Mark Campanale
Founder & Executive Director
Carbon Tracker Initiative

Boston Carbon Risk Forum
Harvard Law School

29 September 2014
Global Warming's Terrifying New Math

Three simple numbers that add up to global catastrophe - and that make clear who the real enemy is

“A movement now global….

“…an easy and powerful bit of arithmetical analysis first published by financial analysts in the U.K. has been making the rounds… (it) up-ends most of the conventional political thinking about climate change. And it allows us to understand our precarious position with…. simple numbers”. Bill McKibben
Our research path

2011
UNBURNABLE CARBON

Based on carbon budget allowed to keep below 2°C of global warming, there is more fossil fuel listed on the world’s capital markets than can be burned.

2013
WASTED CAPITAL & STRANDED ASSETS

We alerted the financial world that $674bn invested annually in “unburnable” fossil fuel assets can potentially become stranded.

2014
CARBON SUPPLY COST CURVE

Investors now need more market insight in order to understand how to manage the carbon asset risk. The first report of the new research series is focused on oil.
The carbon bubble concept
Why carbon budgets?

• Carbon dioxide remains in the atmosphere for around 200 years,
• Cumulative volume of emissions over decades, rather than rate in any particular year that drives climate change.
• Budget tells us how much more carbon dioxide can be emitted before a target temperature level is exceeded.
Understanding Carbon Budgets

IPCC and Carbon Tracker CO₂ budgets from 2012 - 2100 against fossil fuel reserves

GtCO₂

>50% probability, IPCC
>66% probability, IPCC
80% probability, Carbon Tracker
>80% probability*, IPCC
Total fossil fuel reserves

Final remaining budget
Emitted by 2011
Non-CO₂ forcings

*estimate based on rate of budget decline

© Carbon Tracker 2013
Carbon budget deficit for listed companies

Only 20% of proven reserves can be burnt to keep global warming below 2 degrees celsius: this is the “bubble”

745 GtCO2
Proven coal, oil & gas reserves owned by listed companies

565 GtCO2
Remaining budget for 2 degrees (2010 -50)

2795 GtCO2
Total proven coal, oil and gas reserves

Data 2013
Current reserves on stock exchanges (2013)

- Global Total: 762 GtCO2
- 388 GtCO2
- 273 GtCO2
- 101 GtCO2

Map showing carbon reserves at various stock exchanges around the world.
Potential reserves on stock exchanges (2013)
°C Budget: broken in just few decades?

When will we break the carbon budget?

80% probability limiting to 2°C; IPCC estimate

YEAR

2031

2045

CUMULATIVE CO2 EMISSIONS PROJECTIONS (GtCO2)

IPCC RCP2.6

IPCC RCP8.5

IEA current policies

IEA 450
Rebalancing is needed between flows: is this the right business model?

Interest: $27bn

Debt: $1.27tn

Equity: $4tn

Dividends: $126bn

EBITDA: $927bn

CAPEX: $674bn

Develop reserves: 762 - 1541 GtCO2

Data 2013
The situation

We know that the financial markets can be structurally flawed and that an inadequate response to climate change is one of these failings. Currently financial markets thinks we’re going to burn all the coal, oil and gas – so thinks of fossil fuel resources as assets.

But as governments move to control carbon emissions, this market failure is creating financial risks for investors - notably the threat of fossil fuel assets becoming stranded.
Is the fossil fuels industry betting on an unsustainable future?
This analysis assists **investors** to continue their **engagement** with companies over **carbon asset risk**. It introduces the concept of a carbon supply cost curve to **global oil projects**.
CARBON SUPPLY COST CURVES:
EVALUATING FINANCIAL RISK
TO OIL CAPITAL EXPENDITURE

6 Takeaways

1. A 2°C carbon budget context
2. The Private sector has a pivotal role in developing oil by 2050
3. Stress-testing the logic of rising upstream oil capital expenditure
4. Introducing the Carbon Supply Cost Curve
5. Projects needing an above $95/bbl market price are most vulnerable in a low carbon demand scenario
6. Significant exposure for private companies, including Majors

Research Launch May 2014
CARBON SUPPLY COST CURVE & OIL PRODUCTION BY BEOP 2014-2050

Real Brent Price Equivalent

Break Even Oil Price (USD/bbl)

Cumulative Carbon Production (GtCO₂ 2014-2050)

Oil Production (MBPD average)

Breakeven

Brent

key market price levels
Conventional: CAPEX $ by BEOP (2014 to 2050)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Above 150</td>
<td>3970</td>
<td>1793</td>
<td>1466</td>
<td>1685</td>
</tr>
<tr>
<td>120-150</td>
<td>2142</td>
<td>646</td>
<td>887</td>
<td>843</td>
</tr>
<tr>
<td>100-120</td>
<td>1004</td>
<td>255</td>
<td>743</td>
<td>336</td>
</tr>
<tr>
<td>80-100</td>
<td>1175</td>
<td>69</td>
<td>639</td>
<td>464</td>
</tr>
<tr>
<td>60-80</td>
<td>1472</td>
<td>67</td>
<td>456</td>
<td>451</td>
</tr>
</tbody>
</table>
Unconventional: CAPEX $ by BEOP (2014 to 2050)

