WilderShares, LLC

Q2 2020 Quarterly Report: WilderHill Clean Energy Index®, June 30, 2020

The Clean Energy Index® (ECO) began 2nd Quarter at 56, and ended at 84, strongly up +50%. But there's richer context to this Q2 and 1st half (1H) 2020. Over a remarkable, memorable, volatile first half of 2020, ECO gained sharply +30% to go over 90, crashed late Q1 under 50, then rebounded. Intra-day moves could be abrupt, on March 24 ECO sprang up 15%. Even after Q1's big fall the story ECO captures bounced +75% from late March to go positive year to date. Or since, say, start of 2017 when ECO Index® was 38, in 3 ½ years it has risen over +115%.

ECO passively captures an emerging and highly volatile theme, so it can & does at times also 'drop like a rock.' That was amply proven in 2020. Big gains have occurred, as well as bigger declines. Plus we offer a mere observation: it's counter-intuitive perhaps yet ECO's theme has spiked sharply up at times in Bush II & Trump Presidencies - though neither promoted green energy. There were drops during an Obama administration which had favored this sector (that however was unique, as China was gaining new market share in clean energy).

Look back 5 years at Benchmark ECO Index® live since 2004, 1st for climate solutions, and here ECO is up by over +50% during a time when perhaps any energy gains may be rather notable. For in those same 5 years, dominant dirty energy themes are all far negative: fossil fuels plunged. Oil & natural gas are down hefty -80%, while coal is down -30%. Thus oil, coal & gas are far behind green energy. Last 10 years, fossil fuels are again down most, with the greener, clean energy decarbonization stories having significantly strongest relative returns.

Worldwide clean energy is seen in the WilderHill® New Energy Global Index (NEX) that also outperformed vs. fossil fuels. Notably too both NEX & ECO have outperformed vs. a good but separate, global clean energy Index for YTD & past 1, 5, 10 years and more; there's far fewer components captured in that latter, separate Index which helps explain the difference. Meanwhile the new Clean Ocean Index (OCEAN) story for healthy seas & zero-carbon jumped. As seen pages ahead ECO, NEX, OCEAN all sharply contrast with the fossil fuels. And lately, energy storage is coming into sharper focus with better, lower-cost batteries.

Live performances since 2004 show that oil, coal & natural gas alone no longer cover the broadening energy story: clean energy is now far more than 'niche'. The ECO Index® is best-known, the Benchmark, and has outperformed all fossil fuels last 1, 5, 10 years and more. Leading green ECO, NEX, plus OCEAN uniquely capture the climate change solutions story, decarbonization, solar, wind, and electric vehicles; they've also shown strong performances and helpful non-correlation vs. fossil fuels. Looking ahead they provide diversification, transparency, and ESG that may help diversify a model portfolio.

Highly volatile, as always, here's the Clean Energy Index® (ECO) to late 2nd Quarter,

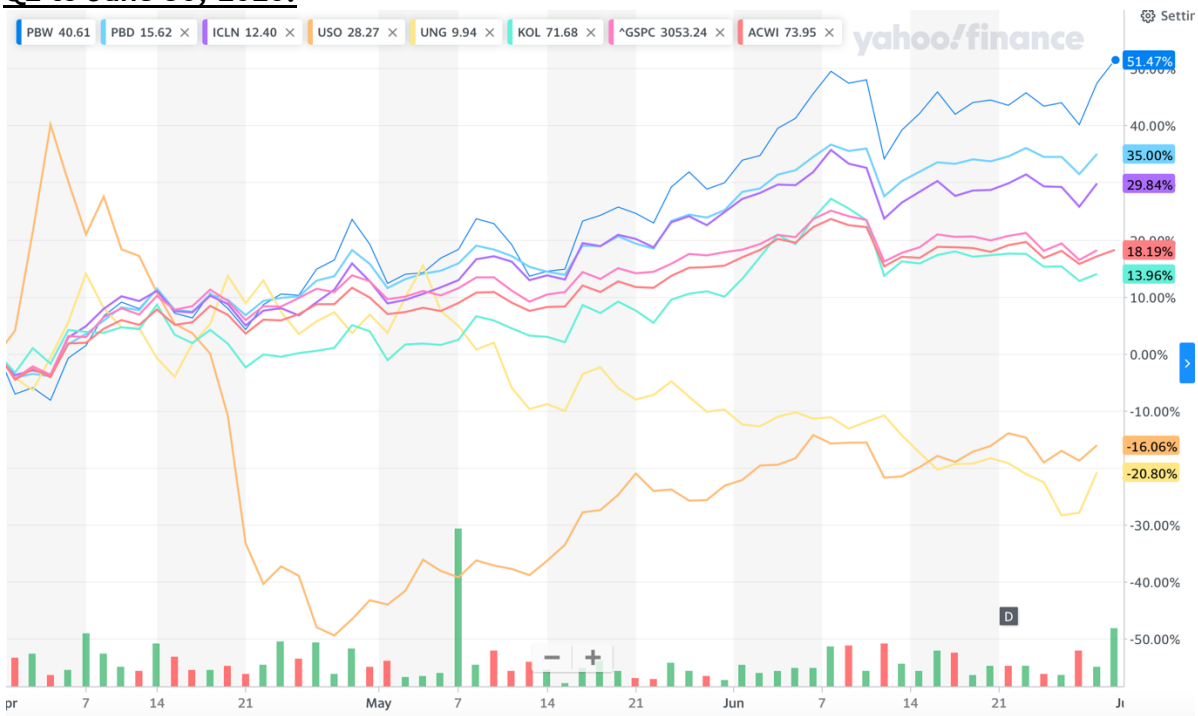
Source: NYSE.com

2020 is but halfway over – and already feels like it's been a fully remarkable exhausting year. To start with here's a Q2 chart: the world hasn't seen anything quite like the past few months. With so very much to unpack, there's an unusually prolific number of pages here – some 50(!). Overshadowing all both Q2 & 1H is of course COVID-19 pandemic. Job losses skyrocketing on a Great Lockdown. Stock markets cratering. Oil imploding to places not seen in 100 years. Recent attention to climate change – lately being overtaken by global pandemic fears.

And yet. This first chart for Q2 to late June shows ECO the most sharply rising about +50%. Why? Partly it may be put down to late Q1, just before Q2 when all equities steeply fell. Consider then a rising 2nd Quarter was maybe partly set up by declines Feb/March. And that 3 green themes all do 'better' than brown fossil fuels, oil, coal, gas. After ECO is NEX – both 'above' a good, but separate global clean energy Index (not ours); and those 3 clean themes outperform 2 broader Benchmarks, S&P 500 & an all country world theme. While broader Indexes aren't quite ideal comparisons to energy, they're well-known so briefly included.

Rather distorting to this Chart the other direction (falling -50% *Downwards*) is an oil theme: oil futures fell tremendously going remarkably negative, before rebounding some in June. A few words about that unique oil index basket & its tracker. Very unlike ECO/NEX/OCEAN, that oil theme is instead based upon a commodity - rather than on equities. 'Worse' it was based on furthest front-end oil future contracts, pricing in turn influenced by a tracker that can't take physical possession of oil. It's constrained by known rules & subject to pricing attack. When those very nearest front-end month oil contracts 'broke' in contango, that oil index went extremely hard to downside in 1H. Very nearest month moved unlike more stable futures 12 months out, and that better represented prices for physical oil. We'll discuss unique moves in oil from March to June pages farther below, but oil nonetheless vastly fell.

Q2 to June 30, 2020:



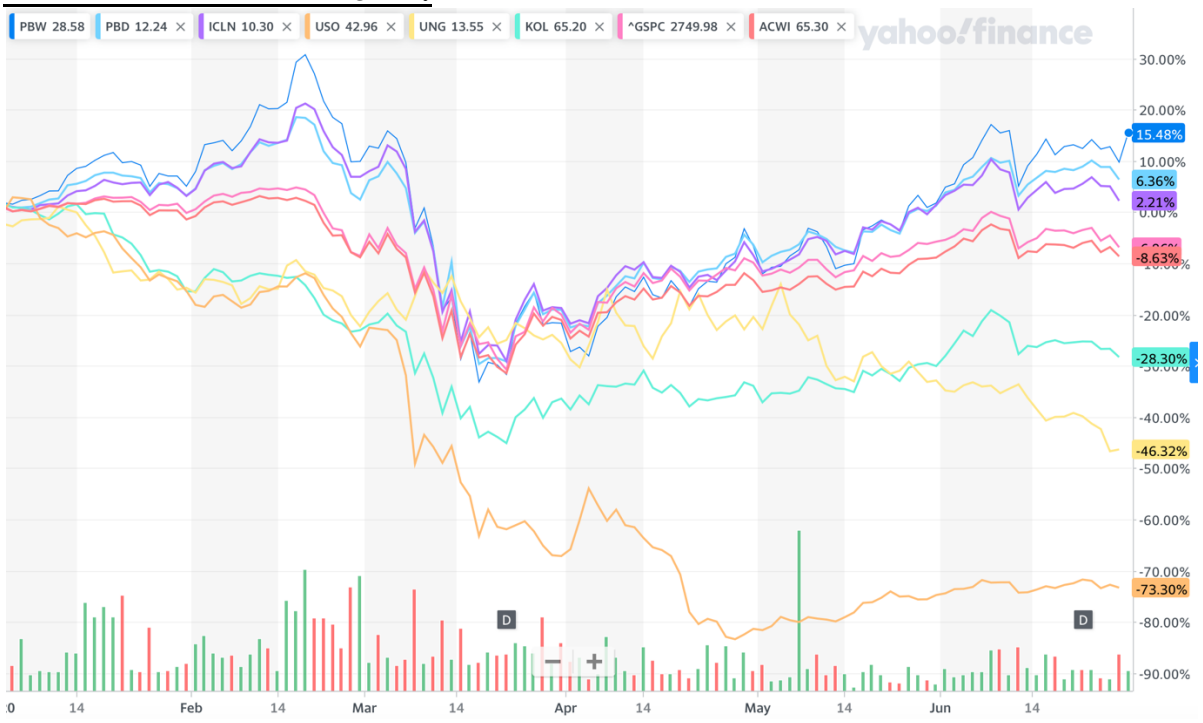
Source: finance.yahoo.com

For last 6 months, the Year to Date (YTD) clean energy is positive here late June even after those huge falls Q1. And a useful non-correlation ECO often shows vs dirty energy, is again vividly seen in this chart. What fine example of diversification among these themes! While a much-followed oil story is in unprecedented historic free fall, instead we see clean energy's story and thus ECO Index® – marching through 1H to a very distinctly-different drummer.

Thus a decarbonization story within ECO far outperforms 3 dominant dirty energy themes – and it betters broader Indexes here too. ECO/NEX again outperform that good, independent, but other global clean energy Index as discussed ahead. 2020 began rosy up to mid-February, thematic clean jumping. As captured by ECO, NEX, OCEAN, all spiked upwards more than broader Indices. As we'll show ahead in greater detail, a COVID-related crash hit everything hard mid-February 2020, dropping markets and ECO/NEX to 1H nadir by latter-March.

Yet past 6 months now leave clean stories relatively unscathed, at near start of 2020 levels vs. dirty energy stories. Falls in clean energy were fast subsumed by a bounce back, declines less enduring than fossil fuels (down still). Oil fell hardest, rebounding some though not fully. Indeed a small slice of S&P 500 in energy (mainly made of fossil fuels) fell Q1 by -51%, while the S&P 500 was down 'only' -19% in Q1. Just 1 big component in an S&P 500 basket weighted by market capitalization, may have a heftier role than all energy components combined.

First Half of 2020 to late-June:



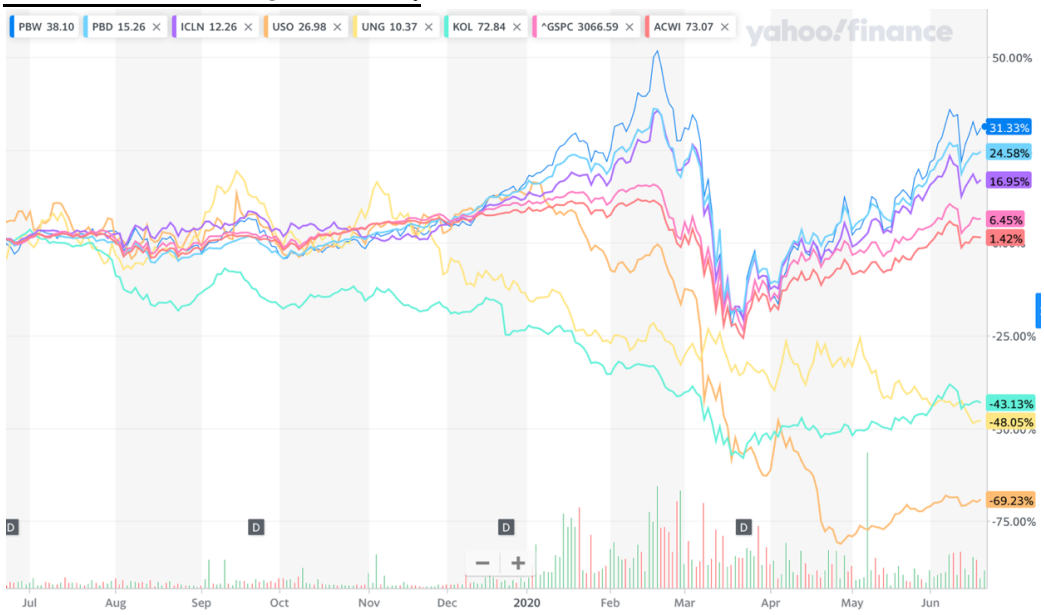
Source: finance.yahoo.com

In sum the 2 'best performers' past 6 months among these themes are again ECO & NEX. As seen via independent trackers they're both up YTD. That contrasts with oil, exceptionally down here -70%; natural gas off some -45%, and coal 'only' down some -25%. ECO & NEX do 'better' too than an S&P 500 story, and an all country world theme - but because those two major Indexes are very broad, they're less-than ideal bogeys for energy comparison.

Last 12 months too, late June 2019 to June 2020, clean energy (ECO) is up most, some +31%; nearby it is NEX up +25%. Both again beat an independent, and separate, global clean energy Index; we address that other global clean energy Index – just noting it contains far fewer components, so many countries represented there may only be seen in 1-2 components each. And yet these 3 varied clean energy stories all do far 'better' vs. dirty fossil fuels. Rolling 12 Months for ECO and NEX, and a separate global clean story – plus 3 brown energy stories - shows no great surprise a rather barbell-shaped return. At far bottom are oil, gas, coal; they're all greatly down via passive Indexes/trackers -70% to -40%, fossil fuels rather clumped, all negative, with very large declines. At opposite end, all up, are clean energy stories.

In the middle are 2 broader market themes. They're included a last time for being so major - yet are non-ideal bogeys given little exposure to energy. They finish near nil, just up.

Past 1 Year to late June 2020:



Source: finance.yahoo.com

A COVID-related crash seen Q1 hasn't been negligible. ECO went from most components well up early 2020 YTD and the Index up Year to Date +30% by mid-February, to having all but one constituent down YTD by late March. Similarly all but 5 components in NEX & in OCEAN went negative by that low March nadir, as seen in pages below (since rebounding). And now at very end of June 2020 there's reasons to foresee perhaps declines in broad markets in Q3 as market fears again return very last few days of Q2 2020, with COVID spikes returning, bigger stimulus checks soon ending for many sadly unemployed, and bankruptcies beginning to bite.

Corrections happen, trees do not grow to the sky. End of 2019 a 1-year clean energy story via ECO already gained a rather sizable +59% - so perhaps some correction was maybe, arguably then 'unsurprising' early in 2020. Moving on, let's consider the Past 5 years next. Dirty fossil fuels again stand out for their declines. In early 2020 vantagepoint, energy (as mainly fossil fuels) was worst performing Sector of the S&P 500 for 4 of past 6 years. True, clean themes too had been in a long spell down, as seen in prior Quarterly Reports that then showed *all energy* negative for past 5 years. Yet that monolithic view was lately changing, a lot.

By end of 2019 the 5 year Chart had broken with that past - clean energy had shifted well positive, returning +50%. At near 1st half 2020, this divide's grown more stark. ECO is up over +50% while dirty since fell more - for striking divergence between the clean energy themes - vs. the dirty themes. Two temporal factors broadly at play in this 5-year Chart are perhaps: a) clean energy and so ECO/NEX are leaving 3 Down years 2014-2016 and b) they have captured 3 strongly Up years 2017-2019 (2020?) – with gains across ECO, NEX, OCEAN.

Re-added to charts are 2 focused energy themes: one an excellent passive solar-only story, and an active alternative energy fund. (Broader stories less useful 'bogeys' since energy is but a small sliver, and having too many lines here clutter, so they're replaced for clarity).

Past 5 years the ECO tracker is strongest of these energy stories, up over +50%; global NEX is up +25%. A separate global clean energy Index (not ours) via tracker is 'only' up +13%.

Interestingly that other, separate global clean energy Index has underperformed and now trails ECO & NEX every period here: for Q2, YTD, the last 1 year, 5 years, 10 years, & 12 years. For why ECO/NEX so outperformed that independent global Index, it may be partly that ECO/NEX weightings are distributed more equally; that other Index (rightly or wrongly) is far more concentrated so a few components account for much weight there. The Global NEX may reflect too nearly 3x more components – for example in Q2 2020, NEX had 87 components – while that other world clean energy Index had only 30 - so composition differs significantly. Hence so can/do their themes, as the NEX captures and tracks many more countries, has more diversification, and also more types of renewables and stories in global clean energy. Next, after that other passive story, an active-managed fund trails at near nil. And an excellent solar-only theme is here off -4%; perhaps partly as electric vehicles, hydrogen & fuel cells so core to ECO's theme (all 3 unusually up here) – are all outside of any focused solar theme; but that excellent solar-only story has done very, very 'well' in more recent years.

ECO tracker, NEX tracker, plus varied clean & fossil fuels themes the past Rolling 5 years: early July 2015 to late June 2020. Once 'tough times' across all energy increasingly has become Differentiated – especially ECO/NEX at top greatly outpacing dirty:

Source: finance.yahoo.com

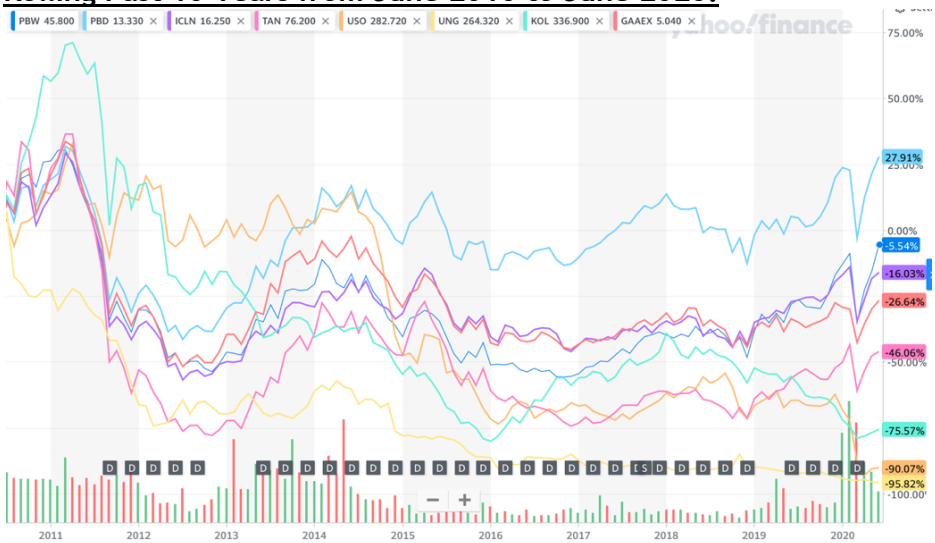
Let's next step back farther – looking back in time. Going back to earlier last decade shows not only dirty – but clean energy too is well down at times. This warrants attention. Here's a rolling chart for past 10 years, a decade June 2010 - to June-2020. Not visible is a Great Recession that hit just *before* 2010, thunderously dropping many to lows 2008/2009. That had put in bottoms at numerous *non-energy* stories, many springing back up afterwards. But not so for much of dirty energy (and partly clean too). As seen below, especially *dirty energy* themes have typically gone on falling for long after, no immediate rebounding.

