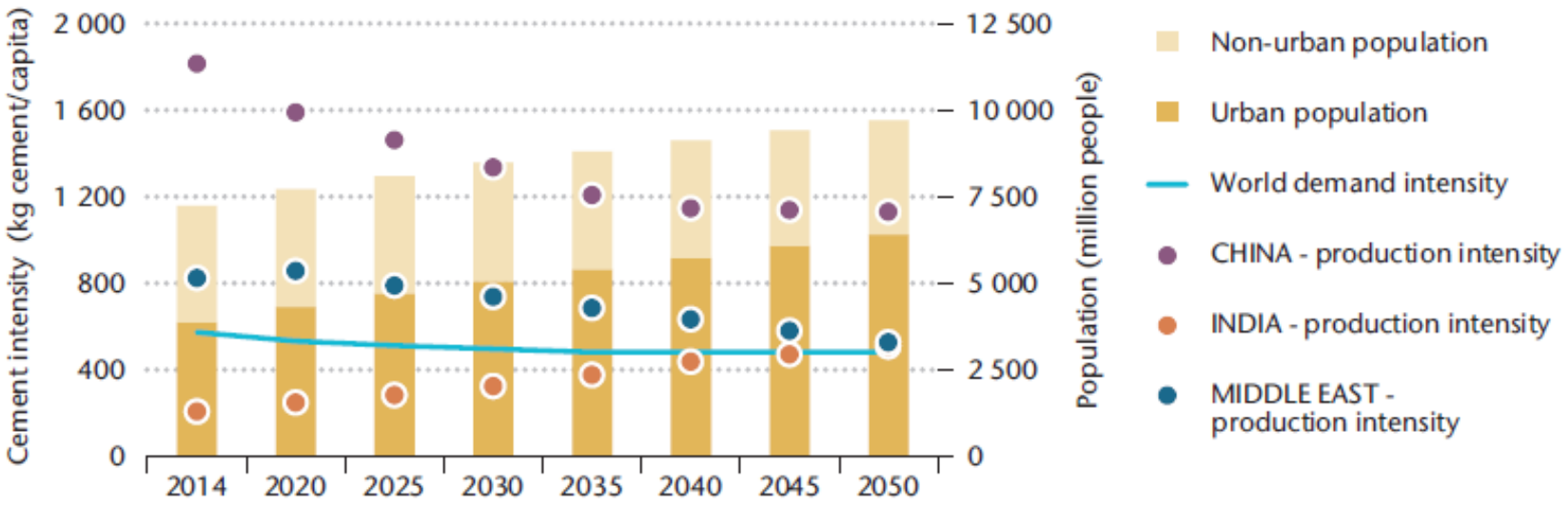
THE FUTURE IS WORTH IT

國際碳關稅挑戰與因應

全球水泥需求量：2050年，全球人均水泥需求將保持穩定

Figure 3: Global cement demand intensity and population, and cement production intensity for selected regions



Note: Cement demand and production intensities displayed refer to the low-variability case.

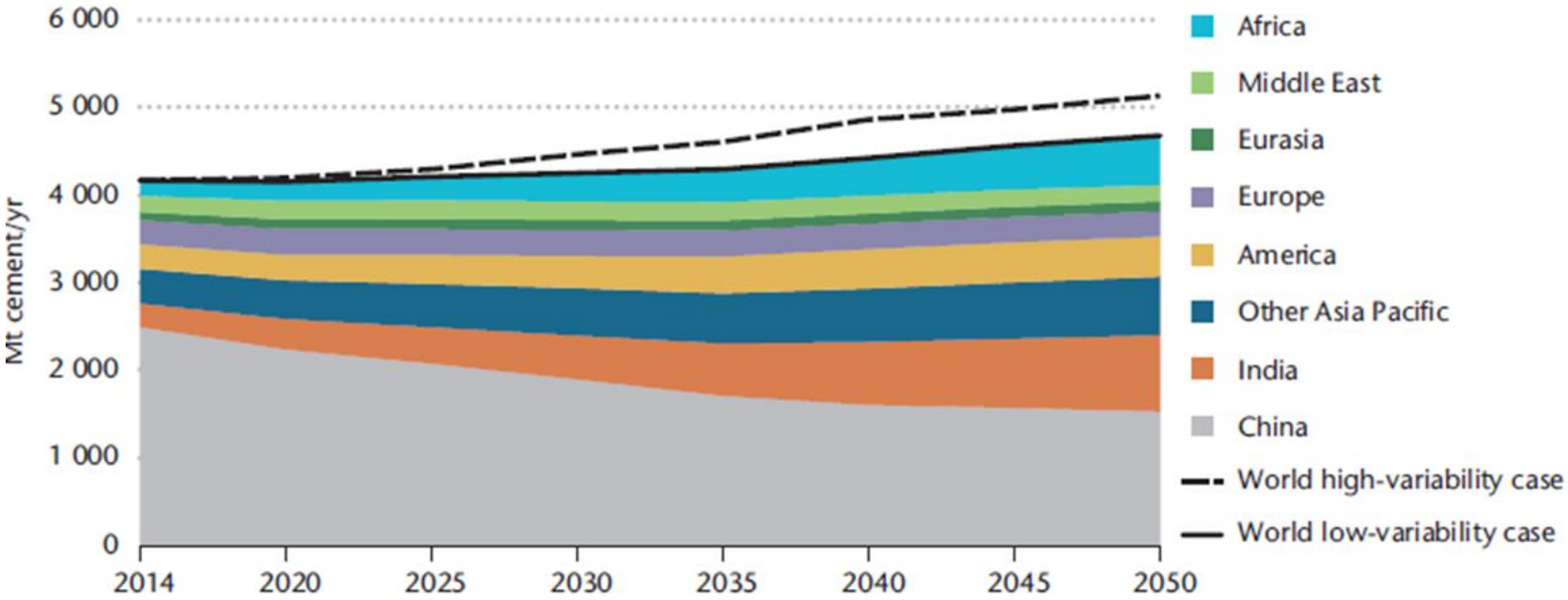
Sources: Population data from UN DESA (2015), *World Population Prospects: The 2015 Revision*, https://esa.un.org/unpd/wpp/. Base year cement production data from van Oss, H. G. (2016), *2014 Minerals Yearbook: Cement*, United States Geological Survey data release, https://minerals.usgs.gov/minerals/pubs/commodity/cement/myb1-2014-cemen.pdf

