STRANDED ASSETS

PROGRAMME

SMITH SCHOOL OF ENTERPRISE AND THE ENVIRONMENT

UNIVERSITY OF OXFORD

Stranded Assets and Environment-related Risks

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Agenda

Part I – Stranded Assets

- What are stranded assets and how might assets become stranded?
- Who is exposed and what are the potential implications?
- Are there systemic implications?
- What might this mean for your institution?

Part II – Stranded Down Under?

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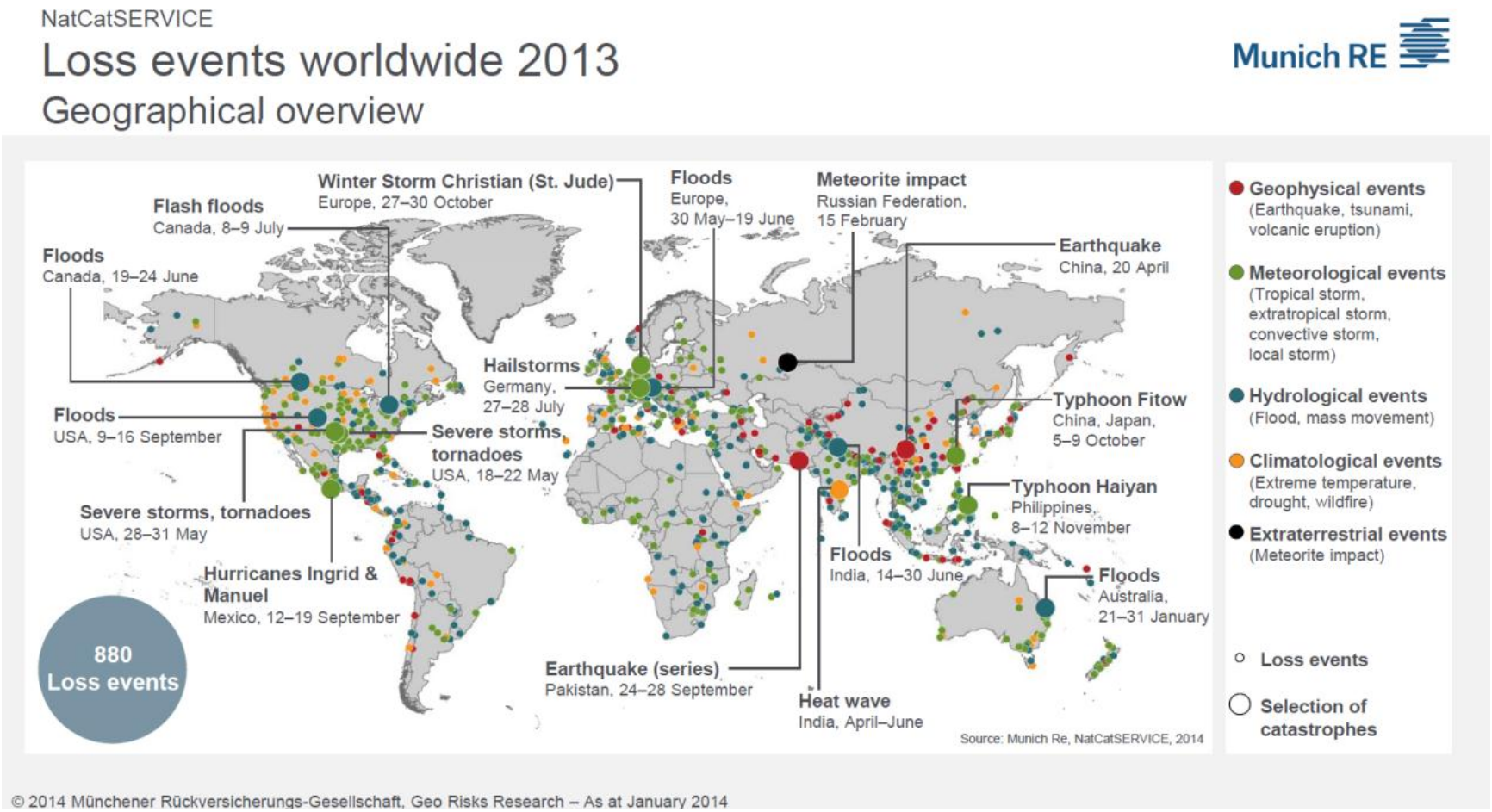
What are stranded assets in the environmental context?

- Unanticipated or premature write-down, devaluation or become liability.
  - Creative destruction
  - Technology and regulation
  - Extreme events
- Confluence of new risks may make some assets more prone to stranding.
  - Significant and accelerating
- Rarely understood or considered in decision making, especially amongst investors.
- Significant benefits associated with managing these risks.

