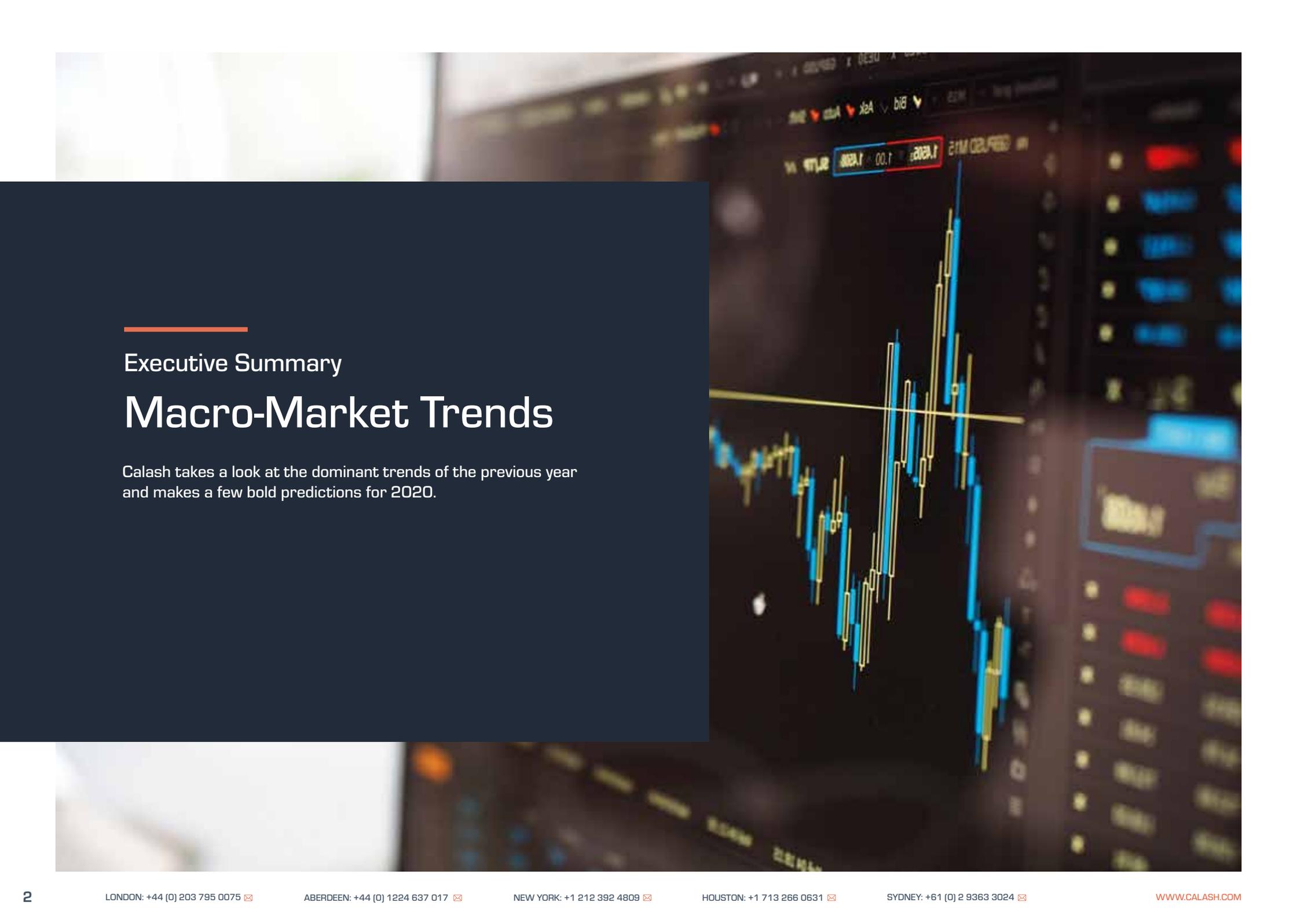


Energy Outlook 2019 - Annual Review

London Aberdeen New York Houston Sydney



Executive Summary

Macro-Market Trends

Calash takes a look at the dominant trends of the previous year and makes a few bold predictions for 2020.

Macro-Market Trends

After a disappointing 2018, 2019 was to be the year of recovery, and in some regions it started out that way, only to fall away in the second half. 2020 is envisaged with some anticipation but, if 2019 has taught us anything, there are obstacles along the way: mismatched demand/supply, global trade tensions, and the environment will all add their pressures. But with challenge, comes opportunity. Here are some of the trends we picked up on in 2019.

Global Trends

- **Increased production, but declining demand.** Geopolitical pressures with US/China and US/Europe tariffs have weighed heavily on the market and with Venezuela and Iran under sanction, and domestic challenges in Argentina, Brazil, Libya to name a few, this trend shows now sign of abating in 2020.

- **OPEC+ tightens production.** The balance for them will be to manage the oil price range where they can maximise revenue, but not so high that US shale once again flourishes to the detriment of the wider market.

Data Sharing

- **Start with the basics.** With a huge focus on granular data capture, machine learning and artificial intelligence, it's easy to forget that basic data is still jealously guarded in many parts of the world. For the OFS sector, the lack of transparency is a massive frustration, stifling efforts to be more focussed in their approach to clients.

- **Sharing is caring.** It may seem simple, but a more open approach to sharing more (non-commercial) data would work to everyone's advantage allowing much more focus from the suppliers and less effort from the procurer so they don't have to compare apples with three-legged donkeys - unless they want three-legged donkeys that is, but then the supplier can stop offering apples.

The Operator/OFS Divide

- **Operators engage with suppliers.** As part of the recovery from the oil price collapse, Operators worked with the supply chain to share risk and reward to drive efficiencies. Whilst Operator Senior Management continue to extol the model and its benefits, it appears that no-one informed the procurement departments who largely remain focussed on cost, often to the detriment of value.

- **Low price comes at a cost.** The service sector has seen no relief from the depressed margins they had to accept as a cost of low oil prices, whilst the Operators are now seeing a balance sheet recovery. With little ability to trim their own costs further, there is a risk that many within the service sector will be finished. Surely it is better to pay a bit more for value-adding services than wait for the boom-and-bust cycle to increase cost with no gain? As the old adage goes, "low price comes at a cost."

- **Cultural challenge.** Driven by procurement departments looking to maintain their status amidst the collapse in oil prices, companies dramatically cut costs. But cost alone is not an appropriate metric for procurement, it should be value or total cost of ownership. And yet, the people with that experience are often not included in the commercial decision making - typically being left to a committee with no, or very limited operational experience. It defies common sense.

Environmental Pressures

- **Changing Perceptions.** 2019 was the year of the environmental protest. And the energy markets must adapt. There is a realisation that we need to utilise resources in a manner which is less damaging to the climate, but there also needs to be some education of the wider population as to the multitude of beneficial products and uses without which a horse & cart and sackcloth era beckons.

