Senate Committee Hearing May 15, 2024
Water, Agriculture & Rural Affairs

Chairman Perry and members of the committee, my name is Joanna Friebele, I am here as an independent unpaid voice for our Texas rural communities.

I am here to speak on added threats to our water reliability and runoff associated with solar facilities.

Most astonishing to most people is the acreage we will lose to solar in the next couple of years. 155 GW of solar on the ERCOT interconnect list equates to 1.5 million acres, this is in addition to the 220 thousand acres of solar currently generating.

1. During construction: Dust has been devastating for some communities and neighbors. Water usage can be tremendous to stay within EPA limits and most local officials are not up to the job of monitoring and dealing with this, so it doesn't get done.

2. During operation: The panels must be cleaned for maximum generation and using SEIA figures, washing 1.5 million acres of solar panels would require anywhere from 6.5 to 338 billion gallons of water annually.

3. Runoff: Flat impervious surfaces with drip lines compact soils below, enhancing greater runoff. Some studies have started but more work needs to be done. Numerous EPA and civil cases have been won against solar farms causing runoff damage.

4. Pollution affecting waterways: - There are studies on the use of cadmium for conducting and lead for solder and another study shows micro & lines cracks in solar panels increased to 85% last year, increasing the chance for leaching and pollution.

- I want to thank Chairman Perry for SB 1290. While waste is extremely important, most neighboring landowners are worried about runoff and water contamination. This is not being addressed by this bill.

- Senator Kolkhorst SB 624. I thank you for your concern addressing regulation of solar. I would like to start a conversation with you about this bill since I am afraid these regulations will be extremely detrimental to local communities, and it will completely hamstring any further beneficial regulation.

Factors to Consider and Associated Risks:

While we have no standard source for water usage and this will vary with the terrain from site to site and changes in the weather – here are some estimates.

High Range Water Use - 338 Billion gals.

1057 gallons/MWh; - see paper below

Mid Range Water Use - 73 Billion gals.

228 gallons/MWh - see paper below

Low Range Water Use - 6.5 Billion gals.

20 gallons/MWh - SEIA figures

Comparison Water Uses:- Coal 19,185/ MWh; Gas 2,803/ MWh; Nuclear 800/ MWh
Nuclear and some coal plants will recycle much of their water.

Water usage per acre.

While solar ranks lower on the list of water usage for generators, this water will contribute to runoff and will not recycle. The vast amount of acreage will add to an already strained water system, affecting water resiliency.

I am here to make you aware of the enormous amount of acreage that has been and will be developed for solar in the next few years and the risks to water systems.

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Water Requirements for Large-Scale Solar Energy Projects in the West

George B. Frisvold and Tatiana Marquez

University of Arizona, Tucson, AZ

Abstract: This study estimates how much water would be required to meet Renewable Portfolio Standards for electricity generation in five western states if 100 percent of this demand were supplied by solar power. Future renewable electricity demand (net of current supplies) is estimated for 2025 and 2035. One scenario assumes the most water-intensive solar thermal technology supplies all this future demand. Although not a feasible scenario, the assumed water intensity (1057 gallons/MWh) provides an upper-bound estimate of solar power water consumption that may be compared with regional water balances. A second scenario assumes the water intensity of future projects is comparable to the average of solar projects actually being deployed. Water intensity for these 34 projects with 8.7 GW of capacity averages 228 gallons/MWh – a lower rate than many conventional electricity facilities (i.e., coal, natural gas, nuclear). Water requirements by 2035 would be 0.8 percent of regional consumptive use of water under the upper bound scenario and 0.2 percent of consumptive use based on current, average water intensities.

Keywords: *Solar, electricity, renewable portfolio standards, West, water*

Solar and Other Energy Generation Footprints

Current and proposed Solar will have a **4x** greater footprint than oil and gas

Current Generation acreage:

OIL & GAS - 426,800 acres with 388,000 wells with avg. 1.1 acre pad sites.

SOLAR - 220,000 acres in operation

SOLAR - 1.5 million acres planned

Solar panel coverage of the land is near total on the leased acreage, unlike wind, oil & gas. Wind and oil & gas have large lease acreage, but the actual footprint of the equipment is small. This lends itself to agricultural operations around the sites, whereas solar does not and should not.

- **Footprints need to be considered, as they take away from agriculture land.**

Other considerations

If renewables replace coal – for a reliable grid the buildout is a **3X** factor, plus transmission.