In the apt words of a Wall Street Journal piece, 'Green Energy is Finally Going Mainstream" (June 24, 2020), "After many false dawns, the sun is finally starting to shine on green-energy bets. …. The poor long-term track record of clean energy stock indexes and funds has much to do with the period roughly a decade ago when Chinese solar-panel manufacturers scaled up and drove down costs. That accelerated panel installations but crushed margins, leaving many much-hyped U.S. and European manufacturers, and their shareholders, in the red."

Clean energy, now, has clearly climbed. Global NEX captures this most comprehensively and is positive here about +28%; similar ECO is back at near nil. An independent and separate global clean energy Index tells a differing/narrower story, again lower at some -16%. An active fund is off about -26%. Meanwhile, fossil fuels are plumbing depths. Hence 10 years shows all themes trail NEX/ECO, with the dirty down -45% or more. It's a tale of declines outside clean, fossil fuels plus others trailing ECO & NEX by at times inarguably large amounts.

Natural Gas is very lowest down -95%. Just 'above it' deeply down is an Oil story: even with brief spikes, oil is down -90%. Nearby is Coal, down roughly -75%. Moving upwards 'above' 3 fossil fuels is a passive Solar-only tracker down about -45%: again, this theme has done far 'better' in more recent years – yet is brought low when seen over that tough past decade. An active-managed fund shows again that it's very tough to beat the passive Indexes. So highest is more encompassing global NEX, with ECO near nil. ECO & NEX outperformed vs. other energy themes – yet trail well behind broader Indexes like say, an S&P 500. On other hand, clean energy ECO & NEX clearly did 'best' last 10 years – vs. other energy stories.

<u>Rolling Past 10 Years from June 2010 to June 2020:</u>



Source: yahoofinance.com

One last point about charts before moving on. A small problem with *rolling* Charts like past 5 years, 10 years etc is in a few years they *may* show much stronger relative returns for ECO. Once Charts leave a huge fall in ECO, 2008-2012, and tough times in all energy 2014-2016, relative drops removed, ECO *may* show far stronger relative gains. For that reason, a view is needed with ECO's declines preserved: hence this new Chart below. From fixed mid-2008 it looks onwards. Longer-running ECO + tracker could have allowed starting back to 2005, yet other trackers didn't all commence until later – so earliest feasible start was mid-2008.

Over now 12 years & growing, this *non-rolling* chart shows again a tale of pervasive declines. Unsurprisingly fossil fuels lag behind green by big amounts. But relative to rolling 10 years, above, a difference increasingly stands-out; the global crash 2008/2009 is now brightly highlighted and strongly forever preserved. What energy charts may perhaps show ahead will doubtless be of interest as 2010s scroll away. Long-viewed as a tough time across all energy – it *may instead* show as being just mainly tougher for the fossil fuels, only.

This chart now emphasizes enormous drops across energy, after a steep run up mid-2000s. That bull run mid-2000s was largely captured by ECO, which increased mid-decade. Then from about mid-2008, as other trackers were commencing near the peak, all would plunge. That crisis and crash caused huge falls across countless themes globally. A bog & deep mire seen since stretching well across clean as well as dirty energy, is brightly preserved here.

Starting from bottom are fossil fuels, plus a solar-only theme; the 3 + 1 fell near some -90%. Next 'up' is an independent, other global clean energy Index well off near -80%; the narrower theme it captures fell much over this period: with some 30 components it differs vs. the outperforming NEX that has at times near 100 components here. Roughly tied / just above it is an active fund. 'Above' those is ECO again outperforming that separate global clean energy theme. And clearly 'highest' here is global NEX, though underwater. Again, much broader Indexes outside energy did *far* 'better' here, yet they're different: energy is a sliver. Plus since 2017, clean energy has shown some up volatility too, which *may* change everything.

<u>Roughly Last 12 ½ Years starting from Fixed June 1, 2008, to June 2020:</u>

Source: yahoofinance.com

Lest this Report overly-emphasize negative points, spotlighting e.g. sharp declines long ago last decade, there's also sharp rises at times like recently late Q1 & Q2 2020. For example the ECO components jumped just 3 days from March 24th in sharp +25% rebounding; that acute volatile up action early in 2020 (after lows) pushed ECO upwards some +15% in just hours.

From close under 50, March 23rd at just 48.75 on fears of 25% unemployment & Depression II, the Index then reached 55.87 March 24th, closing at 55.74 on hopes of $2 Trillion stimulus. Focused green energy support wasn't expected in a stimulus Phase 3, an absence that was 'fulfilled' since it was opposed politically. Yet clean energy is today nonetheless fast-growing cost-competitive *without* subsidies (unlike fossils/nuclear always needing support). We'll discuss the rapid changes in the costs of solar, wind, and storage much more below.

So gains *may* happen too in global/clean energy. At times they may arrive with broad markets, perhaps with more volatility. Consider say, April 6th to 10th: in 1 week the S&P 500 & Dow rose some +12%, biggest 1-week S&P gain since 1974, 7th largest for Dow. And the ECO & global NEX (which 'can at times drop like a rock' downwards to be sure - but also may rise up) were just as, or even more volatile: ECO rose +19%; a volatile NEX gained over +12%.

For a world perspective, here's NEX components end of week in ascending order from bottom. Bunching shows best performers in solar, energy efficiency infrastructure, electric vehicles, and hydrogen (H2) fuel cells. New, green H2 would first need breakthroughs in production & storage – meanwhile fuel cells would require breakthroughs to be competitive and durable. That said there's growing interest in H2 like in Australia or using ammonia to transport H2 + nitrogen like an energy currency. ECO, NEX, OCEAN & our earlier Fuel Cell Indexes all have had exposure to hydrogen & fuel cell stories since an initial inception in 1999.

NEX Index; Component Name and % Changes for the Week, April 6th - 10th

Overall % total NEX Change for Week = +12%

Daqo New Energy Corp	-2.9%	Xinyi Solar Holdings Ltd	3.2%
Canvest Enviro	-2.8%	EDP Renovaveis SA	4.2%
CS Wind Corp	-1.3%	Byd Co Ltd	4.6%
Xinyi Energy Holdings Ltd	-0.9%	West Holdings Corp	5.2%
Novozymes A/S	-0.3%	CS RE Fund Green	5.3%
Ormat Technologies Inc	0.0%	Mercury NZ Ltd	5.7%
Gurit Holding AG	0.1%	Meidensha Corp	5.7%
Signify NV	0.7%	Kingspan Group PLC	6.4%
Neoen SA	0.9%	SMA Solar Technology AG	7.1%
Vestas Wind Systems A/S	1.4%	Renewables Infrastructure	7.9%
Terna Rete Elettrica SpA	1.4%	Gigasolar Materials Corp	8.0%
Landis+Gyr Group AG	2.0%	Verbund AG	8.1%
Orsted A/S	2.0%	Sociedad Quimica y Minera SA	8.2%
Meridian Energy Ltd	2.0%	Northland Power Inc	8.3%
Siemens Gamesa Renewable	2.1%	Eolus Vind AB (publ)	8.4%
Contact Energy Ltd	3.0%	CropEnergies AG	8.4%

Everlight Electronics Co Ltd	8.6%
Tilt Renewables Ltd	9.0%
Acciona SA	9.1%
Albioma SA	9.3%
Solaria Energia y Medio SA	9.3%
Ecopro Co Ltd	9.3%
GCP Infrastructure	9.4%
Audax Renovables SA	9.5%
Greencoat UK Wind PLC	9.9%
Lextar Electronics Corp	10.0%
Atlantica Yield PLC	10.1%
Samsung SDI Co Ltd	10.4%
Xinjiang Goldwind	10.6%
TransAlta Renewables Inc	10.7%
Innergex Renewable Energy	10.8%
Nel ASA	10.9%
NIO Inc	11.3%
GS Yuasa Corp	11.3%
Nordex SE	11.7%
Sino-American Silicon	12.3%
Verbio Vereinigte Bioenergie	12.4%
Epistar Corp	12.7%
Ameresco Inc	13.1%
Falck Renewables SpA	13.2%
Encavis AG	13.2%
JinkoSolar Holding Co Ltd	13.2%
Renova Inc	13.8%
Plug Power Inc	14.0%
Cree Inc	14.4%
Caverion Oyj	15.2%
TerraForm Power Inc	15.4%
Itron Inc	16.5%
Willdan Group Inc	16.5%
Universal Display Corp	16.9%
Nibe Industrier AB	17.0%
First Solar Inc	17.7%
Renewable Energy Group	17.7%
Veeco Instruments Inc	18.1%
eREX Co Ltd	18.3%
Tesla Inc	19.4%
Ballard Power Systems	21.0%
Boralex Inc	21.2%
Scatec Solar ASA	21.6%
Ricardo PLC	22.2%
Powercell Sweden AB	22.6%
TPI Composites Inc	23.3%
Bloom Energy Corp	28.2%
Solaredge Technologies	29.8%
Sunnova Energy Intl	29.8%
Sunrun Inc	32.5%
Enphase Energy Inc	32.7%
SunPower Corp	33.0%
Vivint Solar Inc	41.6%
Hannon Armstrong Sustain.	44.0%

==========

Returning to clean energy's plummet 1st Quarter 2020, crashing February to mid-March had left only 1 ECO component positive at a so-far YTD bottom, on March 17/18, 2020. We'll look in a granular way next at that COVID-19 bottom at a so far, low 2020 nadir. Below are individual components & their YTD % changes at March 17/18 lows for three Indexes: ECO, NEX, OCEAN. (ECO Index composition Q1; latter 2 Index compositions are as of Q2).

That March 18 inflection was a bit memorable as ECO opening at 51.88, fell to an intra-day low of 45.85 losing -12.57%, and closing at 47.37. So this was ½ off a recent 93.65 high intra-day on Feb. 20, 2020 when it closed at 92.53. In a month ECO had plummeted -50%, as world markets were crashing amidst fears of 2nd Depression unemployment. Fears were rampant in all - and so too in clean energy baskets – as seen here March 18th: - and could (ever) return.

ECO Index at a nadir on 3/18/2020. Components in Ascending Order % Change YTD

Name	YTD % Change
Bloom Energy	-58.9%
Hexcel Corp	-57.2%
Vivint Solar Inc	-54.7%
Woodward Inc	-53.0%
Advanced Energy	-50.1%
Itron Inc	-49.4%
MYR Group Inc	-48.9%
Workhorse Group	-48.4%
TPI Composites	-48.0%
Universal Display	-47.8%
First Solar Inc	-46.0%
Veeco Instruments	-45.9%
JinkoSolar Holding	-44.4%
Sociedad Quimica	-40.5%
Willdan Group Inc	-40.2%
American Super.	-40.1%
NIO Inc	-39.6%
Canadian Solar	-39.0%
Sunnova Energy	-37.3%
SunPower Corp	-36.9%
Renewable Energy Grp.	-36.3%
Sunrun Inc	-35.6%
Gentherm Inc	-34.6%
Quanta Services Inc	-33.3%
Livent Corp	-32.5%
Atlantica Yield PLC	-27.0%
ESCO Technologies Inc	-25.3%
Cree Inc	-25.1%
Solaredge Technologies	-19.3%
Daqo New Energy Corp	-16.3%
TerraForm Power Inc	-14.2%
Air Products & Chemicals	-14.2%
Tesla Inc	-13.7%
Plug Power Inc	-10.4%
Ormat Technologies Inc	-10.2%
Enphase Energy Inc	-8.2%
Albemarle Corp	-5.5%
Ameresco Inc	-2.1%
Ballard Power Systems	+2.1%

==========

NEX Index at a nadir 3/17 & 3/18/2020. Components in Ascending Order % Change YTD

Name	YTD % Change
Bloom Energy	-58.9%
Ricardo PLC	-58.0%
Vivint Solar Inc	-54.7%
Itron Inc	-49.4%
Hannon Armstrong	-48.8%
TPI Composites	-48.0%
Universal Display	-47.8%
Nordex SE	-47.4%
GS Yuasa Corp	-47.3%
First Solar Inc	-46.0%
Veeco Inst.	-45.9%
JinkoSolar	-44.4%
Verbio Bio.	-44.3%
Meidensha	-42.7%
SMA Solar	-42.5%
CropEnergies	-41.8%
Landis+Gyr	-41.1%
Gigasolar	-40.8%
Sociedad Q.	-40.5%
Willdan	-40.2%
Lextar Elect.	-40.2%
CS Wind Corp	-39.6%
NIO Inc	-39.6%
Canad. Solar	-39.0%

Caverion Oyj	-38.3%
eREX Ltd	-37.8%
Sunnova	-37.3%
SunPower	-36.9%
REGI	-36.3%
Sunrun	-35.6%
Verbund AG	-35.1%
Xinjiang Gold.	-34.0%
GCP Infrast.	-33.9%
Gurit AG	-32.9%
Signify NV	-32.8%
Everlight Elec.	-32.4%
Greencoat UK	-31.4%
Renova	-31.2%
Audax SA	-29.8%
NibeAB	-27.1%
Atlantica Yield	-27.0%
Vestas Wind	-26.8%
Renewables I.	-26.3%
Eolus Vind	-25.8%
Kingspan PLC	-25.1%
Cree Inc	-25.1%
Encavis AG	-24.0%
Ecopro	-23.8%
TransAlta	-22.2%
Falck SpA	-21.7%
Solaredge	-19.3%
Siemens	-18.8%
Epistar	-17.9%
Xinyi Solar	-17.0%
Daqo	-16.3%
Mercury NZ	-16.2%
Contact En.	-16.2%
Meridian En.	-16.0%
Sino-A. Silicon	-15.3%
TerraForm	-14.2%
Tesla	-13.7%
Orsted A/S	-13.0%
Neoen SA	-12.9%
Northland P.	-11.6%
EDP SA	-11.5%
Tilt Renew.	-11.5%
CS. RE Green	-11.2%
Plug Power	-10.4%
Ormat	-10.2%
Terna Rete Sp	-9.1%
Enphase	-8.2%
Innergex	-8.2%
Byd	-6.9%
Novozymes	-6.3%
Samsung SDI	-6.1%
Albioma SA	-5.8%
West Holdings	-5.4%
Solaria Ener.	-4.5%
Canvest	-2.8%
Ameresco	-2.1%
Boralex	-2.0%
Powercell AB	-1.6%
Scatec Solar	**+0.1%**
Nel ASA	**+1.5%**
Acciona SA	**+2.4%**
Xinyi Energy	**+10.3%**
Ballard Power	**+13.3%**

==========

OCEAN Index at a nadir 3/17 & 3/18/2020
Components Ascending % YTD

Name	YTD % Change
Itron Inc	-49.4%
Evoqua Water Tech.	-48.7%
First Solar	-46.0%
Wartsila Oyj Abp	-45.3%
Cargotec Corp	-44.5%
Pentair PLC	-44.0%
Bollore SE	-41.5%
Landis+Gyr Group AG	-41.1%
CS Wind Corp	-39.6%
Canadian Solar	-39.0%
Sunnova Energy Intl	-37.3%
Pure Cycle Corp	-37.0%
SunPower Corp	-36.9%
Sunrun Inc	-35.6%
Grieg Seafood ASA	-35.4%
Verbund AG	-35.1%
Xinjiang Goldwind	-34.0%
Torm PLC	-33.0%
Signify NV	-32.8%
Nomad Foods Ltd	-31.1%
Beyond Meat Inc	-28.5%
Alfa Laval AB	-28.5%
Nibe Industrier AB	-27.1%
Veolia Env. SA	-27.0%
Kurita Water Ind, Ltd	-26.9%
Vestas Wind Systems A/S	-26.8%
Intertek Group PLC	-26.6%
Eolus Vind AB (publ)	-25.8%
Kingspan Group PLC	-25.1%
Cree Inc	-25.1%
Koninklijke Boskalis	-23.9%
Tassal Group Ltd	-23.8%
Watts Water Tech.	-23.6%
Kuehne und Nagel AG	-22.7%
Austevoll Seafood ASA	-22.3%
Cia Pesquera Cam.	-21.3%
Badger Meter	-21.3%
Solaredge	-19.3%
Metawater Ltd	-18.9%
Mowi ASA	-17.9%
Norway Roy. Salmon	-17.7%
Xinyi Solar Ltd	-17.0%
Clearwater Seafoods	-16.7%
Xylem Inc	-16.6%
P/F Bakkafrost	-16.5%
Meridian Energy Ltd	-16.0%
Sino-Am. Silicon	-15.3%
Leroy Seafood ASA	-13.8%
SalMar ASA	-13.7%
Tomra Systems ASA	-13.4%
Essential Utilities	-13.1%
Orsted A/S	-13.0%
Neoen SA	-12.9%
EDP Renovaveis SA	-11.5%
Tilt Renewables Ltd	-11.5%
Samsung SDI Ltd	-6.1%
Solaria Energia SA	-4.5%
Powercell Sweden AB	-1.6%
Nel ASA	+1.5%
California Water	+5.4%
American Water Work	+6.3%
American States Wat.	+7.7%
Ballard Power	+13.3%

==========

We avoid politics. So it's just a small side-note mid-2020 that there's maybe sparse hope right now for U.S. stimulus squarely for green energy. 180 lawmakers did sign a June 15th Letter to House Leadership calling for directed relief here, given the loss of 600,000 clean energy jobs since the pandemic. But calculus for a directed, focused big new green-only funding now – let alone a Green New Deal, like vetted now in the European Union – isn't aligned end of Q2. Senate leadership squarely now opposes it, and it's a non-starter at the White House.

Just musing what *may* conceivably catalyze such support ahead, it's imaginable a new Phase Stimulus package could include clean energy as part of a bigger Infrastructure Bill. And just possibly, post-2021, federal action may include say Tax Credits that in theory extend a key 30% Solar Investment Tax Credit, and Production Tax Credit for Wind. The credits otherwise step down. Senate & White House strongly oppose that right now, so again odds today at late June 2020 are very, very meager. Yet it *may be* imaginable soon - especially post-2021.

A green stimulus here could be helpful. In pandemic-hit China, renewables manufacturing and demand have slowed; auctions for enormous solar farms are now paused as it addresses this pandemic - and China has cut subsidies 50%. Gears of the world's economy are seizing of late, velocity of money slowed, prospects for clean growth dim in a slump. It's decades since *less* solar was installed in a new year, than year before, but it may happen in 2020. Stimulus checks in the U.S. may end Q3. Yet there's some outlier hopes for a perhaps good 2021 here. Hope may be for flowering green growth; better new batteries & storage are hardy perennials for big improvements – lodestones for vastly improving intermittent renewables & EVs.

There's precedent for focused green stimulus. The U.S. 2009 ARRA package boosted climate-friendly sectors by $90 billion out of $800 billion. That tripled U.S. solar/wind installations, grew U.S. clean energy jobs from a few hundred thousand, to 3+ million. Today in Europe, a Green Deal and new carbon tax are being considered. Though the 2020 U.S. CARES Act did boost jobs in carbon-heavier, older industries – a package 2021 may potentially be greener. Plus cost reductions earned here, aren't like oil or coal; once renewables *earn great cost declines, they hold on and grow them;* these are stickier, sustainable and welcome.

Pandemic ought not take our eyes off the climate 'solutions' prize. Yes, a juggernaut that was clean energy only months ago is now throttled back by economies prostate on their backs. Focus on climate change & CO2 is diverted, demand for clean energy lightened, solar & wind auctions waylaid, tax credits to incentivize solar/wind stepping-down; no one knows if/when global economies or clean energy may regain confidence & growth. It's conceivable too that economies yet crash – and as we always observe, volatile ECO can drop like a rock too!

Still, it's also becoming accepted now that longer term - clean solar & wind energy will thrive - without subsidies. Same can't be said of fossil fuels plants which ever-require costly fuel – nor of their brittle supply chains. Nor of riskier, costlier nuclear power, seen no place without immense government support. Meanwhile, CO2 & climate change risks bedevil all fossil fuels, like never before, perhaps making *clean & more-affordable* choices wiser long-term.

A key turning point start of 2020s, is renewables are often now *the most affordable* choice. Conversations can & should shift, once fossil fuels are no longer the cheap choice. In a coming decade, U.S. energy *may* yet pivot towards a more fossil-free low-carbon grid that saves money to boot. It is now feasible. We'll look at this freshening bold new possibility next.

