

May 2017

Could renewables be the Majors' next big thing?

Executive summary

Wind and solar are poised to radically reshape energy markets. Though the timing of the energy transition is highly uncertain, oil and gas companies need to prepare. Expertise, balance and optionality will be needed to hedge against any future erosion of the upstream value proposition and hardening investor sentiment towards carbon. Our latest Thought Leadership insight looks at how the Majors are leading the way in shaping strategies to capture a piece of the action in this fast-growing market.

- **The growth opportunity in renewables cannot be ignored.** The entire global market for wind and solar is currently just 4% that of oil and gas, but is set to grow at a rapid rate and much faster than oil demand. By 2035 annual revenues from wind and solar will be around one-twelfth those of oil and gas in our base-case; a 'carbon constrained' scenario would result in much greater penetration.
- **The Majors need to commit substantial investment to establish portfolio materiality.** We estimate spend of US\$350 billion on wind and solar out to 2035 is needed for the Majors to replicate the 12% market share they hold in oil and gas. But even this 'bull' scenario would lift renewables to just 6.5% of the Majors' production in 20 years time, indicating how long it will take to establish critical mass in portfolios.
- **The value proposition is competitive versus some upstream investments.** Risk-adjusted returns rank favourably with many of the Majors' pre-sanction long-life developments, the most comparable upstream asset class. Wind and solar economics also stack up against the industry's full-cycle returns; and high cash flow visibility is a key attraction. And some next-generation wind and solar projects no longer need subsidy support after dramatic reductions in costs.

Offshore wind may be the most attractive route to organic growth in the near term. It offers scale and scalability on a par with upstream mega projects. The European Majors, spearheaded by Statoil, already have opportunities close to home markets. Solar is a more fragmented and competitive sub-sector, and Total has used M&A to establish early mover advantage here. But most Majors are still weighing up the options and have yet to make telling strategic moves in renewables. We expect business development to focus on rapidly growing emerging markets with M&A helping to establish a footprint in target technologies.

So what could a Major's portfolio look like by 2035? Players that push this growth theme hard such as Statoil and Total will have more diverse, less volatile portfolios sooner. The other European Majors will also be attracted by the dividend support that the stable, long-life cash flow from wind and solar provides. In contrast, the US Majors, with bountiful low cost tight oil and shale gas resource on their door step, may take longer to embrace this new asset class. Strategic polarisation will likely lead to even greater differentiation of the peer group.

The transition to 'New Energy' will be the biggest shift in strategic direction in a generation. The Majors are only just starting to sow the seeds for the radical changes that lie ahead. There are still question marks over scale. But wind and solar will be increasingly important strategic growth themes that cannot afford to be ignored as the Majors plan to 2035 and beyond.

The Majors need a piece of the action in renewables

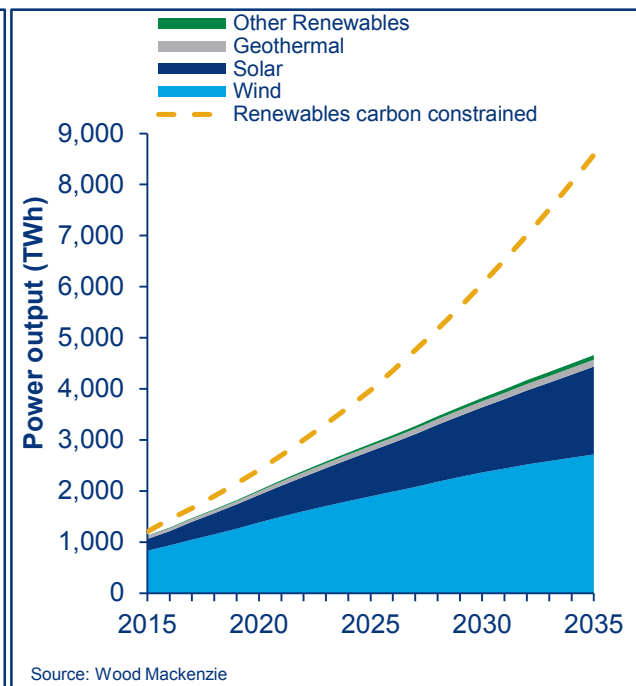
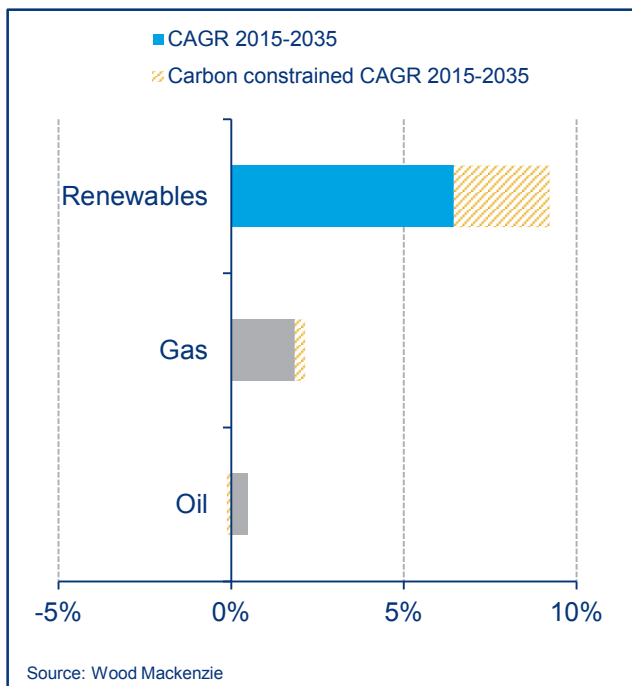
The shift to alternative energy is underway and in time will transform energy supply. The transition is forcing the oil and gas industry to rethink its future. The Majors, among others, are taking stock.

