Global Corporate Venturing

Global Energy Council
Q1 2023

Cleantech's bubble

Vast investment in the sector must lead to viable companies to prevent another boom-and-bust cycle

IN PARTNERSHIP WITH

Chevron

Boom-and-bust risk for cleantech investment

Engie prepares for hydrogen and biomethane transition

O&G companies' investments not rising in line with profits

Contents

2 Boom-and-bust risk for cleantech investment

> VC has poured into the cleantech sector over the past couple of years

> Concerns are growing that startups may not be able to scale into viable companies that generate expected returns

Global Corporate Venturing

Address: PO Box 77202, London, SW17 1HJ

Global Corporate Venturing

A 2021 recipient of The Queen's Award for Enterprise for international trade

Editor-in-chief: James Mawson
Email: jmawson@mawsoniacom

Senior editor: Maija Palmer
Email: mpalmer@globalventuring.com

News editor: Robert Lavine
Email: rlavine@globalcorporateventuring.com

Analytics: Kaloyan Andonov
Email: kandonov@mawsonia.com

Supplements: Liwen-Edison Fu
Email: efu@globalcorporateventuring.com

Global University Venturing: Thierry Heles
Email: theles@globaluniversityventuring.com

Reporter: Fernando Moncada Rivera
Email: fmoncadarivera@globalventuring.com

Managing director: James Gunnell
Email: jgunnell@mawsonia.com

Head of partnerships and engagement: Charlie Hayward
Email: chayward@mawsonia.com

President for Asia: Tim Lafferty
Email: tlafferty@mawsonia.com

Production editor: Salvatore Spagnuolo

Cover image: Alexas_Fotos on unsplash.com

Boom-and-bust risk for cleantech investment

> Venture capital has poured into the cleantech sector over the past couple of years
> Concerns are growing that startups may not be able to scale into viable companies that generate expected returns

BY **KIM MOORE**
Senior reporter

National Grid Partners' Pradeep Tagare remembers the last cleantech boom-and-bust cycle, when venture capital piled into the sector in the heady investment years between 2006 and 2009. The bubble burst in the years immediately afterwards, as recession dried up follow-on investment and renewables struggled to compete with falling oil and gas prices.

The head of corporate venture investing at National Grid Partners, the venture arm of the UK-based utility, is worried the industry could be heading into a similar boom-and-bust cycle. The past two years have seen what some argue is an oversupply of capital coming into the sector. The question now is whether the industry can generate returns from all that capital.

"There is real capital that has been deployed into projects that are viable," says Tagare. "At the same time, these startups have to evolve into viable companies. In some areas, most of these projects are at pilot stage. Can they scale to really solve the problem?"

Cleantech has had a good year. Together with gaming, it has outperformed other sectors for receiving corporate funding in the second half of 2022. But climate technologies require a lot of investment and time to reach commercial scale, much longer than the three to five years that venture capitalists expect from software startups.

It was impatience and a lack of long-term vision that burned startups in the last cleantech boom-and-bust cycle. Investors didn't keep investing in projects that take years to come to fruition.

$369bn

Amount that the US Inflation Reduction Act will provide in green subsidies and grants for climate and clean energy tech

COMPETITION FOR DEALS

An influx of new financial investors and impact funds has driven up the valuations of cleantech companies over the past two to three years, making it harder for corporate investors to participate in deals.

"All of these are high capex items," says Aruna Subramanian, managing director, SABIC Ventures, the corporate venture arm of the Saudi chemical manufacturer. "They have long development cycles. We will spend four years and tens of millions building pilot plants without generating any value. They will take a long time and you don't know if they will be successful."

Now fears of a global economic downturn are growing, with parts of Europe already technically in a recession. >

As interest rates rise, growth equity capital that is needed to fund large clean energy infrastructure is expected to dissipate, leading to the delay of projects.

An upside is that valuations of tech companies have come down, making it a good time to invest. Roee Furman, managing director of Doral Energy-Tech Ventures, the corporate venture arm of the Israeli renewable energy company, says it is "great timing" for investments, but he worries about the funding of clean energy projects that will require long-term investment.

"What might get tricky are capital-intensive deeptech businesses that will need greater support from growth equity funds. When they need growth equity capital, they will not necessarily have numbers to show yet," says Furman.

> *"Decarbonisation as a theme got real in 2022. We were pleasantly surprised the industry focused on decarbonisation. For a lot of net zero plans that were announced four to five years ago the question was: is anyone going to act on them"*
>
> **Pradeep Tagare**
> Head of corporate venture investing, National Grid Partners

ENERGY CRISIS

What will keep attracting investment to the cleantech sector in the coming year is the energy crisis resulting from Russia's invasion of Ukraine. European policymakers have taken steps to accelerate investments in renewables and carbon-free energy sources, so that Europe becomes less dependent on Russian imports of fossil fuels. Carbon reduction goals have also spurred innovation.

"Decarbonisation as a theme got real in 2022," says Tagare. "We were pleasantly surprised the industry focused on decarbonisation. For a lot of net zero plans that were announced four to five years ago the question was: is anyone going to act on them? We were surprised that there were a number of technologies that not only got funded but started doing pilot projects."

This focus on decarbonisation is likely to continue in 2023, particularly given the large amount of government support for clean energy. The US passed its largest ever climate bill, the Inflation Reduction Act (IRA), in August 2022. The legislation provides $369bn in green subsidies and grants for climate and clean energy tech.

"We are excited about the IRA and the dollars it will pump into the ecosystem," says Tagare. "It will lead to a lot of innovation in energy storage. We will see a lot of investments in utility-scale storage and cheaper storage."

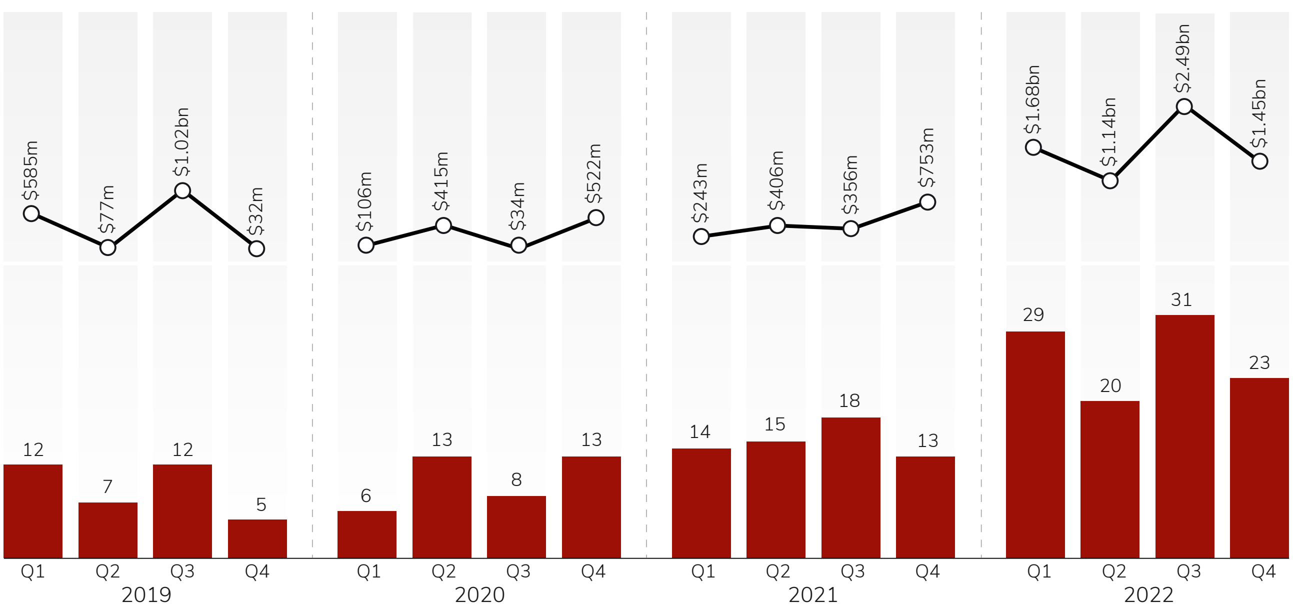
Cleantech sectors that are expected to receive continued investment in 2023 include hydrogen, long-duration energy storage and virtual power plants.