Assume for a moment that the climate science is correct. If so then the world will have to act much faster – cutting CO2 emissions in half by 2030 to avoid worst ravages of warming, with 'only' maybe 1.5 degrees C. Yet, we're nowhere close to 50% cuts. Weaker trends today go more languidly to 2050+ before seriously decarbonizing: that will be much, much too late.

Given science requires faster action towards net-zero, starting now, it's key that dramatically plunging solar, wind & energy storage costs *can immediately change everything*. In the U.S., a power grid with 90% less CO2 is not only feasible, it can be done in 15 years - with *cheaper* electricity. In past competing analyses differed over the last bits of 100% zero-carbon models. But beyond 90%, is a smallest bit. Since analyses *can and oft do agree* on the first 90% or so – that it can be done in the U.S. (and elsewhere) more quickly than commonly understood with far less cost – a major new Report released June 2020 by U.C. Berkeley is very important.

It shows exactly how 90% zero-carbon can now be achieved swiftly: within 15 years by 2035. That retail electricity costs consumers pay in 2035 would be 10% less than today. So common assumptions get it badly wrong both on how long to clean 90% carbon-free power (much sooner than thought), and costs of this new U.S. path (it actually saves money).

Remarkably getting to this 'no-regrets' 90% less CO2 is sensible and is better too than the status-quo No New Policy, delivering cost savings. It's detailed in a "2035 Report: Plummeting Solar, Wind, and Battery Costs Can Accelerate Our Clean Electricity Future" (June 2020), https://www.2035report.com – and companion Report, "Rewiring the U.S. for Economic Recovery" from Energy Innovation (June 1990). Their conclusions differ sharply from reports of only 7 or 8 years ago, that foresaw carbon-free electricity as adding costs. Instead, now:

> "Given the plummeting costs of clean energy technologies, the United States could reach 90 percent zero-carbon electricity by 2035, maintain reliability, while *lowering* customer electricity bills from today's levels, on the path to 100 percent zero-carbon by 2045. To reach 90 percent, this infrastructure build-out would productively put about $1.7 trillion dollars in investment to use over the next 15 years, supporting about 530,000 more jobs each year and avoiding at least $1.2 trillion in cumulative health and environmental damages. And it would reduce economy-wide greenhouse gas emissions (GHGs) by 27 percent by 2035.
>
> Building a reliable 90 percent zero carbon electricity system is a huge opportunity for economic recovery – a fantastic way to invest in a healthier economy and support new jobs, without raising electricity bills. But America's current electricity policy framework is not on track to deliver this economic opportunity."

This study allows for use of all known 'zero-carbon' generation options. As expected the focus is on cleanest solar, wind, storage; yet baseload big hydro, geothermal, biomass, and nuclear are also permitted. (As would in theory be fossil fuels on carbon capture/ sequestration only – but least-cost models do not include new nuclear or sequestration). In contrast to a 90% No Carbon path, is a No New Policy of mere state & federal trends status-quo. That latter model reaches only to 55% clean power by 2035, falling way far short of what's required.

Crucially this 90% Plan delivers reliable firm power that's fully dispatchable, as needed. It will meet all demands, every hour of each day; there's no compromise on performance.

To reach a 90% zero-carbon target by 2035, annual U.S. deployment of U.S. solar & wind must double through 2020s, then triple historical bests in 2030s. This rises up hard up from a 15 GW of solar that was installed in 2016, and 13 GW of wind installed in 2012.

Tremendous growth was seen before; natural gas plants grew by 65 GW in 2002. Now, what's needed, has changed: *energy storage* is 3rd leg of a crucial triad to solve intermittency of those renewables: energy storage deployment thus needs to grow by 25% per year. Starting from a mere 523 megawatts in 2019, it should grow to 20,000 megawatts storage in 2035.

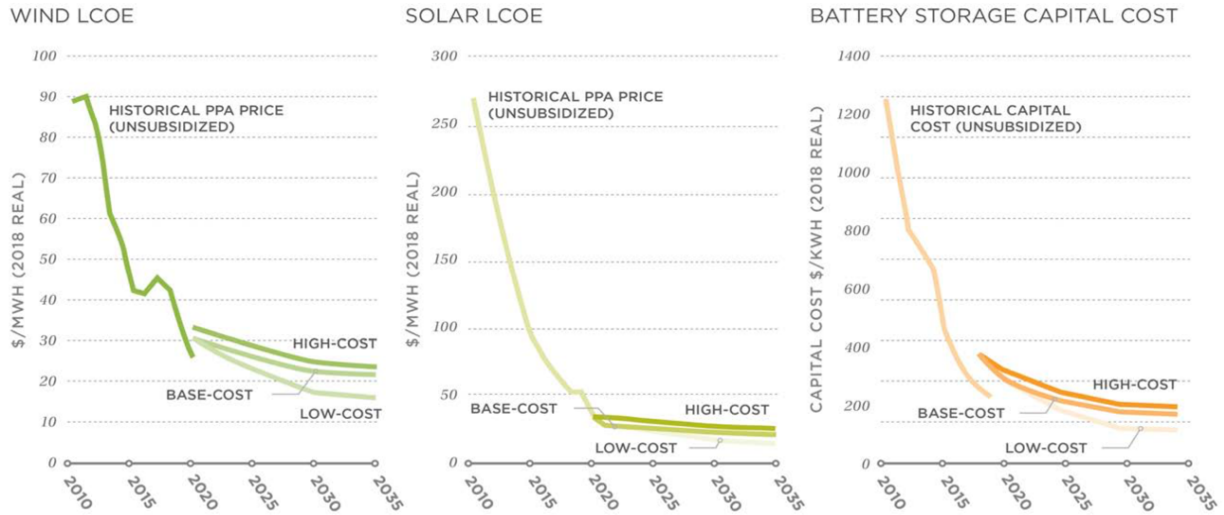
Only a modest amount of new transmission or spur lines are needed to interconnect expanding clean power, so there's no pressing need for costly, long-to-build intergenerational lines. No imposing need for overturning grid infrastructure which requires longer lead times. But, what does change, is the composition of generation and storage in a fast-coming 15 years.

First off, all U.S. coal plants need to be permanently shuttered by 2035 under this plan. In places like California that's already happened. Extant plants elsewhere generally have been running many years now, so 15 years in this Plan leaves lead-time to recoup original capital investments. It's doubtful coal plant owners would consider burning longer, given higher costs and liabilities vs. clean power – but recouping those costs is addressed in this Report.

Second, no new U.S. natural gas fired plants would be built. Existing gas plants and those going up now remain; they'll play a decreasing role in grid stability as new storage grows. Again, capital investments are recouped over this period – finally ending with fully 100% zero-carbon grid by 2045. Currently there's about 540 GW of gas capacity operating in the U.S.; in this Plan 361 GW of dispatchable natural gas is kept to 2035, another 90 GW in reserve for reliability. That natural gas meanwhile is used for only generally 10% of generation.

Since gas-plants pay for fuel, reducing their use helps achieve 2035 clean wholesale electricity costs *10% less* than now. In low solar & wind generation periods, gas does have backup role – but utilization rates as noted only 10%. The Plan suggests a federal 'clean' (carbon-free) standard of 55% by 2025, 75% by 2030, 90% by 2035; then 100% by 2045. In the past when the renewables were more costly than fossil fuels, such standard was not yet embraced.

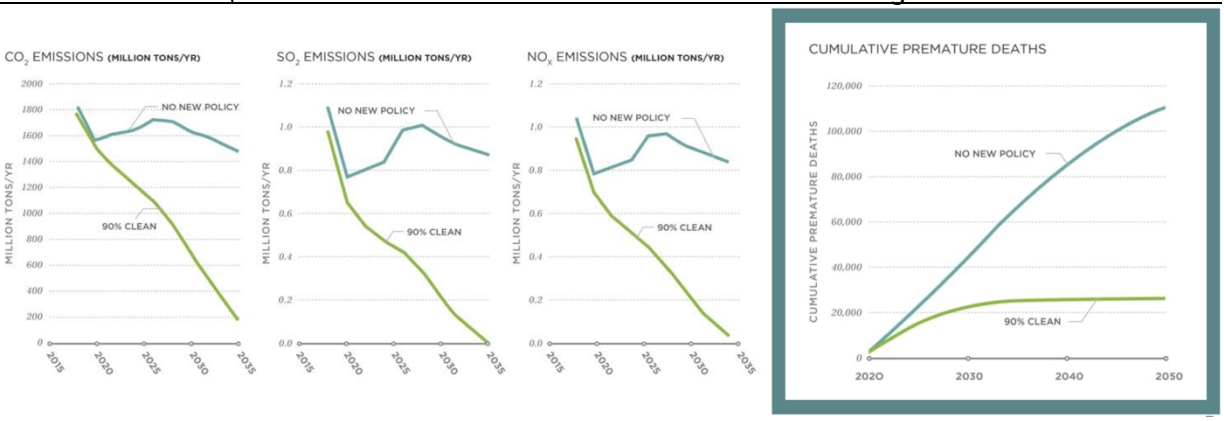
<u>Dramatic Declines in Costs Have Arrived in 2020 and Far Sooner than Expected:</u>



Source: 2035 Report: *Plummeting Solar, Wind, and Battery Costs Can Accelerate our Clean Electricity Future*, slides (June 2020).

Relative to current trends seen under status-quo No New Policy, this 2035 Plan would instead reduce CO2 emissions from energy generation by a whopping 88% by 2035. As a direct human health consideration, it reduces human exposure to polluting fine particulates (PM 2.5) and Nitrogen Oxides (NOX) and Sulfur Dioxides (SOX) emissions by 96% and 99% respectively. The clean Plan separately saves over $1 Trillion in health and environmental costs.

2035 Plan Avoids $1 Trillion in Human Health + Environmental Damages vs. Business as Usual:



Source: 2035 Report: *Plummeting Solar, Wind, and Battery Costs Can Accelerate our Clean Electricity Future*, slides (June 2020).

Thus 3 fundamental points are it's *feasible, *saves money, *and lowers climate risks, to boot. Getting there, means constructing 70 GW of new solar & wind capacity a year on average, for 1,100 GW total by 2035. Yet contrary to conventional wisdom, renewables can go in most of the country. The public might assume solar for instance needs warmest climates, yet in fact solar power does quite well in freezing settings - even say, at Poles and literally space.

Electricity in this model can be made by solar at less than 3.5 cents per kilowatt/hour (kWh) in 2035 at places shown here in yellow/green: most of the U.S. Wind power similarly is made at less than 3.5 cents kWh in much of the country, shared widely via the grid or stored. Such zero-carbon renewable energy prices are, remarkably, less than any of the fossil fuels.

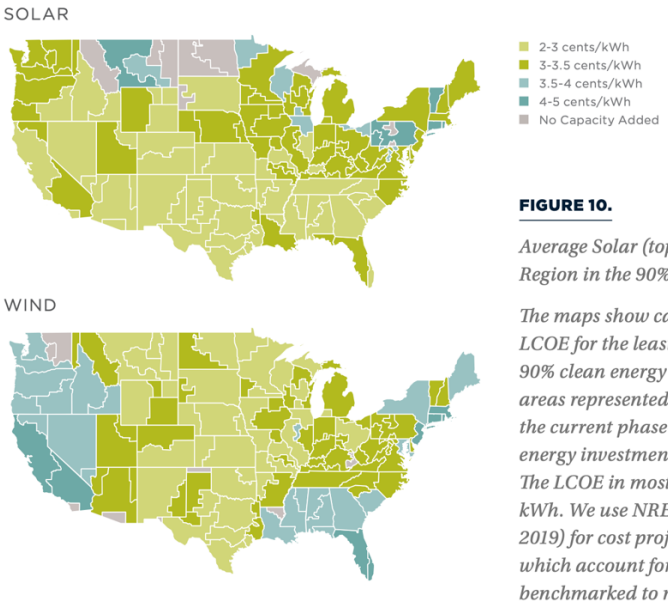


FIGURE 10.

Average Solar (top) and Wind (bottom) LCOE by Region in the 90% Clean Case in 2035

The maps show capacity-weighted average LCOE for the least-cost portfolio to meet the 90% clean energy target for the 134 balancing areas represented in ReEDS. LCOE includes the current phase-out of the federal renewable energy investment and production tax credits. The LCOE in most zones is lower than 3.5 cents/kWh. We use NREL's 2019 ATB Mid-Case (NREL 2019) for cost projections with some modifications, which account for the cost reductions already benchmarked to recent PPA pricing.

Source: 2035 Report: *Plummeting Solar, Wind, and Battery Costs Can Accelerate our Clean Electricity Future.* (June 2020).

Relative to the No New Policy case, this Clean Plan can creates 500,000 new jobs/per year. From 2020 to 2035 this is a cumulative 29 million job-years. Many of these jobs can and should be located near closing fossil fuel power plants; new jobs building solar, wind, storage going in where fossils are shuttering. Jobs will be front-loaded & prolific in construction - not so much in later operations though, since neither fuel nor much maintenance is required. It will arguably also be very important to assist local communities that were dependent on coal; shoring up pensions, healthcare, jobs & training programs in a move to green energy.

In terms of aiming for 'only' 1.5 degrees C warming as set out in the 2018 IPCC Report, global emissions as noted have to be halved by 2030. This green Plan contributes to a 27% reduction in CO2 from U.S. electricity generation by 2035. That doesn't give 50% by 2030, nor globally, but there'll be (one hopes) big reductions too in industry, building, etc. And under this Plan's glidepath, finishing up with a fully 100% CO2-free grid before 2045 could be compelling.

Delivering *less-costly* power in 2035 that's also *cleaner* – wasn't regarded as feasible before - since studies done a dozen years ago, even 7 or 8 years ago, didn't foresee how drastically solar, wind & storage costs would fall. Now that they have, modeling far-less-costly electric power may be undertaken. This lets us understand how storage is necessary, to replace (costly) unneeded fossils - for reliable renewables meeting all our needs all of the time.

Dependability in modeling for this Plan was defined as minimum meeting all power demand needs, every hour of the year. Hourly operations were simulated in America's power system over 60,000 hours. This was done for every hour, across 7 weather years. In each one of these hours, sufficient power was assessed as meeting all of the demand in every one of the 134 regional zones of the model. Ramp rates and minimum generation levels were included for more than 15,000 individual electricity generators, and 310 transmission lines.

A crucial ingredient too making it possible is how far storage capacity costs have dropped now – and will do so ahead. 2035 models seminally found that adding 600 GWh (150 GW for 4 hours) of short-term battery storage, cost-effectively can achieve that 90% zero-carbon grid goal. About 20% of daily electricity demand is then met by storage. (Limitations to the computer models keep battery storage capabilities envisioned to this 4-hour window).

Renewables are oft criticized as their capacity must be built out several times what's needed - compared to more firm, always-on power because of intermittency & variability. (Portrayed as a liability here, versus nuclear, coal, and natural gas). But it's just a characteristic.

Over the 7 weather years modeled, in normal conditions, wind, solar, and battery storage generally, regularly provide 70% of annual generation; hydropower & nuclear provide 20%. But when there's low generation by renewables solar/wind – and/or there's unusually very high demand, then existing natural gas plants, hydro, and nuclear together with batteries can in cost-effective fashion compensate for that mismatch and they are able to meet needs. Natural gas-plants still will only contribute around 10% of annual electricity generation.

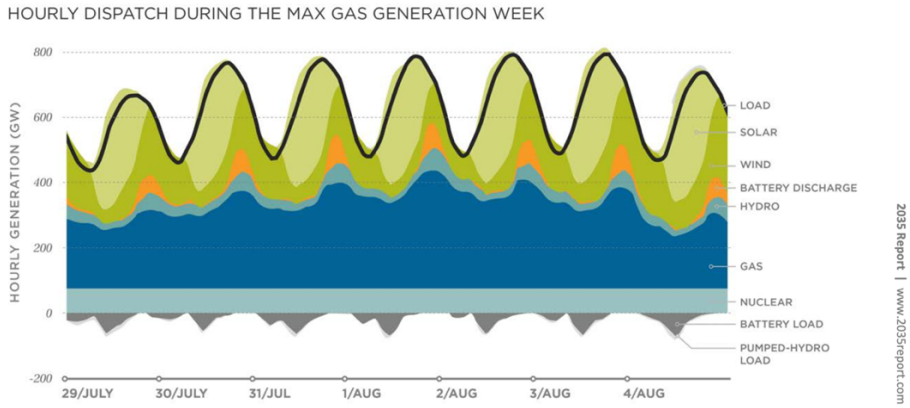
This Plan is so very different from what's seen today, one may naturally ask: How is this done? We know solar is sublimely binary in output: every day it makes zero all night. So what happens when a nighttime hour – overlaps with little wind – drastically curtailing output?

Let's start then with a tough-case; A no solar power nighttime hour and little wind as well. Total solar & wind generation are then 94% below rated capacity, bit of wind somewhere in grid - so an enormous 1,220 GW of rated capacity - is making only 75 GW actual generation.

That's 80% below annual average yearly output of combined solar/wind generation. Over 7 weather years modeled, such very toughest hour/s come August 1st, when there's the largest gap between green power (solar, wind, storage) – and dirty generation to compensate.

8 pm Eastern time (night, no wind) the very greatest natural gas capacity that's needed then to meet demand, would be 360 GW. Intermittent solar + wind are making little, despite far higher nameplate capacity. With a total demand of 735 GW, immediate dispatch need is met partly by 2 other zero-carbon sources, hydropower & nuclear – and 80 GW battery discharge – and by noted by 360 GW of natural gas capacity. That's in a worst-case scenario.

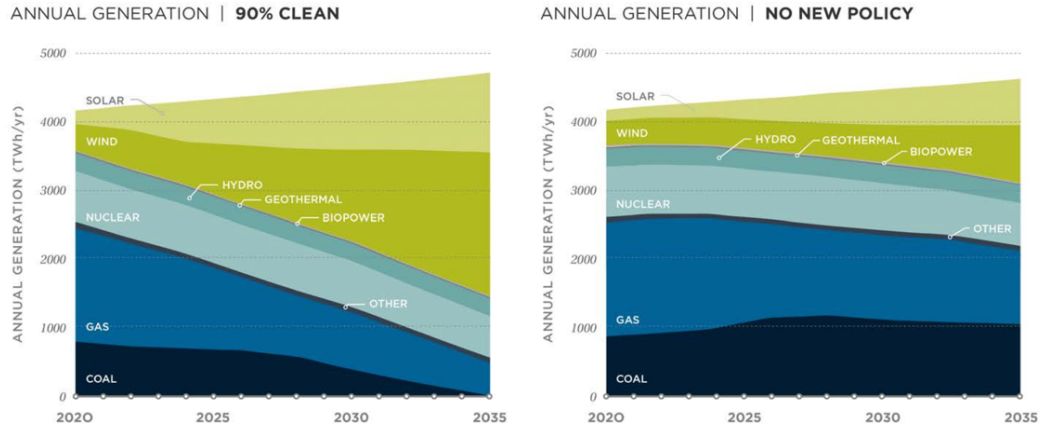
A Worst-Case Generation Period for Renewables: Still Moving Off of Fossil Fuels/Nuclear:



Source: 2035 Report: *Plummeting Solar, Wind, and Battery Costs Can Accelerate our Clean Electricity Future*, slides (June 2020).

Over 7 weather years, highest demand hour for natural gas baseload is always in August, on least wind and at nighttime so zero solar. But gas-fired power need over 300 GW is still kept here below 45 hours per year. In sum, decarbonization progress today is suddenly real.

A 2035 Grid Mainly Solar/Wind/Storage, at Less Cost – than Coal/Gas/and Nuclear:

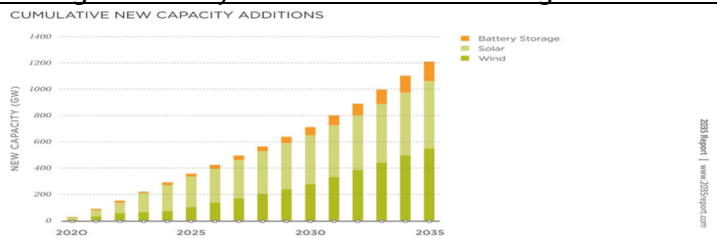


Source: 2035 Report: *Plummeting Solar, Wind, and Battery Costs Can Accelerate our Clean Electricity Future*, slides (June 2020).

