

EI NEW ENERGY™

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ANALYSIS

Climate Week Urges Steely Resolve from All Players

Staying resolute in the transition away from fossil fuels — rather than sputtering in the midst of overlapping global crises — has been the prevailing theme at Climate Week in New York. Corporations, including oil companies, have been urged to stand strong on their emissions targets and chase next steps, such as deeper strategies around climate disclosure and carbon offsetting. Persistence has also been urged from investors and developers of low-carbon technologies, especially to scale them up and slash costs. And governments have been implored to hold the line in phasing out fossil fuels, despite geopolitical turmoil, rampant inflation and the food crisis.

Here are the areas receiving the most attention:

Corporate Action

Large corporations, including oil firms, have been called on to keep up the pace on net-zero emissions targets they've set in recent years. Helen Clarkson, CEO of the nonprofit Climate Group, criticized oil and gas companies that have proposed more exploration in the near or medium term. And Laura Corb, a senior partner at consultancy McKinsey, urged companies to get ahead now. "Set your sights on 2025 and 2030, not just 2030 and 2050," said Corb, who advises corporations on sustainability. "Real progress can, and needs to, be taken in the near term. Many footholds in the climate transition will be established early."

Carbon Offsetting

Carbon offsets have been touted repeatedly at Climate Week as a solution for companies to start deepening their progress now. Large oil firms are "already among the biggest buyers of carbon offsets in the world," says Francisco Benedito, CEO of the Climate Trade offset marketplace. The global offset market has been growing "exponentially since 2017" — and is only slated to grow further as net-zero targets approach their pinnacle in the decades ahead.

Crucially, many of the kinks and controversies surrounding offsets are being ironed out. A big concern is that some offsets are sold more than once or based on illegitimate projects, but Climate Trade works to circumvent this by verifying ownership and checking for fraud before an offset goes up for sale.

Next Steps on Disclosure

Climate disclosures are moving beyond just a data-gathering exercise toward an approach in which that data is applied to decision-making. Monitoring and reporting of emissions is "more than just putting out a single page or a few pages in your annual reports," said Matthew Linakis of Uncork, who advises companies on bespoke solutions

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RENEWABLE ENERGY PRICE PARITY

	Gas (\$/MMBtu)	CO2 (\$/ton)
Europe		
Market Price	32.14	70.53
Wind Onshore	0.84	0.00
Solar PV	-3.10	0.00
US		
Market Price	7.72	0.00
Wind Onshore	2.62	0.00
Solar PV	0.10	0.00
Japan		
Market Price	40.00	0.00
Wind Onshore	8.52	0.00
Solar PV	5.31	0.00

Market prices Sep 20. Table indicates either gas or CO2 price needed for new renewable energy to match profitability of new gas-fired power, without subsidies. High US carbon prices reflect low gas prices. Japan at parity so no carbon price needed. Source: Energy Intelligence

for tracking their emissions. Many environmental, social and governance (ESG) metrics should be watched closely and then used strategically, from carbon offset purchases to returns on low-carbon investments, he said.

Corporations should stand firm in their focus on long-term value creation to assuage future climate risk, says Rob Fisher, impact leader at advisory KPMG. And they should ensure this strategy is not forgotten when they think about “next quarter’s numbers” in the midst of short-term pressures. “There is only one economy we are going to have in the future, a low-carbon economy,” he said.

Technological Scale

Hopefulness was palpable about technological advances in areas like direct air capture, hydrogen, and electric vehicles. These are at varying stages of maturity but all marching forward — and working past growing pains.

Corporate members of the EV100, who have committed to fully electrifying their vehicle fleets by 2030, said their goals are already saving them money, but proving easier to achieve in some regions than others. Ikea said 17% of its home deliveries around the world are now done by EVs. Overcoming challenges around the availability of charging infrastructure has been a big focus area, in addition to buying the vehicles themselves. “We are not there yet, but we are on our way,” says Franziska Barmettler, the furniture giant’s interim global head of climate. Building up economies of scale is the main challenge across all low-carbon technologies, panelists agreed.

Political Vigilance

Russia’s invasion of Ukraine has highlighted the risk of relying on fossil fuels, especially imports, said Australian Minister for Climate and Energy Chris Bowen. He touted renewables as a “very secure” alternative to gas — assuming enough transmission and storage is in place. “There is no geopolitical crisis that can impact the flow of sun to our land mass or the stream of wind on our shores and on our land,” he emphasized.

The Climate Group’s Clarkson said many politicians who have proposed a loosening of fossil fuel restrictions have “good intentions” about keeping the heat on this winter. Yet while the Ukraine crisis has “reopened the conversation about fossil fuels, we cannot let the West backslide on this issue,” she said.

Mood Setter for COP27

Naturally, the speakers at Climate Week mainly comprised strong advocates of climate action. But, in the face of fracturing opinions on the right balance to climate action, it was clear many of them felt the need to defend their stances — including the notion that the Russia-Ukraine crisis should not foster greater reliance on gas or other fossil fuels.

