

EI NEW ENERGY™

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CONTENTS

- 3** US CLIMATE EMERGENCY DECLARATION?
- 4** JUST THINK, POWER ACROSS THE SEAS
- 5** MOTIVATIONS MOUNT FOR UK ACTION
- 6** GERMANY PROVIDES STARK LESSON
- 6** IN BRIEF: CANADA WEIGHS OIL GHG CAP
- 8** EI NEW ENERGY DATA

POLICY

Extreme Weather Keeps Climate at the Forefront

Extreme weather events this summer are serving to keep climate change at the top of political discourse. This is forcing decision-makers to factor it within crowded agendas — including war, energy security and rampant inflation. In the UK, headline-grabbing fires and temperatures could moderate some of the country's drift back toward fossil fuels seen in the wake of the Ukraine crisis. In the US, severe weather appears more to be deepening political polarization. It is reinforcing those calling for stronger climate action, while skeptics are urging a laser focus on energy security while noting that no individual weather event can be definitively linked to the changing climate.

Some of this year's striking weather-related events include:

- The London fire brigade has recently been its busiest since the Blitz during World War II, with fires breaking out across the city and first-time recorded temperatures above 40°C.
- In Japan, the rainy season ended earlier than usual and the country has experienced intense heat since end-June, the worst since 1875. It has prompted warnings of a power crunch in the summer and triggered calls for power conservation. It's a similar situation in Korea.
- India, Pakistan and Bangladesh have experienced heat waves since May, which started earlier than normal. In India, it didn't rain in March so it was hotter — the average temperature in March was recorded as the highest in 122 years. Many other Asian countries are experiencing heat waves now, including China, Japan and South Korea.
- Wildfire season has already started in the western US, affecting states like California, New Mexico, Arizona and Texas. Further east, the Atlantic hurricane season in the coming months is expected to be above average in severity.

“Climate change is driving this heat wave, just as it is driving every heat wave now,” said Friederike Otto, co-lead of World Weather Attribution, in a statement about the unprecedented temperatures across Europe in recent days. “Heat waves that used to be rare are now common; heat waves that used to be impossible are now happening and killing people.”

Europe: Trend Reinforced

Climate never fell down the agenda in Europe, as the Ukraine war and security of supply issue strongly reinforce the trend toward more renewables and more energy savings. To be sure, Europe will push coal-based power generation this year and probably for a few years, but this is not considered a pushback on climate action — green activists are of course lamenting, but that's their role. Crucially, Europe plans to import

>> *continued on page 2*

REGIONAL POWER GENERATION COSTS

(\$/MWh)	US	Europe	Japan	Asia	Mideast
Large Solar PV	37	70	117	37	32
Wind Onshore	41	54	83	47	61
Large Hydro	58	76	78	47	93
Gas CCGT	59	224	211	197	193
Coal	73	208	96	66	145
Geothermal	85	85	127	38	163
Wind Offshore	95	93	192	110	102
Nuclear	104	104	118	58	87
Gas OCGT	105	352	325	312	305
Solar CSP	116	176	NA	188	115
Biomass	132	132	132	108	125
Coal w/ CCS	142	240	195	137	254
Wave-Tidal	274	274	268	260	260

Levelized cost of energy, or cost of generating electricity over lifetime, including capital, operating, fuel and carbon costs. Dvlp. Asia = developing Asia, mostly China and India. Source: Energy Intelligence

more gas for now not because it wants to use more gas but, naturally, because it needs to substitute some Russian gas — and ultimately the intent is to use less gas.

European officials and leaders in countries most affected by recent weather have explicitly linked the extreme events to the climate crisis. “It is clear these erratic weather patterns are a consequence of the climate crisis,” Frans Timmermans, executive vice president of the European Commission in charge of the European Green Deal, said recently. Visiting areas hit by wildfires, French President Emmanuel Macron said these were a consequence of climate change. And declaring a state of emergency after a glacier collapse and severe drought in Italy, Prime Minister Mario Draghi said there was “no doubt” this is linked to the “climate situation.” Similarly, Spain Prime Minister Pedro Sanchez has stated that “climate change kills,” while his Portuguese counterpart Antonio Costa argued that there’s “no time to lose” in taking steps to address this.

The UK is currently focused on a leadership campaign to succeed outgoing Prime Minister Boris Johnson. He championed climate action but there have been some concerns that the two contenders to replace him might dilute some green measures as they seek support within the ruling Conservative Party. However, recent polling suggested any new Prime Minister can’t lose sight of climate goals — with 70% of voters viewing climate change as a driver of the recent unprecedented temperatures in the UK, and more than half saying the heat wave makes them think governments and societies need to be more ambitious in tackling climate change, according to think tank The Energy and Climate Unit.