Climate change



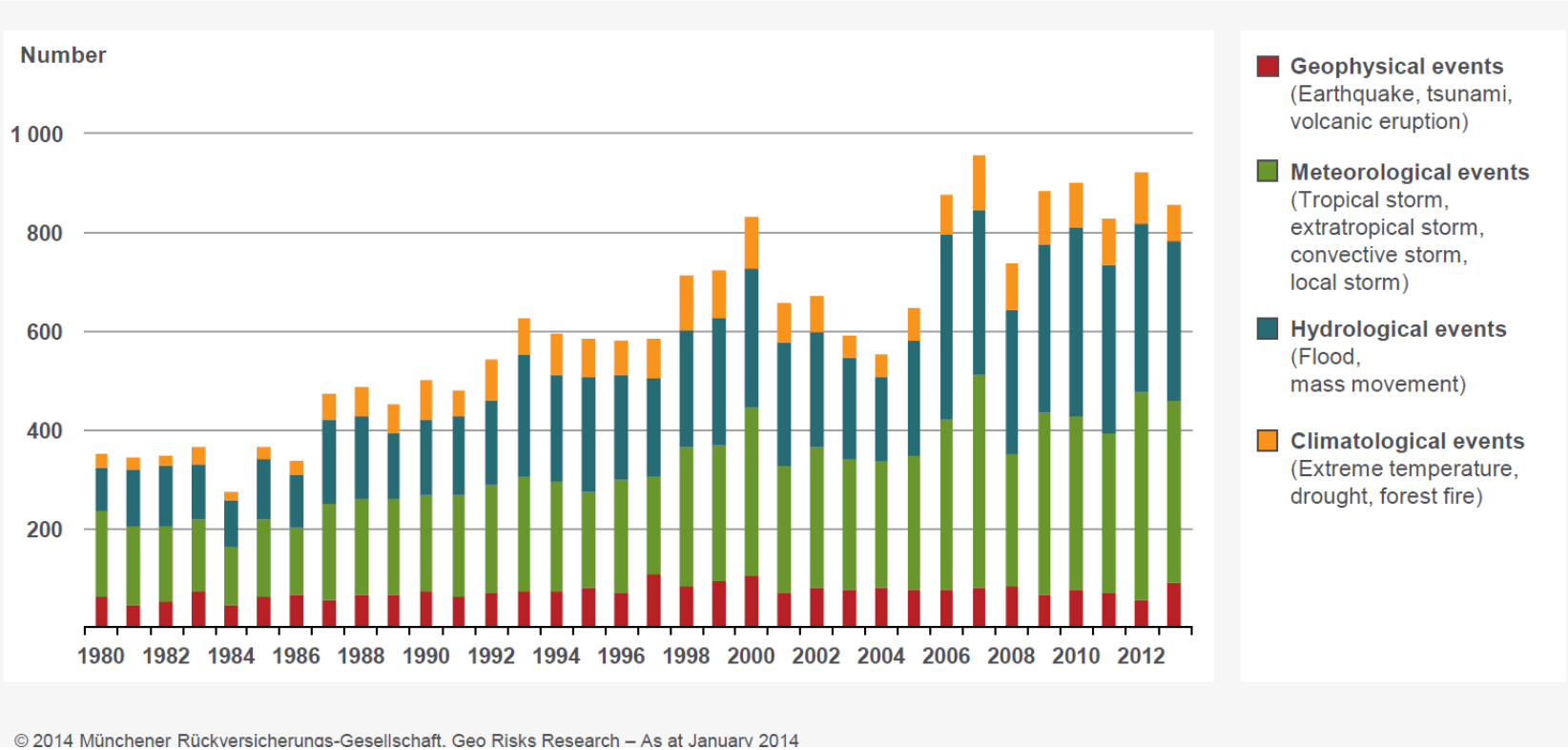
Climate change

NatCatSERVICE

Loss events worldwide 1980 – 2013

Number of events

Munich RE



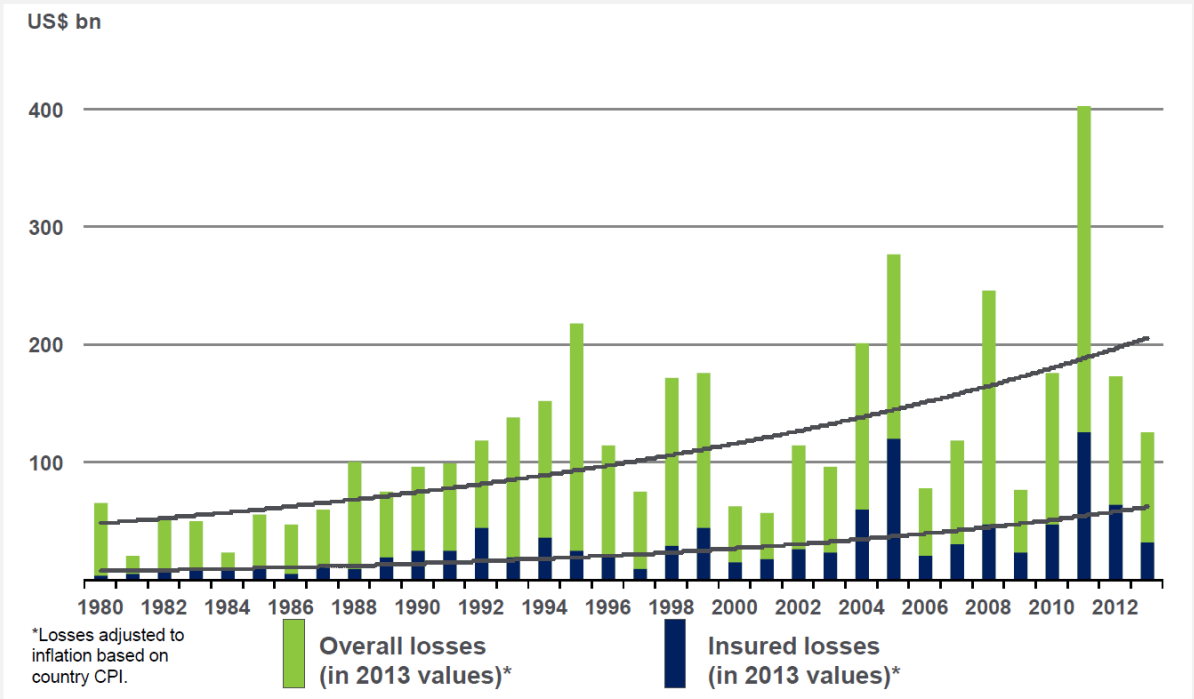
Climate change

Global Natural Catastrophe Update

Loss Events Worldwide 1980 – 2013

Overall and insured losses

Munich RE

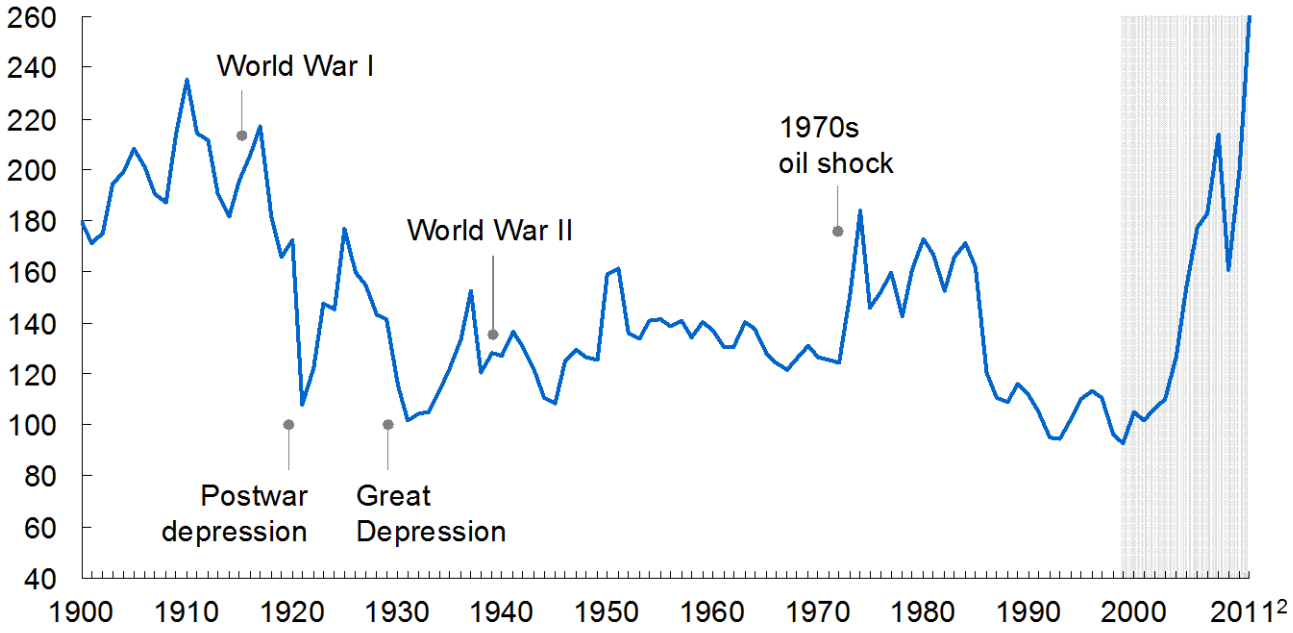


Source: Geo Risks Research, NatCat*SERVICE* – As at January 2014

Prices and resource availability

Commodity prices have increased sharply since 2000, erasing all the declines of the 20th century

MGI Commodity Price Index (years 1999–2001 = 100)[1]



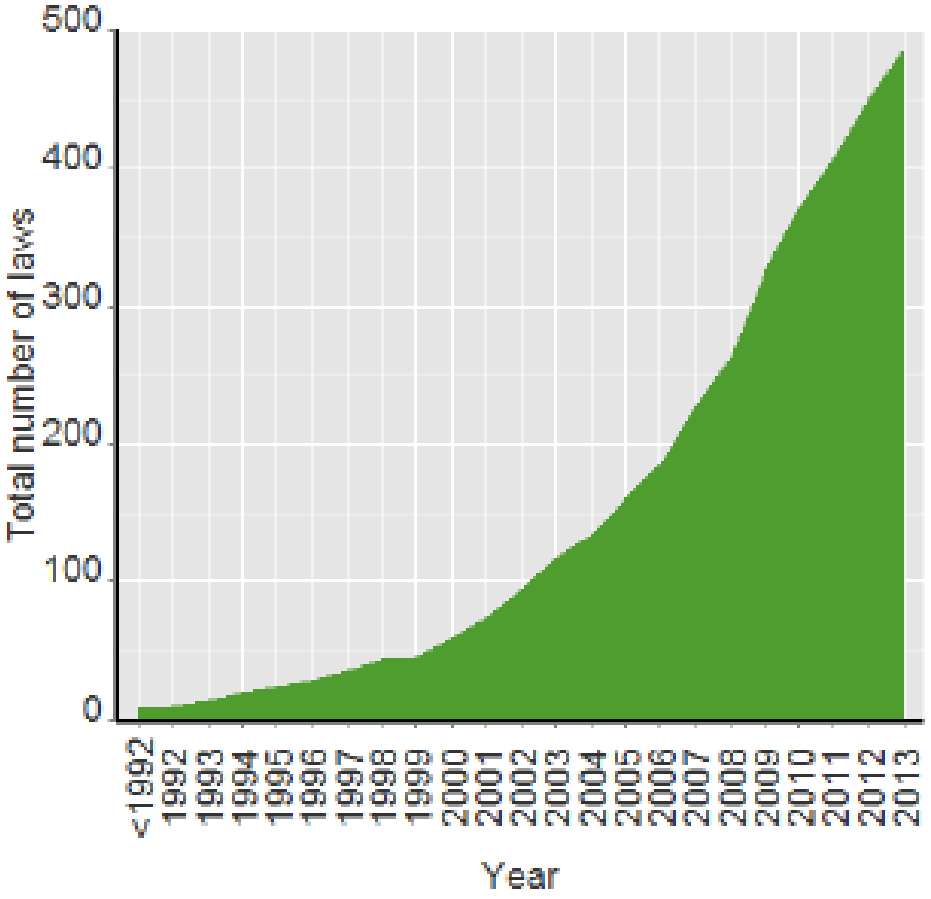
1 See the methodology appendix for details of the MGI Commodity Price Index.
2 2011 prices are based on average of the first eight months of 2011.
SOURCE: Grilli and Yang; Stephan Pfaffenzeller; World Bank; International Monetary Fund (IMF); Organisation for Economic Co-operation and Development (OECD); UN Food and Agriculture Organization (FAO); UN Comtrade; McKinsey analysis

