The need for new manganese alloy capacity and where it will emerge in the future

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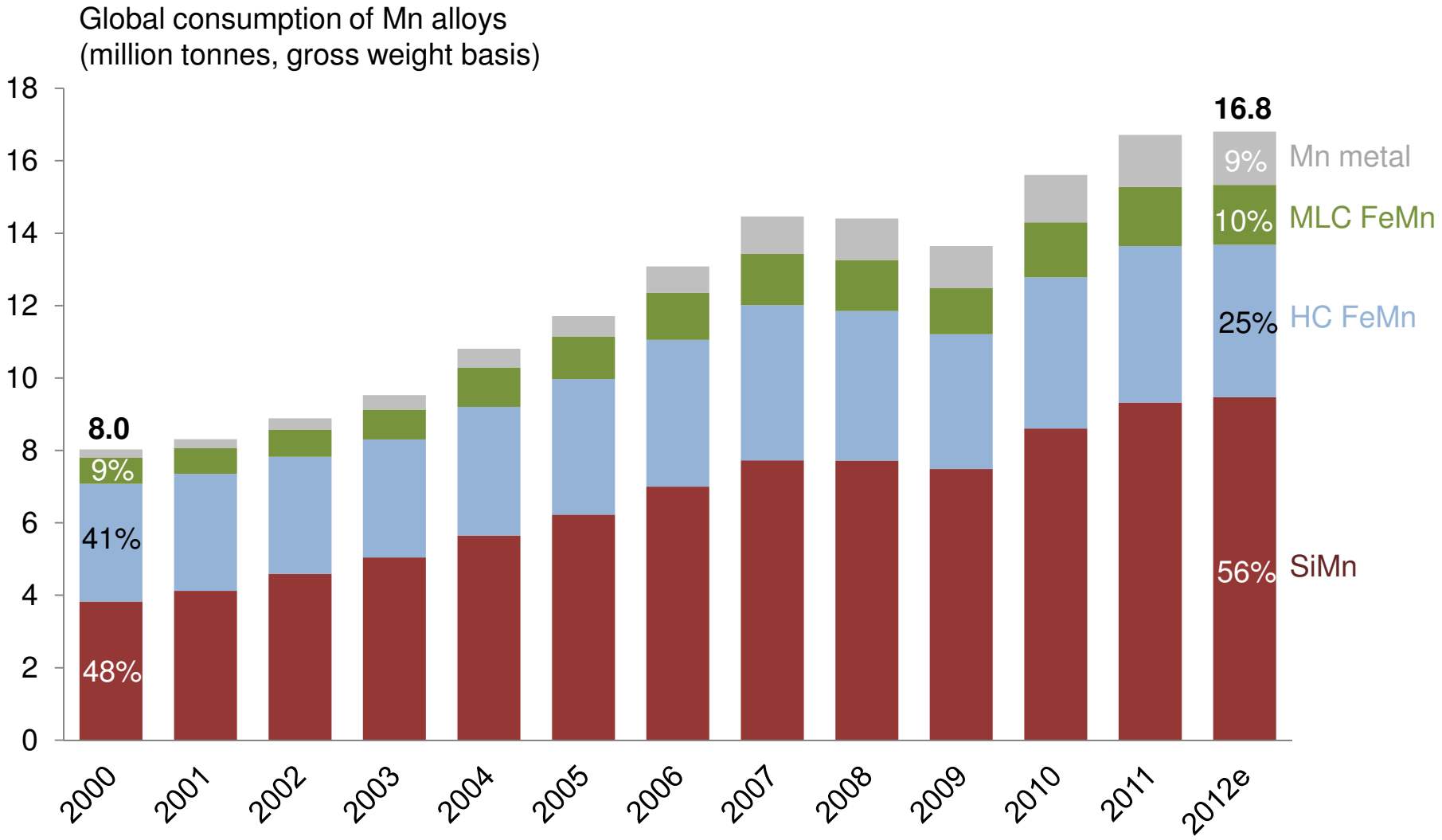
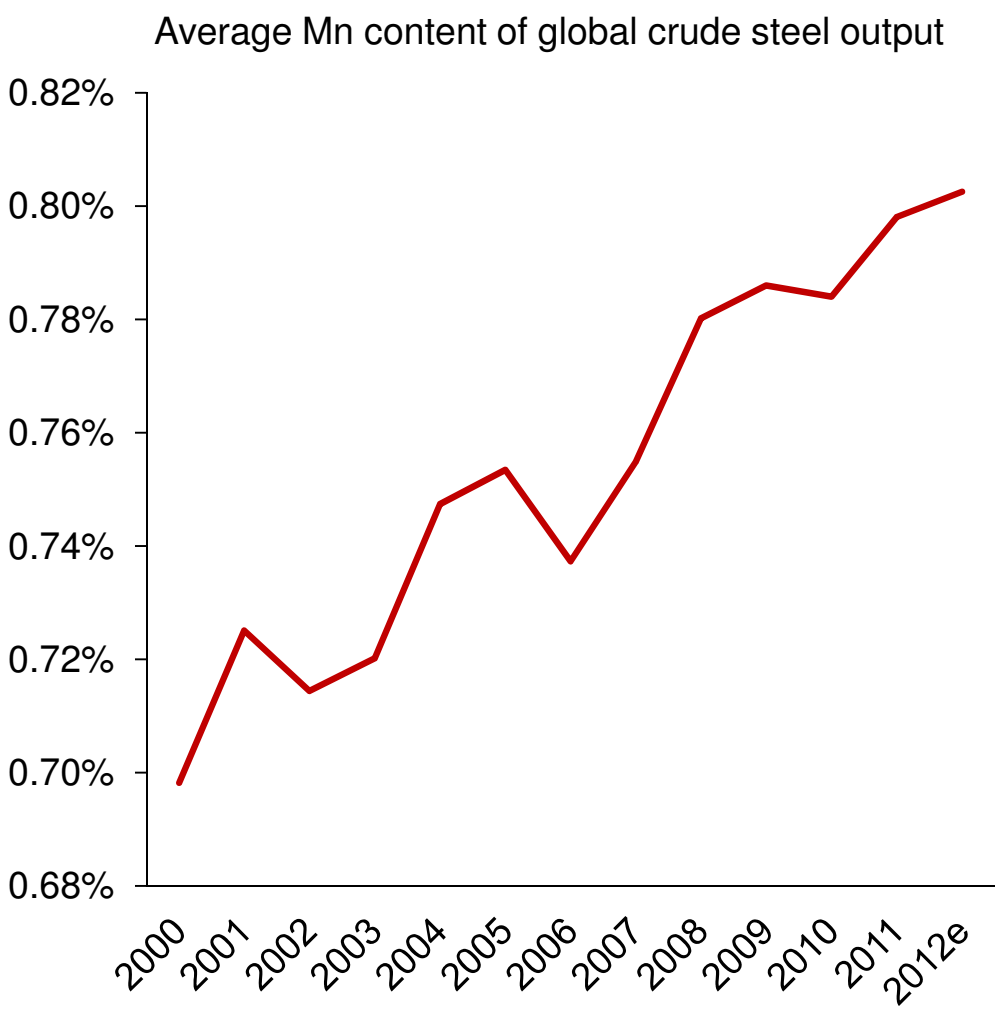
What is manganese?