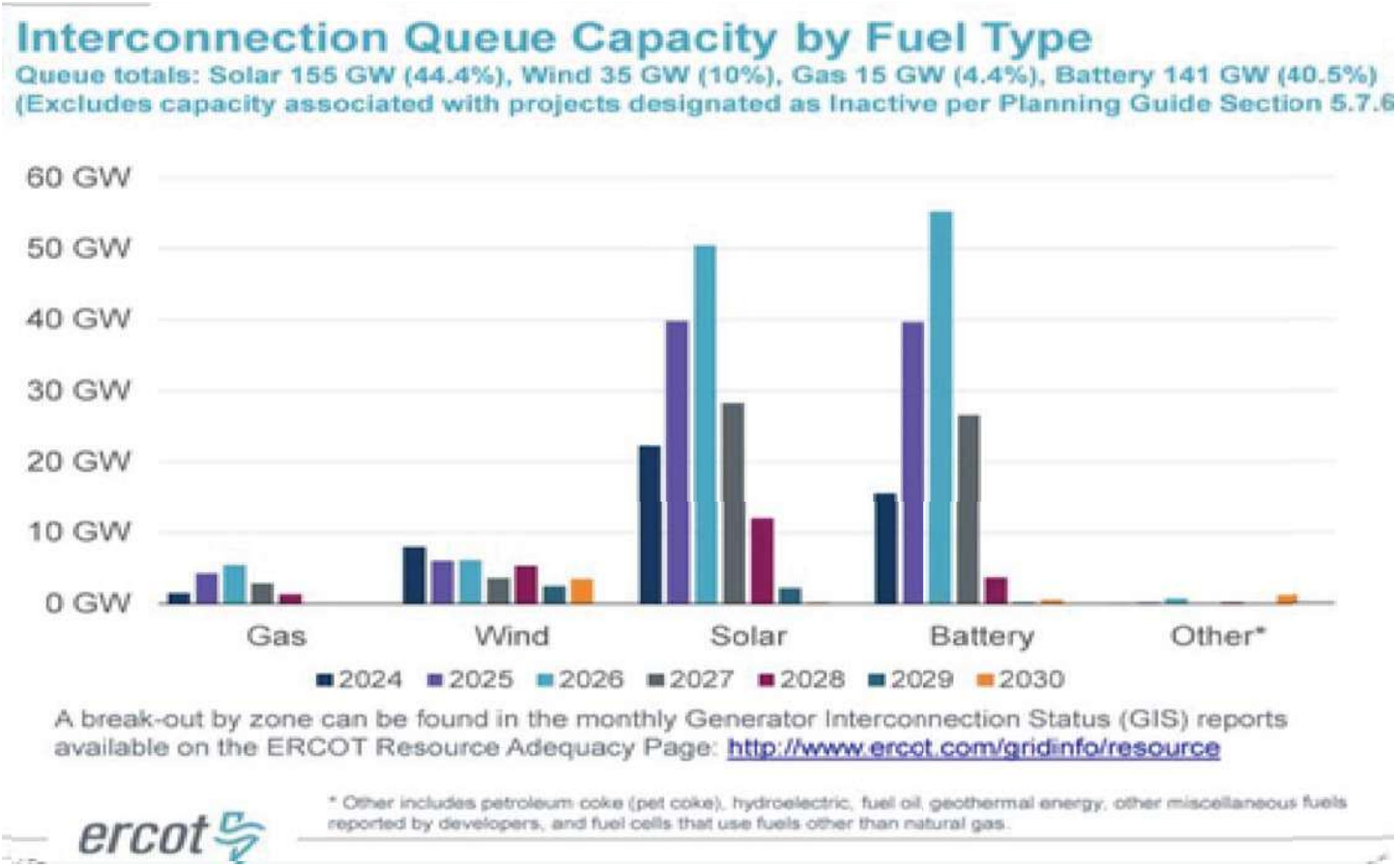
100 MW coal retired - Replacement factor =

100 MW wind

100 MW solar

100 MW gas for just in case, wind and solar are not available.

Batteries for short term grid balancing



Pollution

Equipment can be damaged by Flood, Fire and Hail

From Study: Institute for Photovoltaics and Research Center SCoPE, University of Stuttgart.