Renewables pose a threat to legacy oil and gas operations. Upstream strategies will have to adapt to slowing demand growth by focusing on advantaged, low cost oil and gas. But there is also opportunity in this energy megatrend. Both wind and solar exhibit sustained high growth into which oil and gas companies can diversify and strengthen portfolios for the changes coming.

The Majors' strategic response is already under way. They've made progress in re-positioning oil and gas portfolios towards the lower end of the cost curve to defend against extended low-price scenarios. Portfolios are shifting towards gas, viewed as the bridging fuel to a low carbon future. And the Majors have taken the first steps to move beyond the core oil and gas business into wind and solar power, where:

- The investible market will lift off.** Even in our base case renewables will be the fastest-growing primary energy source globally over the next 20 years. We forecast average annual growth rates of 6% for wind and 11% for solar. The majority of the growth will be in the power sector: by 2035 wind and solar will have captured respective 8% and 5% shares of global power supply. In contrast, total primary energy demand for oil grows at only 0.5% per year.
- Tighter environmental policy means more opportunity.** Wood Mackenzie's 'carbon-constrained' scenario – a forecast that assumes more rapid renewables penetration – sees solar and wind combined taking a 23% share of the global power market by 2035, and 6% of the total market for all forms of energy. Oil demand peaks before 2030 under this scenario and subsequently enters a slow decline, putting prices under pressure.
- Achieving 'Major' scale exposure will be difficult.** In 2017, non-hydro renewables (primarily wind and solar) will satisfy only 1% of the world's total energy needs. In terms of electricity supply, this share rises slightly to 6%; whereas oil and gas account for 55% and 25%, respectively.

Total primary energy demand growth from 2015 to 2035 Renewables power market growth, 2015 to 2035