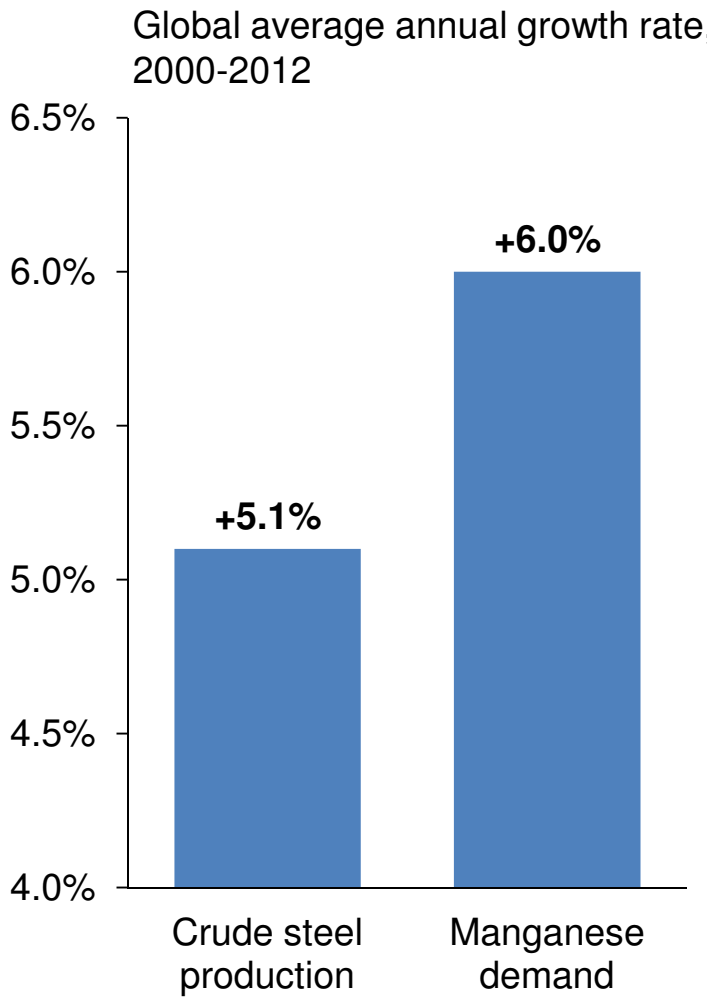
- Manganese is the world's fourth most heavily consumed metal
- Global mine output of 15 million tonnes in 2011 – over 90% goes into steel
- All steels contain manganese
- Manganese is used to remove sulphur from liquid steel (sulphur causes steel to crack)
- There is no viable substitute for manganese as a de-sulphuriser
- Manganese is also used to improve the strength of certain steels (structural steels, high strength flat steels)
- Non-steel consumption of manganese includes de-polarisation of dry-cell batteries, and as an additive in certain aluminium and copper alloys

Global demand for Mn alloys has doubled in the past decade. Trend has been towards SiMn, away from HC FeMn