Capital required is some $1.7 Trillion of new clean energy investment. An enormous sum, although less than an early COVID stimulus, and here with enormous positive benefits.

The No-Regrets path not only lowers consumer electricity costs, it improves human health and reduces damages - *without* considering climate change. Compared with business as usual No New Policy, this 90% Plan saves money. Especially if one considers just impacts from say, sea-level rise over many centuries, maybe millennia ahead – advantages can be compelling. (We'll briefly discuss ahead some potential impacts of possible sea level rise).

Scaling Needed by 2035 Solar/Wind/Storage is Feasible – and Saves $$ Over Business As Usual:



Source: 2035 Report: *Plummeting Solar, Wind, and Battery Costs Can Accelerate our Clean Electricity Future*, slides (June 2020).

Given renewables' intermittency and their range, there's another side to this coin too: they can & do at times generate Far MORE power than immediately usable. At times electric power prices can even go Negative. It's not a disaster for clean energy - like it was for fossil fuels when oil prices briefly went negative – everything possible then done to get oil prices back up like Spring 2020. Instead, it is here a *feature* of the clean renewables system – and one that really ought to be taken advantage of. Happily there's many ways to do so ahead.

In the 2035 Plan so much solar & wind is built, 14% 'surplus' renewable power is curtailed/ shut at times. Or… consider that arguably, it can be stored! Ponder here, hydrogen (H2). It *still requires breakthroughs* to be cost-effective. And basic physics presupposes if one has made electricity (must be used immediately), it makes little sense to lose efficiencies via electrolysis converting water to hydrogen for long-term storage. One incurs then further loses in converting hydrogen back into electricity later, via fuel cells, or by combusting it.

But: if a unique situation presents itself with 'free' electricity, that alters this equation. Sun shining & wind turbines spinning making too much power that must be put to use (or sadly curtailed) when prices go negative - could in a case for green H2 be made renewably, no CO2. Clean, zero-carbon renewable hydrogen – unlike steam reformed natural gas/CH4 is still today costly and impractical yet mused about for decades. (For just an example of 20 years ago, see e.g. R. Wilder, 'We Need Clean Hydrogen Soon'. Engineering News Record. 244/59 (May 8, 2000); also, 'Develop Eco-Industrial Parks'. ENR (June 7, 1999)). In Europe, dirty 'grey' H2 from gas now costs around $1.5/kilo, while far better clean and green H2 might be more than 4 times that. And vast hype over hydrogen has even spiked enormously of late.

Hydrogen is fiendishly difficult to handle. It's unwieldy, an uneconomic energy carrier, a tiny molecule vexing to store, transport, embrittling steel and tied to dirty fuels. Pile uneconomic H2 atop of uneconomic fuel cells, especially as today solar & wind are now least-cost power - and no wonder many aptly call them 'fool cells" – also making a strong case for a passive Index basket, like here. So there's hype about H2, an energy carrier that today is a ways off. But… if green electricity comes one day 'for free' – or better yet if one is paid to split water to make green H2 – it's a new ballgame. Sunnier, windier hours of excess power for green H2, can time shift that surplus to windless nights. It could be used high temperatures ways too like in making steel and cement. In sum with abundant renewables bringing negative prices, *and with needed breakthroughs in H2 & fuel cells,* then much may be possible.

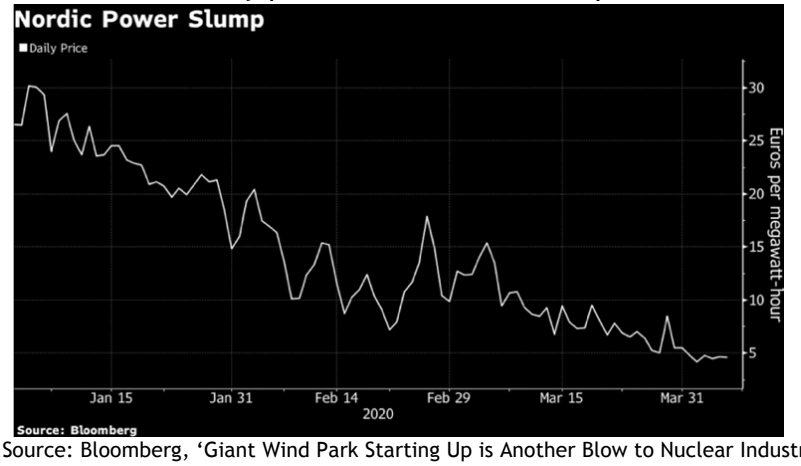
Moving on, let's peer into *applied* clean energy today. And cases where renewables prices do drop swiftly – as can happen now, in good and snowballing ways (unlike oil). So note 1st that Solar power has just hit a Record Low: only 1.35 cents per kilowatt/hour at a big 1.5 gigawatt solar farm going up in Abu Dhabi! True, it's in excellent solar circumstances, a desert for instance. But there are great available deserts too in the Western U.S., and that 1.35 cents cost is far cheaper than U.S. coal power, today, tomorrow, or in short ever. Solar power at about a penny is less pricey than natural gas too. Frankly, no fossil fuel comes close.

Or as a practical matter, consider 2 renewables today at a world-leader like say, Sweden. There clean new energy tells a bit of a startling story. Especially as yet more renewables get built like is happening now, these can show interesting possibilities that could be repeated. So note that April 2020 when Sweden's then-largest onshore wind farm opened, it right away changed the landscape for its nuclear plants – given how wind power (like renewable hydro, or solar) can in good circumstances heartily underprice more costly, non-renewable nuclear. That new wind farm in Sweden is owned by a Dutch Pension Fund and consists of 80 large turbines each rated 3.6 MW, together near 300 MW of installed capacity expected to produce annually some 900 GWh. For more, https://www.vasavind.se/askalen-eng.aspx

Wind isn't the only big renewable operating there. Sweden already has big hydropower plants, so is harnessing water in addition to wind. (Indeed most places on Earth could boast myriad free untapped renewables even if still inexplicably ignored; blowing winds can be captured onshore/offshore, there's often sunny sites for solar power, some underground geothermal potential, or run of river smaller hydro that's much better than limited big-hydro etc etc).

Thus Sweden also has hydropower for significant power. And very rapidly, indeed just 1 day after this wind farm had opened, as hydropower was already making abundant cheap power, 2 units at a big costly nuclear plant north of Stockholm had to ratchet down to just 50% power production. With 2 other units at an older nuke plant also shut due to national shift away from nuclear, these renewables were obviously fast becoming impactful.

Now should there happen to be both extant wind farms capitalizing on windy days – plus good hydropower conditions – these together will make good use of all 'for free'. Such situations certainly increasingly crowd-out fossil fuels, & nuclear plants that pay much for fuel and operations. (Ricky nuclear moreover pays to store toxic wastes long after closed). An upshot was that electricity prices there at start of April 2020 were hitting welcome new Lows:



Source: Bloomberg, 'Giant Wind Park Starting Up is Another Blow to Nuclear Industry', Apr. 8, 2020.

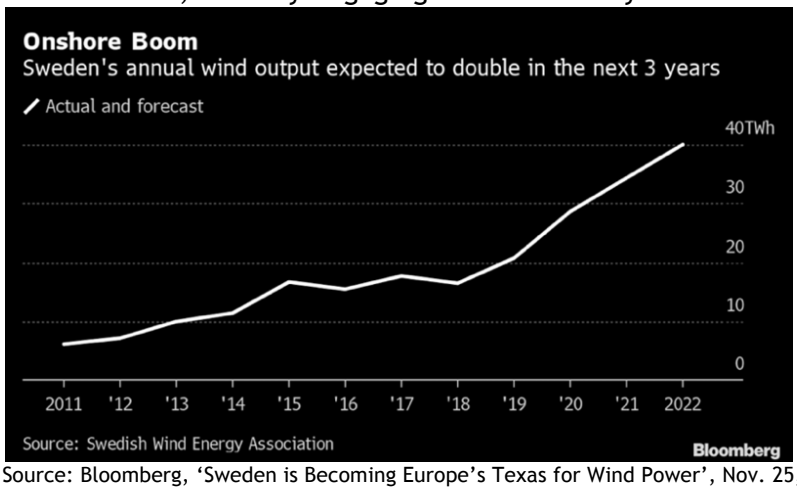
Of course, these renewables are intermittent. There's not always blowing wind, nor rain for hydro. Yet at such times other types of renewables may be tapped in theory. For instance geothermal might possibly grow more common firm power ahead. Especially when oil rig counts drop on cheap crude, geothermal drilling could be more attractive. Idle drill capability may perhaps be harnessed, to help accelerate some geothermal as baseload power.

Big Oil hasn't typically looked much at large renewables projects. But if oil is long near or below $35 barrel, renewable projects could rival the $ returns seen from a new oil field. Geothermal is costly now – maybe 3x more-than wind/solar. But geothermal makes firm power – and its build-out can utilize the skills well-understood in an oil/gas industry: how to drill holes deeply into the ground. In time, geothermal too might grow more affordable.

Now this recent natural situation in Sweden was exacerbated in good ways when windy days coincided with high-hydropower output. These charts from Bloomberg New Energy Finance (BNEF, prior longtime partner on the global new energy innovation NEX Index) illustrates nicely how daily power costs in Sweden, were driven down "naturally" to lowest-ever.

In Spring 2020 electric power day-ahead pricing fell by half. For comparison to get to just break-even before profit, that region's nuclear plants needed a much higher price floor. Costly-nuclear thus faces a thorny pricing dilemma given how low renewables *can* go. Especially if a region combines resources: say rain, wind, and maybe solar power etc.

For local industries desiring plentiful low-priced power, big hydro has been welcomed. Sweden's mills, smelters, miners, aluminum manufacturers are energy-cost-sensitive. Yet big hydro is a static source, potential capped, limited to areas for big dams – with huge ecological burdens. So more recently, wind power has entered the scene in a major way. A recent BNEF article is aptly called "Sweden is Becoming Europe's Texas for Wind Power" - for Sweden, a bit like Texas, is lately engaging understandably in a boom in wind power:



Source: Bloomberg, 'Sweden is Becoming Europe's Texas for Wind Power', Nov. 25, 2019.

Because wind, solar, and micro-hydro enjoy free fuel, they get *very* inexpensive (pain for a Utility, but a bonanza to off-takers) in abundant times. Combine micro-hydro nearby, say, abundant wind & solar power, and the benefits can indeed snowball. Unlike pricier risky nuclear – and unlike natural gas power, unlike electricity made in traditional dirtier ways – this renewable power potentially can get very inexpensive (even below zero!).

Intermittency, as emphasized, is an issue. Solar makes zero at night very predictably so; less forecastable, it drops greatly on clouds. (Future solar may do better such as by rechargeable flow batteries). Wind works best only in windier conditions obviously. Hydropower has requirements, it needs dimpled landscape, snow/rain; some seasons have less precipitation (run of river micro-hydro is ecologically far less burdensome than big hydropower dams). Yet, we are in early innings of renewables and there's one hopes, great progress ahead.

Source: Bloomberg, 'Giant Wind Park Starting Up is Another Blow to Nuclear Industry', Apr. 8, 2020.

The U.S. is making some progress too – while thankfully moving beyond big hydro. A decade ago, renewables made up just 10% of U.S. electric power 2010 - much of that from big hydro despite the vexed ecological impacts & its limited room for growth. Somewhat noteworthy then is the U.S. renewables slice grew to near 20% by end of that decade - thanks mainly to rises in more scalable clean wind & clean solar which still have enormous room to grow.

End of decade U.S. solar capacity had risen to past 100 GW. (A gigawatt may be thought of as about roughly one nuclear plant – yet is intermittent, unlike firm nuclear, coal, natural gas power). By 2020 just solar & wind were making nearly 10% of U.S. electric power. That's both interesting – and an underwhelmingly small start. Yet, how did the growth happen? Partly it flowed partly from consequences of the 2009 meltdown. Jobs were being lost at rates of half a million per month; stock markets and housing both cratered. In response the massive $800 billion stimulus, American Recovery and Reinvestment Act (ARRA) was signed with a crucial $90 billion for clean energy, electric vehicles, energy efficient infrastructure.

At that time in 2008, solar was making only 0.1 percent of America's electricity (!). Wind was less than 1 percent. So they were vanishingly small in the U.S. energy mix. The ARRA sought to change all that while creating good new jobs and growth. It contained $25 billion for the renewables, $20 billion for better energy efficiency, there was $18 billion for transit, $10 billion for improving the grid, and more for other varied green programs.

Tax credits were unusable to many at the time, so became more liquid cash payouts. Developers were allowed as much as 30% of project costs, available instead of credits. In 2009 that stimulus really helped prime the pump for that decade of growth seen since. Also of help at start of that decade was a U.S. SunShot Initiative, which reached its end of decade goals years early, and helping make solar much more competitive vs. dominant dirty energy. Consider that in a decade since the Recovery Act, U.S. solar power generation capacity has grown 48 fold, starting from a small base. Wind generation capacity has grown 4 fold.

Also of key importance was China, which was strongly entering solar, wind etc arenas. Seeking to gain market share in a big way, it pushed down pricing per kilowatt dramatically. So that put many established firms out of business in Japan, Germany, the U.S. and elsewhere. Profit margins dried up, many unable to keep up. Chinese firms enjoyed much lower costs of capital, cheaper labor, often free land, less environmental regulations, and local governments were glad to see big employment gains that these factories brought. Solar etc prices plummeted.

Germany too was ramping up a good deal in the 2010s; in 2012 alone it installed 7.6 GW of solar panels. It and other European nations like Denmark fully embraced wind power. Thus by 2013, subsidized wind power was reaching cost-competitiveness many places with coal & gas. Where winds are plentiful, it was growing *very* favorable. America's Midwest power auctions saw just 2.5 cents per kilowatt/hour bids for wind power, making it the best choice.

By mid-decade, 2015, another marker was hit as more renewables were installed, 150 GW – than all fossil fuels plants added that year. Diverse kinds of renewable energy were growing common in Europe & the U.S. Various clean energy forms all put together good days, began to briefly even meet 100% of demand on occasion. Thus in 2016 all of Portugal ran just on its renewable sources alone - solar, wind, hydropower for some 4 straight days.

Seen by generation type, renewables pulled ahead of nukes. For in a first in its long industrial history the U.K. made more renewable power in 2019 – than from fossil fuels combined. Not-sunny U.K. made clear renewables work, wind, hydro, & solar (plus not-green biomass). On April 20, 2020 solar made 9.7 megawatts, meeting 1/3rd of its power demand; though a one-off, it was 10 times what it normally produces in a day there. What a change; in 2010 dirty fossil fuels had met ¾ of demand, 10 times renewables. Renewables since jumped to 40% by 2020 and were gaining. Meanwhile, U.K. coal-fired power fell from 70% in 1990, to under 4%. It now seeks to end coal within 5 years. The E.U. aims for climate neutrality by 2050.

It's been some early growth. Considering the world had an unprecedented, yet puny, 15 GW of solar in 2010. Yet, as emphasized at ECO, NEX, OCEAN and predecessor Indexes, a key issue is renewables are intermittent. That has held them back but needn't do so ahead. Like overcoming high early costs of solar, & wind – storage is beatable, too. Need for firmer power spotlights better batteries & energy storage. Intermittency's an, issue no doubt. *Yet it can surely be overcome*. Coordinating renewables in an improved grid, ideas like rechargeable flow batteries, carbon taxes, even speculative H2 as an energy carrier (with breakthroughs) and fuel cells may ascend one day. We *could* do much to advance renewables.

Asia made its leadership commitment to advancing batteries clear years ago – that has paid off handsomely. Lately Europe and its Green Deal are trying to catch up; it identified batteries for leadership in technology & manufacturing. Efforts at decarbonizing energy, before 2050 - and battery catch-up can possibly move it forward. Inexplicably the U.S. ceded ground very early here such as to China. Yet China having missed out on any early prowess making older gasoline cars – now seems determined not to make same mistake twice in electric vehicles - essentially a battery on 4 wheels. Innovative storage and batteries, it's clear will be part & parcel soon in advancing intermittent renewables worldwide to replace fossil fuels.

Yet don't overlook practicalities. A Great Lockdown in 2020 is slashing jobs across U.S. clean energy - as in most other industries and nations. In March 2020, 100,000 new unemployment claims were made in U.S. clean energy. According to the group E2, these included 69,800 job

loss claims in energy efficiency, another 16,500 in renewable energy, 12,300 from clean vehicles, and 7,700 jobs lost in the grid, storage, and cleaner fuels.

End of 1H there may have been 600,000 clean energy jobs lost in the U.S. Yet as will be discussed, far greater losses have been/are being seen in coal, and oil. There, things are far worse. Coal today employs but a shadow of its former heft – though mechanization there was brought in by that industry itself - not by clean technologies. Here, in clean energy, there is now steeply waning consumer confidence in Q1/Q2, meaning residential solar cancellations, new caution at Utilities, auctions halted on fresh wind/solar projects. That said, the far side after this pandemic – when/if reached, could possibly bring much activity. And, renewed Solar ITC and Wind PTC credits as noted 2021 or after – could potentially mean quite a boost.

Because costs of renewables are fast-dropping here, naturally in a good way – unlike fossil fuels & nuclear – one useful change could be for Utility procurement processes ahead to better consider all potential power sources – including new green alternatives. The fact that wind and solar power are already often heaps better than coal – is well accepted many places – but not yet everywhere. When vertically-integrated Utilities tilt procurement towards fossil fuels, to the status quo, and their own bottom-lines, that might mean excessive power generation – rather than clean competition, a look at climate impacts, and truly lowest-cost power.

Places that have decoupled Utility's revenues - from amount of power produced – new bottom lines better advance efficiencies and lower the system costs. 'Steel for fuel' swaps can reward operational savings that come from new 'steel' (new wind & solar farms) - over uneconomic older fuel-intensive fossil fuel generation. Without such total re/views, an encumbrance of inertia and old-ways of thinking can allow more-costly fossil fuels and CO2 to unduly linger.

Change is now happening so fast, even young-ish decision-makers who 'knew' in the early 2000s that 'Renewables were the Most Costly' – are startled by the change. It's something of a wonder that in not even a decade, from 2010 to 2018, Utility-scale solar power capacity grew amazingly 30x, for a 30-fold scaling-up swiftly to reach over 60 GW. And it had just looked to potentially double again in another 5 years (maybe not in a pandemic).

Clean technology cost reductions once l/earned – like new capacity here once built – are unlikely to be forgotten. New energy solar or wind sited in favorable circumstances, often now makes electricity the most economical way of all. Some two-thirds of the world now sees well-sited solar and wind as the very *least expensive* forms of new power!

According to a useful November 2019 Lazard Report, in just a decade, wind energy costs have fallen some -70% on average. Solar photovoltaic costs have dropped more, near -90%. That's made clean renewables less than half the cost of nuclear power (with still decades+ of costly toxic-waste-to dispose of). Thusly have renewables become often the best, lowest-cost path for Utility generation – preferable to even once-dominant levelized cheapness of King coal. At times it's lower too than 'cheap' natural gas. Issues are thus shifting to energy *storage* - to complete the firm power picture. See Lazard, Levelized Cost of Energy and Levelized Cost of Storage 2019. version 13.0. https://www.lazard.com/perspective/lcoe2019

Lazard's 2019 analysis was done just before a 2020 pandemic, but outcomes are clear. Solar & wind in good circumstances (strong sun, windy places) increasingly are least-cost.

What's key to consider here is the *levelized cost* of energy - that is, all in including fuel costs. End of the day all fossil fuels increasingly struggle with this fact of 'free' solar/wind fuel. Especially as solar and wind only get cheaper. Take solar cells, likely built soon that can use many wavelengths of the sun. Built with say group III-V semiconducting materials from the periodic table, much more solar output can be captured - rather than the limited cells today. Concentrate that sun further, using mirrors, and it may be possible for these innovative solar cells to capture 400 times more solar power over an equivalent surface area.

Or consider Perovskites. These solar materials of crystal lattice structure are nicely cheap and abundant; they could become some 50% more efficient than solar cells today. Able to capture low light too, they could open entirely new possibilities years ahead.

