



Divestment and Stranded Assets in the Low-carbon Transition

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EXECUTIVE SUMMARY

Keeping global average temperature increase to 2°C requires structural changes to reduce our economies' reliance on fossil fuels and associated CO₂ emissions. Vast quantities of recoverable fossil fuels will need to remain underground in order to stabilise the global climate. Energy-using equipment in electricity and other economic activities will have to be retired at an accelerated pace to make space for less carbon-intensive technologies and practices. As climate policies drive this transition, some assets will become 'stranded' – i.e. unable to recover their investment cost as intended, with a loss of value for investors. The value of these potentially stranded assets cannot be estimated with precision, as much depends on the clarity of investors about climate policy interventions and their effectiveness and on underlying macro-economic trends, as well as the uncertain response of financial markets once the transition is engaged.

Recognising this risk, a range of individuals and investors has begun divesting assets in fossil fuel activities. Other stakeholders have been motivated by the observation that if fossil fuel use threatens the planet, earning profits from such activities is unethical. According to recent estimates, investors engaged in divestment managed a total of USD 50 billion in assets in 2014; this figure stood at USD 2.6 trillion earlier this year (Arabella Advisors, 2015). The divestment from fossil fuels can therefore no longer be ignored by policymakers.

Divestment is presented by some as a response to the risk of stranded assets, and as part of an investor's fiduciary duty as climate policy starts impacting fossil fuel companies. Others question the effectiveness of divestment on these same grounds. In either case, divestment is only one of the responses available to minimise stranding risks and influence companies to formulate climate change response strategies – active engagement and financial hedging are other alternatives.

Are divestment and stranded assets topics for policy intervention? On the one hand, disruptions in incumbent fossil fuel-related activities are meant to happen if economies are to shift to a carbon pathway in line with the 2°C objective: stranded assets are an inevitable effect of effective climate policy. On the other, it is argued that investors today are ill-informed about the consequences of upcoming climate policy (and climate change impacts) on companies and are vulnerable to losses from stranded assets; therefore governments should ensure as much transparency as possible in this area. Consistent and comparable corporate disclosures on climate-related risks would be a strong step in this direction. In addition, there may be other policies or regulations in governments' toolkits to minimise value destruction and maximise re-investment in low-carbon solutions.

1. INTRODUCTION AND DEFINITIONS

1. In 2010, at the 19th Conference of the Parties to the UNFCCC (COP 19) in Cancún, countries agreed to contain global warming to 2°C relative to pre-industrial times and reduce greenhouse-gas (GHG) emissions accordingly. Further impetus towards this goal is expected from the 21st Conference of the Parties (COP 21) in December 2015 in Paris, as evidenced by submitted Independent Nationally Determined Contributions (INDCs). A core element of these announcements is the reduction of the use of fossil fuels.

2. In order to have at least a 50% chance of meeting the 2°C target, the Intergovernmental Panel on Climate Change states that cumulative CO₂ emissions must stay below 3010 GtCO₂ (IPCC, 2013). By 2011, 1890 GtCO₂ of this ‘carbon budget’ has already been used, leaving 1120 GtCO₂ to be emitted. At the same time, the carbon embedded in current fossil fuel reserves (coal, oil and gas) corresponds to 2860 GtCO₂ (CTI, 2013).

3. If the international community succeeds in its attempt to minimise climate change, a substantial amount of these reserves would not be marketed, leading to a potential stranding of fossil fuel assets. This represents not only a challenge to the current business models of coal, oil and gas companies but also to utilities and their fossil-fuel powered plants (IEA, 2014).

4. In parallel, in the face of the climate constraint some actors have begun reconsidering their investments on moral, political, economic or financial grounds. Actions range from complete to partial divestment from coal, oil and gas companies and electric utilities to stress-testing investment portfolios, to maintaining the *status quo*.

5. Moreover, concerns have arisen about the stability of the financial system due to the long-run challenges posed by climate change and the transition to a low-carbon economy, considerations which usually fall outside the traditional horizon of business and politics. Bank of England Governor Mark Carney recently identified these as physical risks (impact from climate- and weather-related events), liability (compensation for parties who have suffered loss or damage from the effects of climate change) and transition risks (changes in policy, technology and physical risks prompting a reassessment of a large range of asset values) (Bank of England, 2015). Earlier this year, France introduced a change in its Energy Transition Law requiring corporations to disclose climate-related vulnerability and counter-measures adopted and mandating institutional investors to disclose the carbon exposure of their assets (Assemblée Nationale, 2015).

6. This paper provides an overview of divestment and stranded assets, two sides of the same coin and important elements of climate policy. It also asks how policy intervention could support a more effective and less disruptive transition to a 2°C world.

1.1 Scope

7. Our focus is on the risk assets being as a result of climate mitigation policy. This can occur as the result of policy interventions that curb the demand for fossil fuels through carbon pricing, energy

efficiency measures or support to low-carbon technologies. Some stakeholders are divesting as a means of minimising the impact of such stranding on their investment portfolios.

8. Physical assets will also become stranded by climate change itself – coastal infrastructure, for instance. This aspect is not covered in the analysis, notwithstanding the fact that it is likely to grow in importance as climate change impacts become more severe.

1.2 Definitions

9. Stranded assets have been defined as “assets that have suffered from unanticipated or premature write-downs, devaluations or conversion to liabilities” (Caldecott and McDaniels, 2014a: ii). This phenomenon is often associated with the concept of ‘creative destruction’ in modern capitalism. In the case of stranded fossil fuel assets, creative destruction would primarily be driven by climate policy, from country-level targets and how they will be interpreted by economic actors, to sectoral policies meant to drive the transition to low-carbon. Table 1 illustrates environment-related risks that can lead to stranding.