Prices and resource availability

Source: UK Price Indices, Castle Cover Insurance

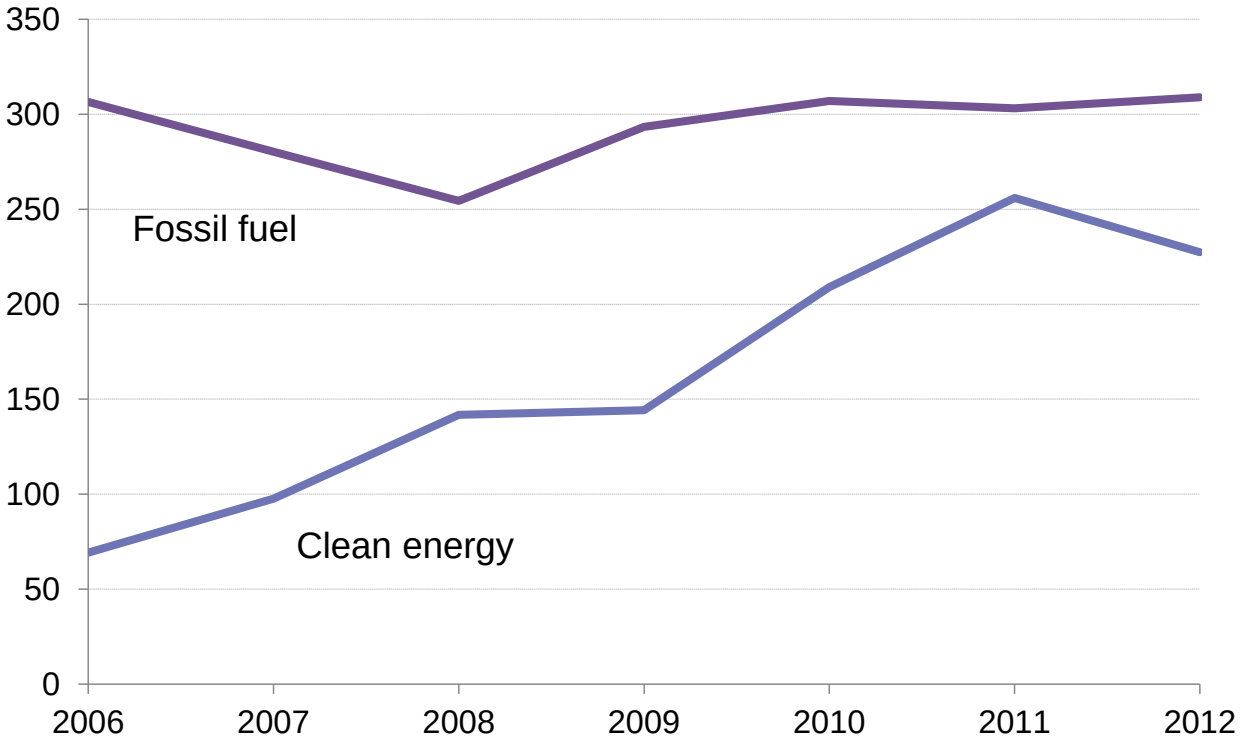
Government regulations

- Over the past decade climate change regulations globally have increased rapidly.
- According to Globe International, 88% of global CO2 emissions come from 66 countries.
- These countries currently have 487 laws pertaining to climate change, up from <100 in 2002, and <40 in 1997.



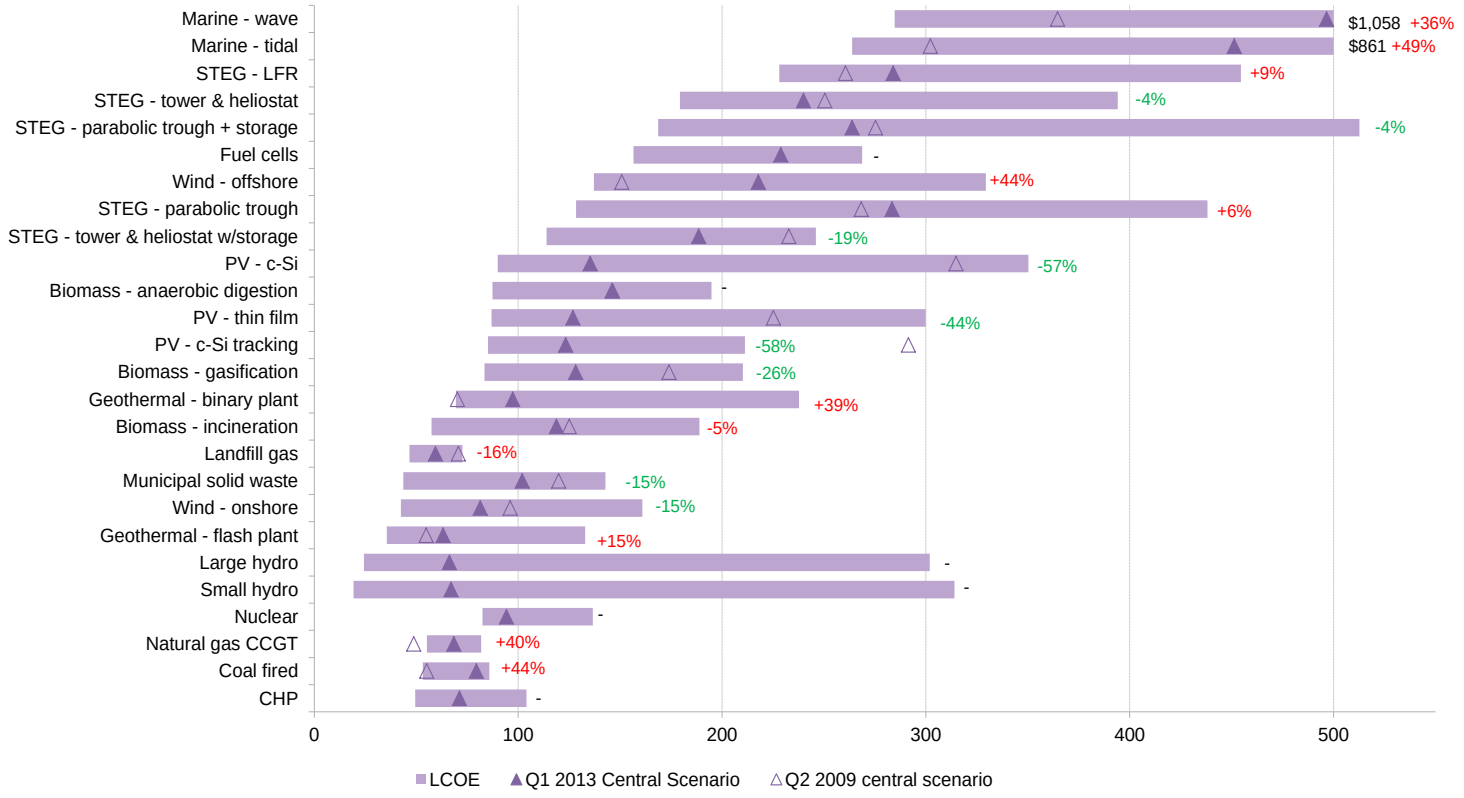
Source: Globe International, Globe Climate Legislation Study 4th edition