HYDROGEN

The popularity of hydrogen investments in 2022 is expected to continue and even ramp up in 2023. Johann Boukhors, managing director of Engie Ventures, the

>

FIG 1 CORPORATE-BACKED DEALS IN RENEWABLE ENERGY TECHNOLOGY 2019-2022 BY QUARTER



venture subsidiary of the French utility, says his unit will continue to invest more in green hydrogen, as well as biogas and biomethane in 2023. "A new value chain [for green hydrogen] is being set up that didn't even exist until two years ago," says Boukhors.

Building a hydrogen economy is a "multi-decade investment opportunity given the sheer size of what is required." Innovations in hydrogen production, transportation and its end use are required, says Tagare.

As a natural gas utility, National Grid Partners is interested in using hydrogen to reduce the carbon impact of its gas network. One approach is mixing hydrogen with natural gas, so that it can flow through pipelines. Another approach is generating hydrogen at the point of consumption. "We look at companies that enable large-scale production of hydrogen at cost parity," says Tagare.

LONG-DURATION ENERGY STORAGE

As more renewable energy is brought onto the electricity grid, storage systems that can help balance their intermittency are increasingly vital. Investors are looking at innovations in energy storage that have a range of up to 16 hours. This would allow for a grid that could potentially rely 24/7 on renewable energy.

Lithium-ion is most commonly used for storing renewable energy, but a global shortage and the negative environmental impact of mining the material means startups are working on alternatives. Sodium-ion and iron-air batteries are two technologies that are likely to receive investment this year.

"A virtual power plant can reach out to all these renewable resources in real time. This is an example of decentralisation and digitisation where digitisation is really required for decentralisation to work."

Pradeep Tagare
Head of corporate venture investing, National Grid Partners

VIRTUAL POWER PLANTS

With more renewable energy coming onto the electricity system, it is becoming increasingly complex to integrate these decentralised sources of energy. Machine-learning modules are being developed that can work out when to turn renewable sources on and off. The AI systems can learn which resources can be optimised and when the grid needs to dip into the virtual power plant.

National Grid Partners sees virtual power plants as a continued source of investment in 2023. "A virtual power plant can reach out to all these renewable resources in real time. This is an example of decentralisation and digitisation where digitisation is really required for decentralisation to work," says Tagare. ■

Engie prepares for hydrogen and biomethane transition

> Robert Lavine speaks to Johann Boukhors, managing director of French energy utility Engie's strategic investment arm, about potential technology breakthroughs for energy transition, as green hydrogen and biomethane enter the mix

BY **ROBERT LAVINE**
News editor

The energy sector hasn't had a technology breakthrough for a decade. But Engie New Ventures' Johann Boukhors is excited about the potential for green hydrogen and methane.

Green gases such as hydrogen and biomethane will be an important part of the future energy mix, says Boukhors, managing director of French energy utility Engie's strategic investment arm.

"It's more complex than only switching to renewables," Boukhors says. "We don't believe there's only one technology or one vertical that will be the future. It's a question of the energy systems that need to be made. This energy mix will need to include renewables, of course, but also nuclear and low-carbon natural gas including biomethane."

Engie has invested in a number of hydrogen-focused companies. In June it backed Spanish on-site hydrogen production specialist H2Site's series A round. The following month, it invested in a $34m round for Californian startup C-Zero, which is developing a way to process natural gas into hydrogen and water using a mixture of molten salts to trap carbon dioxide in solid form. Boukhors is particularly interested in the potential to make hydrogen 'greener'.

"Hydrogen used to be 100% 'grey' and for very limited and specific uses," he says. "We now see it as a major way to get energy. Not as concentrated as nuclear or conventional fuel, of course, but with many advantages, particularly the fact it can be made clean and renewable.

"We see hydrogen right now as being where renewables were about 15 years ago, and the context being set is similar, meaning regulation – not only on one continent, but across the globe – and also subsidies and support to this industry in order to build an evolved system."

REGULATORY SUPPORT

Some of this support can already be seen, with the Inflation Reduction Act recently passed in the US offering a 10-year tax credit for clean hydrogen facilities. The European Union's Fit for 55 plan also sets ambitious targets for hydrogen energy and fuel consumption.

The energy crisis, which has led to spiralling fuel prices across the world, is a chance to bring about the big changes necessary to transform the energy system, says Boukhors.

$34m
Amount Engie invested in California startup C-Zero last summer

>

"There's a big opportunity right now, which is not only the need for an energy transition against climate change, but also the need to deal with the energy crisis that Europe is facing together with other geographies," he says. "When you combine two crises, that's always a good opportunity for moving forward with bold changes."

But Engie New Ventures, which invests out of a fund topping €200m, is targeting a complex mix of technologies to be ready for the big change.

The unit essentially divides its investments into three groups. One area is green gases, which have potential uses for green steel production – Engie New Ventures was recently part of a consortium backing GravitHy, a sustainable iron and streel producer based in the south of France. It has also invested in Ineratec, a German startup working on clean kerosene production.

There is also a focus on renewable energy, with investments in startups such as Raptor Maps, a developer of solar power optimisation technology.

The third trend in future energy systems is performance – "the best energy is the energy you don't consume," says Boukhors. Those portfolio companies include Redaptive, which installs energy-saving equipment for businesses and then gets a return from the savings they make, and Ndustrial, the creator of an analytics engine for energy use.

AN EVERGREEN STRATEGY

Engie New Ventures operates with a team of 12, mostly based in Europe and North America, though it also has a presence in Israel and Asia. The fund invests around €30m a year across new and follow-on deals, and it operates through an evergreen structure.

"We can say that what we invest would correspond more or less to what we divest," Boukhors says. "But, in general, five years after the investment, when we feel that either the sector is not strategic for us anymore or not necessary for good collaboration or deployment to happen, then we are open to an exit and to sell."

"Five years after the investment, when we feel that either the sector is not strategic for us anymore or not necessary for good collaboration or deployment to happen, then we are open to an exit and to sell"

Johann Boukhors
Managing director, strategic investment, Engie

The unit's aim is to find companies with breakthrough technologies that can be used by Engie's business units, and Boukhors estimates that about 75% of its portfolio fits that bill. The remaining 25% portfolio startups have pivoted or simply never reached the stage of commercialising their technology.

One of the biggest problems in finding breakthrough technologies is that the energy sector isn't particularly suited for rapid disruption, Boukhors says.

"Apart from renewables and nuclear energy long ago, the energy system over the past decade has never had a breakthrough innovation," he says. "None of the current energy players have been disrupted when you compare it with the retail, mobility or telecoms systems, for example."

The other factor is that the scale of the energy system and its related infrastructure makes it inherently difficult to change it quickly. You can't replace or transform an energy grid overnight.

"It takes time to build assets, it takes time to build a value chain that is optimised enough to be efficient," Boukhors says. "It is not easy to transport electrons or gas molecules, so you basically need a system and a value chain in order for it to work, and that takes time.

"I doubt it can change overnight. Will there be more of a disruption than we're seeing now? There will be a number of limited disruptions or innovations, and that is what we are working on right now every day." ■

O&G companies' investments not rising in line with profits

> Oil and gas companies' profits have risen more than five-fold in the past two years, but investment activities are increasing more slowly

BY **KALOYAN ANDONOV**
Reporter and analyst

Oil and gas companies have seen their pre-tax earnings increase five-fold over the past two years, but their spending on corporate investments have not gone up nearly as fast. The number of deals being done has doubled, but, apart from a blip in the first quarter of this year, the amounts being invested are similar to two years ago.

We would have expected corporate investing commitments to show more of an increase, given the urgency of tackling the climate emergency and the fact that energy companies have some of the fattest corporate wallets at the moment. But while energy companies have invested in the $150m series C completed by robotics factory robotics producer and a $250m series G round raised by fusion power developer TAE Technologies, there has been no big rise in investment activity in line with growing profits, despite the energy sector remaining the most buoyant sector amid a general market pullback.

It is worth a quick recap – in Q2 2020, as the covid pandemic took hold, the West Texas Intermediate benchmark price for oil went into negative territory, due to a technicality of the futures contracts. Even in November 2020 it was still at around $37-$40 a barrel. In the second quarter of 2022, fuelled by Russia's invasion of Ukraine, the price had reached $120 per barrel. It has eased a little since then to fluctuate between $75 and $100 a barrel, discounting a looming recession in the western world which may hold back demand.