On Washington’s Radar ...

In recent years, extreme weather is among several factors cited for a palpable yet gradual leftward shift in Washington on climate issues. Once reluctant Republicans have been acknowledging the need to address warming and a wider swath of Democrats are backing more drastic action to end fossil fuels. Since Biden’s inauguration, however, climate and energy have been nothing if not divisive, and that leftward shift has blurred.

While extreme weather events have lessened the tendency of GOP lawmakers to deny climate science in recent years, overlapping factors are at play, making the trend far from clear or linear. Notably, skyrocketing fuel prices and national security concerns in light of the Ukraine crisis have caused many congressional Republicans — plus centrist Democratic Senator Joe Manchin — to double down on resisting clean energy policies.

Wildfires and storms may become more relevant to US climate policy should the Biden administration opt to declare a national climate emergency, as some green groups have pushed in the wake of climate legislation collapsing earlier this month, which would unlock more authority for the administration to take stronger climate action. Legally speaking, climate change may not fit the textbook definition of “emergency,” which requires some-

thing to be “unforeseen,” and climate change is not a new federal concern, academics note. Yet pointing to record-smashing heat, deep freeze storms, and hurricanes seen in recent years could bolster the legal case.

US national security agencies have long pointed to extreme weather events as a national security threat, notes Dan Farber, a Berkeley Law professor. “In written testimony to Congress about threats to national security, the Trump Administration’s own Director of National Intelligence discussed climate change,” Farber wrote earlier this month in the *Legal Planet*. “His discussion didn’t equivocate about the reality or dangers of climate change. Rather, he took the science, and the threat, seriously.”

Biden, in remarks on climate action last week, leaned into recent examples of extreme weather: “We see here in America, in red states and blue states, extreme weather events costing \$145 billion ... powerful and destructive hurricanes and tornadoes.” He was citing the annual 2021 cost estimate from the National Oceanic and Atmospheric Administration on the impact of storms, fires and floods, which is the third-highest level seen since 1980. “I’ve flown over the vast majority of them out west and down in Louisiana, all across America. It’s amazing to see. Ravaging hundred-year-old droughts occurring every few years instead of every hundred years. Wildfires out west that have burned and destroyed more than five million acres — everything in its path.”

US national security is at stake as well, Biden argued. “Extreme weather is already damaging our military installations here in the States. And our economy is at risk. So we have to act. Extreme weather disrupts supply chains, causing delays and shortages for consumers and businesses.”

... and Radar of US Voters

High-level government officials aren’t the only ones taking notice. A recent survey of registered US voters by Navigator, designed as a guide for climate advocates, finds that 55% of independent voters believe this summer’s weather has been different from past summers — a 12-point jump from last year. Of those voters, slightly higher percentages cited more droughts, wildfires, and tornadoes than last year’s survey for the same time frame. “Those who say that the weather in their community has changed are most likely to cite hotter temperatures and increased droughts and wildfires,” the Navigator report says.

Texas voters feel similarly. A poll conducted in February — nearly a year after a severe winter storm ravaged the state — found that 70% of Texas voters remain worried about a grid failure, and 64% connected the storms to climate change. The poll surveyed 933 registered Texas voters and was conducted by Nexus Polling, the Yale Program on Climate Change Communication and the George Mason University Center for Climate Change Communication. Of those polled, 55% responded they would prefer their energy provider use “renewable energy like wind and solar” compared to 4% who choose coal and 24% natural gas.

Competing Priorities

No matter the region, the picture is far from simple because climate and weather are competing for attention with many other priorities, from war to energy security to inflation. But extreme weather certainly keeps climate at the front lines of political discourse and compels decision-makers to factor it within already-packed agendas, especially given a growing perception that climate action can work complementarily with other priorities.

“The extremes of the debate will not be shifted — those [protestors] who were already gluing themselves to Shell headquarters will continue to do so — and those who argued that it is ‘just weather’ will not shift. My sense is that the softer center of the political spectrum can be swayed by such growing, concrete evidence,” says Alex Martinos, Head of Energy Transition Research at Energy Intelligence. Extreme weather will “not wipe off” other issues from the agenda and the memories of extreme weather are bound to fade. But the examples and imagery can still be referenced, especially if they recur, Martinos adds.

