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Pricing tomorrow's cost of carbon today

London versus 5 Big Oil Companies: the dates that make the difference to the dollars

PAL calculates about $30billion could be payable to London, crucially depending on the date when losses are deemed to have started

PAL estimates that about $295million annually is payable to London from 2018

Preliminary Report

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Executive Summary

- **The PAL carbon pricing system is used from 1750, the start of the Industrial Revolution, to calculate the compensation payable to London by the 5 Big Oil companies for the loss and damage caused by the CO_2 emissions of their gas and oil products since their incorporation in around 1880 to the present, corresponding to about $30billion (see Table 1).**
- **This compensation figure can be mitigated substantially, but crucially depends on the date when losses were first deemed to have started, and could be as low as $6.5billion (see Table 1).**
- **PAL uses its future carbon price to project future losses incurred year on year of about $295million (see Fig.1) from 2018 onwards.**
- **If the law of England permits, Mayor Khan could, like Mayor de Blasio of New York has done, bring a suit against five of the largest oil companies ('The 5 Big Oil': BP, Chevron, ConocoPhillips, ExxonMobil, Royal Dutch Shell) to compensate the city for past climate-related losses and to provide for future infrastructure to enable London to adapt to sea level rise.**

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About PAL

Predict Ability Ltd (PAL) is the world's only company to have scientifically determined the actual dollar cost of CO_2 emissions. This carbon price is the foundation stone upon which PAL has developed and productised a comprehensive and sustainable solution for combatting climate change. Published by PAL in June 2016, the book *Predicting the Price of Carbon: How to crack the climate change code for good*[1] by Richard H. Clarke, Director of Research at PAL, addresses the goals and strategies for tackling climate change and sets out the methodology of PAL's algorithm-based carbon-pricing system. The underlying research and findings compare well with a recent, major, evidence-based study in the US by Hsiang et al[2].

This unique carbon-pricing system is embodied in PAL's suite of complementary products and services. It covers every aspect of evaluating loss and damage caused by manmade climate change to provide dollar-costed Carbon Pricing, Enhanced Carbon Auditing plus the associated current and projected Carbon Liability across all sectors. Example applications include:

Carbon Value-at-Risk Metrics: Using their analytically verifiable cost of CO_2 emissions, PAL can put an accurate $ value on corporations' current carbon footprint *and* their future carbon liability risk. The revolutionary technology behind PAL's IP enables a huge range of unprecedented capabilities e.g.:

1. monetized carbon auditing of big-ticket projects such as nuclear power plants
2. measurement of carbon liability of, say, proven reserves of oil companies
3. assessment of carbon liability Value at Risk (VaR) for asset managers across all industry and energy types including renewables.

Enhanced Carbon Auditing (ECA): PAL's bespoke audits provide in-depth financial analysis of the real $ carbon costs impacting any enterprise. Effective carbon costing for Life Cycle Assessments (LCA) of projects involving all manner of major infrastructure or development planning can optimise decision-making and reduce costs.

Carbon Pricing: PAL's real-time carbon pricing data factors in the true cost of loss and damage caused by CO_2 emissions – past, present and future. A problem specific to carbon pricing is that a one-size-fits-all carbon price is too blunt an instrument for encouraging behavioural change. PAL's spectrum of prices based on regional factors (PAL's Universal Carbon Price) and impact (PAL's Carbon Intensity Weighting) is more effective as well as future-proof.

Catastrophe Loss Modelling: PAL's computing engine, PALgamma, provides algorithm-based forecasting of extreme weather-related disaster trends and loss events. It clearly identifies, in dollar terms, the financial impact of man-made climate change, as well as the most likely proximities and timelines of future loss events.

For further information, please visit predictability.ltd.uk or email contact@predictability.ltd.uk

PAL calculates over $30billion could be payable to London, crucially depending on the date when losses were deemed to have started

PAL estimates that about $295million annually is payable to London from 2018

If the law of England permits, we believe Mayor Khan could, like Mayor de Blasio of New York has done, bring a suit against five of the largest oil companies ('The 5 Big Oil': BP, Chevron, ConocoPhillips, ExxonMobil, Royal Dutch Shell) to compensate the city for past climate-related losses and to provide for future infrastructure to enable London to adapt to sea level rise (as reported in the Appendix of this preliminary report, the Thames Barrier is in increasing demand and needs backup).