New technologies – clean vs fossil generation investment (bn $)



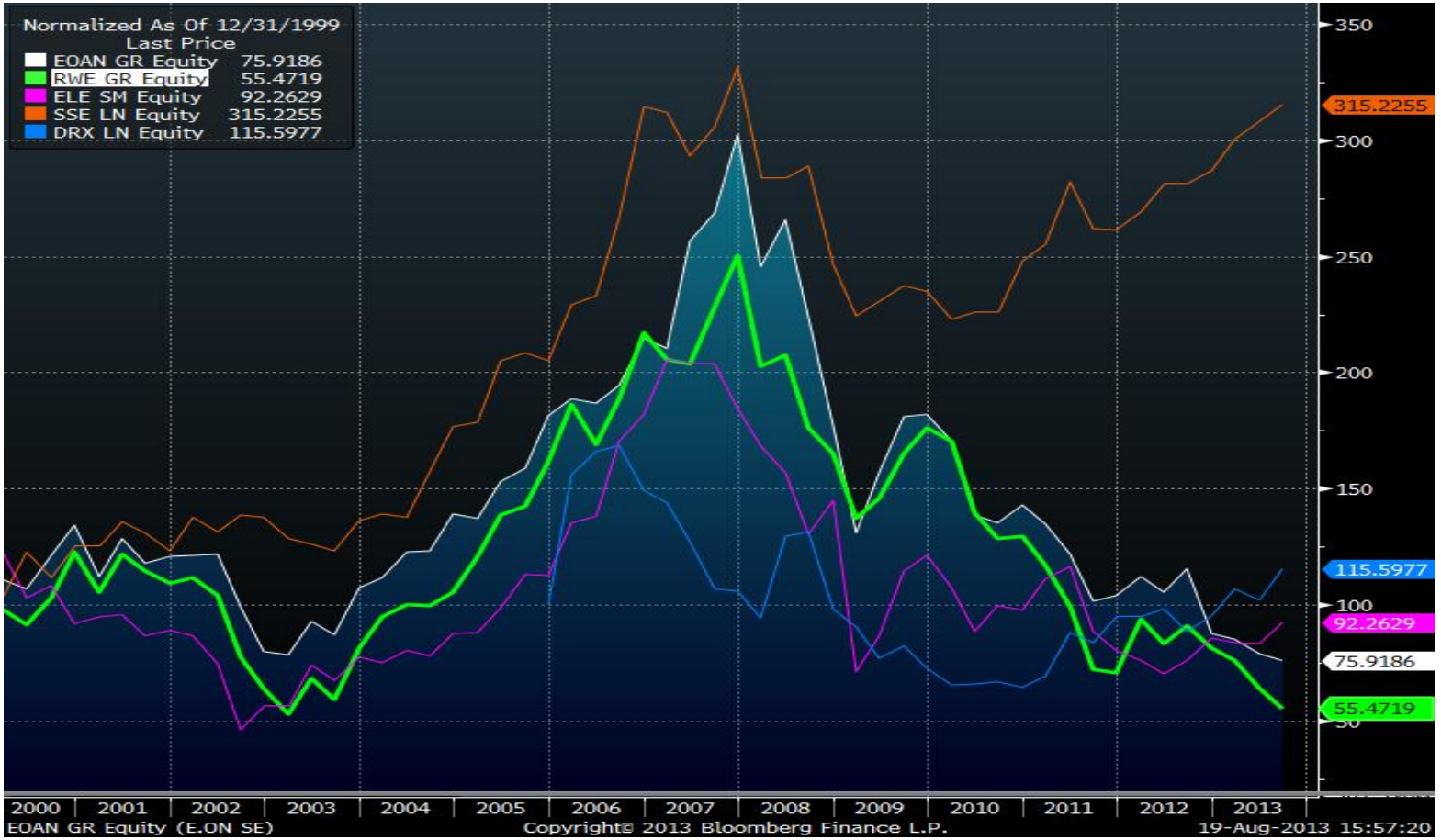
Source: Bloomberg New Energy Finance

New technologies – LCOE Q2 2009 vs Q1 2013, per MWh



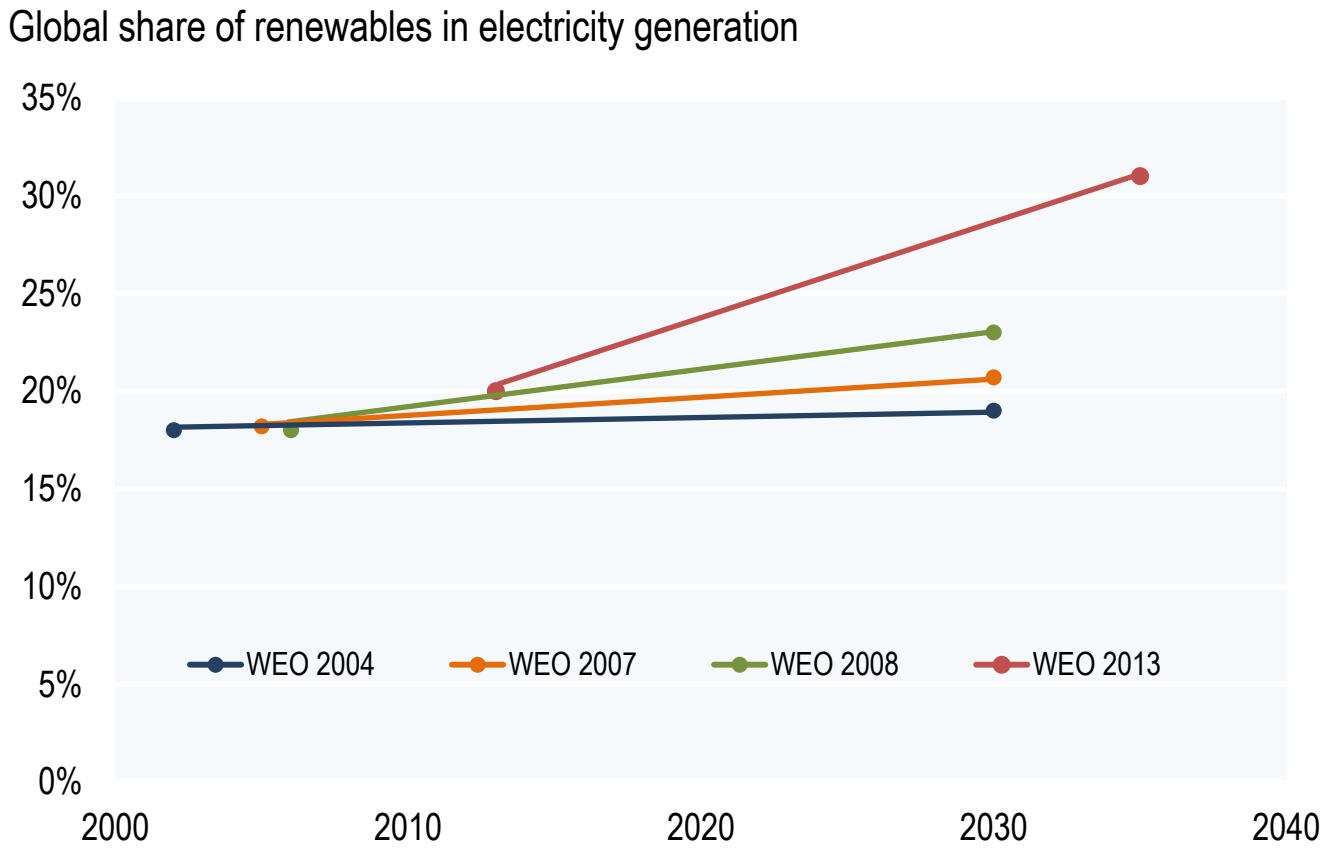
Source: Bloomberg New Energy Finance

New technologies – EU Utility Share Prices



Source: Bloomberg

Technologies move faster than projections



Source: OECD analysis based on projections of IEA World Energy Outlooks in Reference Scenarios of WEO 2004, 2007 and 2008, and New Policies Scenarios in WEO 2013.