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POLICY

Biden Weighing ‘Climate Emergency’ Declaration

US President Joe Biden’s administration is weighing how to add some fresh firepower to US climate policy, with clean energy legislative efforts again falling flat in the US Congress. Top of mind in Washington in recent weeks is the notion of a formal “climate emergency” declaration under the National Emergencies Act, which several environmental groups have urged in recent months. The idea of an emergency declaration, which a US president can use to activate a more robust suite of executive authorities than they would normally possess, has gained a surge of momentum following centrist US Sen. Joe Manchin’s rejection of a climate and energy package due to his concerns about rising inflation numbers. While Manchin left the door open to revisit his position on a climate bill in September — after the Senate returns from recess and July’s inflation data has been published — the stalled legislation has reinvigorated the debate around executive climate action.

Biden on Jul. 20 announced the administration would be pursuing new executive action on climate change over the next several weeks, calling it a “clear and present danger.” So far, those steps — expanding offshore wind leasing in the US Gulf of Mexico, new funding for helping communities with extreme weather preparedness and low-income home energy programs

— fall far short of an emergency declaration. Biden has since told reporters he is “running into traps on the totality of the authority I have.” Likewise, US Climate Envoy John Kerry says the administration is “very close” to an emergency declaration but acknowledged there are internal divisions on the issue.

Legislation vs. Emergency Declaration

The stalled legislation would have unleashed a spate of expanded and powered-up tax credits for clean energy technology. Without these, a recent Rhodium Group report found that the Biden administration would fall short of its topline goal of slashing 50%-52% of emissions by 2030 versus 2005 levels. Biden doesn’t have great options for replacing the infusion of funding that tax incentives would have provided, because Congress controls the power of the purse. But an emergency declaration could help somewhat.

The Defense Production Act could be leveraged under emergency authorities to respond to “industrial shortfalls” by expanding battery or electric vehicle production, or to hand out loan guarantees to support critical industries, according to Dan Farber, a University of California at Berkeley School of Law professor. Last month, the administration did activate the defense law — citing the Ukraine crisis — to ramp up solar, electric grid components, heat pumps, electrolyzers, fuel cells and other clean energy technologies.

But activating emergency authorities would unlock additional emergency DPA provisions that could hurry things along. The “DPA could help fill part of the gap,” but “legislation can do things that simply can’t be done by the executive branch acting alone,” Farber adds. According to a Center for Biological Diversity (CBD) report from earlier this year laying out the case for an emergency declaration, the “president can leverage DPA funds and the federal procurement budget of \$650 billion per year to purchase these technologies and allocate them in federal agencies and in partnership with priority environmental justice communities and public entities.” The administration could also use emergency powers to block fossil fuel exports, leasing or trade, although it is not clear it would take those steps given concerns about fuel prices ahead of US midterm congressional elections.

Pros and Cons

While some — including congressional Democrats and groups like CBD and the League of Conservation Voters — have fought for an emergency declaration, other progressive interests are hesitant. According to that line of thinking, there is a lot more the administration can do outside the auspices of a formal emergency designation. Further, formalizing powers under the National Emergencies Act ups the political ante in a way that could harm future chances of comprehensive climate legislation, they argue.

Bridget DiCosmo, Washington

POWER

Imagine Electricity Flowing Across Oceans

Green hydrogen is often touted as the best way of moving renewable electricity around the world, but underwater power cables are another viable option. Experts say moving electricity through high-voltage lines is quite feasible — and proven — from a logistical standpoint. The costs are competitive in certain scenarios and less competitive in others, depending on the distance involved.

Hydrogen vs. Long-Distance Power

Even if everything electrifies, many experts have been saying that hydrogen is needed and will be extensively traded. This is because locations such as Europe or Japan likely cannot generate enough renewable power domestically and would need to import large amounts of green energy from sunny places such as the Mideast or Australia, they argue.

Hydrogen and derived molecules such as ammonia are frequently claimed to be the best — if not the only — way of doing so. But electricity can also be exported directly via cables, which can learn from the much older technology of telecommunication submarine cables. More than a million kilometers of those currently sit in the globe’s oceans.

