



Rethink Energy monitors the transition to fully renewable energy markets

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Key Issues

UK sticks doggedly to an energy strategy that will cost a fortune

- **UK Government plans now include two new “decarbonized” gas plants**
- **These gas plants will become stranded assets before they ever reach installation**
- **Combined with new nuclear plants this threatens to push electricity prices up**

The UK government appears to have gone all out to stick to its guns on using Carbon Capture and Storage (CCS) and plans to open two gas power stations in the UK, in the North East Humber region, both of which are being described as decarbonized.

To us this appears to be a completely blind alley that the UK government has gone down – one power station will have a pipeline created to dump captured carbon into the now well known Equinor undersea carbon storage facility under the North Sea, while the other claims it will burn Hydrogen. However given that Equinor is involved in the project, it is likely to that this is Blue hydrogen, with created by steam reforming natural gas to remove the CO₂, and that will join the other CO₂ under the North Sea.

We say this is a blind alley because the cost of CCS will have to be added to the price of capturing CO₂ post burning of natural gas, and in the case of the hydrogen turbine, also add the cost of CO₂ storage to the cost of steam reforming and natural gas.

Luckily as green hydrogen from electrolyzed water, falls in price, the gas turbine can switch to using this, and the CCS storage costs could then disappear. But the natural gas turbine will just have to go on with the costs of CCS and storage, until it is a stranded assets, in about ten years and is uneconomic when it won't be close to competing with electricity from solar.

The two power stations are ironically described as being part of a 'clean power hub' near Scunthorpe, North Lincolnshire, with Keadby 3 and Keadby Hydrogen replacing older, carbon-intensive generation on the UK grid.

Keadby 3 will be a 900MW gas turbine and both of these projects are being brought about in a partnership between Norway's Equinor and SSE Thermal, a subsidiary of SSE (previously Scottish and Southern Energy) one of the big 6 UK energy providers headquartered in Scotland.

A formal consultation for Keadby 3 has just been concluded and is now going for development consent and if all this moves unhindered, it will be online in 2027, in line with Government ambitions for 'Track 1' industrial cluster projects.

The Keadby Hydrogen power station would peak at 1.8 GW of hydrogen, and produce zero emissions when the hydrogen burns. The UK is claiming it would be the world's first major 100% hydrogen-fired power station, but there are quite a few similar hydrogen projects due to come online before then based on burning hydrogen in turbines. It should be turned on in 2030.

We have doubts that it will ever be turned on. Hydrogen is currently too expensive with the round trip of providing natural gas, reforming it to create hydrogen, then burning it, and then losing about 55% of the energy in thermal losses, making it a "last resort" for the hydrogen economy. Ahead of this will be hydrogen to power large transport, hydrogen for steel-making and hydrogen for home heat, before it will be low enough in price to compete in the Gas to Power market.

However prices are falling and the cost of green hydrogen could become competitive with natural gas quite a way before 2030. However, existing natural gas turbines will cease to be competitive with solar or wind long before 2030, so getting down to that price is just not low enough. If you add the potential costs of a carbon tax and/or the cost of storing CO₂, it becomes even less competitive, and will end up as a stranded asset, just before it is turned on.

The UK government remains misguided and ignorant of the economics of renewables, and hell bent on an energy strategy that is a third renewable, a third natural gas with CCS and a third nuclear, without factoring in future cost changes, as renewables fall, nuclear remains expensive and thermal has additional costs heaped on it.

If the government underwrites the cost of these two power stations, as it has the £92 per MWh nuclear power station at Hinkley Point, it will foist the world's most expensive electricity on its public, and spend more on supporting natural gas that it ever spends on renewables.

Hydrogen will become competitive in transport, industry and heating long before it can join the power grid

The projects will also rely on other services from the Humber Saltend facility which will come online to produce blue hydrogen from 2026. That was put together by the Northern Endurance Partnership launched last October which includes Equinor, BP, Eni, the National Grid, Shell and Total – none well known for zero emissions.

Key Issues

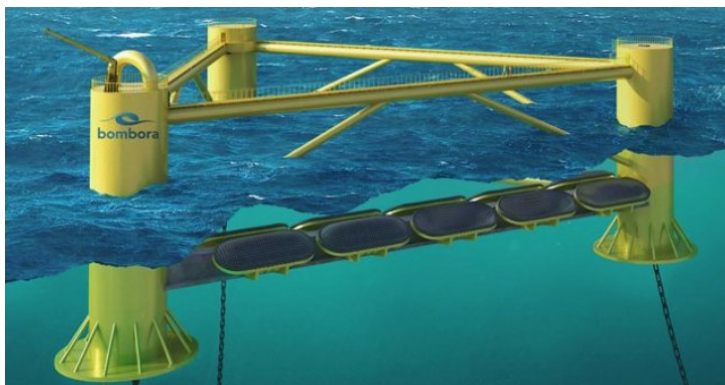
Bombora to pair wave power with floating wind for new lease of life

A fresh wave of echoes that “wave power is nearly there” are starting to emerge, with several pilot projects showing early signs of success. But after years of difficulties trying to reduce costs in such extreme offshore environments, companies like Bombora are marking a shift in the technology’s perception. Instead of stand-alone units, one of the most promising use cases for wave power now lies as a bolt-on extra for those aiming to add some oomph to floating offshore wind projects.

This isn’t the [first](#), or indeed [second](#) time that Rethink Energy has discussed the concept of hybridizing offshore wind with wave power. However, Bombora’s mWave concept has finally laid out a design which could be easily incorporated within floating wind platforms, allowing the two generation types to share transmission, moorings and development costs, which can account for up to 30% of a project’s cost. Naturally, this provides a huge benefit for anyone trying to maximize the output and cut the levelized cost of energy of an overall energy project.

The patented mWave design entails modules of air-inflated rubber membrane covered cells, which are compressed when a wave passes above the system. Mounted in series, the aggregated cells push air into the company’s Power Take-off module – a one-way air duct flowing through a unidirectional flow turbine, which in

turn drives a variable-speed electricity generator.



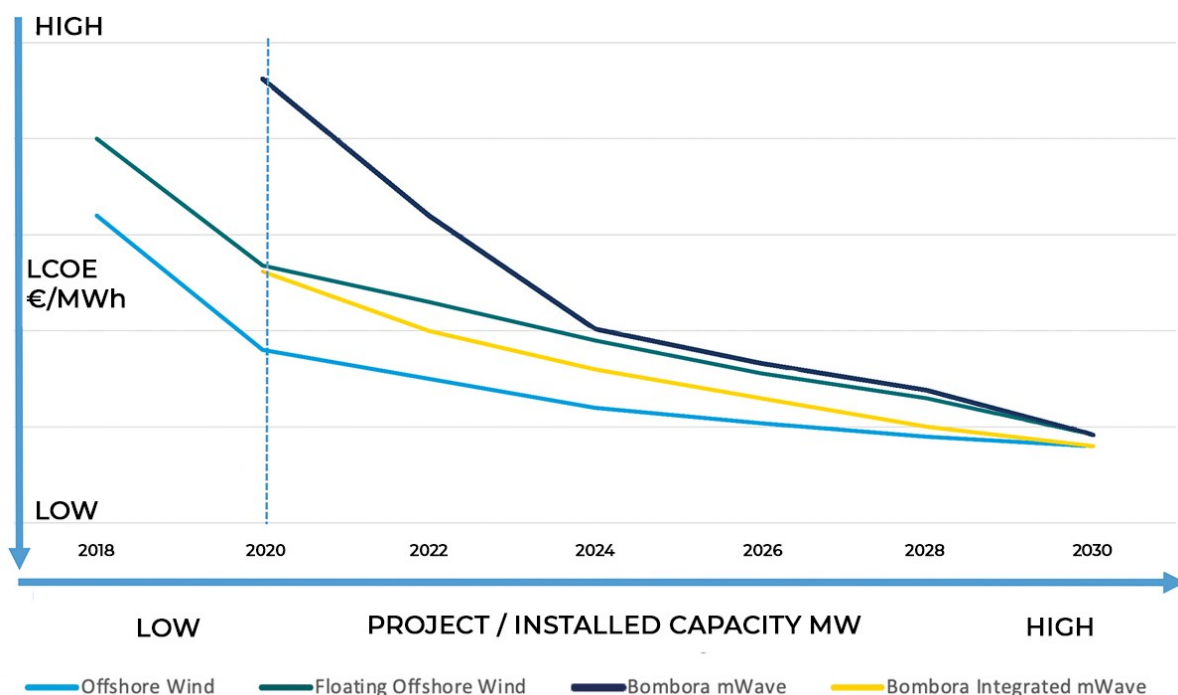
Throughout operation, the device will be submerged at a depth of around 10 meters, with no external moving parts and designed to withstand extreme ocean storm conditions with an appropriate safety factor.

