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Refractory Grade Magnesia Market Review

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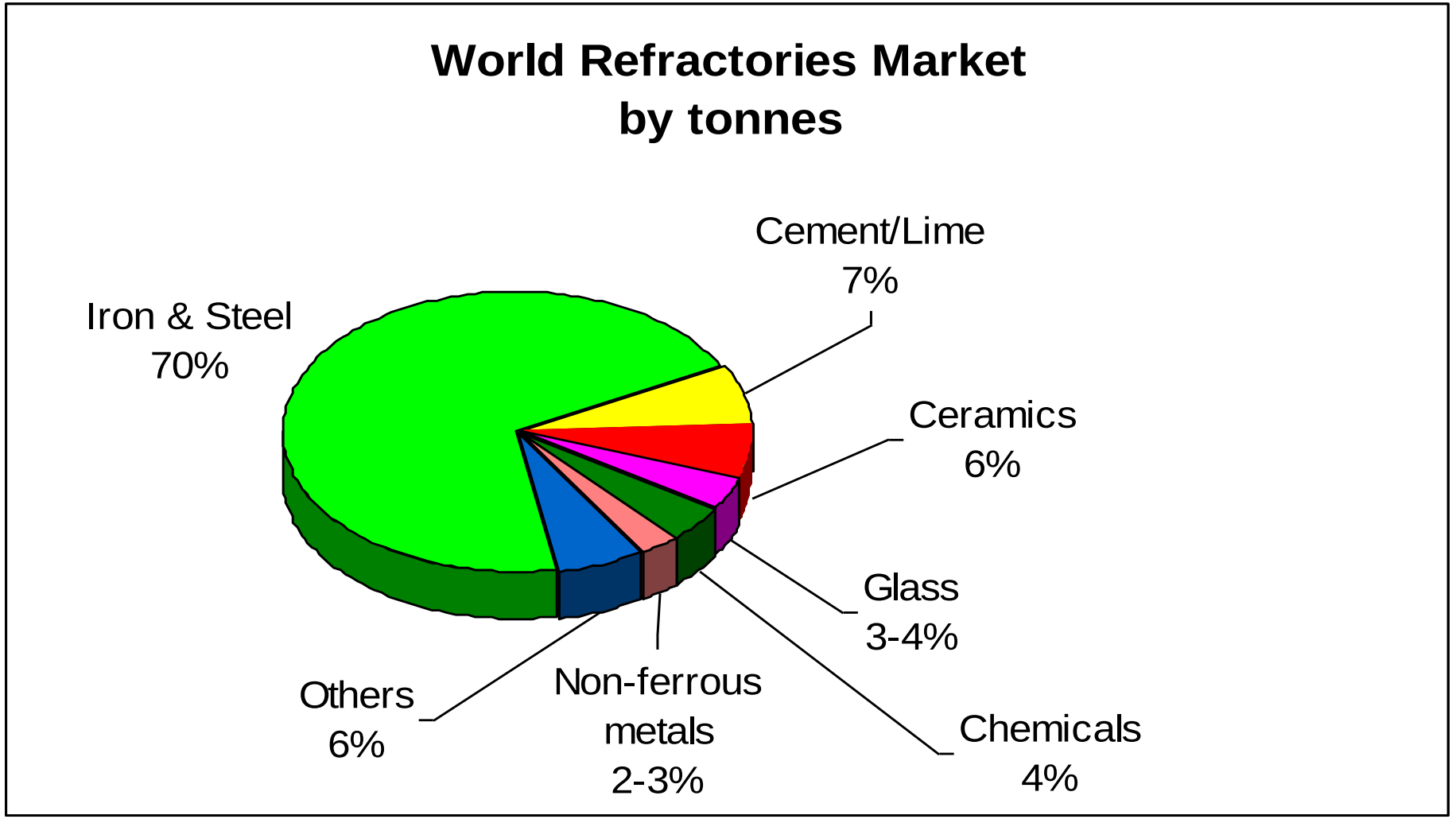
Traditional Market Drivers

Two industry sectors consume most of the magnesia refractories

- Steel Industry
  - Growth in steel production modified by reduced unit consumption of refractories per tonne of steel
- Cement & Lime
  - Very large and growing volumes of cement production but much lower unit consumption
- Ceramics, Glass, Non-Ferrous Metals, Power Generation, Chemicals plus other diverse uses smaller consumers of refractories but less important for magnesia