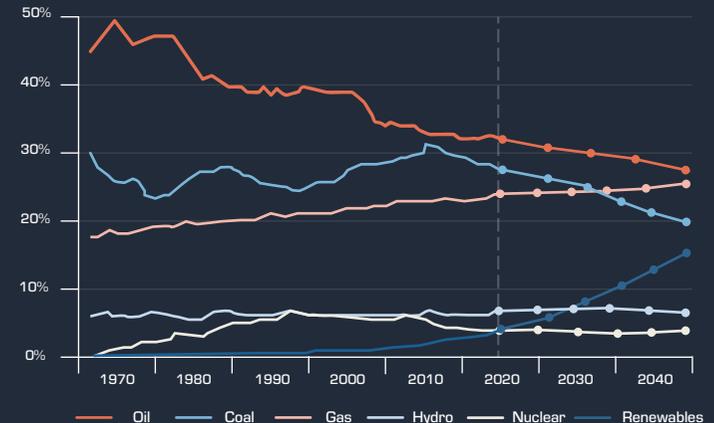
- **A myriad of conflicts.** The oil and gas industry will be part of the energy transition and our future faces a myriad of conflicts; the pressing need to limit pollution, developing countries looking for revenue and energy security, small Operators looking for capital gain, major Operators wanting greener credentials, and developed country politicians swaying with the mood of the loudest voices.

- **Education and awareness are key.** Operators and OFS companies alike need to develop, implement and portray energy transition strategies. Burning oil and coal to generate electricity will, rightfully, come under increasing pressure but what about all the by-products? It is appreciated that Extinction Rebellion are raising awareness around the environmental challenge, but without hydrocarbon products, they would be running around naked with no way to get home. We need to be, and be seen, as part of the solution rather than something to be berated and preferably shut down. The opportunity is to be part of a sustainable future.

Prior to joining Calash, Iain gained over 15 years of corporate banking experience handling the funding requirements of a broad range of companies, supporting restructuring, growth and diversification. As a Senior Project Manager, he has worked on numerous transactions from modest management buyouts through to multi-million pound acquisitions.



Global Shares of Primary Energy | BP



Three predictions for the energy market in 2020.

COP26 is a Cop Out

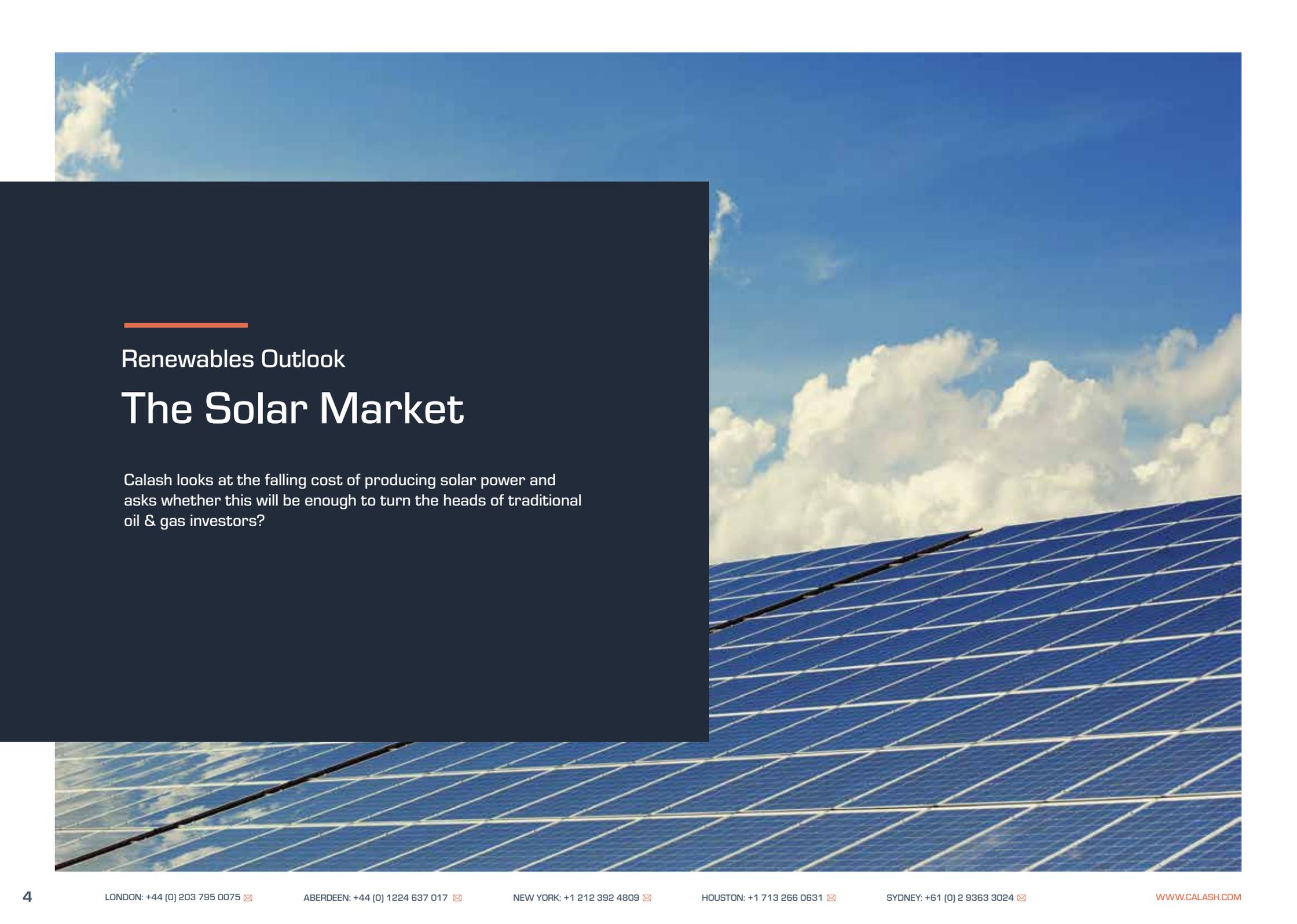
A proposed global carbon trading agreement would allow richer economies to essentially greenwash emissions by procuring carbon offset certificates from poorer countries - one of the most realistic ways to reach climate goals. But a failure to gain consensus at COP26 with the world's largest emitters, alongside the USA's withdrawal from the Paris Climate Agreement make reaching an agreement impossible.

Wind Cleans up its Act

Sulphur hexafluoride - a synthetic gas used as an insulating material in wind turbines, has the highest global warming potential of any known substance (according to the BBC 23,500 times more warming than CO2). In fact, SF6 leaks in the EU in 2017 were the equivalent of putting an extra 1.3m cars on the road.

The Hydrogen Market Takes Off

Green hydrogen - the answer to the environmentalist's prayers - starts to be taken seriously. Around 95% of hydrogen is currently produced from fossil fuels, but a wave of investment in other renewable energy projects (like offshore wind), makes the production of green hydrogen viable on a major scale. Hydrogen fuel cells become a viable alternative to batteries.



Renewables Outlook

The Solar Market

Calash looks at the falling cost of producing solar power and asks whether this will be enough to turn the heads of traditional oil & gas investors?

Solar: Looks Can Be Deceiving

As investors turn their attentions to clean energy opportunities, the increasing efficiencies in the solar market present an intriguing case for the energy transition. Mainly because the cost per kW of Solar PV has fallen drastically over the last 10 years and is now on par with gas and onshore wind. Solar photovoltaic (PV) panels now convert power from the sun into one of the cleanest and cheapest sources of electricity available. The benefits are clear: the technology is highly versatile, requires very little maintenance and is the greatest driver of growing renewable power today. But how has this change come about?