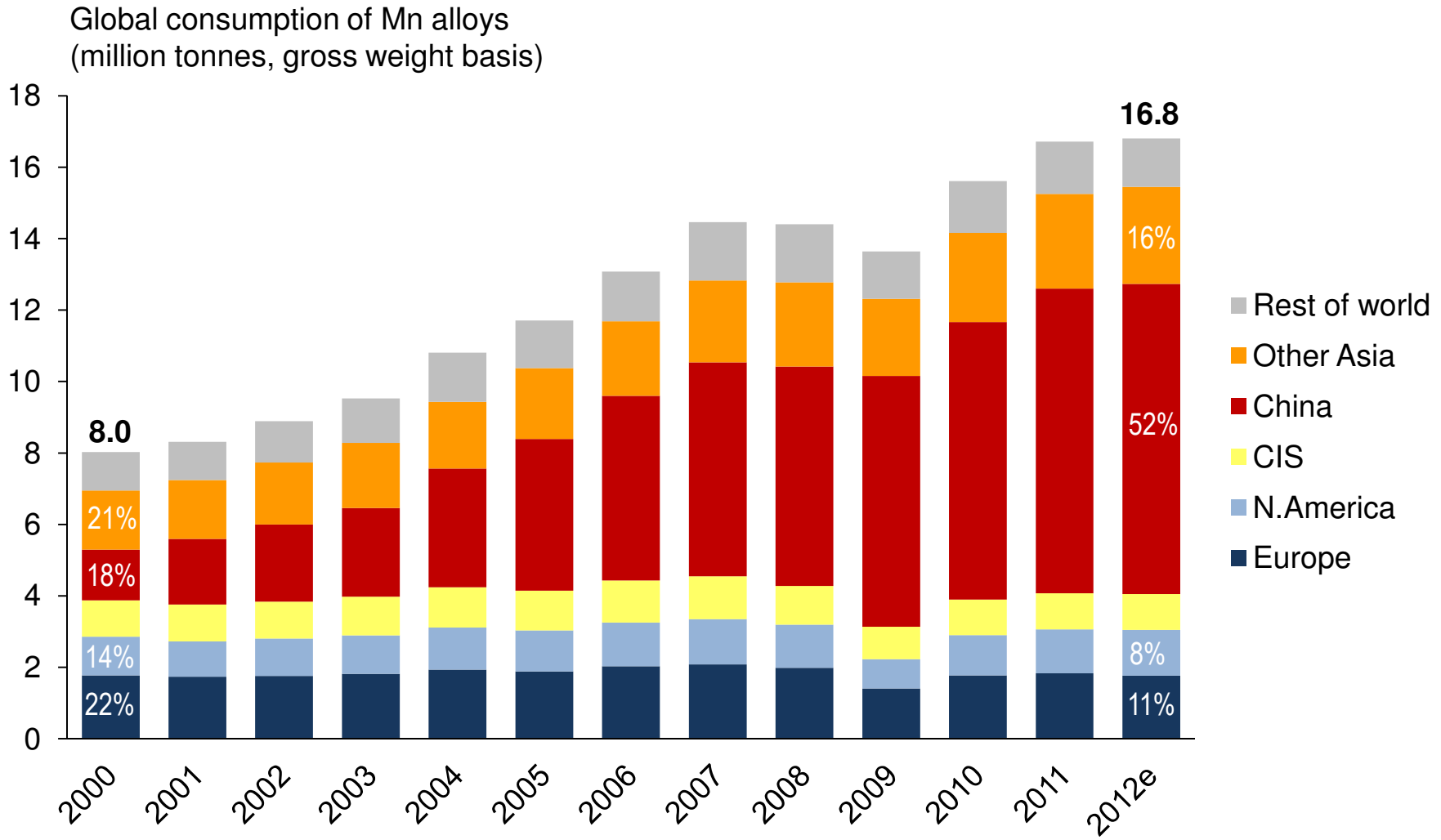


Average Mn content per tonne of steel has increased by 15% over the past decade

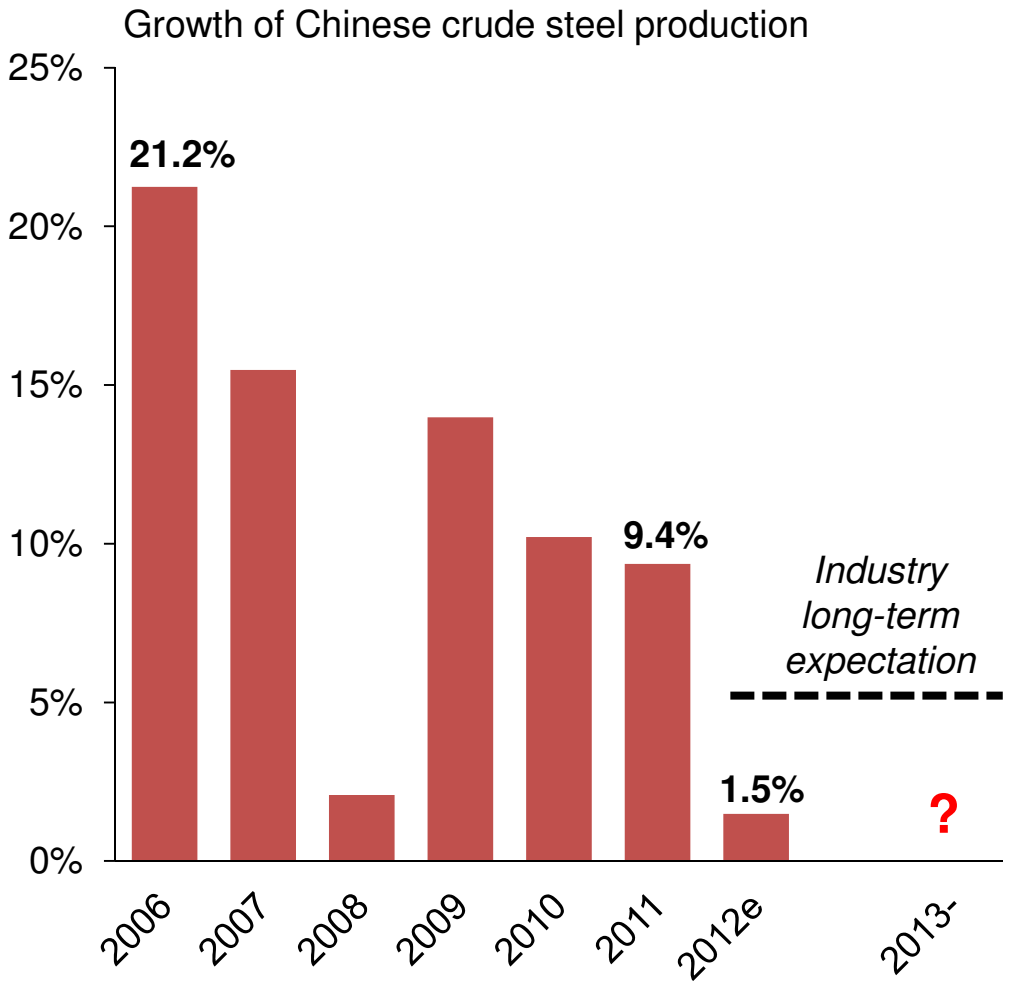


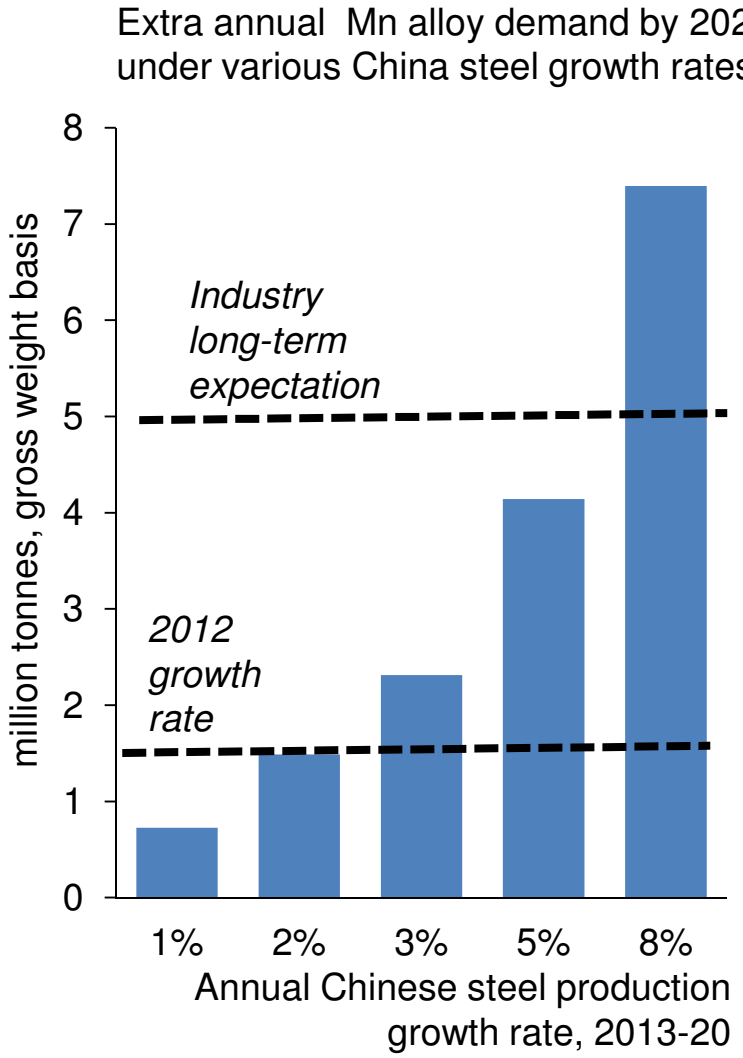


Demand growth has been fuelled by China. In 2012 China accounts for 52% of global demand, Asia in total for 68%