And yet. Big picture to dramatically cut CO2 as science implies is so urgent *right now* - has not even begun. Let alone is it won. CO2 is today over 400 parts per million (ppm) and rising. That's after hundred/s of years accelerating greenhouse gas emissions. Yet more CO2, it too accumulating over time, could soon mean much. Just look at potential sea level rise.

Importantly a crucial fraction of the airborne carbon already emitted from the industrial revolution, plus in this century and next, can persist for tens of thousands of years. In short the CO2 from a window just 150 years ago to a mere two centuries ahead, may well be committing the world given great inertia, to impacts of rising seas lasting for millennia.

Notably the science indicates 50 ft, 100 ft or more of accelerating sea level rise may be locked-in by CO2, perhaps going for many hundreds or even thousands of years.

This may happen, quickly. In a past meltwater pulse (from CO2 although by natural causes, at rates less than now), the seas rose between 50 ft and 80 ft in just 400 to 500 years. That's to say, massive ice sheets that have retreated very swiftly before, could do so again.

Global reshaping is what we're talking about. So put aside a moment political debate about global warming. Ignore other aspects like maybe storms, disease, famine, drought, collapsing ecosystems. Set aside too follow-on consequences that might spread as ripples on a pond.

Instead look at just at one first domino to fall: on current CO2 trends, warming for centuries, accelerating sea level could possibly go on millennia. This is all said with unhappily robust confidence. Scientists now assume a loss of say, Bangladesh, or of Miami. Being a real threat, one might reasonably assume it's long since been thwarted. After all the Paris Climate Agreement was the latest word here, and it was famously signed by almost every nation.

And yet. Reality is the Paris Accord's so-called targets are not close to being met; rising CO2 hit new records in 2019. Peak CO2 / greenhouse gases aren't expected a soon-foreseeable year. Not by 2025, nor by 2030 - despite flowery aspirational words to contrary aiming for 'just' 1.5 or even 2 degrees C of warming. Blowing past the hopes of Paris is a certainty.

1H 2020 did bring inspiring wins at margins. In Q1, a greening Ireland's slice of electricity made from wind surpassed all other sources, including natural gas. Wind turbines met 43% of Ireland's demand – vs. 41% met by natural gas. Spain, looking to its natural blessings turned on in April Europe's largest solar farm, 500 megawatts (MW) of power for 250,000 people. In May, a bigger 690 megawatt U.S. solar farm was approved in Nevada to power about as many people (as Americans consume more) – notably it includes 380 MW of battery storage.

Yet things are very bleak on CO2. Coal plants remain one of the largest sources of carbon. And hundreds of brand-new coal plants are being built, in 2020, mainly across Asia. For example in China coal is still very cheap, and a leading fuel there given its very lax pollution and other regulations. Building new coal plants there is some 30% less than renewable power. True, solar & wind are growing cheaper, and they may beat coal around 2026 in its wealthier regions. That said, China remains heavily dependent on coal (and on big hydro) for some 83% of its electricity mix - vs. growing wind and solar but that are still only 7% in 2018.

In 2019, coal capacity in China grew by a staggering 37 GW, more than in the whole world - because while coal is being shut down other places like in Europe, U.K., and the U.S. - enough permits have been granted in China to expand its coal by about another 25% more. Early in 2020, China either had already permitted, or it had under construction, an enormous 135 GW of new coal capacity; that's about half of the entire built U.S. coal fleet capacity.

Besides coal going up in China, & in India, wealthy-Japan is set to burn coal for decades. Look at Japan in 2020: next 5 years it plans to build up to 22 new coal plants, at up to 17 locations. If they're all built, they'll emit nearly roughly as much new CO2, as all cars sold in the U.S., annually. Even Germany still makes about 33% of its electricity from coal. While renewables are at least 40% there, it has OK'd a (final) coal plant in June 2020. Many European plans to shut coal are being brought forward, shuttering sooner than expected in pandemic – but that's not happening everywhere. It's all a tremendous current to swim against - if one aims not just to *slow rates of growth* of emissions – but absolutely to *Cut* total CO2 concentrations.

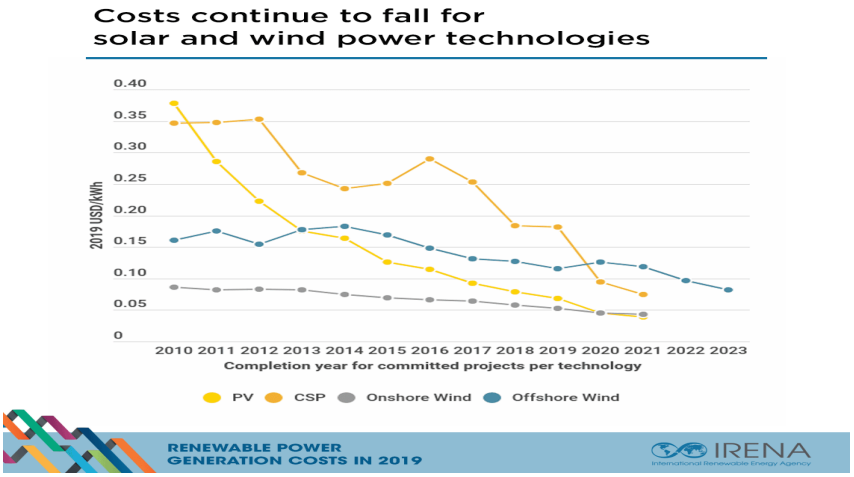
There's a Paris Agreement. Yet wealthy Japan set itself a low bar, aiming for just a meager 26% less greenhouse gases by 2030, than in 2013. Even that's merely a goal. Coal makes up one third of Japan's power; by 2030 it expects coal to still be ¼. Renewables, 10% of its power in 2010, in 2018 made up only 17% (and much of that from big hydro). In sharp contrast, France expects to fully shut all coal plants by 2022. The U.K. to close all by 2025.

Japan's course is uninspiring. While clean renewables could become the cheapest power there by 2025, it's standing by coal. Unsurprisingly after that horrific nuclear accident, nuclear dropped there from some 1/3rd of its power, to under 4%. Yet fossil fuels instead grew to 4/5ths today. And its renewables are dominated by that non-optimal, big hydropower. Plus it is exporting bad practices; only China gives more finance for coal plants overseas. There's airy talk of so-called 'clean coal', always in future, a concept that's never been real.

In the U.S., demand for thermal coal for power is dropping. In 2019 it was 556 million tones and is less in 2020; Europe has declined to some 534 million tons and is dropping too - especially with renewables becoming a least-cost, best option. Yet necessarily measured against those declining numbers, are increases in Asia – China alone last year used around 3.6 billion tons thermal coal and their figure is growing; it accounts for half the world's demand/ consumption. India used 946 million tons thermal coal and is adding coal power plants. So while the U.S. and Europe are decreasing coal burning by closing 22 gigawatts of coal power – that's being swamped by the 49 gigawatts of brand new coal plants across Asia-Pacific.

So it's quite a mixed bag. A bit of good news, since 2010, is costs of utility-scale solar PV dropped last decade a remarkable 82%, onshore wind by some 39%, offshore wind by 29%. Global average solar PV power cost 2019 was 6.8 cents per kWh; onshore wind just 5 cents per kWh. And average solar PV costs continue to fall; soon maybe just 3.9 cents in 2021.

So beyond places where burning dirty coal is still super-cheap say in China, India, renewables are now making great progress. This IRENA chart shows the price declines,



Source: IRENA, Renewables Increasingly Beat Even Cheapest Coal Competitors on Cost. 02 June 2020.

Yet there's huge bad news. The Earth doesn't care about renewables' growth from scratch, or economic successes among wealthy nations. And we ought not pretend coal's dollar costs, or effects on just us alone, are all that matters. As air-breathing mammals we tend to see only terrestrial impacts for we humans. Arguably that's a mistake. Earth's surface is mainly oceans: they're declining fast. Skeptics who've questioned whether CO2 is linked to warming, have little ground on which to stand here. Ocean uptake of CO2 is direct; undeniably rising CO2 concentrations in air equate to ocean acidification. Surely devastating harms if unabated for reefs, kelp forests, fish populations, shellfish, marine mammals and more. Marine life, weakened by acidification, stands less chance of surviving marine heat waves.

Ways shellfish for example will calcify and grow their shells from surrounding seawater are widely understood. It's thus so perplexing to consider we already know that acidification lowers pH, doubtless enfeebling species essential to ecosystems, yet we care not a bit. Shells getting too thin, accreting calcium in seawater too difficult – may mean catastrophic collapse. Places where more 'acidic' waters are naturally now perturbated like near volcanic seeps, the fish and habitats are negatively impacted by CO2 levels only a little above that today.

And then, there's warming. Post-2050, the deep seas may warm at rates possibly 7x that now – a climate velocity sure to overthrow life evolved within highly stable thermal settings. There may be tipping points, likely complex and cascading losses. In sum, energy storage greatly expanding clean zero-carbon renewables – can be vital, even to life in the sea. We perceive of clean energy – and oceans – as wholly separate topics, yet they're intimately linked.

Near term, nickel might replace vexing cobalt; costlier batteries over $150 kWh can transition in short order to lithium iron under $100 kWh. Novel energy storage like new 'million-mile batteries', flow battery electrolytes, sodium, nanostructures etc may change the world. Farther ahead green hydrogen would require many breakthroughs – as would affordable fuel cells (unlike today's solar, or wind now) – yet they're conceivable. With CO2 rising 1 ppm/year at a first Earth Day, now by 2.4 ppm/year – real progress this decade is first order.

Given how the renewables uniquely thrive on declining prices – let's briefly look by contrast at Oil in Spring 2020 (given ample time in lockdown). Pricing dynamics at oil, a commodity, are so *very different* from clean energy. Vivid moves in Oil are discussed next. With oil and coal on their backs, cost declines painful – and unsustainable - they are so unlike renewables – where lower costs are a *great *feature** leading to further, useful cost reductions.

Major Crash of Oil in Spring 2020

Intriguingly 2020 has brought a maybe once-in-lifetime oil crash. While some have call the oil crash completely illogical, it has arguably unfolded with rather explainable logic of its own. To start the Demand for oil collapsed of course on COVID-19. Businesses froze globally. Very quickly, surplus oil began backing up worldwide, as was forecast here in the Q1 Report. Demand destruction swiftly grew so large, as anticipated, that where to store that oil had by April, become a real question (and narrowly oil prices as expected, went negative).

At start of 2020 the world had been producing 100 million barrels/day, well-matching rising needs. Demand/production were then expected to only grow. Indeed only 2 of last 35 years, had demand for oil dipped – and even then for only a brief bit. Yet suddenly, March, a monster demand collapse due to COVID loomed large of perhaps some -25% or more.

Normally on slightly slackening demand for some reason, supply could be slightly curtailed, excess stored and so mopped up. But instead, Saudi Arabia & Russia had *ramped* production up wrestling for market control. One an important day, March 9th, crude prices plummeted by -30%, the greatest one-day 'fall off the cliff' in oil for roughly the past 30 years.

In March U.S. benchmark West Texas Intermediate (WTI) crude fell by -60% in an historic drop, from $60 to $20. A big factor was that Saudi/Russia ramp; but greater was that *demand* was dropping tremendously by -25% or more as world economies halted. A fear come Ides of March was that America's crude might yet drop well under $20/barrel absent intervention; there may be 1.8 billion surplus barrels of crude, yet 'only' 1.6 billion of storage capacity.

Pricing under $30 is a threat to America's oil industry, including the shale and conventional producers. From the huge to tiny, it's a diverse lot and all felt pain. Texas some has 174,000 wells with most every imaginable kind of rig – some are curious sites hard to believe.

So latter Q1 the White House embarked on an unusual path for an American President. It tried to rally nations to *raise* crude prices. A hope among many in industry was to get prices up above $30, a profitability floor for many. Particularly for the indebted shale producers. But oil then near $20 at that point was likely going lower due to demand destruction. It could go briefly below zero some places, or due to volatile futures contracts trading. Storage was filling, nearer tank tops, so fixes badly needed as a bridge until activity bounces back.

Now, May front-month WTI contracts would expire late-April. So on 25% less demand, if not met by great production cuts, fears were piling up of tank tops, like in Cushing, OK. May contracts would then need to be unwound fast by traders with neither desire, nor capacity to take crude delivery; it pushed front-end oil briefly under zero, to some -$37 by April 20th.

That temporary artificial move in finance wasn't really a great surprise at all! And not too much should be read into -$37 close. Contracts many months out were better, less distorted picture of physical crude, than May contract expiring as storage evaporated. But WTI oil near

$20 still showed that oil markets were still in distress. Even global benchmark costlier North Sea Brent crude briefly dropped down to near $20 by late April.

Oil near $20 furthermore meant production would change worldwide. Perhaps 1 million oil patch jobs and expertise might potentially disappear. Rig counts were fast dropping, capacity tightening, wells shut-in, bankruptcies – many wells perhaps never (expensively) re-started. Maybe forcing U.S. shale producers to shut in was perhaps an initial aim, like 2015. But this time, oil's ramp in supply had begun just before a pandemic's sudden demand destruction. That, with COVID, made disorderly consequences greater than maybe initially expected.

Perhaps all put-down to the timing. In 2014-2016, opening spigots failed because in a thriving well-lubed oil hungry world, impacts were muted. Oil had dropped near $50 briefly. Excesses soon readily absorbed, not enough to kill off America's shale boom. And shale which did bounce-back strongly, put something of a cap on prices that WTI oil might one day fetch.

Here a playbook might have been a world awash in oil could allow lowest-cost conventional producers, to later raise prices, post shale bankruptcies. It's long been said the cure for cheap oil, is cheap oil – as seen again & again in this industry. Commanding market-share could then be re-captured by those able to lift oil from the ground most cheaply by conventional means. Once competing shale capacity was well-gutted, low-prices should disappear. Unlike then clean energy, where lower prices go lower, oil prices going back higher is what's sought.

With pandemic + tank tops and oil unexpectedly under $20, quickly reviving economies & demand thus getting oil back up was essential. Oil-wealthy nations might ideally seek higher crude prices nearer $80. Such might in theory allow them to better balance their own books and their own national budgets. But now, regaining firm oil demand came first. Proposed conventional big new projects are often uneconomic, without oil at least above $40.

Plus for nations it's important to realize crude's intrinsic vitality while richly valued. Vast underground reserves, if held too long look increasingly like maybe stranded assets. Those assets might in time become of sharply diminishing value, whether due to CO2/ climate change concerns, or an ascent of electric vehicles, or simply changed economics.

Globally then industry was facing pressing fears in April: Inland wells for instance without a Port or storage nearby, nor distribution pipelines - might sell crude for unthinkably low-prices. Lacking close off-takers could mean dreaded tank tops. April in Western Canada for instance, inland wells far from ports were lifting heavy crude that's difficult to move; suddenly, mounting product upended all, raising fears of runaway cratering. Vast demand destruction was being further benighted by the industry's fast evaporating total storage, and that was changing everything. This was a 'logic' of oil fear and crisis as it was in Spring 2020.

So it was in April that OPEC+ with Russia agreed to a production cut of around 10 million barrels/day. With 25, even 30 million barrels of demand gone – those cuts really could have been more. Saudis in agreeing to cuts understandably felt fellow producers should do so too, reducing their own production. And Russia understandably felt U.S. 'organically' cutting – that is, producing less on low prices – rather than cutting capacity, was as different as width from length. But U.S. can't cut by diktat. Anti-cartel laws meant apart from say a Texas Railroad Commission (rather like mini-OPEC, long before OPEC) ordering rare cuts, called proration, it's not an option. So with a wink and a nod, Saudis & Russia agreed to a 10 million cut. And even that unprecedented big move was just a (necessary) patch-up fix.

It made headlines. Concerns among technical oil-watchers were this cut was 2x or 3x smaller than it needed to be. Plus it didn't start until May, so it was pretty-much no surprise in April when in local cases lower-grade crude oil went cost-negative, less than zero. Even for more desirable light sweet crude grades, cutting 10 million barrels/day did Not match up exactly to perhaps 25 million barrels/day suddenly no longer being needed.

But it was about making it past the immediate crisis, re-starting oil demand. Crude might then rise organically. Free markets are how U.S. oil prices work, rather than fiat, and paths were envisioned to this stimulating rebounding. If say U.S. States begin re-opening, pandemic still-potent, lethal, yet is increasingly endemic more like a seasonal virus; if immunity gets conferred even if only for a season, if effective treatments arrive, or better yet a robust vaccine is developed, there were thus hopes for some return to demand normalcy.

A fascinating side effect of plunging oil was that coal – long the dirtiest/cheapest – while still the dirtiest – had just become most costly. Fracking long ago had pushed down natural gas prices wildly, as seen in charts above. Natural gas -90% cheaper became very attractive for making power (and unsurprisingly, another 15% of U.S. coal power plants had closed).

Thus when benchmark Brent crude fell in Q1 to around $26/barrel, with Australian coal sitting at $57 /metric ton, roughly equivalent by an analysis to $27 oil, broadly-speaking crude became cheaper than coal. True, coal vs. oil don't much directly compete. Thermal coal is burned in power plants – unlike say light sweet crude made into gasoline, or heavy sour into asphalt. But a thing is: coal became the most-dear. And tellingly it wasn't just natural gas taking market from Coal. As levelized Solar & Wind costs fell, they grew attractive. More polluting coal, in sum, was becoming both much less desirable, and relatively costly.

It was hard to fathom pathways to oil rebounding, other than by economies reviving, demand returning, plus production cuts so that falling storage capacity wouldn't pinch. A worse oil collapse had been uncomfortably near, which may have upended more in the oil patch.

A key hub, Cushing, Oklahoma has 4 huge tanks that were once nervously filling in April. Pipelines normally too forward crude; had they slowed becoming more like storage, it could have meant a kind of oil constipation backing-up to the producer. Or, there's 5,500 miles of conduit pipes meant to send refined product from Gulf Coast Refineries to Washington D.C. Those might have stopped even accepting gasoline, without sure-contracted-buyers as the product off-takers. So that fascinating and scary April, yielded to a much different June.

As anticipated/many hoped for, oil prices rebounded in June, to $40.That was mainly on both partially reviving economies, as well as production cuts by OPEC+ largely complied with (though Iran pumped freely). So a Q2 that began with oil crisis on everyone's lips, ended with oil largely unseen – or at least – not a pressing concern as other matters came to the fore.

Through it all, clean energy has been on a path perhaps least impacted (in energy) by this Q2 crisis. "Storage" continues to be a key issue there, of a much different sort. It involves storing electricity – which could be done as very simply as by pumped-hydro pushing water uphill to be released when power is needed, or pushing air into caverns. Or by less-expensive, new 'million-mile' batteries. We'll return to clean energy here. But before doing that, moving on next, oil wasn't the only volatile story seen here in the larger energy complex.

Beyond a brief Q2 oil ride, there's larger trends standing out in an evolving energy landscape. One in particular needn't be guessed at. Nor pondered as mere possibility ahead, since it has begun: *Coal recently lost a huge slice of the energy pie in the last 10 years*. As Yogi Berra said, "It's tough to make predictions, especially about the future" – so let's briefly ponder this seminal shift, one underway, a movement away from coal that's *already* started.

In 2005 little thought was given to such idea: that coal could see dramatic losses. At that time 'King coal' made up about 50% of U.S. electric power generation. Minor gains (small in absolute terms, big as percentages) were being seen in solar & wind – in natural gas more so – but they hit coal only incrementally taking coal 'down' to some 45% by 2010.

Last 10 years though U.S. coal really dropped, from ½ - to under ¼ of American power generation. Now, renewables are at 20%+ and rising, with natural gas near 40%. The why is easy. A fracking/shale revolution pushed down natural gas costs tremendously. That has cut into coal badly. If a power plant has a 30+ year-life, it's sensible to choose a clearly safe, inexpensive, long-term fuel. This became U.S. natural gas that doesn't suffer the opprobrium & pollution vexing coal. Gas enjoys ample domestic supply; it's embraced as safe & smart by power industry. Smaller plants can start/stop to meet peak brief demand – unlike coal. Natural gas became an easy choice, over coal. It delivers dispatchable firm power, is less-dirty, has more stable fuel-term cost dynamics; it's widely popular and unquestioned.

