2390 (± 240; likely range)					
Approximate global warming relative to 1850–1900 until temperature limit (°C)[a]	Additional global warming relative to 2010–2019 until temperature limit (°C)	Estimated remaining carbon budgets from the beginning of 2020 ($GtCO_2$) *Likelihood of limiting global warming to temperature limit*[b]					Variations in reductions in non-CO_2 emissions[c]
		17%	*33%*	*50%*	*67%*	*83%*	
1.5	0.43	900	650	500	400	300	Higher or lower reductions in accompanying non-CO_2 emissions can increase or decrease the values on the left by 220 $GtCO_2$ or more
1.7	0.63	1450	1050	850	700	550	
2.0	0.93	2300	1700	1350	1150	900	

Source: IPCC 2021, Summary for policy makers

Global primary energy consumption by source

Primary energy[1] is based on the substitution method[2] and measured in terawatt-hours[3].



Data source: Energy Institute - Statistical Review of World Energy (2023); Smil (2017) OurWorldInData.org/energy | CC BY

Note: In the absence of more recent data, traditional biomass is assumed constant since 2015.

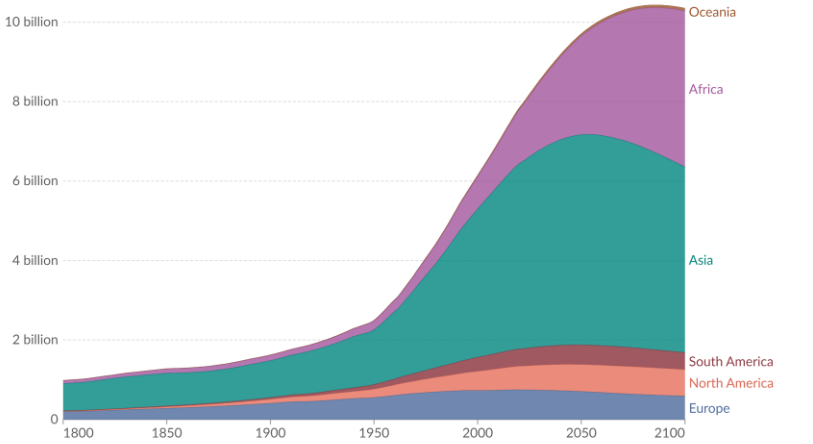
1. Primary energy: Primary energy is the energy available as resources – such as the fuels burnt in power plants – before it has been transformed. This relates to the coal before it has been burned, the uranium, or the barrels of oil. Primary energy includes energy that the end user needs, in the form of electricity, transport and heating, plus inefficiencies and energy that is lost when raw resources are transformed into a usable form. You can read more on the different ways of measuring energy in our article.

2. Substitution method: The 'substitution method' is used by researchers to correct primary energy consumption for efficiency losses experienced by fossil fuels. It tries to adjust non-fossil energy sources to the inputs that would be needed if it was generated from fossil fuels. It assumes that wind and solar electricity is as inefficient as coal or gas. To do this, energy generation from non-fossil sources are divided by a standard 'thermal efficiency factor' – typically around 0.4 Nuclear power is also adjusted despite it also experiencing thermal losses in a power plant. Since it's reported in terms of electricity output, we need to do this adjustment to calculate its equivalent input value. You can read more about this adjustment in our article.

3. Watt-hour: A watt-hour is the energy delivered by one watt of power for one hour. Since one watt is equivalent to one Joule per second, a watt-hour is equivalent to 3600 Joules of energy. Metric prefixes are used for multiples of the unit, usually: - kilowatt-hours (kWh), or a thousand watt-hours. - Megawatt-hours (MWh), or a million watt-hours. - Gigawatt-hours (GWh), or a billion watt-hours. - Terawatt-hours (TWh), or a trillion watt-hours.

Population by world region

Historic estimates with future projections based on the UN medium-fertility scenario[1].



Data source: HYDE (2017); Gapminder (2023); UN (2022) OurWorldInData.org/population-growth | CC BY

Note: Historical country data is shown based on today's geographical borders.

1. UN projection scenarios: The UN's World Population Prospects provides a range of projected scenarios of population change. These rely on different assumptions in fertility, mortality and/or migration patterns to explore different demographic futures. Read more: Definition of Projection Scenarios (UN)

HOW MUCH ARE 38 GIGATONS?