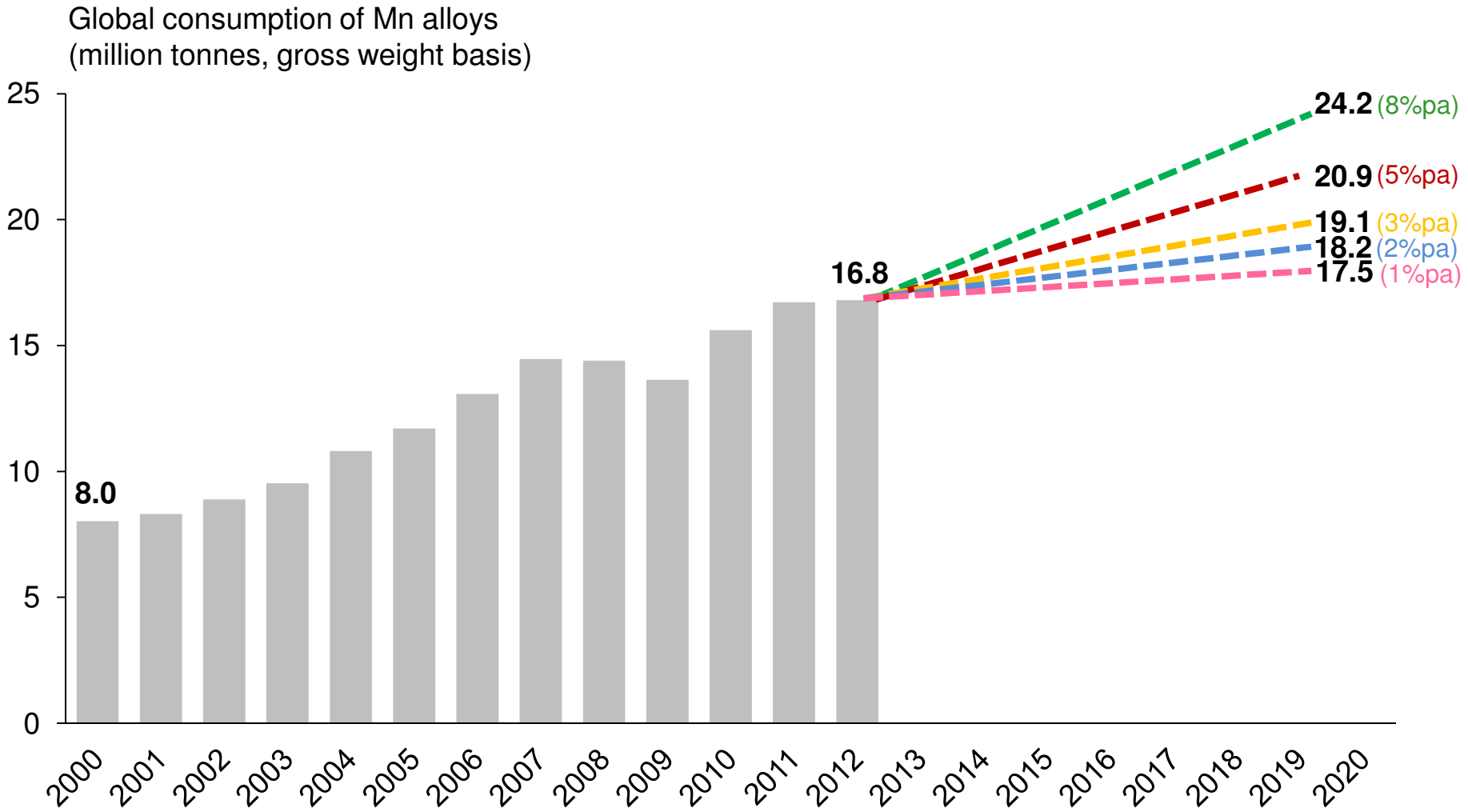
Demand level for Mn alloys over the next decade depends on steel growth rate in China, which has fallen sharply in 2012





* assumes Chinese Mn alloy consumption per tonne of steel at 2012 level

Assumptions on Chinese steel consumption/production growth make a huge difference to Mn alloy demand forecast for 2020



Forecasts assume Chinese Mn alloy consumption per tonne of steel at 2012 level

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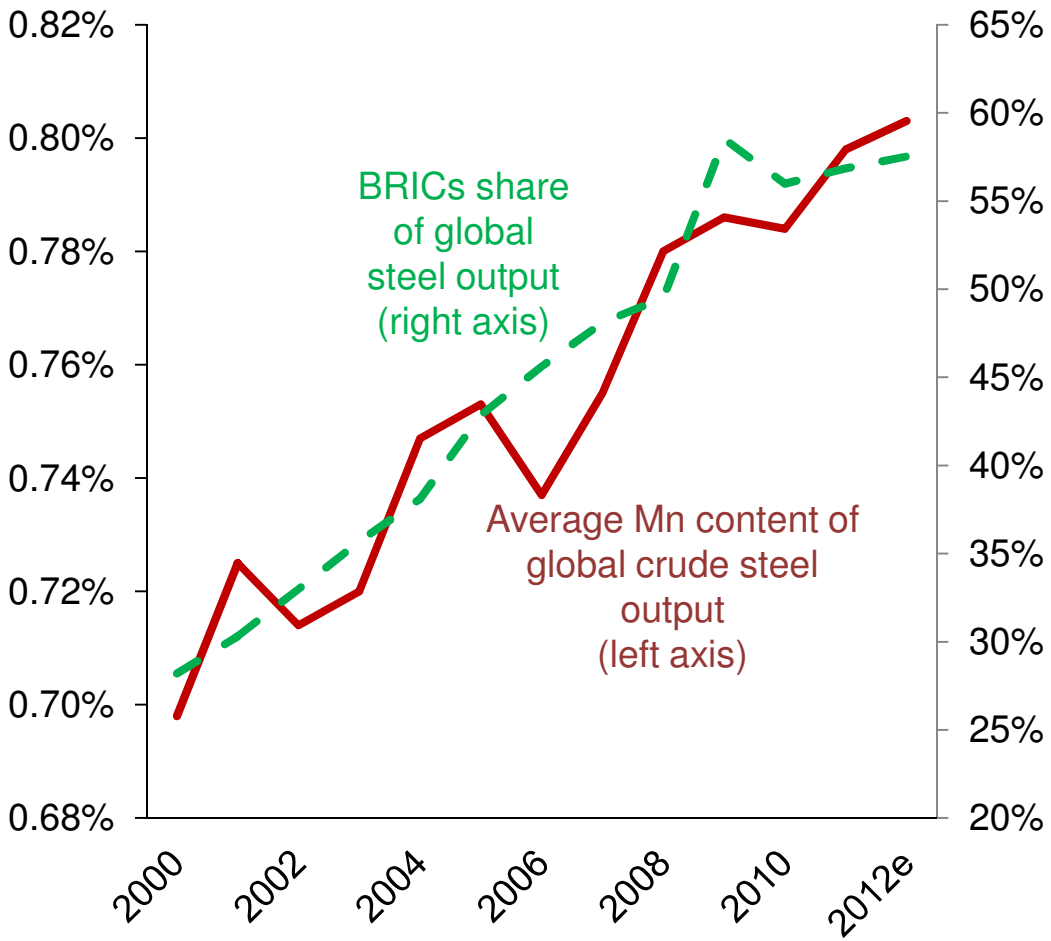
More positively, there are reasons to believe that the average Mn content of steel will continue to rise