Because this disagreement is unlikely to be resolved before the upcoming UN climate conference in Egypt, this is an important topic to watch as the big event approaches. The UN talks will also feature a heavy emphasis on climate finance, and given the location, many expect a more prominent seat at the table for oil industry players.

Lauren Craft, New York

POLICY

Saudi Arabia’s Energy Transition Ramps Up

Top oil exporter Saudi Arabia is pressing ahead with a range of initiatives aimed at helping it meet its 2060 net zero emissions target set in October last year. Progress is being made on landmark projects such as the pioneering Neom green hydrogen plant and large-scale renewables developments, while the introduction of nuclear power to the energy mix remains on the agenda.

At the same time, the Opec member has committed to further developing its massive hydrocarbon resources, which thanks to their low-cost, low-carbon characteristics are considered to be advantaged versus higher-cost, higher emission resources in a world that’s moving away from fossil fuels. These resources will also be needed if future energy crises are to be avoided and world energy requirements are to be met and remain affordable, Saudi Arabia argues — along with other oil and gas producers such as the United Arab Emirates.

Given a lack of investment in the upstream sector, global spare capacity is being eroded at a high pace, especially as demand for oil continues to grow. In response, Saudi Arabia has moved to expand oil production capacity to 13 million barrels per day from 12 million b/d by 2027. Implementing renewable energy plans and boosting gas output for domestic use are set to help free up another 1 million b/d of hydrocarbon liquids for export — demand for which Riyadh and other oil producers believe will continue for decades to come.

The president of Saudi Arabia’s King Abdullah Petroleum Studies and Research Center (Kapsarc), Fahd al-Ajlan, recently told Energy Intelligence in an interview that overall global investment in the energy sector, whether in renewables or upstream, had been lagging and contributed to the energy crisis the world is facing today. “We need investment in all forms of energy as we transition into a decarbonized world and achieve the net zero emissions goal,” he said.

At home, Saudi Arabia currently generates 49% of its electricity from gas and 51% from petroleum liquids, including crude oil, according to sources familiar with the matter. By 2030, it plans

to generate 45%–50% of its electricity from renewable resources and 50%–55% from gas, the sources add. With gas viewed as a transition fuel, this is part of the country's long-term goal of achieving carbon neutrality by 2060.

Renewable Energy Drive

Part of the renewable energy push in Saudi Arabia includes the construction of 70 renewable parks and \$100 billion worth of investments, according to industry sources familiar with the matter. So far, the kingdom has invested an estimated \$15 billion and has 15 projects with a power generation capacity of 7.1GW, the sources added.

“The targets are large and have to be done quickly ... and this is a challenge in terms of organization,” Robin Mills, CEO of consultancy Qamar Energy told Energy Intelligence, adding that it was a matter of making sure the plans stay on track. Saudi Arabia “is capable; what they struggle with is getting the tenders out and executing them in time. As they do, they will get better at it. I don't see a challenge in grid integration yet, but this will become one with time.”

With an eye on economic diversification, the kingdom's leadership hopes that — beyond producing cleaner energies — renewable projects will also help create much-needed jobs in the non-oil sector, which is in line with the economic reform “Vision 2030”, that was conceived by de-facto ruler Crown Prince Mohammed bin Salman.

One obvious area of interest for Mideast Gulf states is investing in solar power. Last year, the Sudair Solar PV project was announced, which is poised to become one of the largest single-contracted solar PV plants in the world with an installed capacity of 1,500 MW. The project is part of the renewable energy program backed by the Public Investment Fund (PIF), the kingdom's sovereign wealth fund, and is being managed by a PIF-backed consortium, led by Saudi-based Acwa Power.

Integrating Oil With Transition

With a view to keeping its hydrocarbon industry relevant, the kingdom is putting a greater focus on developing a circular carbon economy (CCE), which essentially seeks to reduce, reuse, recycle and remove carbon.

State-controlled Saudi Aramco has also set its own net zero target for 2050, a decade ahead of the state. Aramco recently published its inaugural sustainability report, outlining ways the company plans to achieve Scopes 1 and 2 greenhouse gas emission cut across wholly owned operated assets by 2050. These include the capturing, utilizing and storing of 11 million metric tons of CO₂ equivalent annually by 2035, the generation of 12 GW of solar and wind power by 2030, and reducing upstream carbon intensity by at least 15% by 2035. The company also aims to produce 11 million tons of blue ammonia annually by 2030.

Work is also ongoing on the country's sole green hydrogen and ammonia project at Neom, which is being viewed as a future benchmark for the region and beyond given its scale and built-in offtake. Execution of the \$54 billion scheme is proceeding with financial close due by year end.

Amena Bakr, Dubai, and Yusra Samaha, Dubai

TRANSPORTATION

China: BYD's Electric Car Sales Surpass ICE Rivals

Electric vehicle (EV) sales in China continue to ride on apparently unstoppable momentum — roaring to another all-time monthly sales record in August of 666,000 units, which is some 12% higher than the previous peak attained just two months ago.

