

Lower bills, cleaner air, what's not to like?

By U.S. SENATOR MARTIN HEINRICH (D-N.M.) • JUL 28, 2021

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CREDIT SENATOR MARTIN HEINRICH (D) NEW MEXICO

Commentary: You have to give Paul Gessing points for creativity. It takes enormous confidence in how much you can stretch the truth to turn a voluntary rebate program that lowers your monthly utility bill, improves your family's indoor air quality and puts local plumbers and electricians to work into a doom's day scenario.

If the climate crisis wasn't so dire, his hyperbole might be funny. It represents

Our Fundamental Rights

For a Sustainable Future

**Protect our right
to**

CLEAN

Air

Water

Land





Fossil Fuels: Lest we Forget Clean Electricity: The Solution To: Build Back Better

Calculations and Base Presentation
By Tom Solomon, Electrical Engineer (Intel - Feb 11)

*To Our Legislators: Who are working **WITH** and **FOR** the people*

Presented To Michael Sullivan - Senator Heinrich's Office
Sep 22, 2021

By
Athena Christodoulou, Energy & Environmental Engineer (CDR, ret.)



Almost \$1 Trillion on Fossil Fuels A YEAR!

We Pay to burn it

And what do we do
with this product?



Creator: dvargg | Credit:
Depositphotos



FF Air Pollution Causes 8.7M Deaths

We Poisoned our Air

- 8.7m deaths globally in 2018.
- **13.1% of all US deaths.**
- Nearly 30% of deaths in east Asia, including China.
- S. America and Africa significantly lower.



Climate Action is now an **Emergency!** Because of FF lies

Global total net CO₂ emissions

Billion tonnes of CO₂/yr

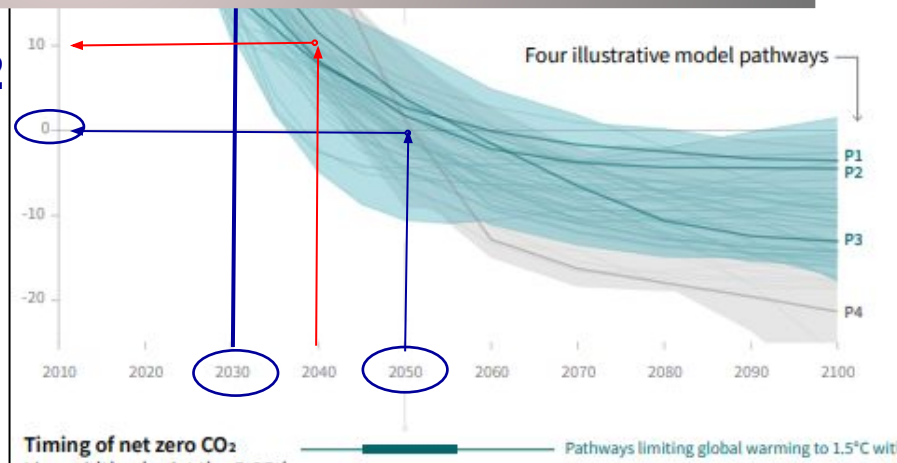
50

This must be our goal

They've almost killed
humanity's future

IPCC R

- ❑ <9 years left to **cut global CO₂ emissions in half**, by 2030
- ❑ **In half again by 2040**
- ❑ And to zero by 2050





Orphan Wells and Radioactive piping!

They've left a mess for US to clean up

NM St
Land

- With 130,519 active or inactive wells in New Mexico, cost of cleanup exceeds \$5 billion.
 - OCD's \$5.29 million budget cover salaries, operations, and plugging of wells.
 - Removal of over 14,000 miles of radio-active laced pipe would cost hundreds of millions.
-
- Oil and Gas industry- **bad players leaving US to clean up their mess**
 - Not only NM, but entire U.S.
 - **Over 500,000 uncapped, leaking oil and gas wells**



Hydrogen Economy

- “Clean” blue may be worse than gas or coal
- **Dangerous - highly flammable** (ask NASA)

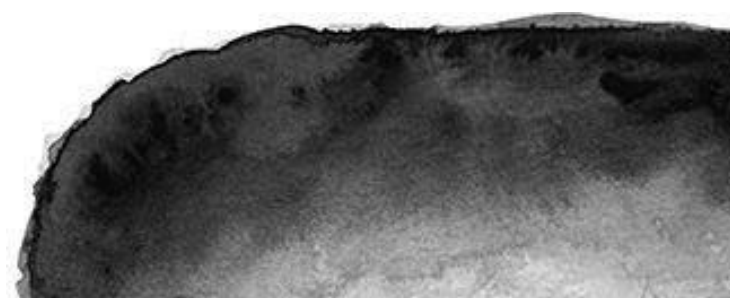
And now they want to keep
getting handouts?!

- NIM Energy Storage Group - Statewide Universities, Labs
- Sec DOE, Governor's call, & NMED

O/G Industry needs to clean up now! Not make more messes



Fooled Us Once



D. W. Woods

Chairman and CEO

\$16,424,332

[View details](#)

N. W. Duffin

President, ExxonMobil Global Projects Company

\$7,309,481

[View details](#)

Twice a fool?



"Yes, the planet got destroyed. But for a beautiful moment in time we created a lot of value for shareholders."



