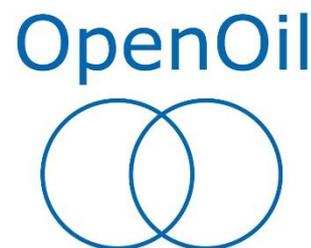


Aramco IPO: what price energy transition?

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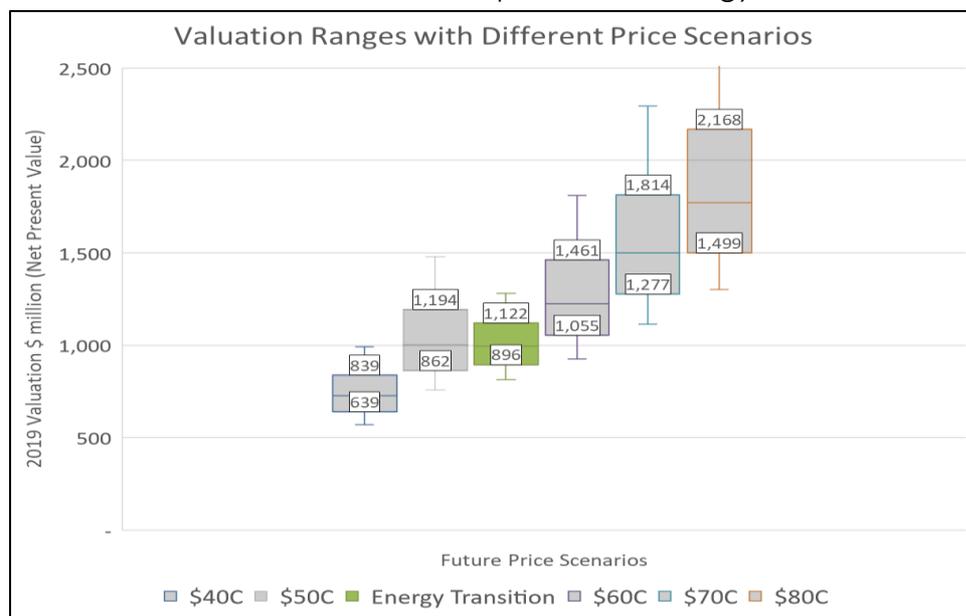


Introduction

The partial flotation of Saudi Aramco has been billed as the biggest Initial Public Offering in history, based on the determination of the Saudi government to achieve a record valuation. Throughout the run up to the flotation, the government's preferred valuation was at \$2 trillion. Perceiving resistance among international investors to this price level, this was adjusted down to \$1.7 trillion in initial price guidance offered as the subscription got underway.¹

This paper uses a discounted cash flow (DCF) model and Aramco's own assumptions, in as far as they have been published in its IPO Prospectus², to build a valuation using standard Net Present Value (NPV) methodology, and to assess the many other valuation figures that have entered public domain.³

Table 1. Valuation under constant price, and energy transition



Our findings show that if two key parameters are modestly adjusted, Aramco's valuation will almost halve, to under \$900 billion. The first is to assume peak oil demand congruent with the Paris Climate Change accords of 2015. The second is to allocate a standard project-level of risk to Aramco, rather than the lower level of risk the company itself has sought, which is more similar to established, listed multinationals.

Executive Summary

Two factors dominate valuations of Saudi Aramco's IPO: future oil demand, and what discount rate to apply to reflect "above ground" risk. Different views on these two factors alone account for most of the wide range of valuations made by analysts, from \$1 trillion to \$2.3 trillion.

A view on oil demand which takes the Paris Agreements seriously, and puts peak demand in the mid-2020s, would see Aramco's valuation lose at least half a trillion dollars from its \$1.7 trillion guidance price.

Using even a modestly higher discount rate (10%) to reflect Aramco's "above ground" risk triggers a second drop in valuation, to below \$900 billion – even assuming Aramco's business growth strategies succeed.

Under all scenarios, nearly all investor value is created by operations in the next 12-20 years. Most of Aramco's stated reserves of 261 billion barrels could be stranded with little extra added to any asset valuation today.

¹ As reported in global business media November 17, 2019

² <https://www.saudiaramco.com/-/media/images/investors/saudi-aramco-prospectus-en.pdf>

³ <https://www.bloomberg.com/news/articles/2019-11-13/morgan-stanley-is-latest-bank-to-offer-1-trillion-aramco-spread>

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The essence of the findings is in Table 1 above. A range of discount rates from 4% to 12%, reflecting investor view of risk, is contained within each vertical bar. Valuation totals using more normative risk rates of between 6% (a standard yield on shares in international oil companies, and 10% (a standard oil industry discount rate on projects which have not been de-risked), are shown in the top and bottom of each coloured block. Each vertical block represents a range of valuation at a particular assumption about future oil price. The five lightly shaded blocks assume oil at a constant price varying between \$40 and \$80 per barrel (in real terms).