More importantly, the oil demand erosion impact from EVs has reached a higher notch: Local automaker BYD, which only manufactures EVs, has snatched the crown for best-selling auto brand for two consecutive months since July, beating rivals which produce and sell both electric and conventional internal combustion engine (ICE) vehicles.

The smashing of EV sales records — in apparent defiance of multiple unfavorable factors such as economic headwinds, Covid-19 disruptions and power cuts last month in Sichuan province that affected the auto manufacturing chain — has by now become almost routine in China, where EVs have firmly entered the fast lane. Persistently high oil prices continue to benefit EV sales, helped by a slew of new models catering to a wide range of consumers' requirements and budgets, said the China Passenger Car Association (CPCA). Other factors underpinning the strong EV performance include continuous improvements in charging infrastructure availability and ongoing government policy support.

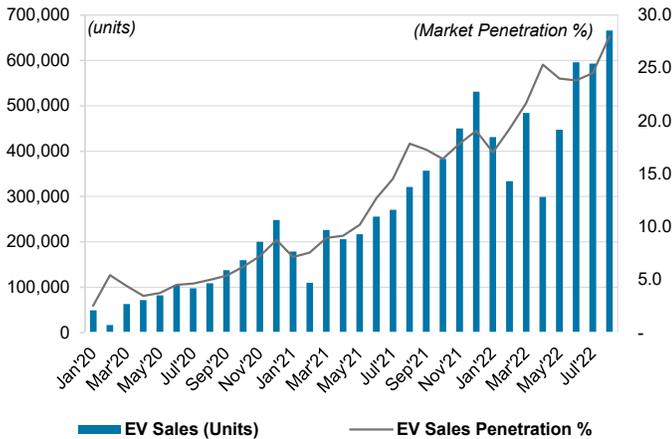
In the coming months, sales of EVs — comprising all-electric, plug-in hybrid and fuel cell models — are expected to remain “in full acceleration mode,” especially for smaller and budget-friendly models, the association predicts.

Penetration Exceeds Expectations

Brisk sales in August brought the EV market penetration rate to nearly 28% of all new automobiles sold for that month — which is another all-time high. That represented an increment of 10 percentage points from the year-ago penetration ratio.

Full-year EV sales in 2022 could reach 5.5 million units for a year-on-year rise of over 56%, the China Association of

CHINA EV SALES, MARKET PENETRATION



Source: China Association of Auto Manufacturers

CHINA DOMESTIC AUTOMOBILE SALES (UNITS)

	Aug'22	Y-o-Y % Change	Jan-Aug'22	Y-o-Y % Change
All Automobiles	2,383,000	32%	16,860,000	2%
ICEs	1,717,000	16%	13,000,000	-12%
EVs	666,000	100%	3,860,000	110%

Source: China Association of Auto Manufacturers

Automobile Manufacturers (Caam) has predicted. But combined automobile sales — including both EVs and oil-fueled vehicles — are expected to post much weaker year-on-year growth of only around 3% to a total of 27 million units, according to Caam forecasts. This means full-year EV sales penetration would average around 20%. In other words, one in five new cars sold in China during 2022 would be an EV.

EV Maker is Top Auto Seller

Shenzhen-based BYD — which has ceased production of internal combustion engine (ICE) vehicles since March — has good reasons to celebrate the success of its strategy. The company has snatched the crown for the best-selling auto brand in China — based on monthly retail figures — edging out strong rivals which produce both EVs and ICEs.

BYD posted August retail sales of nearly 168,885 units from all-electric and plug-in hybrid models for a 9% share of the domestic passenger vehicle (no larger than nine-seaters) market, according to data from the CPCA. Its closest rival is FAW-Volkswagen, a joint venture between China's First Automobile Works and the German automaker, which took 8.7% of August passenger car sales.

BYD's popularity in China has also exceeded that of Tesla in terms of monthly EV sales. The Chinese automaker has an advantage in that its sales figure includes both pure-electric and plug-in hybrid models, whereas Tesla can only capture the pure-electric market segment. The top two best-selling SUVs in China during August were both electric models — with BYD's plug-in hybrid Song in the lead, followed by Tesla's Model Y.

Record EV Exports

August was also a record month for EVs in terms of export volume. China exported 83,000 EVs last month, up by over 80% year on year, according to Caam figures. Tesla remains the top export contributor by selling over 42,000 units to overseas markets from its Shanghai Gigafactory in August, grabbing the lion's share of 51% of China's EV export volume. Another Shanghai-based automaker SAIC was a distant second, exporting over 15,000 EVs in August.

Despite its top position in the domestic market, BYD trailed at fourth place when it comes to export volumes, selling just over 5,000 units overseas in August. But the company is ratcheting up its overseas presence, announcing late last month that it would launch three fully-electric passenger cars this autumn for sales in Europe, two of which would be SUVs. The models to be offered in Europe "are well-suited to the expectations and needs of European customers with a premium feel and extensive specifications, making them accessible for large and diverse groups of customers," said BYD.