Having undergone prototype testing and feasibility studies, Bombora has now moved onto commercial scale testing of the platform, having established European operations in Pembroke Dock, Wales. Through £17 million of investment – including £13.4 million from a European Regional Development Grant through the Welsh Government the company has constructed a 1.5 MW mWave prototype, which will soon be demonstrated 1 kilometer off the coast, where it will sit for six to twelve months collecting operational data to validate and monitor performance at full-scale.

Bombora's full-scale device is currently being built at its Pembroke Dock assembly center, and is being showcased as part of a [virtual tour](#) prior to installation.

From 2021 onwards, the company's focus will be on commercialization. The mWave is being developed in two formats – Bottom Fixed and Floating – with capacities per unit set to reach 3 MW to 6 MW. The installation of the first demonstrator mWave is scheduled for mid-2021.

Bombora's modular cells will be key to driving down capital costs through economies of scale as production volumes increase. As such, Bombora is expecting its technology to become cost competitive with floating offshore wind by the middle of 2024.

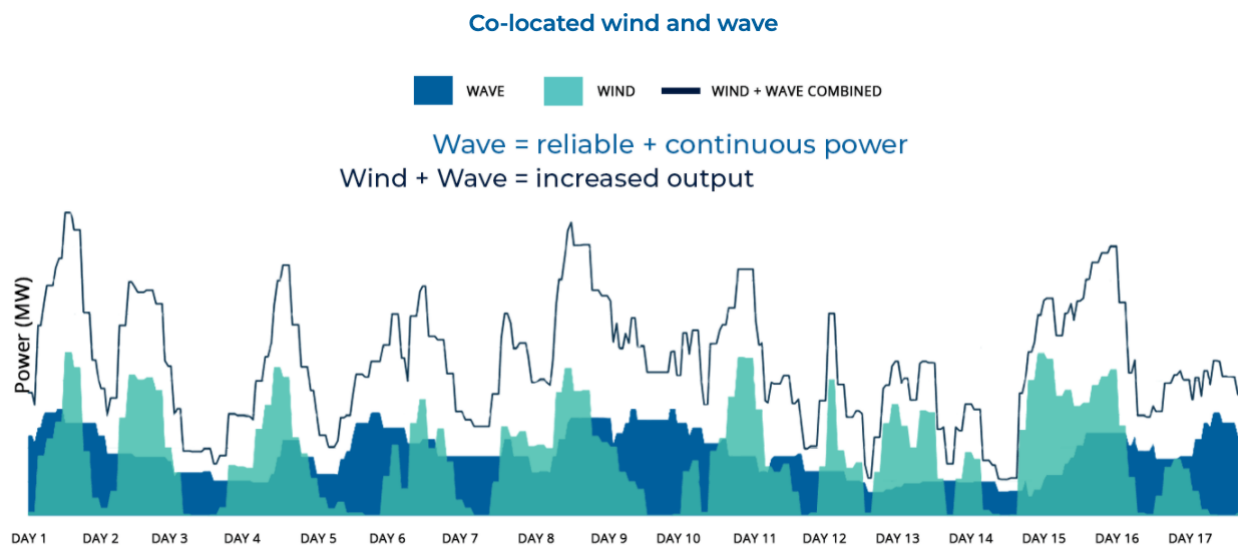


However, the primary opportunity for Bombora – as we see it – is within integrated platforms, where cells are mounted at the base of the semi-submersible structures for floating offshore wind turbines. Leading designs of such platforms are being developed by the likes of Principle Power (WindFloat), Fukushima (Forward), Ideol (Floatgen) and Hexicon.

Through the addition of an mWave unit, the capacity of individual turbine stations could be increased by 25% to 50% depending on the size of turbine, without the need for additional subsea transmission infrastructure. Given that wave power is more predictable than wind and solar, diversifying the generation types at a single project location will also reduce investor risk with minimal additional environmental impact.

A review from IRENA in 2014 indicated that the foundation and mooring of wave energy platforms accounts for 6% of lifetime expenditure, with grid connection responsible for another 5%. Up to 41% of project costs for wave power would be offset through retrofitting to an offshore wind project.

Bombora recently announced a partnership with TechnicFMP to develop a hybridized system for floating wind and wave power, which it claims can reduce the levelized cost of energy by 20% to €50 per MWh by 2030, through a unit with a rated capacity of 18 MW. This will be preceded by demonstrator units of 6 MW (2 MW wave and 4 MW wind) in 2023 before a 12 MW (4 MW wave and 8 MW wind) later on.





Compared to fixed-base offshore wind, floating wind power provides benefits in allowing onshore construction and access to waters of greater depths than 50 meters. Rethink Energy's conservative forecast predicts that floating offshore wind will surpass 100 GW of capacity by 2040, which could then triple again through to 2050.

If the market continues to consolidate towards semi-submersible platforms and wave power developers can develop systems at an economically viable price, then there is no reason that we couldn't see companies like Bombora gobbling up a sizable chunk of what could be a 75 GW addressable market. Bombora is also currently progressing the first phase of a project in Lanzarote, which is expected to be completed in 2022. Feasibility studies are also underway for the use of mWave units in Japan and integrated within offshore oil and gas platforms as the fossil fuel industry looks to decarbonize extraction processes.

Bombora was founded in 2012 in Perth, Western Australia, and sits among a dwindling number of wave power companies persisting with development; its MW-scale pilot project sits among the largest in the sector.

Ocean Energy has also tried to focus the development of its OE50 buoys towards collocation with offshore wind, while companies like [Wave Swell Energy](#) continue to concentrate on nearshore systems using Oscillating Water Columns – largely targeting small islands for future projects.

Electric Vehicles

European EV sales surge again in Q1

The surge in EV sales is relentless, and this week a few European countries had Q1 sales numbers showing continued significant growth over and above sales achieved in 2020. The shape of EV sales in Europe last year was fairly hard to predict, with Q1 numbers down, Q2 flat, and then soaring numbers in Q3 and Q4, at a time when conventional car sales were way down.

March					
	2021	2020	% change	Mkt share -21	Mkt share -20
Diesel	30,730	44,794	-31.4%	10.8%	17.6%
MHEV diesel	23,273	10,231	127.5%	8.2%	4.0%
Petrol	137,557	152,816	-10.0%	48.4%	60.0%
MHEV petrol	31,472	13,066	140.9%	11.1%	5.1%
BEV	22,003	11,694	88.2%	7.7%	4.6%
PHEV	17,330	6,872	152.2%	6.1%	2.7%
HEV	21,599	15,211	42.0%	7.6%	6.0%
TOTAL	283,964	254,684	11.5%		

All in all EV sales were up from around 2.5% of total car sales in 2019 to 10% in 2020, but much of it focused on numbers achieved in the last quarter. Now Q1 looks to be beyond last year’s numbers – to infinity and beyond.

The UK Battery Electric Vehicles (BEV) sales in March hit 22,000, a rise of 88.2% over this time last year, and for the entire quarter it was 31,779, up 74.1%. For plug in hybrids (PHEV), the rise was even greater with March numbers up 152.2% to 17,330. For the quarter Plug in hybrids were 93.6% up to 26,613.

This makes both types combined make up 13.8% of the total car market in March, and the same percentage for the year to date figure. The sequence for Europe is beginning to look like 2.5% then 10%, and now it is already heading past 14%, and if later quarters this year go even higher, electric cars could top out at 18% to 20% of the total in the UK for 2021. At present this is despite not one, but two falls in the subsidy the UK is offering for electric vehicles, including another drop last month, and with total car sales up just 11.5% over 2020, although still down on 2019 numbers.

At the current rate the two combined (BEV and PHEV) look like going above 50,000 each quarter, which would take it way beyond our forecast for the UK for EVs of 171,607 for 2021 (from our Look Back in Anger Report).

In France in March the combined plug in electric share reached 16.1% during March and 14% for the year to date figure – virtually identical to the UK's numbers. France in particular benefitted from the availability of more Tesla cars, which were exported from the Shanghai Gigafactory with Tesla registering 4,524 Model 3 sales in France in March, by far its highest ever monthly total. Tesla beat out most of its global forecast in Q1 also.

Numbers out this week from the CCFA which registers cars in France shows 31,146 PHEVs and 30,439 BEVs for the quarter. Diesel sales hit an all-time low of a 23% share during March. The numbers are on track to just beat our own forecast of 233,910 plug in EVs of all types in France during 2021. This is still in a market that is selling about 30,000 cars a month less than in 2019. In France, Italy and Spain gross car sales have been hit even worse than the rest of Europe, mostly because dealers have been shut throughout their third Pandemic lockdowns which will go on into April

In Italy total car sales were 169,684, around 24,600 less than two years ago in March 2019, and hit 4.5% of sales for PHEV and 4.3% for BEVs, totaling 8.8% between them, up from 6.6% combined a year ago. Italy is about a year behind the rest of Europe in EV adoption so far.