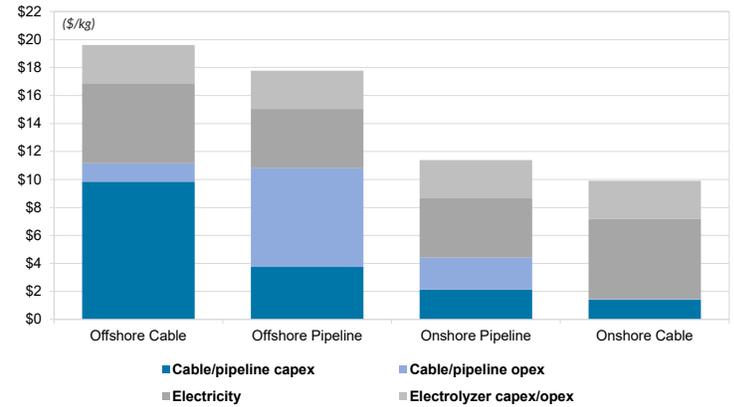
Momentum Building

The AAPowerLink project, which is expected to transmit 2 gigawatts of solar electricity from Australia to Singapore through a 4,200 kilometer (2,600 mile) subsea cable, may still be seen as hypothetical. That’s despite the fact that it involves reputable partners such as the US’ Bechtel and Australia’s Macquarie Capital. Construction is only planned to commence in 2024 and full operation in 2029. But thousands of kilometers of power cables are already in use globally, mostly in Europe, where the first 90 km submarine line was laid down in 1954 between mainland Sweden and the island of Gotland.

While the majority of subsea power cables span less than 200 km, some are much longer. These include the 720 km North Sea Link between Norway and the UK, the 580 km NorNed between Norway and the Netherlands, and the 500 km NordLink between Norway and Germany. The 740 km Viking Link is currently under construction between Denmark and the UK. It is expected to be commissioned by the end of next year, at which point it would be the longest existing subsea cable, Philip Sandy, head of new interconnectors at the UK’s National Grid, tells Energy Intelligence.

Looking forward, the proposed EuroAsia interconnector, which was recently awarded €657 million (\$670 million) under the

EXPORTING GREEN HYDROGEN



Levelized cost of green hydrogen using electricity generated 4,000 km away from hydrogen demand, in \$ per kilogram. Hydrogen is either produced near the point of power generation and exported by pipeline, or produced near the point of consumption with electricity exported by cable. Source: International Journal of Hydrogen Energy (April 2021)

EC’s Connecting Europe Facility, will consist of a 900 km Greece–Cyprus section and a 310 km Cyprus–Israel section. It will be the deepest power cable ever laid, with a part 3,000 meters below sea level. “Other than cost, I wouldn’t say there’s any particular challenges associated with length, and there’s vessel technology out there capable to lay up to 3,000 meters deep,” Sandy notes. Similarly, submarine cable maintenance is “well understood.”

Cables Cheapest, to a Point

In a recent report, a group of Spanish and Norwegian researchers compared the cost of exporting green energy overseas either as electricity in a cable, gaseous hydrogen in a pipeline or liquefied hydrogen in special ships. They found that cable is the cheapest option for all distances under around 2,000 km. Beyond that, liquefied hydrogen becomes more competitive. This is because investment costs in the liquefaction value chain are independent from distance as the same ships can be used regardless of how far they have to travel, and while there are transportation-related operating costs involved in this, operating costs are always small compared to investment costs. By contrast, investment costs increase linearly with distance in the case of cable or pipeline — the longer they are, the more expensive they are to build. Power losses in cables also increase with distance. They could for example reach 13% for AAPowerLink, according to Jens Peter Kjaergaard of Denmark’s grid operator Energinet.

Growing Up to Do

The problem with liquefied hydrogen is that the technology is far from being mature. “Making LNG costs about 11% of its energy content versus 35%–40% for liquefied hydrogen,” says Engie’s Didier Holleaux. The company knows of prospects in the window of 20% or so for liquefied hydrogen production, which “would be more reasonable, but having the

adequate ships will be extremely challenging.” A first — and relatively small — carrier was however launched in 2019 in Japan, and a first cargo was shipped between Australia and Japan earlier this year.

Pipelines were never found to be the cheapest option in the Spanish–Norwegian report, but its authors did not consider repurposed natural gas pipelines. Those could be the best option between North Africa and Europe, Holleaux believes. Repurposing existing pipelines is two to three times cheaper than building new ones, according to French transmission system operator GRTgaz’s Anthony Mazzenga.

Tradeoffs

One key benefit of pipelines over cables is their much higher energy density and transmission capacity. This explains why power cables are more expensive to build on a per kilowatt basis. Large power cables typically feature 1 GW–2 GW of capacity. By contrast, the equivalent capacity of major gas pipelines such as Nord Stream or Yamal–Europe is well over 50 GW.