Structural steels require strength, so tend to have a high manganese content

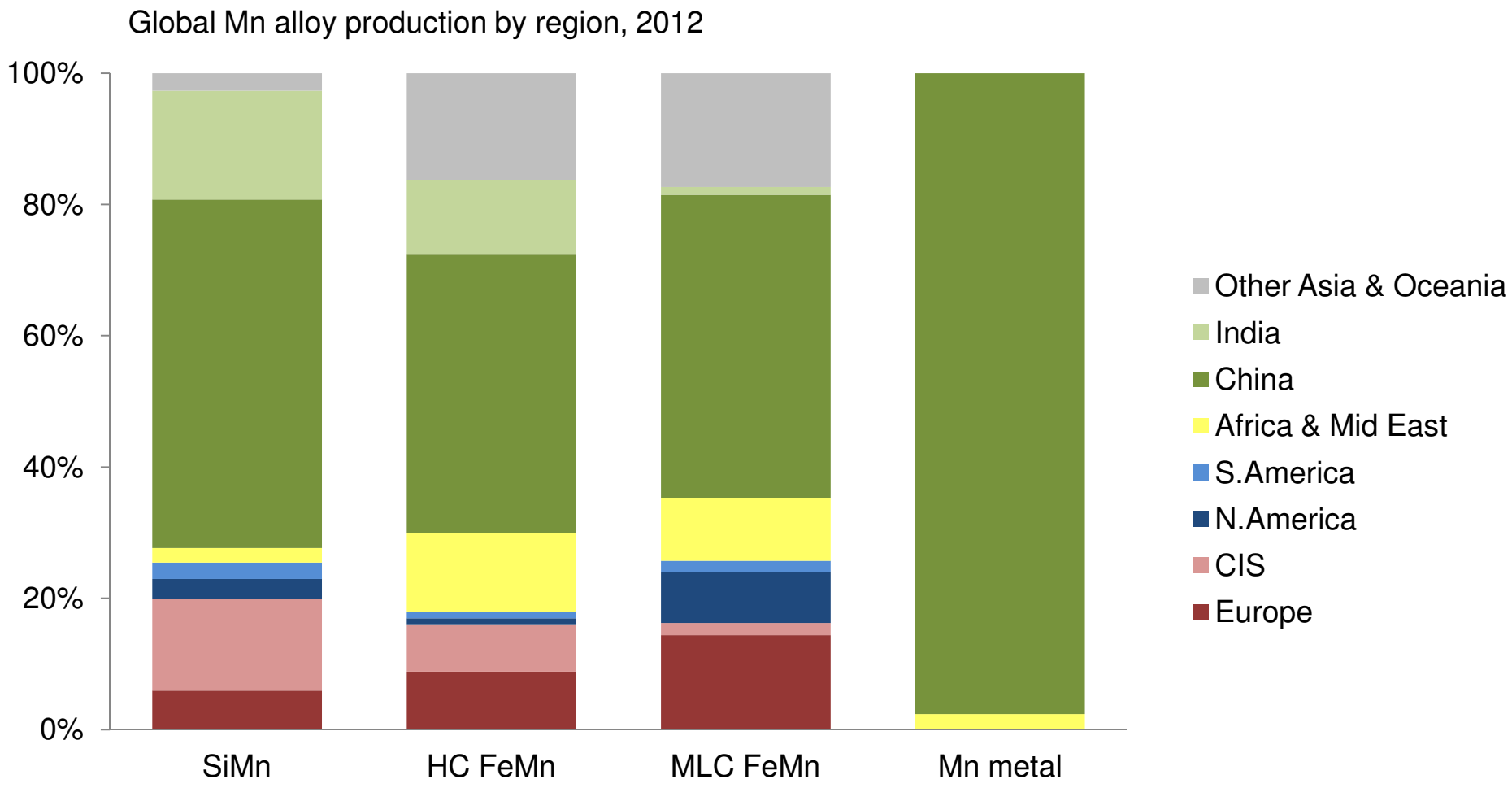
Developing countries focus more on structural steel consumption – for infrastructure and buildings

Chinese building / earthquake resistance standards will continue to tighten, leading to higher Mn content in steel (especially rebar)

Strong demand potential from India and other early-stage developing nations

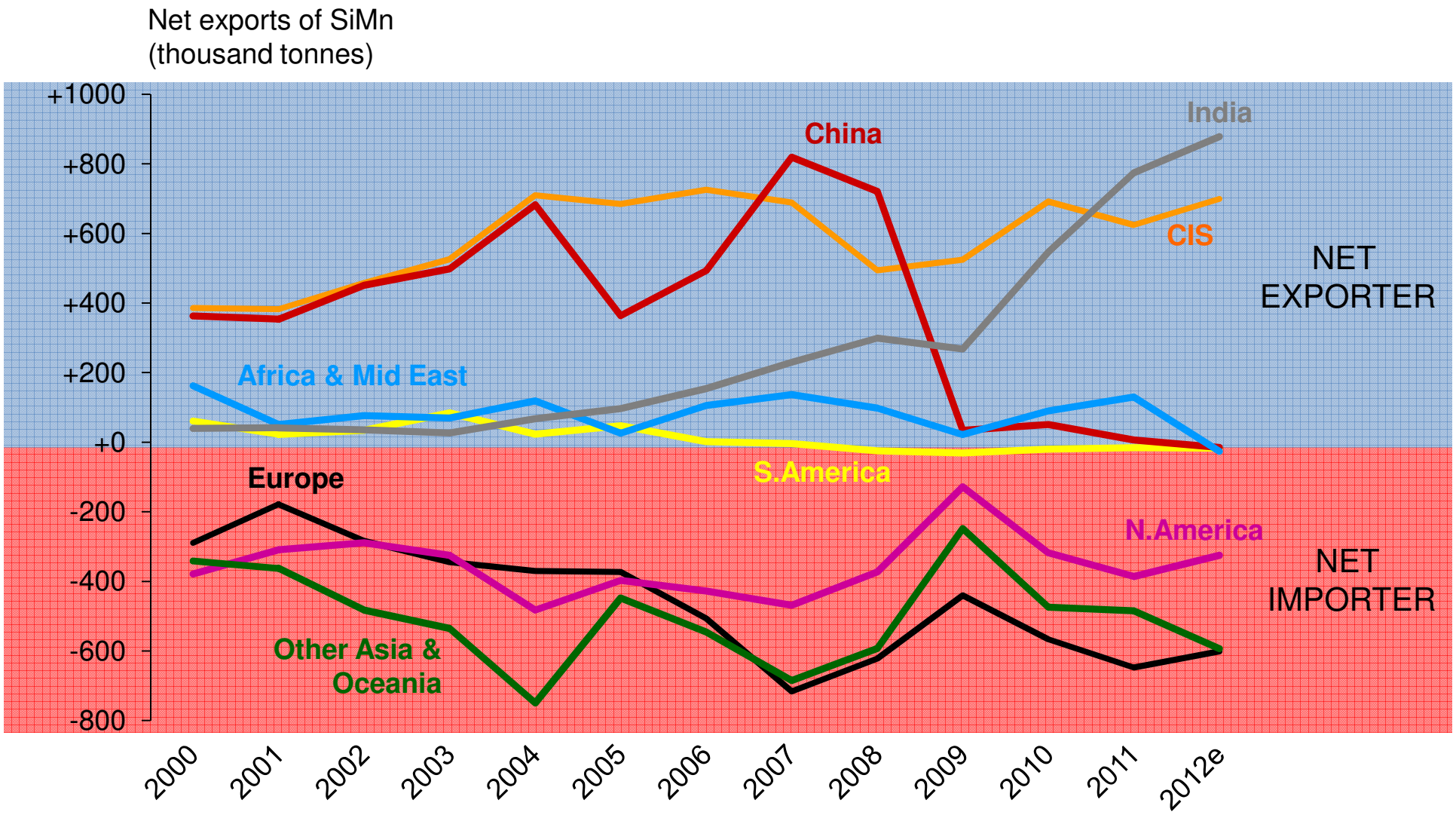
Increasing use of high-strength steels in automotive sector