New car registrations have not yet been released for Germany but most pundits have it closely following the UK market.

Norway although far smaller than all of these other markets is exceptionally strong on EVs, and also has numbers out this week, with 56.3% of its car sales as BEVs, and another 28.6% PHEVs, making a combined total of 84.9% plug in vehicles out of 15,315 cars sold there in March. It was 75.2% a year ago. But it is worth pointing out that fossil fuels will be banned first in Norway, in 2025 for new cars, a full five years before other parts of Europe.

Most other advanced European markets have not yet published their registration numbers for the quarter.

Even our forecast has been exceeded in the UK, which could see 200,000 new EVs this year

On a related subject JPMorgan has issued a note to investment clients this week saying that the global share of plug-in EVs grew in February to 7.5% from 5.5% a year earlier. This does show how advanced Europe is right now – it currently has reached a penetration rate of 12.9% says JP Morgan with China on 8.7% and the US way back with 3.2%. It also forecasts that by 2025, EVs in Europe will reach 33% - we reckon that target will be reached closer to 2022.

Meanwhile India has released numbers for plug in vehicles for March with a record 25,640, and some 134,000 for the trailing 12 months, according to JMK Research.

The registered EV sales in March 2021 has steeply grown to 25,640 units, registering m-o-m increase of 34.2% and y-o-y increase of 88.2%. The FY2021 sales of registered EVs is more than 1,34,000 units.

Fig 2.1: Registered EV sales in India (Jan 2020 –Mar 2021)



Source: Vahan Dashboard, JMK Research
 Note: Sales figure represent EVs registered across 1277 RTOs in 33 states/ UTs.

Meanwhile the rather interesting experiment of the Indian Oil Corporation to use Zinc and Aluminum batteries for cars, has moved on a step or two in the last few weeks. The technology uses the surrounding air as one electrode, and was cooked up by Israeli firm Phinergy, which claims they can be recharged (although they may have to be removed for this). It now has a joint venture company where it will work with Ashok Leyland, a truck and bus maker there, and Maruti Suzuki, which makes cars and two wheelers, to put its batteries into their vehicles.

It already has a deal with Mahindra Electric for electric rick-shaws. They will all collaborate on the commercial uses of the aluminum-air battery, which Phinergy claims can deliver a range of over 1,000 miles between charges.



Typical Ashok Leyland truck

Reports have just come in overnight from China that 466,000 new energy vehicles were registered to the end of March, a rise over this time last year of 295% by the Traffic Management Bureau of the Ministry of Public Security. It says this brings the total number in China to 5.51 million, most of which are BEVs. Rethink forecast a total of just under 2.5 million EVs in China this year, rising to a total of 6.6 million cumulatively. Looks like our forecast numbers are the only ones close to being accurate, given that every other forecaster has forecast at about 50% of that rate.

Electric Vehicles

Canoo – looked like an original, generic EV stock – now SPAC fodder

It's not ideal to hold your first quarterly results meeting as a public company when you are in the EV and autonomous car space, and use it to publicly dump a major vehicle manufacturing partner, and to decide to change your core business model – no longer is Canoo working with Hyundai nor is it planning to continue with its original idea to sell its electric minibus via a subscription model, despite subscription models being all the rage.

But as much as these were surprises, conducting such a results meeting without the current CEO present, days after the old CFO has resigned, and other executives were “released,” is pretty much asking for trouble – and trouble is now has.



One of Canoo's incoming EV designs

We are fairly sure that in the whirlwind financial circles of Special Purpose Acquisition Companies (SPACs), the energetic legal eagles that can recite corporate and securities law backwards in their sleep, takes little more than the filling of a form to target a new SPAC public venture such as law firm such as Robbins Geller Rudman & Dowd. By its own admission it is one of the best law firms at representing investors in securities class action litigation. By best it means that it gets more money back than anyone else.

While the SPAC as a species of investment has risen alarmingly, cutting costs and corners on the route to taking companies public, its growth has yet to attract a similar number of class action lawsuits – something Robbins Geller Rudman & Dowd plans to do something about. It has launched more SPAC legal actions than any other New York law firm.

While we are not suggesting for a moment that it limits its attention purely the clean energy stocks, during the past two months it has begun such actions against EV maker Lordstown Motors, autonomous car specialist Velodyne, and vehicle electrification firm XL Fleet, online car reseller Vroom and electric delivery vehicles builder Workhorse – and now Canoo.

However, perhaps wisely, Robbins Geller Rudman & Dowd is **not** the firm that has gone after Volkswagen Group for an April fools joke on its website, which claimed the company was going to change its name to “Volkswagen”, because of its commitment to electric vehicles – that was Rosen Law. CNBC reported it as an accidental leak, but of course Wall Street is not known for its sense of humor, and nor are New York law firms. Millions of dollars may yet be involved.

In almost all cases these complaints fall into one of two buckets – either the new board convened and on the first board meeting it decided to “change direction” because it’s opinion of the existing management is low, or because no-one has thought it through; or slightly exaggerated statements were made by desperate private company officials, who had no idea that within a month or so a big Wall Street SPAC would buy out the business, and all those statements would get repeated in the process, and they would come under deep scrutiny – perhaps because the SPAC itself had gone public when they were made.

Several startups are starting to suffer post-SPAC legal actions

Take Vroom – after its SPAC it is accused of failing to disclose it could not shift existing inventory partly because it relied too much on third-party sales people and had not really trained its own sales team; XL Fleet was all about salespeople allegedly being encouraged to inflate their sales pipelines; while Workhorse said as far back as 2016, that the US postal service “might” opt for some of its electric fleet to replace its 165,000 package delivery vehicles, only for someone from the postal service to pick non-EVs as replacements, while saying that EVs would be far too expensive.

It’s all very well suing Workhorse for not knowing that, but the truth is that it would be a complete shame for the company to be successfully sued to the point where it is no longer competitive, just in time for the US postal service to realize that its executive is after all an idiot, and electric vehicles are, in fact, cheaper. But that’s how legal actions work – you should have known and you certainly should have recited safe harbor statements until you were blue in the face before you took onboard public money. Taking the postmaster general’s words as gospel let’s Mssrs Robbins Geller Rudman & Dowd, appear certain that Workhorse’s statements were materially false and misleading. Canada’s Oshkosh Defense won the business in the end. We presume if it had not, that Robbins Geller et al would have been after them.

Canoo lost 30% of its share price from a sudden post-SPAC strategy change

The key in all of these cases is that the share price goes down. When Workhorse lost that contract, its stock fell 50%.

One of the benefits of using a SPAC to acquire a private company and take it public is to take advantage of “safe harbor” provisions of the Private Securities Litigation Reform Act around all of its forward-looking statements. So a prospectus issued in connection with a de-SPAC transaction should make it actually safer to go public with a SPAC, rather than an IPO. Statements made just have to be clearly “forward looking,” and not expressed with outright certainty.

A key trick is to say “This is the company we are taking over, if you don’t like it redeem your shares and walk away.” This is how to make claims for damages very hard to prove.

Canoo Holdings was formed with the merger of a SPAC from Hennessy Capital Acquisition and Canoo and the deal was mooted in August and completed in December. But running a results conference where the numbers were ostensibly good, but with a CFO who had been in place for just a few days, and without the 30 year BMW veteran Ulrich Kranz who is the company’s CEO, and having the new chairman announce a dramatic new strategy, has obviously led to the share price falling over 30%, no surprise that Robins Geller Rudman & Dowd raised the paperwork on another class action lawsuit within a day.

The change in strategy there is to no longer partner with Hyundai, which amounts to getting some good early cashflow from a relationship with a credible Asian car maker. This change in direction was couched as “deemphasizing its engineering services business,” and to decrease its focus on selling vehicles to consumers through a subscription model.

For anyone who has taken on finance and seen a brand new set of directors and turned up to the first board meeting only to find the agenda has changed and your original idea has been totally usurped and replaced with highly conventional thinking, this will be no surprise. But you can’t do it in a SPAC.

The surprise player here is clearly new Canoo chairman Tony Aquila, who has a history as a successful entrepreneur in software in the insurance industry, and we’re sure he feels he knows best how to run a car maker, better than Kranz, who has mostly just

been in the car industry for upwards of 30 years. Rethink does not know which of the two characters has the bruised ego or the right idea, just that the two should have talked out strategy “before” the SPAC made the investment, not after, and certainly before it that strategy it planned to abandon had been front and center of the SPAC merger.

