ELECTRICITY GENERATED by WIND TURBINES in WA-OR, A COMPARISON to SNAKE RIVER DAMS --**EXAMINING PERFORMANCE, COST, EFFICIENCY WORLDWIDE and AVISTA'S RESPONSE TO GREEN NEW DEAL**

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WASHINGTON'S & OREGON'S WIND RENEWABLE ELECTRICITY

Facts:

46 wind farms (about 2,391 turbines est.) Balancing authority: Bonneville Power Administration Nameplate Capacity: 4,782 MW (2014); 4,065 MW (2017); 2,764 MW (2018)

Large, unresolvable & secret problems of wind turbines:

- 1. **Back-up** power source:
- BACK-UP Required 80% of life Wind *back-up* requirement
- $4,782 \text{ MW} \times 0.8 = 3,826 \text{ MW}$ Back-up must be running fulltime, hot, costing \$\$
- *Back-up* choices: hydro dams, 4 nuclear, 8-1/2 coal, or 11 natural gas plants
- 2. Intermittent, only part-time power
- 3. Excess power is not salable; means an additional cost
- 4. Low efficiency (~26% in Wash.)
- 5. Output is mis-aligned with
- demand
- 6. Disadvantages not disclosed

Leaning Junip Goodnoe Hills (C Leaning Juniper (C

List of wind farms in

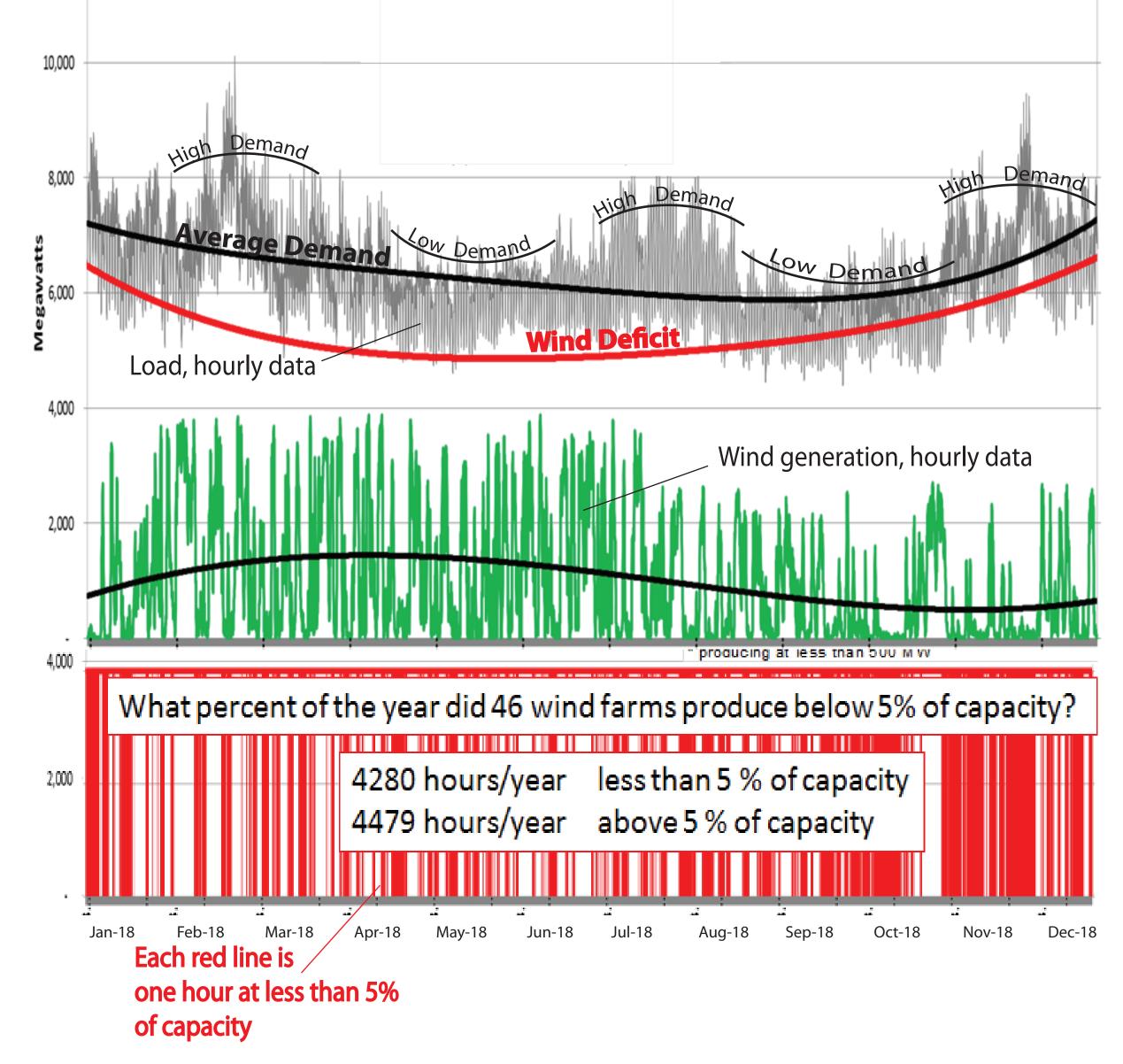
WA & OR:

HOW INTERMITTENT is WIND in WA & OR? WHY DO WIND TURBINES not PRODUCE ELECTRICITY FULL-TIME? -- EXAMPLES..

EX. 1. Wind Generation, Load, and Wind Deficit, 8,670 hours, Jan. 1-Dec. 31, 2018

- Bonneville has a large demand during Nov. to Feb. period, but wind-generated electricity comes in Spring to Summer.

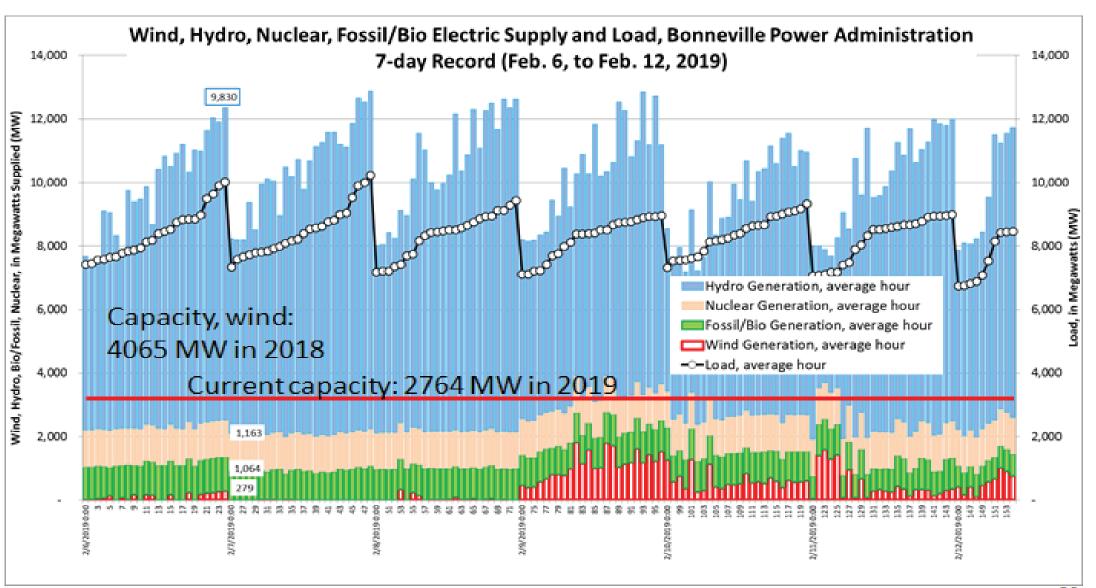
- Wind Generation is mis-aligned with demand (load) as a result. This means equipment is idle so is not a benefit.



HOW INTERMITTANT is WIND? ...MORE EXAMPLES (continued)

EX.2. A 7-day Record of Load and Supply (Feb. 6 - Feb. 12, 2019)

- Question: Why no wind electric generation for first three days of period (Feb. 6-Feb. 8)?