Size and Surface Dependent Solubility of Cadmium Telluride in Aqueous Solutions

Renate Zapf-Gottwick 1,*, Matthias Zorn 1, Jessica Nover 1, Michael Koch 2, Carolin Feifel 2 & Jürgen H. Werner 1

From the text: Despite the toxicity and the cancerogenic action of the element Cd, its use in CdTemodules still is not yet legally restricted within the European Union. The lack of legal sanctions against CdTe modules usually is justified by arguing that cadmium telluride is "chemically stable", in particular in aqueous solutions, for example, in rainwater. Indeed, when compared to the elements Cd and Te, as well as to other Cd compounds, the crystalline compound cadmium telluride (CdTe) has a higher stability [1]. Therefore, intact CdTe photovoltaic modules seem to impose no risks for environment and health [2]: unbroken modules, the CdTe layers are protected by two glass plates and the edge sealing of the module. However, at the end of use of intact photovoltaic modules questions remain concerning the decommissioning and recycling of CdTe [3]. Possible ways of recycling of the CdTe-modules are crushing and leaching in acids like sulfuric acid with low pH (pH < 1) [4,5]. For a long time it has been stated that even unprotected CdTe layers would only decompose in strong acids. Neutral water and rainwater were stated to not decompose CdTe [1]. These statements were based on experiments that were carried out over 24 h only.

Recently, however, we gave direct experimental proof that CdTe layers in photovoltaic module pieces do not only decompose in strong acids, but (if waited long enough) even in neutral water [6,7].

Study warns of environmental risks from solar modules

Published on May 13, 2018
Some excerpts from the article

PV Type	Chemical Hazards
Crystalline silicon (c-Si)	Silicon tetrachloride waste, lead in solder and metallization pastes, strong acids (HF, HCl), caustics (NaOH), solvents, dopants, pyrophoric gases (silane)
Amorphous silicon (a-Si)	Pyrophoric gases, (silane), solvents, indium tin oxide
Cadmium Telluride (CdTe)	Cadmium compounds, solvents
Cooper indium gallium selenide (CIGS)	Cadmium, selenium, & indium compounds
Gallium arsenide (GaAs) crystalline	Arsenic compounds, phosphine gas, trichloroethylene
Polymer/organic	Ruthenium, indium compounds, nanoparticles
Dye-sensitized	Indium compounds, nanoparticles, ruthenium

Source – Dustin Mulvaney PHD, Professor in the Environmental Studies Department. San José State University, Solar Power

Contrary to what is believed, the pollutants contained in solar modules are water-soluble.

This is shown by a study commissioned by the Ministry of Economic Affairs. It is the EU's turn to solve the problem.

The researchers investigated whether the pollutants used in the four most important photovoltaic technologies are water-soluble.

Contrary to previous assumptions, the result shows that pollutants such as **lead or carcinogenic cadmium** can be almost completely washed out of the fragments of solar modules over a period of several months, for example using rainwater.

The exemption from the European Restriction of Hazardous Substances (RoHS) for solar modules (/themen/solarenergie-solarfoerderung/) results in serious environmental risks. This comes from a study commissioned by the Federal Ministry of Economics on the "release of pollutants from photovoltaic modules".

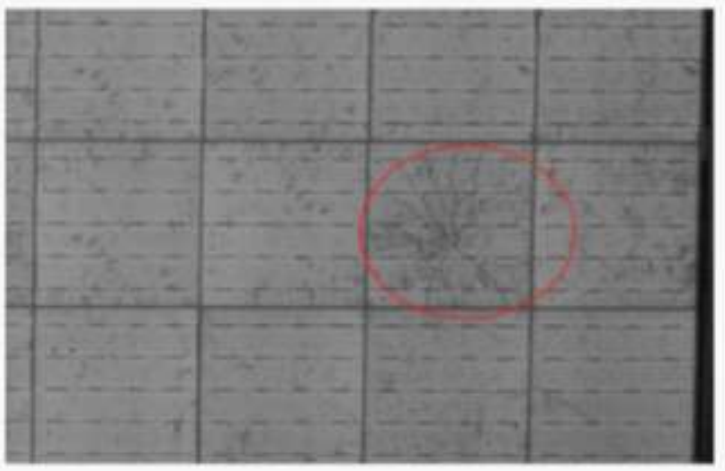
"From the installed power and the power-related weight, we can estimate that photovoltaics will produce around 11,000 tonnes of lead and around 800 tonnes by 2016 "Cd (cadmium) spread," the study says.

Pollution continued..