Power Needed for 100% Renewables

939 GW for all purposes



RE generation capacity of **4,545 GW**:

- **2,000 GW**
- **2,300 GW**
- **160 GW**
- **100 GW** of Solar CSP+Storage

We know what we need

THE US CAN TRANSITION TO 100% CLEAN, RENEWABLE ENERGY

The technology is available today. 100% Wind Water Sun. For all purposes. For all people.

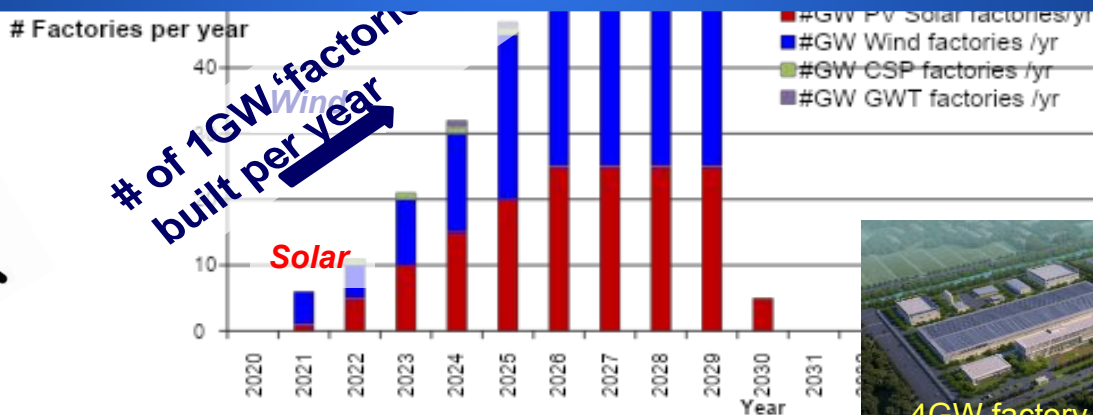
<http://thesolutionsproject.org/>

2019 US avg end use was **451 GW** for electricity only



We Build 350 New 'Giga-Factories' in 9 Years

Wow that's a lot!



- build **350** new gigafactory-equivalents from 2021-2030,
- growing to **57 factories per year** by 2026.
- 156 GF for Solar PV, 180 for Wind, 8 for CSP and 5 for GWT.



We Install Fast! for 100% CRE

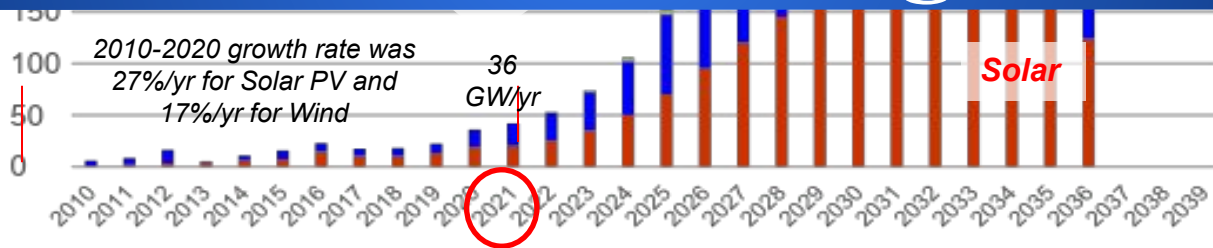
Rate of WWS Installs GW/yr
wind, water, and sunlight (WWS)

2000 GW total

450

Even more work?
At least we've begun!

5 GW/yr
2030



- Ramp up from 36 to 385 GW/ yr by 2029 to hit 50% by 2030 (2270 GW total)
- The 2030 install rate would be 175 GWyr for Solar PV, 197GW/yr for Wind, 8 GW/yr for CSP and 5 GW/yr for GWT (geothermal, wave & tidal).



Wind Turbines & Utility Solar

- 5.3MW G
- Rotor dia
- Hub heig

New Mexico
could be a hub of CLEAN!

00 acres.
30 days



50MW Encino solar farm in NM

<https://patternenergy.com> > news > news > pattern-begi...

Pattern Begins Construction on 1,050 MW of Wind Capacity in ...

Jan 11, 2021 — Renewable-energy developer **Pattern Energy** Group on Jan. 4 said it began construction on the first of four planned **New Mexico** wind farms and a ...



Current Solar & Wind: 350k Jobs

- US \$ over
- S
- Wind ~ **120k** in 2020 per [ACP](#)

We've got a core workforce!

Use specified		
compared to 2017 change)		
		-3.2%
		3.5%
		2.2%
		-0.8%
		4.8%
Geothermal	8,526	7.6%
Waste-to-Energy*	7,000	—
Total	555,168	-0.2% [^]

Note that this table does not include nuclear energy.
*Source: Energy Recovery Council
[^]Calculated based on assumption that waste-to-energy jobs remained constant from 2017 to 2018





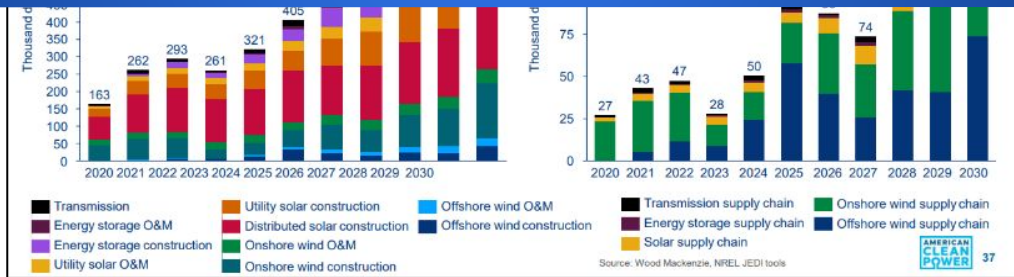
1.5M net jobs added by 2050

- +791k more jobs for 480 GW (2000 GW by 2030)
- Need 4x for 100% WWS $\Rightarrow$ 2.8M RE jobs added.