The best way to get the pressure off the back of whomever is now running the show is to see the share price rise once again, but until Kranz makes a re-appearance and either re-asserts control or resigns, it is likely that this is another clean energy start up that is going to being dragged down by a successful class action suit.

What must have been confusing for the meeting was hearing Canoo unveil two brand new EV ideas - a multi-purpose delivery vehicle and a pickup truck which it will sell directly – neither have ever been part of the plan and came out of the blue.

During 2020 SPACs raised around \$82 billion in 248 US IPOs up from \$13.5 billion and just 59 IPOs in 2019. As more cash goes through these types of deals, we should not be surprised to see more legal actions.

One of the dangers is that SPAC investors have no idea of where their money is likely to be spent – it is a trust judgement in the organization that has created it, that it knows what type of company to buy – but more importantly that it knows what do to with that company - how to ensure that the strategy that it adopts post-merger, is workable and that everyone is onboard with it. Canoo was well understood and popular, perhaps Hennessy Capital Acquisition, was not quite so much.

For a SPAC merger the private company should not simply have promises it made in the past trotted out during the merger proceedings. Private company executives usually learn all of this as they prep for their IPO, guided by sell side teams.

People have made a lot of money in SPACs, as their target is often a company that is being acquired from being private. So it is acquired on a multiple (value) which is below that typical in a public market. The result is that post-merger if everything goes well, public shareholders simply see that this is undervalued for a public company and vote it up by buying the stock.

Unless the CEO Ulrich Kranz re-surfaces, Canoo may be dragged down by a class-action lawsuit

One of the most worrying trends isolated right now in the US market is the way stimulus checks, especially those sent to people who don't need them urgently, are being plowed into SPAC funds, in the hope of making some serious money, tripling or quadrupling the amount in short order.

That money may not be needed now, but it was still hard come by and investors will not be happy to lose it.

And if anything does go wrong, and a lawyer lines up a class action to make good on an investment, it does absolutely no harm to its cause, if it leaks "public statements it thinks are misleading," for instance to a company that wants to short the stock. The lower the stock goes, the easier to prove damage and how badly those statements were misleading. So if a company like Hindenburg Research can take an idea that a new EV is behind schedule or unlikely to win a particular order, and "firm" it up through detailed in-depth interviews with current and past employees, then the stock will fall further. Only a company shorting the stock has enough skin in the game to do this kind of detailed work.

So it comes as little surprise that both Hindenburg and Robbins Geller Rudman & Dowd both separately happened upon the situation at Lordstown Motors, whereby the company is accused of being behind its schedule for production simply because its Endurance vehicle burst into flames on a dry run.

And it's just as little a surprise that shorting specialist Muddy Waters Research shares an interest with Robbins Geller Rudman & Dowd in XL Fleet Corp.

Solar Power

China's immediate CSP pipeline grows towards 2 GW

China now has a considerable pipeline of Concentrated Solar Power (CSP), much of it to play an auxiliary role in hybrid renewable energy megacomplexes, as well as some smaller PV-CSP projects.

Most of these projects use improved molten salt or thermal oil designs which are not fundamentally new. This stands in contrast to the West, where CSP has just begun a revival only due to a variety of new higher-tech designs. Most notable of these was Heliogen's recent announcement of a project to supply 1,000-degree

process heat at Rio Tinto's borate mine in California. In the West, these new approaches seemed necessary to rescue CSP from being relegated to a mere handful of projects worldwide, with one in progress in the UAE, one in Morocco and one in Chile, and precious little else.

At the start of this year, Chinese CSP developer Pacific Green estimated China's CSP pipeline of projects imminently to begin construction - at 1.4 GW, which is shy of a quarter of global installed capacity.

One project noted by Pacific was the 1 GW Chayouzhongqi CSP plant announced this year, and since then we have seen a \$1.8 billion, 2 GW PV, 200 MW CSP plant announced by Jiangsu Xincheng Solar Thermal Company in Yumen City, Gansu Province. CSP cannot rival photovoltaics for cost-effective generation, but is valued for long-duration thermal energy storage which typically ranges from 10 to 15 hours.

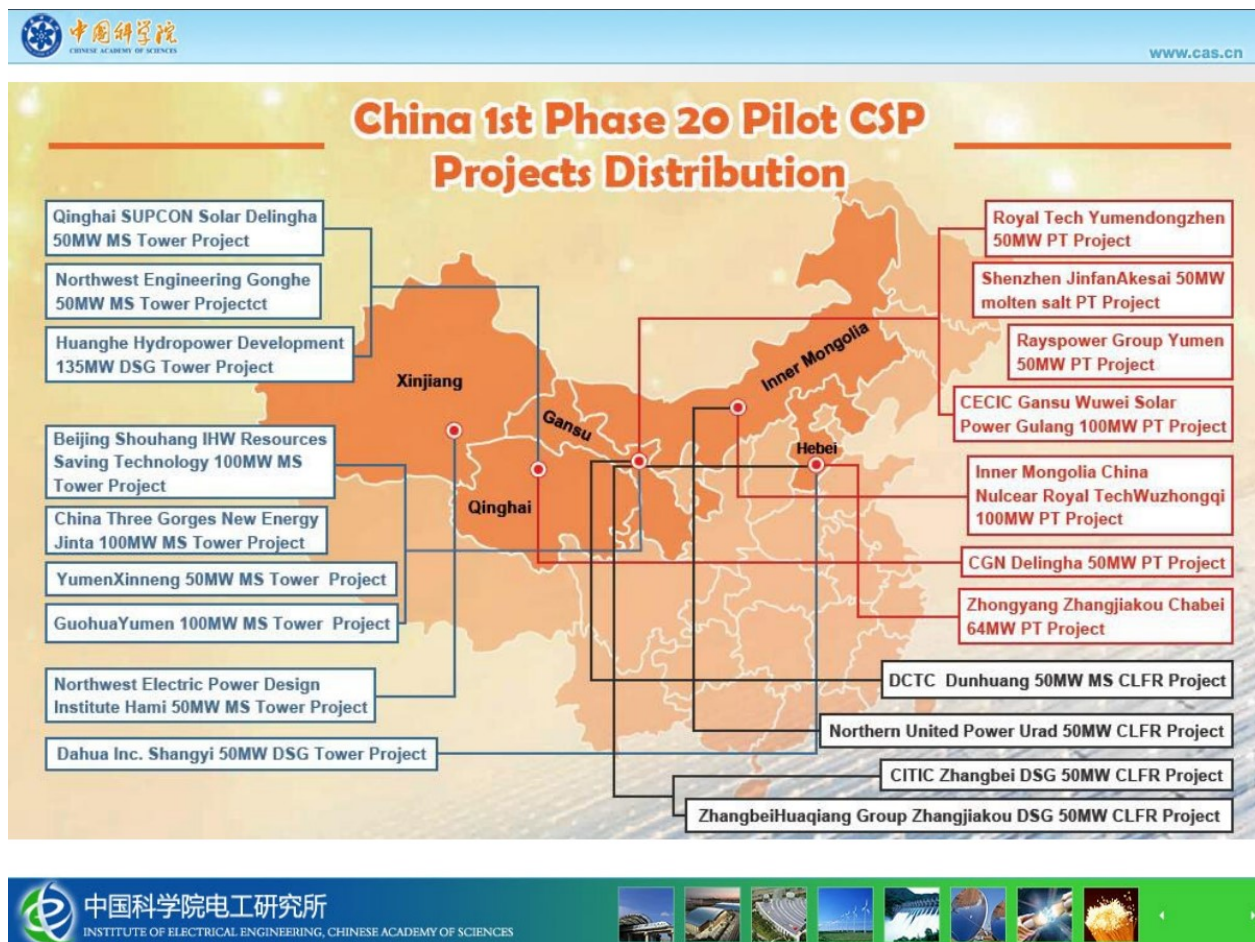
But the most common CSP announcement over the past year or so has come in the form of a few hundred MW as part of a wider complex incorporating PV, and usually wind power, battery energy storage, and even green hydrogen promises. One typical example of a green hydrogen desert complex is the 500 MW-or-1 GW hybrid power plant announced last June by Panda Green Energy, which would be located close to a reservoir in Xinjiang to provide water for green hydrogen, and would power its electrolyzers from a mixture of PV, CSP, and lithium-ion batteries. Another green energy complex announced in 2020 was courtesy of Baofeng Energy, at a more modest scale of just 200 MW.

China's 14th Five-Year Plan had a disappointed absence of new commitments, but that hasn't prevented companies and local authorities presenting their own Five-Year targets. Yumen City for example recently announced its renewable energy targets for 2025, which included 8 GW of photovoltaics, 1 GW of concentrated solar power, 1 GW of wind power, and 1 GW of battery energy storage.