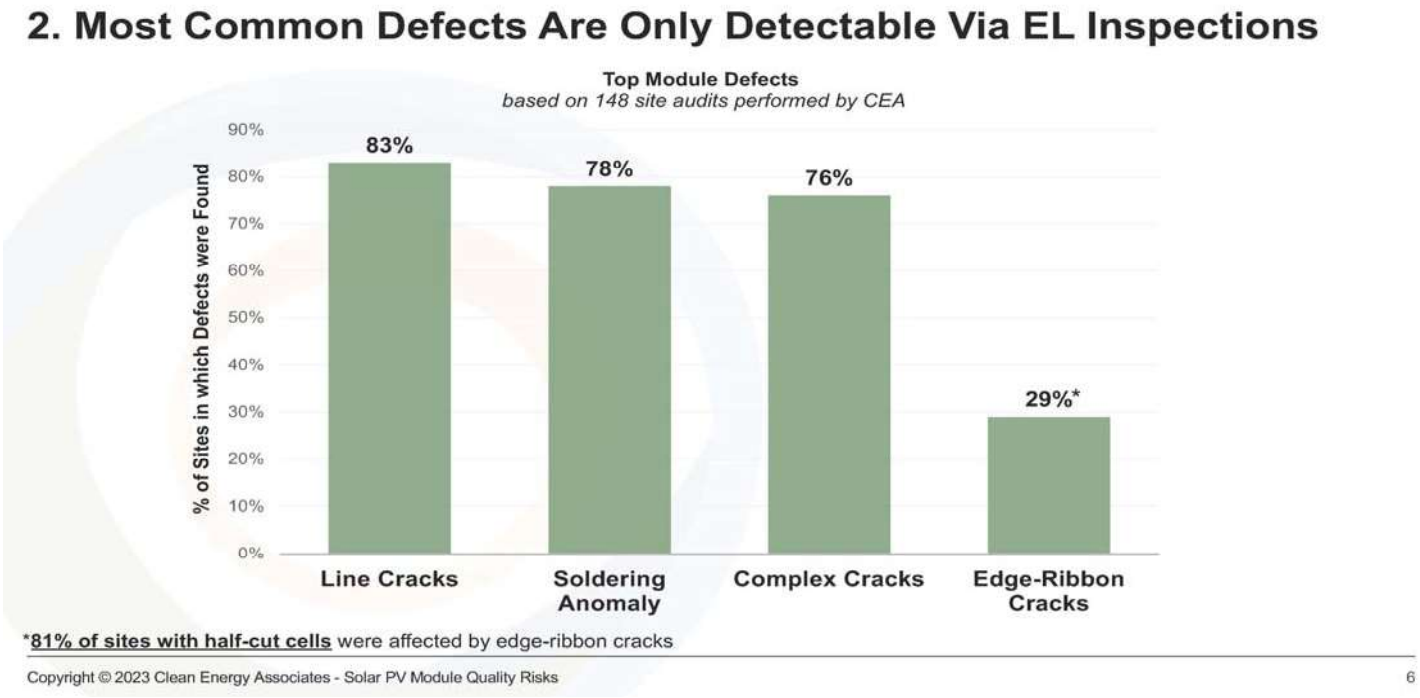
Equipment may be installed with existing defects

Sinovoltaics

In the past year, our quality engineers inspected over 4.2GW of solar modules and found a significant amount of micro cracks in 53.6% of inspected orders.



While later the anomalies like line cracks were ranked at 83% by CEA. See below.



Why this is important?

1. We do not know if these panels are leaching continuously with rainwater.
2. In Texas we have had numerous sites affected by hail storms, where panels have been destroyed, some significantly. In 2016, some 400,000 panels destroyed at Midway Solar Farm and more recently a site in Fort Bend County with 3,500 acres of broken solar panels from hail damage.

Do we know what is happening as far as contamination? Is it being investigated. TCEQ reported to me they had no complaint on their database.

Why is no one investigating this site to find out about pollution?

This site is the perfect opportunity to have many questions addressed concerning pollution and possible runoff contamination.