Fossil fuels jobs drop 1.3M $\Rightarrow$ 1.5M net jobs added.

This so
the ne
the 48
achiev
electric

But we'll need MORE!



Civilian Climate Corps!



Civilian Climate Corps

-
-

Good Paying Union Jobs and more!

- **Installing** solar, wind, heat pumps, mini-splits
- **Upgrading** mass transit, charging infrastructure and broadband

Mechanics convert
gasmobiles to local EVs

**Need industrial and environmental
engineers again**

Our Military Industrial Complex morphs





We Spend \$100B less on Energy

Remember **\$885B** was spent on fossil fuels a year?

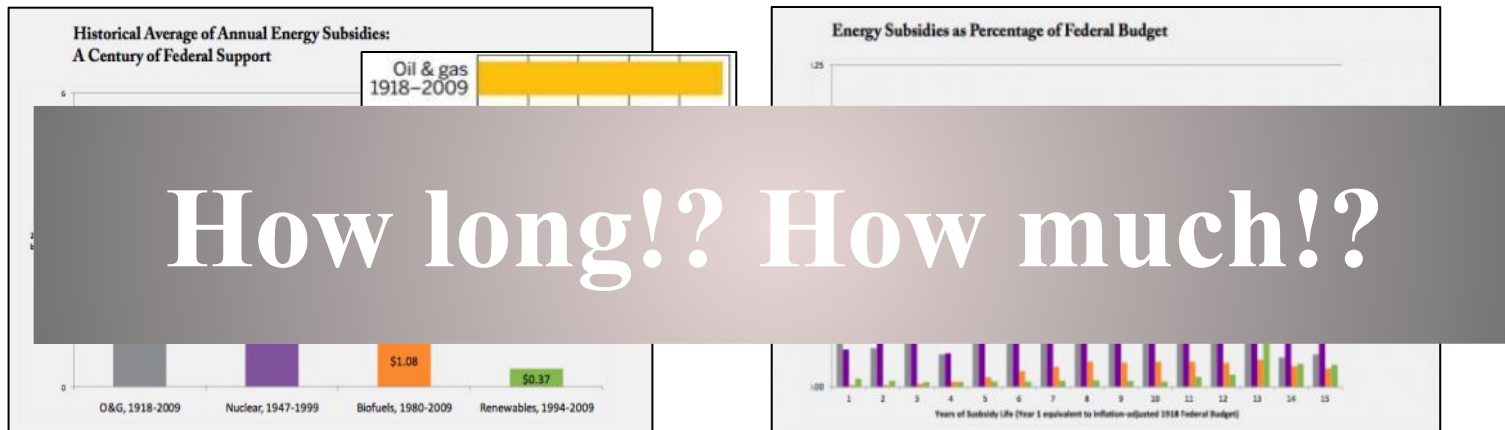
Energy spending would shift from fuels to
cheaper WWS electricity, at **\$768B/yr**

WE will pay less?!



Subsidies: FF 75X vs RE

US Gov report on fossil fuel tax subsidies – worth \$4.5B/yr
<https://www.treasury.gov/open/Documents/USA%20FFSR%20progress%20report%20to%20G20%202014%20Final.pdf>



How long!? How much!?

- Oil and Gas industry- \$446.96 billion - **100 years** of federal support.(1918 to 2009)
- Renewable energy - \$5.93 billion (1994-2009)⇒ **75 times less!**
- Average **annual** support:
 - Oil and gas industry - **\$4.86 billion** (1918-2009) w/ 96% going to profits
 - Nuclear - \$3.50 billion (1947-1999) without permanent storage place assigned
 - Renewable energy - **\$0.37 billion** (1994-2009) ⇒ **13 times less!**



STOP
all
Fossil Fuel
Subsidies!

For
humanity's
sake



Building Back Better is ONLY Option

1. **Electrify** everything
2. **100% renewable electricity**
3. **No Fossil Fuel Subsidies in Infrastructure Bill**
4. **Create a Civilian Climate Corps**



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STOP
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Fossil Fuel
Subsidies!

For
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"Be grateful your kid only lives in your basement."





Appendix



US Energy Costs 2018- US EIA

Table ET1. Primary Energy, Electricity, and Total Energy Price and Expenditure Estimates, Selected Years, 1970-2018, United States