Why do stranded assets matter?

- **Size of potential VaR and risk at variety of levels, sectors and geographies**
  - e.g. listed and unlisted, equity, debt, sovereign, business models, and development strategies

- **Stranded assets are beginning to have real impacts today**
  - Firms in many sectors have been left with significant asset impairments and write-downs, necessitating changes in strategy

- **Asset stranding is occurring in unexpected and counterintuitive ways in some sectors**
  - Domino effect and correlation

- **Asset stranding may increase the costs of achieving sustainable and resilient economies, for firms, governments, and society**
  - Potential negative impacts on efficient transitions to sustainable business models, the ability of governments to facilitate effective low-carbon transitions, and the stability of the global economy and financial system

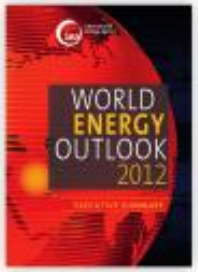
Yet stranded assets remain poorly understood

- **Complex dynamics**
  - Materiality
  - Reversibility
  - Typologies
  - Correlations

- **Asset stranding may affect value in a number of different ways.**
  - Economic
  - Financial
  - Capital
  - Natural
  - Social assets, intangible assets, and goodwill

- **Thresholds for stranded assets are highly context dependent, and ways to value them are different across sectors.**

Stranded assets – A developing literature



2011 2012 2013

‘Unburnable Carbon’ – significant attention, what impacts?

- Implications of “carbon bubble” imposed by climate policy for the value of fossil-fuel industry has inspired debate

Nuanced perspective? Components of value, sectoral and geographic approaches

- Acknowledgement of environment-related risks
- Increasing involvement of actors: Banks, Analysts, Universities, IGOs
- Examination of more detailed risk, impact, and response profiles
- Shift beyond equity to examining debt, capex, cost of capital
- Differentiation among assets, projects, products – move to cost-curve approach

Mixed actions and responses across the investment chain

- Increasing public awareness and concern in different countries/regional markets
- Development of fossil-fuel divestment campaigns in the US and EU
- Shareholder resolutions, notable divestment actions, pressure for increased performance

Criticisms and counter arguments

- *"Short term valuations insulate investors from these long term risks."*
  - **Counter argument**: Some environment-related risk factors are actually quite immediate, with complex relationships emerging.

- *"Markets already appropriately value environmental risks."*
  - **Counter argument**: Vast quantities of evidence show that global financial markets are mispricing or ignoring these risk factors.

- *"This is just the same as creative destruction elsewhere in the economy, why care?"*
  - **Counter argument**: Confluence of related risk factors is significant; drivers, consequences and responses to such stranding are still not understood.

- *"Even if there are stranded assets, markets will have time to readjust."*
  - **Counter argument**: Flexibility depends on time horizons; exits always appear bigger than they actually are and liquidity could be a major problem under certain scenarios.

Systemic risk?

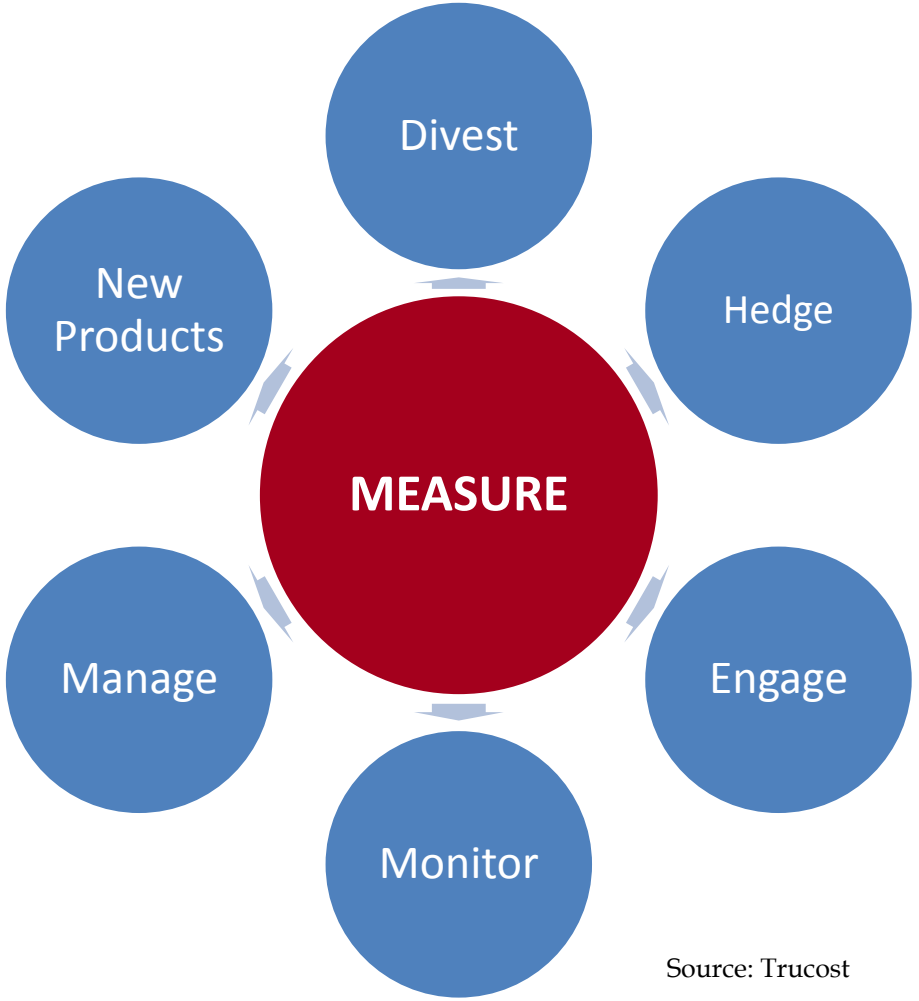
- **Levels of exposure across different parts of the financial and economic systems likely to be very significant.**
  - Listed equities are the only area where we currently have ok data.

- **Bank of England tests:**
  - Exposures of financial institutions to carbon-intensive sectors are large relative to overall assets;
  - Impact of policy and technology is not already being priced into the market, either through lower expected returns or higher risk premia;
  - Subsequent correction would not allow financial institutions to adjust their portfolios in an orderly manner.

- **What could central bankers and financial regulators do?**
  - Track exposure; stress testing; macro-prudential tools to deflate exposure.