Jiuquan City, also located in Gansu Province, likewise mentioned CSP in its Five-Year planning, albeit without putting a number to it.

China 14th Five-Year plan was short on new commitments, but various local authorities have made plans—including CSP

This pipeline follows on from around twenty pilot projects – a mixture of fresnel, parabolic, beam-down and other approaches – which were mostly commissioned across 2019 and 2020 after years of delays caused by CSP’s then tiny and thus unreliable supply chain. The last few laggards from this group should be completed this year, ahead of the pilot scheme’s extended Feed-in Tariff deadline of 2021, having finally finished procurement.



Even these “pilot projects” together total 1.3 GW, not far short of the total capacity in the two other world-leading countries’, Spain and the USA – which each installed them in the early years of the 2010s.

At the start of 2019, China had 210 MW of CSP in operation, all coming from four of these pilot plants; due to the high freezing point of molten salt, CSP plants which use it cannot be below a certain scale of say 10 or 50 MW depending on the design, or they fail to reliably keep the salt over 200 degrees. Almost all of the pilot projects used molten salt, though some use thermal oil.

These first four pilot projects ranged in cost from \$3 per Watt to \$6 per Watt – far above the typical \$1 per Watt of photovoltaics, but entirely competitive once a higher capacity factor and long-duration energy storage are added to the equation.

The largest CSP plant in China to reach construction so far is the 135 MW Qinghai Zhongkong Delingha CSP Project, which broke ground a couple of weeks ago. It has 11.2 hours of storage, which amounts to 1.5 GWh – that much lithium-ion battery energy storage would cost the better part of a billion dollars, but the cost of this CSP project was \$578 million. This Zhongkong project also exceeds any utility-scale lithium-ion battery energy storage project so far, although InterGen's planned 640 MWh DP World London Gateway could expand to 1,280 MWh.

Chinese developers have branched out overseas in Greece, Thailand and elsewhere

Admittedly there are significant differences between CSP and lithium-ion batteries which make such a direct comparison dubious. CSP can only store power from the grid via an electric heater, although heat exchanger plus electrical heater setups are becoming more common and are typical of PV-CSP hybrid plants. Additionally, CSP's steam turbines can't respond anything like as swiftly to demand fluctuations as a battery.

The Zhongkong project is located in Qinghai Province, which is geographically an extension of the Tibetan Plateau – part of China's northern desert swathe which along with Tibet itself is highly suitable due to the near-total lack of cloud cover and high Direct Normal Irradiation (DNI). China's industrial base is increasingly attracted to the north and west of the country, partly by cheap land and labor, but primarily by cheap electricity, with electricity-heavy industries such as data centers shifting north the most decisively. However, there is already a huge pipeline of renewables in the north, most demand will remain in the south-eastern heartland, and building UHV transmission lines for thousands of kilometers is doable but expensive: all of this means that the mammoth developments of solar and wind in provinces such as Inner Mongolia will benefit hugely from energy storage to ease its passage to the south-east.

China's developers have also begun playing a significant role in global CSP project development. The past year saw Chinese companies in charge of the planned 50 MW Minos plant in Greece, the 200 MW Kalulushi parabolic trough project in Zambia, and a \$500 million, 90 MW PV-CSP project in Dongmeng County, Thailand.

With recent Chinese developer interest in Latin America, it would not be surprising to see them take a hand with CSP projects in Chile next, and in Spain if that country sticks to its guns with 2.5 GW of CSP to be awarded at auction.

Solar Power

REC Silicon sees Violet Power partnership cancelled

Singapore headquartered REC Silicon has announced that its polysilicon supply deal with Oregon-based solar startup Violet Power, which was to take effect later this year, has ended before it began.

The phrase used by REC Silicon in its press release was “REC Silicon advises that the strategic partnership between REC and Violet Power (VP) announced on October 13, 2020 has been terminated.”, and Violet Power’s CEO Desari Strader subsequently asserted that “We are the ones that terminated the strategic partnership.” Strader further explained, “REC cannot be a supplier of ours because they are not producing polysilicon in Moses Lake.”

REC Silicon’s facility in Moses lake was reduced to 25% capacity in 2018, then fell dormant in 2019, a casualty of the US-China trade war. The facility finally ceased production entirely last August, around when the partnership with Violet Power was announced. The contest on polysilicon tariffs goes back to 2013, when President Obama imposed tariffs on Chinese solar panels. Most domestic US manufacturing now comes from First Solar, whose unique CdTe photovoltaics don’t use polysilicon.

Violet Power’s CEO asserted after the cancelled partnership that the startup still plans to produce solar panels there. It remains to be seen what effect the REC cancellation will have; the original plan was to reach a 500 MW production line by the end of this year, then expand towards 1 GW by 2022, and a mooted 5 GW in 2025.

REC Silicon’s press release was acrimonious - “REC believes it yields greater positive outcomes for its shareholders to collaborate commercially with established, proven, active and relevant solar supply chain partners.” Little wonder that Violet Power reacted by asserting that it, and not REC Silicon, had cancelled the partnership.

Western attempts to revive domestic solar manufacturing are at their most solid where perovskites are concerned – it is high technology, where China is at a slight technological lag, and uses totally

different production lines compared to silicon PV, where China has a massive infrastructure and scale advantage. Heterojunction is another promising high-tech route for Western industry to partly dodge China's insurmountable lead in silicon PV.

In contrast Violet Power is, of course, silicon-based, with one of its unique claims to fame being vertically-integrated – an odd thing for a startup to aspire to in an established technology. It's not entirely without novel technological appeal though – it's made a grandiose promise of a 50-year warranty, far beyond the 30-year industry standard; there have been reports that it will use ZEBRA Interdigitated Back Contact (IBC) cell technology, and it has partnered with fellow US startup SunFlex Solar, which uses aluminum in place of the expensive silver and copper usually seen in IBC cells.

The past couple of years have seen a further consolidation of global polysilicon manufacturing into China, where it can enjoy very low electricity prices in the northern provinces such as Xinjiang and Inner Mongolia. If China is seeking to attain a global strategic monopoly on solar power, it is succeeding, with the still oft-repeated figure of "64% of global supply" being wrong – it's more like 80% for polysilicon now, thanks to the recent exit of most of South Korea's capacity.

One of the major remaining Western polysilicon makers, Germany's Wacker, incurred an \$890 million write down of the value of its facilities in December 2019 due to Chinese competition. At the time, it rather furiously blamed Chinese policy, describing excessively low polysilicon prices created by overcapacity, with the Chinese government subsidizing the industry via low electricity, ironically from coal plants, as well as via loans and incentives.

The description of Chinese policies no doubt holds true now. But since 2019, the polysilicon price has doubled within China, and the material has gone from oversupply to undersupply. Until vast new polysilicon capacity comes online in China's north over the next year or so, polysilicon suppliers in the wider world should be able to enjoy those high prices. The public relations issue of Uyghurs in Xinjiang could have been highly impactful as part of a Western tariff campaign, since something like half the world's polysilicon manufacturing is located there, and even factories located in the adjoining provinces and autonomous regions could also be accused of forced labor due to Uyghurs migrating outside of Xinjiang.

Non-Chinese polysilicon makers blame the subsidies enjoyed by Chinese industry for their woes

This could have added up to a resurgent Western polysilicon industry protected by various new tariffs and even sanctions, but in practice we have yet to see this materialize. Perhaps it is still a matter of time – the Uyghur forced labor angle hasn’t died down in Western media, The Biden Administration is looking to massively boost renewable energy in all aspects, and the European Commission is expected to publish a report in June on how the EU can support a domestic solar manufacturing supply chain, including polysilicon. REC Silicon observed in its statement on the Violet Power cancellation that it “anticipates additional policy support for alternative supply chains and sustainably made solar materials and lower carbon solar panels, in the near term.”

Clean Steel

Vattenfall kicks off cavern-based hydrogen storage in green steel push

A green steel project being developed by SSAB, LKAB and Vattenfall could lay the foundations for a massive amount of cavern-based hydrogen storage in Europe, with construction starting this week.

As one of three components of the Hybrit initiative, which aims to produce the world’s first fossil-free steel by 2024, the group has now broken ground at a rock cavern facility in Svartoberget, Sweden, with the capacity to store green hydrogen on a pilot scale for use in the direct reduction of iron in the adjacent town of Lulea.

The project will entail an investment of just over \$29 million, divided equally between the shareholders and the Swedish Energy Agency, with ambitions to have the storage facility in operation between 2022 and 2024.

The facility itself entails a 100 cubic meter volume enclosed within a Lined Rock Cavern (LRC) approximately 30 meters below ground, meaning that the walls of the cavern are covered with a carefully selected material as a sealing layer.