Growth in Capacity and Falling Costs

Growth of the solar market has been steady over the last decade in which Solar PV additions doubled in both 2016 and 2017 before global policy changes and market uncertainties - the US and China trade war for example - destabilised growth in 2018. Despite this, solar PV still accounted for nearly half of global total net renewable capacity growth in 2018 (IEA 2019). Projections also remain highly confident, predicting that solar PV could reach 3,300 TW capacity by 2030; equivalent to a 16% year-on-year growth.

Key to the success of solar PV has been its dramatically falling cost to produce electricity. Driven by market expansion, increasing global competition, and supply chain efficiencies, the relative cost of solar has decreased 80% since 2008, putting it on par with onshore wind and natural gas power developments. Taking the US as an example, there was a 77-80% reduction in the cost of utility-scale solar PV farms between 2010 and 2018. The majority of this cost decrease (63-69%) came from falling hardware costs, with the spot price of solar modules dropping 81% over the period. Installation and soft costs also fell substantially, helping to create greater project efficiencies.

Investment Prospects in Solar

For global energy market investors, on paper, Solar PV appears to be the most attractive renewable proposition. With strong market growth and global reach (nearly 50 countries participated in Solar PV auctions in 2017/18) it

would seem to be ripe for investment. However, despite the obvious attractiveness of the Solar PV market, there could be a struggle to find suitable investors.

The solar PV market is chiefly driven by new-build CAPEX developments, and the supply chain is formed by equipment manufacturers supplying solar modules, inverters, electrical components and installation services. However, increasing competition (particularly from Chinese companies) continues to push down the price of solar modules and associated equipment.

Simultaneously, while cumulative global solar PV capacity is growing, the actual volume of solar PV being installed per year is relatively flat. This means that equipment manufacturers will likely have to work harder to maintain financial performance over the next five years. This is bad news for a typical oil and gas focussed PE investor looking to transition to renewable ventures. Unless a potential acquisition target has any niche market offerings or future product developments that would give it a competitive advantage, it will likely struggle to increase market share and revenue, limiting the investment return.

Unlike in other sectors (oil, gas and wind), the potential to invest in an after-market service provider is also limited in the solar PV market. Once a solar farm is installed, the maintenance and repair requirements are minimal and are largely restricted to general inspections, aerial thermography and module cleaning services. Again this limits the scope for investors.

Who will Invest?

All of this begs the question of who is best placed to invest in solar PV? The answer to that is the oil and gas E&P companies themselves. Solar PV, as a renewable energy source, has become a clear target for E&P companies as a means to transition into greener technologies; switching from oil and gas production to electricity generation. Falling equipment prices means investing in new solar PV developments is also only getting cheaper, meaning it is a win-win scenario for the right investor.

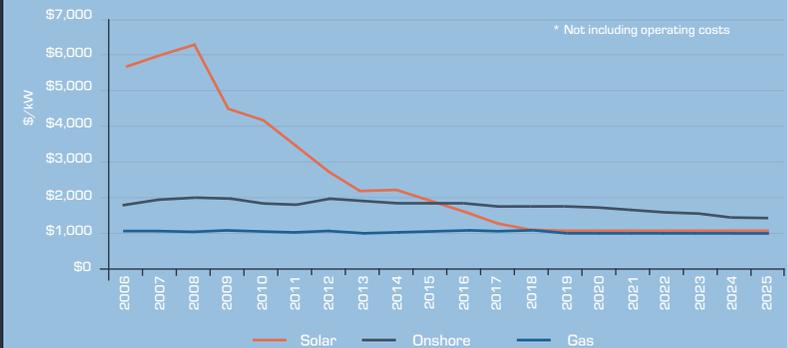


Andrew Wrapp joined Calash following fifteen years working in various manufacturing, commercial planning and marketing managing roles for several large energy equipment suppliers. He has extensive experience in commercial budgeting and forecasting, risk analysis and market assessment.

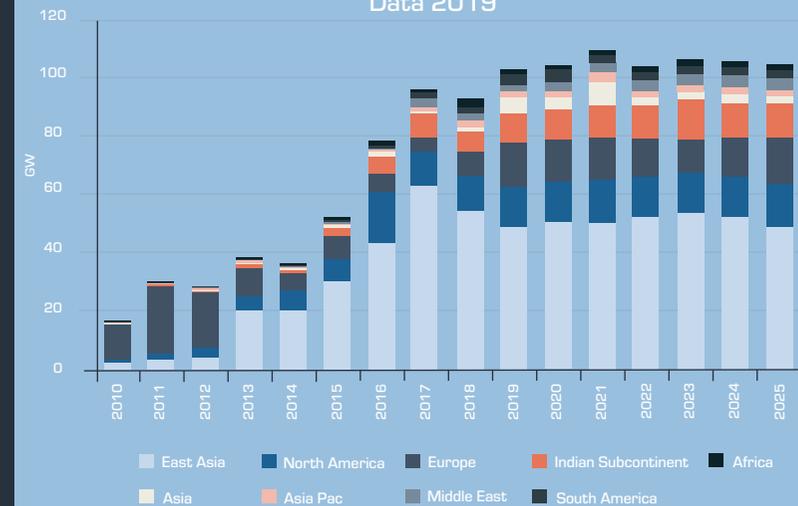


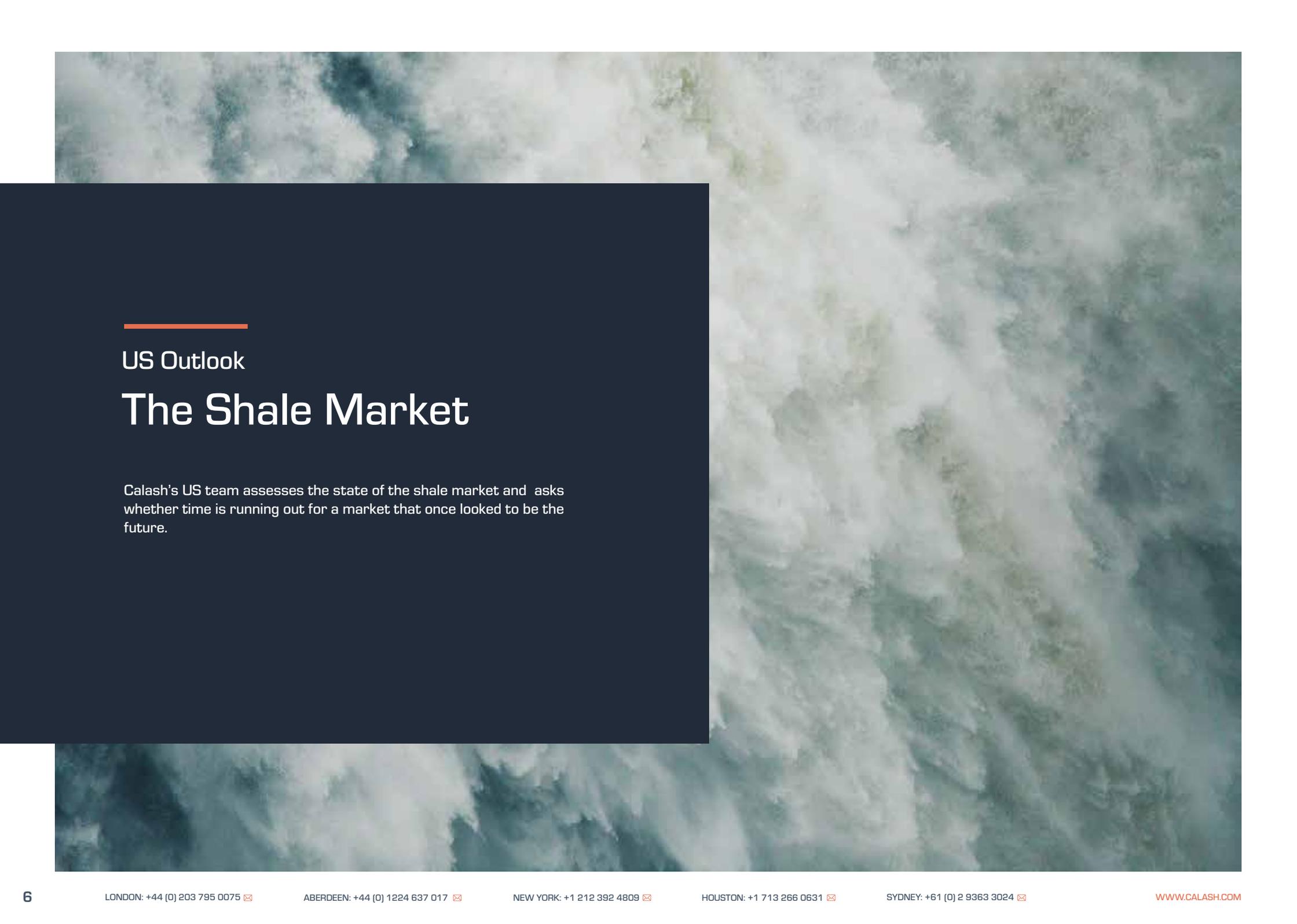
Jonathan Clarke is an experienced Senior Market Analyst at Calash with a history of working in the oil and energy industry and a particular focus on oil & gas commercial due diligence and strategy analysis projects.