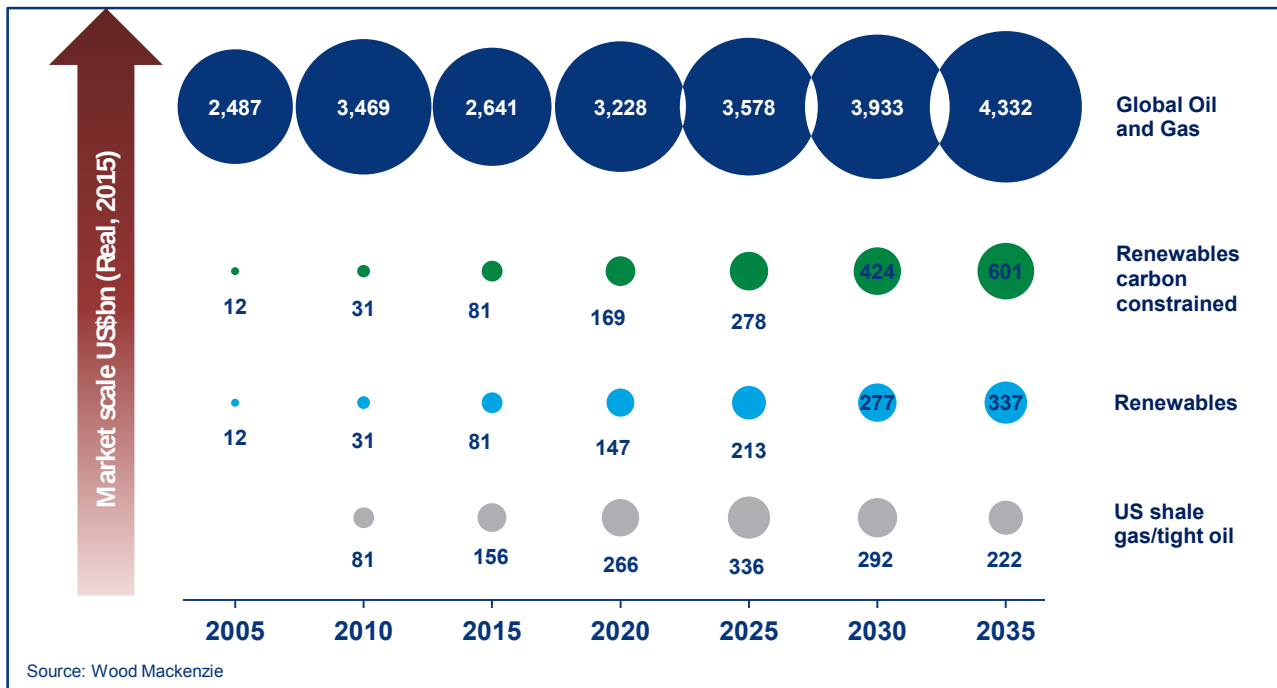
Carbon constrained scenario is additional growth to base case.

Carbon constrained scenario is total renewables generation.

Could renewables be the Majors' next big thing?

The case for the Majors to build a renewables position is increasingly compelling. A niche energy market now, renewables will be much bigger by the middle of the next decade, as oil and gas demand growth slows. A simple comparison of sector revenues shows that the global renewables market will narrow the gap with oil and gas – the latter is 33 times bigger in 2015, but just 13 times the scale in 2035. We also project overall revenues from renewables in 2035 will be nearly three times greater than those from US unconventional – the industry’s number one growth segment - in our carbon constrained case.

Evolution of real revenues from renewables and global oil and gas (base case and carbon constrained scenario)



Assumptions: Total global demand for each energy type multiplied by price. Long-term real oil price assumption of US\$65/bbl; average global gas price of US\$5.1/mcf in 2017, rising to US\$10/mcf in 2035; for shale gas a long-term Henry Hub assumption of US\$3.25/mcf is used; flat global power price of US\$70/MWh.

Large-scale investment needed to grow a meaningful position

Upstream is what the Majors do, of course, and the growth prospects from oil and gas opportunities will be a critical factor driving the pace of transition. A strong suite of high-returning greenfield upstream investments will likely trump renewables – there’s also comfort in carrying on doing what you know best.

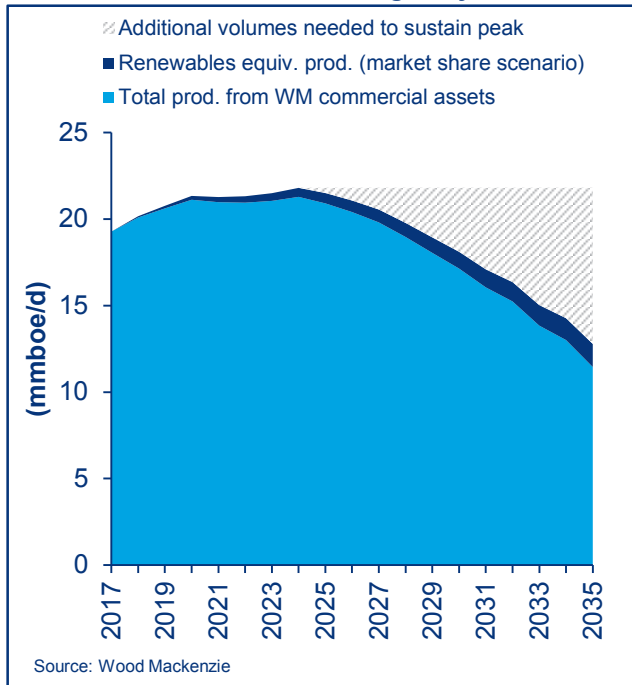
A potential tipping point for the shift into wind and solar is an anticipated decline in the Majors’ hydrocarbon production. New resources are needed to sustain volumes through the next decade and beyond. If a combination of discovered resource commercialisation, M&A and exploration fails to deliver, or economics weigh against continued development, wind and solar could step in to the breach.