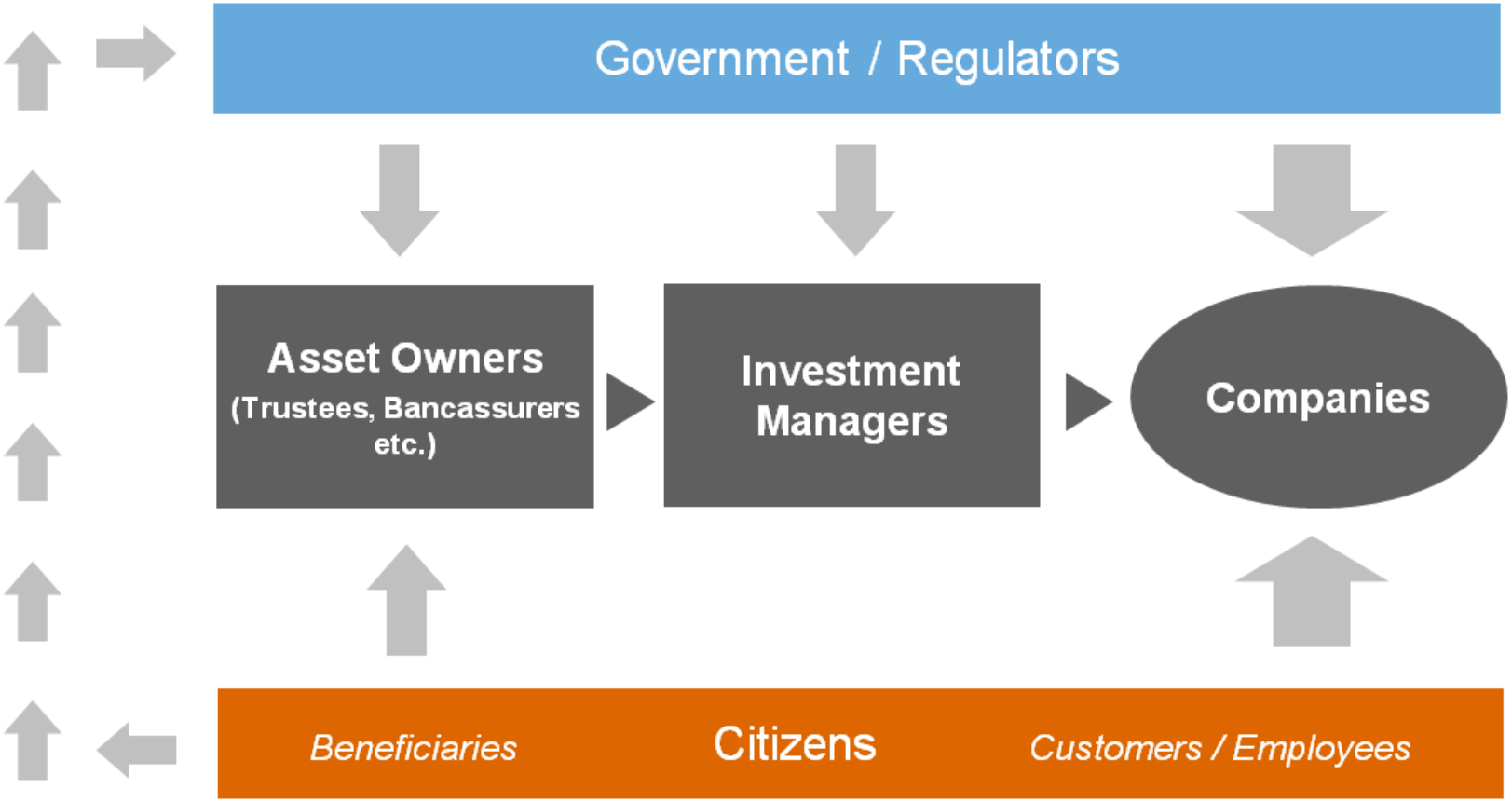
Managing risk

- Need to understand whether risks are material and when they might be material.
- Monitor, measure, track.
- Scenarios and stress testing.
- Time horizons, sequencing and correlations.
- Quantitative vs qualitative (risk vs uncertainty).
- Embed in credit risk/due diligence processes.



Source: Trucost

Application depends where you are in the investment chain



Source: Russell Investments

Conclusions

- **Stranded assets are poorly understood**
  - Complex dynamics – materiality, reversibility, typologies, and implications – need to be more clearly understood if firms are to be resilient to environment-related risks

- **Nonetheless, stranded assets are beginning to have real impacts today**
  - Firms in many sectors – including oil and gas, mining, utilities, agriculture – have been left with significant asset impairments and write-downs, necessitating changes in strategy

- **Asset stranding is occurring in unexpected and counterintuitive ways**
  - E.g. Stranded high-efficiency CCGT power plants, where coal was thought to be at risk

- **Need to understand whether risks are material, when they might be material, and what you can do to mitigate such risks.**
  - Scenarios and stress testing
  - Time horizons, sequencing and correlations
  - Quantitative vs qualitative (risk vs uncertainty)
  - Disclosure
  - Embed in credit risk, due diligence processes

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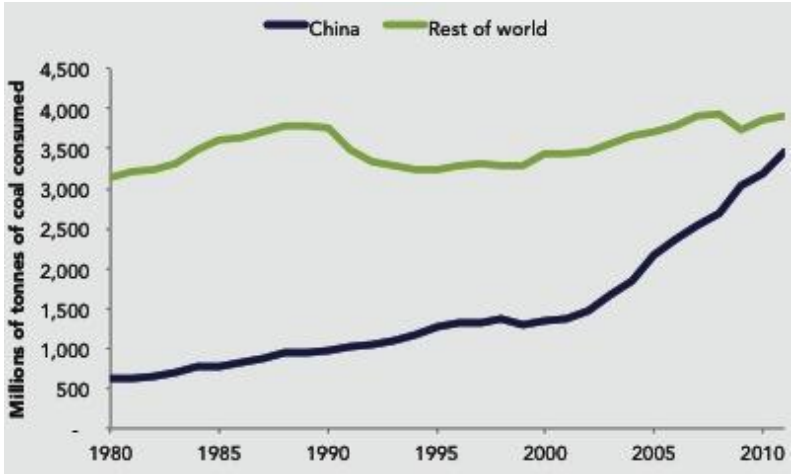
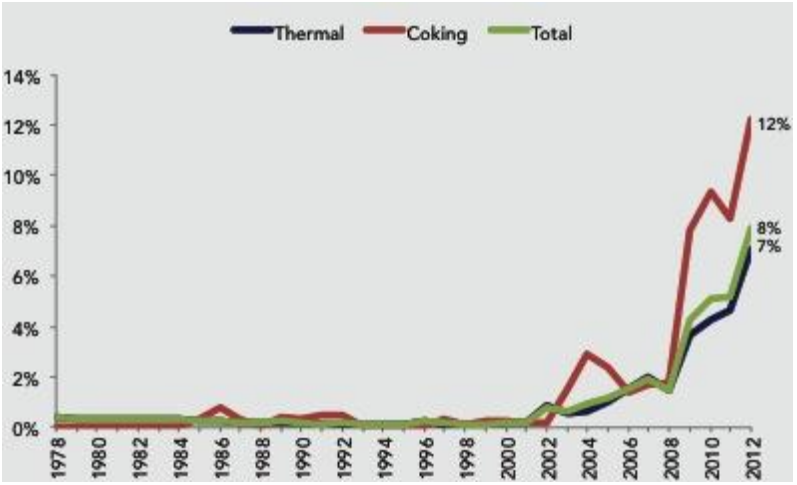
Stranded Down Under?

Environment-related factors changing China's demand for coal and what this means for Australian coal assets

China's coal consumption provided by imports

- Net importer of coking coal in 2004 and a net importer of all coal in 2009.
- Domestic market is now 3x the size of the international coal trade.
- Exports to China made up just 3% of Australian thermal coal exports in 2007 and this grew to 18% in 2012.
- Recent surge in coal demand has led to proposals for a large number of new coal projects and expansions.





Environment-related factors changing demand

Environment-related factors that could reduce demand for Australian coal

- Carbon pricing and trading
- Coal to liquids and chemicals
- Coal quality
- Energy intensity and efficiency
- Environmental concern
- Gas and shale gas
- Iron and steel sector
- Local pollution
- Non-fossil fuel energy and electricity
- Water

What is exposed?

- Value of mineral resources in the ground
- Value of infrastructure investments
- Revenue from mining royalties and company tax; losses from joint ventures and under-utilised or unused infrastructure

Who is exposed?