Capital Cost (\$) of New Projects per Kw* | Global Data 2019



Total Additional Capacity Installed by Region per Year | Global Data 2019





US Outlook

The Shale Market

Calash's US team assesses the state of the shale market and asks whether time is running out for a market that once looked to be the future.

The Money Runs Dry

Living within means

Every year since 2010, shale producers have outspent cash flows. Historically, banks, private equity, and other investors have been willing to underwrite additional investment in the sector. However, starting in 2016 and gathering pace in 2017 and 2018, investors have increasingly demanded that shale producers live within cash flows.

However, planned efficiencies have not materialised to the extent expected and per well production has not met forecasted production curves, especially due to parent child well effects (frac hits), movement into non-core acreage, and in some cases companies trying to copy and paste the unconventional model into areas where it was ill-suited - a large portion of the SCOOP and STACK plays are prime examples of this.

Fantasy Economics

While it's perhaps foolhardy to speak of US unconventional as a monolith, as the operational astuteness, rock quality, and willingness to down space varies widely, the vast majority of US shale wells have significantly underperformed over time, with decline rates being much greater than expected. This trend has been amplified by a large number of E&Ps previous willingness to marry best in type production curves with costs (and thus potential returns). However, this conveniently excludes costs such as lease acquisition, G&A, and for the worst offenders much more. Quoted break-evens for many producers and plays were essentially fantasies that were detached from basic company and even asset level economics. All of this leads to the sector essentially becoming uninvestable for both generalists and increasingly, specialists.

Survival Mode

Adding to the headwinds, investors are increasingly focused on emissions and climate change, with some institutional investors including pension and sovereign wealth funds reducing or eliminating exposure to the sector. An industry in survival mode is not well placed to counter this challenge, with technologies which could improve the industry's ESG

profile seeing slow adoption due to an inability to pay the associated costs.

Overall, this has led to reduced CAPEX in the onshore US unconventional market. Some may explain that Q4 is always a challenge due to budget exhaustion and weather, but the reality is the slowdown started earlier and has been of a greater magnitude than previous years. CAPEX next year will likely be 15-20% below 2019. Production will grow, though Calash suspects that 2020 may represent a peak for US unconventional production - an unorthodox view that most analysts would disagree with.

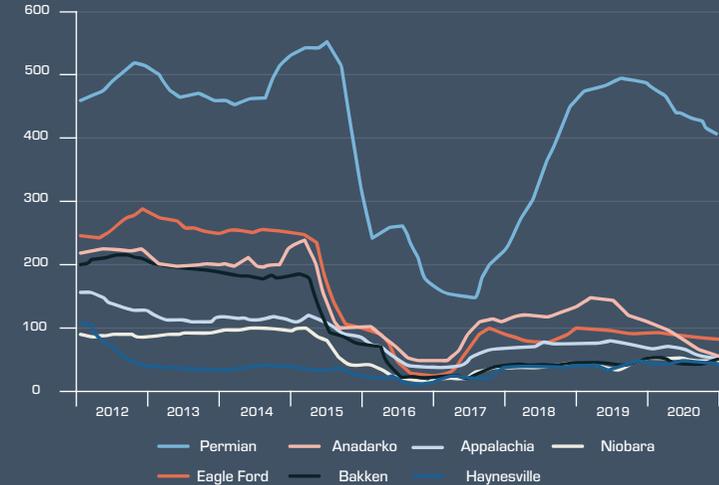
As earnings continue to disappoint, we naturally expect more companies to continue reducing CAPEX as well as 2020 activity levels being materially lower than 2019 levels. Reduction in shale CAPEX portends another difficult year for OFS companies and pricing should continue to decline albeit the industry is approaching a resistance level (beyond which OFS companies would rather leave their equipment at the yard or close the doors). In recent weeks, Halliburton has indicated that at least for some geographical areas and service lines that is the case for them, with the closure of their frac super center in Oklahoma, the closing of their cement service line in Alberta, and nationwide mass layoffs of frac engineers.

Will things get better? When? A lot of this depends on oil prices (duh), and what activity levels are sustainable in a world where companies are required to provide a market or better economic return to shareholders. Recent developments in Iran have caused a geopolitical quake that has boosted oil prices, but will it be enough to sustain higher prices? You only have to look at the blink-and-you-miss-it impact of the Saudi processing plant attack to know that a cataclysmic event would be required to buck the trend, otherwise it looks to be a rough few years for most US land E&Ps and the OFS companies who serve them.

Sean Shafer is the Vice President of Operations at Calash. An experienced oil and gas professional who has led or participated in over 100 advisory engagements, Sean is an expert on the economic impacts of the oil and natural gas industry.



US Drilling Rigs at Work | US EIA 2020



Three predictions for the OFSE sector in 2020.