KEY MESSAGE: Global aggregated cement demand per capita is expected to remain stable towards 2050, while population is set to increase by about one-third over the same period.

資料來源：IEA Technology Roadmap
Low-Carbon Transition in the Cement Industry

全球水泥生產量：2050年將較目前提高12-23%

Figure 4: Cement production by region



Note: See Annex for regional definitions.

Sources: Base year cement production data from van Oss, H. G. (2016), *2014 Minerals Yearbook: Cement*, United States Geological Survey data release, https://minerals.usgs.gov/minerals/pubs/commodity/cement/myb1-2014-cemen.pdf.

KEY MESSAGE: Strong growth in cement production growth in Asian countries compensates for the decline in Chinese cement sector activity, but the region still loses 10% of its global production share by 2050.

資料來源：IEA Technology Roadmap
Low-Carbon Transition in the Cement Industry

國內近五年熟料及水泥進口佔比

項目 \ 年	105年	106年	107年	108年	109年
進口普通水泥(A)	347,978	476,975	498,064	381,094	441,576
進口特種水泥(B)	36,835	36,130	33,484	29,626	27,973
進口熟料(C)	1,049,607	1,360,619	1,577,009	1,914,460	2,040,646
進口量合計(D)=A+B+C	1,434,420	1,873,724	2,108,557	2,325,180	2,510,195
國內水泥消耗量(E)	10,245,815	10,173,998	10,683,015	11,379,892	12,105,825
進口市佔率=D/E	14.0%	18.4%	19.7%	20.4%	20.7%
國產業者出口水泥	3,194,869	2,483,941	2,324,790	2,181,007	1,737,478
國產業者出口熟料	37,000	69,700	54,000	140,007	529,016
國產業者出口量合計	3,231,869	2,553,641	2,378,790	2,321,014	2,266,494
出口 V.S. 進口量 (水泥)	2,810,056	1,970,836	1,793,242	1,770,287	1,267,929
出口 V.S. 進口量 (熟料)	(1,012,607)	(1,290,919)	(1,523,009)	(1,774,453)	(1,511,630)

※特種水泥：白水泥、純白水泥、高鋁水泥、水硬水泥

※資料來源：財政部關務署、台灣區水泥工業同業公會

強制性碳足跡及正確標竿值的重要性

What is changing in the allowances allocation process / Free Allowances formula

Free allocation (tCO2) **= Benchmark** (kgCO2/tkk) **x HAL** (tkk) **x CSCF**

Benchmark (EU-28 level)

- **EU-ETS Phase III** (2013-2020): Data 2007-08 → **766 kgCO2/tkk**
- **EU-ETS Phase IV** (Part I) (2021-2015): Data evolution since 2007-08 to 2016-17(23) → **689-709 kgCO2/tkk ??**
- **EU-ETS Phase IV** (Part I) (2026-2030): Data evolution since 2007-08 to 2021-22(28) → **685-704 kgCO2/tkk ??**

HAL (Historic Activity Level) (Installation level)

- **EU-ETS Phase III** (2013-2020): Data was 2004-08
- **EU-ETS Phase IV** (Part I) (2021-2015): Data is avg 2014-18
- **EU-ETS Phase IV** (Part II) (2026-2030): Data is avg 2019-23

CSCF (Cross-Sectoral Correction Factor)

- Let's consider, for simplification, =1, however, it could slightly lower if 43%(+3%) for FA is attained