<table>
<thead>
<tr>
<th></th>
<th>Shale Oil</th>
<th>Oil Sands</th>
<th>Extra Heavy Oil</th>
<th>Tight Liquid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Above 150</td>
<td>24</td>
<td>61</td>
<td>233</td>
<td>8</td>
</tr>
<tr>
<td>120-150</td>
<td>48</td>
<td>91</td>
<td>272</td>
<td>9</td>
</tr>
<tr>
<td>100-120</td>
<td>122</td>
<td>451</td>
<td>187</td>
<td>23</td>
</tr>
<tr>
<td>80-100</td>
<td>441</td>
<td>601</td>
<td>56</td>
<td>133</td>
</tr>
<tr>
<td>60-80</td>
<td>560</td>
<td>1084</td>
<td>91</td>
<td>456</td>
</tr>
</tbody>
</table>
Map of oil provinces with high cost potential production
Exxon: As in the Golden Goose fairy tale:

- Big oil has been a great long term investment
- Helped by supranormal returns – due to OPEC price support?
- But…..
“Has the Golden Goose Been Cooked?” Jeremy Grantham

- Performance has been dreadful for 3-5 years
- Underperformance despite high oil prices. Why?

Source: msn.com
Sector Returns are deteriorating despite rising oil prices

Shell reported ROCE

- Oil price quadruples…
- Returns halve…
Capital employed driven by accelerating capex

• Sector Capex rising, production falling
Growing capex, falling production

Costly Quest
Exxon, Shell and Chevron have been spending at record levels as they seek to boost their oil and gas output. It has yet to pay off. Below, change in production and capital expenditures since 2009.

Exxon Mobil  Royal Dutch Shell  Chevron
Capital expenditures
51%  39%  89%
Production
6%  1%  -3%

Note: Spending in 2013 reflects company estimates; for Shell it is net of asset sales; production rate in 2013 is through the first nine months. Source: the companies The Wall Street Journal

Wall Street Journal, Jan 2014
Oil and Gas – Value spread

• Payback periods – how long is capital at risk?
  – Conventional: 2-5 years from first oil or gas
  – Capital Intensive - LNG/GTL/Tar sands: 7-15 years

• Around 30% of a company’s NPV is in the first 5 years
• Around 60% in 10 years – assumes ongoing capex

Source: HSBC, Company data.
How can our research be applied?

The debate with oil majors..
The ongoing debate with companies on “stranded asset risk”

Case study: Shell & CTI

Shell’s letter on Stranded Asset and Carbon bubble, May 2014

CTI Responding to Shell. An analytical perspective, July 2014
Ceres & CTI / Carbon Asset Risk

Carbon Asset Risk engagement initiative co-ordinated by CTI and Ceres, with support from the Global Investor Coalition on Climate Change.

Investors with over $3 trillion in assets raised these issues with 45 of the largest fossil fuel companies.
Recommendations for Investors

1. Understand **risk exposure** of your portfolio/fund to the upper end of the carbon cost curve.

2. Identify companies with majority of capex in high cost projects.

3. Focus engagement on projects requiring $95/bbl market prices as a starting point.

4. **$1.1 trillion** of capex at stake for the private oil sector over the next decade.

5. Set thresholds for exposure to projects at the high end of the cost curve.

6. Require improved disclosure of demand and price assumptions.

7. Ensure **remuneration policy** at companies is consistent with shareholder return objectives not just rewarding reserves replacement or spending capital.

8. Make it known to company management that you are seeking value not volume.
Does Corporate History Repeat Itself?

“Steam Locomotion will remain the dominant form of transport until well into the 1980s….”

Chairman, Baldwin Steam Locomotive Company, Wall Street, 1930

- Baldwin, American Steam Locomotive Company, Olivetti, Kodak, Blockbuster, Shell, BP, Exxon?
- Who will be the energy majors of the future?
Carbon Tracker Initiative (CTI) and Energy Transition Advisors (ETA) are not investment advisers, and make no representation regarding the advisability of investing in any particular company or investment fund or other vehicle. A decision to invest in any such investment fund or other entity should not be made in reliance on any of the statements set forth in this publication. While the organisations have obtained information believed to be reliable, they shall not be liable for any claims or losses of any nature in connection with information contained in this document, including but not limited to, lost profits or punitive or consequential damages. The information used to compile this report has been collected from a number of sources in the public domain and from CTI and ETA licensors. Some of its content may be proprietary and belong to CTI, ETA or its licensors.
Thank you.

Mark Campanale
Founder & Executive Director
mark@carbontracker.org

@CarbonBubble
www.carbontracker.org