Currently, Mn alloy output is dominated by China. India, Korea, Ukraine, S.Africa and Norway are also very large producers



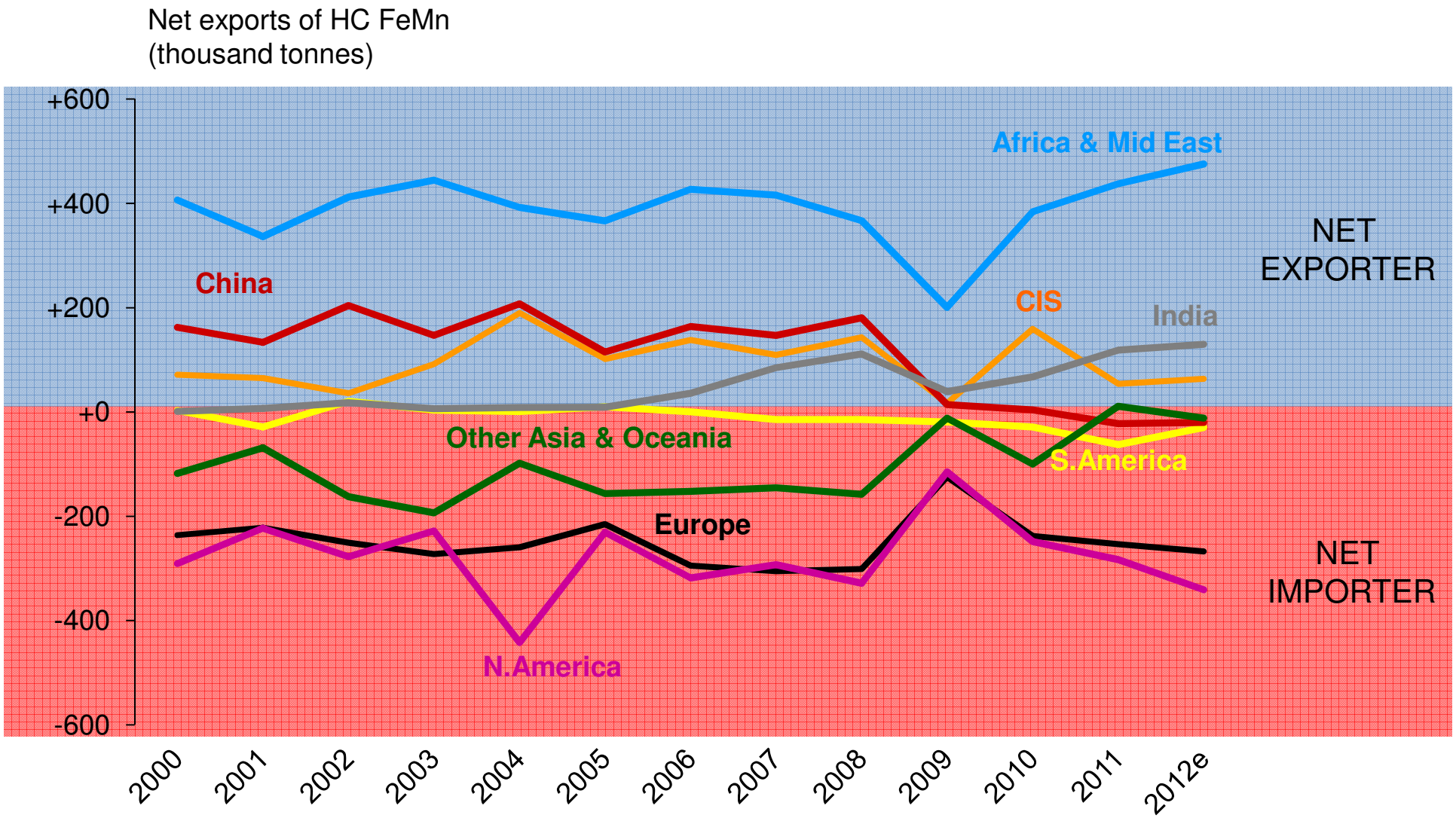
SiMn world trade flows

India has supplanted China and Ukraine as the number 1 net exporter



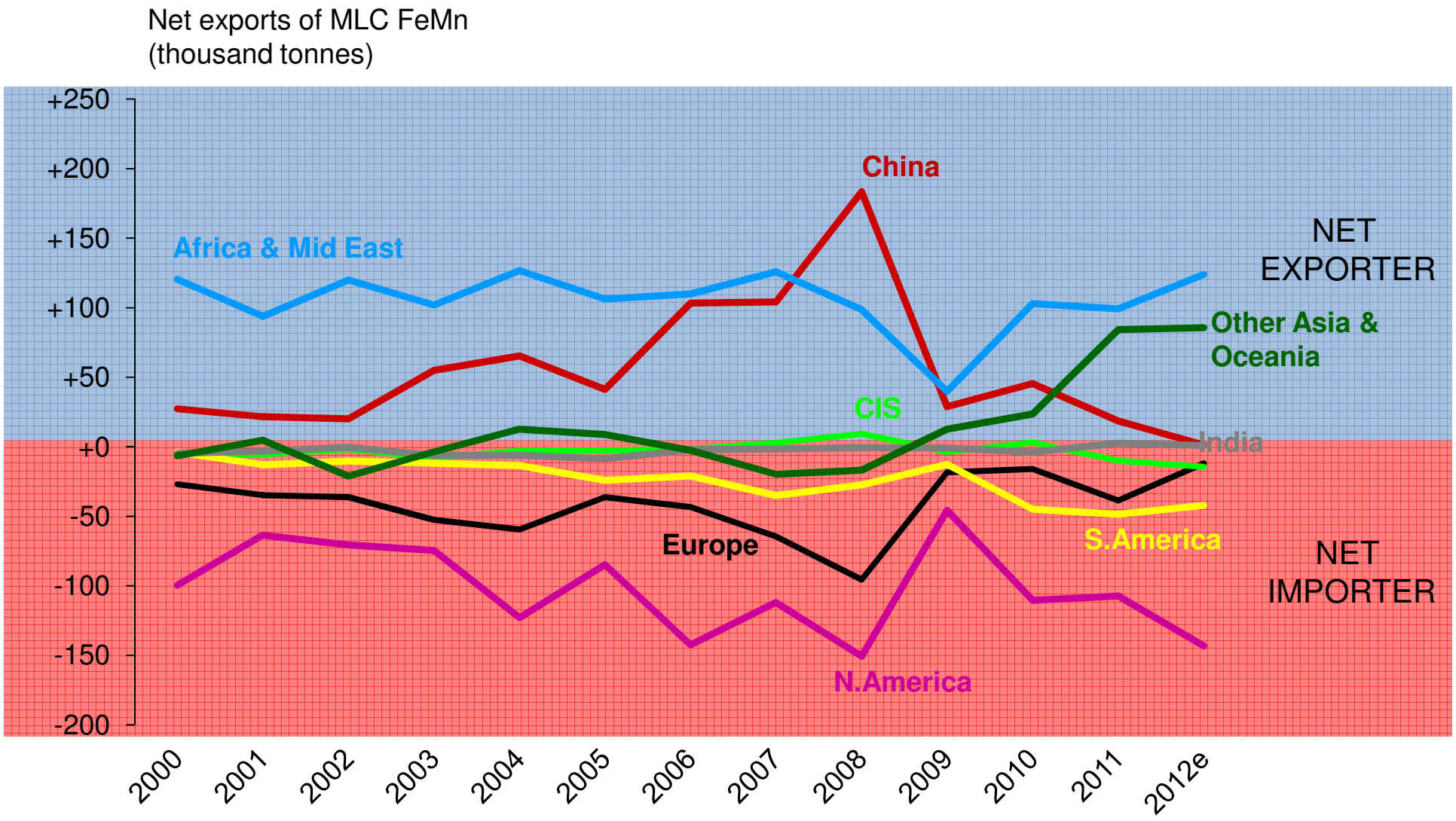
HC FeMn world trade flows

South Africa is extending its domination of world net exports



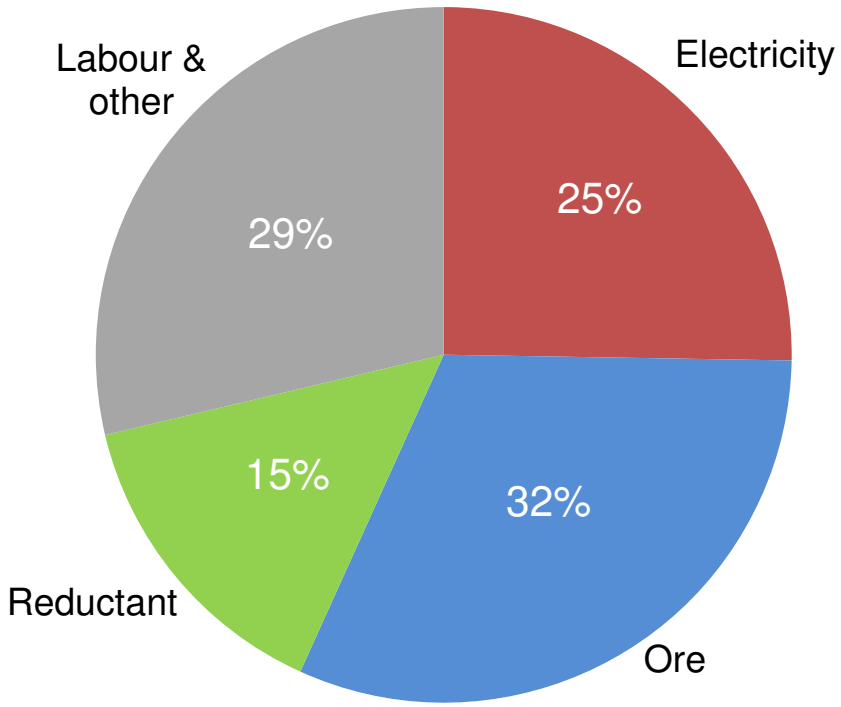
MLC FeMn world trade flows

South Korea starting to rival South Africa's lead in world net exports

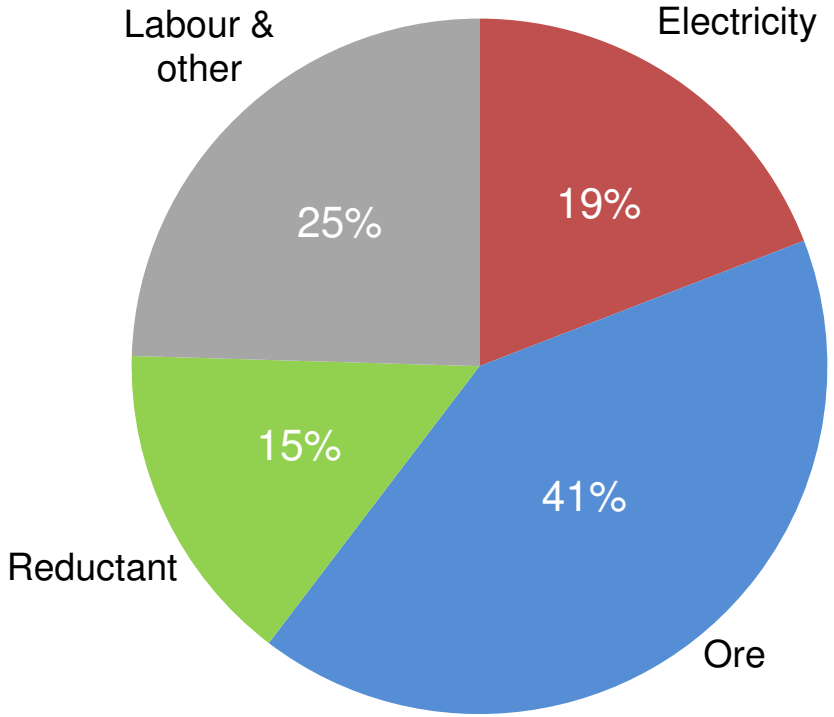


Global average Mn alloy production costs
by component, 2012

SiMn

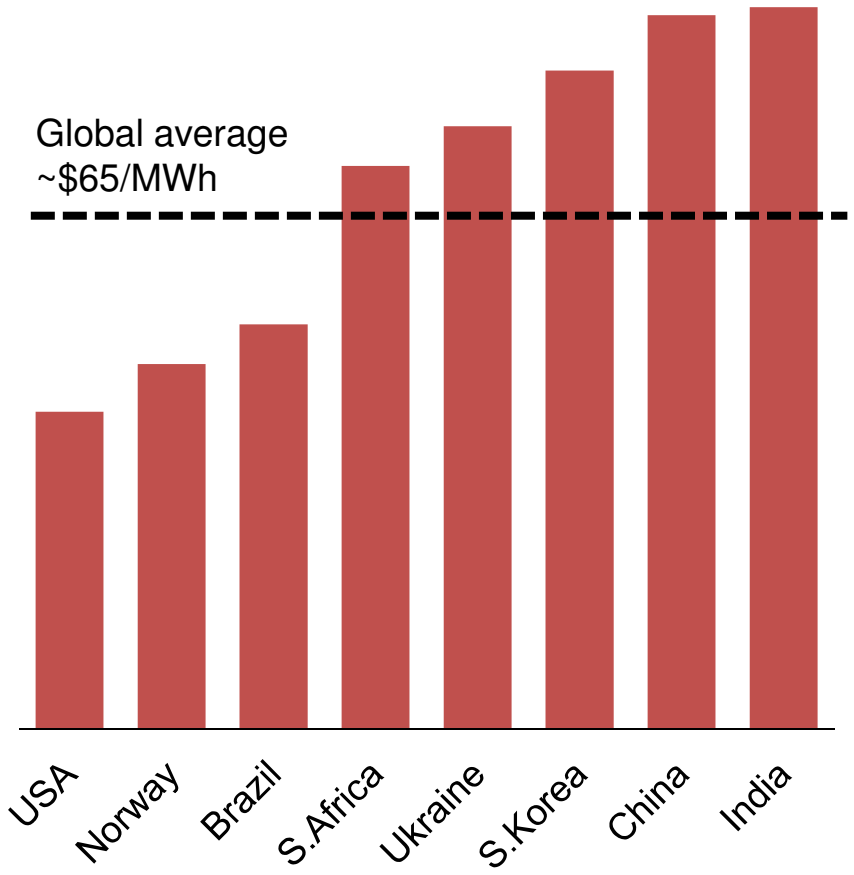


HC FeMn

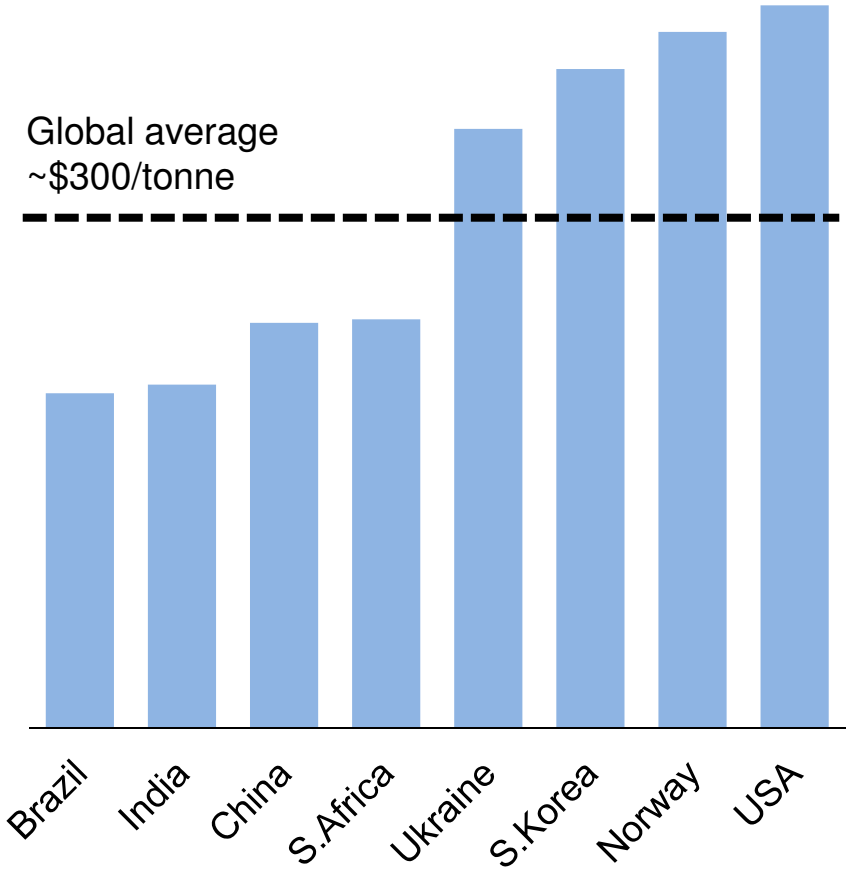


Electricity + labour are ~50% of production costs, and are the two cost components which vary most widely between countries

Average power prices in Mn alloy production, 2012



Average total labour-related costs in SiMn production, 2012*



* includes all maintenance, R&D and overhead costs

Conclusion
Analysis of Mn smelting potential by region

- China
- India
- Rest of Asia
- South Africa
- Middle East
- USA

Future Mn alloy smelting potential
China

- Huge nominal capacity of ~15 million tpy of Mn alloys
- New capacity still being built despite well-publicised closures
- Export taxes render export markets unprofitable, but future of export taxation uncertain in face of WTO opposition and economic slowdown
