



## CRU iron ore and coal briefing

# Managing uncertainty in commodity markets

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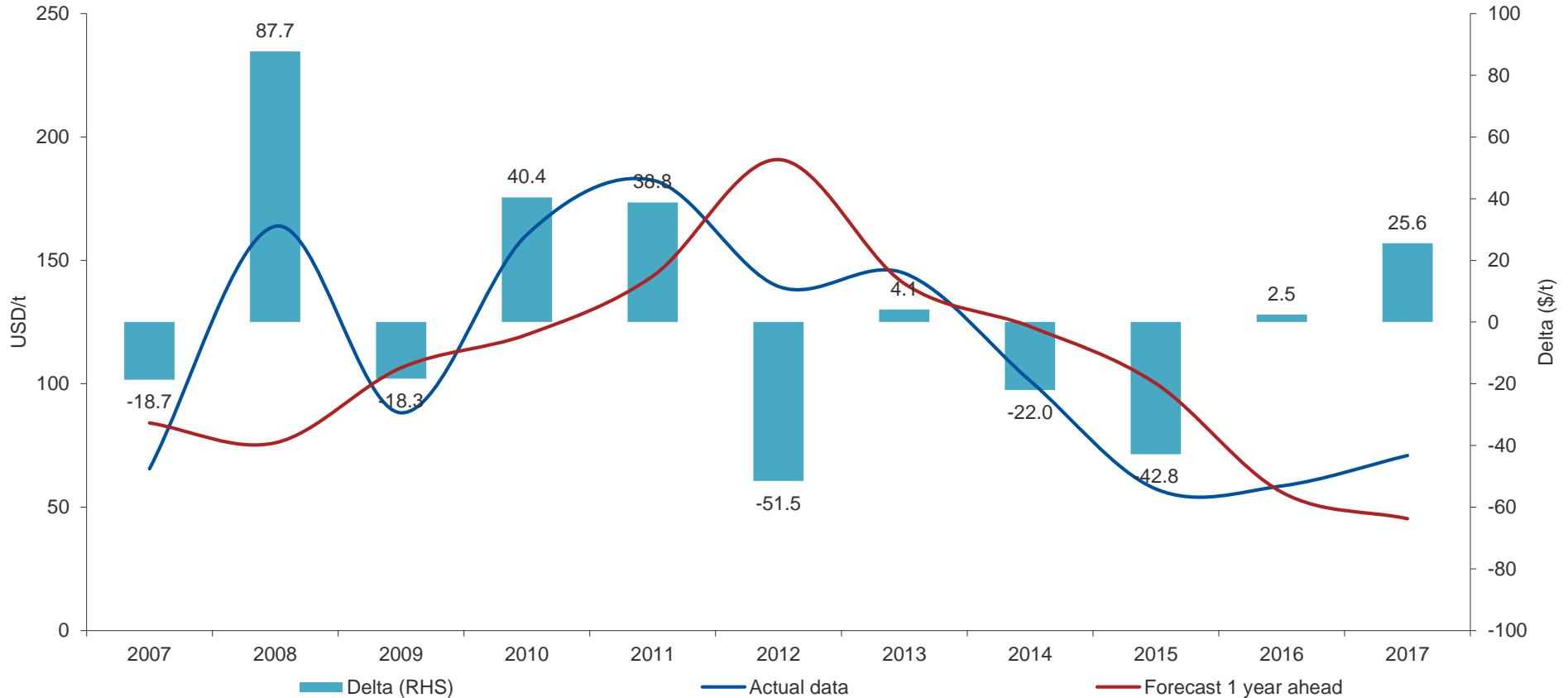
## Managing uncertainty in commodity markets

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- Why do we need to factor in uncertainty when making strategic decisions in commodity markets ?
- What tools are available to help us do this ?
- What can be the benefits from using these tools (and pitfalls) ?