The more heavily coloured "Energy Transition" block in the middle is based on a price estimate not of a single point, but of a price trajectory which starts at current levels today and then declines gradually, but structurally, to \$15 per barrel (real) by 2040. The series is based on a working paper published by the IMF⁴ which makes a case that oil demand could peak as early as 2024. The paper is discussed in detail below.

This view of a structural decline in oil price, albeit modest, caps Aramco's valuation of a little less than \$1.1 trillion even assuming established-stock level of risk, using a discount rate, or yield, of only 6%. If a higher discount rate of 10% is applied, to reflect a view of higher risks attaching to Aramco's positioning, NPV drops to \$896 billion.

The DCF model, released under Creative Commons license⁵, also shows a critical difference between an "energy transition" price trajectory for oil, and any constant price assumption – a much lower possible range of values. Assuming even modest compliance with the Paris Climate Change accords locks Aramco's valuation in to much lower levels than the guidance price, whatever other assumptions are made.

This is because structural price declines occur in the late 2020s, soon enough to affect present valuation significantly. Crucially, falling prices also "cross over" a cost curve which rises over time, slashing future free cash flows. It is important to note that this occurs even though the model incorporates the conventional assumption that Aramco has the largest low-cost oil reserves by an order of magnitude. It follows then that these trends are present, and rising, throughout the oil industry, among companies which do not have Aramco's unique asset base.

Other major conclusions are:

- Aramco's own attempts to steer valuation to between \$1.7 and \$2 trillion have relied on assuming oil markets continue to function as they do today for decades, and that the company's asset base and established operations qualify it for low risk discount rates of 5% to 6%. The market has not bought that.
- The lower bound on many valuation estimates by analysts, of between \$1 trillion and \$1.3 trillion, reflect a full working of only one of these two variables – either higher risk around Aramco, or some kind of energy transition pricing – but not both. They are still too high, and the lack of engagement by international investors suggests the market has not bought these analyses either.

It is important to stress that the base scenario of the model accepts a number of

⁴ <https://www.imf.org/en/Publications/WP/Issues/2017/05/22/Riding-the-Energy-Transition-Oil-Beyond-2040-44932>

⁵ Happy URL

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positive, but unproved assumptions about Aramco: that its declared reserves of 261 billion barrels are proven, that up to 100 billion barrels of that is producible at under \$20 per barrel pre-tax, that Aramco can continuously expand production in the coming years, that its low cost base would allow its market share to thrive in a lower demand environment, that Saudi Arabia can implement reforms to bring prices for resources allocated to the domestic market, which represent a third of Aramco's production, to international levels, and that plans to expand natural gas and downstream operations proceed as planned. If any of these assumptions are proved to be unfounded, Aramco's valuation should drop lower still – perhaps as low as \$400 billion⁶.

The rest of this paper lays out the assumptions and methodology of the model, discusses oil price scenarios under energy transition and the specifics of the IMF paper, and addresses further technical questions around the valuation.

This paper is the first of three dealing with Aramco's flotation. The second will discuss "above ground" risk around Aramco, quantifying in business terms the implications of its future relationship with the Saudi state. A third paper will assess the flotation's potential influence on other national oil companies, its impact on international oil companies, and possible relationship to the "Green Paradox". The papers form part of OpenOil's library of open financial analysis⁷ of natural resource projects.

Assumptions and Methodology

This analysis is built upon a DCF model produced according to the FAST financial standard, which is in wide use in the international financial services sector.⁸

Groping in the Dark

Aramco's economics continue to be hard to grasp on the basis of published information. Despite its 638-page IPO Prospectus, and documents relating to a bond issue earlier in 2019, the market continues to harbor doubts about its reserves and cost structures, in the upstream as well as the downstream. Aramco has announced ambitious plans to be a global-level vertically integrated company, and has made some acquisitions and planned others to achieve that goal. Nevertheless, the IPO lacks projections from Aramco around future profit levels.

Because the model has been designed to isolate and test first the implications of climate change policy, the base scenario incorporates as many of Aramco's own assumptions as possible – for instance lifting and capex per barrel, stated reserves.

Table 2. Economic Parameter Assumptions

Main Economic Parameters	
Life of Project	Unlimited, subject to an Economic Limit Test (ELT) to cover operating expenses and sustaining capital.

⁶ In 2017 Wood Mackenzie was quoted by Bloomberg news with a valuation for 5% of Aramco of \$20 billion at a discount rate of 10% - which would have yielded a valuation of \$400 billion. The quotation was subsequently withdrawn.