- Publically-listed coal intensive companies; companies exposed to the supply chain – infrastructure and transport
- Investors and employees in coal companies and dependent companies
- State and federal governments
- Towns and cities exposed to significant mining sector employment

Summary of environmental-related factors and their potential impact on China's coal consumption

- Each factor has been analysed to see if it could have an impact on coal demand or not.
- If so, whether this would be slight (5% or less), moderate (5-10%) or significant (10% or more) within 5, 10 and 20 year time horizons.
- Based on an analysis of supply changes that have affected coal prices in the past

Reduction/increase in coal use below/above business-as-usual projection	No significant reduction ○	Slight reduction ●	Modest reduction ●	Significant reduction ●
		Slight increase ●	Modest increase ●	Significant increase ●

FACTOR	SHORT TERM 5 YEARS	MEDIUM TERM 10 YEARS	LONG TERM 20 YEARS
Carbon pricing and trading	●	●	●
Coal to liquids and chemicals	●	●	●
Coal quality	○	●	●
Energy intensity and efficiency	●	●	●
Environmental concern	●	●	●
Gas and shale gas	○	●	●
Iron and steel sector	●	●	●
Local pollution	●	●	●
Non-fossil fuel energy and electricity	●	●	●
Water – downside	●	●	●
Water – upside[8]	●	●	●

Non-fossil energy and electricity

- **If China's renewable energy plans are realised and the increase in non-fossil energy comes at the cost of coal-fired electricity, coal consumption would fall from 70% of electricity generation to 63% by 2020.**
  - This would reduce China's total national coal consumption by approximately 5% by 2020.

- **Decrease in coal imports would be modest in the short term but potentially significant in the medium to long term as more coal is displaced.**
  - China's policymakers are also likely to prioritise domestic producers of coal, which would result in exporters being disproportionately affected by a fall in demand.

- **Based on policies already announced, the IEA expect renewables to make up 28% of China's electricity generation in 2035.**
  - Consistent underestimate of RE deployment

Carbon pricing and emissions trading

- **China has set a non-binding target to reduce carbon intensity by 40-45% below 2005 levels by 2020.**
  - In line with this target the 12th Five-Year-Plan (FYP) set a 17% reduction target for carbon intensity between 2010 and 2015.

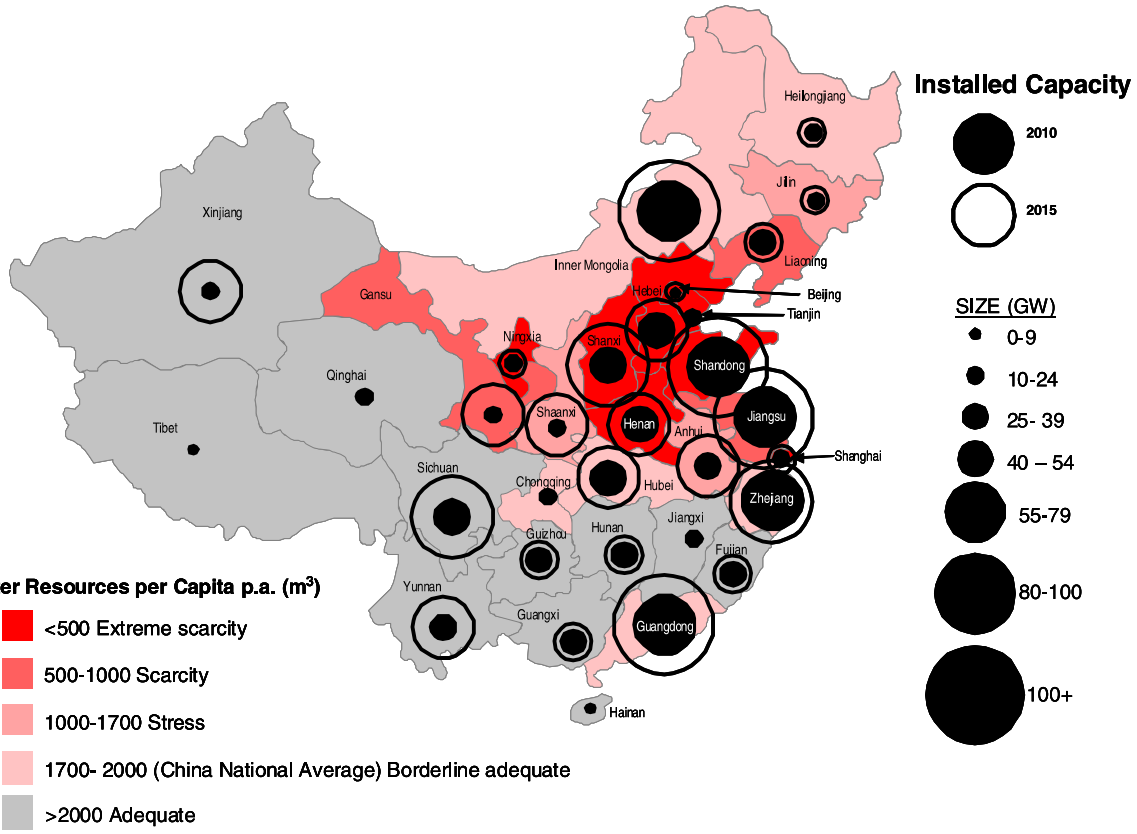
- **In 2012 the Chinese government mandated Shenzhen, Beijing, Shanghai, Guangdong, Tianjin, Chongqing and Hubei to implement an emissions trading scheme in 2013.**

- **China has ambitious plans to move quickly from emissions trading pilots to a national scheme.**
  - In its 12th FYP for 2011 to 2015 the government announced its intention to implement a nationwide ETS by 2015.
  - Provincial scale schemes will begin before China moves to a national scheme in 2015 or 2016.

Water

- In 2011 the coal industry accounted for 17% of China's water withdrawals, and this figure is expected to increase to 27% by 2020.
- 70% of China's coalmines are located in water scarce regions and 40% are expected to experience severe water shortages, with some already slowing production due to lack of water.
- Coal-fired power generation, which makes up the largest portion of this water use, is also predominantly located in water scarce regions.
- 60% of thermal capacity is in the north, which contains only a fifth of the country's water supply.

Map 1: Location of China's total installed capacity and its growth (GW), 2010-15e



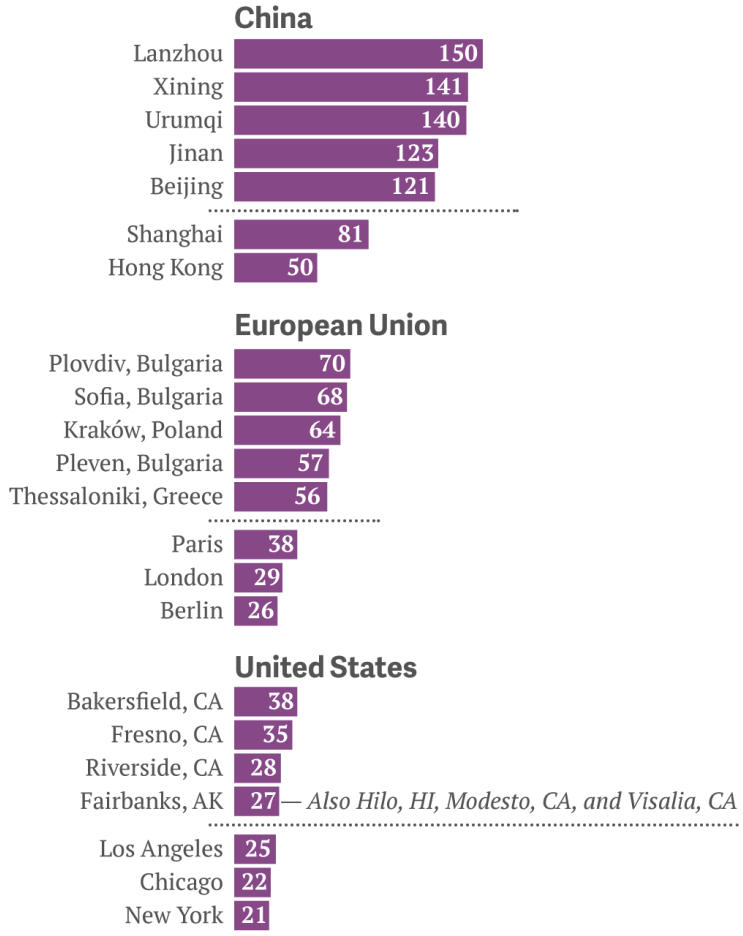
Source: China Water Risk (based on China Electricity Council, China Statistical Year Book and Provincial 12FYPs)