But even winning a big share of the renewables market won’t change the Majors’ portfolios materially for many years. The Majors currently control 12% of the world’s oil and gas production, and less than 1% of the global renewables market. If they managed to replicate their share of oil and gas, renewables would still only make up about 6.5% of their total production on an energy-equivalent basis in 2035.

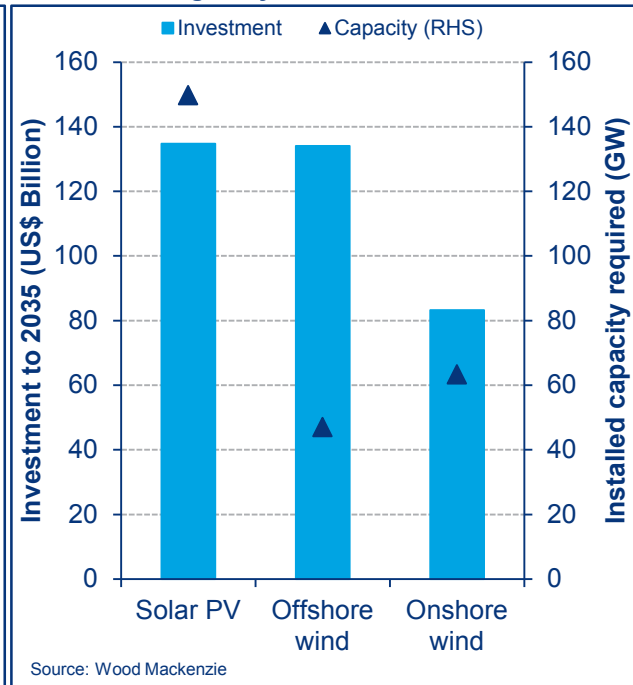
We calculate that to secure 12% of the global renewables market by 2035 would need US\$350 billion of investment at current costs. This is around a quarter of the US\$1.5 trillion we estimate the Majors need to spend to sustain upstream volumes to 2035. It seems an unlikely scenario.

That said, we expect renewables costs to trend down sharply over the period, and capital to increasingly be diverted from upstream to build globally material positions in wind and solar. Renewables could account for over one fifth of total capital allocation for the most active players post-2030.

Production profile for Majors if renewables' market share matches oil and gas by 2035



Capex needed for renewables' market share to match oil and gas by 2035



Energy-equivalent basis. We assume the Majors will develop a similar percentage stake in the global renewables market as they hold in oil and gas at peak production. The renewables production growth displaces oil and gas volumes.

This is the indicative investment that would be needed if the Majors were to achieve a 13% market share in wind and solar by 2035. This is under current cost assumptions. Investment is split across the three main renewable technologies in line with the outlook presented by Wood Mackenzie's Energy Markets Service. These include total generation of 600 TWh with total capacity split 44%, 26% and 31% respectively between solar PV, onshore wind and offshore wind.

Renewables value proposition is competitive

So is the renewables sector a genuine opportunity to create value and boost profitability? Returns at first glance seem modest, but a deeper dive reveals a more appealing value proposition.

Returns versus upstream options

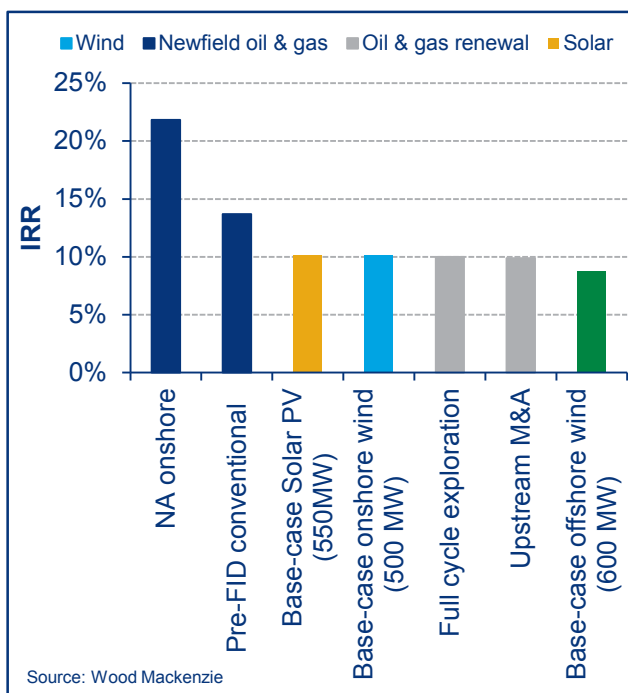
The returns for renewables range from 7% to 10%. We calculate 7% for offshore wind, 9% for onshore wind and 10% for solar PV under our base-case assumptions (see Appendix for details). This is around half the 18% the Majors could make on their next generation of upstream growth projects; a weighted average of the 22% from future drilling onshore North America and 14% on conventional pre-FID projects (both modelled at US\$65/bbl).