Big players get cold feet

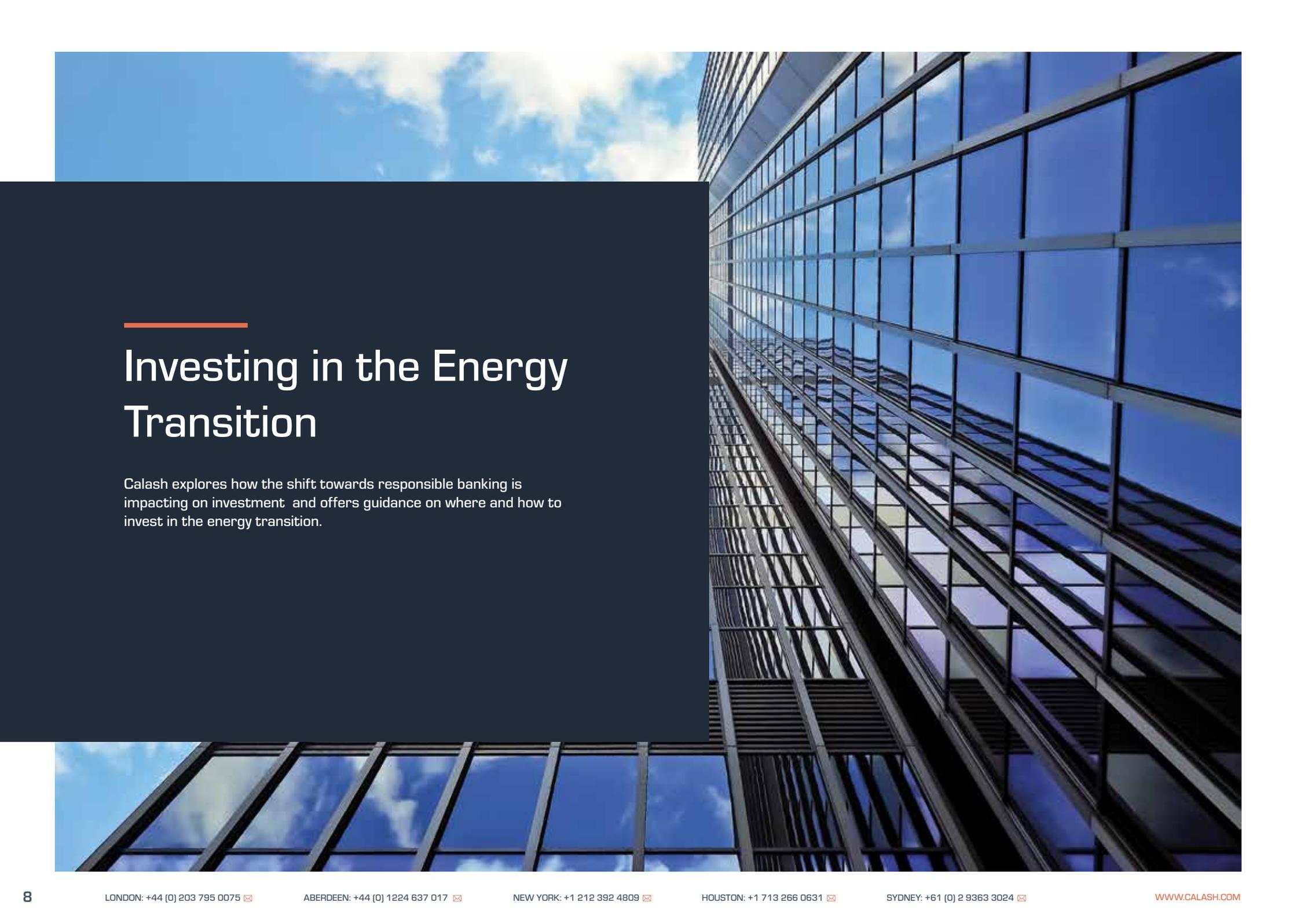
Large companies with healthy balance sheets reduce their exposure to the sector by shutting down product lines/geographies. For sectors where they remain, cost cutbacks will be severe, with a focus on reduced maintenance and skeleton staffing levels. One of the big two (SLB?) exits Frac, and Baker continues to move away from traditional OFS.

Smaller players adapt to survive

Smaller OFS companies use reduced pricing to maintain and grow market share while running equipment into the ground. A potential long term positive if it leads to a reduced supply base more in line with activity levels.

An unwanted hat-trick

Many balance sheets across the OFS (and E&P) sectors are unsustainable and deep restructurings based on realistic assumptions about the near-medium term difficulties will be common as will Chapter 7 bankruptcies. Multiple OFS (and E&P) companies will complete a dreaded chapter 29 (11+11+7) bankruptcy hat-trick.



Investing in the Energy Transition

Calash explores how the shift towards responsible banking is impacting on investment and offers guidance on where and how to invest in the energy transition.

Unlocking the Potential of the Energy Transition

The wheels of the energy transition are in motion and the recent pledge from the heavyweights of the global banking sector to strategically align their investment principles set out by the United Nations Environment Programme Finance Initiative (UNEPFI) in their Principles for Responsible Banking manifesto, which aligns with the goals of the Paris Agreement on Climate Change, should provide the capital to turbo-charge a green energy revolution. The numbers alone are staggering. The signatories include one hundred and thirty of the leading players in global banking, who between them hold \$47 trillion in assets. They account for one third of the entire global banking sector.

The question is how to reach this number in a way that does not compromise the investment principles laid down? The challenges ahead lie in ensuring investors are properly informed of the 'green' credentials of their chosen sectors while also getting them to adopt somewhat unconventional investment strategies that will target the disrupters in some of the less competitive markets.

Responsible banking principles

With the likes of Credit Suisse, Deutsche Bank and Lloyds Banking Group to name a few on-board, there is real weight behind this collective effort. From there, the first step toward achieving these ambitious targets was the agreeing of the three key steps that all signatories will abide by. The framework for these was based on the understanding that within eighteen months of signing, all banks must publish a

self-assessment report measuring their progress against the principles for responsible investment and then annually thereafter. To ensure progress is swift, a four-year target has been set to fully implement the three steps outlined below.

The Problem of Greenwashing

One of the challenges investors face in meeting these principles is sifting out which clean energy opportunities are genuinely 'green', and which are being packaged up to seem 'greener' than they are. There have been cases of investors being misled or they themselves have misunderstood the actual sustainability of their investment targets.

The other issue is that on the surface, investment from ETFs is pouring into 'sustainable' companies, but the reality is that these funds are ignoring ESG options and oil and gas investments are 'hidden' within ETF funds. This means that investors see a similar level of returns on what they think are ESG investments that ultimately lack the credentials of genuine ESG investments.

This is not necessarily the fault of investors when the term ESG is vague enough to make it open to interpretation. This lack of a universal definition is enough to allow the likes of BP and Total to remain concealed within funds that may claim to be adhering to ESG investment principles. This has resulted in suspicion and scrutiny of whether

funds are over-selling their 'green' credentials, which has had the adverse effect of companies being reticent to trumpet their achievements for fear of not wanting to exaggerate the sustainability of their portfolio. This problem is likely to persist until there is greater clarity and the decision as to which funds meet any responsible investing criteria, is taken out of the hands of fund managers.

How and where do you invest in the energy transition?

With targets for investment to achieve a successful transition ranging from \$60-120 trillion, it's clear that the entire way we generate, store and distribute energy will need to be radically overhauled and the same applies to investment approaches. In order to be successful, there will need to be several fundamental changes in the way power is generated and used, the conditions for investment and consumer behaviours. These changes can be broadly characterised as decarbonisation, electrification and efficiency improvements. All three are worth exploring closely for investors looking to turn their portfolios green.



Merlyn Gregory, Managing Director of our sister company Candour, has many years of experience providing clients with origination services, strategic support and due diligence. With Candour, she has built an extensive expert network offering invaluable insights and practical support to some of the world's most successful operators, private equity and strategic consulting firms.

The collective value of the assets held by the 130 banks who have signed up to the UNEPFI's Principles for Responsible Banking.

\$47 trillion

Impact Analysis



- Bank's must analyse where they have a positive or negative impact on society, the environment and economy.
- They must then identify where they can realise the greatest positive impacts and reduce the significant negative impacts.
- Working with stakeholders and civic society, they must take on-board their views to inform their analysis. They should consider the scale of their activities, the context, the location and the intensity of developments.