Kim Feng Wong, Singapore

POLICY

Utilities Cautious Over EU Tax And Solidarity Measures

Last week, the European Commission tabled its latest set of measures to help reduce bills for struggling consumers and businesses in the European Union. Brussels proposes a temporary revenue cap of €180 per megawatt hour (\$180/MWh) on "inframarginal" producers such as renewables, nuclear and coal-fired generators. Or basically, most generators that don't use gas. Money generated through this proposal could reach €117 billion a year, according to Commission estimates and would be used to bring down energy bills. The second item focuses on gas-fired generators. They will be subjected to a separate claw-back measure in the form of a "solidarity contribution." This measure "covers profits which are above a 20% increase on the average profits of the previous three years, at a rate of at least 33%," according to Brussels, and could generate €25 billion a year. The idea is to bring some top-down EU intervention into member states and fight the energy price crisis in a uniform, non-fragmented way. Revenues will be collected by member states and they have the final say on how funds are distributed.

Supporters of the measures say Brussels' proposals are workable and make sense. Opponents fear that low-carbon investments could be jeopardized as a consequence and implementation will be fragmented across the bloc. Europe's big utilities have been lukewarm at best in their support of the plans. Most have yet to

digest the implications of the measures proposed and have been relatively quiet in public comments on profitability and low-carbon spending plans in their wake. “I think the [€180/MWh] cap is set sufficiently high to prevent compromising renewable investments,” Simone Tagliapietra, senior fellow at Bruegel tells Energy Intelligence.

Utility Viewpoints

German utility E.ON tells Energy Intelligence that it hopes “the final version of the Council Regulation will minimize distortions and other unintended consequences of market interventions, while providing the much needed tools to tackle the current crisis and protect consumers.” Struggling French utility EDF tells Energy Intelligence that “the actual impact of a revenue cap for non-gas power plants is not clear and could vary greatly from one member state to another. While this measure aims to free up revenue to help households and businesses, it will not lower prices in electricity markets as such.” Denmark’s Orsted tells Energy Intelligence they weren’t ready to comment on the EC proposals yet. Spain’s Endesa has taken a similar standpoint, telling Energy Intelligence that “at the moment we are not making any assessment on the proposals announced by the European Commission or their potential impact.”

Some energy experts think the €180/MWh inframarginal cap will be an unsolvable puzzle. “We need to realize that it is very difficult to establish exactly what constitutes windfall profits for inframarginal generators. It requires a very precise disentangling of short and long-term trades and transparency of those trades. No regulator has the capacity to do this”, Bram Claeys, senior advisor at think tank Regulatory Assistance Project told Energy Intelligence.

Green Jeopardy

Lobby group WindEurope is concerned that member states could impose harsher rules and may continue to implement price caps already in place, ultimately endangering investment in renewables. “Investors need visibility. So an EU-wide cap on revenues from wind should be precisely that — a single EU-wide cap. Allowing countries to deviate from it and have lower caps creates confusion and uncertainty — and will slow down the investments we so badly need,” says WindEurope CEO Giles Dickson. SolarPower Europe, that sector’s lobby group, has similar concerns.

Paul Giesbertz, program manager for electricity markets at Energie-Nederland, thinks the measures are ill-conceived and will be difficult to oversee and implement. “It is practically impossible to measure market revenues for specific assets,” Giesbertz tells Energy Intelligence. Therefore it may be extremely difficult to work out how much utilities will have to pay back. Giesbertz adds that the measures are “counterproductive” because “the incentive to invest in the availability of inframarginal technologies is reduced. Consequently more gas-

fired generation is needed. Prices will go up and costs for society will go up.”

EDF tells Energy Intelligence that it thinks a better solution would be “to intervene at the European level on the price of gas for the production of electricity ... as has already successfully been carried out in Spain and Portugal.” The proposals will be voted on by the European Council at the end of the month. They need a qualified majority to pass.

Jason Eden, London

FRANCE

French Energy Systems Should Scrape Through Winter

France’s power and gas systems will be under stress this winter, but should remain balanced, system operators believe. They also warn that waves of cold weather could generate disruption and, potentially, trigger outages. But those can be avoided with relatively small doses of “energy sobriety,” such as temporary reductions in heating temperatures. Power system operator RTE and its gas counterparts GRTgaz and Terega unveiled their winter projections at two separate press conferences last week. They looked at a variety of weather and technical assumptions, such as nuclear availability, but assumed in every scenario that Europe would no longer receive Russian gas this winter — or anytime later.

Gas Projections

On the gas side, projections show that with average winter conditions, the system would be “just balanced,” said GRTgaz’s boss Thierry Trouve. This would include fully serving every segment of demand, notably combined-cycle gas turbines as much as needed by the power sector and gas exports to — instead of imports from — Germany.