But there is much dead wood in this pool of upstream opportunities. A total of US\$90 billion of the Majors' discretionary investment fails to make a development return of greater than 10% in our base case, over one fifth of the total. These lower return projects are typically risky – sensitive to movements in commodity prices. The all-in returns for wind and solar stack up against this lower returning subset. They also look good against average full-cycle exploration and M&A economics:

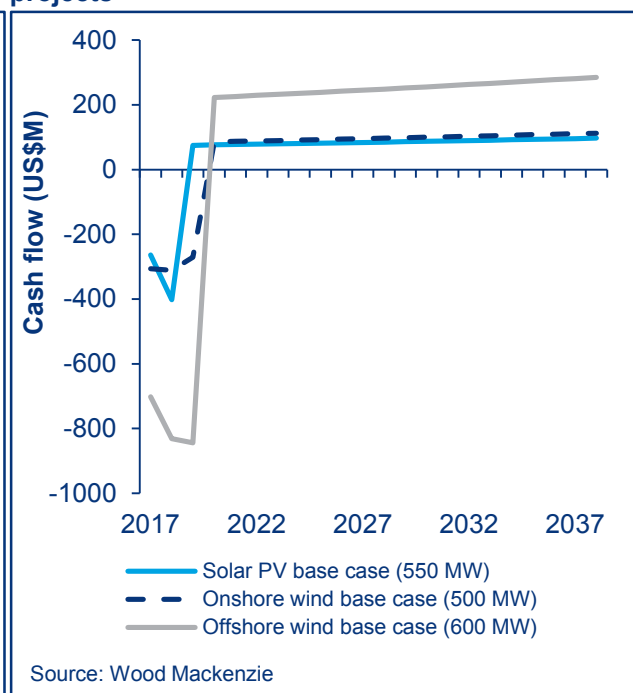
- **Full cycle exploration (around 10% IRR):** returns slumped to the low single digits in 2013/2014. They have since recovered as the benefits of cost deflation and more disciplined investment flow through. But they are unlikely to rise much higher than low double digits and under-performers will only achieve single digit full-cycle returns.
- **M&A and discovered resource opportunities (around 10% IRR):** buyers on the M&A market are on average making 10% returns at US\$65/bbl in recent transactions. This is broadly mirrored for discovered resource opportunities since 2015. Yet recent deals reflect bottom-of-the-cycle economics: the vast majority of acquirers destroyed large amounts of value through upstream acquisitions pre-2014.

The best exploration successes and M&A deals will continue to deliver very attractive returns. But prospective returns from renewables aren't materially lower than the upstream average on a full cost basis.

Comparison of wind, solar and upstream IRRs*



Cash flow from base-case wind and solar projects



*Using base case assumptions for solar PV, onshore wind and offshore wind (see Appendix)

Cash flow visibility is a key attraction

Long-life cash flow is an important trade-off for more modest returns. Wind and solar projects churn out annuity-like cash flow for several decades after initial up-front capex - generally with little or no price risk. They are most akin to long-life upstream asset classes such as LNG, domestic piped gas, oil sands or fixed fee oil contracts – projects that are typically at the low-return end of the spectrum of oil and gas investments. For instance, our set of pre-FID LNG projects delivers an 11% weighted average return.

- **Risk-adjusted renewables economics are competitive:** long-life upstream assets usually have price and project execution risk. We calculate that oil and gas mega projects sanctioned since 2009 have suffered returns erosion of five percentage points relative to the IRR at project sanction because of project slippage, cost overruns and the oil price collapse. The mechanics of building a solar or wind project are more straightforward (but not without challenges, especially in offshore wind). Learnings may also be more transferrable due to greater standardisation.
- **Long-life cash flow is a key attraction:** plateau cash flow varies from US\$80 million for solar to US\$230 million for offshore wind in our base case. These long-life cash flows could help support dividends. But projects currently lack

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scale to move the needle materially – the Majors annual dividend payments range from US\$2.8 billion (Statoil) to US\$15 billion (Shell).