Obviously, the competitiveness of hydrogen versus cable transmission very much depends on how the energy is to be used, says Kjaergaard. If importers need hydrogen, a recent paper by Singaporean researchers suggests it is cheaper — but only slightly — to produce it on the power generation side and use a pipeline to export it. But if importers want electricity, a cable is probably better. Burning hydrogen in a power plant would only achieve around 50% efficiency. The other 50% is heat, which is usable but only in certain applications. “In this sense, the submarine cable alternative presents a higher quality than the energy received in the form of hydrogen.” A more effective option in the future could involve fuel cells, where the conversion efficiency of hydrogen’s energy content could reach 95%.

Philippe Roos, Strasbourg

POLICY

UK Sees Rising Motivations to Act

Energy security and transition plans are progressing in the UK against the backdrop of a Conservative party leadership contest and rising political pressures to act. Prime Minister Boris Johnson is set to be replaced in early September by either ex-Chancellor of the Exchequer Rishi Sunak or Foreign Minister Liz Truss. The last week has seen a number of low-carbon policy developments — including a hydrogen funding road show, planning permission for a new nuclear power station and some 8 gigawatts of offshore wind capacity. All of these moves are

designed to both advance the energy transition — especially in the face of wildfires and record heat — while reinforcing energy security in light of the Ukraine crisis.

Green and Blue Hydrogen

For sectors not suited to hydrogen, London says green and blue hydrogen are vital to achieve net-zero carbon emissions in 2050. In April, the government outlined plans for up to 10 GW of hydrogen production capacity by 2030, with “at least half from electrolytic” sources. Last week, the government announced more details of its funding programs for hydrogen, including a £240 million (\$287 million) grant program — Net-Zero Hydrogen Fund — and a revenue-supporting Hydrogen Business Model, offering similar contracts-for-difference to those supporting large-scale renewables such as offshore wind farms. London says “this is a major next step in delivering the government’s ambition to have 1 GW of electrolytic — or green — hydrogen in operation or construction by the end of 2025.”

Business Secretary Kwasi Kwarteng says the government’s package of financial grants and revenue support schemes should help attract up to £9 billion (\$11 billion) in private sector funds. The government has also appointed Jane Toogood, chief executive of catalyst technologies at Johnson Matthey, as the UK’s first hydrogen champion, tasked with driving the industrial development of clean hydrogen in the UK. London also published updated numbers on what can qualify as low-carbon hydrogen. This will have important ramifications for the production of blue hydrogen in the UK, which is supported by the government and by European oil majors including BP, which has huge blue hydrogen projects — using natural gas and carbon capture and storage — planned for industrial clusters in the UK. Latest guidance from the government states that any hydrogen produced with less than 20 grams CO₂ per megajoule to be classified as “low-carbon hydrogen” and thus able to seek government support.

Offshore Wind

Harnessing wind across the seas is another top priority. Conservative leadership candidate Rishi Sunak is backing a huge expansion of offshore wind capacity in the UK, while vowing to get rid of proposed location rule changes that would have made it easier to build onshore wind farms. The UK has raised offshore wind targets repeatedly in the last couple of years. The newest target is 50 GW by 2030, including 5 GW of floating wind capacity, supported by very low offshore wind costs in recent auction awards. Last week, London granted planning permission for 8 GW of offshore wind capacity at six sites, enough to power 7 million UK homes. Oil major BP is a partner with German utility EnBW in two of the six projects. A statement from the UK’s Crown Estate states “as the climate emergency intensifies and demand for offshore wind accelerates, [this] agreement has the potential to make a critical contribution to delivering sustainable, renewable energy for the UK’s net-zero future.”

New Nuclear

Nuclear is also getting a wave of support to advance the twin goals of climate action and energy security. Notably, the Department for Business, Energy and Industrial Strategy has granted planning permission for a new 3.34 GW nuclear power station at Sizewell in Suffolk, led by soon-to-be-nationalized French utility EDF. London also gave more details of a new financing model for nuclear power stations — a regulated asset base (Rab) — that could be used to finance Sizewell C. Kwarteng said “under the new Rab scheme, private investors receive greater certainty through a lower and more reliable rate of return in the early stages of a project, lowering the cost of financing it, and ultimately helping reduce consumer electricity bills.”

London hopes to approve eight new nuclear power stations by 2030 and add up to 24 GW of nuclear capacity in the UK by 2050. Previous attempts to get new nuclear power stations at Wylfa and Moorside built under a contract-for-difference — as used to finance Hinkley Point C — failed, resulting in those projects being canceled.