資料來源：ON FILED INVESTMENT RESEARCH

強制性碳足跡及正確標竿值的重要性

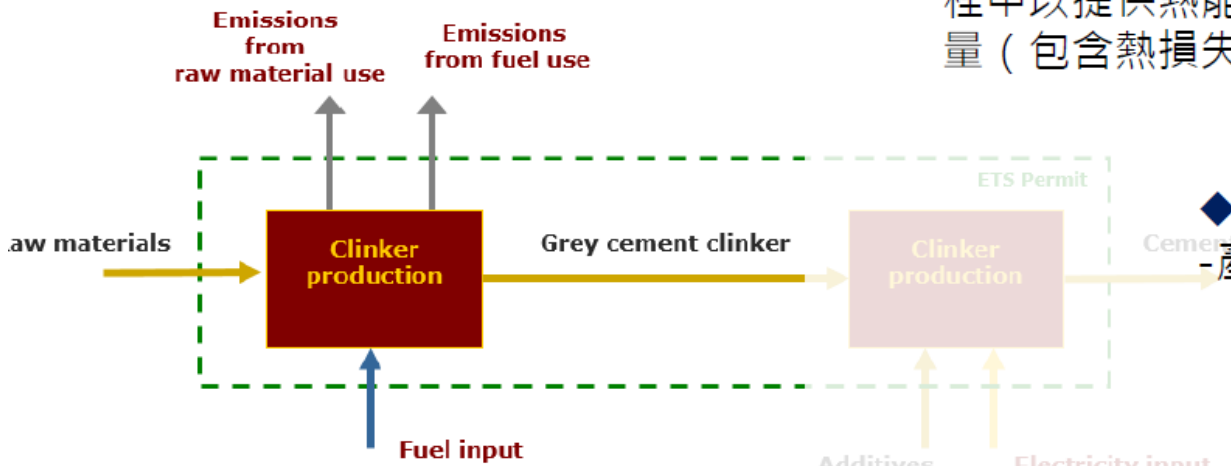
一. 產品定義

- 產品標竿：**0.766CO_2e/公噸**
- 產品單位：每噸灰水泥熟料。
- 產品定義與範疇解釋：灰水泥熟料為總熟料生產
- 涵蓋PRODCOM 2007版的24.51.11.00

PRODCOM CODE 工業生產產品	描述
26.51.11.00	**Cement clinker 灰水泥熟料**

二. 產品標竿製程邊界範疇

✓灰水泥熟料產品的直接或相關間接製程。

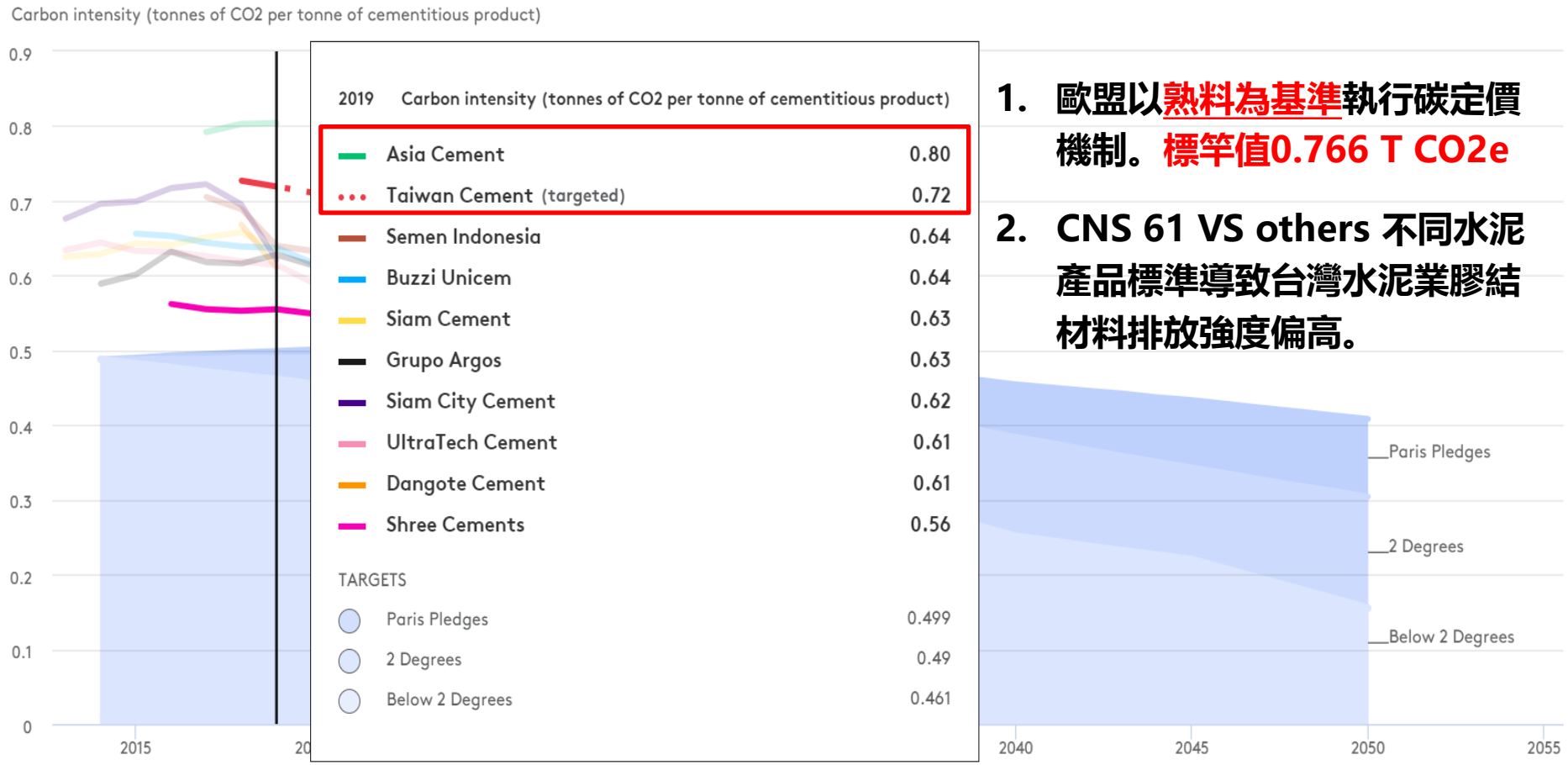


◆生產排放量包含:
從煅燒過程之排放量及在生產製程中以提供熱能的相關燃料排放量（包含熱損失）➡熟料燒成(旋窯端)