$6.82bn
Total deal values backed by the oil and gas peer group in Q1 2022

OIL AND GAS PROFITS

Exactly how that has translated into profits for oil and gas producers is a little nuanced, and it is possible for accounting minutiae to obscure these. But we've taken EBITDA (earnings before interest, taxes, depreciation and amortisation) as a measure and aggregate it for such large energy companies involved in corporate venturing – Shell, Chevron, BP, Equinor, Saudi Aramco and TotalEnergies.

While EBITDA is not a standardised accounting measure, it is widely used in the world of finance and investing as a more or less credible proxy for the company's free cash flows.

Quarterly EBITDA have grown several-fold since the second quarter of 2020 and the outbreak of the covid-19 >

$164.19bn

The aggregate estimated EBITDA in Q3 2022, down from the $185.66bn in Q2 2022...

...But up from the relatively dismal Q2 2020 figure of

$33.58bn

pandemic. In the dismal Q2 2020, they constituted an estimated $33.57bn, while in Q2 2022 year they were $185.66bn – that is more than five and a half times more. In Q3 2022, the aggregate estimated EBITDA amounted to $164.19bn.

These are, by any measure, significant increases in quarterly profitability figures. But has there been a corresponding increase in corporate venturing? Before we dive into that question further, it is worth noting that there have been governments levying "windfall profit taxes" on oil and gas companies.

WINDFALL TAXES

The argument is that an increased tax burden for a cyclical industry, such as oil and gas, would eat up capital which could be otherwise invested in capital expenditure, refining capacity and innovation to ultimately drive down prices of oil and natural gas, as well as refined products. The same argument could be made around reducing extra funds for VC investing respectively.

While it is true that many governments, particularly in Europe, have imposed such levies to grapple with the ongoing energy crisis and rising costs of electricity, these measures have not been uniform in rates or structure. According to data cited by the Tax Foundation, some countries, such as Greece and Romania have imposed rates as high as 90% over a baseline period, while Spain has imposed a rate of just 1.2% over sales of domestic power utilities of more than €1bn. Other countries have failed to implement such tax schemes altogether. According to Reuters, the windfall tax proposed by the Biden Administration in the US seems unlikely to go through Congress at the moment.

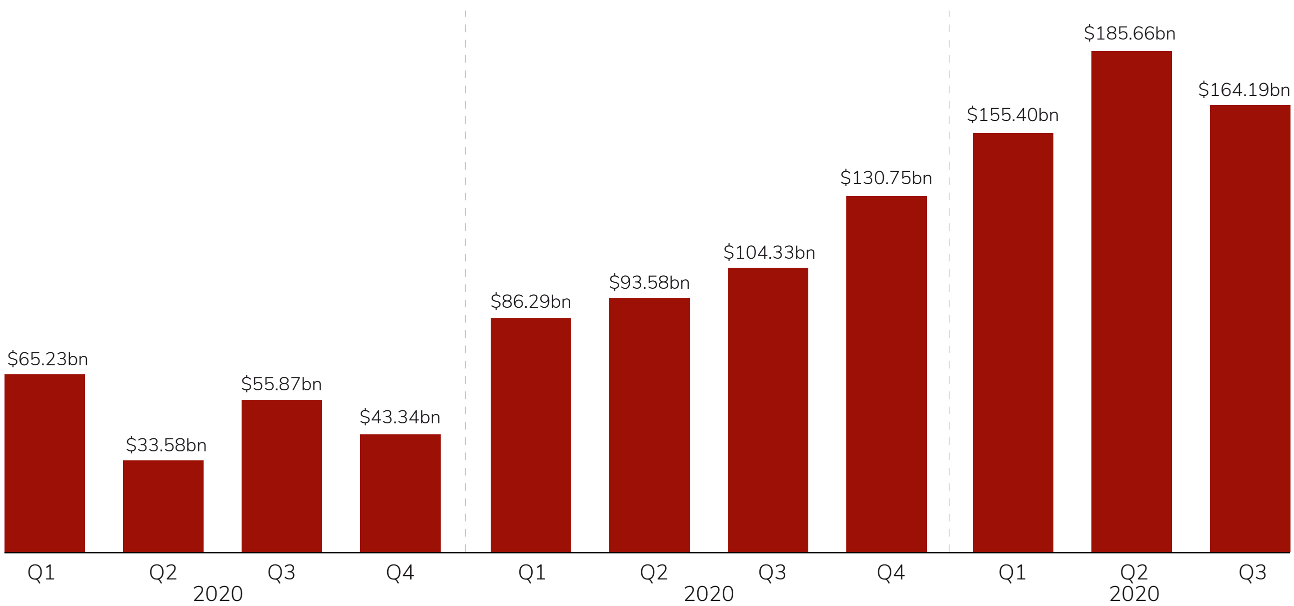
Where a levy is announced, it is also worth reading the fine print. The UK, for example, imposed a 25% tax that applies to profits made from extracting UK oil and gas, excluding activities such as refining oil and selling petrol. It also gives companies 91pence of every £1 invested in fossil fuel extraction in the UK.

According to the BBC, Shell, for example, stated it wasn't expecting to pay any windfall tax at all this year, but it expected to pay some in 2023. Windfall taxes are, in short, variable, but not nearly as onerous, in many cases, as headlines would suggest.

VENTURING ON STANDBY

Oil and gas companies should, then, have increased budgets for venturing. Certainly, it is true that, in the second quarter of 2022, the same peer group of oil and gas >

FIG 1 TOTAL EBITDA OIL AND GAS PEER GROUP 2020-2022



companies did almost twice the number of deals (21) as they did in the same quarter of 2020 (11). But that is a smaller increase than the five-fold growth of EBITDA.

In total dollar terms, the picture is mixed. The first quarter of 2022 saw total deal values backed by the oil and gas group reach a high of $6.82bn (the $775m Silicon Ranch deal backed by Shell, among other investors, was one of the deals in that quarter). That is nearly 18 times the total deal value ($381m) in Q1 of 2020. The overall bull market is likely to have bolstered valuations in the first quarter.

But overall, this year's first quarter number looks like an outlier, and the trend has been for deal values to bounce around the $1.5bn level across most of the past few quarters.

One investment professional in the oil and gas industry – who wished to remain anonymous –told us that it may be a case of deliberately holding back firepower. "The limiting factor for us has never been the capital," he said. "For established CVCs, consistency is more important. Instead of feast or famine, executing the fund strategy is key. Overall [being in a] syndicate, driven by smart money is key. We see movement in the right direction for the core oil and gas [businesses], mostly by private equity, which should help to fuel startups in this area."

For future energy, any overall slowdown in the general climate change environment is actually productive – getting the valuation of the pre-revenue companies back to reality. Funding is still there, but more aligned with fundamentals"