Jason Eden, London

POLICY

German Energy Crisis Provides Stark Lesson

Germany’s energy crisis offers a lesson learned on how to avoid energy transitions that go too far, too fast, and make incorrect assumptions. Europe’s largest economy, which is heavily dependent on imports, is facing an unprecedented energy crisis that could worsen this winter. In recent years, Germany has remained keenly focused on its “Energiewende” energy transition policy and its rapid expansion of renewable energy capacity. This enjoyed strong public and industry support and made the country a climate leader, but it was carried out in a way — and at a speed — that arguably came at the expense of a comprehensive, diversified energy strategy.

Several factors led up to this: Even as Germany built out renewables capacity, it remained heavily reliant on fossil fuels, in particular on gas imports from Russia. That dependency only deepened over the past two decades and was reinforced by the political decision to phase out nuclear power by 2022 after the 2011 Fukushima disaster in Japan. Instead of caution, Germany assumed that commercial ties with Russia would remain of mutual interest, and that Moscow would continue to be a dependable supplier of hydrocarbons — as it had for many decades and through previous crises. It is now clear this was a miscalculation. The fallout means higher energy prices, and

even energy shortages, for Germany and the EU amid a partly self-imposed embargo on Russian hydrocarbons. Alternatives — from coal, nuclear and renewables to non-Russian oil and gas supplies — seem unable to fill the gap.

Vulnerabilities

Germany’s energy strategy under former Chancellor Angela Merkel was dominated by advancing climate goals. Russian gas did most of the so-called “bridge” work amid a declining role for nuclear and coal. The rushed decision to exit nuclear energy, while well intended, created an energy security vulnerability as Germany instead built more gas-fired power plants to bridge the transition to renewables. Relatively more expensive but diversified LNG supplies did not get a look in.

Russia’s annexation of Crimea and military intervention in eastern Ukraine in 2014 could have been an opportunity to launch a full review of Germany’s energy ties. Instead, Germany doubled down on cost-competitive Russian gas imports, reflected in the start of construction of the Nord Stream 2 pipeline in 2018 — which the Green Party opposed on climate grounds and the US advocated against on energy security grounds. Some analysts argue that the mistake was at least partly down to a lack of serious effort to understand Russia’s relationship with Ukraine and the drivers behind President Vladimir Putin’s decision-making — even after Russia’s annexation of Crimea in 2014.

New Flexibility

Even as the current crisis highlights some hard realities about the need for fossil fuels now, the sense of being on a war footing is translating into stronger policy action on longer-term transition goals. In the wake of Russia’s invasion, Berlin announced plans to reach 100% renewable power by 2035 against a previous target of around 2040. The coalition government had already announced plans to double the land available for onshore wind farms, easing permitting bottlenecks, a step complemented by Brussels’ decision in May to slash permitting times in so-called “go-to” areas for renewables.

The energy-saving measures Germany is adopting to survive the current squeeze on Russian gas could have a lasting effect, even as the tightness drives home some realities about gas’ role. Europe, for example, may need to be willing to sign 15–20-year LNG import contracts to secure supplies also being sought by Asian buyers. And Germany’s coalition government is handling its accelerated coal phaseout differently from the country’s nuclear shutdown: The aim to stop using coal power by 2030, versus an earlier 2038 target, is conditional on a sufficient renewables buildup.

This story first ran in sister publication Energy Compass.

Oliver Klaus, Cologne

IN BRIEF

Canada Mulls Oil GHG Cap

Canada is weighing two options for an oil and gas industry cap on greenhouse gas (GHG) emissions in support of its economy-wide reduction goals: an industry-specific carbon price and a sectorwide cap-and-trade system. The preferred options for enforcing a cap on oil and gas emissions were outlined earlier this month by the Canadian federal government, which is accepting comments through Sep. 30. Several questions are under consideration as both options are examined, including whether to give more flexibility to smaller emitters; whether to exempt refineries and natural gas transmission lines; and how stringently to set or ratchet up the cap's trajectory over the next decade through 2050. Ottawa is targeting economy-wide emissions cuts of 40%-45% below 2005 levels by 2030 and net-zero emissions by 2050. Reducing emissions from the oil and gas sector, which is responsible for 27% of Canada's emissions, is considered a major prong of the strategy to get there.

Saudi Arabia Eyes Exports

Saudi Arabia's plans to boost output of gas and renewable energy will help the kingdom reduce its own consumption of liquid hydrocarbons by up to 1 million b/d by 2030, thereby increasing the kingdom's oil export capacity, industry sources told Energy Intelligence last week. With global upstream production capacity stretched and oil prices north of \$100 a barrel, there is considerable interest in quantifying how much spare production and export capacity Saudi Arabia and other Mideast Gulf producers hold.