◆ 系統邊界不包括：
-產品耗用電力的排放量

資料來源： C(2011) 2772，歐盟執行措施(CIMs) Annex I, point 2

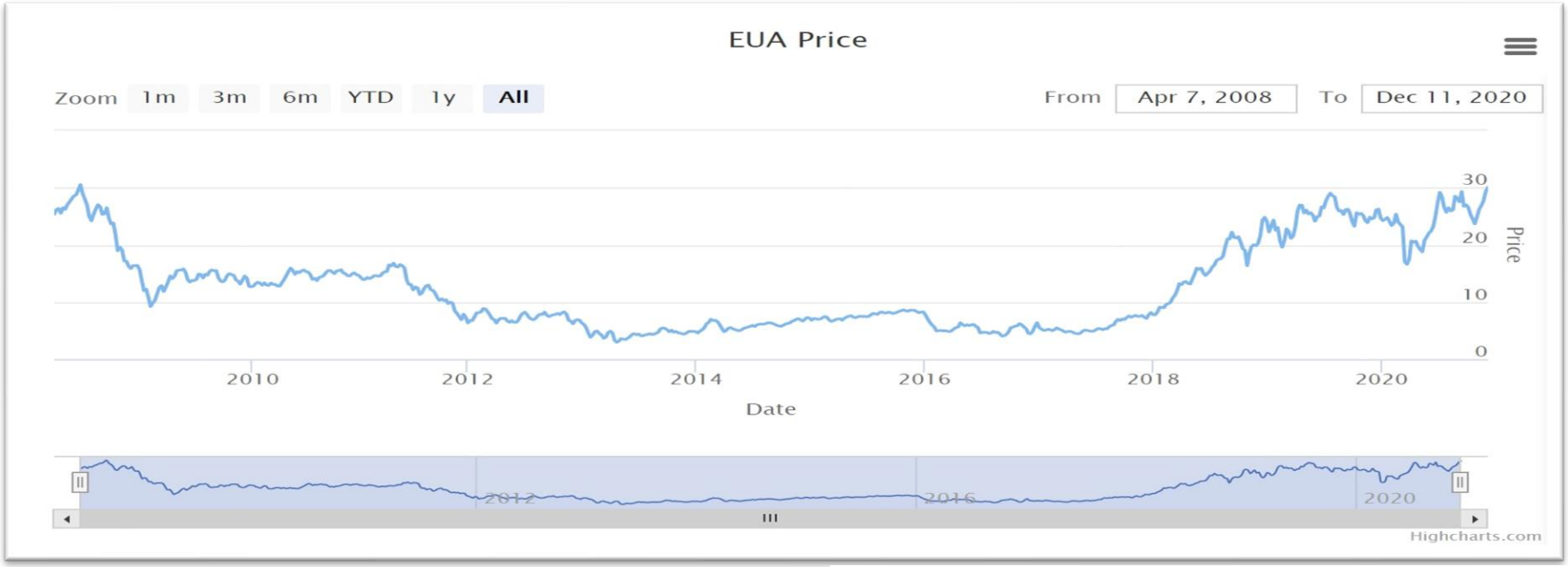
強制性碳足跡及正確標竿值的重要性



1. 歐盟以<u>熟料為基準</u>執行碳定價機制。標竿值0.766 T CO2e
2. CNS 61 VS others 不同水泥產品標準導致台灣水泥業膠結材料排放強度偏高。

資料來自：https://www.transitionpathwayinitiative.org/sectors/cement#carbon-performance