Chancellor Olaf Scholz and President Emmanuel Macron agreed earlier this month that Germany would export electricity to France this winter in return for France sending gas to its eastern neighbor. GRTgaz is evaluating the feasibility of reversing flows between the two countries, Trouve said. He believes France will be able to export up to 100 gigawatt hours of gas per day to Germany soon, or the daily energy equivalent of four nuclear reactors.

A colder than average winter or a temporary cold wave would generate shortages of up to 5% of winter consumption, GRTgaz found. The system would however remain “manageable” as “we have levers” to adjust demand, Trouve said. Those include activating “interruption contracts” with industrial users whereby

200 GWh/day could be saved, and asking customers to temporarily reduce demand. Diminishing heating temperatures by 1°C can for example save 170 GWh/day. By comparison, the most severe case GRTgaz has been testing, a cold snap towards the end of winter, would generate a supply deficit of 260 GWh/day.

Power Management

The supply-demand situation and emergency tools would be comparable on the power side. As for gas, a supply deficit of usually less than 1% but possibly up to 5% could appear in case of very cold weather or events such as temporary gas shortage. That would never be for a full day but only during peak hours, between 8am-1pm and 6pm-8pm, said RTE boss Xavier Piechaczyk.

With a “red Ecowatt alert,” based on generally-reliable forecasts three days ahead, the system operator will warn of outages unless consumers adapt. RTE believes they could rapidly cut demand by 5 GW out of around 80-100 GW. Reducing heating temperatures by 1°C can for example save 2 GW. Likewise, reducing public lighting and just making sure the light is off in empty rooms and offices would save another gigawatt.

In addition, RTE can reduce consumption by almost 4 GW via demand-side management contracts many users have with their suppliers, and by another gigawatt via its emergency interruption contracts with a dozen power intensive companies. Those can be activated without notice in just 5 seconds. Finally, RTE can reduce voltage by 5% in the distribution grid, which is almost unnoticeable by users and would reduce total demand by around 4%.

Sobriety Plan

In addition to emergency measures, both RTE and GRTgaz hope the “sobriety plan” currently being elaborated by the government will trigger lasting demand cuts. It is targeting a 10% decrease in French energy demand within two years. RTE expects power demand could diminish by 5 GW during peak hours if, for example, enough users permanently set heating temperatures at 19°C — as recommended since the 1973 energy crisis — instead of the current 21°C or so. They would be called on to cut an additional degree for a few hours in case of a red Ecowatt alert.

WINTER IN FRANCE

Weather Condition	Gas Deficit	Hours of Power Emergency		
		High Nuclear	Base Case	Gas Shortage
Average Winter	0%	0	3	90
Cold Winter (2012-13)	2%	1	6	140
Very Cold Winter (2010-11)	5%	15	45	300

Gas and power winter outlook in France under various weather assumptions. Potential gas deficit in % of winter consumption. Power emergency measures involve public calls to reduce demand, activation of interruption contracts, voltage reduction and, as last recourse, outages. “High nuclear” means higher than expected nuclear availability. “Gas shortage” means Europe faces gas shortages. All projections and scenarios assume no Russian gas is supplied to Europe. Source: System Operators (RTE, GRTgaz, Terega)

Beyond 2022-23, both system operators are confident tension in the French energy system will ease. A new floating storage and regasification unit (FSRU) is expected to start receiving LNG at Le Havre next summer while biogas production, which remains small but becomes “visible,” will continue to grow, Trouve said.

The real fix to the energy crisis is electrification, Piechaczyk insisted. “We already knew we needed to phase out fossil fuels for climate reasons; we now know we need to do it for our independence and sovereignty, not to mention hydrocarbon prices which are set to stay high for quite some time.”

RTE expects the French power system will remain stressed for a couple of years due to “well identified short-term issues” regarding the nuclear fleet. Those include corrosion problems on some reactors and the fact that many of them are reaching 40 years of age and need life extension outages almost at the same time. “By 2024-25, the nuclear fleet should be closer to its full potential while renewables will continue to grow rapidly,” said Piechaczyk.

Philippe Roos, Strasbourg

NEW TECHNOLOGIES

Cost Cuts in Focus as Spotlight Shines on Geothermal

The US Department of Energy’s (DOE) launch this month of a new initiative to accelerate the development of geothermal technology shined a spotlight on an emissions-free energy source that has been gaining steam for years. The so-called “Enhanced Geothermal Shot” — fourth in the Biden administration’s ongoing series of “Earthshots” aimed at reducing emissions and fighting climate change — brought a new level of public support to the evolving technology and validates much of the work already well under way in the private sector.

New technologies to harness heat from the earth’s core and convert it into usable energy have opened the door to making this nearly inexhaustible resource widely available around the world. But there is a long road ahead, and making a breakthrough that is scalable and cost effective will not happen overnight. DOE’s focus is on reducing costs and improving technology readiness to get to a point where the vast promise of geothermal can start to be realized on a global level. By 2035, the department wants to cut the cost of enhanced geothermal energy by 90%, to \$45 per megawatt-hour.