EX. 3. A 776 Day Record of 44 Wind Farms in WA & OR, (Jan. 1, 2013 - Feb. 10, 2015)

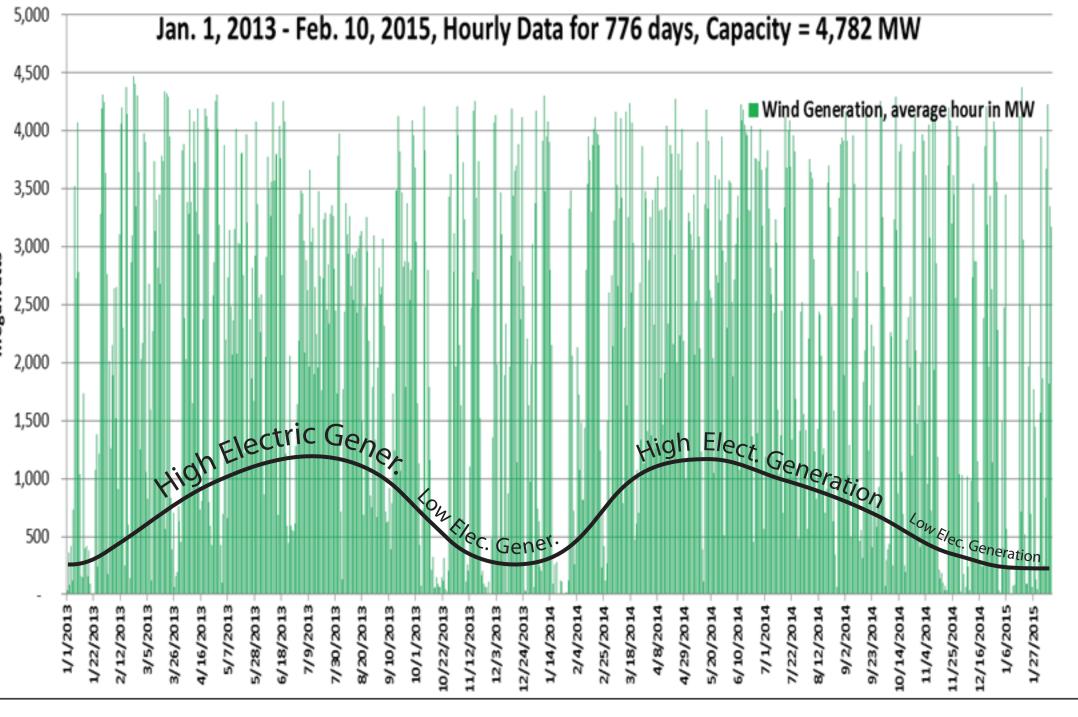
- Wind in WA-OR has sufficient capacity to serve 3,864,000

- DAYS WITHOUT ELECTRICITY means wind electric @ less than 5% of capacity:
- 265 days/776 days (34% of period)
- DAYS WITHOUT ELECTRICITY: For 265 days (34%), customers are NOT served electricity promised

...NO wind electric generation: October - February This 5-month period without electricity averages 14 days per month