歐盟碳交易價格

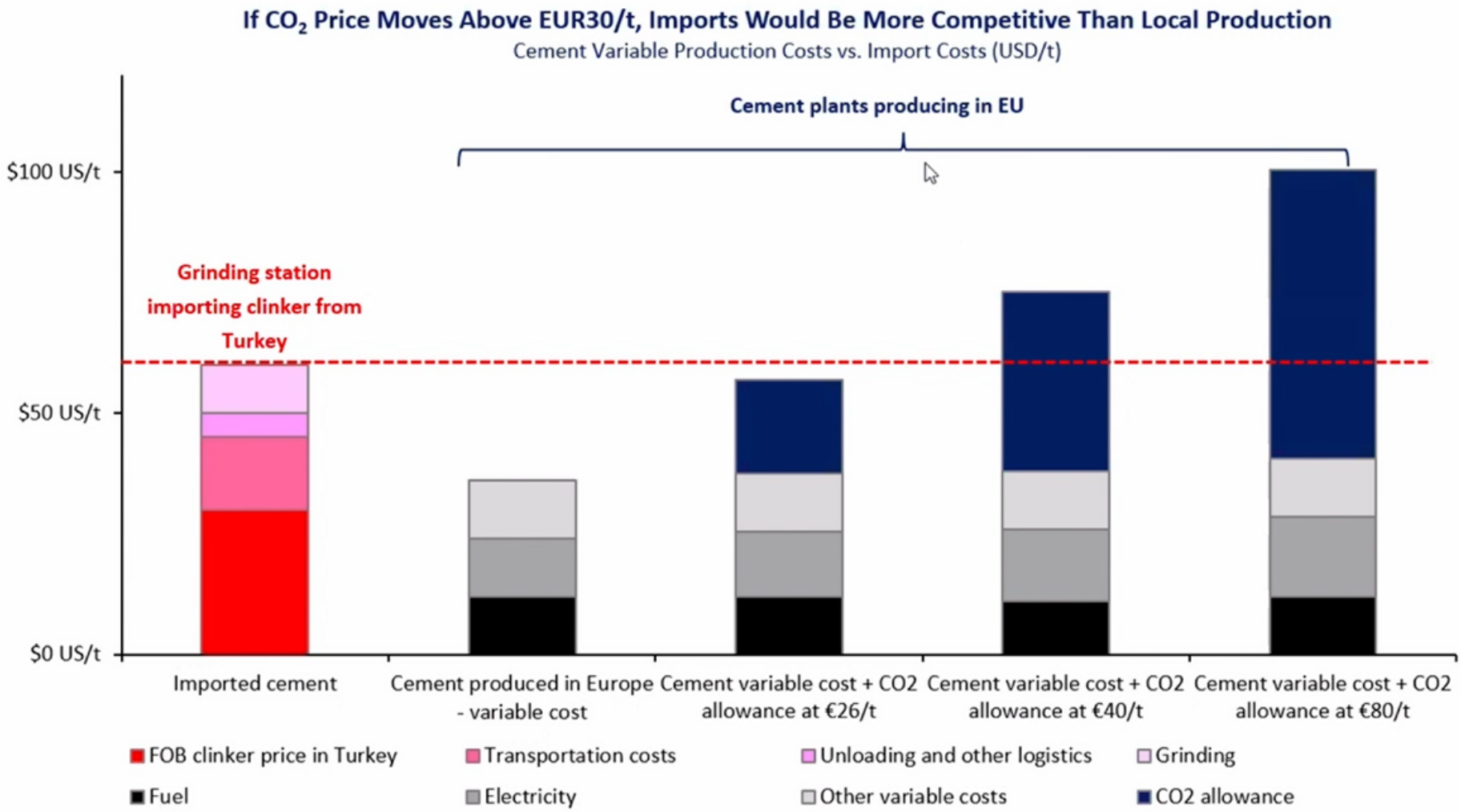


EU ETS price €32-65/t under 2030 scenarios

The price of allowances under the EU's emissions trading system (ETS) could rise to €65/t of CO2 equivalent (CO2e) by 2030 under the European Commission's most ambitious scenario for greenhouse gas (GHG) cuts in the bloc, although alternative scenarios could produce much lower prices.

Six potential pathways to achieving higher GHG emissions cut targets in the EU would see the price of EU ETS allowances at €32-65/t CO2e in 2030, according to an impact assessment published today by the commission.

歐盟- 碳價高於30歐元/T；境內水泥業者將無法與進口者競爭

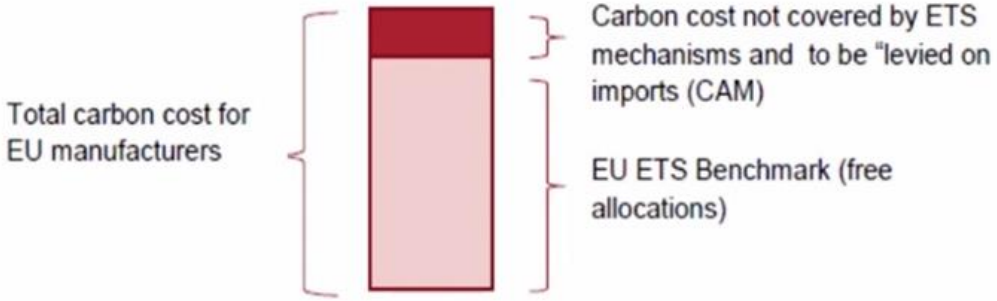


碳邊境調整機制 – 歐盟主要水泥業者的建議

LafargeHolcim Suggestion Regarding How EU Could Calculate a Carbon Border Adjustment Mechanism While Keeping Free CO_2 Allowances for Cement Industry (January 2020)

Compatibility with EU ETS & Free Allocation

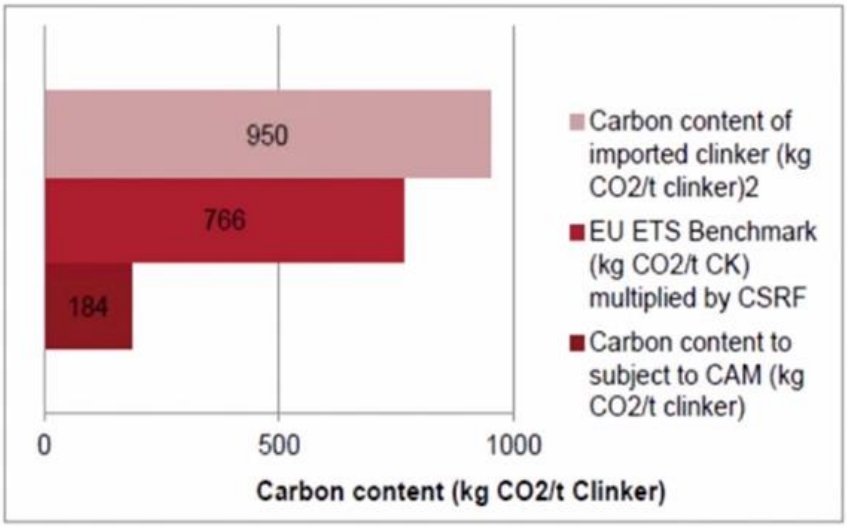
"EU ETS phase IV comes into force, free allocations are unlikely to cover the full carbon cost paid by EU manufacturers. A CAM [Carbon Border Adjustment Mechanism] should cover that cost difference and does not require any changes to the EU ETS as it is fully compatible and complementary. A CAM should take into account the free allocations received by EU manufacturers in order to calculate the carbon adjustment in a non-discriminatory manner. This allows to ensure that it does not interfere with the EU's carbon budget, that it remains separate from the EU ETS but be made compatible with it."