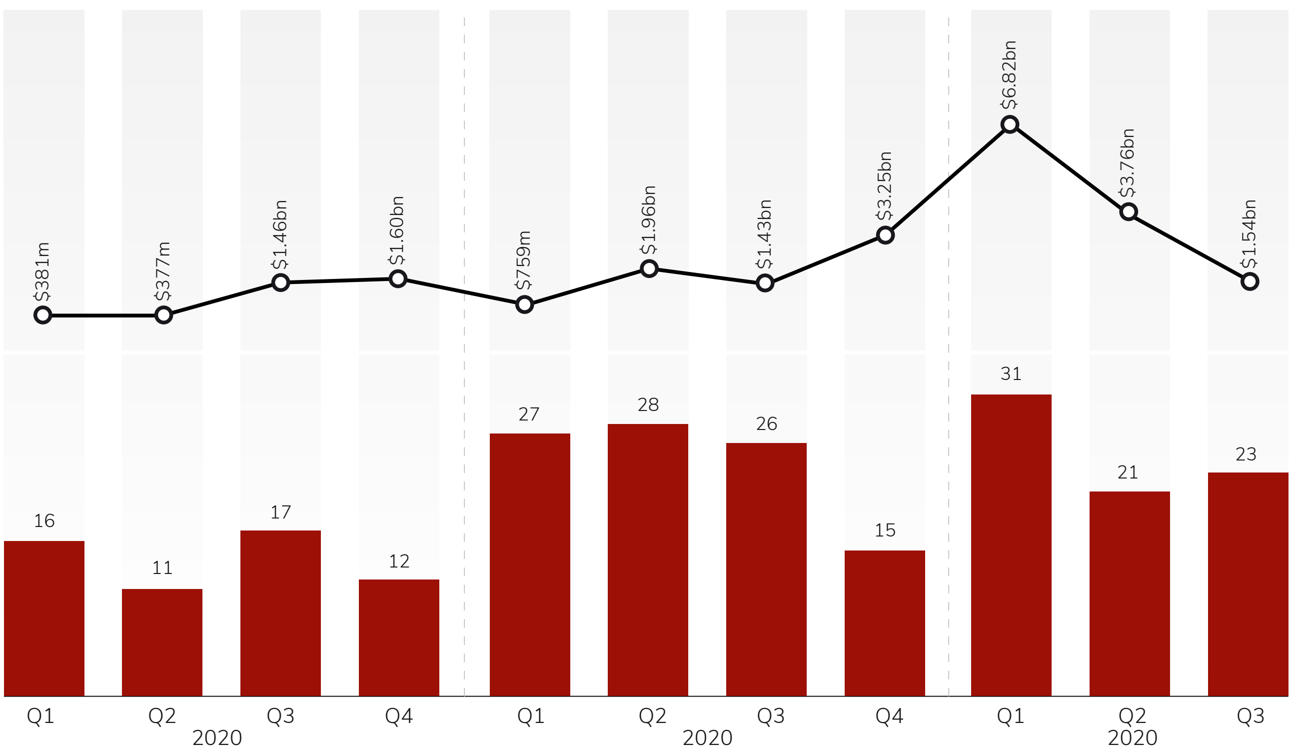
Investment professional

But we may be about to see a little more capital being deployed by the oil companies, as the investment pullback continues. "It is good to get dumb and plentiful money out of the system," he said. As well as investing in core oil and gas applications, energy companies also invest in digital tech and cleantech. The valuations of digital companies, in particularly, have been "slowing down in a good way", he says.

"For future energy, any overall slowdown in the general climate change environment is actually productive – getting the valuation of the pre-revenue companies back to reality. Funding is still there, but more aligned with fundamentals."

So while we haven't seen investment by the oil majors rise at anything like a pace to match their rising profits, it may well be that an increase is coming, with energy investors waiting to opportunistically strike as the market cools just a little more.

FIG 2: VENTURE DEALS BACKED BY OIL AND GAS PEER GROUP 2020-2022



Siemens' venture to take a crack at green hydrogen

> German company Siemens Energy has partnered with cleantech firms to build an ammonia cracker that could produce emissions-free hydrogen at industrial scale

BY **KIM MOORE**
Senior reporter

Once, the factory in Newcastle in northeast England was where Siemens Energy built steam turbines for use in coal-fired power plants. Now, it has become the location of an experimental facility to create green hydrogen through ammonia cracking – a process that could be the key to establishing a clean energy ecosystem for the renewable fuel.

Siemens Energy is building a prototype ammonia cracker that will produce 200kg of hydrogen a day to power buses and trucks. The clean fuel will also be used for off-grid electricity generation to replace diesel generators.

Producing green hydrogen at scale is difficult because separating hydrogen from water through electrolysis requires a large amount of energy. Ammonia, on the other hand, has a high concentration of hydrogen, takes less energy to extract and is readily transportable in bulk. A number of companies are investigating setting up ammonia-cracking facilities, including a project announced in December by the Port of Rotterdam Authority in the Netherlands.

What is novel about Siemens Energy's £3.5m project is its use of a metal membrane technology designed by Fortescue Future Industries, an Australian green energy technology developer, to produce high-purity hydrogen required for fuel cells.

The membrane technology, which acts like a sieve through which only hydrogen can pass, gives Siemens Energy's prototype an edge over other ammonia crackers, says Zac Cesaro, programme manager of ammonia cracking and e-fuels at Siemens Energy. "This is the most competitive technology to use," he says.

AN INTERNAL VENTURE

Although Siemens Energy has a corporate venture arm, the idea for the ammonia cracker emerged internally. It is partnering with Fortescue Future Industries and GeoPura, a UK renewable off-grid energy generation manufacturer, which will both provide technology and customers for the renewable fuel.

Siemens had already worked with GeoPura on the development of a hydrogen fuel cell, making it a natural external partner in the venture, which it may spin out as a new business in the future. It also collaborated with its venturing unit and Innovate UK, a government agency. >

200kg

Amount of hydrogen Siemens Energy's prototype ammonia cracker will produce a day to power buses and trucks

GeoPura zero-emission hydrogen power units were used to provide off-grid power for the BBC's *Winterwatch* programme in the UK

"Venture building for us at the moment is all about collaboration and co-creation," says Julia Reid, communications partner at Siemens Energy Ventures, the company's CVC. "We always try to partner with others, partly because we know then that there is an interest and it is a safer bet. The pooling of resources means we can do this quicker and get these solutions to market more quickly."

> *"We always try to partner with others, partly because we know then that there is an interest and it is a safer bet. The pooling of resources means we can do this quicker and get these solutions to market more quickly"*
>
> **Julia Reid**
> Communications partner,
> Siemens Energy Ventures

GREENER AMMONIA CHALLENGE

Siemens Energy will use power from the grid to heat the ammonia for the cracking process. It plans to buy renewable energy through power purchase agreements to make it fully green. In future, it will use waste heat from the ammonia cracking in a self-contained system that will require little external power.

The hydrogen from this first prototype will be used by partner GeoPura to supply its hydrogen power units, which replace diesel generators as an off-grid zero emissions-power solution for industries including television production, construction and outdoor events.

The system will produce enough hydrogen a day to power between five and 10 hydrogen fuel-cell electric buses. This type of decentralised ammonia cracker could be installed at hydrogen refuelling stations for buses and trucks, as well as at train depots that are being retrofitted to power hydrogen-powered trains.

Siemens Energy's prototype is specifically designed for transport and off-grid uses, but larger centralised crackers are also being developed to bring hydrogen into pipelines for heating homes and for industrial use. Germany has announced plans to build green ammonia import terminals that will be an emissions-free alternative to imports of liquified natural gas.

A challenge of scaling the technology is the sourcing of green ammonia. Manufacturing ammonia is energy intensive and is made almost exclusively from fossil fuels.

This may soon change, as several green ammonia projects are under construction in areas including Australia, where renewable energy is plentiful. One big cost saver is the fact that infrastructure for transporting and storing ammonia is already in place. "Because we have ships and import and export terminals around the world, we know how to handle ammonia industrially," says Cesaro. ■

More deals by oil and gas investors but fewer dollars

> Oil and gas companies backed more startup funding rounds in 2022 than the previous year, but the dollar valuation of deals fell by more than two thirds

BY **KALOYAN ANDONOV**
Analyst and reporter

$27.6m

The median size of deals oil and gas corporate venturing peers took part in during 2022, slightly up from $25m in 2021

Oil and gas corporate venturers backed 182 startup rounds last year, up from 175 in 2021. However, the total estimated dollar value of those deals stood at $9.26bn, a fraction of the estimated $28.28bn bumper deal value of 2021, when a flood of liquidity and accommodative monetary policy elevated valuations, amid buoyant public equity and M&A markets.

We only saw a few exits, reflecting a lack of appetite and overall bearishness in public equity and M&A markets.

On a sector-by-sector basis, the number of deals in cleantech and IT increased in 2022, but fell in areas such as core oil and gas (O&G) operations, as well as transport and mobility.

The median size of deals O&G corporate venturing peers participated in, amounted to $27.60m in 2022, slightly higher than in 2021 ($25m). Both these figures have been distorted by the presence of some very large deals in both 2021 and 2022. Both represent a surge from previous years, though, which implies that valuations in areas of investment interest have been generally hot.

Shell and Chevron have been taking the lead in cleantech investments since 2014, as well as in IT technologies. Total, Shell and BP have had most investments in transport and mobility startups.

Over the years, we have consistently observed the focus of O&G corporate venture investors shifting to non-core areas, primarily into IT and cleantech, as well as transport and mobility.

Such non-core businesses possess the most disruptive potential to the core of O&G companies. Media, governments and society overall reinforce the notion of the necessity and inevitability of a low-carbon world and, ultimately, the complete phaseout of fossil fuels.

The increasing adoption of electric vehicles may affect a considerable part of the customer base of O&G companies, though how quickly or slowly still remains a matter of debate. There has also been a growing digitisation of industrial activities, which exerts a tangible impact on production and efficiency.