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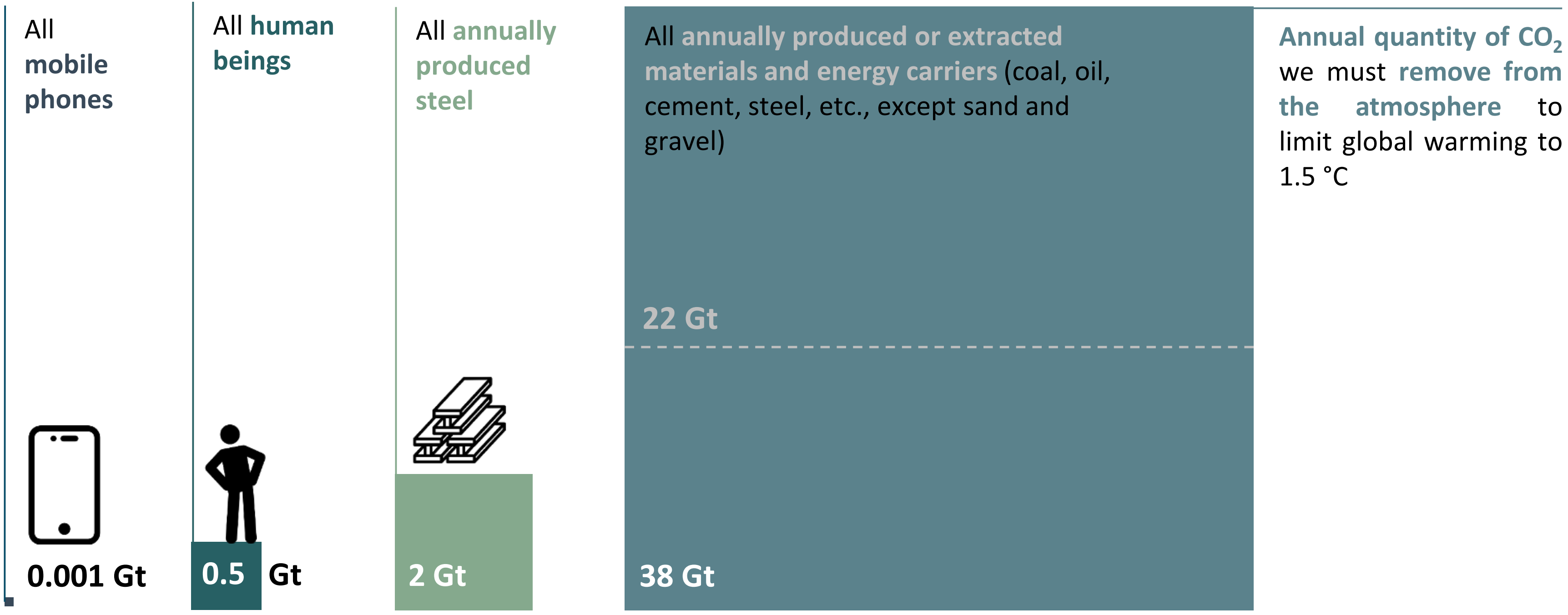
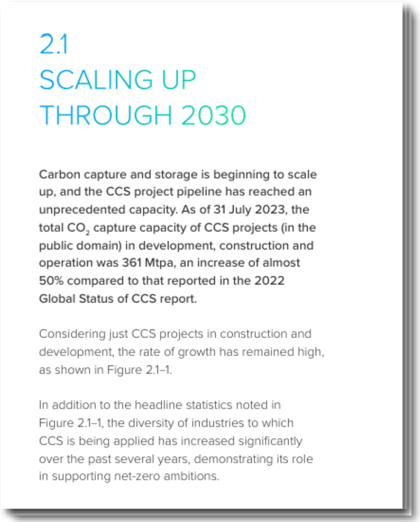


HOW MUCH ARE 38 GIGATONS?