# The problem with single point, deterministic forecasts...

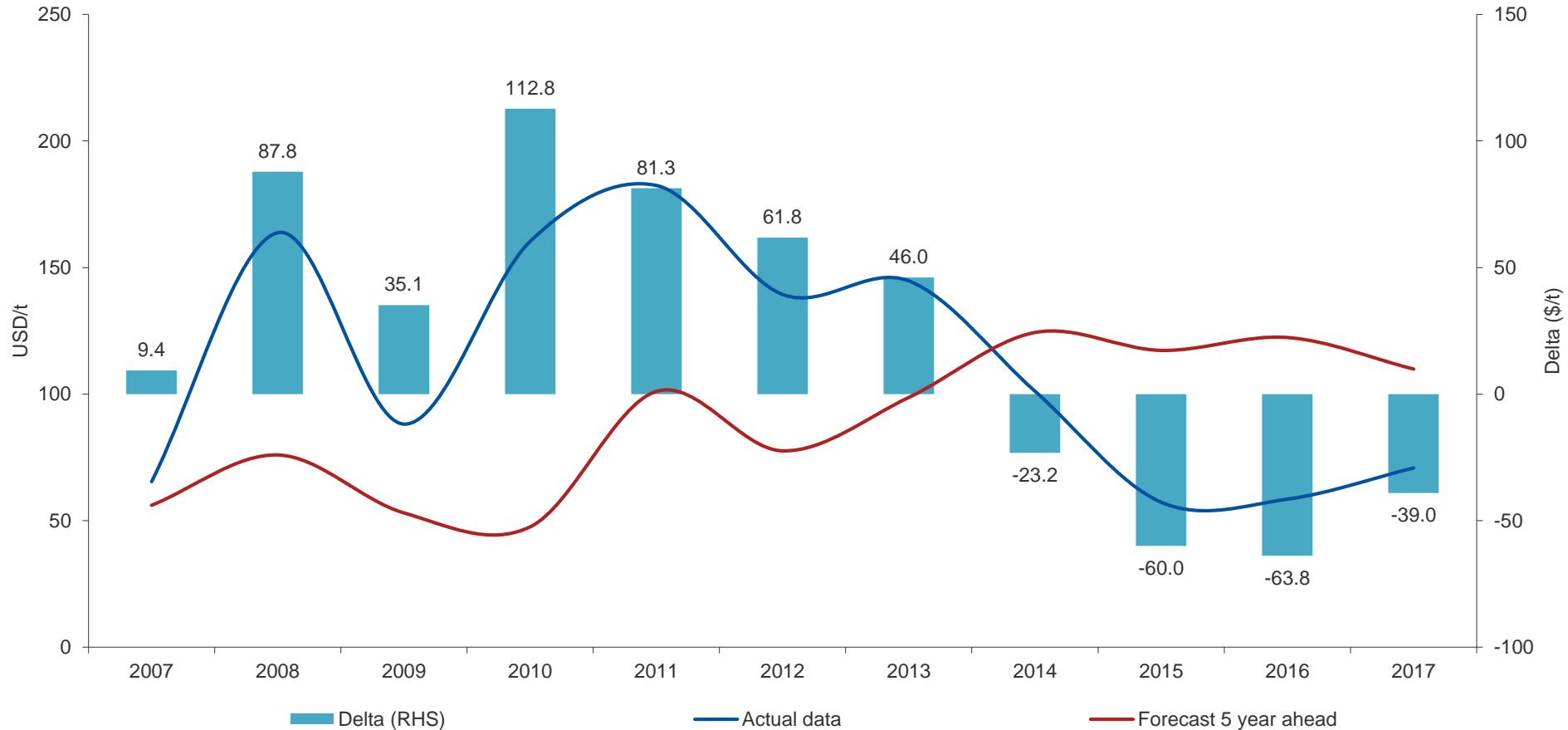
Iron ore prices, China spot, 62% Fe fines, real 2017



...directionally correct but some variances...