Source: HSBC

Local pollution

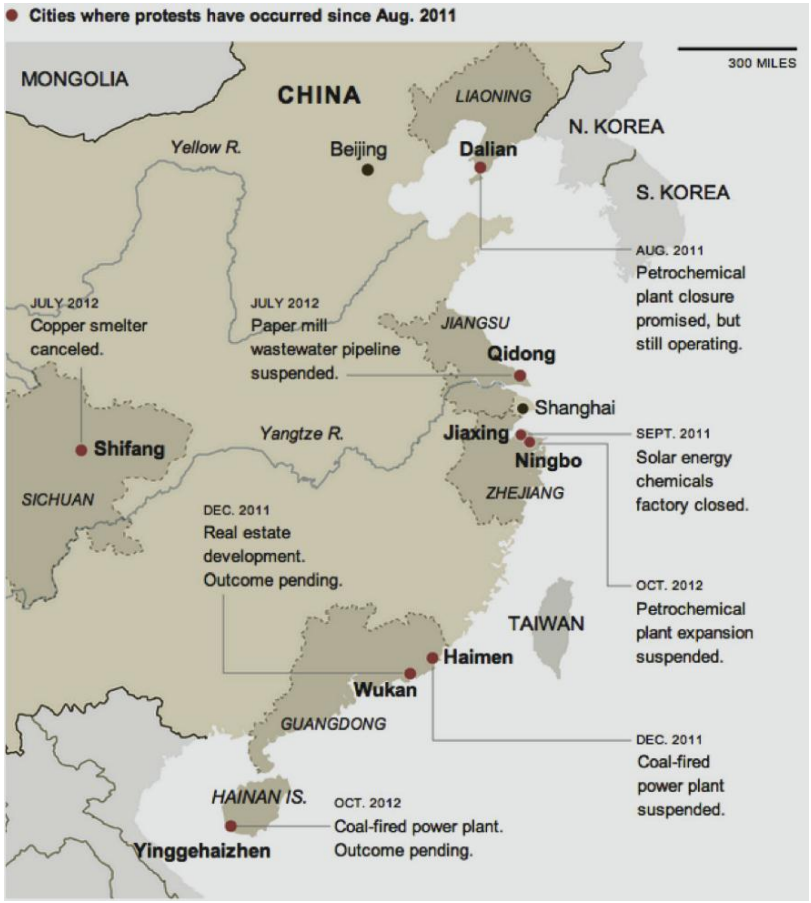
- Decision to provide free coal for household heating to homes north of the Huai river between 1950 and 1980 resulted in life expectancy in the north estimated as being 5.5 years shorter than it would otherwise have been.
  - 2.5 billion life years lost to air pollution.
- Cost of environmental degradation to the economy has been estimated at US$200 billion in 2006 and 3.5% of GDP in 2010.
- Chinese premier, Li Keqiang, "declared war" on pollution, saying it was "nature's red-light warning against the model of inefficient and blind development."

Airborne particles less than 10 micrometres in diameters (PM10). Annual averages in micrograms per cubic meter of air.



Environmental concern

- The number of environmental protests increased on average by 29% a year from 1996 to 2011.
  - Between 2010 and 2011 the number of environmental protests jumped by 120%.
- Many of the protests have been targeted towards coal-fired power stations.
  - Main concerns were over local air pollution, which they blame for an increase in cancer rates, as well as water pollution
- Chinese survey on climate change found 85% of respondents agreed that people were at least partially to blame, and 71% believed they had a responsibility to mitigate their emissions.



Source: The New York Times

Implications for Australian coal assets and Australia

- **Coal producers already under pressure**
  - According to Wood Mackenzie at least half Australia's coalmines operate at a loss when the price of coal is below US$96/tonne. The price is currently approx. US$82/tonne.

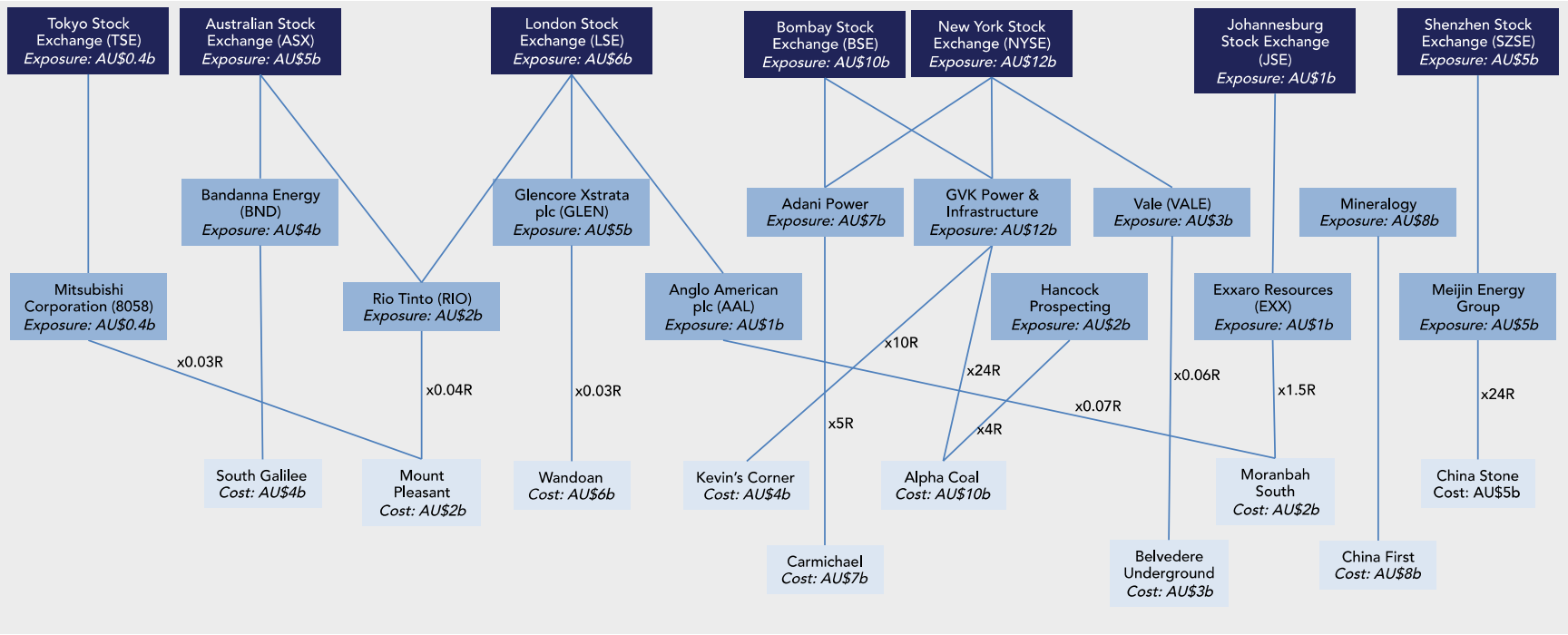
- **Less demand from China would reduce prices below those assumed or estimated in investment cases – projects uneconomic and could become stranded assets**
  - Major problem given size of irreversible investments.

- **New supply so large that it could depress prices and affect the economics of existing mines**
  - What's the right export earnings maximization strategy? Less is more.
  - Proceeds for development?

- **Lopsided economic strategy and strong AUS$ puts sustained pressure on manufacturing, services and other export sectors (e.g. wine).**

- **Climate change and local environmental pollution at home and abroad.**

Ownership of top ten proposed coalmining projects by cost (and cost as a multiple of company revenue)



- 10 largest projects by capex owned by 12 companies, which are together listed on 8 stock exchanges.
- These companies should stress test their coal price assumptions given China's changing demand for coal and in particular how these could be affected by environment-related factors.