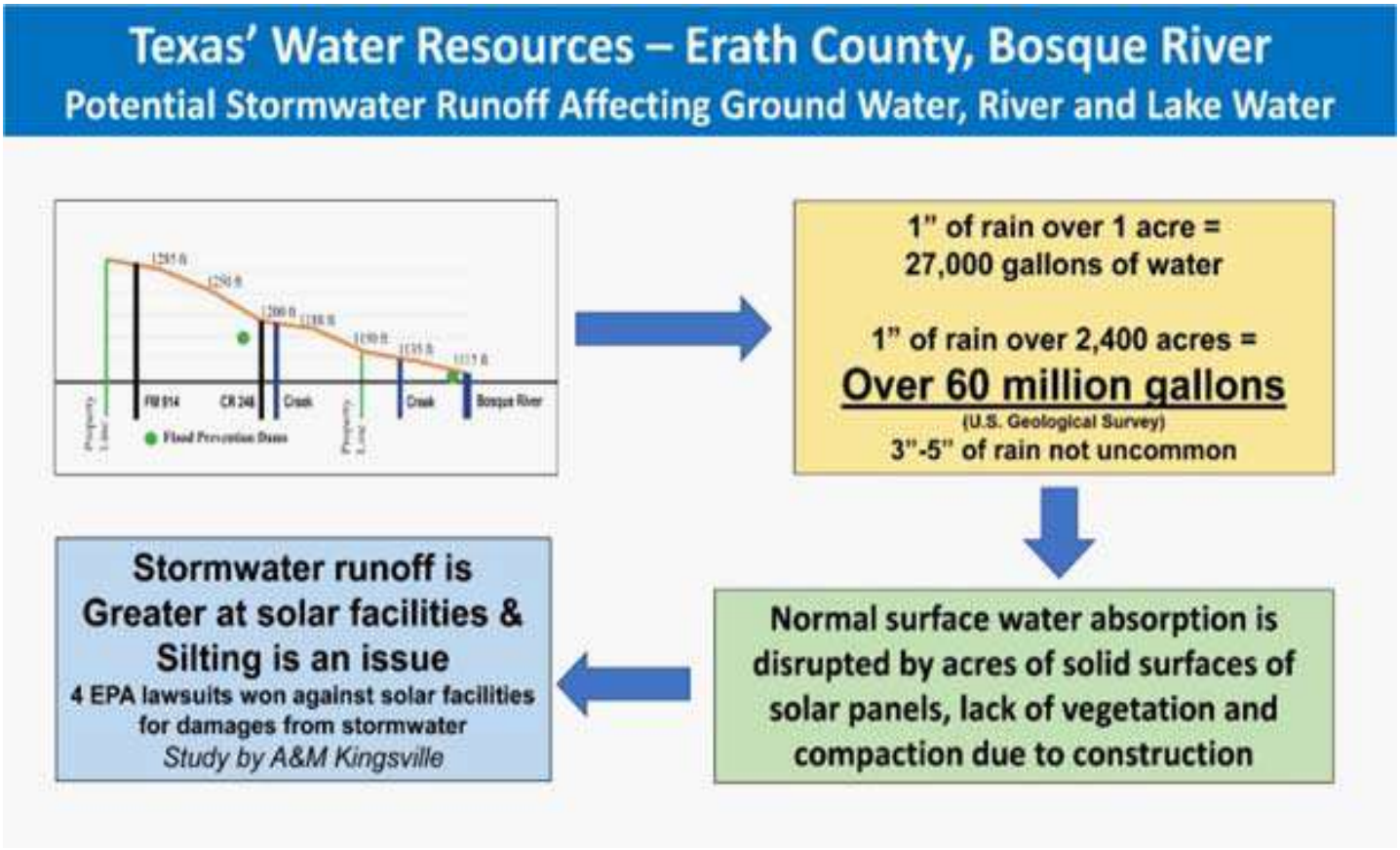
Can we trust solar companies to self report and self regulate?

Hydrologic Impacts of Large-Scale Ground-Mounted Solar Require More Research

By Bridget Beaudoin and Brian Yellen / UMass Amherst, February 2, 2022

From the text: “Lack of scientific publications on potential hydrogeological implications — which could include changes to runoff patterns, stormwater drainage, and retention pond capacity on newly sited solar installations — have left professional engineering consultants unsure of how a project that is being advertised as environmentally conscious may have externalities related to clean water.”

There are several lawsuits pending in Texas courts over runoff issues and solar facilities.



Washington State: Solar Panels will Damage Farm Soils

By Don Jenkins

from the article: “The Washington State Department of Agriculture says solar installations will damage soils, disputing a claim by an energy company that 1,000 acres of prime farmland in Klickitat County could revert to agriculture in 25 years and be as productive as before.

Agriculture department policy adviser Kelly McLain said Jan. 24 in an email to the Energy Facility Site Evaluation Council that the proposed Carriger solar project near Goldendale would compact and shade ground, depriving it of sunlight and organic material.