- Smuggling via Vietnam already a major factor in Mn metal & FeSi markets
- China has not become significant net importer of Mn alloys; where this has become the case (eg FeCr), it is diminishing
- Uncertainty over slowdown of Chinese steel growth – could this eventually lead to a return of Chinese exports?
- Environmental factors will become more important – in Mn metal especially

Future Mn alloy smelting potential
India

- High market power prices, but captive power plants common
- Labour costs cheaper than China
- Expansion of ferroalloy production driven by anticipated growth of steel output which hasn't happened yet
- Consequently, Mn alloy exports have risen substantially
- Increasing reliance on imported ore – from 10% to 50% of consumption over past 5 years – especially for FeMn production
- Arguably exports have "maxed out", and may reduce as rising local steel production absorbs more Mn alloys
- However, Indian Mn consumption per tonne of steel is highest in the world, and will gradually fall more in line with rest of world

Future Mn alloy smelting potential
Rest of Asia

- Potentially low power prices & low labour costs
- But highly dependent on future market growth and what happens to China
- Restrictions on ore exports may force more local smelting (eg Indonesia)
- Proposed projects:
  - OM Holdings, Sarawak, Malaysia
    265,000 tpy Mn alloys, 310,000 tpy FeSi
    Commissioning 2014-2015
  - Asia Minerals Limited, Sarawak, Malaysia
    350,000 tpy Mn alloys & FeSi