Given the density of the pressurized gas, this will only be able to hold a maximum of around 2 tons of hydrogen, but the facility will serve as a demonstrator for the pressures that can be used within hydrogen storage and how Scandinavian bedrock conditions can be developed further.

“We’re really pleased that Hybrit is continuing to lead the development of efficient production for fossil-free steel, as we’re now also

building a pilot storage facility for large-scale fossil-free hydrogen in Lulea. Storage provides the opportunity to vary demand for electricity and stabilize the energy system by producing hydrogen when there's a lot of electricity, for example in windy conditions, and to use stored hydrogen when the electricity system is under strain," says Andreas Regnell, Head of Strategy at Vattenfall.

The ability to store green hydrogen will not just be key to providing a consistent supply of fuel in the value chain of fossil-free steel production without coal and coke, as being developed through the rest of the [Hybrit initiative](#), but will also play a very important role in future power and energy balancing, and in large-scale hydrogen production.

Hydrogen cavern storage is little different from natural gas storage

A [recent study](#) from the Julich Institute for Energy and Climate Research has identified that underground salt caverns in Europe – both onshore and offshore – could safely provide up to 84,800 TWh of hydrogen storage, by injecting the gas into bedded salt deposits and salt domes. The stated potential of such salt caverns would push it past pumped-hydro as the world's most promising form of long-duration energy storage.

Projects for hydrogen in salt caverns already exist, with at least three in operation in the North of England and a further three in the USA. That such caverns already exist in nature offers a benefit in terms of initial capital requirements. It is estimated that caverns cost around €50 per cubic meter to buy and prepare, including equipment.

While it may seem intuitive to think that any risk of leakage leads to a risk of explosion – the hydrogen sector has always struggled to shake off the connotations of the Hindenburg – using caverns to store hydrogen doesn't vary from storage methods for natural gas. In fact, cavity requirements in terms of design, construction and operation would be near-identical, and safe technical parameter guidelines have already been specified.

With caverns being concentrated most densely in Northern Europe, this potential is greatest in Germany (35.7 PWh), followed by the Netherlands, the UK, Norway, Denmark and Poland – in that order. The 2014 HyUnder study, which identified the total number of caverns required for hydrogen storage by 2050, saw a similar distribution, with 74 in Germany, 43 in the Netherlands, 24 in Spain, 21 in the UK and 1 in Romania.

Outside of Europe, the abundance of appropriate locations is defined by a relative proximity to the sea, alongside the historic salt-mining activity of each region. This opens up key opportunities across the UK, as well as in countries including Pakistan, Chile, Indonesia and Peru, which are home to some of the world's largest salt mines.

Through the rest of the Hybrit project, SSAB, LKAB and Vattenfall intend to create a completely fossil-free value chain for steel production, including fossil-free iron ore pellets, using hydrogen in the direct reduction of iron (DRI), and renewable electricity in an electric arc furnace to produce crude steel. From as early as 2021, Hybrit's pilot facility for DRI will be able to produce fossil fuel sponge iron. Overall, the initiative has the potential to reduce the carbon emissions of Sweden by around 10%.

Clean Steel

UK steel needs clear, accelerated support for net zero transition

The UK Government is facing increasing pressure to bail out the country's struggling steel industry both in the wake of Covid-19 and as the necessity to transition to green methods of production become more acute. Once again, this provides ministers with an opportunity to pair the country's economic recovery with advancing a leadership in decarbonization, with many pleading for a £250 million Clean Steel Fund to be accelerated from its scheduled release in 2023.

As we've seen in industries from power generation to automotives, the mantra of 'grow or die' has fast been replaced by a 'change or die' alternative, with those resisting a transition to net-zero facing dismal stock market performance. The moment a clean and economically viable technology emerges to transform any industry, the need to become a fast adopter is imminent. With snowballing momentum, decarbonized steel production will become the new normal much faster than expected, leaving those that are unable to transition their operations on the scrap heap.

The UK steel industry has been in disarray since the start of Covid-19. Tata Steel – the country's largest producer with 3 million tons of output per year – was unsuccessful in its plea for a £500 million rescue package from the government.

Liberty Steel was also unable to secure a £170 million bailout after its main lender, Greensill Capital, recently collapsed. It still appears likely, however, that keeping the company afloat will fall to the UK taxpayer.

The country's second largest producer, British Steel, only managed to stay out of insolvency through a buyout by China's Jingye Group. The company announced several weeks ago that it would invest £100 million in its transformation, which will largely focus on clean methods of production.

This is the sort of funding that has been lacking across the board in the UK, providing the basis for the new pleas to accelerate the Clean Steel Fund – with the taxpayer funding the industry's revival, but on the condition that it mandates a transition towards net zero emissions. The UK's Climate Change Committee has previously suggested that UK steel production needs to be “near-zero” emissions by 2035.

The £250 million Clean Steel Fund was launched before the 2019 general election and was widely considered as a trailblazing step in the world of green steel. However, with funds not becoming available for distribution until 2023, and with the movement towards decarbonized production happening at a much faster rate than anticipated, UK steelmakers are at risk of being left behind.

Indeed, Kwasi Kwarteng, the country's business secretary, has stated that the UK steel industry only “has a future” if it can shift towards a low-carbon output, although did not indicate plans to advance the fund. Outside of this, the government claims that it has already provided £300 million to help the sector decarbonize, and has made steel companies eligible to apply for the £315 million Industrial Energy Transformation Fund, which is now open for bids. Some estimates, however, have placed the price tag of the industry's transition at in the region of £6 billion to £7 billion.

Ex-British Steel CEO Ron Deelen has previously admitted that the company has held back on investment in green steel production due to a lack of clarity in support from the UK government – resulting in the UK falling behind countries like Sweden and Germany that already have green steel pilot projects in the pipeline.

Whatever support the UK government gives from here on in, it must give clear direction for the industry's decarbonization, and must be clear on how it will help compensate for any operational challenges.

Lack of clear policy has resulted in companies limiting their investment into green steel

Electric arc furnaces and re-use of scrap steel will be important to the green steel transition

The steel industry currently accounts for 3% of the UK's total CO₂ emissions. However, given that 8% of global emissions can be attributed to steelmaking, providing a leadership in the decarbonization of production could allow the UK's presence to expand significantly – some anticipate that output could grow by as much as 50%.

Currently in the UK, each ton of steel produced results in around 1.6 tons of CO₂. This is largely due to the fact that 79% of the country's crude steel is produced using blast furnaces and basic oxygen furnaces, powered by coking coal. Just two sites at Port Talbot and Scunthorpe, managed by Tata Steel and British Steel respectively, account for more than 90% of UK steelmaking emissions. In total the UK produces just over 7 million tons of steel per year – less than 0.5% of global production.

The UK has, however, already established 4 electric arc furnace facilities (EAFs), which will be key to increasing the amount of scrap steel used within the industry's feedstock and facilitating a shift towards the sector being powered on renewable energy.

In terms of decarbonization, the UK currently remains agnostic on its route to green steel. Carbon capture methods have so far proved unsuccessful, causing more and more companies to back concepts using green hydrogen. Australia's Fortescue Metals Group – the world's fourth largest iron ore miner – recently unveiled a plan to produce hydrogen for use in downstream steelmaking. Other concepts are being developed through initiatives from Hybrit, Boston Metals and Thyssenkrupp in Europe.

Most of these focus on increasing the amount of scrap steel used in existing processes, while replacing traditional blast furnaces with a hydrogen-powered direct reduction of iron ore (DRI) process, and an electric arc furnace (EAF) powered by renewable energy.

According to Rethink Energy's upcoming forecast on the shift towards low carbon steel, the UK's scrap steel usage will rise from around one-third to two-thirds between now and 2050. By the middle of the century, electric arc furnaces, currently used in just 21% of the country's production, will be used in nearly all of the country's steel production.

The shift towards this process will also see a rise from the negligible amount of Direct Reduced Iron (DRI) used in the country to around one third of the steel industry's feedstock. While this may initially

use natural gas, a shift towards to a majority green hydrogen blend in the 2030s will see electricity demand from the UK's steel sector rise from around 1.0 TWh in 2020 to 9.4 TWh in 2050.

Electric Vehicles

Biden identifies key climate bottlenecks in \$2trn infrastructure spend

Just after Rethink Energy went to print last week, US President Joe Biden unveiled his \$2 trillion infrastructure spending package, with an expected fresh wave of support for clean energy. Rather than the age-old promises for new capacity, measures to target specific issues through the US energy transition should start to alleviate investors' fears of bottlenecks for development.