Table 1. Typology of environment-related risks

Environmental challenges	Climate change; natural capital depletion and degradation; air, land, and water contamination; and freshwater availability
Resource landscapes	Price and availability of different resources such as oil, gas, coal and other minerals (e.g. shale gas abundance, phosphate scarcity)
Government regulations	Carbon pricing (via taxes and trading schemes); subsidy regimes (e.g. for fossil fuels and renewables); air pollution regulation; the ‘carbon bubble’ and international climate policy
Technological change	Falling clean technology costs (e.g. solar PV, onshore wind); disruptive technologies; and electric vehicles
Social norms and consumer behavior	Fossil fuel divestment campaign; product labelling and certification schemes; changing consumer preferences
Litigation and statutory interpretations	Carbon liability; litigation; damages

Source: Caldecott and McDaniels, 2014b.

10. Especially poorly understood, resulting in a potential over-exposure to such risks throughout the financial system, is the risk of assets becoming stranded due to climate-related policies or technological change with clean energy alternatives limiting future demand for fossil fuels.

11. Moreover, it is useful to distinguish between book value and market value of a company: while for coal, oil and gas companies the value of their physical assets (e.g. drilling platforms and fossil fuel reserves) are affected, for financial investors the market value of their equity and debt holdings are at stake.

12. Divestment is understood in this paper as “the action or process of selling off subsidiary business interests or investments” (Stevenson, 2010) motivated by climate change-related risks (including climate policy). The term covers a range of actions by stakeholders with different motivations, from ethical to financial. Recently, it has gained prominence among both activists and institutional investors, with the fossil fuel divestment campaign becoming one of the fastest growing social movements in history (The Guardian, 2015) and the concept gaining traction among investors (Arabella Advisors, 2015).

2. ESTIMATING STRANDED ASSETS

In practice [...] investors can misread signals from policymakers, receive misleading signals from them and/or misjudge the way that markets will evolve.

International Energy Agency, 2014

The conventional business model of recycling fossil fuel revenues into replacing reserves is no longer valid.

Carbon Tracker Initiative, 2013

13. A number of public and private organisations have speculated on the amount of assets that could be stranded by the transition to a low-carbon economy. There is a wide divergence in the estimates put forward, as detailed below. The lowest numbers are nonetheless significant, even more so when considered from an investor standpoint.

14. The IEA's 2°C-compatible 450 Scenario estimates the amount of stranded assets – defined as those which do not recover “all or part of their investment during the time that they are operational” – to be on the order of USD 304 billion by 2035 (IEA, 2014). This is subdivided into USD 180 billion for upstream oil and gas investments, USD 120 billion for new fossil fuel capacity in the power sector, and USD 4 billion for coal mining (since most mines have already recovered their initial investment costs).¹ Importantly, state-owned companies would be affected most in the case of oil and gas, as they own the majority of reserves (Mitchell, Marcel and Mitchell, 2015).

15. The IEA stresses the conservative nature of its estimates, assuming that decision-makers have a “high degree of clarity [...] over the evolution of climate policies and their impact on demand and prices” (IEA, 2014: 43). Research by the University of Oxford indicates that adverse market situations for EU electric utilities – caused by a combination of developments in climate policy, energy prices and renewable technology costs – may have already caused nearly EUR 6 billion in stranded assets in gas plants in 2013, while coal-based power generation has increased (Caldecott and McDaniels, 2014a).

16. Other studies have also quantified potentially stranded assets in a transition to a 2°C world. The Climate Policy Initiative's *Financial Impact of the Low-Carbon Transition* provides estimates of stranding in power generation and gas and coal sectors as suppliers to the electricity sector (CPI, 2014). Spanning the

¹ The IEA applies a rigorous definition of stranded assets: in oil and gas, they represent the *exploration costs of fields* that are developed in the IEA's New Policies Scenario but not in the 450 Scenario; these amount to USD 130 billion in oil and USD 50 billion in gas. In the power generation sector, assets are stranded if they face an unrecovered sunk cost, meaning when a plant is idled before its revenues have covered investment costs; some 165 Gigawatts of fossil-fuel capacity would be in this situation (another 90 GW are also idled but after they have recovered investment costs and therefore are not counted as stranded by the IEA). Stranded assets in coal correspond to sunk capital costs for exploration and development, which make up only a small share of total production costs.

same period as the IEA, CPI estimates that USD 50 billion will be stranded in power generation,² USD 600 billion in coal, and USD 400 billion in gas.

17. Differences in the IEA and CPI estimates can be tracked to different methodologies and policy assumptions. Most notably, they rely on different definitions of assets:

- IEA: physical capital;
- CPI: net value of output, including foregone revenues due to a combination of lower volumes of fossil fuels in a 2°C scenario, sold at lower prices than in a hypothetical business-as-usual scenario.

18. The Carbon Tracker Initiative (CTI, 2013) provides a different look at the stranding risk by focusing on publicly-listed companies. Its report *Unburnable Carbon 2013* argues that the allowed carbon budget, when allocated *pro rata* to listed companies, cannot justify observed capital expenditures in the development of new fossil fuel reserves. Only 20-40% of fossil fuels currently booked as reserves for these companies could be burned if the 2°C is to be met (Figure 1).