⁷ <https://openoil.net/case-studies-2/>

⁸ <https://www.fast-standard.org/the-fast-standard/>

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Crude Oil: Production profile	Two profiles, subject to the ELT: one "flat" on current production of XXX, the other, "growth", rising by 0.9% per year.
Reserves	261 billion barrels (the official Aramco stated figure since 1990).
Forecast price	Constant price in 2019 dollars as user variable; scenarios of \$40 to \$80 used for scenarios; An "Energy Transition" price sequence based on demand peaking in 2024, causing a structural decline in prices to \$15 a barrel by 2040.
Cost	A cost curve starting at \$6 per barrel all-in costs, rising gradually over cumulative production to \$20 per barrel after 80 billion barrels, then rising on a curve to \$40 per barrel at the end of the reserves.
Natural Gas: Production	Growth of 3.8% in production on current production of 9.61 MMBtU per day.
Natural Gas Price	\$1.40 / mBtU domestically, with annual price rises to KSA price of \$6.19 / MBtU by early 2020s
Downstream:	Production: rising by 2% per year from current levels
	Refining margins averaging 7%
Domestic Market Obligation	Current allocation of 33% of Aramco production (boe basis), "Equalisation" measures fully covering gap from Blended domestic prices to international spot.

Table 3. Fiscal Regime Assumptions

Main Economic Parameters	
Royalties	Sliding scale of 15% for oil under \$70 per barrel, XXX, YYY
Cost Recovery	75% ceiling of capex and opex against post-royalty revenues
Corporate Income Tax upstream	50% on taxable income
Corporate Income Tax: Mid- and Downstream	20% on taxable income

Aramco's Reserves and Cost Base

The most critical determinant of value in the IPO after future price is Aramco's crude oil reserves and cost base. Analysts have long noted that the company's reserves, which have never been independently audited, have remained at 260 billion barrels for three decades, despite the fact that it has produced some 90 billion barrels of oil during that period. Also, although there is general consensus that Saudi Arabia's cost base is the lowest in the world, detailed data are hard to come by. The Aramco

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prospectus defines lifting costs as averaging \$2.8 boe in 2018, and capital costs and upstream capital expenditures as \$4.7 per barrel.

The model builds upstream cost structures from estimates derived from Rystad and the International Energy Agency which appeared in a 2017 analysis of the potential Aramco IPO by Oil Change International⁹. Under this cost curve, reproduced here, Aramco can produce about 80 billion barrels at very low cost in global terms – under \$20 a barrel in real dollar terms. The model assumes that the company produces out all its lowest cost production at any point in time, gradually moving up the cost curve¹⁰.

When will Demand for Oil Peak?

The key hypothesis tested is what happens to an Aramco valuation if the possibility of climate change policy congruent with the Paris Agreement of 2015 is implemented. Analysts noted that Aramco itself mentioned a peak in oil demand for the first time in its IPO Prospectus document, with its main scenario predicting such a peak in the middle of the 2030s. The Prospectus also referred to a lower demand scenario under which peak demand could come in the late 2020s. The Prospectus itself does not attach any price predictions to peak demand, limiting itself to predictions around Aramco's production under both scenarios¹¹. Other oil companies have recently begun to talk of peak demand in oil and long-term decline of the industry, some setting peak oil demand in the late 2020s¹².

The IMF Paper

The IMF issued a study in 2017 making the case that the Electric Vehicle is likely to replace the motor vehicle in the next few years and that will cause the oil price to collapse in the late 2020s and 2030s until it is about \$15 per barrel in 2040 (in today's dollars). Attached to the IMF study is an indicated series of price forecasts.

Central to the thesis of the paper is that oil commands a premium as long as it remains the fuel of choice for transportation. But in previous energy transitions – from wood to coal in the last half of the 19th century, and from coal to oil in transport systems in the first half of the 20th century, peak of demand for the old fuel occurred while overall use of the replacement energy sources still accounted for a small percentage of overall consumption.

Carbon Tracker's 2018 report "Why You should see the fossil fuel peak coming"¹³ argues along the same lines as the IMF report on oil, but broadens estimates to the other fossil fuels. Peak fossil fuel demand is likely in the 2020s, even while renewables still account for a low percentage of total use, assuming a rise of total energy demand of 1.5% per year, and wind and solar power to expand by 17% per year.

⁹ <http://priceofoil.org/content/uploads/2017/08/Overheating-Expectations.pdf> p9

¹⁰ In practise, Aramco is likely to have a spread of cost structures in play at any one time.

¹¹ Production increase averaging 0.9% per year is assumed for a later in demand, and 0.7% per year for earlier peak in demand.