World Refractories Market
by tonnes
Iron & Steel
70%
Cement/Lime
7%
Ceramics
6%
Glass
3-4%
Chemicals
4%
Non-ferrous
metals
2-3%
Others
6%

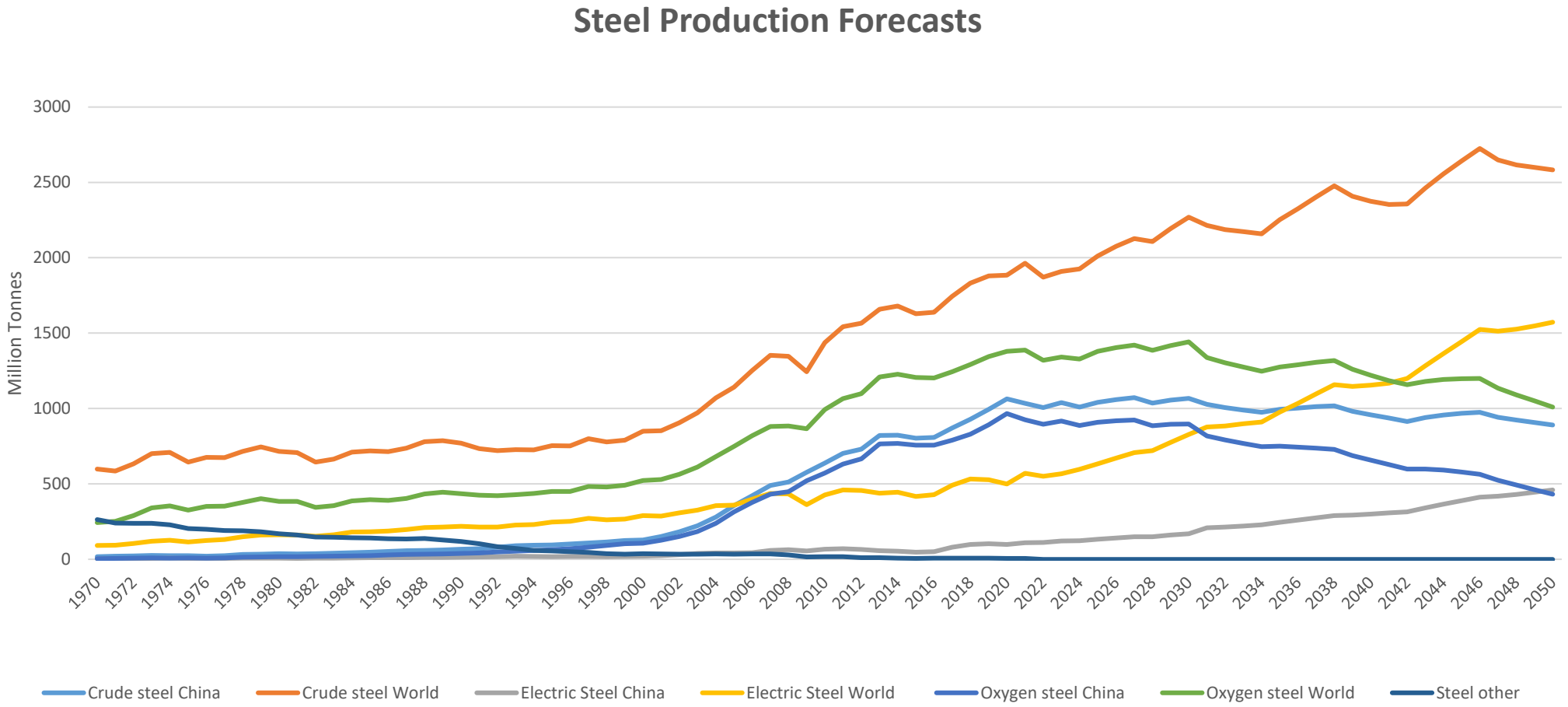
Total current consumption

- Estimated total consumption of refractories ~ 35 million tonnes
- Steel production on a worldwide basis in 2022 was slightly below that of 2019, before Covid, but is expected to rise above that level in 2023
- Total magnesia consumption of the order of 10 million tonnes
- Steel production of 1.87 billion tonnes in 2022
  - Roughly the same as in 2019
  - At average of about 4 kg magnesia per tonne of steel 7.5 M tonnes magnesia
- Cement production of 4.1 billion tonnes
  - At average of 0.4 kg magnesia per tonne of cement 1.6 M tonnes magnesia