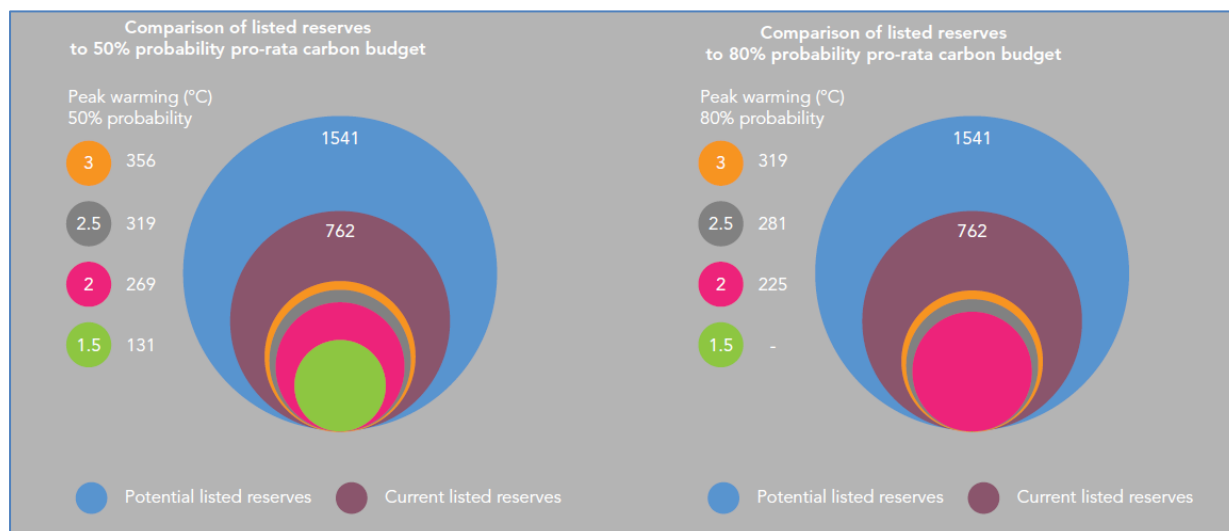
19. By contrast, USD 674 billion have been allocated by the top 200 oil, gas and mining companies “in the last year for finding and developing more reserves and new ways of extracting them” (CTI, 2013: 4). If indeed no new reserves need developing to supply the fossil-fuel consumption under a 2°C energy pathway, these expenditures will lead to stranding of assets. This estimate, unlike those cited before, is on an annual basis only. It also reflects the top 200 listed oil, gas and coal companies, not the entire sector globally. One of the conclusions drawn by CTI (2013) is that fossil fuel companies should not invest in developing new, often high cost reserves, but return capital to their shareholders to minimise the risk of stranded assets and value loss.

20. In response to shareholder enquiries on ‘unburnable carbon’, both Shell and Exxon claim that their proved reserves will not become stranded. However, this is based on the assumption that the world fails to limit global warming to 2°C. Shell compares its demand outlook to 2035 with the IEA New Policies Scenario, not the 2°C-compatible 450 Scenario (Shell, 2014).³ Exxon’s projections match a representative IPCC scenario that leads to global temperature increase above 2°C, finding it “highly unlikely” that governments will manage to cut hydrocarbon consumption to meet the 2°C objective (Exxon, 2014: 12).

² Regarding the impact on power generation assets, CPI assumes a different regulatory arrangement whereby gas and coal-based power generators would partly compensate lower sales by higher revenues from their contribution to maintaining the security of supply in a system characterised by a large share of variable resources (wind and solar).

³ On October 16, Shell’s CEO co-signed the Oil and Gas Climate Initiative, which supports “the implementation clear stable policy frameworks consistent with a 2°C future” (OGCI, 2015).

Figure 1: Fossil fuel reserves of listed companies and 'burnable carbon'



Source: Carbon Tracker Initiative, 2013.

21. IHS (2014) also published a rebuttal of CTI’s argument about the risk of stranding, stating that:

- “The intrinsic value of most publicly traded oil and gas companies is based primarily on the valuation of proved reserves—90% of which are expected to be monetized in 10 to 15 years.” It follows that the rest of a company’s reserves or resources are of limited importance to its value.
- “Bursting the 'bubble' would require abrupt change in the complex global energy system, which is highly unlikely because of technical, economic, and policy constraints”, in line with arguments developed by Shell (2014) and Exxon (2014).

22. Among other counter-arguments, CTI (2015) stresses that small shifts in supply and demand have had an important impact on coal, oil and gas prices, as recently illustrated. Ramping up climate policies increases the odds of such adjustments and the risk of value loss for shareholders. An essential point of CTI’s analysis is that foregone investments in projects higher up the cost curve should be redistributed to shareholders in the form of capital, which can then be made productive in other sectors of the economy.

Box 1. Foregone revenues versus stranded assets

Several studies have relied on foregone revenues as an indicator of the value at risk for companies. Foregone revenues should, in this case, be understood as the difference between total sales low-carbon policy scenario versus a business-as-usual scenario.

Kepler Cheuvreux (2014) puts this figure at USD 28 trillion (in constant 2012 US dollars) for cumulative gross revenues between 2013 and 2035 under the IEA’s 450 Scenario when compared with the New Policies Scenario. Oil accounts for USD 19.3 trillion, gas USD 4 trillion and coal USD 4.9 trillion. These differences reflect lower output and also resulting lower prices, e.g. an oil price of USD 120/bbl

under the NPS and USD 109/bbl under the 450 Scenario. Note that this is a very modest drop in comparison to CPI's (2014) assumptions used in its own foregone revenues estimates: the business-as-usual scenario would see an international oil price at USD 209/bbl against USD 101/bbl. The difference is ten times that assumed by the IEA in 2013 (IEA, 2013). This is a significant difference.