‘Unprecedented Demand’

Prospects of doing so have improved in just the last couple of years thanks to higher demand for geothermal. “We are seeing

unprecedented demand for geothermal energy today,” Tim Latimer, CEO of geothermal start-up Fervo Energy, said at the DOE’s formal launch event in Houston. “We’re at a place where climate goals are getting more ambitious, energy security is more challenging, and geothermal is the answer that more and more power suppliers are turning to.”

Jack Norbeck, Fervo’s chief technology officer (CTO), noted the recent “massive increase” in new power purchase agreements (PPAs) signed by geothermal providers in the US. Between 2010 and 2019, Norbeck says, there were a total of 25 geothermal PPAs in the country. In 2020–21, there were eight new agreements. In 2022 alone, there have been 11 PPAs announced to date, for a total of 500 new megawatts (MW), Norbeck says. He expects another 800 MW in PPAs to be announced by early next year.

Investing in Depth

Investment appears to be following the demand. Big-name players, from upstream oil and gas companies to venture capital firms, are showing increased interest in geothermal. Fervo last month closed a \$138 million Series C funding round, with participation from oil-field services giants Liberty Energy and Helmerich & Payne. Shale E&P Chesapeake Energy last week struck a strategic partnership with Houston-based Criterion Energy Partners ahead of a planned pilot well in Texas.

Land driller Nabors Industries has invested in at least four early-stage geothermal tech firms and Baker Hughes this year led a Series A round for Greenfire Energy, a developer of closed-loop geothermal systems focused on retrofitting non-producing wells.

Despite the excitement, geothermal projects are still widely seen as risky, says Benjamin Burke, CTO of Denver-based Transitional Energy. Investors need to see that “geothermal in general is something that can be invested in without it seeming new or uncertain,” he said during a roundtable discussion with US Energy Secretary Jennifer Granholm in Houston.

Cost Control

The private sector is showing its potential for cost reduction. Alberta-based Eavor Technologies is currently drilling a well in New Mexico to help prove up its “advanced geothermal” concept that involves fracturing heat reservoirs to increase permeability. The real innovation in that project, according to a source familiar with it, appears to be the well design. Eavor is drilling

MUTUAL INTEREST: COMPANIES LEVERAGING EACH OTHER’S SKILLS

Services Company	Geothermal Investments and Partnerships
Baker Hughes	Greenfire Energy, CausewayGT
Helmerich & Payne	Fervo Energy, Greenfire Energy
Nabors	GeoX Energy, Sage Geosystems, Quaise Energy, GA Drilling
Patterson-UTI	Criterion Energy Partners
Petrofac	CeraPhi Energy
Precision Drilling	Eavor Technologies
Schlumberger	GeothermEx*, STEP Energy

*wholly owned subsidiary. Source: Energy Intelligence

the well some 23,000 feet deep using casing made of an epoxy rather than steel, an innovation that could “drastically” reduce well costs if it works, the source said.

The DOE has committed more than \$280 million to research and development (R&D) projects, including the launch last decade of the Frontier Observatory for Research in Geothermal Energy (Forge) project in Utah, which aims to accelerate and improve understanding and capabilities around emerging geothermal technologies. Granholm says supporting Forge is one of the ways the DOE is trying to drive down geothermal costs.

But some observers worry the DOE commitments to date fall short of the industry’s funding requirements. The nonprofit Clean Air Task Force has recommended \$2.5 billion in public investment between 2024 and 2028, with about \$2.3 billion needed for demonstration projects and \$250 million for R&D over that period. Roland Horne, a professor of earth sciences at Stanford, says most enhanced geothermal projects have been “one-off,” which he says does little to alleviate the perception of resource risk. “What we need with risk is to roll the dice more times,” he told Granholm.

Workforce Crossover

The oil and gas industry may hold the key to unlocking the next wave of geothermal development. Workforce expertise in drilling, reservoir characterization and subsurface fluid flow, among other things, translates directly to geothermal. “The technology that has transformed the shale industry will work for the same reasons for geothermal,” Mark McClure, CEO of ResFrac, a supplier of reservoir modeling software, told the roundtable. “What I’ve seen is that oil and gas industries are eager to jump in and do that.”

Luke Johnson, Houston

IN BRIEF

Norwegian Fund's Green Plan

Norway's \$1.2 trillion sovereign wealth fund has set a target that requires all companies it invests in to reach net zero emissions by 2050 at the latest, as part of a new climate action plan announced this week. Norges Bank Investment Management (NBIM), which manages the Government Pension Fund Global (GPF), said it will press companies to reach the goal by setting "credible" interim targets and requiring cuts in both direct and indirect emissions. "The fund has a clear financial interest in the goals of the Paris Agreement being reached. Our analyses show that a delayed climate transition is what constitutes the greatest financial risk for the fund," NBIM said. CEO Nicolai Tangen said the fund's long-term returns would depend on how companies in the portfolio adapted to a zero-emissions society.