Potential future trends

- Decarbonisation of steel industry
- Slower growth in steel production, notably in China
- Potential reductions in cement production as alternatives developed to reduce CO_2 emissions
- Increase in recycling of refractories
- Reducing supply chain distances

Future trends steel



Source: James F. King

Steel trends

Crude Steel and Steel Metallics

Product	*million tonnes*							*annual change*	
	2000	*2010*	*2020*	*2022*	*2030*	*2040*	*2050*	*2000-20*	*2020-50*
Crude Steel - total	849.2	1437.2	1884.0	1871.4	2269.4	2375.3	2582.9	4.1%	1.1%
EAF steel	289.0	427.1	499.5	550.8	827.6	1154.1	1572.7	2.8%	3.9%
BOF steel	522.4	993.3	1378.7	1320.6	1441.8	1221.1	1010.2	5.0%	-1.0%
Other steel	37.9	16.9	5.8	0.0	0.0	0.0	0.0	-9.0%	
Total primary iron	617.8	1103.3	1423.8	1434.0	1606.3	1490.8	1480.1	4.3%	0.1%
Blast furnace iron	570.5	1020.7	1298.6	1290.3	1386.7	1210.8	1055.1	4.2%	-0.7%
Other pig iron	4.4	9.9	18.9	19.1	22.5	23.8	25.1	7.6%	1.0%
DRI	42.9	72.8	106.3	124.6	197.0	256.2	399.9	4.6%	4.5%
Scrap consumption	382.2	602.6	790.2	812.0	1047.7	1283.8	1578.4	3.7%	2.3%
internal steelworks scrap	86.2	130.5	195.3	215.8	192.8	136.1	108.8	4.2%	-1.9%
external new scrap	96.2	190.6	245.1	230.1	291.7	312.4	338.4	4.8%	1.1%
external old scrap	195.1	285.8	348.9	367.9	567.8	692.6	1138.8	2.9%	4.0%
Arisings of scrap	443.8	688.6	893.1	1084.4	1207.5	1232.9	1365.7	3.6%	1.4%
Collection rate	86.1%	87.5%	88.5%	74.9%	86.8%	104.1%	115.6%		

Source: James F. King

Steel trends

- Total steel production to grow by about 1% per annum 2020-2050
- Much slower than previous 2 decades with reductions in China and industrialised countries offset by growth in India and developing nations.
- Still means a total increase of 700 million tonnes by 2050
- Big change in how steel will be made
- Significant growth in electric steelmaking tripling by 2050 but that still leaves over 1 billion tonnes of steel with blast furnace production of liquid iron and BOF furnaces.
- Scrap generation and DRI production not sufficient to sustain greater growth in EAF steel