In its *Energy Darwinism II* report, Citigroup uses a simpler approach, considering unburned reserves between now and 2050 and assessing their value with unique prices for coal, oil and gas respectively – the price of oil is assumed to average USD 70/bbl over the period, much lower than both the IEA and CPI hypothesise. While the report portrays the resulting reduction in total value of just over USD 100 trillion as “stranded assets” (Citigroup, 2014: 84), it adds that “the vast majority of these assets have not yet been developed and are not on companies’ balance sheets, but it is still a vast number, and is more important when considering the growth/capex/returns potential of associated companies, and the impact on the economies, balances of payments etc. of the countries where those assets lie”. It is quite unlikely that the fossil fuel industry would continue developing new reserves until 2050, ignoring the carbon constraint and shrinking demand as a result of ever more stringent climate policy. The drop in oil prices resulting from the massive oversupply would make this impossible.

Overall, foregone revenue estimates are meaningful over a relatively short period. Eventually investors will turn their backs on future reserve developments and put their assets in other more profitable activities.

23. The variety of stranded assets estimates can be explained by differences in:

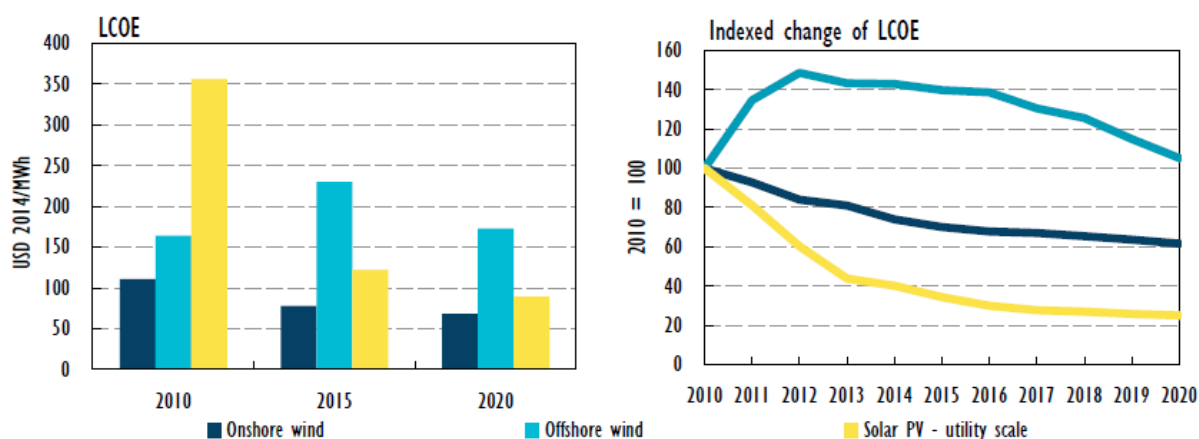
- Scope: the IEA focuses on physical assets whose costs cannot be recovered, with important stranding risks in the long-lived power generation plants; CTI considers the top 200 listed coal, oil and gas companies;
- Methodology: for example, the period over which foregone revenues are taken into account (20 years for CPI, 35 years for Citigroup);
- Key assumptions: for example, future fossil fuel prices in 2°C and business-as-usual scenarios or policy frameworks to facilitate the transition in the power sector;
- Overall approach: CTI chose a different approach, highlighting the risk of significant spending in developing new reserves, when climate policy objectives and expected price effects advise otherwise.

24. Nevertheless, the stranded assets estimates reported here are based on a relatively orderly low-carbon transition: decision-makers in IEA scenarios have clarity over the effectiveness and direction of climate policy, and price changes are relatively smooth.

25. Two factors may lead to more chaotic outcomes. First, low-carbon technology costs are often over-estimated. Further surprises could occur in this domain, whether in power generation, electricity storage, or energy efficient technologies. Such cost reductions are already underway: from 2010-15, global average onshore wind generation costs for new plants fell by about 30%, while utility-scale solar PV saw a reduction of about 66% (IEA, 2015a). It is forecasted that onshore wind costs will further decline by 10%

and utility-scale solar PV by 25% over 2015-20 (Figure 2). Significant cost reductions in electric vehicles could also encourage competitors to the well-established car manufacturers –the development of Tesla and Google cars, for example.

Figure 2: Historical and forecast global weighted average levelised cost of electricity (LCOE) for renewable energy projects, beginning year



Notes: MWh = megawatt hour. The values are indicative estimates of the global weighted average LCOE based on the *MTRMR* deployment forecast and may not represent specific developments in a given market.

Source: IEA, 2015a.

26. Regarding low-carbon technology, the possibility of fitting power plants with carbon capture and storage (CCS) would automatically expand the available carbon budget. Citigroup (2015) refers to CCS as a potential game changer for the industry, but projects only a 2% difference in foregone revenues in projections with or without CCS.⁴ The IEA (2014) projects that 365 GW of power plants in operation by 2035 are retrofitted by CCS – plants which would otherwise have been stranded, tripling the stranded capacity in that sector under the 450 Scenario. Most stranding estimates find that the contribution of CCS between now and 2050 would be modest, but not insignificant: CTI estimates an additional 125 GtCO₂ of available carbon space by 2050, under IEA’s “idealised scenario” (CTI, 2013: 4). This quantity has to be compared with the estimated 2,000 GtCO₂ that must remain ‘unburned’ by 2050 to keep the world on a 2°C pathway.