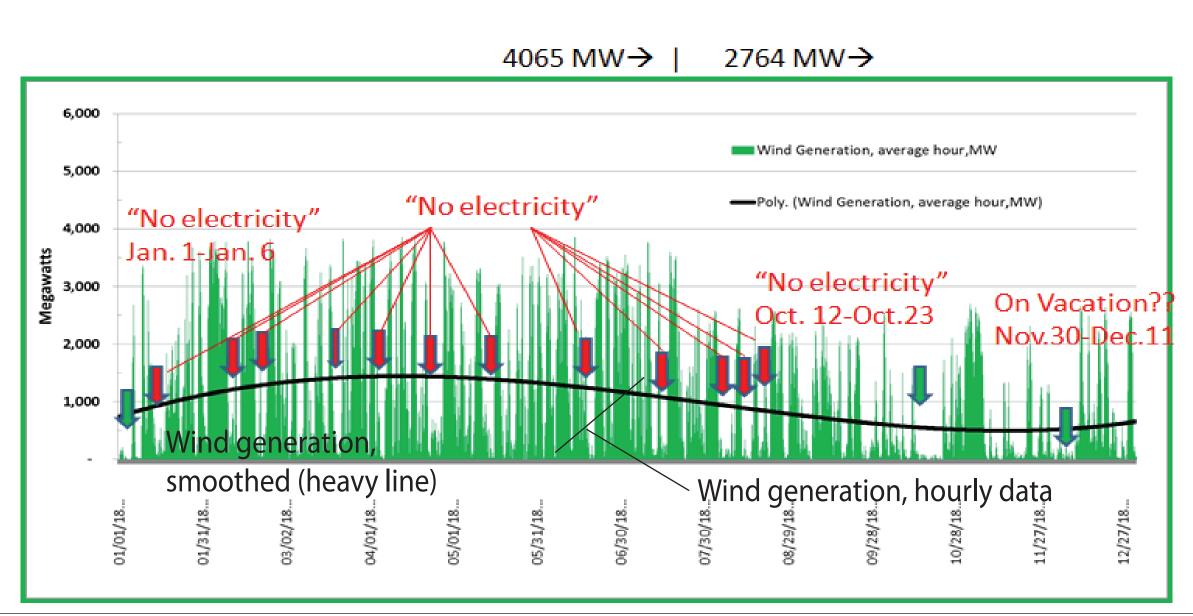
- Wind electricity mis-aligns with demand. (Table)

Electric Generation Record of 44 V



EX. 4. Hourly Wind Generation Record of 46 Wind Farms in WA-OR for 365 Days (Capacity, 4,065 MW) (Jan. 1-Dec. 31 2018)

- PERIOD of NO WIND ELECTRIC GENERATION: 129 days in 2018 or 35.3% of period; averages 15.1 days per month for Aug. - Dec. (35.3%) or 3,092 hours /8,760 hours/year



generation	Wind Generation (WA-OR) Jan. 1, 2013 - Feb. 10, 2015 Number of Days <5% of Capacity*				
generation					
	January February	2013		↑ Wind 15.7 7.4	
	March April		\downarrow	Deficit ^{4.3}	
3,670,000	May June			6.8 8.9	
	July August		4.4 7.8		
	Septembe October		\uparrow	7.3 Wind 18.0	
y period.	Decembe	November December		10.0	
	January February	2014		Deficit ^{8.2}	
4.0 - 14.4	March April		\checkmark	9.2	
	May June			6.2 4.7	
	July August		\uparrow	6.5 9.8	
	October	September October		Wind 14.7	
		November December		Deficit ^{11.2}	
	January February	2015			
Wind Farms	Number of days		265.2		

ELECTRICITY from WIND TURBINES vs. HYDRO DAMS on SNAKE RIVER....A COMPARISON (2014-2018)