ENERGY STORAGE POWERS ON

Looking more closely at the cleantech sector, energy storage, carbon capture, monitoring energy tech and software, as >

well as hydrogen-related technologies were among of the most popular investments in 2022.

In the mobility sector, automotive technology, especially related to electric vehicles, and various mobility-related services were the most popular investments in 2022.

COMMODITY PRICES HOLD

The O&G sector has increased spending fairly steadily, despite the wild swings in commodity prices over the past few years.

West Texas Intermediate prices have gone from being in negative territory in April 2020 to a high of $125-$130 a barrel in 2022, ending the year at around $76-$77 a barrel.

Given the possibility of a recession this year, a correction or more volatility may be on the cards for crude prices. If futures contracts are to be taken as guidance and "wisdom of the crowd", then markets are largely expecting the WTI price to average around its current levels or somewhere near throughout 2023. The confidence intervals around it, however, are much wider, given the wild swings to which crude has been susceptible in the past.

The latest US Energy Information Agency's *Short Term Energy Outlook* report (from early January 2023) expects the WTI benchmark to average around $70-$71 per barrel during this year. The authors of the report justify this forecast on grounds of build-up in global oil inventories "putting downward pressure on crude oil prices."

>

FIG 1: INVESTMENTS AND EXITS OF O&G CORPORATE PEER GROUP 2018-2022

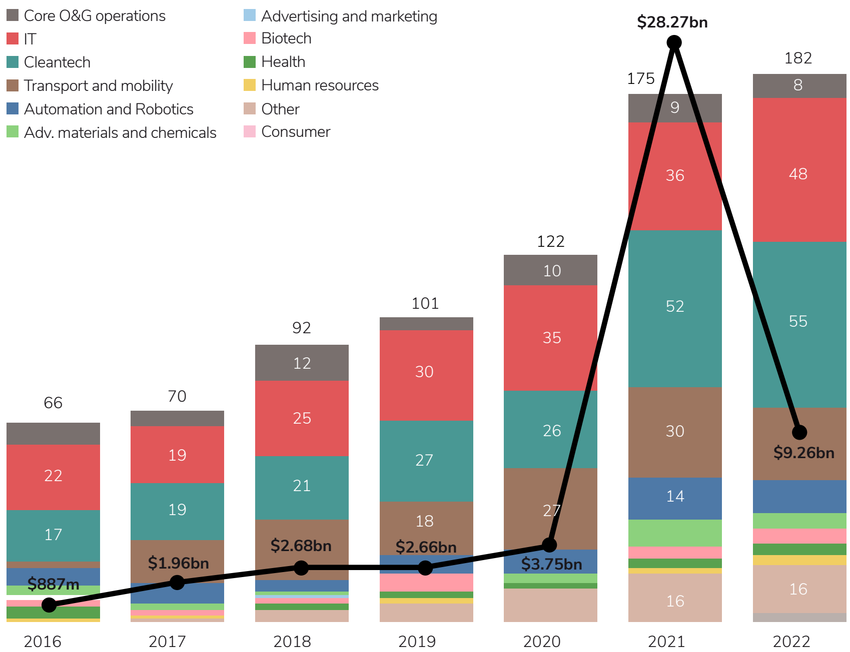
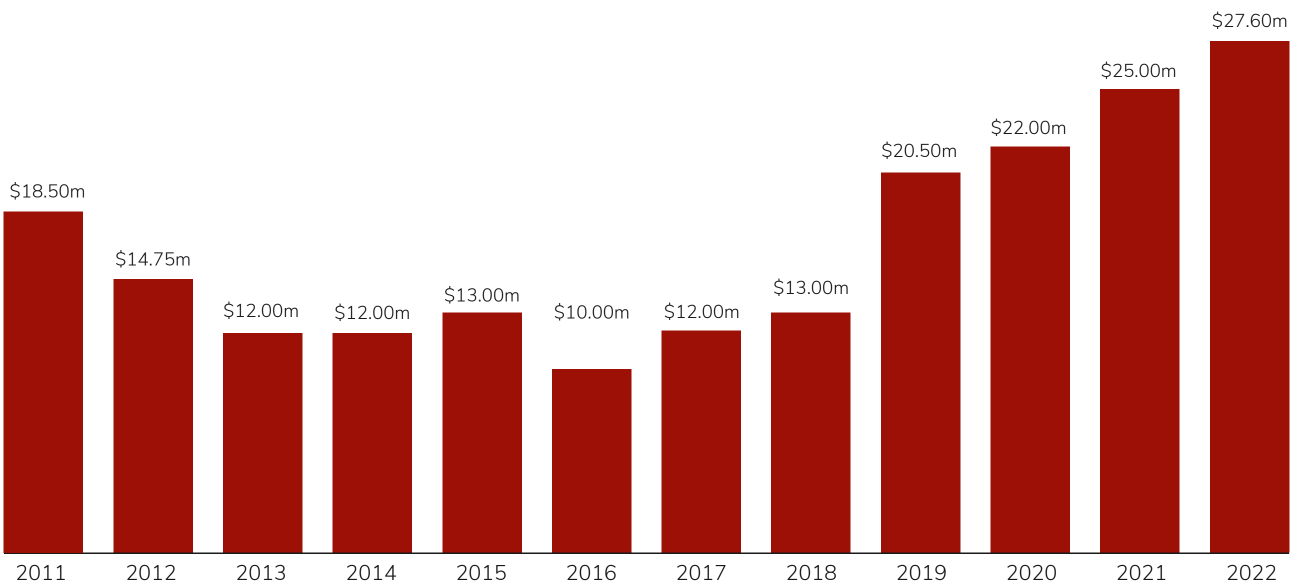


FIG 2 MEDIAN SIZE OF DEALS BACKED BY OIL & GAS CORPORATE PEER GROUP 2011-2022



Note: *Both 2021 and 2022 figures have been distorted by the presence of some very large deals in those years.*

The report also forecasts that wholesale gasoline prices will decline by 29% in 2023 and subsequently a further 14% in 2024, driving retail prices to average around $3.30 per gallon (gal) in 2023 and $3.10/gal in 2024. This prediction is based on an expectation of a fall in refining margins. If this should materialise, it would ease some ongoing inflationary pressures.

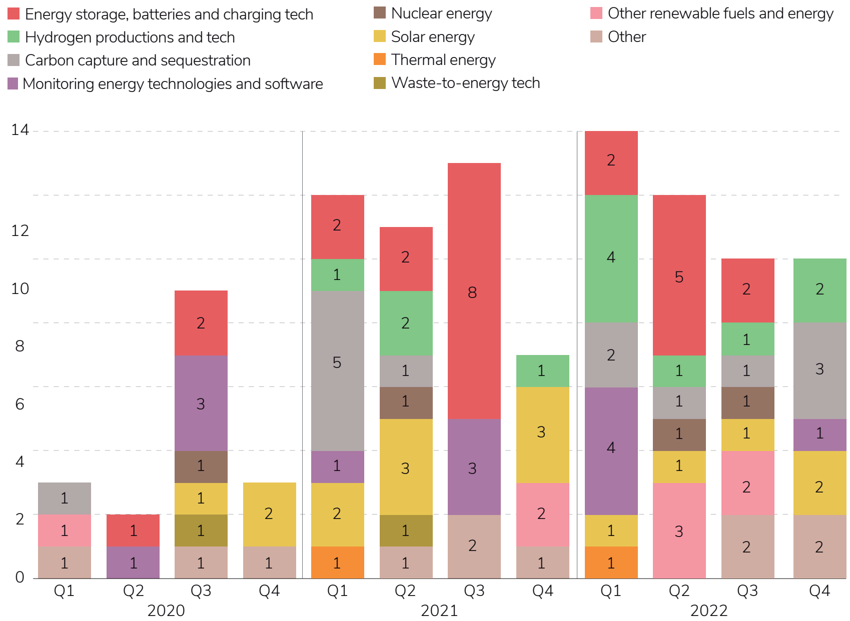
ENERGY OPTIMISM FOR EUROPE

The other important commodity is natural gas, and the provision of this in Europe has been disrupted by Russia's war on Ukraine. A so far mild winter, however, has helped ease pressure on natural gas prices.

Military conflict, the closure of the Northstream pipeline and the overall weaponisation of gas supplies have forced the EU to look for solutions. It hastened to fill gas storage facilities that, according to Reuters were 91% filled by the beginning of October 2022, having reached a November target of 80% well ahead of time.