Target Setting



- Set targets that address the impacts your bank has identified and work towards achieving them.
- Set a minimum of two targets that address your two biggest at least two of your biggest impacts; positive and negative.
- Targets must be SMART (Specific, Measurable, Achievable, Relevant and Time-bound).

Accountability



- Banks must be transparent with how they are implementing the principles for responsible banking.
- Every two years, UNEPFI will publish a collective progress report for all the signatories.

Decarbonisation

How we generate power that will facilitate the energy transition. The first step towards decarbonisation is cleaning up existing means of power generation. The most effective way to do this is to invest heavily in renewables and cleaner energy sources, which sounds simple enough and makes it easy to get carried away with when the production costs of solar and wind are nearly at the same level as some fossil fuels.

But the savviest investors will be the ones who spot the specific opportunities within these markets as opposed to ones who pour money into them. One opportunity could be the shift from the big traditional power suppliers to localised, independent ones, which evens up the market. Therefore, expect independent power producers (IPPs) whose expertise is in renewables to attract attention as they are in sync with the trends of the market which point towards localised energy distribution being the future.

A prime example of where IPPs have thrived is Neoen, the independent French energy provider who has invested heavily in developing solar in Australia. In 2018 they commissioned five utility scale PV farms, able to generate 250 MW and in 2019 they followed this up by adding a further 100 MW to capacity. Neoen have also heavily invested in battery storage, currently owning the biggest lithium-ion battery in the world. This commitment to battery storage has generated significant revenue growth for Neoen and this convergence of renewable energy and battery storage in the hands of an IPP is a prototype that investors should look to if they want to successfully invest in the energy transition.

Electrification

The second part of changing power generation is electrifying energy consumption. The demand for electricity is anticipated to increase far quicker than any other energy source as everywhere we look (industry, construction, transport), electrification becomes commonplace. This presents a series of huge opportunities for investors along various stages of the supply chain. The coming of electric cars is one such opportunity. Oil and gas majors are already snapping up the manufacturers, installers and operators of electric vehicle charging points. The proliferation of these opportunities means there should be plenty to go around for investors of all sizes.

The other key part of electrification is the grid system to distribute it. It is estimated that global electricity demand will increase 57% by 2050 and this would put severe pressure on the current grid system and could lead to blackouts and shortages. To solve this problem, there needs to be a concerted effort to upgrade and modernise sections of the grid that are designed to work with a constant energy source that only a fossil fuel can supply. The move to renewables will require a decentralisation of the grid to allow more variable sources to run smoothly through them. Therefore, investors should explore the building and maintenance of micro-grids as well as the companies that manufacture substations and transformers.

Efficiency

To supplement the previous two changes there will also need to be significant increases in the efficiency of energy usage, particularly in the generation and transportation of electricity. The current methods of transportation are wasteful and on average lose around 5-10% of the electricity produced. Advances in things like superconducting materials, smart meters and micro-grids have all helped to improve efficiency but more needs to be done and worryingly there has been a recent slowdown of global efficiency progress.

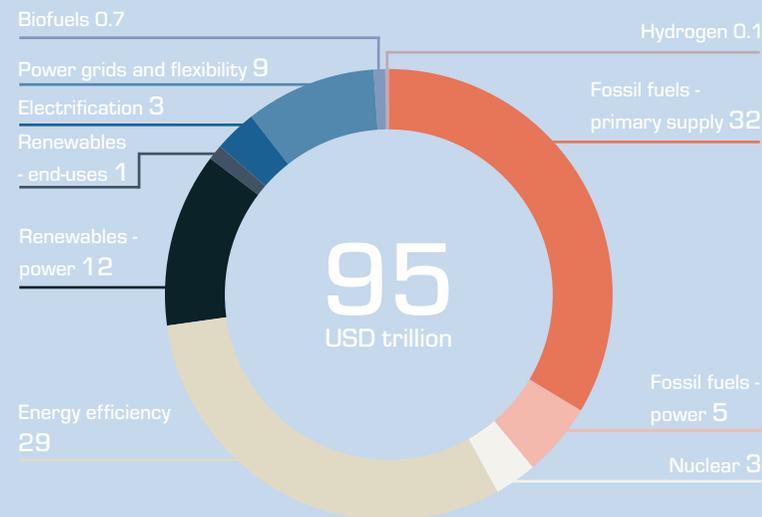
It is critical that this trend is reversed if there is to be any chance of meeting energy transition targets. Fortunately, some have spotted the opportunity that this presents. At the time of writing, the energy transition venture capital firm SET Ventures has raised over €100 million and are looking to expand on their current portfolio that includes success stories such as their successful acquisition and sale of Sonnen (smart energy storage) to Shell no less, and their acquisition of DEPSys, a Swiss company who use cutting edge tools to analyse the health of grids and recommend improvements that increase efficiency. The fact that SET Ventures easily surpassed their funding target of €75 million suggests that their track record of backing energy transition companies has been a success which should encourage other like-minded venture capitalists.

Conditions for investment

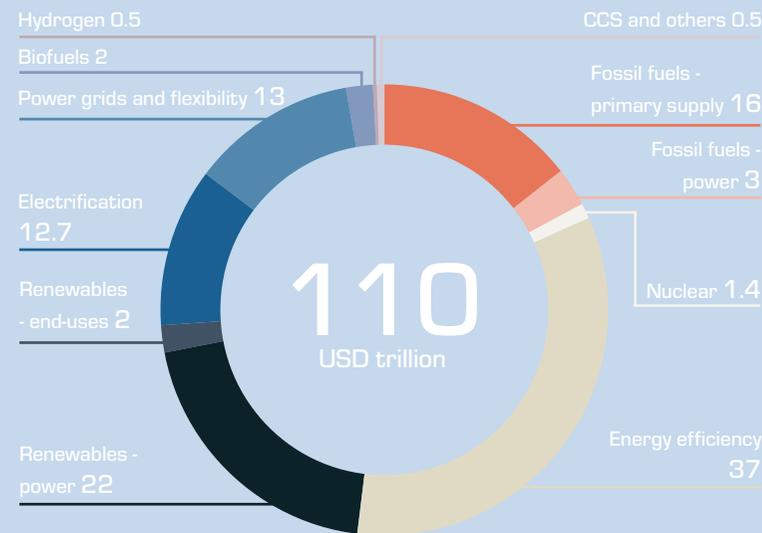
The changes outlined above are underway to differing extents but when all three are in sync and being supported by government policy and consumer action, we will see the optimum conditions for investment – a point some would argue we have almost reached as investors in renewables have started to see returns on their huge capital outlays. Now that the cost of renewable energy is increasingly becoming the most cost-effective option for suppliers, there should be further waves of investment – but will it be enough?

Renewable energy investments are not like traditional ones in that they need a large amount of capital from the outset - which helps to cover any associated infrastructure – but lower operating costs. This means conventional investment strategies are not as applicable. In this case, investors should look to markets like Asia where overall energy infrastructure is not as developed as the west, making it easier to implement new renewable energy infrastructure, as opposed to overhauling that which is established. There should also be more focus paid to smaller and mid-sized companies that specialise in things like localised power distribution, energy storage, energy efficiency saving devices, etc. These companies have the industrial knowledge but are crying out for the financial expertise that the right private equity partner can bring. Whether that is overseeing M&A activity (something expected to pick up in 2020) or helping the big oil companies divest of their fossil fuel assets.