Scale is a challenge – offshore wind is one answer

The Majors' appetite for renewables has been dampened by this lack of scale – most renewables projects are much smaller than typical oil and gas projects. Renewables project investment ranges from US\$660 million for our base-case solar project to US\$2.3 billion for offshore wind. This ranks alongside small to medium-sized pre-FID upstream developments in the Majors' portfolio, even assuming a 100% working interest basis.

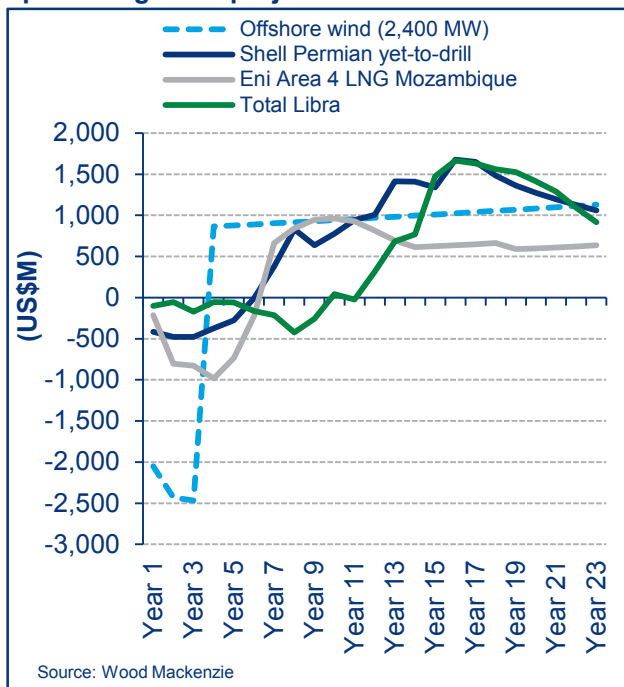
Multiple projects, in multiple locations, are needed to achieve the scale that giant upstream developments bring. This will be easier for smaller Majors such as Eni and Statoil to achieve than Ultramajor giants ExxonMobil and Shell.

Offshore wind is the best current route to scale up. In 2016, Statoil announced a deal to increase its equity in the UK's Dogger Bank project from 25% to 37.5%. This is the world's largest offshore wind development, with an agreed total capacity of 4.8 GW. It potentially ranks alongside some of the Major's largest next generation upstream developments.

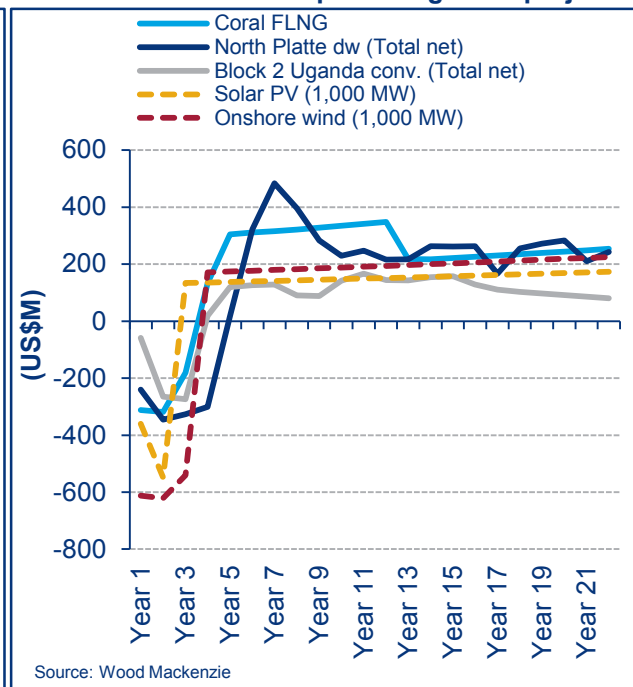
We assume that a 2.4 GW initial development would require US\$7 billion of investment, generating an IRR of 11% and stable cash flow of US\$0.9 billion a year. Only six upstream projects in Statoil's portfolio deliver more cash flow when compared on a net basis.

But offshore wind sector is still at an early stage of development and very localised – opportunities of this scale are, at present, few and far between. Scale ambitions will also have to be much lower in solar and onshore wind, where a 1 GW solar plant or onshore wind project will compete with the Majors' medium-sized growth projects on cash flow metrics. There could be increasing levels of competition for those opportunities that allow scale to be built quickly if the Majors make more material moves into wind and solar.