What's perhaps more interesting now is another big change in the making beginning to unfold. It is that lately, clean renewables are now becoming this landscape's growing best bet. Now it's mainly becoming Energy Storage as fulcrum for really advancing low-cost renewables. Especially in a pandemic shutting-in people & shutting-down industry – the lowest-fuel-cost choice (free sun & wind) made renewables best poised to gain market share – even in a tough market period. In fact, it was rather **due to** current/tough conditions. This is well-explained in a piece from Raymond James, March 2020 so we'll except it unusually at length:

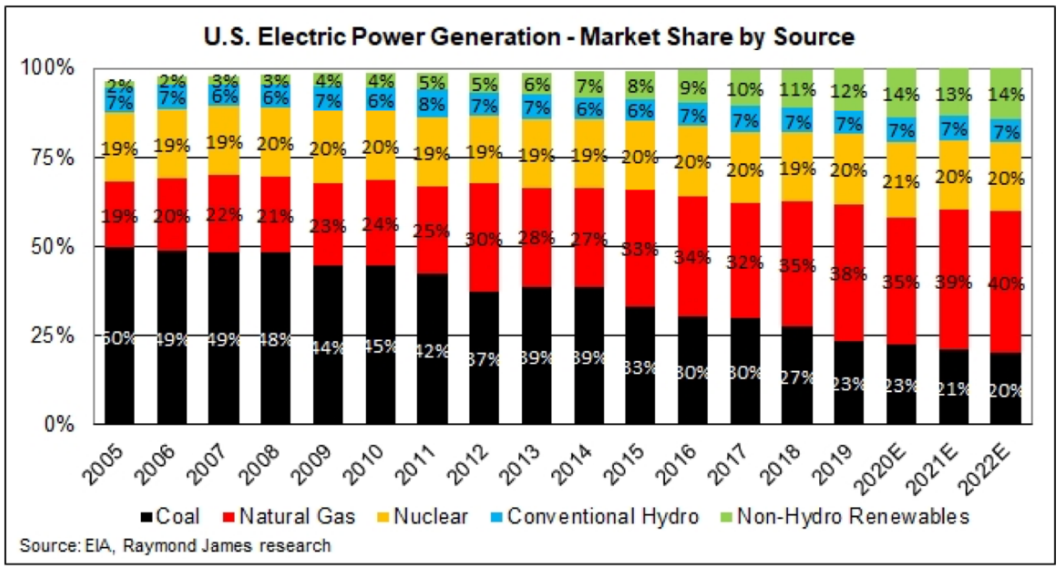
"Amid COVID, U.S. Power Use Set for Record Fall in 2020 - Renewables Gain Record Share

RENEWABLE ENERGY AND CLEAN TECHNOLOGY

> *"…. It may not "feel" like much has changed in the electric power sector - in contrast to how much you pay for fuel at the pump, your personal utility bill is **not** about to plummet - but that simply reflects the largely regulated nature of the sector. In actuality, U.S. power usage is set to drop more steeply in 2020 than in any year at least over the past two decades. However - and this is why we are writing about this through the lens of clean tech - renewables are poised to gain more share in 2020 than ever before. This is **not despite** the tough industry backdrop - in fact, it is **because** of that backdrop. ….*
>
> ***"…. U.S. power usage was down 5% in 2008 and 2009 combined - the drop in 2020 will likely be even steeper. ….*** *Not surprisingly, the last significant drop was in 2009: 4.1%. Combined with the 0.9% drop in 2008, the combined drop over the two years of the financial crisis was 5.0%. So, how bad will 2020 be? With the important caveat that the duration of the lockdown policies as well as other economic dislocation is still very much an open question at this early stage, we are modeling 2020 down 7.0%, followed by a commensurate recovery in 2021 (again, following the pattern of the financial crisis). ….*

....
....

"Renewables are set to surpass 20% of the electricity mix, while coal and (to some extent) gas feel the pain of the fall-off in usage. *When power usage falls abruptly - whether due to weather or economic factors - which power plants are most resilient? The short answer is: those with the lowest cash operating costs - "cash" being the key word. The upfront (capital) cost of the plants is a moot point when generators decide which plants to keep operating, and which to temporarily shut down. Accordingly, it makes sense that wind and solar plants - which have close to zero cash costs - will keep operating no matter how long the pandemic lasts. Essentially the same holds true of hydro. Combining non-hydro renewables (which are growing in absolute terms) with hydro (which is static), we forecast that the share of renewables in the U.S. electricity mix will be 20.7% in 2020, up from 18.3% in 2019, as shown below. This 240 bp share gain is the largest ever - albeit in the context of a smaller market, i.e. reduced power usage. So, who will lose share? Coal, of course, would have lost share even under normal circumstances, reflecting the relentless continuation of pre-planned plant retirements. As things stand, it is likely that some additional coal plants will be temporarily shut down - and a few of those shutdowns may be converted into permanent retirements. Perhaps less intuitively, gas is set to lose share as well, though this is purely a temporary phenomenon. We estimate that one-quarter of the power sector's gas consumption is used in peaking power plants. In periods of ultra-depressed demand, peakers are, by definition, some of the first plants to shut down. Even though the economics of gas-fired generation are certainly attractive at sub-$2.00/Mcf Henry Hub gas prices, gas peakers still have higher cash costs as compared to wind and solar.*



Source: Raymond James, Industry Brief, March 2020.

Hence fuel costs play a key role prioritizing power generation; we saw that when falling prices grew prospects for more natural gas-fired power plants. Recently, oil prices fell too – yet it pays to be wary there - this 'ain't the first rodeo' for cheap oil. Each time seems to only sow seeds of cyclical oil-rises later with wells shut-in, lost of expertise and production capacity. This time, oil storage capacity was depressive, distorting matters wildly. By contrast consider that *zero-carbon Renewable Fuel Is Always Free*: the sun doesn't cost, nor wind.

Consider CO2: A Topic Gaining Importance

In the 20+ years we've been capturing clean energy, as the 1st and leader, our emphasis has been on *Solutions*. Not on Climate Change – but in ecological & economic senses to better bring these into focus and to fruition. A dire specter of warming was an impetus to be sure - but CO2 was hardly discussed by us. Lately however, science increasingly shows that warming is now impacting near worse ends of what the models expected. In short, CO2 matters.

As acute example, this May 2020 piece in Proceedings of National Academy of Sciences states that in a brief span of a "coming 50 years, 1 to 3 billion people are projected to be left outside the climate conditions that have served humanity well over the past 6,000 years." Thus given current trends in CO2 and population, this narrow temperature niche that our species has required is projected to change more in just the next 50 years, than in the past six millennia. See Chi Xu, Timothy Kohler et al, *Future of the Human Climate Niche*. PNAS (4 May 2020). See, https://www.pnas.org/content/early/2020/04/28/1910114117

Hence brief excursion here into climate as it's relevant to a wider clean energy story today. And consideration too of Environmental, Social & Governance / ESG factors (the 'E'). First note that CO2 has long been a hero to our species – seen in moderation. Earth without CO2 would have had a frozen, near 0 degrees F average temperature at surface. Instead, warming thanks to lesser-CO2 increases (much under 400 ppm) naturally gifted us with average surface temperatures near an ideal for us, 59 degrees F. We've evolved well to that fact/level.

Late 1950s as regular CO2 monitoring began, post-industrialization modern readings had already risen from high 200s, to 315 PPM. By 1988 scientists grew alarmed by planetary warming due in part to fast-increasing CO2 levels that then were 350. A world conference held in that year called for reducing a high 350 figure, downwards -20% by 2005.

1992 a global compact was reached. Signed in Rio this U.N. Framework Convention on Climate Change lacked specific cuts. And looking back, that nebulous agreement to just try to act was a real failure – nowhere close to the task. CO2 has continued on rising sharply. Rio only implied *cuts,* like calling for global emissions to be -20% lower in 2005 – yet instead CO2 as it turned out only grew and by +34% *higher by 2005*. (Looking back it would go on rising another +22% higher in 2017). So mere aspirational words, absent real acceptance and robust action like was seen with COVID-19 in 2020, has woefully not achieved what's needed on climate.

So more specific cuts were laid out 5 years later in a 1997 Kyoto Agreement on climate. Yet CO2 again went on rising, even more sharply. It was a mockery of 'action' on CO2. An international agreement was again tried in 2009; that Copenhagen event also failed. CO2 levels continued increasing, temperatures spiking up. In 2015 a Paris Agreement was roughly more of the same, CO2 a uphill scary climb. Only 3 countries met an early target of the Paris terms: Marshall Islands, Suriname, & Norway, which made up only 0.1% of emissions globally. There's no cause today for optimism. A next gathering intended for Glasgow in 2020 was meant to take stock of progress (there's been none); it was postponed due to COVID-19.

In sum, commitment Isn't There. That's why it's crucial that 1) clean renewables are getting cost-competitive *unsubsidized* with fossil fuels; 2) there's growing public recognition of the Science, and 3) with COVID-19 we saw an historic oil crash making a decarbonizing shift from dirty fossils – to cleaner paths while creating jobs - more approachable worldwide.

Looking near-term, just decades ahead to early 2100, there's some good news. In the intercomparisons of some 56 climate models, some most awful possibilities look perhaps a bit less likely. Barring say methane feedbacks, underseas clathrates, water vapor, or permafrost, and hoping for no other major contributions, then of these models, the scariest rises near 9 degrees F by 2100 *may be* less likely on current understanding. (Less than 9 F from here, since there's been some warming to now). Those models assume high fertility, widespread coal, and failure to strongly embrace renewables. Such models may be rather more unlikely at their highest/ worst-case ends predicting an (unbearable) 9 degrees F warming.

Yet if we regard that highest end Representative Concentration Pathway (RCP) unlikely, heavy CO2 emissions in so-called RCP 8.5 - we should also regard lowest RCP 2.6 as even more unrealistic. It assumes widespread vigorous embrace of renewables that's already far greater than seen, and No coal; neither (especially the latter) is close to accurate in 2020.

And a low-end of that wide band heavy-emissions RCP 8.5 band, seems scarily feasible. That foresees arguably catastrophic rise of near 7 degrees F possible, soon as 2100s. Even say 'low-end' RCP 8.5 possibilities ought to concern nations & political leaders greatly. RCP 8.5 was one basis for predictions (above) of the mass loss of inhabitable climate by 2100.

The next 'lower' RCP 6.0 may be rather closer to where we're trending – on present action. It foresees roughly near 5 ½ degrees F warming by 2100s. Under it global emissions peak some 60 years out, 2080 or so, then decline. (CO2 in atmosphere rises, stays high, then drops only slowly since it accumulates). Coal plants would thus be built, as they are now - but soon are regarded as a thing of the past under RCP 6.0. Electric car adoptions fast accelerate.

That assumes a CO2 equivalent to about 850 ppm. For data nerds like ourselves, this translates to radiative forcing of 6.0 Wm^2 post 2100, or 6 watts per square meter for RCP 6.0. (RCP 8.5 translates for example to 8.5 Wm^2). This reflects a core influence of how altered the incoming solar energy vs. outgoing balance gets in our Earth-atmosphere system. Consequences of that may be dire for our species over centuries yet seems about what one may 'hope for'.

Next, better, and very ambitious is most hoped for RCP 4.5: emissions peak in about 20 years near 2040, then fall fast. Thus CO2 levels not long ago stable <300, now past 400 & rising fast, in this scenario only go on rising to 'just' some 650. Strong decarbonization is assumed here to be undertaken, now, with CO2 slowly dropping. That *might* be possible, although it's a huge stretch to be sure. And very unlikely. Especially since hundreds of new coal plants are *still being built, right now today* in 2020. Each may have working lives of 30 years or more, hence shall be operating in 2050 and after unless they are prematurely shuttered.

Since renewables make up only some 20% of electricity in many nations (although growing), coal still burned widely, cars mainly oil-powered, ambitious RCP 4.5 is a very unlikely bet. That said unexpected events like ice sheets destabilizing, might catalyze stronger action. COVID-19 and say, sudden events, could hasten strong and real action on climate.

Climate models, inevitably, are now getting more complicated. Until recently they'd ignored ice sheet destabilization as warming oceans melt glaciers from below. Yet if a pulse of sea rise visibly gets underway, undeniably, skeptics may melt away too. Especially when clean energy creating jobs is the *most economical choice*, unsubsidized and mated to storage.

Conclusion:

The Clean Energy Index® (ECO) began 2nd Quarter at 56, and ended at 84, strongly up +50%. But there's richer context to this Q2 and 1st half (1H) 2020. Over a remarkable, memorable, volatile first half of 2020, ECO gained sharply +30% to go over 90, crashed late Q1 under 50, then rebounded. Intra-day moves could be abrupt, on March 24 ECO sprang up 15%. Even after Q1's big fall the story ECO captures bounced +75% from late March to go positive year to date. Or since, say, start of 2017 when ECO Index® was 38, in 3 ½ years it has risen over +115%.

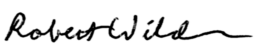
Look back 5 years at Benchmark ECO Index® live since 2004, 1st for climate solutions, and here ECO is up by over +50% during a time when perhaps any energy gains may be rather notable. For in those same 5 years, dominant dirty energy themes are all far negative: fossil fuels plunged. Oil & natural gas are down hefty -80%, while coal is down -30%. Thus oil, coal & gas are far behind green energy. Last 10 years, fossil fuels are again down most, with clean energy stories having significantly strongest relative returns. Both NEX plus ECO have outperformed too vs. a good but separate, global clean energy Index, YTD & past 1, 5, 10 years and more.

Energy storage is vital: potential advances like a 'million-mile battery' and cost reductions can be seminal here. Potentially too green stimulus 2021 or after *may* include tax credits for clean energy, infrastructure funding; also maybe a Green Deal carbon tax in Europe

There was 1 Deletion of TERP, and 1 Addition of KNDI to clean energy ECO Index to start Q3. At Global New Energy Innovation Index NEX: 2 Deletions there were TerraForm Power, and Gigasolar; 2 NEX Additions for start of Q3 2020 were Arcosa, and Xebec Adsorption.

As always, we welcome your thoughts and suggestions.

Sincerely,



Rob Wilder
rwilder@wildershares.com

Appendix I:

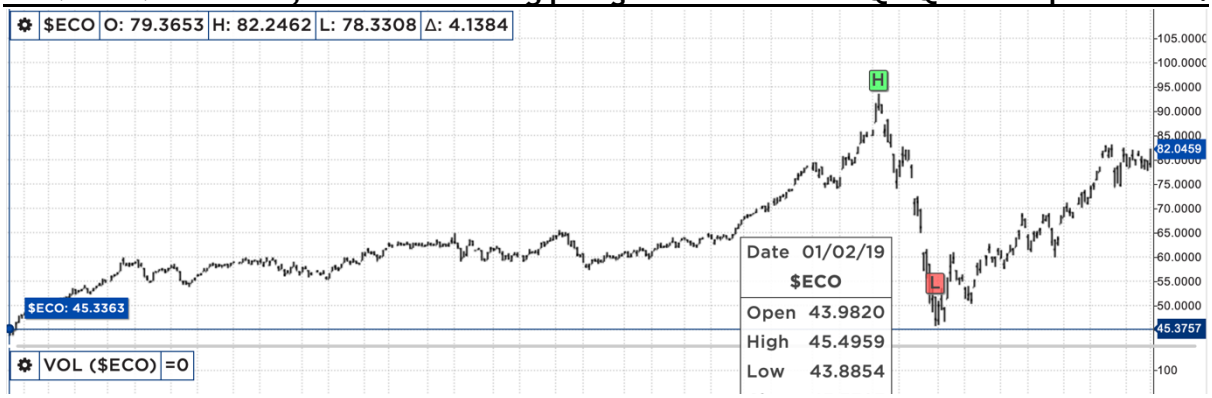
ECO Index (via independent tracker PBW) Descending Weights latter-Q2 on 6/16/2020, or about ~2 weeks before rebalance to start Q3 2020, 40 Stocks:

Name	Symbol	Weight
NIO Inc ADR	NIO	5.02
Tesla Inc	TSLA	3.72
Vivint Solar Inc	VSLR	3.67
Bloom Energy Corp	BE	3.03
Ballard Power Systems Inc	BLDP	2.98
Sunrun Inc	RUN	2.96
SolarEdge Technologies Inc	SEDG	2.94
Sunnova Energy International	NOVA	2.88
FuelCell Energy Inc	FCEL	2.86
Cree Inc	CREE	2.82
Enphase Energy Inc	ENPH	2.78
TPI Composites Inc	TPIC	2.74
Veeco Instruments Inc	VECO	2.65
Livent Corp	LTHM	2.65
First Solar Inc	FSLR	2.63
Ameresco Inc	AMRC	2.60
Albemarle Corp	ALB	2.58
MYR Group Inc	MYRG	2.58
Quanta Services Inc	PWR	2.54
Renewable Energy Group Inc	REGI	2.54
Willdan Group Inc	WLDN	2.52
Advanced Energy Industries Inc	AEIS	2.50
Woodward Inc	WWD	2.44
Plug Power Inc	PLUG	2.42
Itron Inc	ITRI	2.38
Atlantica Sustainable Infra.	AY	2.34
Sociedad Quimica y Minera	SQM	2.33
Universal Display Corp	OLED	2.32
Air Products and Chemicals	APD	2.26
Gentherm Inc	THRM	2.22
TerraForm Power Inc	TERP	2.21
Canadian Solar Inc	CSIQ	2.11
Hexcel Corp	HXL	2.10
SunPower Corp	SPWR	2.01
Ormat Technologies Inc	ORA	1.88
ESCO Technologies Inc	ESE	1.84

JinkoSolar Holding Co Ltd ADR	JKS	1.80
Daqo New Energy Corp ADR	DQ	1.73
Workhorse Group Inc	WKHS	0.75
American Superconductor Corp	AMSC	0.51

Among best performers in this period above, there's representation from *Electric Vehicles, *Hydrogen Fuel Cells, *Solar, and *LED energy efficient Lighting.

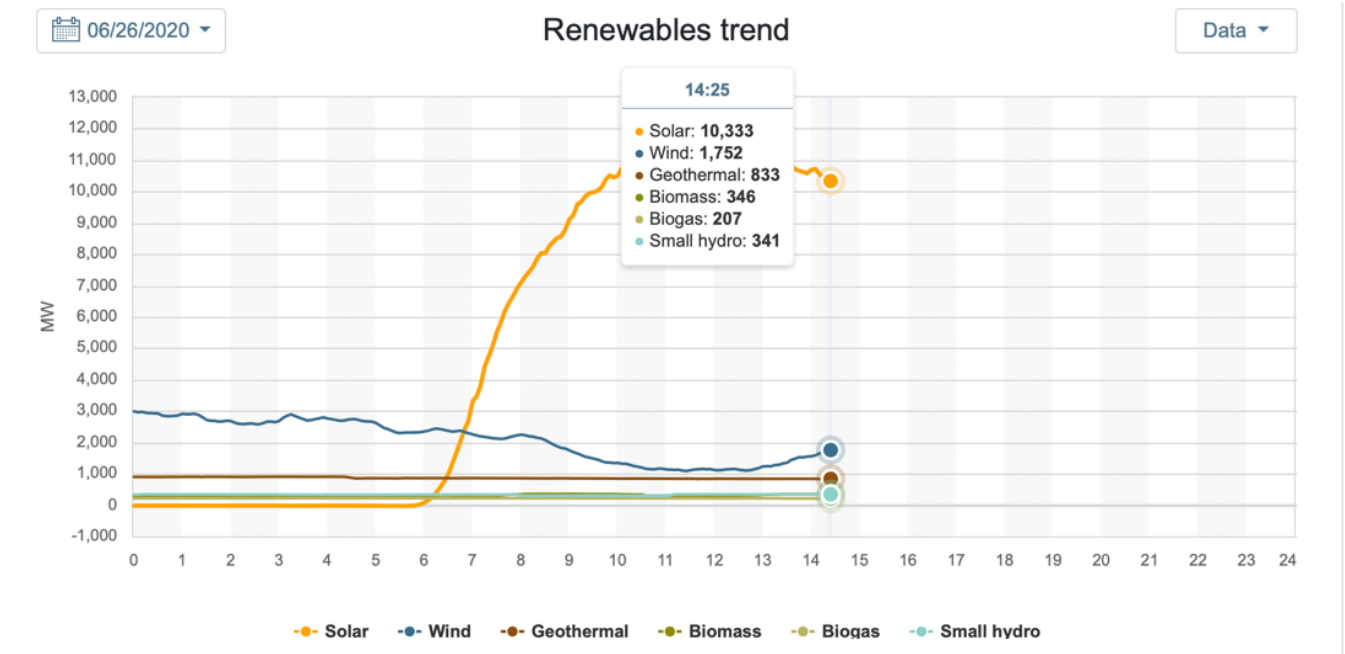
<u>*ECO Index* from start of 2019 to June 29, 2020; a fall late in 2018 perhaps 'amplified' Year 2019's +59% Returns; also seen is a *Big* plunge/ and bounce in Q1/Q2 to midpoint 2020:</u>



Source: bigcharts.com

<u>At a State Leader: this typical Summer day in California Renewables are Supplying ~45% of power: California's Renewables Supply to the Grid, here June 26, 2020 at 2:25 pm</u>

From: http://www.caiso.com/TodaysOutlook/Pages/supply.aspx



Appendix II, ECO Index for Start of the New Quarter:

INDEX (ECO) SECTOR & STOCK WEIGHTS FOR START OF Q3 2020. 40 STOCKS.
Each stock freely floats according to its share price after rebalance.
*Stocks below $200 million in size at rebalance are *banded with a 0.50% weight.