    Commissioning 2013-2014
  - Indonesia

Future Mn alloy smelting potential
South Africa

- Numerous ongoing expansions, focused on HC FeMn:
  - New furnace at BHP Billiton Meyerton
  - Gradual conversion of Assmang Machadodorp now 75% complete
  - Kalagadi smelter
  - Total effect of above +700,000 tpy extra HC FeMn output
- Power situation in South Africa increasingly favours switching to HC FeMn from SiMn and FeCr – strong possibility of further conversions to come
- Plentiful local availability of good quality ore – labour & reductant costs very competitive

Future Mn alloy smelting potential
Middle East

- Low power prices can be negotiated (<$40/MWh)
- Plentiful local capital availability:
  - Sovereign wealth funds full of oil & gas revenues
  - Ambition to diversify into local non-oil & gas projects
  - Sharia compliance and small project size can be problematic
- Rapidly growing domestic market
- Political risk
- Poor track record of previous Middle Eastern ferroalloy projects

Future Mn alloy smelting potential
USA

- Impact of shale gas revolution on energy prices is a game-changer
- Large, resilient domestic market, over-reliant on imports
- Stringent environmental regulation, but much worse for old sites
- Competitive labour costs away from highly unionised rust belt
- Potential expansion of existing capacity & switching from FeSi
- Potential Mn metal projects based on very low-grade domestic ores
- Resource self-sufficiency becoming major issue