Cash flow from scaled-up offshore wind vs large upstream growth projects



Cash flow from scaled-up solar PV and onshore wind vs medium-sized upstream growth projects



*Wind and solar cash flow run on a 100% working interest basis. Upstream cash flow shown net to the company.

Renewables strategies will be polarised but increasingly prominent

The Majors and investors are still getting to grips with the value proposition, weighing up renewables against oil and gas developments and the timing of any transition. This presents difficult capital allocation choices in the near term. The Majors will need to strike a balance between sustaining their core oil and gas business while keeping their options open in alternative energy.

The two main strategic shifts in portfolio focus over the next decade will be toward gas and low breakeven oil. But companies need to be able to adapt to a range of different outcomes, including a “carbon constrained” scenario in which faster renewable energy penetration squeezes oil and gas; and investor sentiment towards carbon hardens. The benefits of achieving first mover advantage will have to be weighed up against the danger of value destruction from an overly aggressive growth strategy. Yet leave it too late and the best opportunities may disappear and entry costs may be much higher.

Long-term upstream growth prospects will play a role in company-specific strategies. EU advocacy of decarbonisation will also be a factor in European Majors' engagement. Total and Statoil are more challenged on our long-term production growth metrics and neither has deep pools of unconventional resources to tap into. We expect both companies to push harder into renewables.

Those companies with large inventories of low breakeven oil in high-growth sectors such as US tight oil or pre-salt Brazil and long-term gas optionality may be inclined to proceed at a slower pace. The US Majors seem most likely to be late adopters: they may instead focus on carbon capture and storage technology in transitioning to a low carbon future. The remaining Euro Majors are likely to sit somewhere in between and gradually step up activity. Both BP (Brazilian biofuels, US onshore wind and previous experience in solar) and Shell (Brazilian biofuels, wind) have the advantage that they can leverage significant legacy renewables businesses.

Five key factors that will influence strategies

The world may be the Majors' playground to build exposure to wind and solar, much as they have in upstream. But the focus may be much narrower in the early stages of portfolio development. Capital will also be scarce over the next few years, constraining the pace of development. A return to oil prices above US\$60/bbl and strong free cash flow generation will be needed to trigger a more aggressive phase of portfolio build. A number of additional factors will also influence strategies as the transition process unfolds.

1. **Exploiting oil and gas synergies:** biofuels, rather than wind and solar, have arguably the greatest synergies with the Majors' traditional liquids fuels businesses. In contrast, the majority of growth in wind and solar will be in the power sector, which has very different characteristics to oil and gas markets. That said, there are synergies between gas and renewables, both of which supply into the power sector. But offshore wind fits most naturally into the Majors' core upstream competencies. It has a long-term time horizon, is more capital intensive and requires technical, engineering and project management skills – which means that barriers to entry are higher.
2. **Leveraging legacy geographies:** the North Sea is a prime target for offshore wind in the near-term, favouring some European majors. But operators will also have to look further afield for offshore wind projects that offer scale and portfolio diversification. Offshore Northeast US, Brazil, Algeria and Asia (China, Japan, South Korea, India) all have potential. In solar, we expect the Majors to focus on emerging solar markets that lack an established group of local players and in which they already have well-established relationships and infrastructure through their upstream operations. These include the Middle East (Kuwait, Oman), North Africa (Algeria, Morocco), Latin America (Chile) and Asia (India, Australia).
3. **Focusing on organic growth versus M&A:** organic-led growth is likely to be the preferred growth option in offshore wind. There will also be farm-in opportunities as developers look to attract financially strong providers of capital into new projects. M&A could play a role in expanding into the solar sector. There is no shortage of stand-alone companies to rapidly establish critical mass and there will also be farm-in opportunities. But competition is intense and the market

fragmented. Our sense is that the Majors are still struggling to justify valuations and understand where they want to participate in the value chain. We expect growth to be measured in the near-term.

4. **Improving risk/reward balance:** a number of factors – larger wind turbines, economics of scale in the supply chain, digitalisation, greater efficiencies, deployment of learnings and repeatable manufacturing style processes – will drive improved renewables' economics over time. This will allow wind and solar to compete on a level playing field, increasingly without subsidies but still generating utility-like returns. Paradoxically, a structural long-term decline in oil and gas prices would increase the rate of penetration. The conventional wisdom is that high oil prices foster disruptive technology. But a low oil price renders more upstream investments as marginal, as renewables costs fall.
5. **Keeping technology options open:** wind and solar are the early 21st century winners, but technology can suddenly change – there is a real danger of backing the wrong horse in this immature market. Could carbon capture and storage (CCS) technology ultimately trump wind or solar, creating a level playing field for fossil fuels? The Majors will spread their bets by injecting seed capital into investor capital funds to incubate early-stage options in renewables, battery technology and CCS.