The EIA's *Short Term Energy Outlook* expects natural gas prices that have seen pullback at the end of 2022 to rise back "above $5.00/MMBtu in late January and stay above >

FIG 3: CLEANTECH INVESTMENTS OF O&G CORPORATES 2020-2022



91%

Europe's gas storage facilities were 91% filled by October 2022, easily surpassing November's target of 80%

Source: Reuters

FIG 4: WTI CRUDE OIL PRICE AND NYMEX CONFIDENCE INTERVALS (DOLLARS PER BARREL)

Source: US Energy Information Administration, Short-Term Energy Outlook, CME Group, Bloomberg, LP and Refinitiv an LSEG Business that in February". This prediction has much to do with cooler temperatures and, consequently, an increasing demand for liquefied natural gas (LNG) exports. The report also notes that "extreme weather events can cause price spikes and volatility."

Increased imports of LNG into Europe have helped it replenish reserves throughout last year. Additionally, higher nuclear power generation in France has also helped with electricity supply across the continent.

Recent sanctions and price caps on Russian products, designed to thwart the couuntry's war machine, appear to be having an economic impact on Russia. According to a recent report by the Helsinki-based Centre for Research on Energy and Clean Air, the price cap on Russian oil costs the Kremlin €160m ($172m) in losses per day. These losses, according to the report, could increase considerably if further sanctions are to be implemented. However, there were few signs of any resolution to the war at the time of writing. ■

FIG 5: TRANSPORT AND MOBILITY INVESTMENTS OF O&G CORPORATES 2020-2022

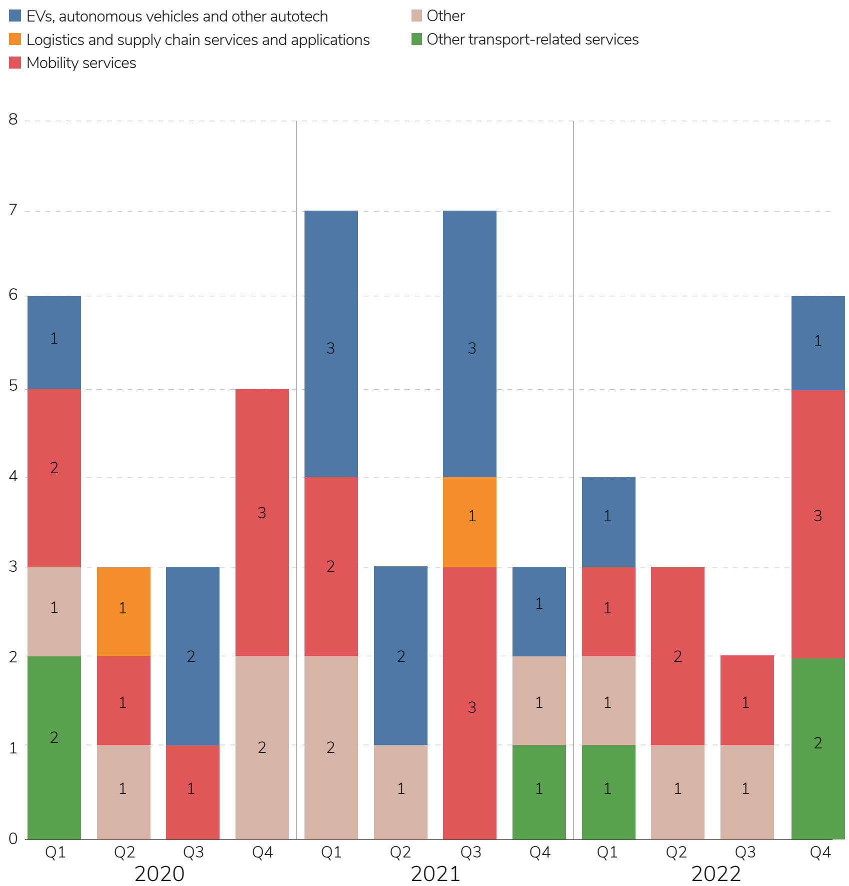


FIG 6: TYPE OF OIL & GAS CORPORATE VC INVESTMENTS BY YEAR

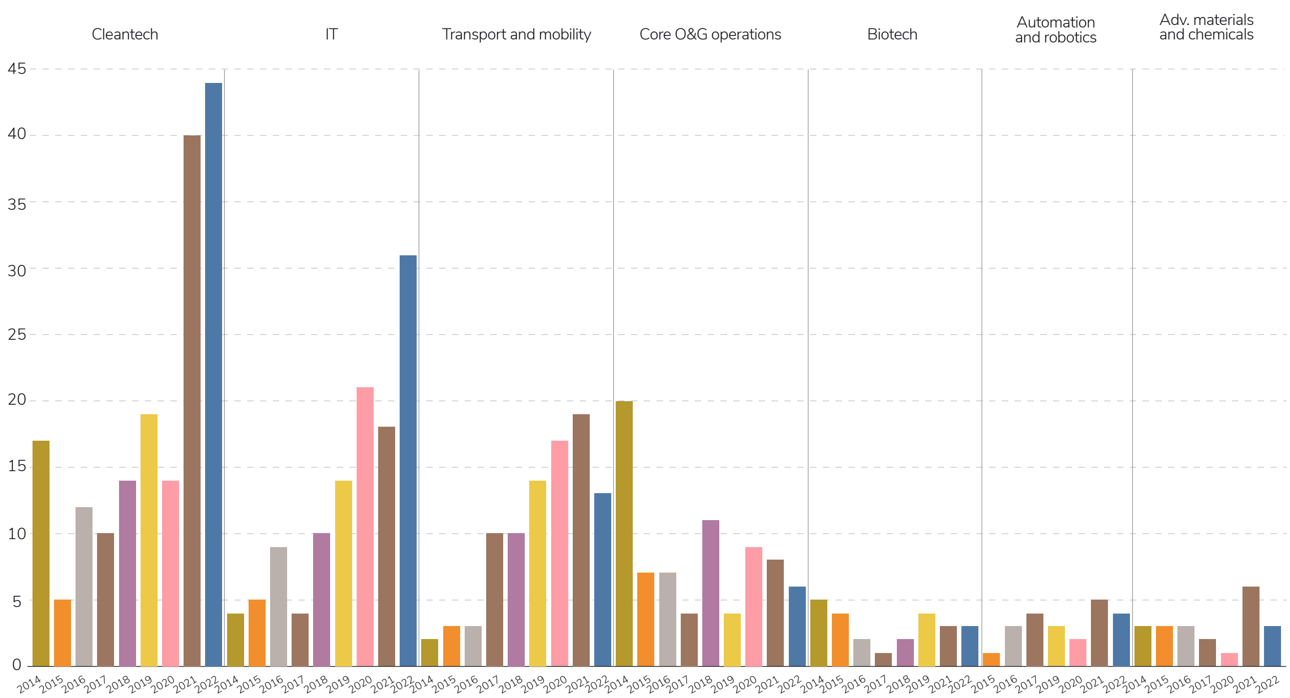
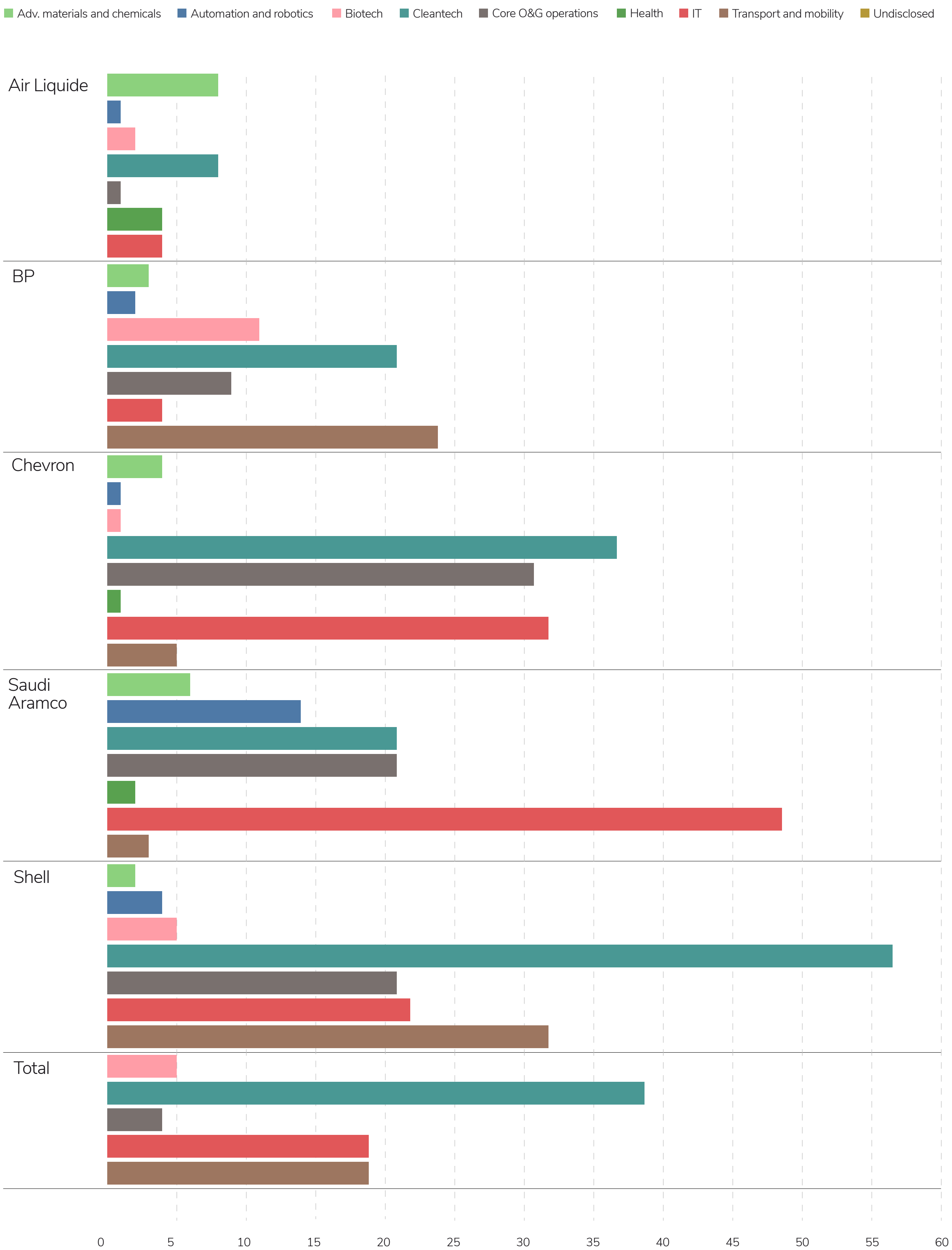