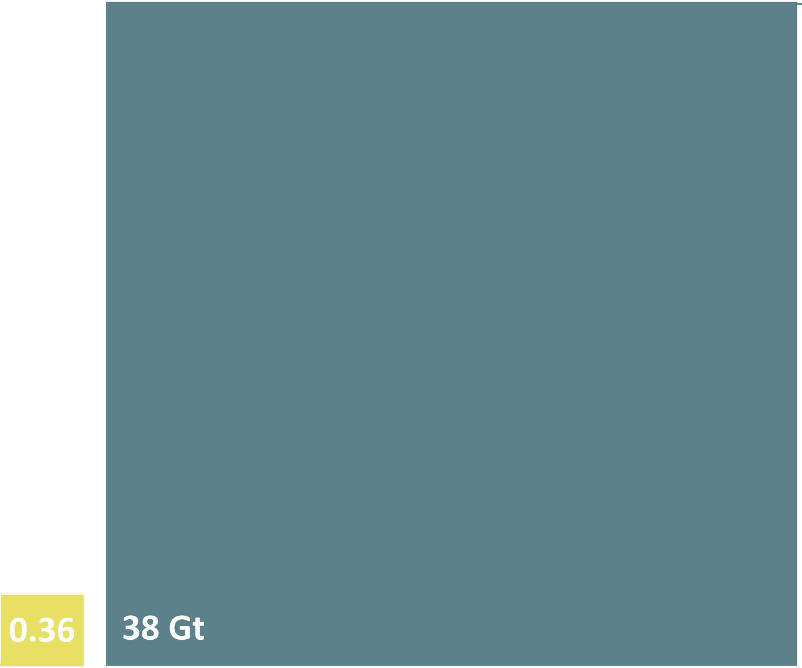

2.1
SCALING UP
THROUGH 2030

Carbon capture and storage is beginning to scale up, and the CCS project pipeline has reached an unprecedented capacity. As of 31 July 2023, the total CO_2 capture capacity of CCS projects (in the public domain) in development, construction and operation was 361 Mtpa, an increase of almost 50% compared to that reported in the 2022 Global Status of CCS report.

Considering just CCS projects in construction and development, the rate of growth has remained high, as shown in Figure 2.1–1.

In addition to the headline statistics noted in Figure 2.1–1, the diversity of industries to which CCS is being applied has increased significantly over the past several years, demonstrating its role in supporting net-zero ambitions.

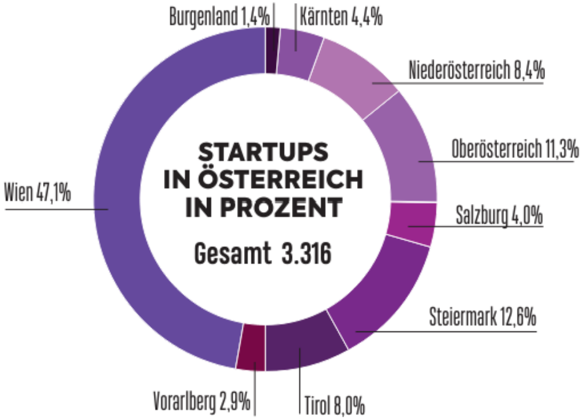
Existing & planned **global capacity** for CO_2 storage[1]



Annual quantity of CO_2 we must **remove from the atmosphere** to limit global warming to 1.5 °C

[1]https://www.globalccsinstitute.com/wp-content/uploads/2024/01/Global-Status-of-CCS-Report-1.pdf
[2]https://www.nature.com/articles/s41893-020-0486-9

NEEDED: BOTTOM-UP DISRUPTION



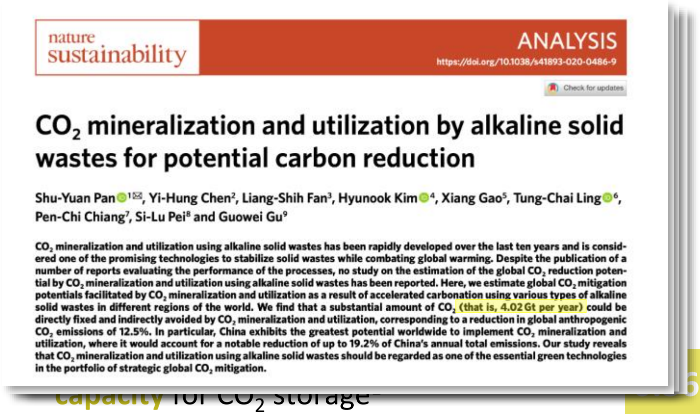
Only **6 %** of Austrian startups are in the **greentech** space.
Only **0.3 %** of Austrian startups are in the **CCUS** space.

https://austrianstartupmonitor.at/wp-content/uploads/2023/04/ASM-2022.pdf

https://www.greentech.at/tools/green-tech-startups-austria/

HOW MUCH ARE 38 GIGATONS?

