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# Stranded Assets and Finance

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The Paris Agreement of 2015 signaled the shift towards net-zero. And the Glasgow summit of 2021 has highlighted the urgency for the change. With climate change becoming a reality, addressing the issue has become critical. The shift to net-zero requires moving away from fossil fuels (coal, oil, and gas) and decarbonizing production processes and supply chains. This move requires dramatic changes. Coal-based plants give way to renewable energy plants. Equipment used in production may need to be replaced with equipment that uses new energy sources or uses energy more efficiently. Thus, new equipment or new methods may be required. All this results in stranded assets. In this piece, I explore stranded assets and their implications and focus on environment-related stranded assets.

## What are stranded assets?

There are two terms that are often used interchangeably – stranded resources and stranded assets. Stranded resources refer to assets that cannot be used. For instance, if the production at a plant must be stopped. Take the case of the Nord Stream pipeline that Germany recently refused permission to operate. By contrast, stranded assets are defined as assets that have suffered from unanticipated or premature write-downs, devaluation, or conversion to liabilities (Caldecott, Ben, Howarth, and McSharry 2013). So, what causes stranding? From an environmental perspective, stranding is caused by various factors outlined in Table 1.

**Table 1: Typology of Environment-related Risks**

<b>Nature</b>	<b>Type</b>	<b>Description</b>
Physical	Environmental challenges and change	Climate crisis, water stress and biodiversity loss.
	Changing resource landscapes	Prices and availability of different resources. For instance, high oil prices lead to shift towards shale gas and liquefied natural gas.
Societal	New government regulations	These can be in the form of introduction of carbon pricing, reduction in subsidies for fossil fuels, regulations on air pollution, increased disclosures required by regulators. EU, SEBI and SEC requiring increased non-financial disclosures.

	Technological changes	Reduced costs of solar panels, improved and cheaper hydrogen-based technologies, new disruptive technologies, etc.
	Evolving social norms and consumer behavior	Consumers increasingly demand sustainable products, Buyers require certification and labeling of products, etc.
	Litigation and changing statutory interpretations	Recent court cases against Royal Dutch Shell, Exxon Mobil etc. Requiring companies to focus on sustainable actions.

Source: Based on (Caldecott 2017)

### Where are assets becoming stranded?

1. **Fossil fuels:** Industries that extract fossil fuels (coal, oil, and gas) are becoming vulnerable to stranding as their emissions are a key contributing factor to climate change. Related products are also subject to stranding. Take the case of plastic. Plastic is known for its poor biodegradability and toxicity. Advances in bioplastics and biodegradable plastics are likely to strand conventional plastic producers.
2. **Agriculture and Forestry:** They have a high risk of stranding. The industry faces advances in agriculture, environmental regulation changes, and risk of natural disasters – floods, droughts, forest fires, etc. The shift to natural and organic produce is stranding traditional agriculture. Milk substitutes impact dairy products, plant-based meat is affecting the livestock industry, and so on. With forestry-based products being viewed unfavorably, the demand for forestry appears to be declining.
3. **Fishery:** Aquaculture, particularly clean fish, is fast replacing regular fishing. There is also increasing consumer interest in vegetarian and vegan diets impacting the fishing industry.
4. **Tourism:** With many beaches being cluttered with plastic waste, tourists are shying away from visiting them. Also, coastal areas are increasingly facing the risk of inundation and thus thwarting tourism.
5. **Transport:** The transport industry is witnessing a dramatic shift from ICE (internal combustion engine) technology to electric vehicles. There is also significant progress in the development of hydrogen-based vehicles. With improvements in battery technology and battery management, large vehicles are becoming viable and popular