This is exactly the sort of situation in which PAL is so well placed to advise. Some key questions are:

1. When did the losses attributable to CO_2 emissions begin?
2. How much loss has there been?
3. How much of that loss is related to London?
4. What proportion of London's losses is attributable to the 5 Big Oil companies?
5. How much compensation should these oil companies reasonably pay for past losses?
6. How much compensation should these oil companies reasonably pay for future losses?

From PAL's perspective, the questions need to be framed in terms of risk. Firstly, London does have a significant risk factor: flooding, especially in the event of a storm surge like that of 1953. Although the ratio of London's risk to the global risk is declining (as the world develops) the yearly risk in dollar terms is likely to remain substantial, as Fig.1 shows.

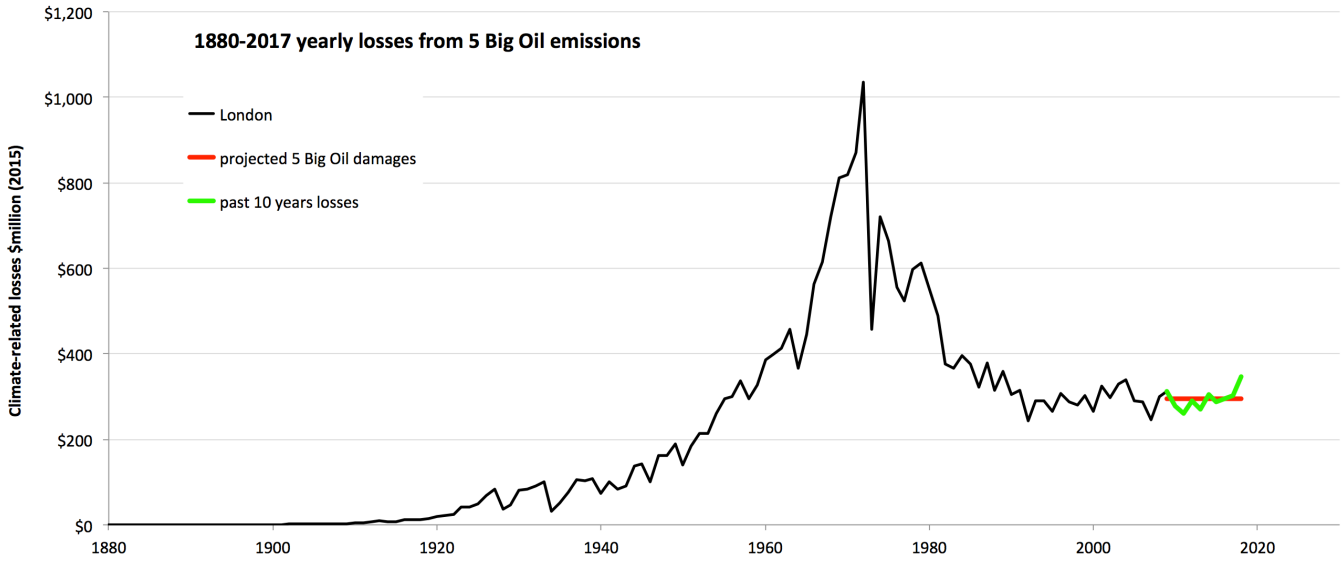

Fig. 1 London's climate-related losses attributable to CO_2 emissions from the 5 Big Oil companies gas and oil products, is down from its 1973 'oil crisis' peak. The future projection average is $295million.

Fundamental to assessing London's climate-related losses that are attributable to the 5 Big Oil companies, and thus their liability in damages, is establishing a start date for calculations to begin. Crucially, there are several options, and the 5 Big Oil companies' fiscal liability varies very substantially across the range of dates.