Carbon Tax Calculation Suggestions

In practice, the charge (for the cement sector) could look as follows:

Carbon import charges (€/t clinker) = (verified emissions* of import + associated transport emissions in kg CO_2/t clinker) - (EU ETS clinker benchmark in kg CO_2/t clinker * CSRF) multiplied by the carbon price (€/kg CO_2)



* Calculated on the basis of EN19694-3

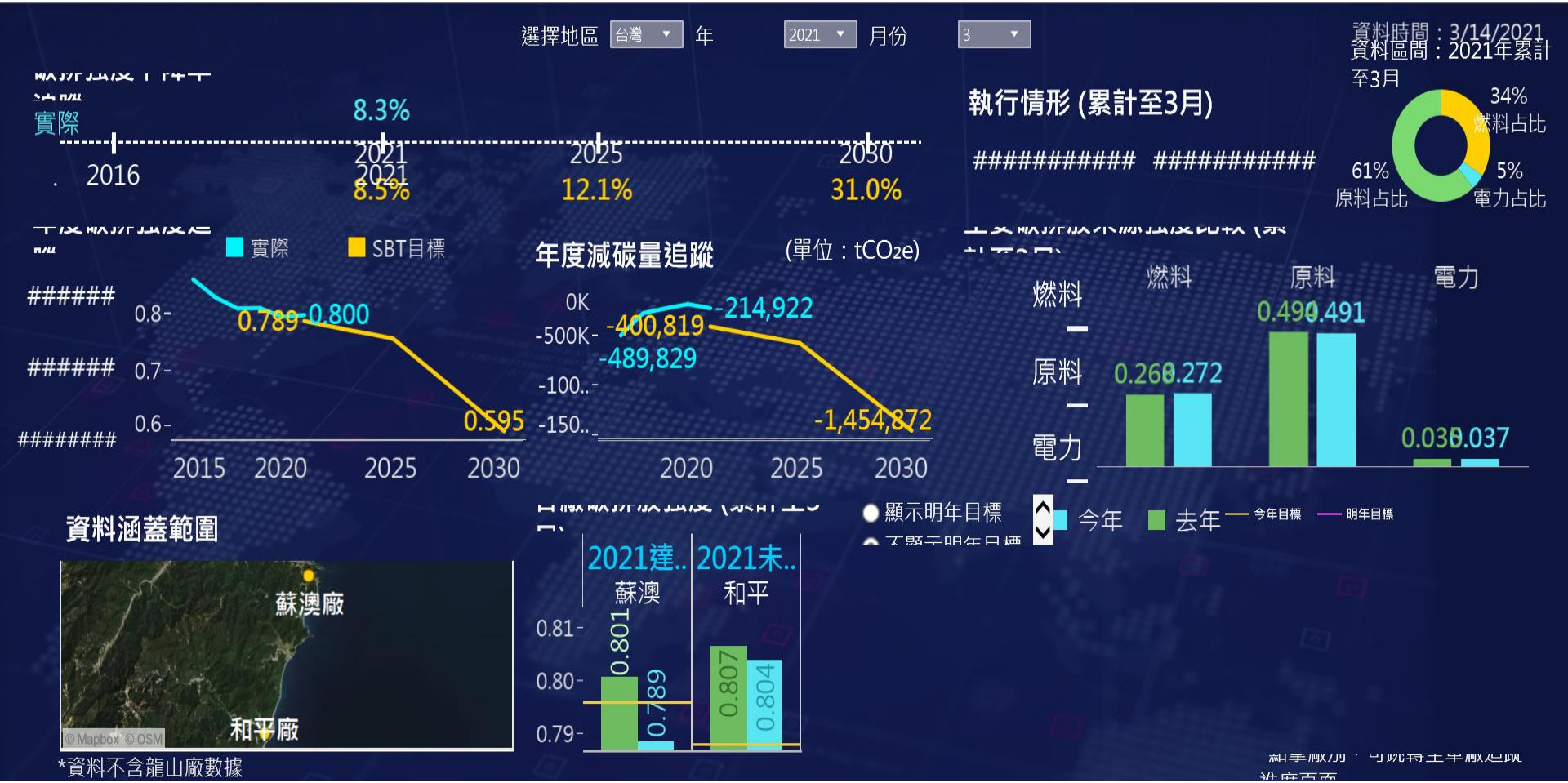
致力減碳因應碳費&碳關稅挑戰-科學基礎減碳目標 SBTi

- 2020年7月16日科學減碳倡議組織（SBTi）正式公告台泥完成目標設定：**「以2016年設定為基準年，承諾目標年2025年，溫室氣體總排放強度減少11%(其中包含範疇1減排11%、範疇2減排32%)」。**
- **為全球通過目標設定的四家水泥業之一，東亞首家完成減碳目標設定的水泥企業。**

致力減碳因應碳費&碳關稅挑戰 (LCA行動訂定降碳指標與考核制度)