	Primary Energy														Nuclear Fuel	Biomass		Electric Power Sector (A)	Electricity Retail Sales	Total Energy (A)
	Coal			Coal Coke		Natural Gas (A)	Petroleum						Wood and Waste (G)							
	Coking Coal	Steam Coal	Total	Exports	Imports		Distillate Fuel Oil (B)	HGL (C)	Jet Fuel (D)	Motor Gasoline (E)	Residual Fuel Oil	Other (F)				Total				
Expenditures in Million Dollars																				
1970	1,175	3,455	4,630	78	4	10,891	6,253	2,395	1,441	31,596	2,046	4,172	47,904	44	452	63,887	-4,357	23,345	82,875	
1975	3,692	9,329	13,021	75	156	20,061	15,680	5,224	4,193	59,446	10,374	8,493	103,409	448	548	137,719	-16,545	50,680	171,854	
1980	3,753	18,853	22,607	130	52	51,061	40,797	10,929	13,923	124,408	21,573	26,049	237,679	1,189	1,232	314,282	-38,027	98,095	374,350	
1985	2,228	27,259	29,487	77	43	72,938	43,972	13,755	14,747	118,048	11,493	22,272	224,288	2,878	1,597	333,080	-43,970	149,233	438,343	
1990	1,862	26,557	28,419	50	72	65,278	49,335	13,845	17,784	126,558	8,721	21,433	237,677	4,104	1,997	338,588	-40,626	176,691	474,652	
1995	1,558	25,740	27,298	91	325	75,020	47,532	16,197	12,526	136,647	4,676	20,036	237,613	3,810	2,938	347,820	-39,073	205,876	514,624	
2000	1,327	26,632	27,959	103	249	119,094	78,208	27,970	23,781	192,153	8,870	28,421	359,403	3,628	3,174	516,187	-60,053	231,577	687,711	
2001	1,247	26,849	28,095	109	191	139,388	75,033	25,543	19,602	185,752	7,266	24,962	338,159	3,524	3,494	515,431	-64,671	245,483	696,242	
2002	1,258	27,143	28,401	64	244	111,536	69,284	22,980	17,802	179,796	6,156	25,828	321,846	3,504	4,005	470,595	-54,229	247,598	683,964	
2003	1,283	27,971	29,254	70	239	144,489	83,613	28,168	21,096	209,493	8,325	26,813	379,508	3,363	3,599	561,750	-64,672	257,992	755,070	
2004	1,499	30,128	31,627	107	1,232	162,843	105,770	34,408	30,219	254,873	9,717	35,444	470,430	3,445	3,692	674,778	-71,701	268,133	871,210	
2005	1,964	34,779	36,742	147	780	200,355	143,596	38,874	44,679	312,047	13,951	43,138	596,287	3,469	5,894	845,859	-95,916	295,787	1,045,730	
2006	2,132	37,662	39,794	128	636	190,589	164,395	45,355	50,007	357,286	12,432	52,309	681,785	3,637	6,096	924,932	-90,074	323,962	1,158,821	
2007	2,175	40,345	42,520	131	478	196,957	177,162	51,081	53,754	389,282	14,129	54,917	740,325	3,871	6,407	993,627	-100,683	340,925	1,233,869	
2008	2,806	46,646	49,253	210	1,676	230,465	220,936	59,610	72,046	436,237	17,949	62,304	871,081	3,976	7,038	1,166,835	-118,530	360,454	1,408,759	
2009	2,192	43,450	45,642	135	93	159,364	131,104	43,052	36,354	317,082	11,284	44,624	583,500	4,680	5,371	800,671	-84,813	350,435	1,066,293	
2010	3,239	47,006	50,245	245	403	161,303	168,183	R 54,931	48,243	376,491	14,382	54,635	R 716,865	5,414	6,893	R 942,924	-94,791	365,913	R 1,214,045	
2011	3,885	46,348	50,233	210	552	155,944	221,972	R 63,532	66,680	462,435	16,517	63,574	R 894,709	5,621	7,525	R 1,116,431	-92,798	368,009	R 1,391,711	
2012	3,916	41,049	44,964	209	384	132,830	220,770	R 49,421	66,736	473,216	14,635	58,571	R 883,349	5,965	7,132	R 1,076,339	-82,466	360,863	R 1,355,033	
2013	3,346	41,914	45,260	186	29	151,672	222,206	R 52,280	65,564	467,328	12,034	59,826	R 879,239	6,523	7,935	R 1,093,186	-89,194	372,068	R 1,376,142	
2014	2,796	42,077	44,873	233	9	174,398	226,833	R 54,029	62,421	452,821	8,861	56,565	R 863,530	6,252	9,032	R 1,100,881	-95,627	389,872	R 1,394,926	
2015	2,340	34,238	36,578	197	20	140,294	156,280	R 34,335	38,596	342,578	5,328	46,036	R 623,132	5,975	7,554	R 816,076	-76,352	388,344	R 1,128,068	
2016	1,678	30,017	31,694	217	33	127,618	129,161	R 32,172	32,639	310,961	5,112	39,277	R 549,322	5,857	6,745	R 723,127	-68,421	383,567	R 1,038,272	
2017	2,069	28,257	30,326	280	10	R 162,081	130,060	R 41,035	41,967	396,456	7,026	41,967	R 631,720	6,735	R 67,627	R 877,174	-95,714	387,222	R 1,136,189	
2018	2,306	26,924	29,230	300	31	157,533	190,165	52,308	55,424	387,586	8,606	47,913	742,002	5,916	6,711	943,258	-75,621	403,427	1,271,064	

^a Includes supplemental gaseous fuels that are commingled with natural gas.

^b Beginning in 2009, includes biodiesel blended into distillate fuel oil.

^c Hydrocarbon gas liquids, include natural gas liquids and refinery clefts.

^d Through 2004, includes kerosene-type and naphtha-type jet fuel. Beginning in 2005, includes kerosene-type jet fuel only; naphtha-type jet fuel is included in "Other Petroleum."