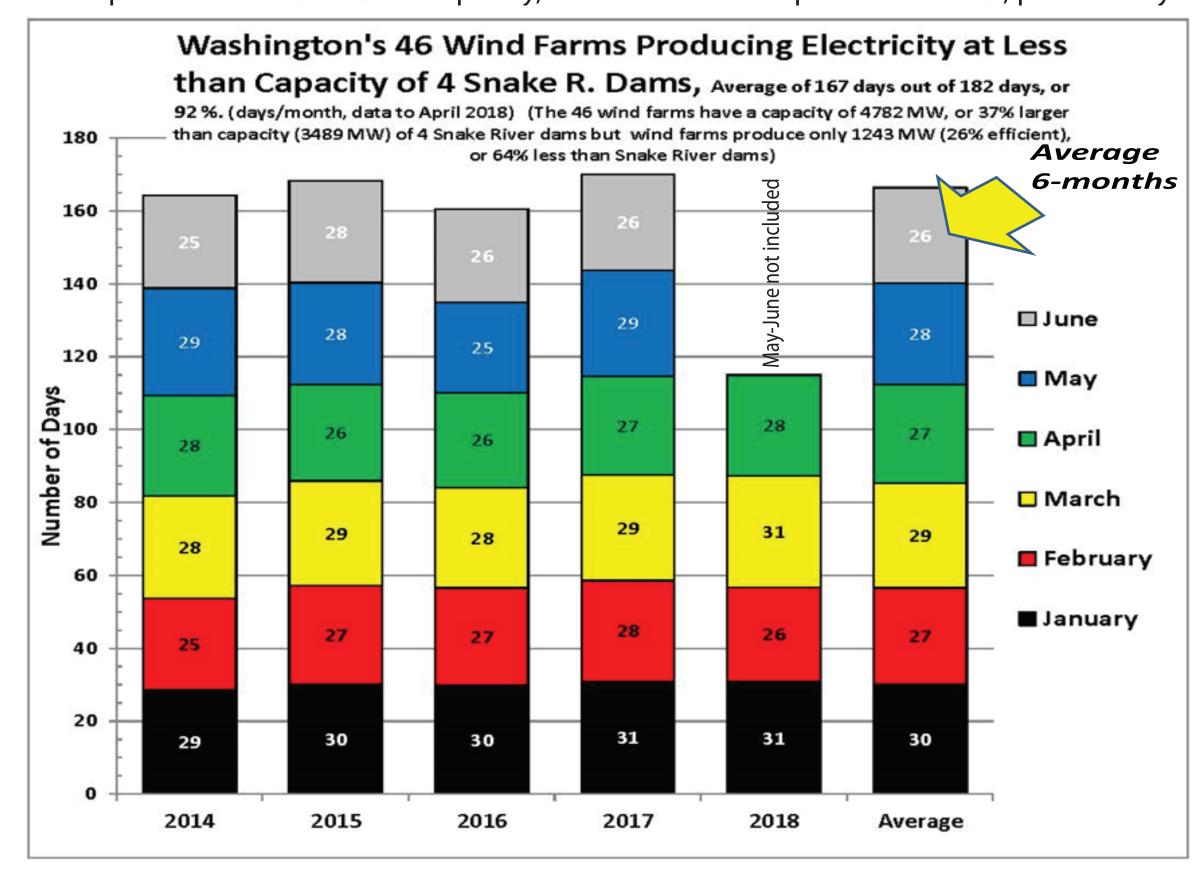
QUESTION 1: What Number of Days Each Month During Jan. to June Does the Output of the 46 Wind Turbines *Underperform* the Output of the Snake River Dams? (chart)

Capacity in Megawatts (MW):

- 4 Snake River Dams = 3.489 MW
- 46 Wind Turbines = 4,782 MW (37% larger than dams)

Answer:

- Wind turbines underperform for 26 to 30 days/ month (92% of time), or
- Turbines underperform 167 of 182 days during 6 month period
- Although wind capacity is 37% larger than dams, the wind turbine output is 64% less
- Dams produce at 90%-95% of capacity, but wind turbines produce at 26%, periodically.



QUESTION 2: How Many Days Each Month During January to June is Wind Electric **Output Less Than 10% of Capacity? (chart)**