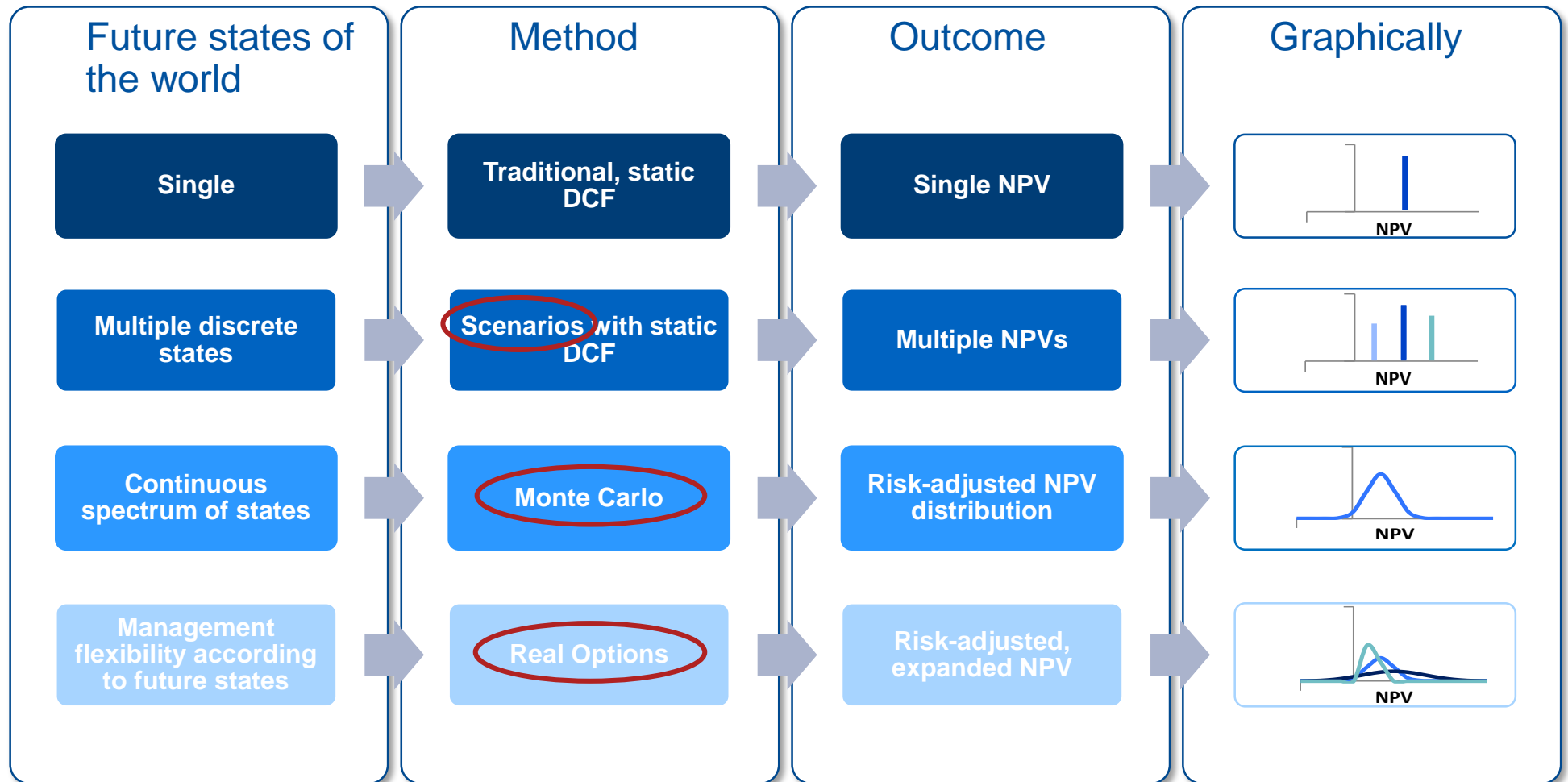
# It gets more difficult the further out the forecast horizon...

Iron ore prices, China spot, 62% Fe fines, real 2017



...for some decisions, methods based on single point forecasts are not adequate...

## When a single, deterministic view of the future is not sufficient...



...other methods exist to analyse a range of outcomes by taking a more **probabilistic** approach...

# Scenarios

## What are they?

- A way of contemplating alternative futures
- Framework to make sense of apparently conflicting or ambiguous market trends / signals
- Imaginative narratives, plausible and logical
- Compelling stories about the world tomorrow to help inform decisions being taken today

## When and why use scenarios?

- High levels of uncertainty: risk
- Longer term view (>10 years horizon)
- Multi-variable and complex problems / decisions
- Test robustness of existing strategy and decisions
- Identify 'no regrets' decisions

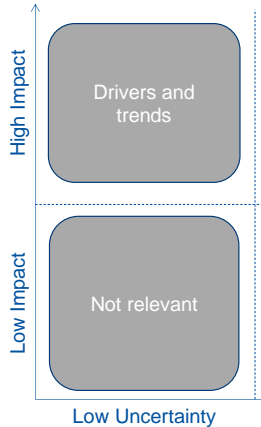
## Benefits of approach

- Combines both data driven views of the past with creative insight on the future
- Challenges perceived wisdom and 'group think'
- Qualitative and quantitative outputs
- Communication tool – people remember scenarios, creates a common language across teams

# Examples from using scenarios

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Scenarios are about identifying the *critical uncertainties*



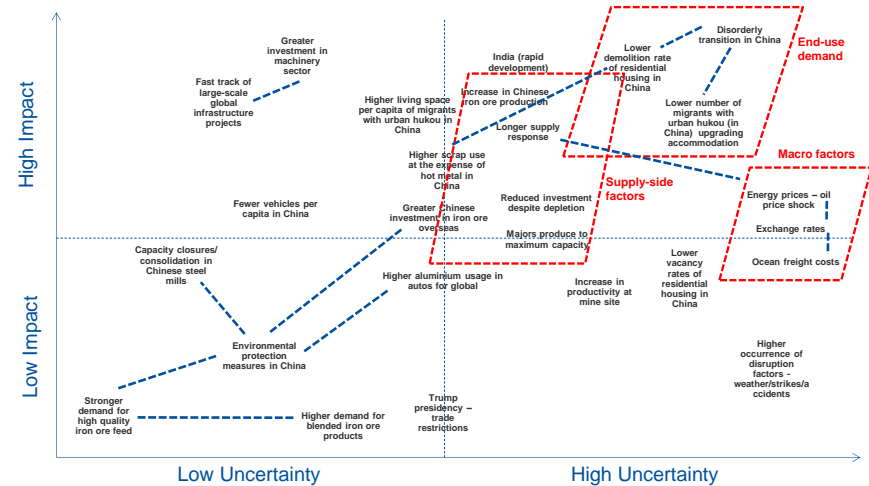
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Output example: volume changes in steel production driven by policy scenarios