We support **hard-to-abate industries** by permanently **storing CO_2 in industrial waste materials** and transforming them into **valuable secondary resources**.


nature sustainability

ANALYSIS

https://doi.org/10.1038/s41893-020-0486-9

Check for updates

CO_2 mineralization and utilization by alkaline solid wastes for potential carbon reduction

Shu-Yuan Pan[1], Yi-Hung Chen[2], Liang-Shih Fan[3], Hyunook Kim[4], Xiang Gao[5], Tung-Chai Ling[6], Pen-Chi Chiang[7], Si-Lu Pei[8] and Guowei Gu[9]

CO_2 mineralization and utilization using alkaline solid wastes has been rapidly developed over the last ten years and is considered one of the promising technologies to stabilize solid wastes while combating global warming. Despite the publication of a number of reports evaluating the performance of the processes, no study on the estimation of the global CO_2 reduction potential by CO_2 mineralization and utilization using alkaline solid wastes has been reported. Here, we estimate global CO_2 mitigation potentials facilitated by CO_2 mineralization and utilization as a result of accelerated carbonation using various types of alkaline solid wastes in different regions of the world. We find that a substantial amount of CO_2 (that is, 4.02 Gt per year) could be directly fixed and indirectly avoided by CO_2 mineralization and utilization, corresponding to a reduction in global anthropogenic CO_2 emissions of 12.5%. In particular, China exhibits the greatest potential worldwide to implement CO_2 mineralization and utilization, where it would account for a notable reduction of up to 19.2% of China's annual total emissions. Our study reveals that CO_2 mineralization and utilization using alkaline solid wastes should be regarded as one of the essential green technologies in the portfolio of strategic global CO_2 mitigation.

capacity for CO_2 storage

38 Gt

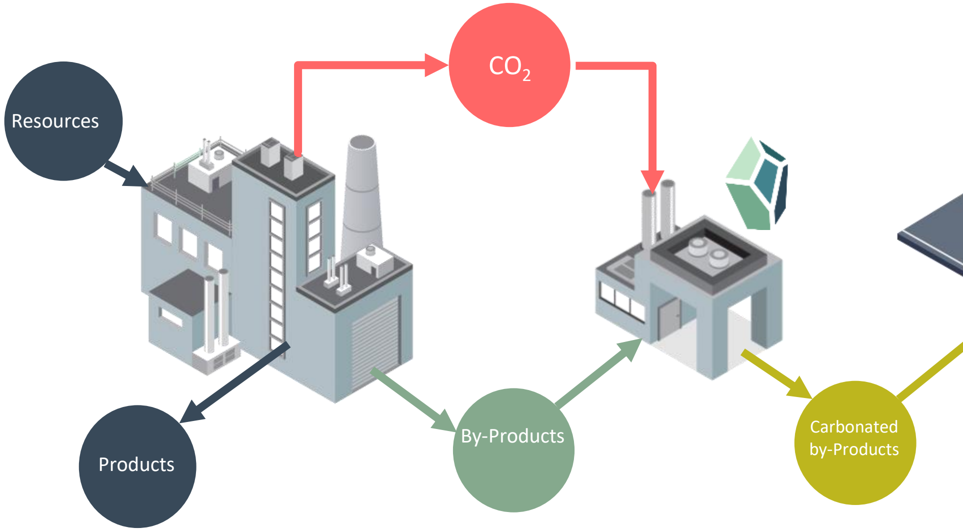
Annual quantity of CO_2 we must **remove from the atmosphere** to limit global warming to 1.5 °C

Our technology can contribute to mitigate 10 %.

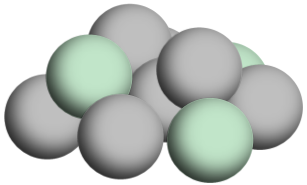
HOW?

[1]https://www.globalccsinstitute.com/wp-content/uploads/2024/01/Global-Status-of-CCS-Report-1.pdf
[2]https://www.nature.com/articles/s41893-020-0486-9

HOW?