The soil may need decades to recover after the solar panels and posts are gone, she stated. “Even with decommissioning, WSDA does not expect the ground to meet pre-project agricultural viability.”

Land Areas Impacted by Solar – a Sampling,

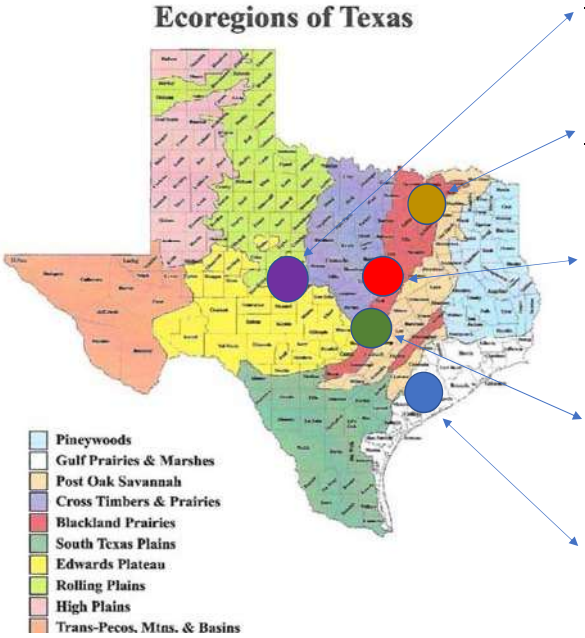
This does not represent all installed solar.

Sampling of 5 Solar Clusters

A few examples of high-density solar populations

And their potential impacts on farmland and river basin resources

Compiled by Joanna Friebele



ERCOT Interconnection Figures from December 2022

Brown, Callahan, Coleman Counties
9 – Solar sites, 4 - Battery storage
2,790 MW – 27,900 acres – 12,555,000 solar panels
Colorado River Basin

Franklin, Hopkins, Lamar Counties
28 – Solar Sites, 12 – Battery storage
6,427 MW – 64,270 acres – 28,921,500 solar panels
Red River, Sulphur, Sabine River Basins

Bosque, Hill, Limestone, Navarro Counties
42 – Solar Sites, 18 – Battery storage
8,534 MW – 85,340 acres – 38,403,000 solar panels
Trinity & Brazos River Basins

Bell, Falls, Milam Counties
31 – Solar Sites, 18 – Battery storage
6,090 MW – 60,090 acres – 27,405,000 solar panels
Brazos River Basins

Brazoria, Fort Bend, Jackson, Matagorda, Wharton Counties
56 – Solar sites, 44 - Battery storage
16,563 MW – 165,630 acres – 74,533,500 solar panels
Brazos – Colorado River Basin & Gulf Coast

Solar Companies are Losing Money

The solar industry is losing $2.5 billion annually from equipment under performance, likely caused by equipment malfunctions and weather conditions, according to an article in kWh Analytics' 2023 Solar Risk Assessment.

from https://www.renewableenergyworld.com/solar/utility-scale/texas-hailstorm-damages-thousands-of-solar-panels-at-350-mw-farm/#gref

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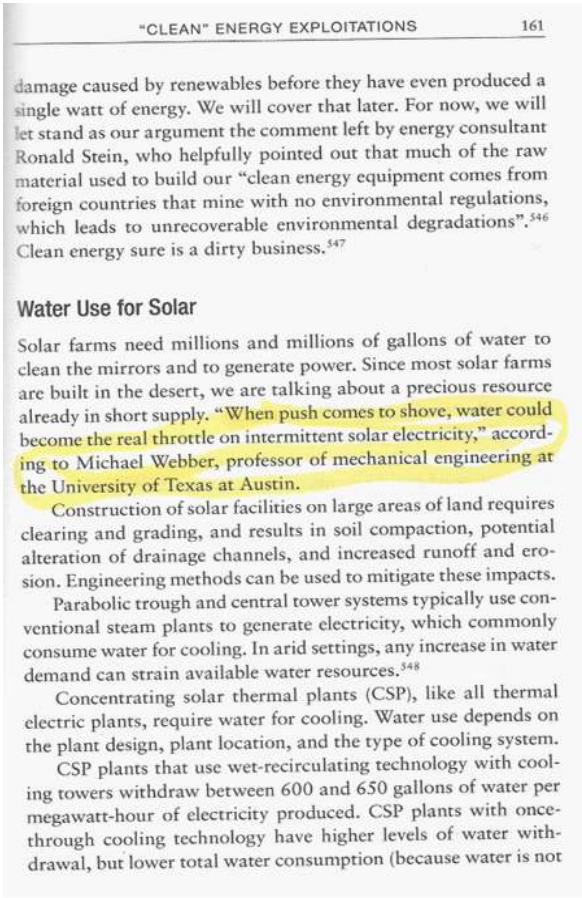
Do you know what is happening with