^e Beginning in 1993, includes fuel ethanol blended into motor gasoline.

^f Includes asphalt and road oil, aviation gasoline, kerosene, lubricants, petroleum coke, and the "other petroleum products" category. See Technical Notes, Section 4.

^g Wood, wood-derived fuels, and biomass waste. Prior to 2001, includes non-biomass waste.

^h There is a discontinuity in this time series between 1988 and 1989 due to the expanded coverage of the use of wood and biomass waste beginning in 1989.

ⁱ There are no direct fuel costs for hydroelectric, geothermal, solar, or wind energy.

^j For 1981 through 1992, includes fuel ethanol blended into motor gasoline that is not included in the motor gasoline column.

^k Electricity imports are included in total primary energy and electric power sector but are not shown separately.

^l Expenditures for fuels purchased for electric power generation, included in the expenditure columns for the primary energy sources, are shown as negative expenditures because they need to be removed from total energy expenditures, to avoid double-counting.

Where shown, R = Revised data.

Note: Expenditure totals may not equal sum of components due to independent rounding.

Web Page: All data are available at <https://www.eia.gov/state/seds/seds-data-complete.php>.

Sources: Data sources, estimation procedures, and assumptions are described in the Technical Notes.

For US fuel costs, use the EIA total for Primary Energy which was \$943.258M in 2018, or **\$943B**.

In the electric power sector, fuel costs for electricity generation are included in the primary energy columns (coal, natural gas, etc) so we exclude the two categories of 'electric power sector and 'electricity retail sales' from the calculation for total US fuel spending



FF Air Pollution Causes 8.7M Deaths

World Africa Americas Asia Australia China Europe India Middle East United Kingdom

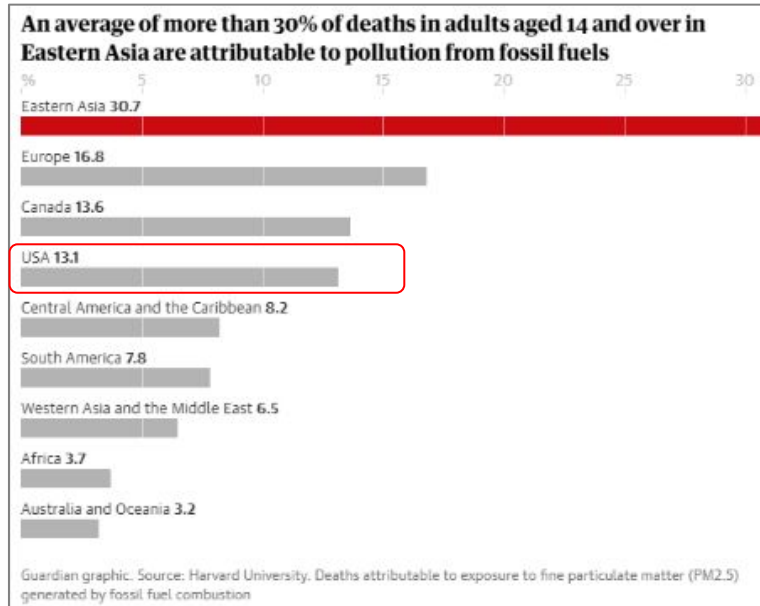
Fossil fuel air pollution causes almost 1 in 5 deaths globally each year



By Ivana Kottasová and Angela Dewan, CNN

Updated 6:51 PM ET, Tue February 9, 2021

- 8.7m deaths globally in 2018.
- **13.1% of all US deaths.**
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Feb 2021 journal Environmental Research

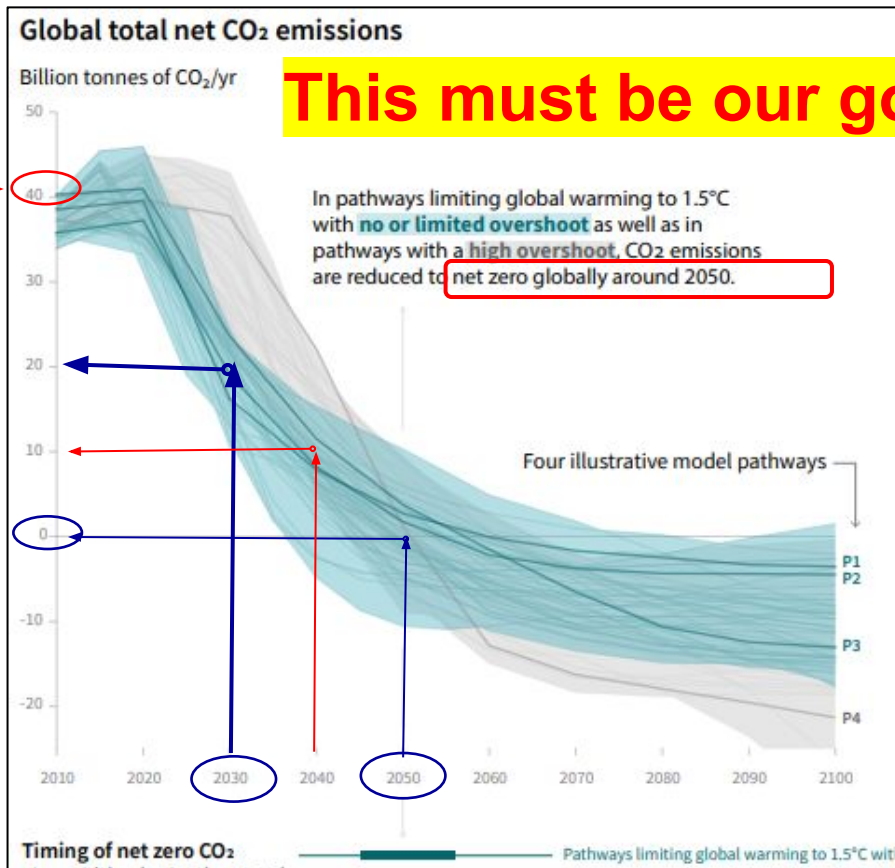


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CO2 emissions now, at
42 billion tonnes/year