Announcing the plan last Wednesday, Biden stated that "The American jobs plan will lead to transformational progress in our efforts to tackle climate change. It's not a plan to tinker round the edges." Indeed, the investment into clean energy is nearly ten-times the record breaking \$90 billion that Biden oversaw as part of the Obama Administration in 2008.

If approved, the plan will see new federal support for a broad range of tools which will aid the transition to net zero emissions in the US, including electric vehicles, transmissions grids and zero-carbon power sources. The bill will aim to realize Biden's ambition of putting the country on course to reach net zero emissions from its power sector by 2035, before an economy-wide net zero by 2050 in line with other western nations.

As we [noted several weeks ago](#), the climate-focused bill and eight-year American Jobs Plan will be split into two: half focusing on 'domestic priorities' including things such as extending the child tax credit for several years; while the other half aims to mobilize a massive spend on transformative infrastructure and job creation.

For clean energy, the plan would see more than \$350 billion directed towards clean energy, including \$174 billion to expand the electric vehicle market through the construction of 500,000 charging points nationwide. Incentives will also be put in place to convert public transit from diesel to electric, with tax breaks for Americans wishing to buy plug-in cars.

Around \$46 billion will be invested in clean energy manufacturing to counter China's rising dominance in the sector, while \$35 billion will

go towards climate-related research and development. The energy industry will also be made responsible for plugging orphan oil and gas wells and cleaning up abandoned mines.

It will also look to set out a “clean energy standard” to mandate the country’s utilities to supply a minimum amount of carbon-free electricity as part of the power mix. Along with Biden’s broader objectives, this will inevitably rise over time, reaching 80% in 2030 and 100% in 2035. It is likely that this ‘carbon-free’ classification will encompass nuclear energy and natural gas with carbon capture and storage technologies.

The Investment Tax Credit is set to be maintained indefinitely

Alongside this, a further \$400 billion could be earmarked to support the extension and expansion of the country’s tax credit system for renewables and storage projects. Such credits, according to the administration, will facilitate the mobilization of tens of billions of dollars of private capital to build a world-class power network and support a huge amount of new employment.

While creating several new tax credits for other corners of the energy sector, extensions have been proposed for the Investment Tax Credit (ITC) – mostly used to subsidize solar power based on the initial capital investment – and the Production Tax Credit (PTC), which mostly allows wind power developers to benefit from each unit of electricity produced.

Specific payment options and 10-year timelines are expected to be published in the coming weeks for both tax credits, marking their longest potential renewable since they were established.

Under current policies, the PTC is now worth 60% of its ‘full value’ at \$25 per MWh of delivered electricity over the first ten years of a project’s life. However, this is set to be phased down to zero at the end of 2021.

The ITC, which currently allows developers to claim a tax credit worth 26% of the initial project cost, is scheduled to phase down to 22% in 2023, before falling to 10% indefinitely thereafter. Both tax credits aim to provide investors with certainty of solid rates of return over the early years of a project’s lifetime, helping to offset risks and to spur a more rapid growth of renewable capacity in the US. At the end of last year, a new 30% ITC was also introduced for offshore wind projects that enter construction before 2025 and are completed before 2035.

Biden's reforms to these tax credits will also provide a direct cash payment option which will allow the industry to become less reliant on expensive tax equity for project financing. With access to cash prior to taxable income, this option should enable developers to complete projects and create jobs more rapidly. It is currently unclear if such direct payment options will be equal to 100% of the value of the PTC or ITC.

Tax credits will also likely be extended to support energy storage projects – an area where they have so far been lacking – especially in light of the major blackouts in Texas in February; the Department of Energy has highlighted that outages cost the US economy up to \$70 billion per year.

Along with the extensions, a new investment tax credit will also be created to spur the development of at least 20 GW of high-voltage power lines across the country. This will encourage both 345 kV and above capacity power lines to allow wind and solar power to be transmitted from high-resource interior and offshore regions to load centers – largely on the coast.

A Grid Deployment Authority will also be established at the Department of Energy to manage the route-mapping of several dozen transmission lines, helping to leverage existing rights-of-way and “creative financing tools.”

Another tax credit will also be made accessible for manufacturers, along with some federal grants, to promote the domestic production of batteries in a bid to prevent a Chinese monopoly in the industry.

In total, along with expenditure in other areas of the economy, the plan will account for around \$2.3 trillion in government spending over the next 8 years, which it hopes to fund by increasing corporate tax from 21% to 28% while also boosting taxes on overseas earnings and individuals earning over \$400,000 per year.

Biden has, however, ruled out the idea of raising gas taxes to fund any of the infrastructure plan, and those trying to build momentum behind a national carbon tax continue to struggle.

In terms of the bill's progressions, there's a chance that several provisions may be passed by Senate Democrats through a second budget reconciliation, although larger policy changes will need the approval of at least 10 Republicans who have been critical of Biden's heavy

Biden will set up a new Grid Deployment Authority at the Department of Energy

The stimulus agenda may have to be moderated to get all Democrats on board

spending in the wake of Covid-19; The previous \$1.9 trillion bill was rejected by every Republican in both stages through congress.

The fact that the new spend will be funded largely by raising taxes will also not sit well with Republicans. Mitch McConnell, the Republican Senate minority leader, rapidly jumped on the early proposals for more stimulus, dubbing them a “Trojan horse for massive tax hikes and other job-killing, leftwing policies.”

It’s also possible that support may not be unanimous among Democrats, with pressure already mounting to scale back some domestic policy ambitions, and suggestions that bipartisan collaboration would be preferable with more incremental spending and legislation. Several of President Biden’s advisors are recommending that the proposal is split into chunks to increase the chances of the bulk of its measures going through, although this would remove the possibility of reconciliation facilitating the full package, if bipartisan support continues to prove elusive.

This debate is somewhat similar to that seen in 2009, when the Obama administration offset the cost of recovery from the financial crisis with tax increases and lower insurance and hospital payments, which many argue was too aggressive in addressing the deficit and not focused enough on recovery. The counter to this was that the US healthcare system was in dire need of reform, so the stimulus was able to kill two birds with one stone –Biden’s stimulus aims to do the same. This time around though, critics seem more muted, [even if spending over \\$2 trillion in 2021 will bring debt close to 110% of GDP for the year](#), although not if the cash is spent over ten years.

Other aspects of the bill include

- Fixing transit systems including bridges, ports and airports
- Delivering clean water, electricity and broadband to all Americans
- Building two million homes
- Modernizing the care economy for children and the vulnerable
- Revitalizing domestic manufacturing

Orders

Renewables Orders this week

Masdar has announced a plan to triple the size of Uzbekistan's first utility-scale wind farm to a capacity of 1.5 GW, having signed an Implementation Agreement with the country's government. The first 500 MW phase of the Zarafshan wind farm is expected to enter commercial operation by the end of 2024.

Nordex will supply turbines to two of **Energiequelle's** onshore wind projects in Finland – the 28.5 MW Takanebacken and 39.9 MW Torvenkyla wind farms – both of which should be completed in 2022.

Wartsila has secured a contract for the battery at **RWE Renewables'** Hickory Solar project in Georgia, USA. The 40MW / 80 MWh DC-coupled storage system is scheduled for delivery in September 2021, with commercial operations to follow in November.

Japan's **Wind Power Group, Tokyo Gas**, together with Singapore-based **Vena Energy**, will accelerate the development of the 160 MW Kashima offshore wind farm in Japan, with works to start in 2024.

The **John Laing Group** has completed the sale of its 36 MW Glencabry wind farm in Ireland to **Greencoat Renewables**, for a fee of €31.2 million. The plant has been operational since 2017.

Spanish renewable energy company **Ecoener** is planning to go public, with the intention of raising €200 million to fund the development of new wind, solar and hydroelectric projects.

Ocean Winds – a joint venture between **Engie** and **EDPR** – has launched a foreshore license application for the 1.6 GW Cailleach offshore wind project in the Irish Sea. Pending approval, this would allow the company to carry out initial site investigations on the proposed site, which is 13 kilometers off the shore of Braehead in County Wicklow.

The world's largest sovereign fund – Norway's \$1.3 trillion oil fund – has made its first direct foray into a physical renewables project, with the acquisition of a 50% stake in **Orsted's** 752 MW Borssele 1&2 offshore wind farm in the Netherlands. The fund stated on Wednesday that it would pay €1.4 billion for its share in the project, which was fully commissioned in Q4 2020.

The government of **Pakistan** has announced that it intends to see 16 renewable energy projects developed in the country this year, mostly wind and solar with a total capacity of 860 MW. Prior to this batch of projects, **Pakistan** has previously announced three other mooted batches of projects – with 531 MW from the first 19-project batch, 1.34 GW from the second 24-project batch, and 6.71 GW from the third, 110-project batch.