Shell Eyes DAC Opportunities

Shell is in the early development phase for potential applications of direct air capture (DAC) technology as part of its broader efforts to lower emissions, according to a company official. Speaking at a breakfast event in Houston last week, Shell's Vice President of Energy Transition Aura Cuella said the company "fully believes" that carbon capture and storage (CCS) and DAC are an essential part of the solution. Shell operates the Quest CCS enhanced oil recovery project in Canada and is a partner in the Chevron-led Gorgon natural gas development in Australia. It has seven other CCS projects in development globally, according to its website. The London-based supermajor has not spoken much about its interest in DAC specifically, although industry observers believe the company has been working on it behind the scenes.

Chesapeake Eyes Geothermal

US shale giant Chesapeake Energy has formed a strategic partnership with Houston-based Criterion Energy Partners to deploy and develop technologies for geothermal energy projects. Chesapeake's involvement in the partnership includes an

investment to assist in the planning and preparation for an initial geothermal test well. The news comes as excitement builds around emerging geothermal technologies that could potentially greatly expand the availability of clean baseload power supplies. Like other oil and gas companies, Chesapeake has identified geothermal as an attractive fit with its existing skillset and energy transition ambitions, although details of the company's investment in Criterion have not been disclosed. Criterion noted that Chesapeake "brings extensive experience in subsurface evaluation, drilling and completions" to the partnership. Chesapeake will have the option to participate in additional future development projects under the terms of the partnership, Criterion added.

CCS Challenging for Browse

Incorporating carbon capture and storage (CCS) to the stalled US\$20.5 billion Browse project offshore Western Australia is proving to be a challenging task, according to Woodside Energy's final environmental report for the proposed Browse to North West Shelf (NWS) project. Woodside CEO Meg O'Neill has said several times in recent months that the 8%-12% CO2 contained in the Browse fields needed to be managed for the project to move forward. "Geo-sequestration was assessed as presently being a high-risk, high-cost mitigation option for Browse reservoir CO2 [carbon dioxide]," Woodside said in its environmental report, repeating almost word for word what it concluded back in 2019 in its draft environmental report. Woodside also said, "CCS for an offshore floating facility remains technically challenging," adding that CCS technology will improve.

CO2 Removal Interest Soars

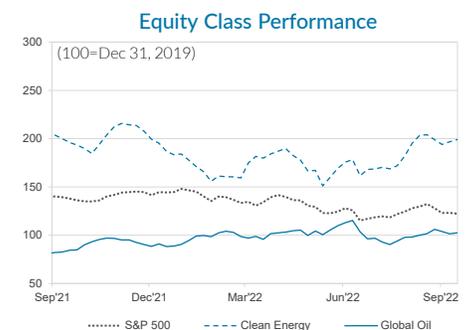
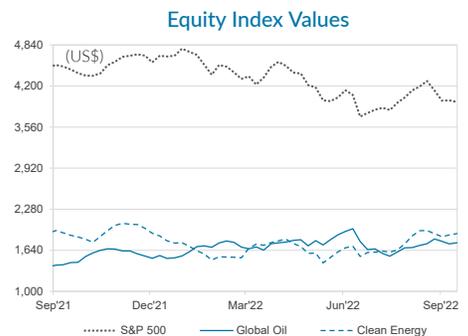
Venture-capital (VC) investor interest in carbon removal hit an apparent record high in the second quarter of this year with nearly \$900 million in funds raised over the three-month period, according to a recent report. Private-capital research and data firm Pitchbook found that some \$882.2 million of VC investment flowed

into carbon capture startups across 11 deals announced between April and June, dwarfing any previous quarter. The prior four quarters combined saw less than half of that total invested, at \$432.1 million, according to Pitchbook.

Korean Nuclear Green Label

South Korea has included nuclear power in a revised draft of its sustainable and green energy taxonomy, reversing its previous position. The environment ministry has classified research and development of technologies such as small modular reactors and accident tolerant fuels as green. Construction and operation of nuclear reactors were classified as transitional activities, which can be removed from the taxonomy in the future. The inclusion of nuclear power in the green taxonomy is not surprising as the new administration led by President Yoon Suk-yeol had pledged to revive nuclear power in the country. Seoul was also influenced by the EU's green taxonomy, which was finalized in July.

CLEAN ENERGY EQUITY MARKETS



Source: S&P Global

EI NEW ENERGY DATA

ENERGY FUTURES: REFERENCE PRICES

	Sep 16	Sep 9	Chg.
Carbon (€/ton)			
ECX EUA	71.45	69.00	+2.46
CME GEO (\$/offset)	4.17	4.08	+0.09
Crude oil (\$/bbl)			
Nymex light, sweet	86.76	84.79	+1.97
ICE Brent	92.69	91.71	+0.98
Natural gas (\$/MMBtu)			
Nymex Henry Hub	8.35	7.97	+0.37
ICE UK NBP	41.05	48.30	-7.25
Coal (\$/ton)			
McCloskey CSX	205.00	204.00	+1.00
ICE Rotterdam	333.84	362.71	-28.87