廠	噸水泥(膠結材料) CO2排放強度			2025對比 2020年		2021~2025 較2020年 每年平均至少應減量		2021年減碳KPI考核目標		
	2016 實際	2020 實際	2025 目標	強度	比例	強度	比例	上半年	下半年	年平均
英德	0.755	0.711	0.672	(0.038)	-5.4%	(0.008)	-1.1%	-1.20%	-3.00%	-2.10%
貴港	0.755	0.728	0.672	(0.056)	-7.7%	(0.011)	-1.5%	-1.20%	-3.00%	-2.10%
重慶	0.720	0.705	0.641	(0.064)	-9.1%	(0.013)	-1.8%	-1.20%	-3.20%	-2.20%
廣安	0.645	0.712	0.574	(0.138)	-19.4%	(0.028)	-3.9%	-1.80%	-3.80%	-2.80%
華鎣	0.660	0.703	0.587	(0.116)	-16.5%	(0.023)	-3.3%	-1.60%	-3.60%	-2.60%
敘永	0.734	0.728	0.653	(0.075)	-10.4%	(0.015)	-2.1%	-1.20%	-3.40%	-2.30%
安順	0.708	0.726	0.630	(0.096)	-13.2%	(0.019)	-2.6%	-1.20%	-3.40%	-2.30%
港安	0.666	0.703	0.592	(0.111)	-15.7%	(0.022)	-3.1%	-1.60%	-3.60%	-2.60%
凱里	0.712	0.731	0.633	(0.098)	-13.4%	(0.020)	-2.7%	-1.20%	-3.40%	-2.30%
懷化	0.643	0.716	0.572	(0.144)	-20.1%	(0.029)	-4.0%	-1.80%	-3.80%	-2.80%
靖州	0.696	0.744	0.620	(0.124)	-16.7%	(0.025)	-3.3%	-1.60%	-3.60%	-2.60%
句容	0.781	0.783	0.695	(0.088)	-11.2%	(0.018)	-2.2%	-1.20%	-3.40%	-2.30%
蘇澳	0.897	0.795	0.798	0.003	0.4%	0.001	0.1%	-1.20%	-2.40%	-1.80%
和平	0.847	0.797	0.754	(0.043)	-5.4%	(0.009)	-1.1%	-1.20%	-2.40%	-1.80%

致力減碳因應碳費&碳關稅挑戰 (LCA行動在線追蹤減碳執行情形)



*資料不含龍山廠數據

減碳行動 - 需政府政策支持

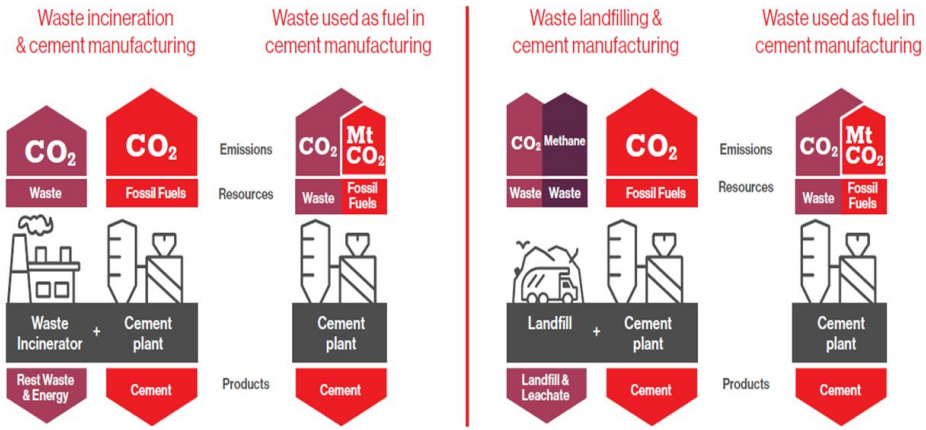
CEMBUREAU – How can we reduce emissions from clinkers

Alternative Decarbonated Raw Materials

As the largest source of CO_2 comes from calcining the raw materials in the kiln, the use of alternative sources of decarbonated materials is one option for significantly reducing CO_2 emissions. Waste materials and by-products from other industries can be used to replace some of the limestone, a good example of industrial symbiosis. These materials ca include recycled cement paste from demolition waste, air-cooled slag and waste lime. A study will be conducted by CEMBUREAU to determ potential sources of alternative waste raw materials and clinker replacement materials from different industries.

CEMBUREAU envisages up to a **3.5% reduction of process CO_2** using decarbonated materials by 2030 and up to **8% reduction by 2050.**

以廢棄物做為替代原、燃料
(循環經濟-減廢又減碳)



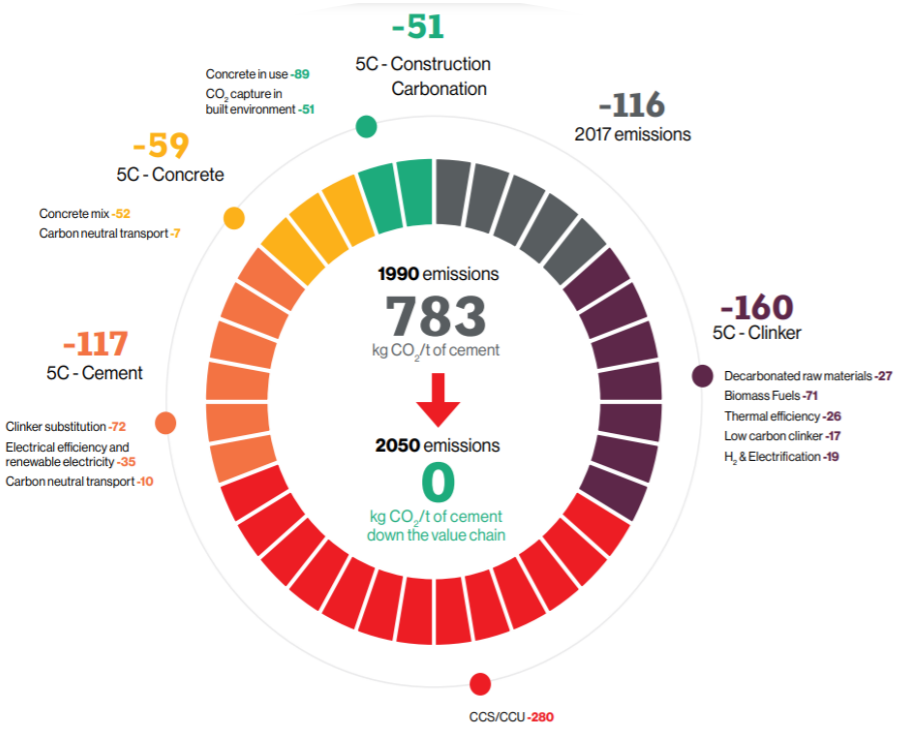
CEMBUREAU targets to reach **60% alternative fuels** containing **30% biomass in 2030**, and **90% alternative fuels** with **50% biomass by 2050.**