The US subsidiary of Japanese developer **J-Power** will develop the 50 MW solar, 240 MW battery energy storage at the Birchwood power plant, converting it from coal to renewable energy. This project will be located in King George County, in the US state of **Virginia**.

UAE-based **Phanes Group** has signed an agreement with **Uzbekistan** to develop a 200 MW solar plant in the country's Navoiy region, with a PPA secured with the national electric utility. Together with Saudi Arabia's **ACWA Power**, there is considerable Arabian activity developing both renewable energy and gas power plants in Central Asia.

NextEnergy Capital has commissioned two subsidy-free solar farms in the **UK**, claiming the 75 MW Llanwern project as the largest photovoltaic power plant completed in the country so far – though there are now far larger ones in the pipeline, such as the 350 MW Cleve Hill.

Worth Noting

The world of renewables this week

Just as the consolidation of US oil was starting to go quiet, **Pioneer Natural Resources** has made a move to acquire rival Texan producer **DoublePoint** Energy in a \$6.4 billion cash and stocks deal. This comes not long after the company's acquisition of Parsley Energy in January for \$7.6 billion, following the oil price crash during Covid-19, which has led to a surge of bankruptcies across the shale industry. Pioneer produced 370,000 barrels of oil per day in 2020, with hopes of adding an additional 100,000 barrels through DoublePoint's assets by the end of June. Through consolidated assets the company hopes that the deal will realize cost savings of \$1 billion over 10 years.

BP claims to have completed its debt-cutting measures ahead of schedule, following a stronger-than-expected first quarter for 2021. Having stood at \$38.9 billion at the end of 2020, the company's debt is expected to have fallen to \$35 billion in its quarterly figures. Following this, the company announced that it will restart its share buyback process sooner than it had anticipated, having previously stated that debt could rise in the first half of 2021. BP will publish its first quarter results on April 27.

The **International Renewable Energy Agency** has reported that 260 GW of renewable capacity was installed in 2020 – nearly 50% more than in 2019. Through the year, more than 80% of all new electricity generation capacity came from renewables, including 127 GW from solar power and 111 GW from wind. China also accounted for more than half of the new capacity, with 136 GW coming mostly from wind (72 GW) and solar (49 GW). The US, in second place, saw 29 GW of renewables installed through the year. Total fossil fuel additions fell to 60 GW for 2020, down from 64 GW in 2019.

LONGi, the solar manufacturer, has confirmed the existence of a new arm which will deal in green hydrogen - **Xi'an LONGi Hydrogen Technology Company**. **LONGi**'s director of industrial research Yunfei Bai posted on WeChat to note the expected cost declines of PV-

powered hydrogen electrolysis, and an expected demand of 60 million tonnes per year which would require 1500 GW of solar capacity to produce. **LONGi** is one of the top 5 global solar suppliers, with over 20 GW shipped last year, and there is a trend of vertical integration and consolidation in the Chinese solar industry.

Dutch energy supplier **Eneco** has announced plans to double its solar and wind capacity to 2,500 MW in the next five years, following the publication of its 2020 financial results. Through the year, Eneco's earnings rose 13% to €484 million, while profits soared by 48% to €113 million compared to the year prior. In 2020, the company added 202 MW of renewable energy, including the Blauwwind and Seamade offshore wind farms, and remains on track to have 2 GW installed by 2022.

Despite criticism for only reporting around 50% of its emissions in 2019, the world's largest oil company – **Saudi Aramco** – is still refusing to fully account for its greenhouse gas output. In a report released in March, the company revised its 2019 figures, increasing them by 23% to account for three wholly owned assets in Saudi Arabia, the US and Germany. However, in its 2020 figures, it has refused to include several assets that weren't fully operational for the entire year – the Fadhili Gas Plant and Jazan Refinery, for example. The company will only reveal emission figures for assets which it has under its operational control, meaning that most of its joint ventures are excluded from data, including refineries and chemical complexes which could account for as much as 28 million tons of direct emissions. Only Scope 1 and 2 emissions are also accounted for, meaning that Scope 3 emissions – from customers burning Aramco's fossil fuels – are ignored. Bloomberg has previously estimated the company's Scope 3 emissions at 1.6 billion tons – 4% of all global emissions.

South Africa is preparing to tighten its emission cuts by 2030, according to a draft climate plan published last week. In the draft, the government plans to set and aim to cut greenhouse gas emissions by between 398 million and 440 million tons by 2030 – a reduction of 28% compared to its 2015 pledge. The country currently estimates that it will need \$8 billion per year from the international community to help fund these efforts.

Volvo-owned electric vehicle company **Polestar** has set an ambition to create the world's first carbon neutral car by 2030, by fully eliminating emissions in its supply chain. In the announcement made on Tuesday, the company claimed that it will not use carbon offset in this endeavor. Polestar's most recent model, the Polestar 2, leaves the factory with a carbon footprint of around 26.6 ton, compared to around 14 ton for petrol Volvo XC40, and reached 'carbon parity' with the fossil fuel model after around 50,000 miles of driving. If all goes to plan, the Polestar 0 will find carbon neutral sources for materials including aluminum, lithium and cobalt, and will be carbon neutral off the shelf in 2030.

The world's largest independent oil trader **Vitol** has reported record profits of \$3 billion in 2020 – up from \$2.2 billion in 2019 – after managing to capitalize on rapidly fluctuating oil prices through a pandemic-driven year. Through the year, the company traded an aver-

age of 7.1 million barrels of crude and refined products every day, and despite a 40% reduction in turnover, prices falling below \$20 per barrel in April presented an opportunity for those with access to storage to buy up cheap barrels and hold them until prices recovered.

Plug Power has teamed up with **Chart Industries** and **Baker Hughes** to launch the FiveT Hydrogen Fund, with combined investments of €260 million to fund the delivery of clean hydrogen infrastructure projects at scale. Plug Power intends to commit €160 million, with the others each committing €50 million, and the ambition of raising a total of €1 billion from both financial and industrial investors.

In **China**, which now holds something like 80% of global photovoltaic manufacturing, PV Infolink figures - as analyzed by Polaris Solar Photovoltaic News - show a 29% and 51% increase respectively in polycrystalline-grade and monocrystalline-grade polysilicon since the start of the year. The downstream prices have now also risen, with polysilicon and monosilicon wafers up 34% and 18%, while poly/mono cells are up 20% and 1%. Several project developments within China have been delayed, and component manufacturers are producing at a loss in some cases.

Renewable Power Capital and **Benbros Solar** have formed a Joint Venture to develop 14 solar projects totaling 3.4 GW in **Spain**. In contrast to the other Western European states - France, the UK and Italy - which all installed between 500 MW and 800 MW - Spain installed 2.6 GW of new solar capacity in 2020. The solar pipeline in the country, which has several deserts, is so large that it will motivate new transmission lines leading to France, North Italy and southwest Germany in the not-so-distant future. Announcements of solar development pipelines such as this one have become common, with another 750 MW from **Iberdrola** a month ago.

LONGi, the solar manufacturer, has confirmed the existence of a new arm which will deal in green hydrogen - **Xi'an LONGi Hydrogen Technology Company**. **LONGi**'s director of industrial research Yunfei Bai posted on WeChat to note the expected cost declines of PV-powered hydrogen electrolysis, and an expected demand of 60 million tonnes per year which would require 1500 GW of solar capacity to produce. **LONGi** is one of the top 5 global solar suppliers, with over 20 GW shipped last year, and there is a trend of vertical integration and consolidation in the Chinese solar industry.

Chinese perovskite startup **UtmoLight** has had its 20.5% efficient mini-module certified by Japan Electrical Safety & Environment. A massive stumbling block for perovskites, however, is maintaining efficiency levels when the modules are scaled up to full size; it's not uncommon for 20% small-scale test cell to fall all the way to 10% efficiency at full size, as a larger surface area suffers more imperfections. However, **UtmoLight**'s mini-module is 64 cm², which is a lot bigger than the frequent 1 cm² test cells cited by perovskite startups.



Rethink Energy monitors the transition to fully renewable energy markets

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Rethink Energy

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About Rethink

Rethink Technology Research has established itself over its 17-year history as a thought leader in 5G, and all forms of wireless; the entertainment ecosystem and streaming media; and has now embarked on energy through its new service **Rethink Energy**.

It offers consulting, advisory services, research papers, plus three weekly research services; **Wireless Watch** which has become a major influence among leading wireless operators and equipment makers and **Faultline**, which tracks disruption in the video eco-system and has become required reading for anyone operating in and around quad and triple play services and digital media and now **Rethink Energy**, which is designed to forecast the changing energy landscape and its investment possibilities as renewables begin to take over from conventional fossil fuels

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