FIG 7: TYPE OF OIL & GAS VC INVESTMENTS BY COMPANY 2014-2022



Deals

> The largest oil and gas startup deals of 2022 involved Chevron, BP and Saudi Aramco

TABLE 1: TOP DEALS OF OIL & GAS CORPORATES AND PEERS

Portfolio	Round	Sector	Size	Investors
Svante	E and beyond	Cleantech	$318m	3M, Chevron, Delek US, Full Circle Venture Capital, General Electric, Hesta AG, Japan Energy Fund, Liberty Media, M&G Investment Group, OGCI Climate Investments LLP, Samsung, TechEnergy Ventures, Temasek, United Airlines.
BluSmart	B	Transport and mobility	$200m	BP, undisclosed investors.
SingleStore	E and beyond	IT	$146m	Goldman Sachs, Saudi Aramco.
Wasabi Technologies	D	IT	$140m	Azura, Cedar Pine, Fidelity, Forestay Capital, L2 Point, Saudi Aramco, SIS Ventures.
PragmatIC Semiconductor	C	IT	$125m	British Business Bank (BBB), In-Q-Tel, Maven Capital Partners, Saudi Aramco.
Locus Robotics	E and beyond	Automation and robotics	$117m	Bond, G2 Venture Partners, Goldman Sachs, Gray?s Creek Capital Partners, Hercules Technology Growth Capital, HESTA, Scale Venture Partners, Siemens, Silicon Valley Bank, Stack Capital Group, Stafford Capital Partners.
Syzygy Plasmonics	C	Cleantech	$76m	Carbon Direct Capital Management, Chevron, Equinor, Evok Innovations, Goose Capital, Horizons Ventures, Lotte Group, Pan American Energy, Saudi Aramco, Sumitomo, The Engine, Toyota.
Kore Power	Undisclosed	Cleantech	$75m	Honeywell, Nidec Corporation, Quanta Services, Siemens, Trog Hawley Capital.
Ki Mobility Solutions	Undisclosed	Transport and mobility	$60m	Castrol.
5B	B	Cleantech	$37m	AES Corporation, Artesian Capital Management, Bandera Capital, BP.

BLUSMART

India-based all electric ride-hailing platform BluSmart is in the process of raising $200m in Series B venture funding from BP Ventures and undisclosed investors. Founded in 2018, BluSmart operates a ride-hailing platform offering electric, sustainable and reliable mobility services. The company's platform offers ride-sharing, car-sharing, as well as shared charging services for electric vehicles.

SVANTE
Canada-based carbon capture technology developer Svante raised a $318m series A round, featuring several corporate backers. Chevron led the round via its Chevron Technology Ventures unit. Other backers included conglomerates Delek (via Delek US), 3M (via 3M Ventures), GE (GE Vernova), media company Liberty Media, electronics and semiconductor manufacturer Samsung (via its Samsung Engineering subsidiary) and carrier United Airlines, through its United Airlines Venture. Svante has developed an absorption technology that captures post-combustion carbon dioxide from industrial fuel gas streams through the use of a rotary absorption machine which functions as a rotary air preheater maximising carbon capture productivity.

SINGLESTORE
US -based cloud database developer for data-intensive applications SingleStore raised $146m F2 series round, featuring Saudi Aramco via its Prosperity7 Ventures arm. The round was led by Goldman Sachs. Formerly known as MemSQL, SingleStore is the creator of a flexible cloud database platform for use with operational analytics, machine learning and artificial intelligence activities.

WASABI TECHNOLOGIES
Prosperity7 Ventures participated in a $140m series D round, which was raised by US cloud storage provider Wasabi Technologies. Founded in 2017, Wasabi provides hot cloud storage services that enable businesses to quickly access their data. It claims its services are cheaper than traditional cold cloud storage offerings and faster than other hot cloud storage services.

PRAGMATIC SEMICONDUCTOR
UK-based developer of flexible integrated circuit technology PragmatIC Semiconductor raised a $125m series C round, featuring Prosperity7 Ventures, among other investors. Founded in 2010 as Pragmatic Printing, PragmatIC produces ultra-thin and flexible electronic materials that can be incorporated into a range of mass market items to facilitate smart objects technology that would be able to engage with its environment.

SYZYGY PLASMONICS
US-based manufacturing decarbonisation technology developer Syzygy Plasmonics completed $76m series C, which included Saudi Aramco through Aramco Ventures, Chevron via Chevron Technology Ventures, Equinor (Equinor Ventures), chemicals producer Lotte Chemical, automaker Toyota through Toyota Ventures, Pan American Energy and industrial conglomerate Sumitomo.

KI MOBILITY SOLUTIONS
India-based digital platform for car services Ki Mobility Solutions raised $60m round, which was backed by Castrol India. Ki Mobility Solutions focuses on sales of auto parts and accessories and the provision of maintenance and repair services.

VOW
Australian cellular meat maker Vow raised A$73m ($49m) in aeries A venture funding in a deal led by Prosperity7 Ventures, Saudi Aramco's non-core venturing arm, and Blackbird Ventures. Toyota Ventures also participated in the round. The funds will be used to speed up getting the company's Morsel product to market, future product development and hiring across new divisions. Founded in 2019, Vow produces cultivated exotic meat made from cells, instead of breeding and killing animals.

>

5B
Australia-based renewable energy company 5B raised $A55m ($37m) in series B venture funding in a deal led by AES and Artesian Capital Management. BP Ventures participated in the round alongside Bandera Capital and other undisclosed investors. 5B runs a solar project development company intended to make clean energy affordable and accessible.

STROHM
Dutch thermoplastic composite pipe manufacturer Strohm raised $30m in a round featuring Shell, Chevron, chemical producer Evonik Industries and bank ING. The corporates participated through their respective venturing arms – Shell Ventures, Chevron Technology Ventures, Evonik Venture Capital and ING Corporate Investments. The latter led the round. The company manufactures fully bonded, thermoplastic composite pipes intended for use in the offshore oil and gas industry. Its products include downlines, well intervention hoses, jumpers, spools, offshore flowlines and risers.