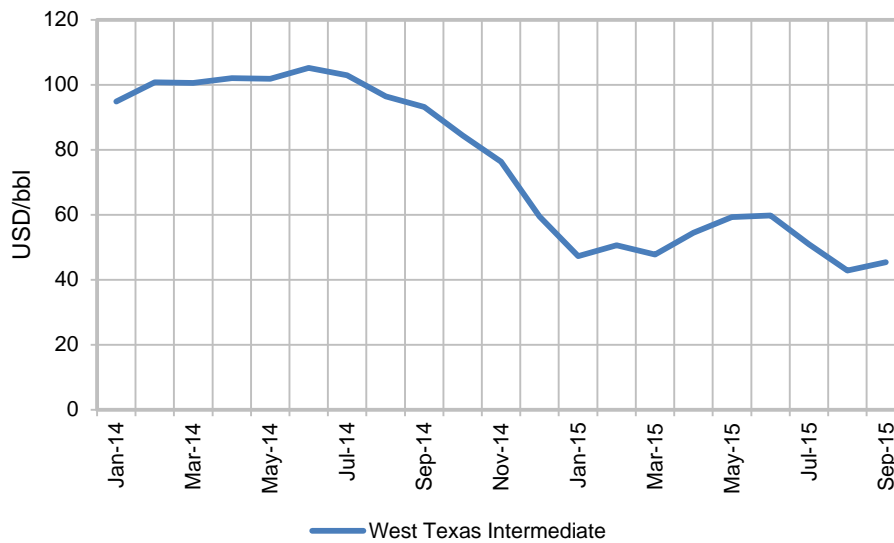
27. Second, energy prices, which generally follow smooth evolutions in scenario exercises, can react quite strongly to changes in economic conditions and to shifts in supply and demand. The following dynamics are important to keep in mind:

- Respective prices of oil, gas and coal determine the economic viability of fossil fuel reserves, as well as the relative competitiveness of fossil-fuel power plants vis-à-vis electricity from renewable energy sources. The price of oil also influences the economic attractiveness of electric and biofuel vehicles.

⁴ From USD 111 trillion to USD 109 trillion (Citigroup, 2015).

- The crude oil price dropped dramatically in the second half of 2014 from USD 105/barrel (bbl) in June 2014 to USD 45/bbl in September 2015 (Figure 3). As a result of the lower oil price and, thus, reduced cash flow for oil companies, the industry is consolidating, focusing on low-cost production and reducing overall investment. This adjustment may also reduce the risk of some oil and gas assets becoming stranded by limiting further high-carbon lock-in (Mitchell, Marcel and Mitchell, 2015).

Figure 3: WTI crude oil spot market price (January 2014 – September 2015)



Source: Authors, based on IEA, 2015b.

28. Changes in the costs of low-carbon solutions and in international energy prices can significantly affect the amount of stranded assets, as they could lead to a ‘disorderly’ transition and cause ‘runaway’ stranding. Due to their reliance on orderly scenarios, the above-mentioned estimates of stranded assets may therefore be considered conservative.

3. DIVESTMENT: WHY AND HOW?

It is our responsibility, as a long term institutional investor, to consider carbon as a risk and to accompany the global energy transition.

Henri de Castries, CEO of AXA

Our starting point for this analysis has been to determine the financial risks associated with the energy sector. By not investing in a number of companies, we are reducing our exposure to risk constituted by fossil-fuel based energy. This decision will help to protect the Fund's long-term return on investment.

Eva Halvarsson, CEO of AP2

29. Divestment has been proposed as one solution to mitigate the risk to investors from stranded assets. It is principally demanded by the fossil fuel divestment campaign, organised by the environmental organisation 350.org, which argues that it is unethical to earn profits from fossil fuel activities which are predominantly responsible for climate change. 350.org's Go Fossil Free campaign (gofossilfree.org) asks investors to:

- Immediately freeze any new investment in fossil fuel companies.
- Divest from direct ownership and any commingled funds that include fossil fuel public equities and corporate bonds within five years.

30. Ansar, Caldecott and Tilbury (2013) identify three distinct aims of fossil fuel divestment:

- 1) Ensure transparency with regard to carbon exposure of fossil fuel companies and pressure governments to restrict fossil fuel extraction.
- 2) Pressure fossil fuel companies to undergo 'transformative change' by switching to less carbon-intensive forms of energy supply.
- 3) Pressure governments to enact legislation such as a ban on further drilling or a carbon tax.

31. Apart from the moral and ethical motivations behind the fossil fuel divestment campaign, institutional investors such as the Norwegian Sovereign Wealth Fund, the French insurance and assets management group AXA, and Sweden's pension fund AP2 have pursued forms of divestment for financial and climate risk-related reasons (Arabella Advisors, 2015). They are concerned that their investments in certain carbon-intensive companies may deliver lower returns – through lower dividends on equity investments or even default of corporate debt – given stricter climate policy and technological change.

3.1 Methods: how various actors are pursuing divestment

32. The main choice for investors adopting a divestment strategy is whether to divest fully or partially and, if so, how. HSBC (2015) distinguishes four approaches to divestment:

- Full divestment from all fossil fuel assets.
- Partial divestment (tilting). This can be conducted in three ways, by 1) reviewing stock market index classification categories to broadly exclude all coal, oil and gas companies; 2) identifying individual companies' fossil fuel-related revenue generation and deciding what level is acceptable; and 3) assessing individual project break-even points to determine the likelihood of stranding.
- Value chain analysis of companies involved in fossil fuels. This extends the analysis beyond primary producers of fossil fuels to users such as electric utilities, cement plants, etc. This raises the question of at what level a sector's carbon intensity creates a risk to investors.
- A worst-in-class approach based on the carbon intensity of individual companies. This analysis enables the identification and exclusion of the 'worst' performers in a given sector in terms of their life-cycle emissions from extracting, processing and consuming fossil fuels.

33. While the fossil fuel divestment campaign calls for a full divestment from fossil fuel equities and bonds, institutional investors have taken different approaches to divestment (Table 2).