- ***abandoned sites***
- ***how many there are***
- ***soil conditions***



"CLEAN" ENERGY EXPLOITATIONS 161

damage caused by renewables before they have even produced a single watt of energy. We will cover that later. For now, we will let stand as our argument the comment left by energy consultant Ronald Stein, who helpfully pointed out that much of the raw material used to build our "clean energy equipment comes from foreign countries that mine with no environmental regulations, which leads to unrecoverable environmental degradations".[546] Clean energy sure is a dirty business.[547]

Water Use for Solar

Solar farms need millions and millions of gallons of water to clean the mirrors and to generate power. Since most solar farms are built in the desert, we are talking about a precious resource already in short supply. "When push comes to shove, water could become the real throttle on intermittent solar electricity," according to Michael Webber, professor of mechanical engineering at the University of Texas at Austin.

Construction of solar facilities on large areas of land requires clearing and grading, and results in soil compaction, potential alteration of drainage channels, and increased runoff and erosion. Engineering methods can be used to mitigate these impacts.

Parabolic trough and central tower systems typically use conventional steam plants to generate electricity, which commonly consume water for cooling. In arid settings, any increase in water demand can strain available water resources.[548]

Concentrating solar thermal plants (CSP), like all thermal electric plants, require water for cooling. Water use depends on the plant design, plant location, and the type of cooling system.

CSP plants that use wet-recirculating technology with cooling towers withdraw between 600 and 650 gallons of water per megawatt-hour of electricity produced. CSP plants with once-through cooling technology have higher levels of water withdrawal, but lower total water consumption (because water is not

A little light reading for later.
This is a cautionary article from Europe. What starts in Europe, doesn't always stay in Europe. We have to be very careful, as you well know, about rules and regulations and the consequences for the future.

Coming for Water

by Irina Slav, Bulgaria, Energy writer for Oilprice.com

A couple of years or so ago, I was surprised to learn that Europe's underground water resources were dwindling. We were using more water than nature was supplying, and it was all going to end in tears and thirst unless we took action.

Now, I am beginning to have doubts there is a real crisis. Because in the past few weeks, there's been a flurry of reports about initiatives aimed at better water management globally. For the common good.
As we all know, any call featuring a version of this phrase is almost invariably an attempt to focus more power in fewer hands, fondly known as centralisation. It looks like this latest attempt is especially serious if, for now, rather vague.

The "No time to waste" scenario is in progress. Water is getting more scarce. Food supply is under threat. We must manage water better. We must use it more wisely — and share it more generously. To that end, we must entrust the management of our water to those who know better than the average national government.

This water push is the latest piece of evidence that no angle shall remain unexploited in the quest for resource management centralisation. Resource control, after all, is as close to total control as any half-sane power junkie knows. And the junkies want this control — starting with plans to take away $700 billion from farmers and the rest of us.

"[W]e must phase out some USD 700 billion of subsidies in agriculture and water each year, which tend to generate excessive water consumption and other environmentally damaging practices."
The quote comes from the website of something called the Global Commission on the Economics of Water, a partnership between the Dutch government and the Organisation for Economic Co-operation and Development. It describes itself as a body "executed by an independent and diverse group of eminent policy makers and researchers in fields that bring novel perspectives to water economics, aligning the planetary economy with sustainable water-resource management." Alas, it is not, in fact, executed. That's just ungood English. It is very much alive and ambitious.

The phaseout plan is part of a seven-point call to action for the — you guessed it — better management of the world's water resources and "collective protection" thereof. The summary of the seven points is a study in what I'm going to call centra-speak. It features, besides "collective", also words such as "justice" and "equity" along with the obligatory stakeholders, investments, and value that make up the starter pack of modern propaganda.
The call to action makes rather scary reading because in addition to the pompous statements devoid of meaning such as "we must adopt an outcomes-focused, mission-driven approach to water encompassing all the key roles it plays in human well-being" it contains a very blunt message of centralising control over the world's water resources.