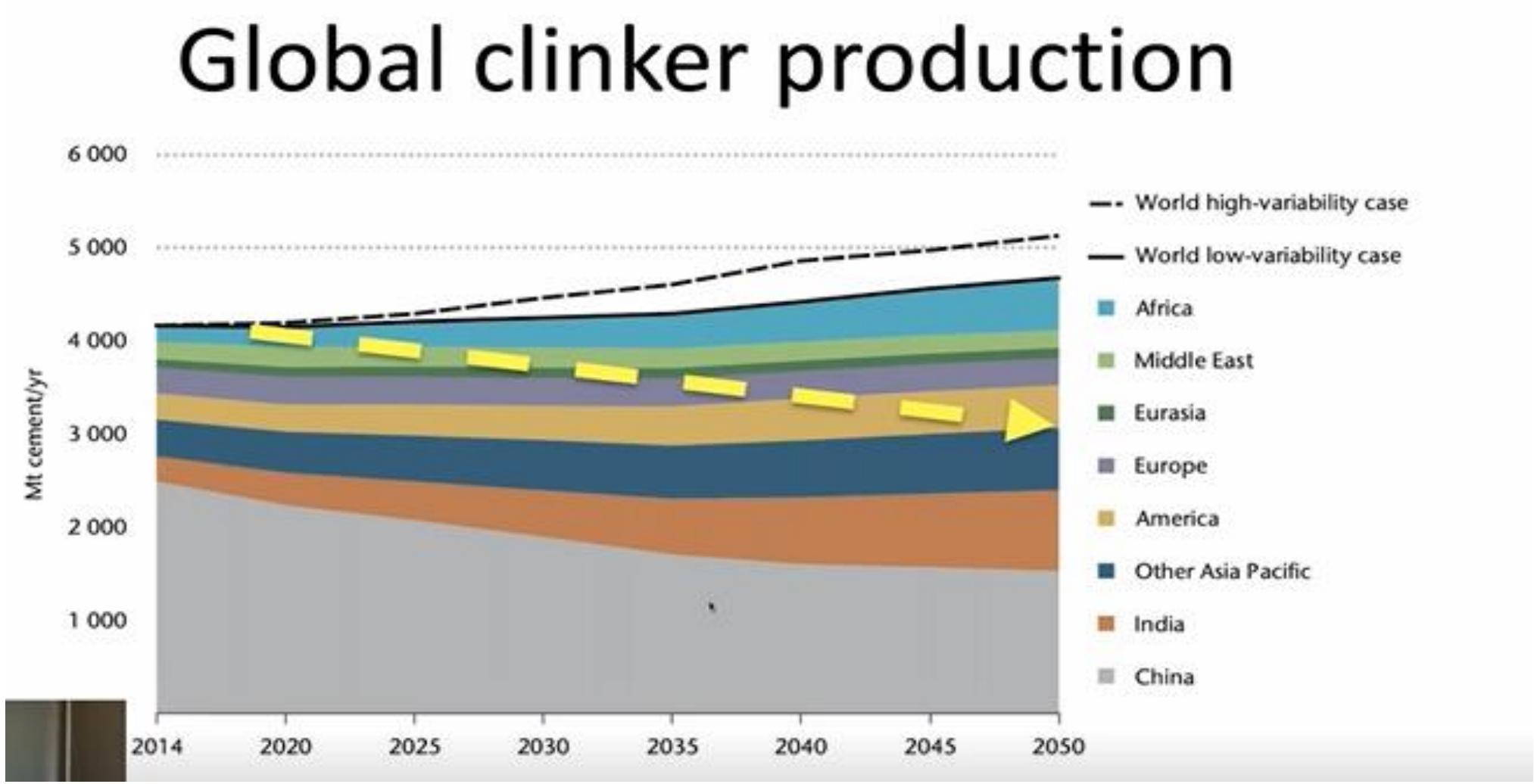
How does this influence refractories consumption

- BOF steel typically uses 10kg refractories per tonne of steel in Europe 15kg in China
- EAF typically 5kg per tonne of steel
- Reduction in total refractories consumption
- Less of a factor for magnesia which is used extensively both in EAF and BOF as well as in ladles and tundishes but not in liquid iron production or transport

Cement Trends

- Efforts to reduce the carbon footprint of cement are challenging with both the calcium carbonate component and the fuel releasing CO_2
- Many efforts looking at reducing the usage of cement with alternative materials
- Could lead to a reduction in total cement production
- Success at finding an economical large scale method for carbon capture or use could mitigate the reduction

Global clinker production



National Grid completes record-breaking pour of cement-free concrete at London Power Tunnels

- National Grid and contractor HOCHTIEF-MURPHY Joint Venture have extensively tested Earth Friendly Concrete prior to its use on the £1bn London Power Tunnels project to rewire London.
- 736 m3 poured saves an estimated 82 tonnes of CO_2, the equivalent emissions of driving a petrol car around the world 18 times
- World record-breaking pour is part of National Grid's ambition to achieve net zero construction across all its projects by 2025/26

Future uncertainty

- Steel production still growing but slower
- Scale of move to electric steelmaking depending on technology changes and DRI developments
- Total refractories consumption to decline but magnesia less influenced by changes
- If cement is replaced by low carbon alternatives consumption of all refractories including magnesia will decline as cement production declines.

Thank you for listening

If you have any questions I am happy to answer in this session if possible.

Otherwise please feel free to send them to me at the contact details below

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