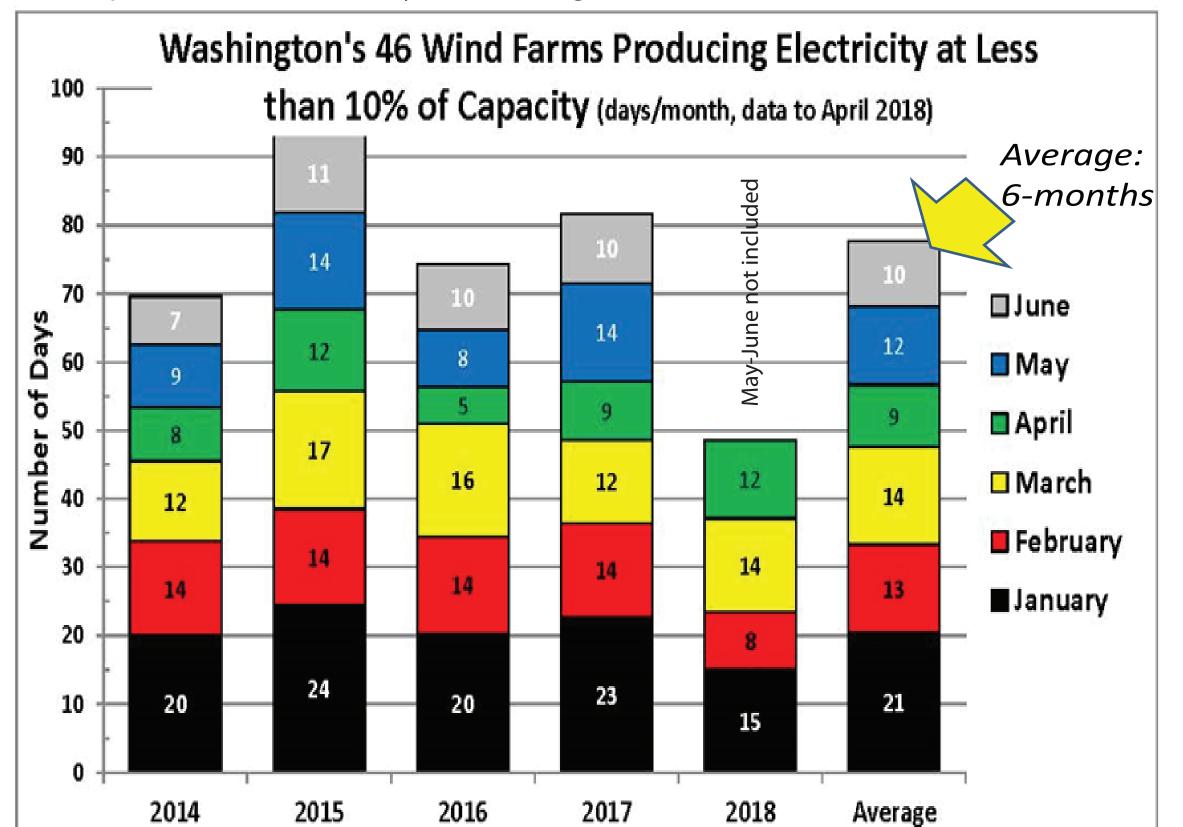
Answer:

- Wind is at less than 10% of capacity for 9 to 21 Days per Month (30% 69% of days/m
- At less than 10% of capacity for 79 Days total (a 5-year average 2014-2018)
- At less than 10% of maximum for 92 Days total in 2015

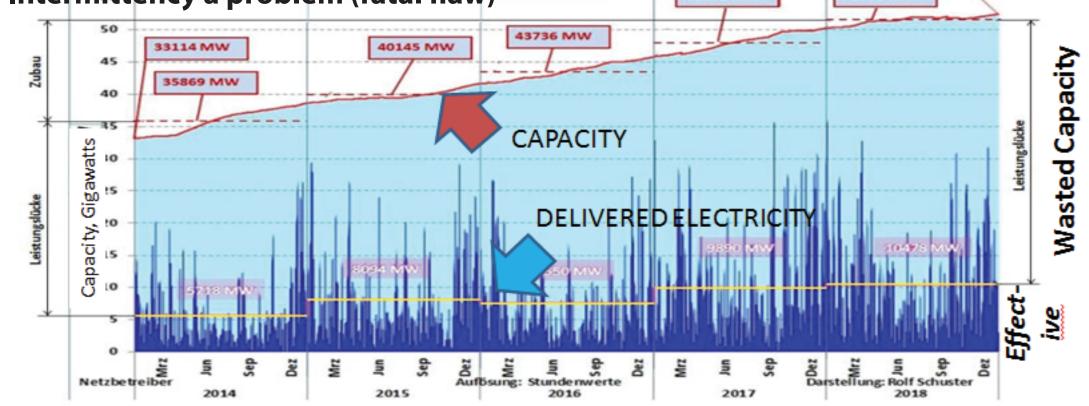
CONCLUSIONS:

- WIND TURBINES CANNOT REPLACE SNAKE RIVER DAMS
- DAMS ARE BASELOAD; WIND TURBINES ARE NOT
- SNAKE RIVER DAMS OUTPERFORM DAMS, CONSISTENTLY
- WIND OUTPUT NEVER TOPPED 1,235 MW (25.8% of capacity)
- FOR 11 DAYS/ MONTH WIND IS UNABLE TO GENERATE 200 MW (4% of capacity)
- Up and Down Like a Yo-Yo, By No Measure Can Wind Power Be a System: "Its Chaos"