34. The majority, however, have not divested in any way. Besides open questions around the materiality of the stranded assets risk, this is often due to implications for benchmarking practices (i.e. investing in funds that track a certain index, such as the S&P500). These benchmarks mostly include fossil fuel assets and remain highly profitable in the short-time horizon. Some index companies are starting to provide benchmarks that exclude certain or all fossil fuel assets – though it is still open to debate whether fossil free indices under- or over-perform compared with traditional ones (MSCI, 2014; HSBC, 2015).

Table 2: Divestment approaches taken by institutional investors

Name of Organisation	Sector	Divestment Approach
AXA	Insurance and assets management	Partial divestment and value chain analysis Divesting and halting investment in the following businesses: <ul style="list-style-type: none"> • Mining companies deriving over 50% of their turnover from coal mining • Electric utilities deriving over 50% of their energy from thermal coal plants
Storebrand	Insurance/pension fund	Partial divestment and value chain analysis <ul style="list-style-type: none"> • Divesting from certain mining and utility companies according to their reliance on coal (threshold undisclosed)
San Francisco, CA, USA	Government	Full divestment
AP2 Pension	Pension fund	Partial divestment and value chain analysis <ul style="list-style-type: none"> • Divesting from mining companies that derive more than 50% of their turnover from the sale of thermal coal • Divesting from oil and gas companies with a substantial exposure in high-cost projects such as oil sands (threshold undisclosed)
California Public Employees' Retirement System	Pension fund	Partial divestment <ul style="list-style-type: none"> • Divesting from companies deriving at least 50% of their revenue from coal mining
Norwegian Government Pension Fund Global	Pension fund	Partial divestment and value chain analysis <ul style="list-style-type: none"> • Divested from 22 companies that are involved in oil sands production, coal mining, cement production and coal-fired power generation according to their reliance on oil sands and coal (threshold undisclosed) • From 1 January 2016: divesting from and freezing new investments in companies that base 30% or more of their activities on coal, and/or derive more than 30% of their revenues from coal
Rockefeller Brothers Fund	Philanthropic foundation	Full divestment

Source: Authors, based on gofossilfree.org/commitments/.

3.2 Other courses of action

35. Investors in fossil fuel assets are also following other courses of action to understand and mitigate the stranded assets risk:

- Monitoring and stress-testing: some actors have started actively monitoring their fossil fuel exposures in portfolios and auditing their carbon intensity. Portfolios can also be stress-tested for different CO₂ prices and variations in fossil fuel demand in order to assess vulnerabilities.
- Engagement: part of an active management of environmental risks is regular engagement with invested companies, either through direct contact with senior management or shareholder resolutions (HSBC, 2015). In terms of stranded assets, companies can be asked to disclose the carbon intensity of their assets and reserves and justify the valuation of their assets, capital expenditure and acquisitions given different demand scenarios. Moreover, companies can be encouraged to diversify into less carbon-intensive assets such as low-carbon energy and to include an appropriate carbon price in their planning, or otherwise present a strategy to reduce the carbon exposure and intensity of their operations (IIGCC, 2015).
- Hedging: investors can also reduce their exposure to stranding risk through a diversification of investments into more low-carbon assets such as clean energy equities, green bonds and low-carbon custom indices (BNEF, 2014; MSCI, 2014).

3.3 Is divestment effective?

36. The question of whether divestment is effective should be considered from the standpoint of those who decide to divest. If the primary motivation is not to invest in companies whose business model runs against one's ethical principles, the financial impact on the investor's portfolio and the divested company is secondary.

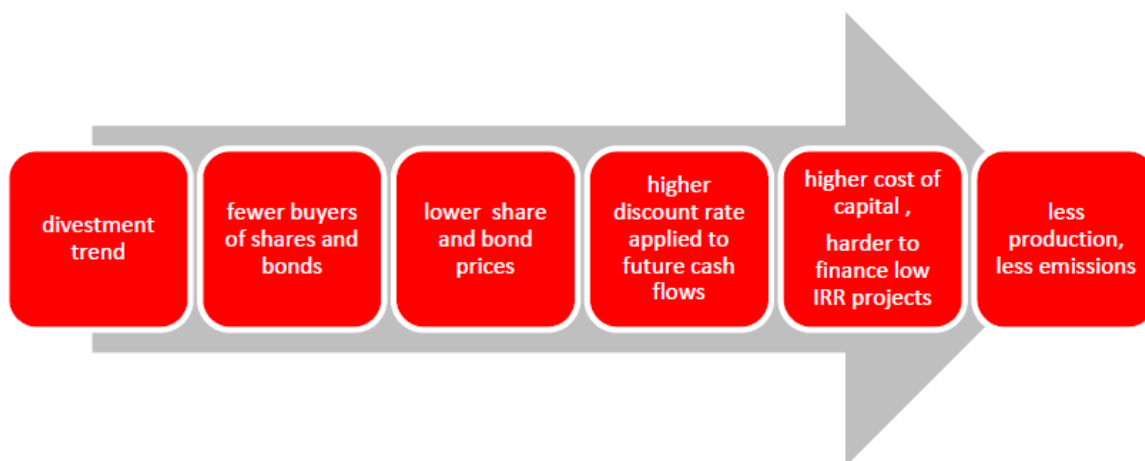
37. Tracking the effect of divestment today and in the future is nonetheless important as the phenomenon gains importance and diversity, with a growing number of institutional investors taking part. To date, 436 institutions and 2,040 individuals across 43 countries and representing USD 2.6 trillion in assets under management have committed to some form of divestment from fossil fuel companies – a fifty-fold increase in total combined assets compared to 2014 (Arabella Advisors, 2015).. In theory, divestment should reduce the demand for shares and bonds and thereby increase the cost of capital to fossil fuel companies and limit their ability to finance high capital expenditure projects (Figure 4).