IPCC Report: $< 1.5^{\circ}\text{C}$ (2018 [link](#))

- ❑ < 9 years left to **cut global CO2 emissions in half**, by 2030
- ❑ **In half again by 2040**
- ❑ And to zero by 2050





Orphan Wells and Radioactive piping!



Bonding Requirements and Abandoned Wells

What We Know

In
New Mexico

- Average cost of plugging ONE oil or gas well is \$28,000.
- OCD estimates there are at least 708 abandoned wells costing nearly \$20 million to plug.
 - OCD only has \$2 million in bonding assurances for ALL wells.
 - With 136,319 active or inactive wells in New Mexico, cost of cleanup exceeds \$3 billion.
 - OCD's \$5.29 million budget cover salaries, operations, and plugging of wells.
- Removal of over 14,000 miles of radio-active laced pipe would cost hundreds of millions.

- Oil and Gas industry- **bad players leaving US to clean up their mess**
- Not only NM, but entire U.S.
- **Over 500,000 uncapped, leaking oil and gas wells**

[1] "Bonding Requirements and Abandoned Wells," NM State Land Office presentation to the Water and Natural Resources Committee, Sept. 3, 2020

[2] "OCD Bonding Requirements and Orphan Wells," Oil and Conservation Division of the Energy, Minerals and Natural Resources Department presentation to the Water and Natural Resources Committee, Sept. 3, 2020





Hydrogen Economy - More Lies

- “Clean” blue may be worse than gas or coal
- **Dangerous - highly flammable** (ask NASA)
- New Mexico will **never** be hub for green hydrogen - water, energy intensive
- Could keep us from the solution -
 - Enchant Energy - PRC, Interim Committees
 - Escalante Coal Plant - PRC, Interim Committees
 - NM Energy Storage Group - Statewide Universities, Labs
 - Sec DOE, Governor’s call, & NMED

O/G Industry needs to clean up now! Not make more messes



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EDITORS' PICK | Jun 8, 2021, 04:56am EDT | 13,445 views

It's Time To Stop Lying To Ourselves About Fossil Fuels



Enrique Dans Former Contributor ⓘ

Leadership Strategy

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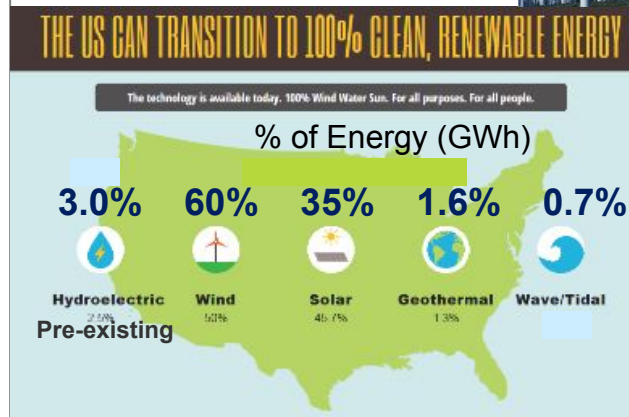


Power Needed for 100% Renewables

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- **2,001 GW** of Solar PV
- **2,295 GW** of Wind
- **156 GW** of Hydro+Geo+Wave+Tidal
- **93 GW** of Solar CSP+Storage



<http://thesolutionsproject.org/>

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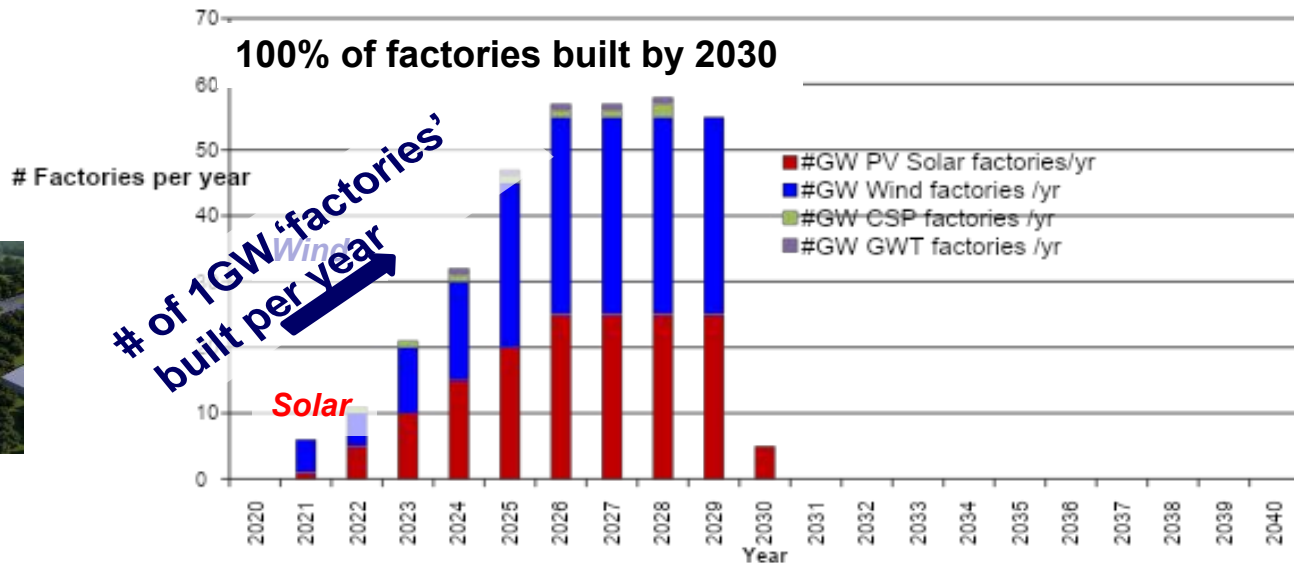
<https://www.eia.gov/energyexplained/electricity/electricity-in-the-us-generation-capacity-and-sales.php>