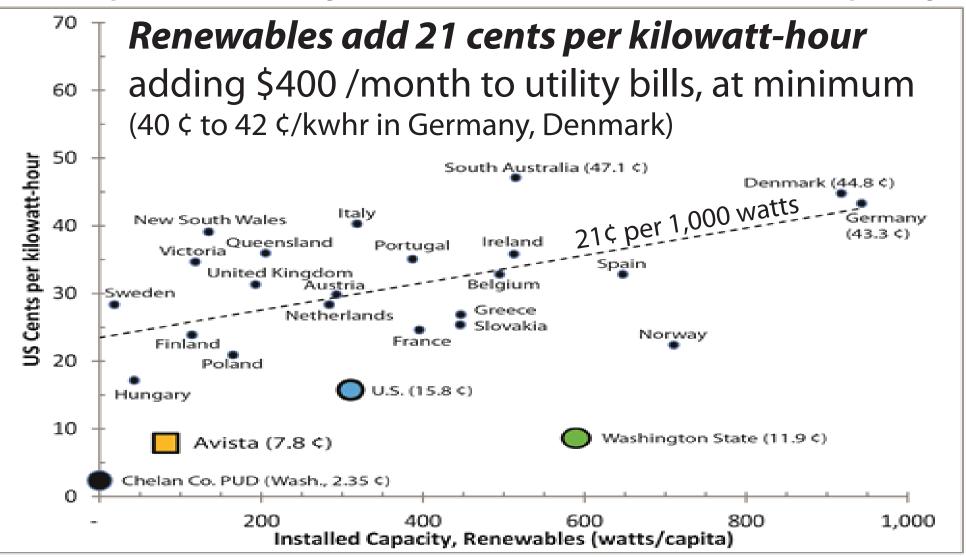
- No amount of wind turbines are able to provide full-time electricity; intermittency still remains a problem. Intermittency and mis-alignment with demand are FATAL FLAWS.



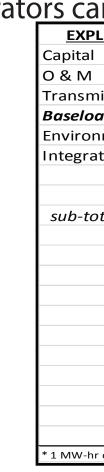
...EXAMPLES



Retail electricity pr
South Austra
Denmark
Germany
Italy
New South W
Ireland
Queensland
Portugal
Victoria
Belgium
Spain
Great Britain
Austria
EU average
Holland
Sweden
Greece
Slovakia
France
Luxembourg
Finland
Norway
Slovenia
Poland
Lithuania
Hungary
Estonia



Ex. 4. WInd Turbines Electricity Costs (by category) Many costs are unknown....or company secrets - Electricity from wind turbines costs >38.8¢ per kwhr - The 2.3¢/kwhr subsidy means wind operators can undersell, and bankrupt other suppliers of electricity **IMPLICIT COST**



WIND TURBINE PERFORMANCE, COST, WORLDWIDE..

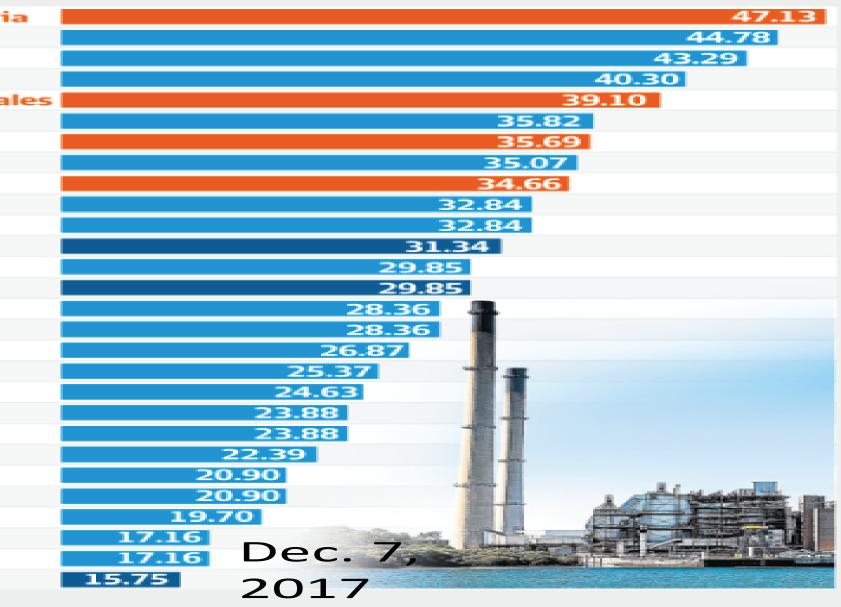
- Ex. 1. German Wind Protest Group MenschNatur says "adding more unreliable wind capacity does not make Germany's energy supply more reliable but makes it less so"
- Adding capacity adds cost but not delivered electricty (a fatal flaw0) mis-aligned with supply (a fatal flaw