We learn, for example, that "we must manage the global water cycle as a global common good, to be protected collectively and in the interests of all." We also learn that "We must act collectively to stabilise the global water cycle. It means mobilising multiple stakeholders, public, private, civil society and local community; utilising innovation policy to catalyse solutions to concrete problems; and scaling up investments in water through new modalities of public-private partnerships."

These are all empty words with no specificity to them. The subtext, however, is anything but empty. The subtext states plainly that we must all help concentrate control over the world's water in the hands of a few who know best how to manage these resources — for the common good, of course.

The key part of that message by the not-so-very-Global Commission on the Economics of Water is contained in point number three, which states "we must cease underpricing water." That's right. The climate crusaders fixed fuels, electricity, and everything these two underpin, and now they're coming for the water. That should cover all bases. Cue the $700-billion agriculture and water subsidy tab — and the recent announcement of a G7 water coalition.

Coming for Water *- page 2*

Agriculture does use a lot of water. The messengers of the water apocalypse make it sound like all or most of this water comes from public mains networks rather than nature but, once again, I have my doubts. It's hard to believe that farmers water their massive corn or wheat fields with irrigation systems tied to the mains for the very simple reason that would make the crops extremely expensive because of the scale at which they are grown.

Sure, animal farming does use water from public networks that also provide drinking water to the general population but I'm willing to bet money that animal farmers with an alternative in the form of local wells or rainwater collection are using those — it's cheaper. Yet we are being told that agriculture is once again a problem, and a big one, at that. The way to solve the problem is to basically kill the industry — and food supply security with it.

Naturally, food security is being touted as one of the grave problems that is being solved with the proposed measures for centralised water control and management, along with greater access to water. It has become standard practice for our political betters to state goals that are the exact opposite of their actual goals, whether they are aware of it or not. Also naturally, there's a point about avoiding the worst of climate change because of course climate change is making everything worse.

"The world has lost around 85 percent of its wetlands over the past 300 years, according to UN figures, and some four billion people globally already face water scarcity for at least one month a year, according to the US-based World Resources Institute," AFP reported in its story on the establishment of the G7 water coalition.

The wording suggests implicitly that 300 years ago no one anywhere experienced water scarcity because the planet was one big temperate climate zone and everyone had unrestricted access to water. Then along came the Enlightenment, then the Industrial Revolution and we messed it all up by setting up dams and hydropower plants, and creating organised water supply for a growing population. So now we need to undo the damage.
"Insufficient or delayed implementation of integrated water management will be unaffordable," a draft document authored by the European Commission and obtained by Politico said in March.

The document also apparently warned water scarcity may lead to conflicts between neighbours because that's how bad it's going to get with climate change and look at Catalonia and the central government of Spain. Too bad it started raining there and the water emergency in Barcelona was partially lifted. Yet it will continue being used for the purposes of promoting "integrated water management".

Activists are doing their share of the work, too. Thousands of activists last year protested against the construction of new water reservoirs for farmers in the western part of the country. The reason for the construction of the reservoirs was to reduce consumption of water from the mains during the hottest months of the year. For any normal person that would be good news and an effective way of managing water supply. Not for activists. For activists, this was a form of theft.

The story reminded me of a conversation I had with a friend from Colorado, whom I asked why there was a ban on the collection of rainwater by households. The explanation dumbfounded me — it appears that Colorado authorities are of a similar mind to those French activists in their belief that collecting rainwater is a form of theft, in the Colorado case theft from Native tribes, to whom, it appears, all rainwater belongs. Talk about overcompensation.

Yet it is not overcompensation that prompted the G7 to set up their water coalition, unclear as its specific purpose may be at this point. And it is not overcompensation that prompted the EU to start talking about sharing and caring about water.

The EU — and their more international pals — are on a centralisation mission and water is a natural element of that mission. It is, indeed, the ultimate prize. If you control the water you literally control life in a much more immediate way than the control of electricity and fuel supply.

Incidentally, you (and your finance friends) might as well make a nice profit off the official commoditisation of water, as brilliantly exemplified by Australia. Of course, then someone would need to come with a way to prevent rains to ensure water scarcity continues but let's not get ahead of ourselves.

Texas needs to preserve it's land and all it's resources.

Texas is the largest producer of beef, but it is an industry that is under attack, as is it's oil and gas.
Oil and gas makes us among one of the largest producers and exporters in the world and pays for our outstanding universities. It also makes up a large part of our annual budget.