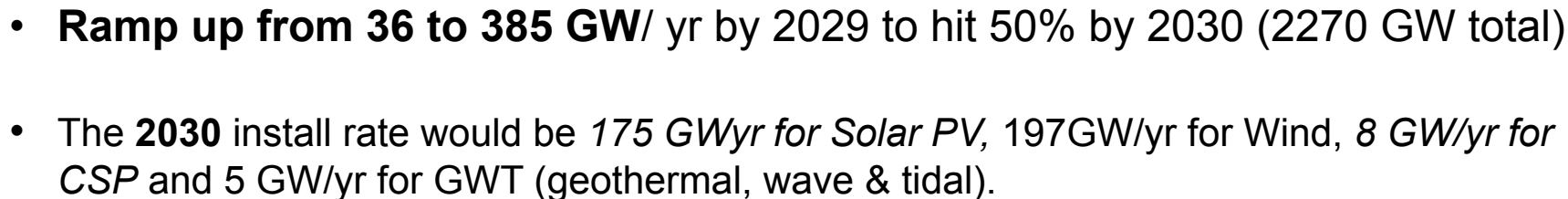
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Goal: install **50% of WWS** by 2030

#GW PV & Wind Factories Built per Year



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- growing to **57 factories per year** by 2026.
- 156 GF for Solar PV, 180 for Wind, 8 for CSP and 5 for GWT.





Wind Turbines & Utility Solar



- 5.3MW GE cypress wind turbine
- Rotor diameter is 158m
- Hub height is 101-160m



50MW Encino solar farm in NM

- 6-8 acres / MW $\Rightarrow$ 50MW = 300-400 acres.
- 3 mo construction phase drop to 30 days

<https://patternenergy.com/news/news/pattern-begins-construction-on-1050-mw-of-wind-capacity-in-new-mexico>

Pattern Begins Construction on 1,050 MW of Wind Capacity in ...

Jan 11, 2021 — Renewable-energy developer **Pattern Energy** Group on Jan. 4 said it began construction on the first of four planned **New Mexico** wind farms and a ...



Current Solar & Wind: 350k Jobs

- US Solar + Wind industries employ over **350,000 direct workers**.
 - Solar ~ **231k** in 2020 per [SEIA](#)
 - Wind ~ **120k** in 2020 per [ACP](#)

Table 2: Renewable energy jobs for Q2 of 2018. Source: USEER, 2019, unless otherwise specified

Sector	Direct Jobs (U.S.)	Growth compared to 2017 (percent change)
Solar	242,343	3.2%
Wind	111,165	3.5%
Renewable Fuels (Corn ethanol, other ethanol including biodiesel, woody biomass, and other biofuels)	109,709	2.2%
Hydropower	66,448	-0.8%
Biomass (Electrical generation)	12,976	4.8%
Geothermal	8,526	7.8%
Waste-to-Energy*	7,000	—
Total	555,168	-0.2%[†]