38. Research on past divestment campaigns has shown that the direct impact of divestment on equity or debt of the affected companies is limited, as other investors can fill the gap relatively quickly (Ansar, Caldecott and Tilbury, 2013). Indeed, direct impact has so far been limited, if one considers changes in divested companies' business choices.⁵ For example, 2014 statements from both Shell and Exxon,

⁵ It is difficult to attribute the recent cuts in capital expenditure by major oil and gas companies of on average - 12% to either the divestment campaign or reduced oil prices (HSBC, 2015). It is likely that the companies involved are more sensitive to changes in the price level than to reputational risks.

motivated by shareholders' enquiries, rejected the stranded assets argument. Similarly, Fischel (2015) and Cornell (2015) argue that the economic costs of fossil fuel divestment (trading costs, costs of reduced portfolio diversification and lower returns) are substantial, and that any benefits (influence on stock prices or business decisions of targeted firms and reputational effects) are likely to be non-existent. These authors, however, analysed only the early phase of the divestment campaign, when college and university endowments were the first to mobilise. The question of impact will have to be revisited with more divestment now taking place.

Figure 4: How divestment theoretically affects fossil fuel companies



Source: HSBC, 2015.

39. More effective seems to be the indirect impact of stigmatisation, which could lead to more restrictive legislation for fossil fuel companies (Ansar, Caldecott and Tilbury, 2013). The fossil fuel divestment campaign has, for example, put a spotlight on fossil fuel companies and high-carbon investments. It has also put stranded assets on the public policy agenda.

40. On a more fundamental level, there are four questions regarding the effectiveness of divestment:

- Divested assets are acquired by other actors in the market. What stance will these new investors take on climate change issues?
- Is divestment more effective than engagement? By divesting certain companies or whole sectors, institutional investors lose their ability to influence corporate behaviour or improve transparency through engagement with senior management or by filing shareholder resolutions.
- How far and how quickly can divestment go? With USD 4.6 trillion in market capitalisation and an average yield of 2.41%, the oil and gas sector has a unique combination of scale, liquidity, growth and yield – outcompeting even information technologies – making investments in this sector attractive and low-risk from an institutional investor's standpoint (BNEF, 2014; HSBC, 2015). In this sense, some may argue that institutional investors are caught in a dilemma as their fiduciary duties oblige them to maximise shareholder value *and* consider climate risks. However, UNEP-FI

(2015) recently indicated that integrating environmental risks into investment processes will improve investment performance and is consistent with investors' fiduciary duties.

- Where is divested capital being reinvested? Divesting from fossil fuel companies does not automatically lead to investing in renewables or energy efficiency. Although clean energy will attract USD 5.5 trillion in investment between 2014 and 2030 (BNEF, 2014), institutional investors will choose carefully from investment possibilities in all sectors. Despite a significant increase in clean energy investment options (especially green bonds and clean energy equities), limited scale remains a major obstacle for institutional investors.

4. ISSUES FOR POLICY-MAKING

41. Section 2 provided orders of magnitude of stranded assets – i.e. the value destruction that will accompany the transition to a low-carbon global economy. However staggering some of these estimates may appear to investors in fossil-fuel intensive businesses, they probably err on the conservative side. Furthermore, they reflect loss of value and not the reactions that financial markets may have as news of stranding comes to the fore. As recent months have shown, when combined with a period of excess supply and low demand, price adjustments can be brutal and disruptive. Climate policy, as it starts having more visible impacts on energy demand, is likely to lead to more such episodes in the future.

42. What could be the role of public policy in this picture, in addition to providing more clarity on climate policy instruments and investing public capital in the transition itself? There are two broad areas of possible action. Governments could take measures to:

- provide investors and stakeholders with better information on the climate vulnerability and climate policy exposure of investments (transparency);
- avoid excessive destruction of value: it is better to re-invest what is divested than to see economic value completely disappear (minimisation of stranding).

4.1 Possible measures to increase transparency

But to make proper decisions, investors need standardised, comprehensive information that is consistent over time. So far they are not getting it.

The Economist (2014), on companies opening up about their environmental risks

43. Information for investors on the vulnerability of corporate assets in the face of a changing climate or more ambitious climate policy is currently inadequate. At the same time, more and more companies are including CO₂ and other greenhouse gas emissions in their corporate environmental, social and governance (ESG) disclosures.

44. A number of private sector initiatives have produced guidelines and frameworks for climate-related reporting, with a view to creating a standard practice. In parallel, measurement standards are also being developed to estimate the carbon footprints of companies, plants and products (see Baron, 2014, for a review of these initiatives).

45. A company's report on its greenhouse emissions is an important indicator for management and other stakeholders, as it can indicate major sources (direct emissions related to energy use, or to emissions embedded in inputs) and direct action for effective reductions. However, such reporting does not in itself indicate a company's degree of vulnerability to climate policy – and of course says nothing about the company's vulnerability to climate change itself. In other words, emission levels and trends are not indicators of the materiality of climate change and climate policy responses for a company's business.

46. In a forthcoming review of climate-related reporting schemes in G20 countries, OECD/CDSB (*forthcoming*) note the diversity of reporting requirements in G20 countries, despite the fact that 15 countries mandate the reporting of direct emissions (scope 1). Different reporting frameworks and implementation make company comparisons difficult. The definition of materiality for climate change reporting requirements is also technically difficult. On a more positive note, OECD/CDSB report that climate disclosures are starting to be requested from institutional investors, *e.g.* in France and Australia, a means of alerting these investors to their possible climate liability.