Renewable Energy Harvesting - 22% weight (8 stocks @2.75% each)
Canadian Solar, CSIQ. Solar, vertically integrated solar manufacturer, China.
Daqo New Energy, DQ. Solar, polysilicon/wafer manufacturer; China-based.
First Solar, FSLR. Thin film solar, CdTe a low-cost alternate to polysilicon.
Hexcel, HXL. Light composites, in wind blades & spars, aerospace, vehicles.
JinkoSolar, JKS. Solar, wafers through solar modules, China-based OEM.
Ormat, ORA. Geothermal, works too in areas of recovered heat energy.
SunPower, SPWR. Solar, efficient PV panels have all-rear-contact cells.
TPI Composites, TPIC. Wind Blades; also light-weighting for transportation.

Energy Conversion - 24% sector weight (9 stocks @2.66% each)
Advanced Energy, AEIS. Power conditioning: inverters, thin film deposition.
Ballard Power, BLDP. Mid-size fuel cells; R&D, PEM FCs as in transportation.
Bloom Energy, BE. Stationary fuel cells, not-yet cleanest/renewable fuels.
Cree, CREE. Power electronics, moved into power devices including for EVs.
ESCO Technologies, ESE. Power management, shielding, controls, testing.
FuelCell Energy, FCEL. Stationary fuel cells, for distributed power generation.
Gentherm, THRM. Thermoelectric, waste heat energy, battery management.
Plug Power, PLUG. Small fuel cells, for e.g. forklifts; drop in replacements.
SolarEdge Technologies, SEDG. Inverters, makes solar optimizers, inverters.

Power Delivery & Conservation - 18% sector weight (7 stocks @2.50% plus one *banded)
Ameresco, AMRC. Energy saving performance contracts, also in renewables.
**American Superconductor,* AMSC. Wind, grid conditioning; superconductors.
Itron, ITRI. Meters, utility energy monitoring, measurement & management.
MYR Group, MYRG. Transmission and Distribution, includes solar & wind farms.
Quanta Services, PWR. Infrastructure, modernizing grid & power transmission.
Universal Display, OLED. Organic light emitting diodes, efficient displays.
Veeco, VECO. Thin film equipment, for LEDs, energy efficient electronics.
Willdan, WLDN. Efficiency, distributed energy, renewables, engineering.

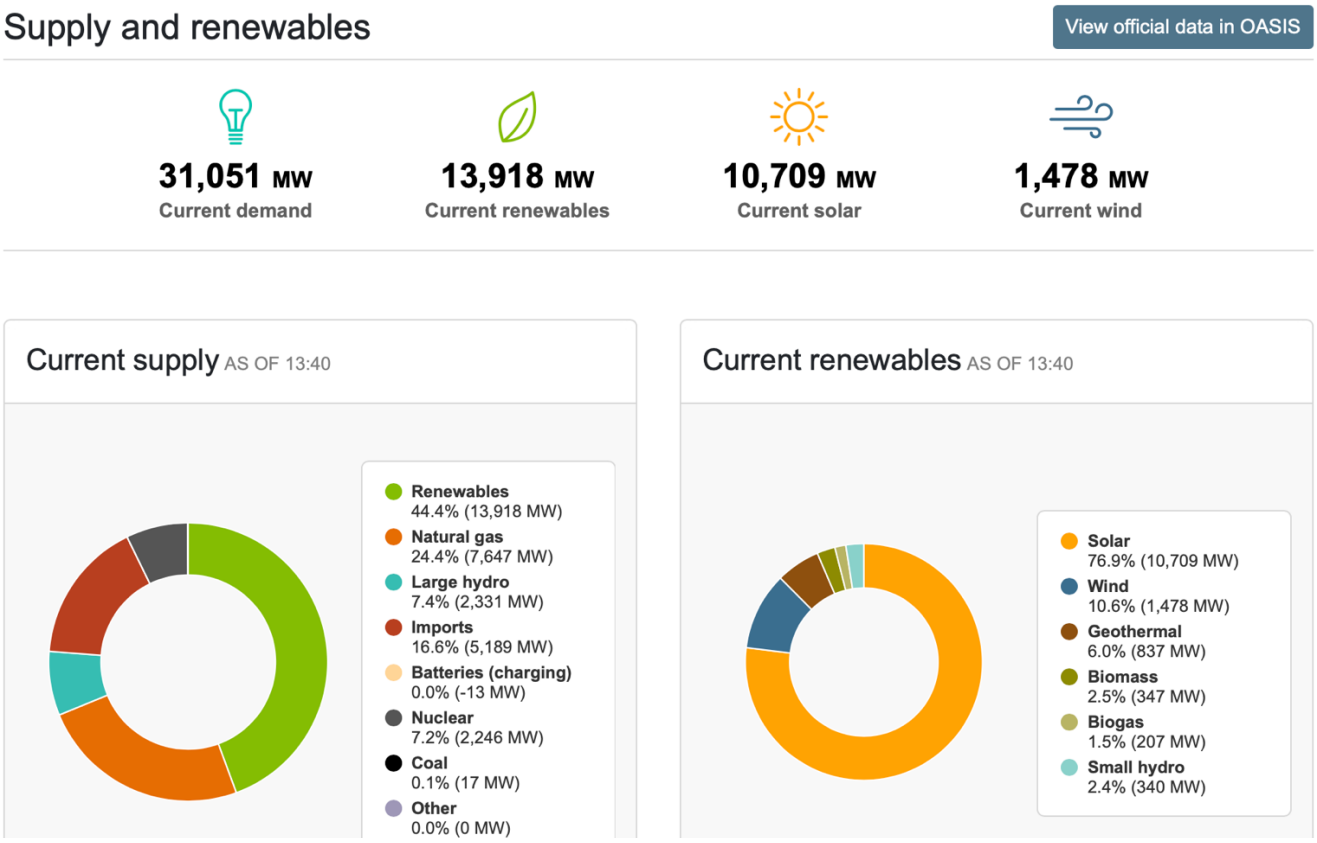
Greener Utilities – 10% sector weight (4 stocks @2.50% each)
Atlantica Yield, AY. Yieldco, Contracted renewables assets, also transmission.
Sunnova, NOVA. Solar provider, operating fleet for residential plus storage.
Sunrun, RUN. Residential solar systems, lease, PPA or purchase rooftop PV.
Vivint Solar, VSLR. Solar, residential plus storage, long-term contracts.

Energy Storage - 21% sector weight (8 stocks @2.56% each plus one *banded)
Albermarle, ALB. Lithium, specialty materials in batteries; for energy storage.
Chemical & Mining Co. of Chile, SQM. Lithium, energy storage, large producer.
Enphase, ENPH. Microinverters, also energy storage systems and software.
**Kandi,* KNDI. Electric Vehicles, inexpensive small cars, early-stage, China-based.
Livent, LTHM. Lithium, and compounds for batteries in energy storage.
NIO Inc, NIO. Electric vehicles, China-based startup but loss-making so far.

Tesla Motors, TSLA. Electric vehicles, solar; pure-play EVs & energy storage.
Woodward, WWD. Converters, controls for wind power and energy storage.
Workhorse, WKHS. Electric Vehicles, electric delivery trucks early-stage.

Cleaner Fuels – 5% sector weight (2 stocks @2.50% each)
Air Products & Chemicals, APD. Hydrogen, is a supplier of industrial gases.
Renewable Energy Group, REGI. Biodiesel, natural fats, oils, grease to biofuels.

Looking at one State Leader: typical Summer day in California there's ~45% Renewables: California's Renewables Supply into the Grid, on June 26, 2020 at 1:45 pm
From: http://www.caiso.com/TodaysOutlook/Pages/supply.aspx



Appendix III: **WilderHill New Energy Global Innovation (NEX)** descending weights late-Q2 via independent tracker (PBD) on 6/16/20 or ~2 weeks before Rebalance for Q3 2020. 87 stocks:

Name	Symbol	Weight
NEL ASA	NEL	2.06
NIO Inc ADR	NIO	1.87
Tesla Inc	TSLA	1.80
PowerCell Sweden AB	PCELL SS	1.67
Cree Inc	CREE	1.65
Sunnova Energy International Inc	NOVA	1.62
Sunrun Inc	RUN	1.61
TPI Composites Inc	TPIC	1.57
Plug Power Inc	PLUG	1.52
Vivint Solar Inc	VSLR	1.51
Enphase Energy Inc	ENPH	1.48
SolarEdge Technologies Inc	SEDG	1.47
Ballard Power Systems Inc	BLDP	1.42
Nibe Industrier AB	NIBEB SS	1.38
Bloom Energy Corp	BE	1.38
Ecopro Co Ltd	086520 KS	1.35
SunPower Corp	SPWR	1.32
Veeco Instruments Inc	VECO	1.31
West Holdings Corp	1407	1.30
Falck Renewables SpA	FKR	1.29
First Solar Inc	FSLR	1.28
Lextar Electronics Corp	3698	1.27
Solaria Energia y Medio Ambiente SA	SLR	1.27
Encavis AG	CAP	1.26
TerraForm Power Inc	TERP	1.23
Hannon Armstrong Sustainable Infra.	HASI	1.21
Ameresco Inc	AMRC	1.20
Scatec Solar ASA	SSO	1.18
Samsung SDI Co Ltd	006400 KS	1.16
Eolus Vind AB	EOLUB SS	1.16
VERBIO Vereinigte BioEnergie AG	VBK	1.15
Albioma SA	ABIO FP	1.15
Epistar Corp	2448	1.14
Atlantica Sustainable Infrastructure PLC	AY	1.13
Novozymes A/S	NZYMB DC	1.13
Northland Power Inc	NPI	1.11
CS Wind Corp	112610 KS	1.11

Xinyi Solar Holdings Ltd	968	1.11
BYD Co Ltd	1211	1.11
Nordex SE	NDX1	1.10
Gurit Holding AG	GUR SW	1.10
Audax Renovables SA	INVALID	1.09
Canadian Solar Inc	CSIQ	1.09
Renewable Energy Group Inc	REGI	1.08
Orsted A/S	ORSTED DC	1.07
Sociedad Quimica y Minera de Chile SA ADR	SQM	1.07
Willdan Group Inc	WLDN	1.06
GS Yuasa Corp	6674	1.06
JinkoSolar Holding Co Ltd ADR	JKS	1.06
Terna Rete Elettrica Nazionale SpA	TRN	1.05
Itron Inc	ITRI	1.04
Vestas Wind Systems A/S	VWS DC	1.04
Universal Display Corp	OLED	1.04
CropEnergies AG	CE2	1.04
Verbund AG	VER AV	1.03
Neoen SA	NEOEN FP	1.03
Siemens Gamesa Renewable Energy SA	SGRE	1.02
Mercury NZ Ltd	MCY	1.02
Tilt Renewables Ltd	TLT	1.01
Xinjiang Goldwind Science & Technology	2208	1.01
Everlight Electronics Co Ltd	2393	1.01
Meridian Energy Ltd	MEL	1.00
Innergex Renewable Energy Inc	INE	1.00
SMA Solar Technology AG	S92	0.99
Boralex Inc	BLX	0.98
Meidensha Corp	6508	0.97
Greencoat UK Wind PLC/Funds	UKW LN	0.96
EDP Renovaveis SA	EDPR	0.96
TransAlta Renewables Inc	RNW	0.95
eRex Co Ltd	9517	0.95
RENOVA Inc	9519	0.94
Kingspan Group PLC	KSP	0.93
Ormat Technologies Inc	ORA	0.93
Caverion Oyj	CAV1V FH	0.93
Contact Energy Ltd	CEN	0.93
Xinyi Energy Holdings Ltd	3868	0.90
Acciona SA	ANA	0.90

Signify NV	LIGHT	0.90
Renewables Infrastructure Group Ltd	TRIG LN	0.89
Landis+Gyr Group AG	LAND SW	0.89
Credit Suisse RE Fund Green Property	GREEN SW	0.87
Daqo New Energy Corp ADR	DQ	0.87
Sino-American Silicon Products Inc	5483	0.86
Ricardo PLC	RCDO LN	0.86
Gigasolar Materials Corp	3691	0.86
GCP Infrastructure Investments Ltd	GCP LN	0.84
Canvest Environmental Protection	1381	0.77

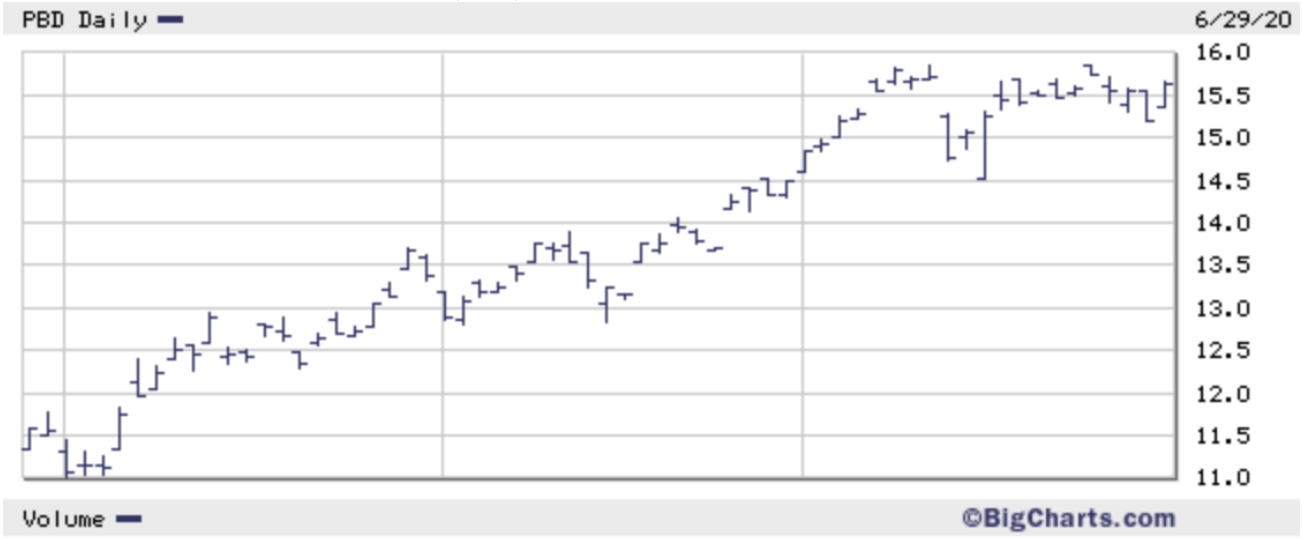
Among best performers in this period above, there's representation from *Electric Vehicles, *Hydrogen Fuel Cells, *Solar, and *LED energy efficient Lighting.

---

*NEX Index Methodology: After a 2019 Market Consultation & Announcement the NEX components have gone from Large / or Small weightings - to a straight-equal-weightings starting with Q3 2019; also NEX Sector Weights are assigned starting Q3 2019 according to the # of Constituents in each NEX Sector rather than by external Survey; these changes were effective Q3 2019.

** Effective 2019, WilderHill New Energy Global Innovation Index (NEX) calculated in $ U.S. Dollars. (Previously also calculated in theoretical way in Euros, Yen, GB Pounds; now only in $ USD).

***NEX via an Independent Tracker (PBD)* past 3 months to June 29, 2020:**



Source: bigcharts.com

Appendix IV:
WilderHill New Energy Global Innovation (NEX) - for start of Q3 2020. 87 Stocks.

(subject to revision, see http://www.nexindex.com/Constituents_And_Weightings.php)
Also Index Composition, https://www.solactive.com/?s=wilderhill&indexmembers=US96811Y1029

Name	Description	Sector	Activity
Acciona	Operates Wind, Solar/Thermal, Hydro, Biomass plants.	RWD	SPAIN
Albioma SA	Biomass, sugarcane, hybrid combustion, cogeneration.	RBB	FRANCE
Ameresco	Energy savings, performance contracts, in renewables.	EEF	US
Arcosa	Wind Towers, structures for electricity transmission.	RWD	US
Atlantica Yield plc	Yieldco, Contracted renewables, also transmission.	RSR	SPAIN
Audax Renovables SA	Wind power, in Europe and the Americas.	RWD	SPAIN
Ballard Power Systems	Fuel cells; R&D, used in transportation and more.	ECV	CANADA
Bloom Energy	Stationary fuel cells, distributed but non-renewable.	ECV	US
Boralex	Renewables generation, operates wind, hydro, solar.	RWD	CANADA
BYD Co.	Batteries, potential use in EVs, rail, solar farms, more.	ENS	CHINA
Canadian Solar	Solar, vertically integrated solar manufacturer, China.	RSR	CANADA
Canvest Environmental	Waste to Energy, China-focused.	RBB	CHINA
Caverion OYJ	Energy efficiency, buildings, infrastructure, Europe.	EEF	FINLAND
Contact Energy	Electric Utility, offers power from geothermal, hydro.	ROH	NEW ZEALAND
Cree Inc.	LED manufacturer power-saving, efficient lighting.	EEF	US
CropEnergies AG	Bioethanol, from cereals and sugarbeet, Germany.	RBB	GERMANY
Credit Suisse Real E. Grn.	Sustainability in buildings, real estate.	EEF	SWITZERAND
CS Wind	Wind power, both onshore, also offshore.	RWD	S. KOREA
Daqo New Energy	Solar, high-purity polysilicon for solar wafers, China.	RSR	CHINA
EcoPro	Battery materials, Pollution Control catalysts, S. Korea.	ENS	S. KOREA
EDP Renovaveis SA	Wind power, among largest producers in world, Iberia.	RWD	SPAIN
Encavis AG	Solar, large solar park operator, also wind, Germany.	RSR	GERMANY
Enphase	Inverters, micro-products for solar panels, storage.	RSR	US
Eolus Vind	Wind power, also consulting services for wind.	RWD	SWEDEN
Epistar	LEDs, large LED manufacturer in Taiwan.	EEF	TAIWAN
eRex Co. ltd.	Power generation, bus./ residential, biomass, Japan.	RBB	JAPAN
Everlight Electronics	LEDs, large manufacturer in optoelectronics, Taiwan.	EEF	TAIWAN
Falck Renewables SpA	Renewable wind, biomass, WtE, solar, Europe.	RWD	ITALY
First Solar	Thin film solar, CdTe low-cost alternate to polysilicon.	RSR	US
GCP Infrastructure	Trust invests in renewables, based in Jersey U.K.	RSR	BRITAIN
Greencoat UK Wind plc	Infrastructure fund, invested in U.K. wind power assets.	RWD	BRITAIN
GS Yuasa	Battery technologies, also Lithium for EVs, Japan.	ENS	JAPAN
Gurit Holding AG	Composite Materials in wind, lightens cars, planes.	RWD	SWITZERLAND
Hannon Armstrong	Energy efficiency, capital & finance for infrastructure.	EEF	US