## What are the Implications of Stranded Assets?

1. For financial institutions, it is important to measure investments exposed to environmental risk. Measurements have to be undertaken across sectors, geographies, and asset classes. For instance, the Carbon Tracker Initiative has done significant work in measuring carbon-related risks.<sup>8</sup>
2. Stranded assets also have implications for financial stability (Jenkins 2020).<sup>9</sup> With an increased focus on net zero, many companies will find themselves saddled with stranded assets. This could lead to asset managers who invest in these companies to lose money. So would banks that have lent money for these assets with risky loans. Insurers will have lower underwriting and higher claims. All of these may impact the stability of the financial system.
3. Stranded assets affect workers, companies, and governments. They create unemployment, lost profit, and reduced tax collection, among others. Mitigating these consequences arising out of stranded assets is important to avoid a potential systemic financial risk. According to Caldecott (2015), the Bank of England has set out three criteria for stranded carbon assets being a systemic financial risk:
  - i. That exposures of financial institutions to carbon-intensive sectors are large relative to overall assets;
  - ii. The impact of policy and technology is not already being priced into the market, either through lower expected returns or higher risk premia; and
  - iii. Any subsequent correction would not allow financial institutions to adjust their portfolios in an orderly manner.
4. The risk and impact of stranded assets will need to be incorporated into a company's corporate strategy and decision-making. Societal action tends to be high in carbon-intensive industries and so these sectors need to evaluate the impact of stranded assets more carefully. Take the recent case where the activist investor took Royal Dutch Shell to court for not paying enough attention to carbon mitigation (BBC News 2021), or take the case of Tesco where investors demanded that Tesco stock healthy products (Retuers Staff 2021).
5. Civil society is making strong arguments for economywide decarbonization to reduce the scale of climate change. While this is truer of Europe, activism is slowly picking up in other parts of the world too.
6. Governments need to keep track of how progress towards reducing emissions is being made and understand how 'committed emissions' should influence the actions of companies and investors.<sup>10</sup>

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<sup>8</sup> Carbon Tracker Initiative, <https://carbontracker.org>

<sup>9</sup> A stable financial system is capable of efficiently allocating resources, assessing and managing financial risks, maintaining employment levels close to the economy's natural rate, and eliminating relative price movements of real or financial assets that will affect monetary stability or employment levels (The World Bank, n.d.).

<sup>10</sup> Committed emissions are the future emissions expected from all existing fossil fuel-burning infrastructure worldwide (Davis, Caldeira, and Matthews 2010).

## Stranded Assets and the Investor

Asset stranding is the process of collapsing expectations of future profits from invested capital (the asset) as a result of disruptive policy and/or technological change (van der Ploeg and Rezai 2019). This has significant implications for investors.

Let us think of a coal-based power plant that was set up, say 5 years ago, with an expected life of 50 years. The expected cash flows from the project were \$400 million per year. The initial cost of the project was, say \$3 billion. At the time of the project appraisal the project looked attractive ( $-3000 + \frac{400}{1.10^1} + \dots + \frac{400}{1.10^{50}} = 966$ ). The project is financially attractive and gets approved and is commissioned. After five years there is a drop in price of solar panels leading to customers installing solar power equipment in their homes. This reduces the cash flows that accrue to the power plant. Let us assume that these cash flows drop by 50%. Thus, the annual cash flows now become \$200 million instead of \$400 million. Also, the capital investment of \$3 billion needs to be adjusted for time value by taking the future value of the capital investment to year 5 (which now becomes the new year 0) when the asset starts stranding. We also need to account for the \$400 million received for each of the five years. Thus, the updated capital investment is  $-2389.5 (-3000(1.10^5) + 400(1.10^4) + 400(1.10^3) + 400(1.10^2) + 400(1.10^1))$  This reduces the NPV of the project today ( $-2389.5 + \frac{200}{1.10^1} + \dots + \frac{200}{1.10^{45}} = -417$ ) making the project completely unviable. From the shareholder's perspective there is a destruction of value, and she suffers a capital loss. This will lead a capital reallocation and a flight of capital from the stranded asset.

Another way of looking at the same problem is that easy availability of solar technology leads to an increased risk for the power plant. This can be translated into a higher rate of expected returns by capital providers. Let us assume that the capital providers (shareholders and bond holders) now demand a 15% rate of return on these assets. This translates into a significantly lower NPV than the original project ( $-2389.5 + \frac{400}{1.15^1} + \dots + \frac{400}{1.15^{45}} = 272.22$ ). I have assumed that the cash flows remain the same. However, in most cases there will be a double whammy of higher risks and lower cash flows. Combining the impact of lower cash flows and higher discount makes the NPV far worse ( $-2389.5 + \frac{200}{1.15^1} + \dots + \frac{200}{1.15^{45}} = -1059$ ).