Developing new oil production capacity is a lengthy and costly process for the few producers that have the necessary resources, but the kingdom is keen to maintain its credentials as a reliable supplier by increasing its export capacity. Changes in its domestic power generation mix will play a big part in this.

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 added. This is part of the country's long-term goal of achieving carbon neutrality by 2060.

Gevo's Record SAF Deal

Biofuels developer Gevo has struck a new offtake deal for 100 million gallons/yr of sustainable aviation fuel (SAF) with American Airlines, marking the Colorado-based company's largest single fuel sales deal to date. Gevo expects the five-year contract with American to generate about \$2.75 billion of revenue over the contract term, with deliveries due to begin in 2026. The deal highlights the increasing demand for SAF, which airlines see as the quickest and most reliable way to decarbonize operations.

Saudi City Project

Saudi Crown Prince Mohammed bin Salman presided over a high-profile event in Jeddah on Monday to share details of a 170 kilometer "linear" city that will run entirely on renewable energy, including solar and wind. The city, known as "The Line," would be home to 9 million people — roughly the same size as London — but its carbon footprint would be only 2% of the UK capital's. It is intended to be the centerpiece of the larger Neom "city of the future" project that was first announced in 2017 as a \$500 billion high-tech development on the Red Sea, divided into several zones and areas.

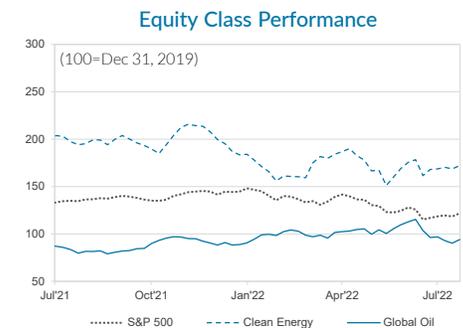
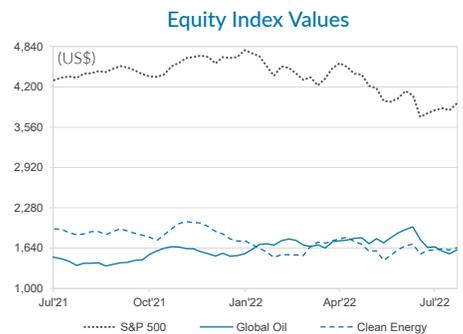
Prince Mohammed and other officials walked through an exhibition hall on Monday where a model of the "The Line" was laid out — two parallel buildings with mirrored surfaces that stretch out further than the eye can see. There will be no cars in the city

and the buildings will offer unobstructed views into the distance. According to a video presentation, the project's sustainable design principles can help "undo mistakes" of previous urban planning projects around the world. Prince Mohammed said the cost of the first phase of Neom is estimated at 1.2 trillion riyals (around \$320 billion).

Nabors Electric Tech

Oil-field services firm Nabors Industries is investing \$7 million into California-based Natron Energy, which specializes in manufacturing sodium-based batteries. The batteries will be used to supplement a drilling rig's conventional diesel engines, similar to how a hybrid automobile's batteries supplement a conventional gasoline engine. The move provides a glimpse into how one of the biggest drilling contractors in the world envisions the electrified oil field of the future.

CLEAN ENERGY EQUITY MARKETS



Source: S&P Global

EI NEW ENERGY DATA

ENERGY FUTURES: REFERENCE PRICES

	Jul 22	Jul 15	Chg.
Carbon (€/ton)			
ECX EUA	80.01	84.25	-4.24
CME GEO (\$/offset)	3.42	3.77	-0.35
Crude oil (\$/bbl)			
Nymex WTI	100.03	97.92	+2.11
ICE Brent	105.52	101.28	+4.24
Natural gas (\$/MMBtu)			
Nymex Henry Hub	7.80	6.58	+1.22
ICE UK NBP	30.89	27.81	+3.08
Coal (\$/ton)			
McCloskey CSX	176.00	175.00	+1.00
ICE Rotterdam	375.66	392.03	-16.37

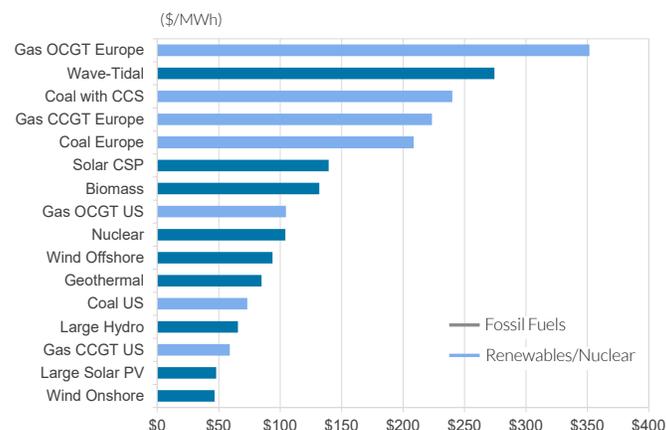
All prices are weekly averages and front-month. EUA = EU Allowances; GEO = Global Emissions Offset. Replaces ECX CER starting 3/30/21. ICE UK gas converted from p/therm. *Short tons. Source: Exchanges