| Country | Policy   | Base case assumption  |
|---------|--|---|
| China   | Steel scrap ratio: the country uses more of the available scrap to make steel  | Steel scrap ratio is 18% in 2020, 24% in 2025. 2035, the EAF-E ratio is 26:74 |
| China   | As above   | As above  |
| China   | Higher growth targets set in the 13 <sup>th</sup> Five year plan are met   | 2015 to 2020: 6% growth in GDP; 2021 to 2025: 5% growth in GDP                |
| India   | 'Make in India': the country becomes a global design and manufacturing hub   | Next decade: share of GDP average 14-15%                                      |
| India   | Voluntary vehicle fleet modernisation: car scrappage dates are pulled forward and additional demand for new vehicles is met domestically | Next decade: it will produce units  |

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Populating the impact / uncertainty matrix



...CRU's approach to developing scenarios helps build a rich qualitative view of different 'worlds' **and** quantify their impact...

# Monte Carlo analysis

## What is it?

- Statistically based technique for quantifying the effect of uncertainty on a forecast
- Most forecasts comprise a range of assumptions about the key variables
- In Monte Carlo analysis, instead of making point forecasts for each key assumption, these are replaced by a range of possibilities (known as a frequency distribution)

## When and why use MC analysis?

- To 'stress test' decisions where significant assets/ capital is at stake
- Solid historical data set available (>20 years)
- Quantified and statistically robust outputs required

## Benefits of approach

- Rigorous approach
- Enables a risk adjusted NPV distribution to be calculated
- 'Worst case' scenario / outcome understood
- Provides management with 'comfort' over outcome of decisions

### BUT

- The past is always an indicator of the future. Beware!



# Examples from using Monte Carlo analysis

**Summary of Monte Carlo simulation results**

| Long term* MC results (real 2017)                                    |   | Base case |
|--|---|-----------|
| Results from MC analysis: historical iron ore prices (\$/t)          | 1 |           |
| Results from MC analysis: iron ore demand and oil price shock (\$/t) | 2 | 58        |
| Results from MC analysis: iron ore demand (Mt)                       |   | 2,143     |
| Results from MC analysis: oil prices (\$/bbl)                        |   | 76        |

Note: \*Long term prices are the average of the prices shown in dry metric tonnes (dmt) and in

**Output example of Monte Carlo results**

**The main sources of uncertainty for iron ore price forecasting**

In this study, we assume that the main source of uncertainties are iron ore demand and oil prices.

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...Monte Carlo analysis is a powerful tool through which to model uncertainty but is only as good as the *historical data* available...

# Real Options Analysis

## What is Real Options analysis?

- An approach to analysing decisions through which both uncertainty (risk) and flexibility (options) can be accommodated.
- A real option involves – as in a financial option – an initial investment for the *possibility* to gain benefits in the future
- Applicable to both tangible assets and intangible assets (R&D etc.)

## When and why use Real Options analysis?

- Complex decisions where many outcomes / paths are possible ie there are options
- When classic dcf based on single point forecasts may under-value an asset
- Need to be able to quantify risks
  - Workshops
  - Delphi method
  - MC analysis

## Benefits of approach

- Affords management the benefit of not committing to a single path
- Can act / decide as more information becomes available
- Quantifies the outcome of different pathways
- Captures potential upside (or downside) of decisions / projects not included in classic dcf methods: strategic value vs financial value

# Examples from using Real Options Analysis

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A well structured methodology is required

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The option to expand partly relies on decisions not at your discretion

Risk identification & business option identification

Identify the key uncertainties involved and the real business options that exist

Acquisition of the 13.5% share.

- Earlier this year Canadian mi Chile – from a local company
- They structured the sale in se
  - 52.5 USD million upfront
  - 60 USD million once they hav
  - 50 USD million one month afte
  - Up to 100 USD million if copp

CRU [Redacted]

Risk-adjusted long term mine planning: Base case vs. expansion options

Simplified example of risk-adjusted valuation from past CRU project

...Real options can help organisations analyse complex decisions where multiple pathways could exist, depending on the outcome of external events and decisions...

## Conclusions

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- Tools exist to help manage uncertainty in forecasts and decision making
- No one panacea – selection dependent on nature of decision / problem
- All approaches need a structured, preferably facilitated approach with good data + expert insight

Get help if you need it !