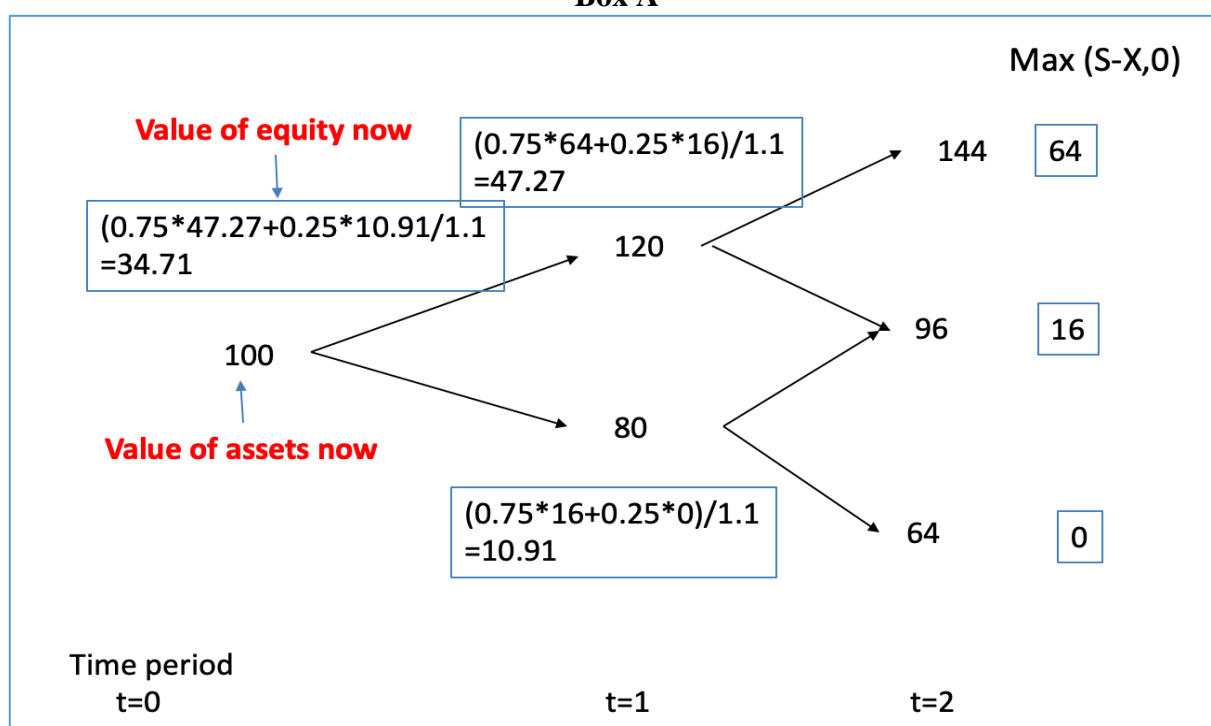
Thus, stranding assets are bad for the shareholders. Let us, now look at it from the bondholder's perspective. The higher risk due to asset stranding translates into a lower credit rating for the bonds. This higher risk also means that the expected yield on the bonds increase and consequently the bondholders face a capital loss.

Another impact would be the reallocation of wealth between shareholders and bondholders. I will illustrate this with an example using real options. Let us take the case of a power utility with the value of assets worth \$100 million. Also, let the value of assets move up in each period by a factor of 1.2 and move down by a factor