2017 替代燃料使用46%（含12%生質燃料）

台灣水泥業要如何做到？

需要政策支持及規範鬆綁
氯離子含量 CNS 61 240 ppm
歐盟 1000 ppm；日本 350 ppm

減碳行動 - 需政府政策支持



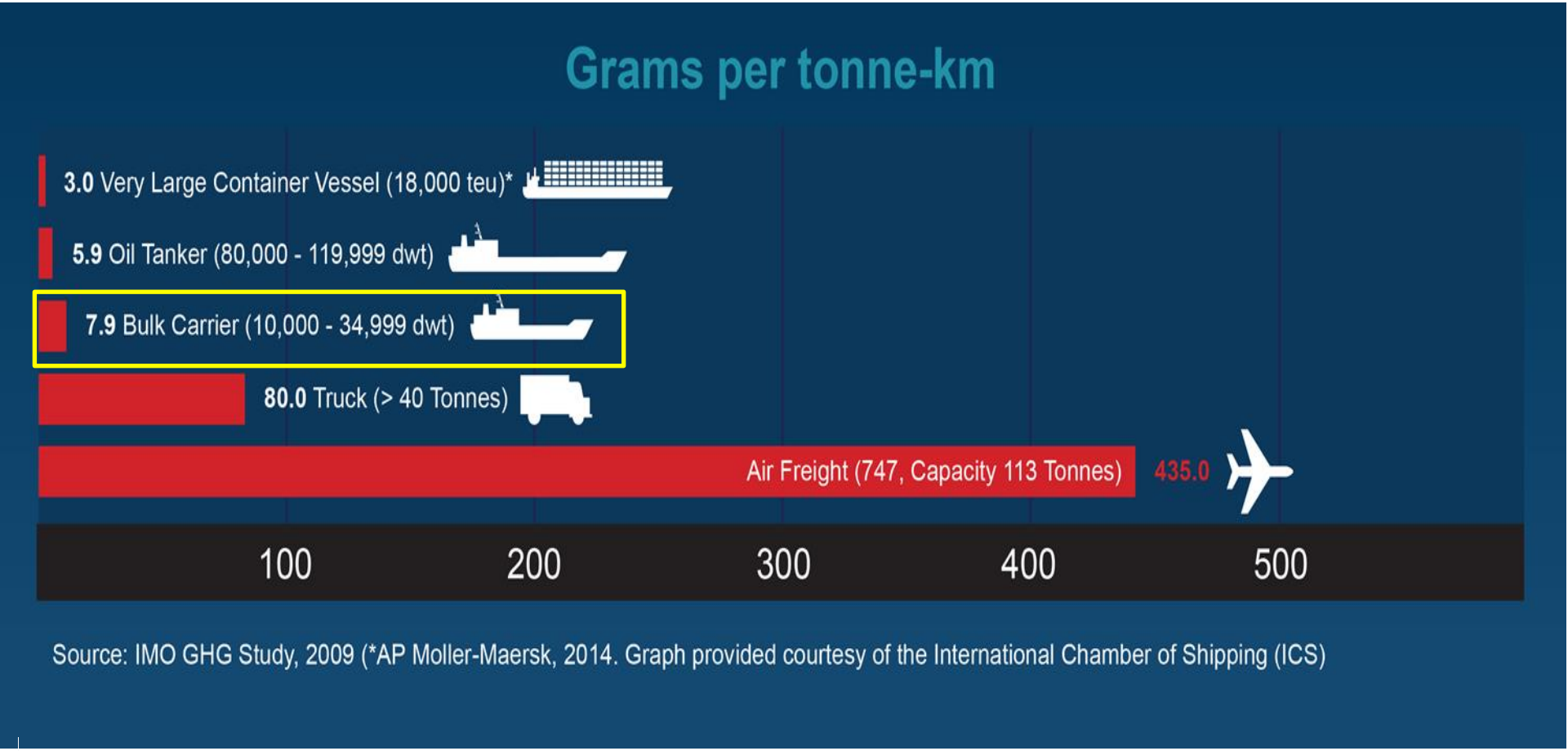
Low clinker cements

In 2017 the clinker to cement ratio in Europe was 77%. This means that, on average, 23% of clinker was substituted by alternative materials such as granulated slag from steel blast furnaces and fly ash from coal-fired power plants. The cement industry is conscious that the phase-out of coal fired power plants will limit the supply of fly ash (currently 10% of total substitutes) and the use of slag from the steel sector (currently 33% of total substitutes) will decrease. Already today, however, 21% of the total substitutes are natural pozzolans, limestone or burnt oil shale and non-traditional substitutes such as calcined clay and silica are being assessed. Further research is ongoing to look at other materials which could be used in the future such as pozzolan materials from waste streams and slag from other industries. Depending on national legislation and market conditions, these substitutes can also be added at the concrete manufacture stage.

CEMBUREAU is targeting to move from **an average of 77% to 74% clinker in cement by 2030** and to move to **65% by 2050.**

CEMBUREAU Carbon neutral by 2050

碳邊界調整機制有無考慮進口額外運輸碳排放



資料：世界航運理事會（WSC）

台泥DAKA再生資源利用中心