¹² For example, Equinor's 2019 Energy Perspectives, where its Reform scenario sees oil demand peaking in 2029 and its Renewal scenario in 2022

¹³ <https://www.carbontracker.org/reports/2020-vision-why-you-should-see-the-fossil-fuel-peak-coming/>

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Aramco Valuation Estimates

This model follows a Discounted Cash Flow method to estimate future earnings and costs, and compute from that the company's present value. But since Aramco announced it would finally go ahead with the flotation, which has been mooted since 2017, other methodologies to achieve a valuation have been discussed.

Per Barrel Valuation

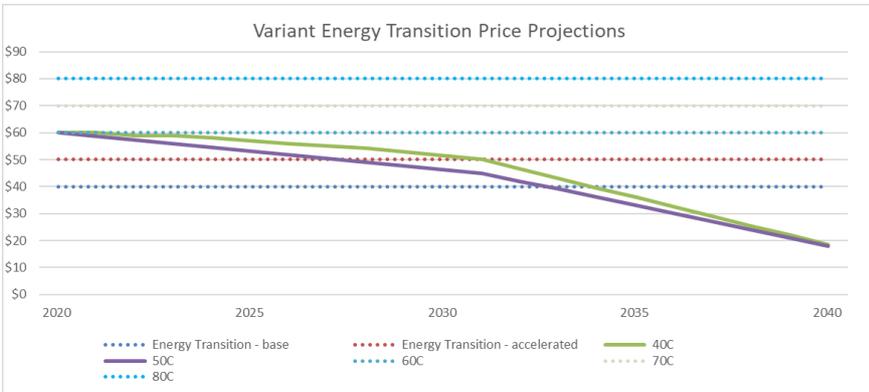
The simplest to calculate is a valuation per "booked" barrel¹⁴. Attributing \$7.50 of value per barrel would yield a valuation of \$1.66 trillion, undiscounted, if its claims about 261 billion barrels of reserves were credited. But that figure decreases sharply if any discount is applied. For instance, applying a discount of 10% would yield an NPV of \$348 billion. Even dropping the discount rate to 6%, a per barrel value of nearly \$24 would be needed to used to achieve Aramco's initial guidance valuation of \$1.7 trillion. Such valuations also do not hold up using any kind of energy transition price forecasting, since Aramco's current reserves to production ratio runs beyond 2080, whereas decreased demand scenarios mean a large portion of the reservoir will be stranded.

"Apple + Google + Exxon"

Another methodology promoted in discussion of the valuation has been the so-called "EBITDA" method, comparing Aramco's future earnings before interest, tax, depreciation and amortization. On this basis it has been suggested that because Aramco's net cash flow in 2018 of \$121 billion matched the combined totals of Google, Apple and ExxonMobil, the company's valuation should be about the same as the combined market capitalization of the three companies. But there are evident differences in the sectors. The first is that Aramco's risk level is perceived to be considerably higher than the tech companies and Exxon, and a resulting higher discount rate will result in a valuation which is a lower multiple of any year's earnings. Secondly, the tech companies operate in markets which experience much higher growth.

Sensitivity Analysis

The model's base scenario valuation of \$896 billion NPV10 includes a string of positive assumptions about Aramco's business model. If these are changed slightly, the valuation could drop another \$150 billion.



¹⁴ One recent precedent often cited is Total's acquisition of Maersk Oil in 2017 for \$7.5 billion against reserves of about a billion barrels of oil equivalent

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Specifically, if production is deemed to be flat into the future, domestic subsidies take 10 years instead of three to reach international market levels, the cost base increases by 20% (which would still leave 50 billion barrels of production at under \$12 per barrel pre-tax by 2030), and oil price declines accelerated marginally, to reach \$45 per barrel by 2030 instead of \$50, then Aramco's NPV at a 10% discount rate would be \$742 billion.

The Riyadh Market

The actual valuation likely to be achieved will not be on the basis of pure market perception. The change in terms around the flotation has ensured this. From initial consideration of a 5% offering on a major international stock market such as London or New York, the final form of Aramco's initial offering is up to 1.5% of shares on the Saudi stock exchange in Riyadh. The Saudi state is undertaking extensive measures to ensure shares are bought at the highest valuation possible: terms for loans within the Saudi banking system have been relaxed, rich Saudi citizens are understood to be under pressure to buy to pass a political loyalty test, and there have been reports of institutional involvement from Chinese state corporations, whose interest lies beyond shareholder value maximization in the realm of long-term geopolitics.

These factors may ensure that the offering is bought at price levels which would theoretically yield a valuation close to the \$1.7 trillion initial guidance level.

About Open Oil

OpenOil is a Berlin-based consultancy which provides financial analysis of natural resource economics for public policy. It has advised 11 governments in Africa and Asia, and has the largest published collection of financial models of extractive industries in the world.