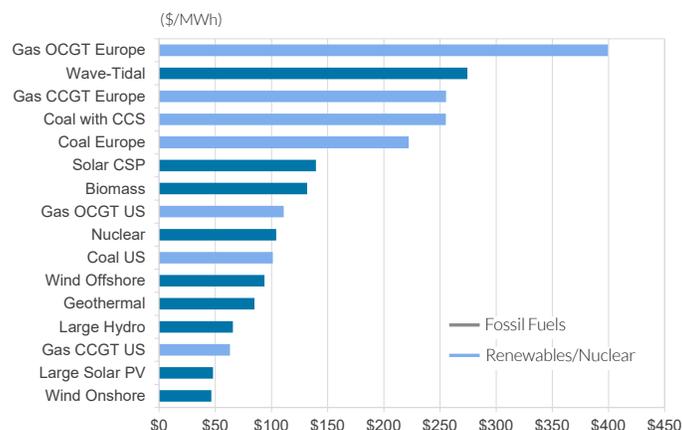
All prices are weekly averages and front-month. EUA = EU Allowances; GEO = Global Emissions Offset. Replaces ECX CER starting 3/30/21. ICE UK gas converted from p/therm. *Short tons. Source: Exchanges

GLOBAL ELECTRICITY PRICES

	Sep 16	Sep 9	Chg.
Europe (\$/MWh)			
Germany (EEX)	261.44	409.25	-147.81
France (Powernext)	357.52	429.61	-72.09
Scandinavia (Nordpool)	101.03	314.13	-213.11
UK (APX)	346.17	323.94	+22.23
Italy (GME)	413.16	465.15	-51.99
Spain (Omel)	142.60	157.40	-14.80
North America			
New England	74.18	75.38	-1.20
Texas (Ercot)	58.68	76.36	-17.67
US Mid-Atlantic (PJM West)	108.28	99.75	+8.53
US Southwest (Palo Verde)	72.00	407.70	-335.70
Canada (Ontario)	46.09	63.26	-17.17
Other			
Australia (NSW)	104.94	108.85	-3.92
Brazil (SE-CW)	10.73	10.71	+0.03
India (IEX)	53.74	91.10	-37.36
Japan (JPX)	216.03	187.93	+28.10
Singapore (USEP)	155.05	168.98	-13.93

Weekly average of wholesale prices. Source: Exchanges

NEWBUILD POWER GENERATION COSTS



Source: Energy Intelligence

DATA: The complete set of EI New Energy data is available to web subscribers, including historical and forecasted levelized cost of energy (LCOE) calculations, EV sales, our Green Utilities rankings, fuel switching thresholds, electricity production by sector, ethanol and biodiesel fundamentals, carbon and energy prices, along with methodologies and reader's guides. The New Energy Data Service can be accessed [here](#).

LATEST INDICATORS: SALES AND FLEET PENETRATION OF EVS

China		US	
NEV sales Jun '22	596,000	EV sales June '22	74,211
% LDV sales NEVs Jun '22	23.8%	% LDV sales NEVs June '22	6.59%
NEV sales Jan-Jun '22	2,600,000	EV sales May '22	73,608
% LDV sales NEVs Jan-Jun '22	22%	% LDV sales NEVs May '22	6.66%
Total NEV fleet as of Jun '22	10,010,000	Annual EV sales 2021	605,958
% fleet NEVs	2.5%	% LDV sales NEVs 2021	4.14%

Europe (EU, UK, and EFTA)

Sales Penetration		NEVs = all New Energy Vehicles. EVs = plug-in hybrids and all-electrics. LDVs = light-duty vehicles. EFTA includes Norway, Switzerland, Iceland, Liechtenstein. Sources: China Association of Automobile Manufacturers, China Passenger Car Association, US Alliance for Automotive Innovation, US Argonne National Laboratory/Wards Auto, European Automobile Manufacturers Association
EV registrations Q2 '22	560,266	
% LDV sales EVs Q2 '22	19.69%	
EV registrations Q1 '22	562,276	
% LDV sales EVs Q1 '22	20.47%	
EV registrations Q2 '21	574,626	
% LDV sales EVs Q2 '21	14.44%	

GLOBAL CARBON PRICES

	Sep 20	Sep 13	Chg.
Europe (€/ton)			
EUA Dec '22	71.14	69.75	+1.39
US (\$/ton)			
CCA (Calif.) Dec '22	27.35	27.52	-0.17
RGGI (Northeast) Dec '22*	13.25	13.39	-0.14
New Zealand (NZ\$/ton)			
NZU (spot)	82.75	84.00	-1.25
Asia (\$/ton)	Sep 16	Sep 9	Chg.
China-Guangdong	8.31	8.38	-0.07
South Korea	19.43	19.64	-0.22

Benchmark months. *Short tons; all others metric tons. Source: ICE, OMF

EU CARBON FUTURES PRICES



ECX front-month futures. Source: ICE