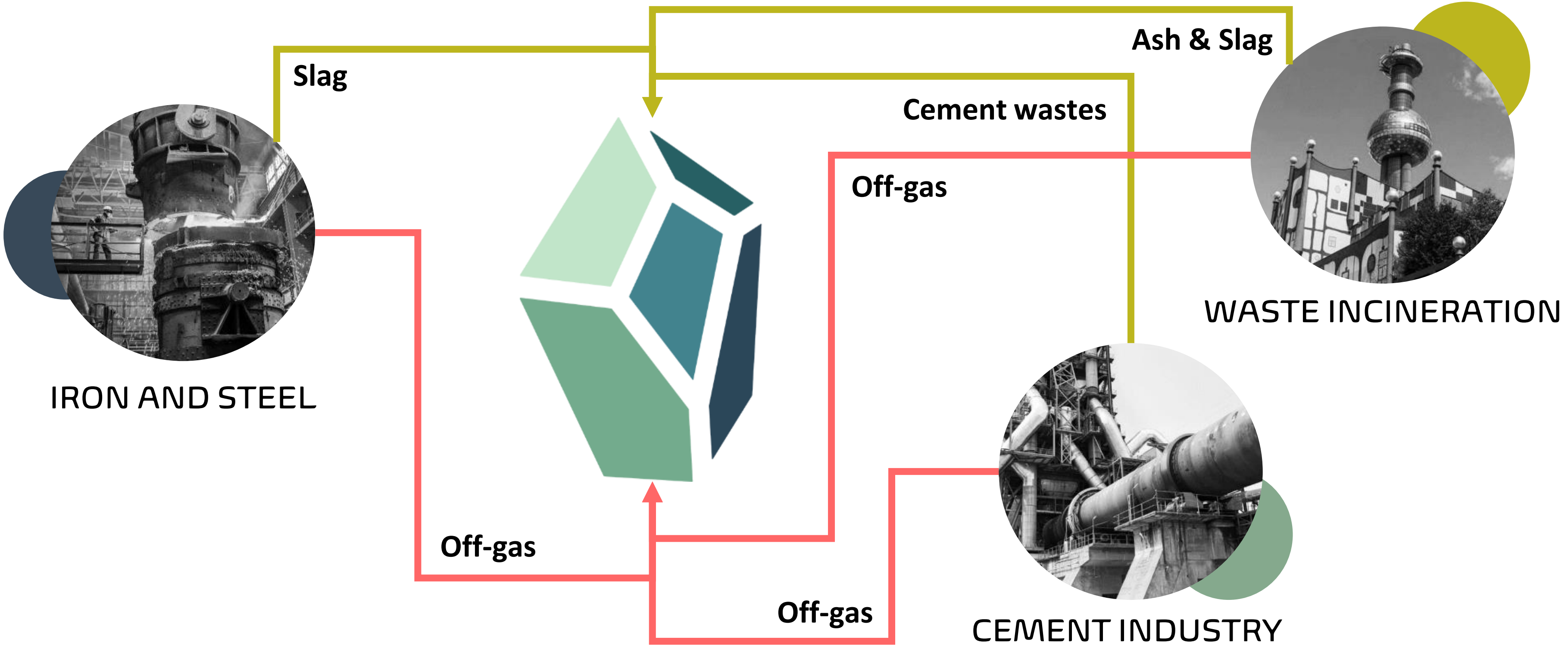


Residual materials are capable of storing **up to 30%** of CO_2 in weight.

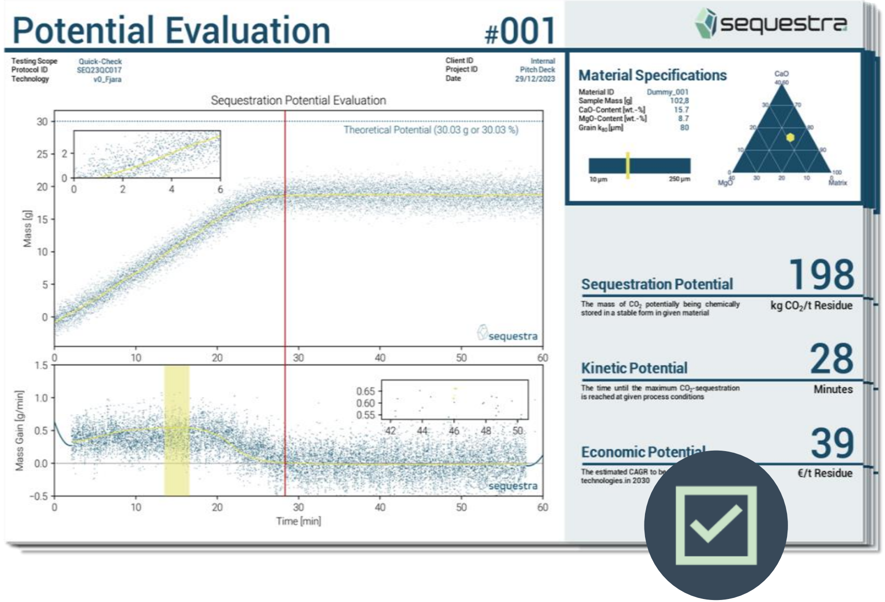


$CaO + CO_2 \rightarrow CaCO_3$

EARLY ADOPTERS



WHERE DO WE CURRENTLY STAND?



WHAT DO WE NEED FROM THE WORLD?

€€€

capital for business and technological development

CONTACTS

to the steel, cement, refractory, and municipal waste treatment industry

COACHING

to enhance our journey of building an industrial startup sequestra