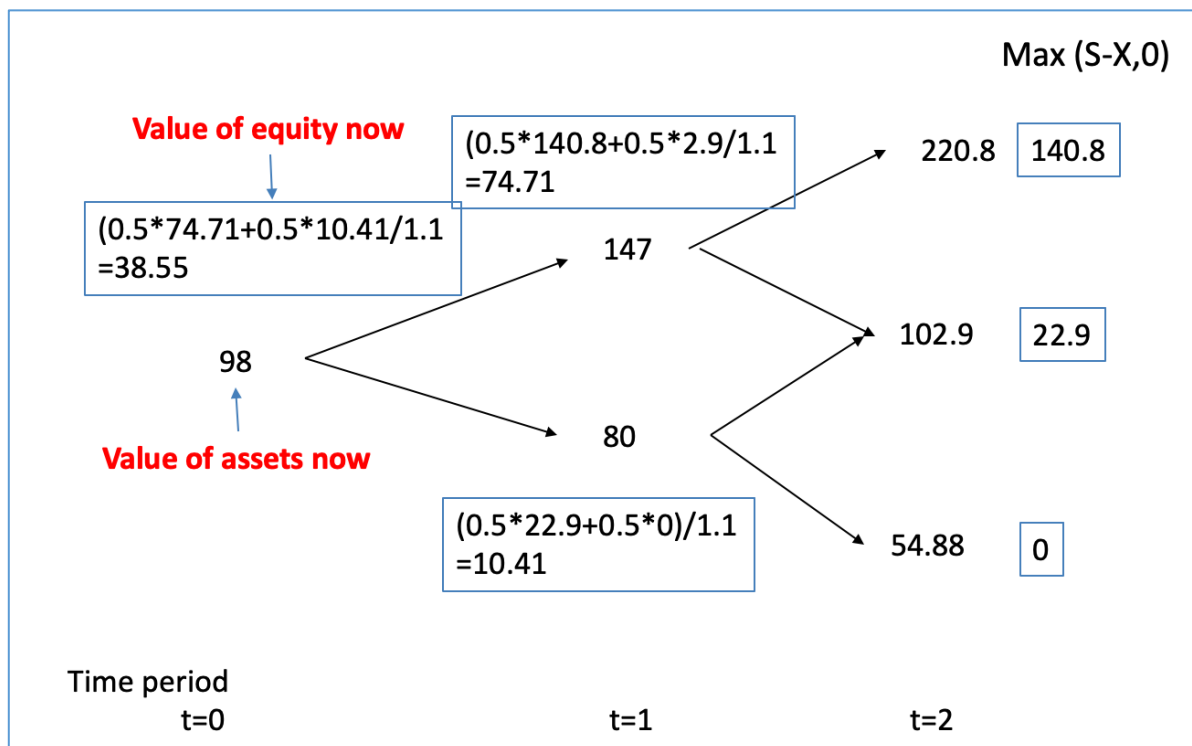
of 0.8. With a risk-free rate of 10% and the company's zero-coupon bonds (due two years from now) have a face value of \$80 million, the value of equity is \$34.71 million and the value of the bonds is \$65.29 million (see Exhibit 1: Box A). To arrive at these values, we use the Binomial Option Pricing Model (Cox, Ross, and Rubinstein 1979). As a first step, we compute the risk neutral implied probability as  $p = \frac{(1+risk\ free\ rate)-down\ factor}{up\ factor-down\ factor} = \frac{(1+0.10)-0.8}{1.2-0.8} = 0.75$ . Next, find the value of the option at maturity. If stock price is greater than the exercise price, the value of the option is the stock price minus the exercise price, else the value of the option is zero. With the option values known at the outermost nodes, we work back recursively at each node in the earlier period being evaluated by  $c = p \times C_u + (1 - p) \times C_d)/(1 + risk\ free\ rate)$ . Thus, the value on the top node at time period  $t = 1$  is evaluated as  $\frac{0.75 \times 144 + 0.25 \times 96}{(1+0.10)} = 47.27$ . We repeat the same with lower node and move back recursively.

Now, assume that the company adds a stranding asset with a negative NPV of (-)\$2 million. This increases the risk and increases the up and down factors to 1.5 and 0.8, respectively. As a result, the value of equity rises to \$38.55 million but the value of debt declines to \$59.45 (Exhibit 1: Box B) using the Binomial Option Pricing Model as described above. Clearly, the value of shareholders has gone up by \$3.84 million and the value of bondholders has gone down by \$5.84 million. Thus, there is a shift in value from bondholders to shareholders. However, the shift is asymmetrical with bondholders losing more than what the shareholders are gaining. Bondholders suffer a lot more than the value of stranded asset.

**Exhibit 1: Impact of Stranded Assets on Capital Providers**  
**Box A**



Value of firm (S) = 100, value of equity (S-X) = 34.71, Value of debt (X) = 100 - 34.71 = 65.29

**Exhibit 1 (continues):****Box B**

Value of firm (S) = 98, Value of equity (X) = 38.55, Value of Debt = 98 - 38.55 = 59.45

**Box C**

	Value without stranded asset	Value with stranded asset	Difference in value
Value of Equity (S-X)	34.71	38.55	3.84
Value of Debt (X)	65.29	59.45	-5.84
Total (S, Firm Value)	<b>100.00</b>	<b>98.00</b>	<b>-2.00</b>

Source: author

**Stranded assets and insurance**

Another important stakeholder is the insurance company that is impacted by stranded assets. Note that for an insurance company, the liability side of the balance sheet comprises of policyholders' funds, whereas the asset side has the investments made by the insurance company to earn a return. Stranded assets impact both sides of an insurance company's balance sheet. On one hand, as more assets underwritten become stranded in an economy, there is a greater likelihood of a fall in the value of the insurance company's investment. This is because an insurance company may own equity and bonds of these companies (including those whose assets it has insured). Thus, the value of assets of an insured company goes down as stranded assets increase in the economy. On the other hand, as the assets underwritten become stranded, the insurance company will be liable

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to compensate the insured. Consequently, the value of liabilities of an insurance company increases with stranded assets. Furthermore, as stranded assets are no longer insured in the future, the underwriting amount in the future will also reduce thereby impacting its future revenues.