GLOBAL ELECTRICITY PRICES

	Jul 22	Jul 15	Chg.
Europe (\$/MWh)			
Germany (EEX)	349.49	318.63	+30.86
France (Powernext)	473.72	398.58	+75.14
Scandinavia (Nordpool)	141.23	70.85	+70.38
UK (APX)	328.32	297.87	+30.45
Italy (GME)	496.84	431.91	+64.93
Spain (Omel)	147.58	140.62	+6.96
North America			
New England	193.45	68.15	+125.30
Texas (Ercot)	120.20	258.83	-138.63
US Mid-Atlantic (PJM West)	147.18	94.20	+52.98
US Southwest (Palo Verde)	107.90	87.50	+20.40
Canada (Ontario)	53.80	46.51	+7.29
Other			
Australia (NSW)	237.03	352.87	-115.84
Brazil (SE-CW)	12.59	10.91	+1.68
India (IEX)	71.09	62.34	+8.74
Japan (JPX)	145.16	177.23	-32.07
Singapore (USEP)	227.78	245.10	-17.32

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 (Mar 2022)	EV sales Mar '22
484,000	72,899
% LDV sales NEVs Mar 2022	% LDV sales NEVs Mar '22
21.7%	5.85%
NEV sales (Feb 2022)	EV sales Feb '22
334,000	59,554
% LDV sales NEVs Feb 2022	% LDV sales NEVs Feb '22
19.2%	5.66%
Total NEV fleet as of Mar 2022	Annual EV sales 2021
8,915,000	605,958
% fleet NEVs	% LDV sales NEVs 2021
2.90%	4.14%

Europe (EU, UK, and EFTA)

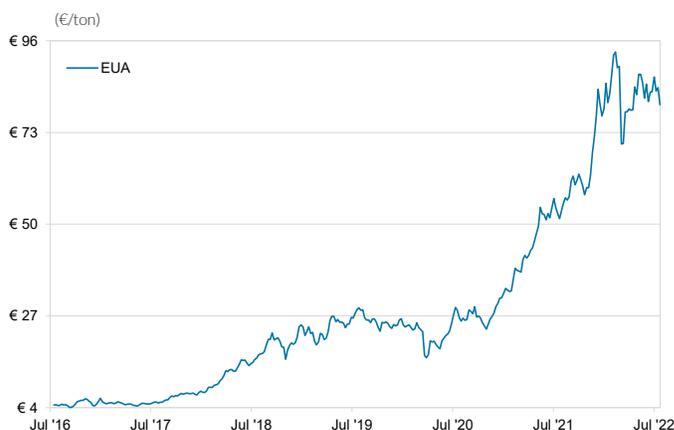
Sales Penetration	NEVs = all New Energy Vehicles. EVs = plug-in hybrids and all-electrics. LDVs = light-duty vehicles. EFTA includes Norway, Switzerland, Iceland, Liechtenstein. Sources: China Association of Automobile Manufacturers, China Passenger Car Association, US Alliance for Automotive Innovation, US Argonne National Laboratory/Wards Auto, European Automobile Manufacturers Association
EV registrations Q1'22	562,276
% LDV sales EVs Q1 '22	20.47%
EV registrations Q4 '21	684,655
% LDV sales EVs Q4 '21	26.2%
EV registrations Q1 '21	454,694
% LDV sales EVs Q1 '21	14.83%

GLOBAL CARBON PRICES

	Jul 26	Jul 19	Chg.
Europe (€/ton)			
EUA Dec '22	76.68	83.65	-6.97
US (\$/ton)			
CCA (Calif.) Dec '22	27.99	28.50	-0.51
RGGI (Northeast) Dec '22*	13.22	13.58	-0.36
New Zealand (NZ\$/ton)			
NZU (spot)	80.75	73.15	+7.60
Asia (\$/ton)	Jul 22	Jul 15	Chg.
China (National)	8.44	8.62	-0.18
South Korea	12.79	14.37	-1.58

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

EU CARBON FUTURES PRICES



ECX front-month futures. Source: ICE