Current planned cumulative global energy investments between 2016-2050 | International Renewable Energy Agency



Renewable Energy Roadmap recommended cumulative global energy investments between 2016-2050 | International Renewable Energy Agency



Outlook Analysis

LNG & Gas Market

Calash's Commercial Director Jimmy Williamson examines the major supply and demand-side changes to the LNG & gas markets and assesses the impact these will have on investment opportunities.



LNG - The Bridge to the Future?

We all know the global energy sector is facing major structural change as it grapples with the energy transition and the increasing impact of environmental, social, economic and political drivers to leave a lower carbon footprint. Whilst much of this draws on readily available market commentary and forecasts, we thought it would be interesting to our corporate and investor client base to summarise not just the potential market trends but to translate this into relevant insights, and try to identify where the changes may create new opportunities for growth, expansion and investment, or perhaps dictate changes to the current operating models, service or product lines. In this article we focus on global LNG, a sector experiencing major supply and demand-side changes impacting the future landscape in power and industrial landscapes.

Backdrop

Whilst a number of our clients are energy specialists and will be familiar with the technicalities, we thought it may be helpful for our broader audience to scene set with a short summary of what LNG is, its characteristics, and what makes it such an interesting fuel source.

LNG, or liquid natural gas, as the name implies, is essentially the same natural gas used by industrial and residential consumers in factories and homes across the world, but in a liquid form to enable ease of storage and transportation. In this liquid form LNG is relatively inert, being odorless, non-corrosive, non-toxic, and non-flammable.

Natural gas is a plentiful and, compared to coal and oil, a cleaner source of energy, although more on that later. However, unlike those fuels, because of its inherent volume in its natural state, storage and transportation by pipeline over long distances can be costly and impractical. This is certainly the case between continents, which is why, unlike oil, gas has always had regional market hubs.

Liquifying the gas, involving cooling it to -162 degrees centigrade, reduces its volume by 600x, and solves natural gas's inherent physical problems, allowing storage and transportation in specialist vessels across global markets which in theory creates more of a global market in supply, demand and pricing. So far, so simple.

Infrastructure

This liquefaction, and subsequent regasification (required before the gas can be used for commercial and industrial applications), however, requires complex and expensive infrastructure in the country of source - liquefaction plants, specialist storage facilities, export terminals. Invariably this also involves gas treatment facilities to process the raw hydrocarbon and remove impurities before it can be liquified. A typical such facility, based on the current investment phase currently occurring in the US, can cost anywhere from \$1bn to \$24bn.

It then needs specialist marine shipping vessels for transportation and, in the country of destination, it requires to a lesser extent the reverse of the infrastructure in the country of origin; import terminals, regasification plants, and pipeline infrastructure to transport it to industrial and commercial consumer hubs.

The LNG market is not new – for many years it has been a relatively stable industry connecting surplus natural gas-producing countries, such as Australia, Russia & Qatar, to those without their own supply, historically this included Japan, South Korea, Continental Europe, but also the US and China. Historic growth in LNG markets has been steady and largely unexciting but the market is now entering a structural change phase, which in some markets is creating mini booms being driven by three primary growth drivers. Two of these are relatively well understood and commented on, but perhaps one less so.

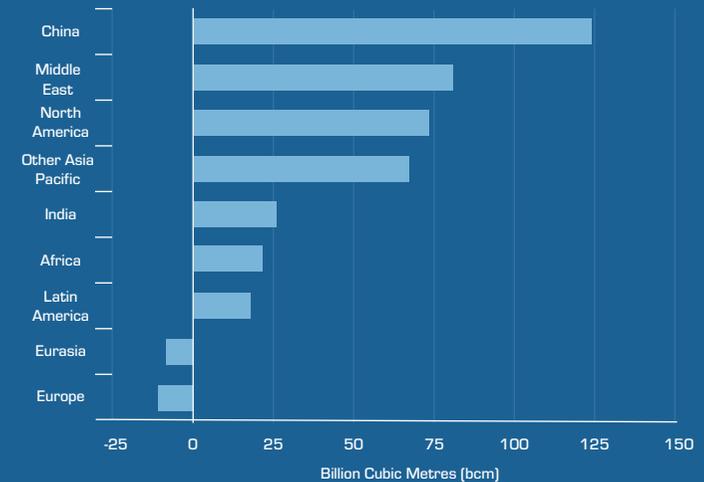
US Supply and Investment in Export Facilities

Firstly, the growth in shale gas production in the US has introduced a large, stable source of new supply, with it transforming the US from a net importer to net exporter by 2017. This creates a new economic issue for producers as US gas prices fall due to the increased supply, which is why we're now seeing unprecedented growth in construction of export facilities in US. Calash analysis highlights there are 16 such facilities totaling \$156bn of cost, either in construction or approved phase, with a further 14 costing \$125bn at the potential or planning stage. Clearly not all of these can or will proceed, and we are already seeing slippage to the right as operators struggle with cost and

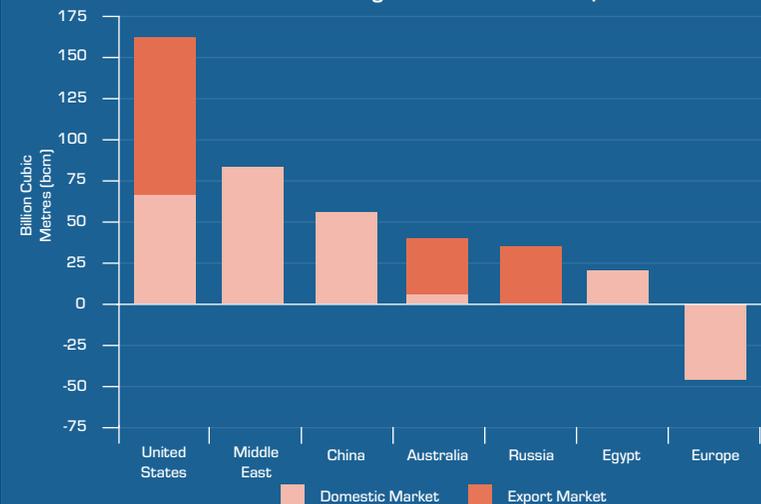


Jimmy joined Calash in 2019 following a career in leveraged finance with Lloyds Bank, heading up regional and sector teams including oil & gas origination and restructuring. Previously he worked in technology private equity with NatWest and has extensive experience of supporting institutional private equity clients across multiple industry sectors.

Natural gas consumption in selected countries, 2017-2023 | IEA



Natural gas production growth for selected countries and regions, 2017-2023 | IEA



complexity, but this investment creates huge additional capacity for export markets outside the US, vying for operational status by 2023/24 when IAE is forecasting a tightening of the LNG supply/demand mix as growth in Asian demand continues.

China and Far East Growth

Second, the expected growth in demand from China and other Asian developing countries as they transition from coal to gas power, partly helped by China's "Blue Skies" air pollution reduction policy announced in 2018, is providing a further structural change. China's LNG usage is forecast to grow nearly 30% to 87 billion cubic metres by 2023, and other Asia Pacific markets by 23% to 140bcm.