This sensitivity to start date is exemplified in Table 1 below using: 1880[c], when the Big Oil industries started; 1896, when the Nobel Prize winning physical chemist Svante Arrhenius clearly identified our global warming vulnerability[1]; 1913, the year in which London could boast 3,522 motor-buses and over 8,000 motor taxis but only 142 horse-drawn buses and 1,900 horse-drawn cabs (nationalarchives.gov.uk); 1950, that heralded the post-WW2 'great acceleration' of global growth and CO_2 emissions; 1977 when it is alleged Exxon management was informed by its scientists that there was "overwhelming" consensus that fossil fuels were responsible for atmospheric carbon dioxide increases. Eliminating all further doubt, 1988 marked a watershed whereby the world could no longer claim ignorance of the link between greenhouse gas emissions and global warming: the IPCC (Intergovernmental Panel on Climate Change) was established "…to prepare, based on available scientific information, assessments on all aspects of climate change and its impacts, with a view of formulating realistic response strategies." The resulting Kyoto Protocol in 1997 set internationally binding emissions reduction targets.

Table 1.

Climate-related losses to London attributable to the emissions from the 5 Big Oil companies' gas and oil products depend crucially on when the losses are deemed to have started (based on carbon pricing from 1750, the start of the Industrial Revolution)

Date when losses are deemed to have started	Losses to London attributable to the emissions from the 5 Big Oil companies' gas and oil products - $billion (2015) - date to 2018
1880 (Big Oil industry begins)	29.67
1896 (Arrhenius publishes)	29.67
1913 (motor buses and cabs replacing horse-drawn buses and cabs on the streets of London)	29.65
1950 (post-WW2 'great acceleration')	27.04
1977 (alleged that Exxon management informed)	14.18
1988 (IPCC established)	9.19
1997 (Kyoto Protocol)	6.50

In total, PAL estimates that the 5 Big Oil companies have collectively caused about 11.5% of London's climate-related losses since 1880. Using that figure, the total damages claimable from the 5 Big Oil companies from 1880-2018 is approximately $30billion (US$2015). Additionally, as shown in Fig. 1, the 5 Big Oil companies should compensate London the sum of about $295million annually from 2018 onwards.

The case London could make is that the 5 Big Oil companies are responsible for 11.5% of all CO_2 emissions since the beginning of the industrial revolution. PAL's unique technology is able to identify, year by year from 1750, the nature, extent and dollar cost of the resulting losses suffered by London. It can also pinpoint the dollar amount reasonably attributable to each of those individual 5 Big Oil companies.

These results have been obtained using oil company emissions data cited by Ekwurzel et al[3]. Using PAL's universal carbon price and gamma risk ratio, the methodology used here can be extended to other cities, states and countries.

[c] Ekwurzel et al (Ref. 3) use 1880. Standard Oil began in 1870 and the average for the 5 Big Oil companies is 1888.

References

[1]*Predicting The Price of Carbon: how to crack the climate change code for good*, Richard H. Clarke, **Predict Ability Ltd** (2016).

[2]*Estimating economic damage from climate change in the United States*, Hsiang *et al.,* **Science** 356, 1362-1369 (2017).

[3]*The rise in global atmospheric CO_2, surface temperature, and sea level from emissions traced to major carbon producers*, Ekwurzel, B., Boneham, J., Dalton, M.W. et al. **Climatic Change** (2017) 144: 579. https://doi.org/10.1007/s10584-017-1978-0

Appendix

The Thames Barrier has saved London - but is it time for TB2?

By Michael Hanlon, The Daily Telegraph, 18 February 2014

"…The design brief was to protect London from storm surges coming from the North Sea – very high tides exacerbated by high winds and low pressure systems which can add several feet to sea levels locally. It is true that no one talked about climate change in the Fifties but it was known that southeast England was sinking, albeit very slowly, into the North Sea as the result of geological settling following the last Ice Age. This sinking, coupled with rising sea levels means that, over time, London is more at risk than before.

But in recent times – and especially this year [2014] – the Barrier has performed the secondary function that was not in its original brief: it has been closed specifically to protect parts of west London from "fluvial flooding" that comes from intense rainfall on the Thames Valley. At high tide, the Thames fills its channel as far as the Teddington weir and there is little capacity to accommodate any additional water coming from upstream. If the Barrier is shut as the tide starts to come in, space is created into which the flood waters can flow – effectively creating a reservoir which can then be emptied at low tide.

The increasing use of the Barrier as a defence against fluvial flooding dictates that not only must rising sea levels be taken into account (an estimated 40-60cm by the 2070s) but also more extreme weather…"

Requesting the full report

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