Innergex Renewable	Renewable power, run-of-river hydro, wind, solar.	ROH	CANADA
Itron	Meters, Utility energy monitor, measuring & manage.	EEF	US
JinkoSolar	Solar, wafers through solar modules, China OEM.	RSR	CHINA
Kingspan Group plc	Efficient Buildings, insulation for conservation, Ireland.	EEF	IRELAND
Landis+Gyr Group AG	Advanced meters, modernizing grid, Switzerland.	EEF	SWITZERLAND
Lextar Electronics Corp	LEDs and efficient displays and lighting.	EEF	TAIWAN
Meidensha Corp	Energy management, power generation & transmission.	EEF	JAPAN
Mercury NZ	Clean power, 100% renewable hydro, geothermal.	ROH	NEW ZEALAND
Meridian Energy	Hyrdoelectric power stations, some wind, New Zealand.	ROH	NEW ZEALAND
Nel ASA	Hydrogen, fuel cell vehicles, renewably, Norway.	ECV	NORWAY
Neoen SA	Renewable energy mainly solar, some wind.	RSR	FRANCE
Nibe Industrier AB	Heating & cooling, sustainable technologies, Sweden.	EEF	SWEDEN
Nio	EVs, design, manufacture, and sale including SUVs	EEF	CHINA
Nordex SE	Wind turbines, based in Germany/Europe, worldwide.	RWD	GERMANY
Northland Power	Wind, solar, biomass; power producer, Canada.	RWD	CANADA
Novozymes A/S	Biofuels, enzymes used in partnerships, Denmark.	RBB	DENMARK
Ormat	Geothermal, works too in recovered heat energy.	ROH	US
Orsted A/S	Sustainable wind, also biomass, thermal, Denmark.	RWD	DENMARK
Plug Power	Small fuel cells, e.g. in forklifts; drop in replacements.	ECV	US
Powercell Sweden	Fuel cells, transportation, marine, stationary uses.	ECV	SWEDEN
Renewable Energy Group	Biodiesel, natural fats, oils, grease to biofuels.	RBB	US
Renewables Infrastructure	Wind Farm & Solar Park revenues assets, U.K.	RWD	BRITAIN
Renova	Wind, Solar, Biomass, power generation in Asia.	RWD	JAPAN
Ricardo plc	Global Engineering, energy, environment, transport.	EEF	BRITAIN
Samsung SDI	Batteries, innovative energy storage, EVs, South Korea.	ENS	S. KOREA
Scatec Solar ASA	Solar power parks worldwide.	RSR	NORWAY
Siemens Gamesa	Wind, onshore & offshore, turbines, gearboxes, Spain	RWD	SPAIN
Signify NV	Lighting, systems increasing efficiency, Netherlands.	EEF	NETHERLANDS
Sino-American Silicon	Solar, semi-conductor silicon wafer materials, Taiwan.	RSR	TAIWAN
SMA Solar Technologies	Inverters for solar, industrial scale storage, Germany.	RSR	GERMANY
Sociedad Quimica Chile	Lithium, a key element in advanced batteries, Chile.	ENS	US
Solaria Energia	Solar, renewable power generation, Iberia.	RSR	SPAIN
SolarEdge	Inverters, panel-level solar optimizers, micro-inverters.	RSR	US
Sunnova	Residential solar and energy storage installation.	RSR	US
SunPower	Solar, efficient PV panels with rear-contact cells.	RSR	US
Sunrun	Residential solar, leasing, PPA or purchase rooftop PV.	RSR	US
Terna SpA	Transmission of electricity, increasingly is renewables.	EEF	ITALY
Tesla	Electric vehicles, solar; in EVs & energy storage.	ENS	US
Tilt Renewables	Wind Farms, Australia and New Zealand, some solar.	RWD	NEW ZEALAND
TPI Composites	Wind Blades; also light-weighting for transportation.	RWD	US

TransAlta Renewables	Renewables, operating wind power, some hydro.	RWD	CANADA
Universal Display	Organic light emitting diodes, efficient displays.	EEF	US
Veeco instruments	Thin film equipment LEDs, energy efficient electronics.	EEF	US
Verbio Vereinigte BioEn.	Biofuels, manufacturer supplier to Germany, Europe.	RBB	GERMANY
Verbund AG	Electricity supplier, hydro, a large provider for Austria.	ROH	AUSTRIA
Vestas Wind Systems A/S	Wind, wind turbine manufacturing & services, Denmark.	RWD	DENMARK
Vivint Solar	Solar, one-stop installer direct to homes sales model.	RSR	US
West Holdings	Solar, Japan-focused residential and commercial PV.	RSR	JAPAN
Willdan Group	Energy efficiency in infrastructure, engineering.	EEF	US
Xebec Adsorption	Gases to renewable energies, hydrogen.	EEF	CANADA
Xinjiang Goldwind	Wind, large turbine manufacturer, China.	RWD	CHINA
Xinyi Energy Holdings	Solar Farms, a spin-off from Xinyi solar glass, China.	RSR	CHINA
Xinyi Solar Holdings	Solar, ultra-clear glass products, China.	RSR	CHINA

Appendix V: NEX Sector Weights for start of New Quarter Q3 2020

Changes to NEX Index for Q3 2020:

2 NEX ADDITIONS for Q3 2020: ACA.N, XBC.V

ACA.N

XBC.V

2 NEX DELETIONS for Q3 2020.

TERP.OQ

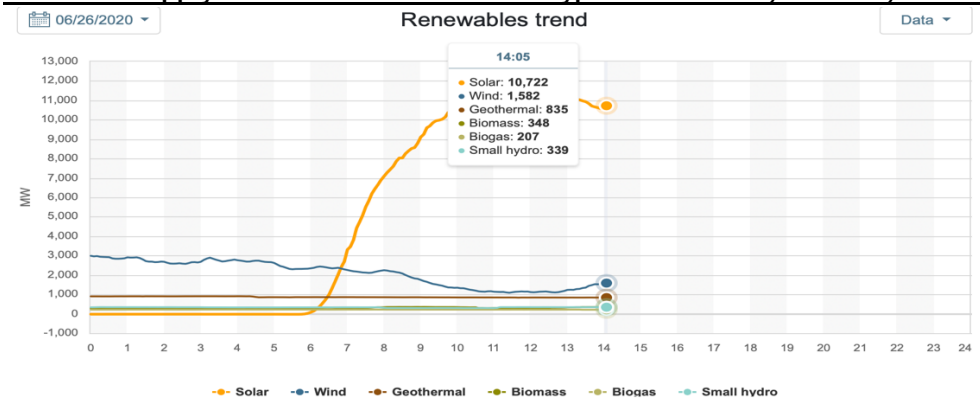
3691.TWO

	WEIGHT EACH COMPONENT
87 stocks/100 = Individual Weights Q3 2020	**1.14942529**

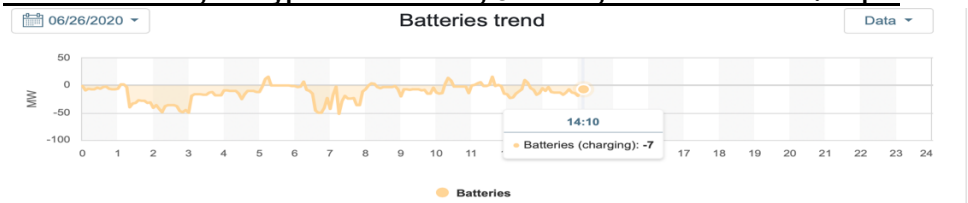
87 Stocks for Start of Q3 2020.

NEX SECTOR WEIGHTS for Q3 2020:	SECTOR	QUANTITY	% Sector Weight
Energy Conversion	ECV	5	5.7%
Energy Efficiency	EEF	21	24.1%
Energy Storage	ENS	6	6.9%
Renewables - Biofuels & Biomass	RBB	7	8.0%
Renewables - Other	ROH	6	6.9%
Renewable - Solar	RSR	21	24.1%
Renewable - Wind	RWD	21	24.1%
		87	100.0%

California Supply Trend for Renewables on Typical Afternoon, June 26, 2020 at about 2:10 pm:



Batteries Trend, on Typical Afternoon, June 26, 2020 at about 2:10 pm



Source: http://www.caiso.com/TodaysOutlook/Pages/supply.aspx

Appendix VI:
Historical Weightings: WilderHill New Energy Global Innovation Index (NEX).

NEX Historical Sector Weight Information

	ECV	EEF	ENS	RBB	ROH	RSR	RWD
Sector Weights start Of Quarter*	**Energy Conversion**	**Energy Efficiency**	**Energy Storage**	**Renewables - Biofuels & Biomass**	**Renewables - Other**	**Renewable - Solar**	**Renewable - Wind**
Q2 2020	5.70%	23.00%	6.90%	8.00%	6.90%	26.40%	23.00%
Q1 2020	5.50%	23.10%	6.60%	8.80%	6.60%	27.50%	22.00%
Q4 2019	4.00%	23.00%	8.00%	10.00%	6.00%	26.00%	23.00%
Q3 2019	3.77%	22.64%	9.43%	9.43%	5.66%	26.41%	22.64%
Q2 2019	1.40%	29.72%	9.11%	6.13%	4.41%	21.75%	27.49%
Q1 2019	1.42%	30.07%	9.36%	8.48%	4.49%	20.72%	25.46%
Q4 2018	1.05%	30.25%	9.00%	7.94%	3.63%	21.78%	26.34%
Q3 2018	0.79%	29.62%	8.48%	6.60%	3.71%	23.67%	27.12%
Q2 2018	0.80%	30.50%	8.80%	7.90%	3.90%	22.50%	25.50%
Q1 2018	1.00%	30.67%	7.64%	7.74%	3.92%	23.37%	25.66%
Q4 2017	1.14%	29.36%	6.75%	8.21%	4.68%	20.58%	29.28%
Q3 2017	0.76%	30.88%	5.91%	9.11%	4.55%	18.80%	29.98%
Q2 2017	0.67%	33.68%	6.50%	8.75%	4.92%	18.73%	26.75%
Q1 2017	1.00%	31.83%	5.64%	9.03%	5.43%	17.92%	29.14%
Q4 2016	0.71%	32.00%	3.58%	8.48%	5.20%	18.84%	31.19%
Q3 2016	1.12%	31.00%	4.54%	7.76%	5.87%	21.09%	28.61%
Q2 2016	1.02%	32.18%	3.69%	7.15%	5.18%	21.60%	29.18%
Q1 2016	1.01%	34.83%	3.61%	9.38%	4.26%	20.14%	26.77%
Q4 2015	0.95%	33.54%	3.09%	9.19%	5.19%	20.40%	27.65%
Q3 2015	0.95%	32.97%	3.18%	8.05%	4.52%	24.65%	25.67%
Q2 2015	1.22%	33.68%	2.26%	9.55%	6.90%	24.88%	21.50%
Q1 2015	1.68%	33.88%	2.14%	11.54%	6.84%	24.86%	19.06%
Q4 2014	1.42%	33.67%	2.26%	12.31%	8.45%	24.67%	17.22%
Q3 2014	1.42%	33.42%	2.30%	12.44%	9.09%	23.78%	17.56%
Q2 2014	1.11%	34.20%	2.00%	12.16%	9.86%	23.16%	17.52%
Q1 2014	1.17%	33.13%	2.34%	12.17%	10.33%	23.95%	16.91%
Q4 2013	1.28%	35.26%	2.28%	14.02%	12.47%	19.58%	15.10%
Q3 2013	1.25%	35.04%	2.35%	14.61%	13.06%	19.10%	14.58%
Q2 2013	1.31%	33.43%	2.63%	15.42%	14.05%	17.54%	15.62%
Q1 2013	1.31%	33.43%	2.63%	15.42%	14.05%	15.90%	14.14%
Q4 2012	1.50%	33.93%	2.97%	14.50%	14.50%	19.59%	13.04%
Q3 2012	2.32%	28.30%	6.70%	14.22%	8.35%	21.17%	19.00%
Q2 2012	1.34%	28.14%	4.16%	14.61%	13.98%	22.00%	15.96%
Q1 2012	1.60%	28.01%	4.01%	13.85%	14.70%	20.83%	17.00%

Q4 2011	1.14%	25.06%	4.12%	12.13%	11.63%	26.48%	19.45%
Q3 2011	1.28%	22.72%	6.24%	10.17%	10.49%	24.60%	24.32%
Q2 2011	1.50%	23.34%	8.06%	10.69%	9.53%	25.76%	21.04%
Q1 2011	1.50%	26.95%	6.99%	10.50%	9.46%	24.59%	20.00%
Q4 2010	1.79%	24.32%	8.80%	11.21%	6.02%	24.16%	23.71%
Q3 2010	1.97%	20.31%	8.86%	11.70%	6.59%	24.42%	26.16%
Q2 2010	1.90%	17.29%	8.53%	12.36%	6.58%	24.29%	29.05%
Q1 2010	2.04%	16.93%	8.65%	12.25%	6.73%	25.03%	28.36%
Q4 2009	2.25%	15.20%	7.10%[1]	11.26%	7.10%	27.51%	29.58%
Q3 2009	2.59%	13.77%	5.38%	10.76%	6.81%	29.24%	31.45%
Q2 2009	2.42%	12.89%	4.79%	12.21%	6.49%	30.57%	30.63%
Q1 2009	2.77%	15.14%	5.29%	14.19%	8.25%	25.70%	28.68%
Q4 2008	2.25% [2]	23.93%	3.57%	12.09%	6.48%	26.63%	25.05%
Q3 2008	3.31%	20.03%	3.33%	13.14%	6.54%	27.27%	26.39%
Q2 2008	3.81%	17.85%	2.81%	14.32%	6.47%	27.03%	27.71%
Q1 2008	3.93%	13.56%	2.94%	14.26%	6.99%	30.00%	28.34%

*To early 2019, NEX Sectors and Weights had been based partly on dividing companies into either large or small and an external survey of companies deemed active in new energy: results adjusted for factors including exposure to new energy and some exchange restrictions. Subsequently, starting Q3 2019 components instead are equal weighted, respective sector weights assigned in accordance with number of Index components assigned to each NEX sector, adjusted if necessary as determined by Index Provider and reviewed each quarter.

[1] PWS (Power Storage) changed it's name to ENS (Energy Storage) at the end of the 4th Quarter of 2009.

[2] HFC (Hydrogen & Fuel Cells) changed it's name to ECV (Energy Conversion) at the end of the 4th Quarter of 2008.

[3] HF (Hydrogen And Fuel Cells) became HFC (Hydrogen & Fuel Cells) after 2007 and then changed it's name to ECV (Energy Conversion) at the end of the 4th Quarter of 2008.

[4] DS (Demand Side Energy Savings) and GE (Generation Efficiency And Smart Distribution) were combined into EEF (Energy Efficiency) after 2007.

Appendix VII, Clean Ocean Index (OCEAN) Composition for late Q2 2020:
INDEX (OCEAN) SECTOR & STOCK WEIGHTS Q2 (as of latter May) 2020. 64 STOCKS.

Name	Theme	Activity	Sector
Bollore SA	Ports, Terminals, Logistics, Transportation.	France	GS
Cargotec OYJ	Ports & Terminals, attention to Sustainability.	Finland	GS
Koninklijke Boskalis	Dredging for Ports, Maritime Transportation.	Netherlands	GS
TORM plc	Shipping tankers, bulk, CSR, exhaust reduction.	Denmark	GS
Wartsila OYJ	Ports, Terminals, energy with sustainability.	Finland	GS

Ballard Power	Fuel Cells, mid-sized PEM.	Canada	CE
Canadian Solar Inc	Solar, panel manufacturer.	Canada	CE
CS Wind	Wind, towers.	S. Korea	CE
EDP Renovaveis SA	Renewables, across wind, hydro, solar.	Spain	CE
Eolus Vind AB	Wind power projects, Sweden, US, Estonia.	Sweden	CE
First Solar	Solar, thin film panels.	USA	CE
Meridian Energy	Power generation 100% from renewables.	New Zealand	CE
Neoen S.A.	Renewables, using wind, solar, biomass.	France	CE
Orsted A/S	Wind, Offshore; also inbioenergy and thermal.	Denmark	CE
PowerCell Sweden	Hydrogen, fuel cells, reformers, marine uses.	Sweden	CE
Samsung SDI	Li Ion Batteries.	S. Korea	CE
Sino-American Silicon	Solar feedstock, wafers.	Taiwan	CE
SolarEdge	Solar MicroInverters	USA	CE
Solaria Energia y Medio	Solar, Wind, power from renewables plants.	Spain	CE
Sunnova Energy	Residential Solar and Energy Storage.	USA	CE
SunPower Corp	Solar, efficient panels manufacturer.	USA	CE
Sunrun Inc	Solar, residential Installer.	USA	CE
Terna SpA	Grid Efficiency for more Renewables.	Italy	CE
Tilt Renewables	Wind Farms, Australia & New Zealand, solar.	New Zealand	CE
Verbund AG	90% of power from Hydro, Austria.	Austria	CE
Vestas Wind A/S	Wind power, in both products and services.	Denmark	CE
Xinjiang Goldwind	Wind, turbine manufacturer, also in services.	China	CE
Acciona SA	Water Treatment; Renewable Energy.	Spain	WT
Alfa Laval AB	Fluid Handling, controls, on vessels.	Sweden	WT
American States Water	Water and Wastewater Services.	USA	WT
American Water Works	Water and Wastewater Systems.	USA	WT
Aqua America	Water and Wastewater Services.	USA	WT
California Water Service	Water and Wastewater Utility Services.	USA	WT
Evoqua	Water, wastewater treatment.	USA	WT
Kurita Water	Water Treatment, wastewater systems.	Japan	WT
Metawater	Water purification, sewage treatment plants.	Japan	WT
Pentair PLC	Water Efficiency and Treatment.	Britain	WT
Pure Cycle	Water, supply and treatment.	USA	WT
Veolia Environn.	Water and Wastewater Treatment.	France	WT
Watts Water Tech.	Water quality, rainwater harvest, flow control.	USA	WT
Xylem	Water Technologies.	USA	WT
Austevoll Seafood ASA	Seafood in Norway; also pelagics Chile, Peru.	Norway	SF
Cia Pesquera Caman.	Fishing, aquaculture, sustainability, Chile.	Chile	SF
Grieg Seafood ASA	Seafood, aquaculture with high ESG scores.	Norway	SF
Leroy Seafood Group	Seafood, with high FAIRR Report score.	Norway	SF

Mowi ASA	Seafood, aquaculture with high ESG scores	Norway	SF
Nomad Foods	Moving to 100% Certified-sustainable seafood.	USA	SF
Norway Royal Salmon	Fish farming, has low carbon footprint vs. beef.	Norway	SF
P/F Bakkafrost	Seafood, aquaculture with high ESG scores	Norway	SF
SalMar ASA	Seafood, aquaculture with high ESG scores	Norway	SF
Tassal	Seafood, aquaculture with high ESG scores.	Australia	SF
Badger Meter	Water Metering.	USA	PP
Beyond Meat	Plant-based meats, less impactful proteins.	USA	PP
CREE	LEDs Lighting.	USA	PP
Intertek Group plc	Cargo and Trade services, quality assurance.	Britain	PP
Itron	Smart Grid Power and Water Management.	USA	PP
Kingspan Group PLC	Building Insulation.	Ireland	PP
Kuehne und Nagel	Shipping Logistics, clean cargo group.	Switzerland	PP
Landis & Gyr	Smart Metering, Better Grid	Switzerland	PP
Nel ASA	Hydrogen, made from renewable resources.	Norway	PP
Nibe Industrier AB	HVAC, other areas in sustainability.	Sweden	PP
Signify NV	LEDs, was Philips Lighting.	Netherlands	PP
Tomra Systems ASA	Recycling wastes, materials recovery.	Norway	PP
Xinyi Solar Holdings	Solar glass, has spun off solar farms.	China	PP

For Rebalance in latter Q2 2020; OCEAN

1 Delete: CLR.TO

2 Adds: ANA.MC, TRN.MI

Equal Weight = 64/100 = 1.5625% each.

OCEAN SECTOR	#	Approx %
GREENER SHIPPING (GS) =	5	8%
CLEAN ENERGY LOW CO2 (CE) =	22	34%
WATER TREATMENT (WT) =	14	22%
SUSTAINABLE FISHERIES (SF) =	10	16%
POLLUTION PREVENTION (PP) =	13	20%
TOTAL CONSTITUENTS =	**64**	