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35



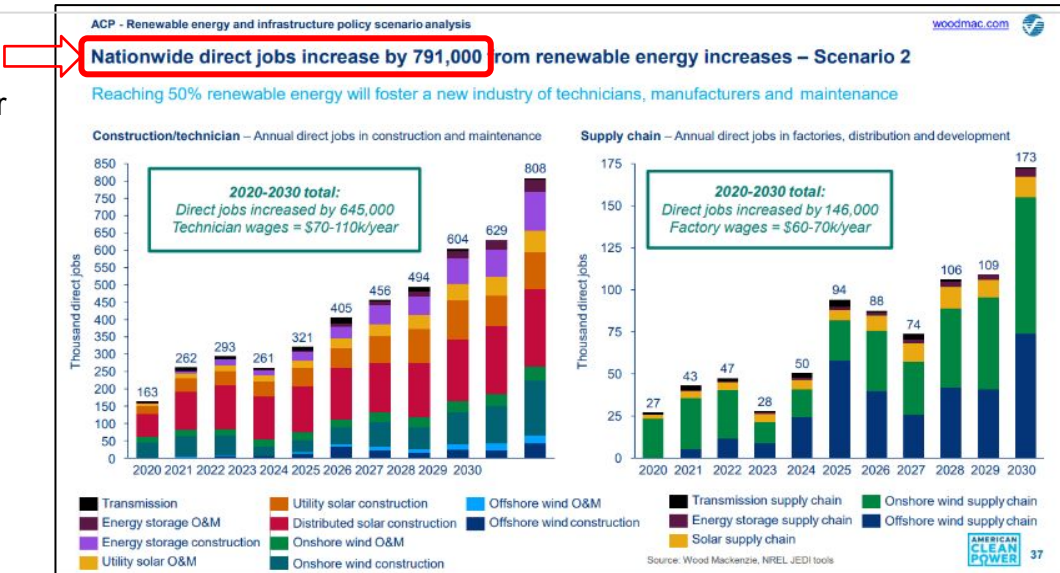


1.5M net jobs added by 2050

- +791k more jobs for 480 GW (2000 GW by 2030)
- Need 4x for 100% WWS $\Rightarrow$ 2.8M RE jobs added.

Fossil fuels jobs drop 1.3M $\Rightarrow$ 1.5M net jobs added.

This scenario only for the new jobs to add the 480GW to achieve 50% clean electricity by 2030.



Civilian Climate Corps!



Civilian Climate Corps

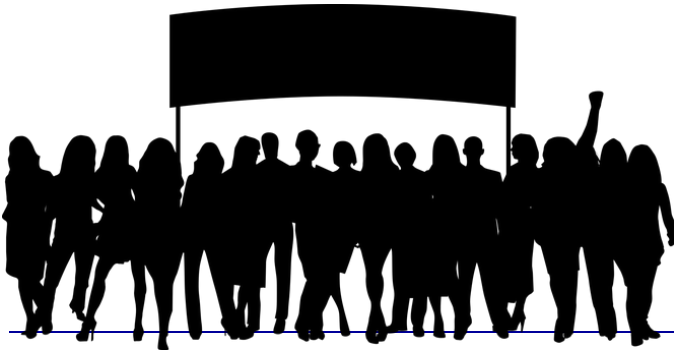
- **Capping** orphan wells
- Training to **manufacture** wind turbines, solar panels, controls and more
- **Installing** solar, wind, heat pumps, mini-splits
- **Upgrading** mass transit, charging infrastructure and broadband

Universities and schools change focus to an electrifying world

Mechanics convert gasmobiles to local EVs

Need industrial and environmental engineers again

Our Military Industrial Complex morphs





We Spend \$100B less on Energy

Remember **\$885B** was spent on fossil fuels a year?

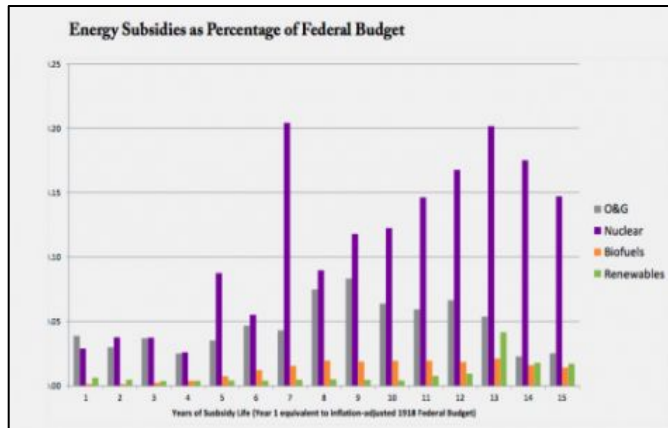
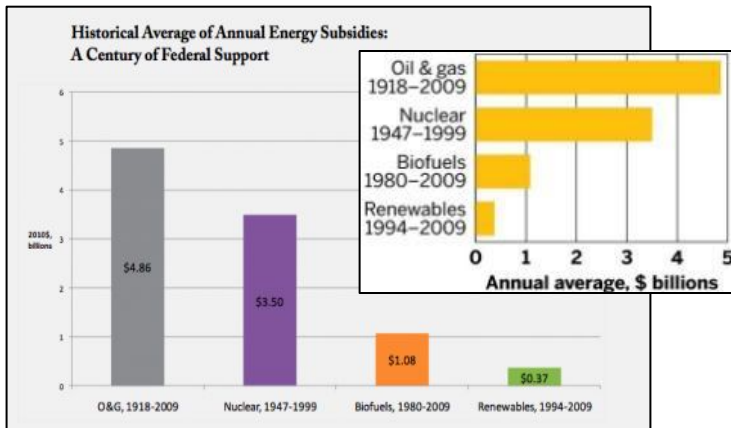
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cheaper WWS electricity, at **\$768B/yr**

Per MZJ, energy spending shifts
to electricity at a cost of \$768B
per year, or \$175 less than just
spending on fuel.



Subsidies: FF 75X vs RE

US Gov report on fossil fuel tax subsidies – worth \$4.5B/yr
<https://www.treasury.gov/open/Documents/USA%20FFSR%20progress%20report%20to%20G20%202014%20Final.pdf>



- Oil and Gas industry- **\$446.96 billion** - **100 years** of federal support.(1918 to 2009)
- Renewable energy - **\$5.93 billion** (1994-2009)⇒ **75 times less!**
- Average **annual** support:
 - Oil and gas industry - **\$4.86 billion** (1918-2009) **w/ 96% going to profits**
 - Nuclear - **\$3.50 billion** (1947-1999) without permanent storage place assigned
 - Renewable energy - **\$0.37 billion** (1994-2009) ⇒ **13 times less!**