As the probability of an asset becoming stranded increases, the risk to the insurance company increases. This will drive up the premiums being charged. As the risk increases, the premium being charged will at some point become too high, making the asset uninsurable. Given that climate change events tend to be unpredictable and are highly non-linear events, insurance may become unaffordable and unavailable at some point. For insurance companies, it will mean that they will need to develop appropriate processes for readjusting premiums to account for the risks faced. This process is also likely to be impacted by social and political pressures to keep premiums low.

High insurance premiums are likely to impact people living in areas that are most likely to face climate risks. Higher premiums may make it uneconomical for people, say in coastal areas, to afford insurance, especially those who are economically weak or migrants. Governments will need to subsidize insurance to them.

Insurers will have to make difficult decisions. By denying insurance to businesses, farmers, and communities in high-risk areas, they will disincentivize investment in these areas. The lower investment would lead to lower income generating opportunities and lower capacity to pay premiums. It becomes a vicious cycle. Government incentives like subsidies may distort asset values. The insurance industry will need to find ways to protect itself, educate corporate customers on climate imperatives, and avoid high climate risk deals. Thus, the insurance companies can contribute to building resilience in the economy and at the same time earn a reasonable rate of return.

### **Accounting for Stranded assets**

According to a study by RBC Global Asset Management, oil majors are showing significant impairment charges (Table 2).

**Table 2: Global oil majors impairment charges (2019)**

USD billion

Chevron	10.4
Repsol SA	5.3
Equinor	2.8
BP	2.3
Royal Dutch Shell	2.2

Source: Richardson and Rusin (2020)



There are two approaches to accounting for asset impairment. The US GAAP specifies that if there is a trigger event suspected to be causing the impairment, the carrying value (original cost – accumulated depreciation – accumulated impairment) must be compared to the undiscounted future cash flows generated by the asset. If the undiscounted future cash flows are lesser than the carrying value then the asset is said to be impaired.

Under IFRS and Indian Accounting Standards, the carrying value is compared to the recoverable amount, which is the maximum of the following two values:

- 1) the fair/market value of the asset minus any cost to sell the asset, and
- 2) the value in use (the present value of future cash flows generated by the asset).

If the recoverable amount is less than the carrying value, then the asset is considered to be impaired.

Given these write-offs, it is important to understand how these write-offs are being accounted for. Take the case of an oil platform operator adopting the US GAAP for accounting. With the increasing popularity of electric vehicles, the company realized that the current carrying value of \$6,000,000 will only be able to generate an undiscounted cash flow of \$4,000,000. This requires an asset write-down of \$2,000,000.

Given that stranded assets are becoming a part of life we will need to evolve a framework that enables us to deal with them. According to Dougans et al. (2022), companies may adopt the following approach:

- a. Build assets that have shorter life spans, are convertible to other purposes, and can be invested in incrementally: This requires building in small chunks which is in contrast to the conventional wisdom of building to economic scale. With small chunks, it is easier to upgrade and build the new chunk of assets. This also requires companies to assume shorter asset lives and will require shorter periods over which assets are depreciated. Wherever possible design in such a way that that lower carbon use is anticipated and design in a manner that value is realized quickly. Shorter investment cycles also imply quicker recovery and may have implications for pricing.
- b. Quantify each project's "uninvestable" moment: Here the managers will have to look at projects to provide quicker returns before the asset turns uninvestable. It requires managers to make an assessment of useful asset lives and estimate the risk of stranding early and figure out how to manage the write-down risk. Shifting to low carbon technology is a real options problem that managers will need to resolve.

- c. Consider the project as a part of an evolving portfolio: Managing the risk of stranded assets becomes increasingly important every year. Management of these risks along with a compelling proposition to stakeholders becomes critical to the manager in the new economic reality.

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