Interestingly, Japan and South Korea combined are still the largest global importers of LNG, but are expected to reduce their consumption of LNG by 5%, from 155bcm in 2019 to 148bcm by 2023, which is reflective of the trend of more developed economies moving towards cleaner energy sources in the short term and renewable energy in the long term. Gas is increasingly seen as a transition fuel for power generation to bridge that journey and it reinforces the position that natural gas as a clean energy source is all relative – primarily to coal. European market forecasts also reflect this and are relatively flat over the same period.

Growth of Industrial Markets for LNG

The third major driver is possibly less well understood and discussed, and that is the increased use of LNG in industrial applications. Historically, nearly half the global consumption of LNG over the period 2011 - 2017, was used for power generation. This will still be an important theme, particularly as developing economies convert from coal to gas in primary power generation activities. However the acceleration of conversion by developed and emerging economies to renewable energy will outstrip this to such an extent that power generation is forecast to fall to 25% of the LNG end markets over the period 2017 - 2023.

However, against a relatively low overall LNG market growth context, combined industrial, commercial and residential use of LNG is expected to grow significantly, from 38% of the mix to 60% when comparing 2011-17 with 2017-23. Without underplaying the impact and opportunities in the huge investment in export facilities in the US, Calash believes this industrial growth on the demand side is the most interesting structural change going on in the industry, with industrial users replacing coal and other energy feedstocks, and commercial and residential users reaping the benefit of improved access to cheaper and more available supply on the back of unprecedented levels of investment in export and import facilities globally.

What does this mean for growth and investment opportunities?

If we take the US investment in export facilities, then clearly there's a huge opportunity for EPC's and engineering services providers and the large tail of product providers involved in construction and commissioning of facilities. This is not new; these projects having been visible and heralded for several years, and many of our clients are actively involved in working on these projects.

Looking at the themes of these projects, with spiraling costs and complexity leading to delays in build schedules, service and product providers should be looking and reassessing how they can help their clients reduce complexity, increase flexibility in their own operating models, and help their clients manage the supply chain risks better.

Looking further afield, we think the lack of storage is likely to become an increasing issue for the global LNG industry. This could well be a growth area in the UK as it has a high propensity for incremental LNG use – owing to good regasification capacity, high natural gas demand in its economy but reducing contribution from its own reserves – but has relatively low levels of long-term storage. The effect of more export supply of LNG will be to equalise regional prices and the UK could start to take advantage of price differentials with the import pipeline prices, provided there were suitable storage solutions.

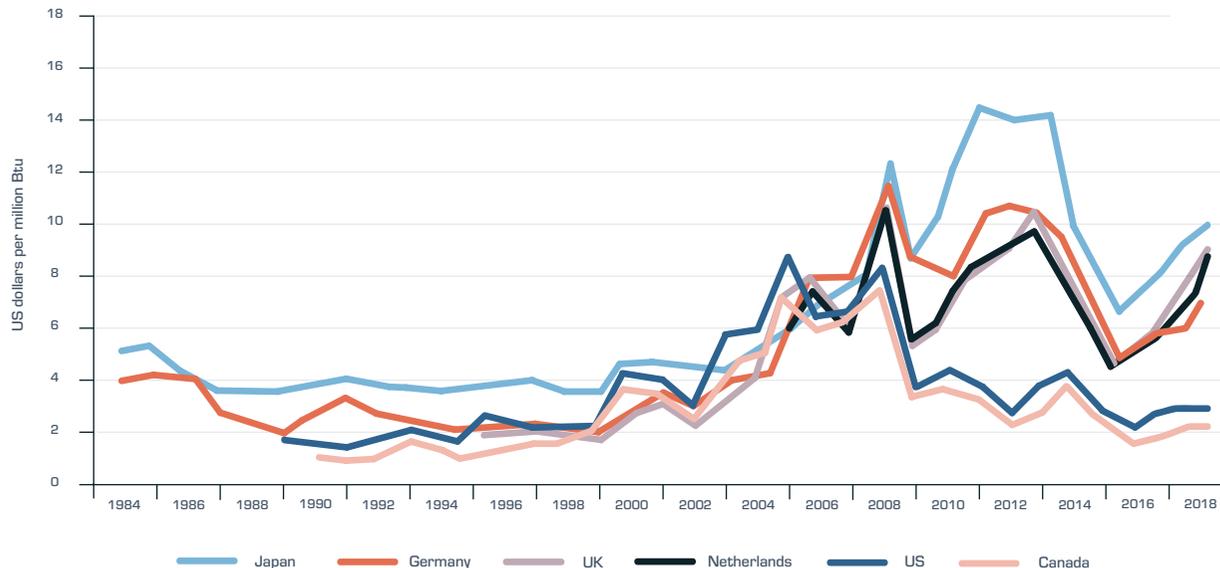
With power generation historically the dominant user, infrastructure was relatively fixed and didn't need to be flexible – power stations tend to be relatively permanent and the associated infrastructure likewise. However, with the exponential growth in industrial and commercial use of LNG, we are likely to see a much more dynamic user base, from chemical facilities, to agriculture, food and clothing manufacturing. Essentially, LNG is well adapted for any industrial process requiring heating, cooling and precision and efficiency in those processes.

But this industrial and commercial footprint is more diverse than the typical power generation one, and we are seeing growth in opportunities for smaller scale (relatively speaking) transportation, handling, engineering, testing, inspection, and maintenance services involved in helping bring LNG applications into new industrial and commercial markets.

This is a good, global example of how low growth markets with structural change can still create very significant and sustainable growth opportunities for businesses and investors focused in the energy sector.

Are you interested in the LNG market? Have you spotted an investment opportunity? Give Calash a call today on +44 (0) 203 795 0075 to see how we can help you develop an investment strategy for the LNG market.

Key natural gas prices by region (US dollars per million Btu) | BP



Further Reading

Current News (2020) SET Ventures raises 100 million for set fund

<https://www.current-news.co.uk/news/set-ventures-raises-100-million-for-set-fund-iii>

Forbes (2019) Why Oil & Gas stocks keep leaking into green investments

<https://www.forbes.com/sites/daviddawkins/2019/07/19/why-oil-and-gas-stocks-keep-leaking-into-green-investments/#66bbe7851034>

Schroders (2019) Investing in the Global Energy Transition,

https://www.schroders.com/en/sysglobalassets/digital/insights/2019/pdfs/2019_sept_global-energy-transition_final.pdf

PV Magazine (2019) Neoen powers ahead as Australia's top independent renewable energy producer,

<https://www.pv-magazine-australia.com/2019/11/14/neoen-powers-ahead-as-australias-top-independent-renewable-energy-producer/>

CALASH

About Calash

Calash offers a broad range of strategic consultancy support to investors and operators; independent market reviews and referencing, benchmarking, commercial turnarounds, strategic development, technical and product assessments and environmental reviews. Areas of expertise include Energy (upstream, midstream, downstream), Renewables, Chemicals and Mining. Within these we cover: development, operations project management, engineering, IRM, supply chain, manufacturing and financing.

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Our Services



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- Post-merger integration & execution support
- Restructuring, divestment and cost-reduction
- Calash pre-transaction 'sniff test'



Strategy

- Strategic reviews, assessment and associated change management
- Commercial, Operational & Technical Diligence
- 100 day planning & associated resource assessment
- Post-transition strategic implementation



Analytics

- Market sizing & supporting strategic initiatives
- White space potential client identification
- Focused, targeted, measurable business improvements
- Data collation, analysis and interpretation to support commercial and operational objectives