47. The lack of comparability of climate disclosures has led to the demand to establish a comparable, consistent, reliable, clear and efficient set of climate disclosures (Bank of England, 2015). Other actors in the non-governmental community had also taken steps in this direction, *e.g.* CDSB with its Climate Change Reporting Framework (CDSB, 2015).

48. It is clear that investors and other stakeholders lack comprehensive information to assess and compare companies from the standpoint of their climate-related performance, an issue as climate aspects and stranded assets are to become a growing material risk. In light of the possible magnitude of stranded assets and impact on companies' future business, policy-makers may need to offer guidance on, if not mandate, disclosures on possible future impacts of climate policy. This is particularly challenging as long-established accounting principles and financial disclosures refer to past performance and not future value creation.⁶

4.2 Possible measures to minimise stranding

A wholesale reassessment of prospects, especially if it were to occur suddenly, could potentially destabilise markets, spark a pro-cyclical crystallisation of losses and a persistent tightening of financial conditions. In other words, an abrupt resolution of the tragedy of horizons is in itself a financial stability risk.

Mark Carney, Governor of the Bank of England, 2015.

49. Stranded assets in the transition to a 2°C compatible world are inevitable and will indeed signal that the world economy is bifurcating from fossil fuels at an appropriate pace. The more progressive the shift away from carbon-intensive technologies and assets, the less value will be destroyed and the more can be re-invested in low-carbon infrastructure. It is therefore worthwhile to ask whether policymakers have in their toolkits instruments to encourage companies and investors to exit while minimising the financial implications for the economy as a whole. No ready-made solution comes to mind, but a range of options could be explored.

50. At its 25 September 2015 meeting, the Financial Stability Board (FSB) discussed how climate change and the transition to a low-carbon economy could impact financial stability, and mentioned the possibility of running stress tests incorporating climate change and climate policy-related impacts (FSB, 2015). The methods used by insurance companies to analyse tail risks under different policy scenarios

⁶ This is a well-identified challenge, in the context of discussions on so-called integrated reporting (IIRC, 2013).

may be of use for such stress-testing, especially for climate-related events. Climate-related ‘stresses’ could be integrated in the existing stress-tests that EU and US financial institutions are subject to.

51. Countries facing industrial-scale transitions have also taken practical measures to minimise disruptions. In Germany, the RAG Foundation was established in 2007 to manage the discontinuation of coal mining “in a socially acceptable manner” (rag-stiftung.de). The foundation will finance the perpetual mine management obligations related to coal mining from 2019 through the sale of shares in Evonik Industries AG – a chemistry company that was established by transferring business areas such as chemicals, energy and real estate from the original coal mining corporation Ruhrkohle AG – and through income from its holdings as well as financial assets. In the same vein, the European trade unions recently called for support for carbon-dependent regions (Euractiv, 2015). The foundation model may inspire schemes to mitigate the social impacts of stranded assets in the low-carbon transition.

52. Among options to enhance the global carbon budget without endangering the temperature stabilisation objective, carbon capture and storage (CCS) is a topic of much discussion. Fitted onto fossil-fuel-powered or industrial facilities, CCS could extend the available carbon budget and thus reduce the occurrence of stranded assets in the fossil fuel industry – coal and, to a lesser extent, natural gas. IEA (2015c), in its tracking of progress towards a 2°C-compatible scenario, noted that CCS just passed a milestone with the first large-scale demonstration in a power plant. Much more is required however: only 60 million tCO₂ have been stored, with monitoring, so far. “To meet the 2DS, the rate of CO₂ being stored per year will need to increase by an order of magnitude” (IEA, 2015c: 90). The potential exists, though its realisation is still very uncertain.

53. There is always a risk that policies intended to protect activities from economic disruption will end up slowing down a necessary transformation. Hence, the question of policy intervention to minimise assets stranding should be considered with care. At the same time, a massive reassessment of companies’ valuation due to their fossil fuel risk exposure, were it to trigger financial instability, could put climate policy ambition at risk.

5. CONCLUSIONS AND FURTHER ISSUES

54. The intertwined issues of divestment and stranded assets are likely to grow in importance in the coming years, if the past few years are any indication. Much can be done to increase the visibility of these issues for interested stakeholders, including the financial sector. The significant economic and technological transformations required to stay on track with a 2°C objective will not leave fossil fuel companies and energy-intensive activities unscathed, as only a fraction of all available fossil fuel reserves and resources can be burned. This will impact assets value, and the sooner the financial sector stakeholders understand the situation, the less disruptive the transition will be.

55. This paper provided orders of magnitude of the stranded assets issue and some information on how divestment is proceeding. Estimates of stranded assets are based on projected transitions that are inherently unable to render possible surprises – abrupt drops and hikes of international oil and gas prices, macro-economic and other geo-political shocks – that can also affect the transition and assets. An orderly transition may be the less likely of all scenarios, and policymakers should strive to provide as much visibility as possible to all stakeholders in order to avoid abrupt reassessments. Better corporate climate disclosures are in order, and stress tests could also shed light on the vulnerability of our financial and economic systems to climate change and related policy interventions.

56. The debate has so far focused on fossil fuel companies, whose role is to deliver to market the various forms of hydrocarbons that our multiple activities demand. Relatively little attention has been paid to assets in other economic activities, with the exception of power generation, where large coal-based power stations in particular are capital-intensive installations, with amortisation running over decades. Other carbon-intensive activities such as cement, steel, petro-chemicals or aviation may also be exposed to the risk of stranding and warrant a closer look by financiers.

57. Last but not least, as stranded assets in a 2°C-compatible scenario could lead to value destruction, it may be worthwhile to look at experience with the management of large-scale, policy-driven sectoral transitions (e.g. Germany's nuclear phase-out) to identify what policy instruments, if any, could facilitate the transition away from carbon.

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