> There were a few other deals in emerging businesses linked to the oil and gas core operations that received backing from O&G venture peers, as well as other corporates

WELLHEAD SYSTEMS
Canada-based oil and gas surface control system provider Intelligent Wellhead Systems raised $13m in an undisclosed round that included drilling data service company Pason Systems. Founded in 2011, Intelligent Wellhead Systems has developed an engineered control system designed to give oil field services a digital window inside their pressure control equipment. It offers proprietary and surface control systems for live well fishing operations, complex snubbing operations, coiled tubing operations, wire-line operations and others.

EXERGY ENERGY
US-based renewable energy platform Exergy Energy raised a round of undisclosed size, backed by engine and power generation product maker Cummins. Founded in 2018, Exergy Energy supplies renewable energy and backup power to commercial and industrial customers, sourcing and delivering renewable energy from utility-scale power projects. The company installs and operates backup generators onsite, enabling clients to eliminate costly downtime and business interruptions.

GYRODATA
There was also one notable exit in this space. US-based data provider Gyrodata reached a definitive agreement to be acquired by oil and gas services company Schlumberger for an undisclosed amount. Gyrodata runs a service technology designed to deliver precision wellbore placement. Its technology provides full directional drilling utilising logging services that can be run standalone or in tandem with a high accuracy rate gyroscopic survey.

Exits

> There were very few other exits in the fourth quarter of 2022 for the O&G peer group, as both public equity and M&A markets dried up

ENOCEAN

Germany-based energy-harvesting sensor tech maker EnOcean, which counts Siemens among its previous backers, entered into an agreement to acquire Parabellum Acquisition Corp. in a reverse merger transaction for approximately $150m. After the transaction, the company will continue to operate from Germany. EnOcean has developed an energy-harvesting wireless technology, with applications in building, home and industrial automation. Its wireless sensor products are based on miniaturised energy converters, ultra-low-power electronics and radio technology, used for batteryless applications in the Internet of Things.

FIXINGCO2

FixingCO2, which counted BP Ventures among its backers, reportedly went out of business as of early December 2022, according to PitchBook. Founded in 2018, FixingCO2was the developer of an environmental technology designed to convert carbon dioxide into fuels and chemicals.

Funds

> We also saw several funding initiatives, including some of substantial size, in the fourth quarter of 2022

ARAMCO VENTURES
Aramco Ventures, the corporate venturing subsidiary of Saudi Arabia-based oil and gas producer Saudi Aramco, formed a $1.5bn vehicle to back energy transition technology developers. Areas of interest for the Aramco's Sustainability Fund include carbon capture and storage, greenhouse gas emissions, energy efficiency, digital sustainability, hydrogen, ammonia and synthetic fuels.

LINSE CAPITAL
Puerto Rico-based growth equity firm Linse Capital raised $700m from LPs (limited partners), including commercial automotive producer Daimler Truck and mobile operator Taiwan Mobile. Other investors including Oppenheimer and more than 400 family offices and high-net-worth individuals filled out the syndicate.

ENERGY IMPACT PARTNERS
Energy Impact Partners, a US-headquartered venture capital firm focusing on the energy transition, closed its EIP Deep Decarbonization Frontier Fund I at $485m with contributions from backers including software producer Microsoft, energy supplier Duke Energy and petroleum provider Williams Companies. EIP has already invested in 12 companies through the vehicle, also known as Frontier Fund.

ENERGY CAPITAL VENTURES
US-based early-stage venture capital firm Energy Capital Ventures, which focuses on environmental, social and governance imperatives and digital transformation of the natural gas industry, closed its debut $61m fund, featuring a group of publicly traded utility companies including Eversource Energy and National Fuel Gas, Avista Corporation, Black Hills Energy, NiSource, Southwest Gas and Spire.

TERNA FORWARD
Terna, the operator of Italy's national energy grid, launched a subsidiary called Terna Forward that will invest an initial €50m in startups, as part of a technological innovation push. The special purpose vehicle will target companies ranging from early-stage startups to large enterprises, making direct equity investments and offering project development support.

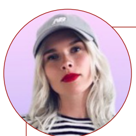
SOPOONG
Impact venture firm Sopoong raised $8m for its sixth fund, from LPs (limited partners), including petroleum refiner GS Holdings, chemical producer Isu and Asan Nanum Foundation, which was set up by carmaker Hyundai Group, *TechCrunch* reported.

People moves

> The year saw a number of shakeups in corporate venturing teams

GARETH BURNS, BP

Gareth Burns announced he was stepping down from his position as vice-president and head of Norway-based petroleum and energy producer Equinor's early-stage investment arm, Equinor Ventures. His new job was announced in the beginning of 2023. Burns joined BP's corporate venturing arm as vice president. As a result, Equinor Ventures is currently looking for a new leader.



EMILIE DANØ, ØRSTED

Maria Emilie Danø Hoffman was promoted from head of ventures and open innovation to director and head of global ventures and open innovation at Denmark-based electricity producer Ørsted. Hoffman began her stint at Ørsted in 2018, starting as a senior business developer and project leader for the offshore innovation group. She has since worked in various positions, including head of innovation and lead business developer.

ADEMIDUN EDOSOMWAN, VIVO ENERGY

Ademidun Edosomwan took up the head of new ventures role at UK-based petroleum business company Vivo Energy. Edosomwan had previously worked as managing director for TotalEnergies Ventures, the corporate venturing subsidiary of the France-based oil and gas producer TotalEnergies, for three years. In total, Edosomwan had served 16 and half years at TotalEnergies. She held various positions, including senior investment manager and senior legal adviser.

BURAK POWERS, LYONDELLBASELL

Burak Powers was promoted to strategy director of circular and low-carbon solutions at the Netherlands-based chemicals industry company, LyondellBasell. Powers began his stint at LyondellBasell in 2021 as the associate director of corporate strategy, before accepting his current position which requires him to support renewable energy solutions and oversee the company's corporate venture capital activities. Prior to this, Powers served six years at Australia-based mining corporation BHP where he held positions including principal analyst for strategy and portfolio development, and manager of portfolio strategy and development.

ANIL ACHYUTA, TDK VENTURES

Anil Achyuta, former investment director of energy and health tech at the corporate venture arm of the Japanese electronics maker TDK, was appointed investment managing director. Achyuta has been at TDK Ventures since its founding in 2019. As investment director he reviewed more than 2,000 startups, made 11 investments and achieved two exits. Investment director Tina Tosukhowong will take on Achyuta's investment portfolio. She will head up the entire cleantech practice and life sciences tech investments.

PHOEBE WANG, AMAZON CLIMATE PLEDGE FUND

Phoebe Wang left Shell Ventures, the corporate venturing arm of the Anglo-Dutch oil and gas corporation, to join Amazon Climate Pledge Fund. Wang will be an investment partner at Amazon Climate Pledge Fund, where she will focus on innovations in transportation and buildings, as well as food and agricultural sectors. She served nearly four years at Shell Ventures, working as the firm's investment director, where she developed and implemented investment strategies.

MELANIE BEYERSDORF, ENBW NEW VENTURES

Germany-based energy utility EnBW's corporate venturing unit, EnBW New Ventures (ENV), brought on renewable energy specialist Melanie Beyersdorf as investment manager. Beyersdorf joined the ENV team from infrastructure specialist Sentus, where she served as investment manager since early 2019, as part of the transaction team for renewable energy investments. Previously, she spent just over seven years at Allianz Climate Solutions – nearly two years as key account manager for Africa as part of the company's scaling-up renewable energy programme, and the rest as a senior analyst.

Global Energy Council

Kendra Rauschenberger
Vice president
Siemens Energy Ventures

Nicolas Sauvage
President
TDK Ventures

Kemal Anbarci
VP & managing executive
Chevron Technology Ventures

Sameer Kenkare
Head, corporate venture capital
Amazon

Stefan Gabriel
Managing director and CEO
Hitachi

Geert van de Wouw
Managing director
Shell

Anil Achyuta
Investment director
TDK Ventures

Matt Tsien
President
General Motors Ventures

Jim Gable
President of Chevron Technology Ventures and VP Innovation
Chevron

Global Corporate Venturing
Global Energy Council