Early adopters will have structurally different portfolios by 2035

Renewables will bring another dimension to a peer group that is already becoming increasingly differentiated in oil and gas. Strategies will diverge as companies seek opportunities that leverage portfolio strengths and synergies. Total and Statoil provide perhaps the best lens into the future as to how portfolios might evolve. They could be the first Majors to emerge from their traditional role as oil and gas producer to 'energy supplier'. What would this mean for the portfolio mix?

Oil and gas would still dominate operations. But there could be a positive high-grading effect on returns as investment in more marginal exploration, upstream M&A and discovered resources gets squeezed out. Wind and solar will also generate more stable cash flow and earnings; a good thing if oil and gas prices come under pressure. Statoil may even have sufficient critical mass to cover its dividend through renewables cash flow by 2035.

Early movers that establish a track record of delivering projects of scale might be at a competitive advantage in accessing new opportunities. These players should also achieve better returns if their initial projects run well. Once there is critical mass and infrastructure, plus the technology improves and costs fall, the subsidies get pulled out. Assets will then make utility-type returns at 'grid parity'.

Players that are slower to embrace new energy will rely much more on low cost oil and gas supply to drive future performance. They could find themselves at a structural disadvantage if there is rapid penetration of renewables into the energy mix and entry costs rise.

Wood Mackenzie has invested heavily to build a strong competency in alternative power and renewables, integrating market-leading analysis on wind and solar from our sister companies MAKE and Greentech Media. Our expert views of the emerging opportunities in wind and solar provide decision support to help make difficult capital allocation decisions as oil and gas companies seek to strike a balance between sustaining their core business and capturing a piece of the action in this fast-growing market.

For more information on GTM Research's reports and data, contact subscribe@gtmresearch.com.

For more information on Wood Mackenzie's reports and data, contact enquiries@woodmac.com.

Appendix

Our Energy Markets Service uses a wide range of newbuild power-project economics, based on market geography and plant type. In this analysis we have assumed that location will be an important factor for the Majors when choosing project sites, given that these companies are less constrained by individual markets, as is the case of some utilities operators.

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For simplicity, we have assumed that all offshore wind will be located where load factors are 45%. This would be a developers target. Similarly, for solar PV projects, we assume that projects will be located in lower latitudes, for example Spain, where load factors are typically 20%. We have considered other variables, for example, unit cost and economic lifespan.

On electricity prices, wind and solar projects are currently eligible for a variety of subsidy payments depending on the location market. Again, for simplicity, we have assumed flat market prices of US\$100/MWh for onshore wind and solar PV, and US\$120/MWh for offshore wind. This is in line with the average breakeven cost of these plants, although admittedly there is a wide range across markets and projects.

The Danish and Dutch governments contracted for future offshore wind projects at prices of between US\$60 to US\$83 /MWh in 2016. Recent projects awarded in Germany have been bid into auction at zero subsidy. This implies that operators expect another step-change in cost reduction post 2020, allowing next-generation projects to achieve similar returns and cash flow profiles for much lower prices. Therefore we expect the breakeven price to come down significantly over the forecast period, translating into falling prices. But we have not included this in our models.

Main assumptions by project

	Project	Market price (\$/MWh)	Lifespan (Yrs)	IRR	Capacity (MW)	Unit cost (\$/kW)	Total capex (\$M)	Load factor	Annual generation (GWh)	Energy equivalent (kboe/d)
Base case	Solar PV base case	100	20	10%	550	1,200	660	20%	964	1.6
	Onshore wind base case	100	25	9%	500	1,750	875	28%	1,226	2.1
	Offshore wind base case	120	20	7%	600	3,900	2,340	45%	2,365	4
Scenarios	Solar PV scale up	100	20	14%	1,000	900	900	20%	1,752	2.9
	Onshore wind scale up	100	25	9%	1,000	1,750	1,750	28%	2,453	4.1
	Offshore wind scale up	120	20	11%	2,400	2,850	6,840	45%	9,461	15.9

Source: Wood Mackenzie

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