Abbildung 1: Zubau der installierten Leisung und Einspeiseleistung der Windgeneratoren in Deutschland Illustration 1: Installation of installed power and feed capacity of wind generation in Germany Von Anfang 2014 bis Ende 2018 hatten wir in Deutschland einen Zubau von 33.114 MW auf 52.422 MW an Windgeneratoren-eistung, also 19.308 MW. Hier an der roten Linie über dem hellblauen Feld gezeigt. Das blaue, gezackte Feld ist die

http://notrickszone.com/2019/03/06/unreliable-power-source-adding-capacity-does-little-to-solve-germanys-green-energy-power-gaps/

Ex. 2. Retail Price of Electricity versus Percent Renewables...

rices of NEM states, including taxes, compared to selected countries (¢ per kwhr)



Ex. 3. Electricity Cost versus Percent Renewables...

Scatterplot: Electricity Costs vs. Installed Renewable Capacity

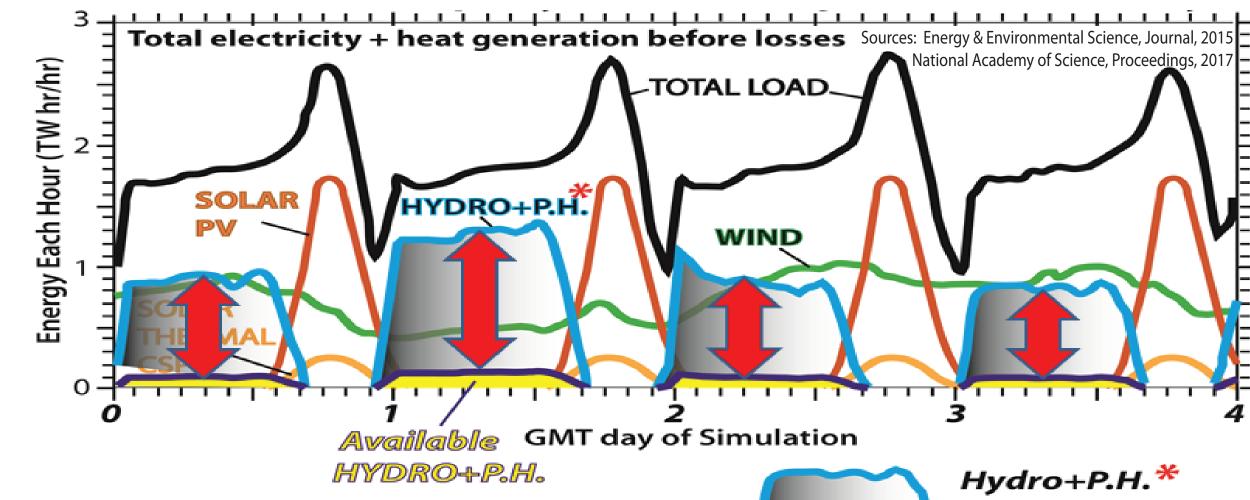
		<u>Ş/IVIVV HOUL</u>		<u> </u>	
		\$	126	0.126	
		\$	10	0.01	
ission, lines losses		\$	43	0.043	
ad cycling, back-up power		\$	23	0.023	
imental		\$	9	0.009	
tion to grid		\$	12	0.012	
	Tariff (a "guarantee" more or less)	\$	78 to 130	0.13	
	Subsidies (federal) \$23 (\$35 pre-tax)	<u>\$</u>	35	<u>0.035</u>	
tal (without "unknowns")		\$	388	0.388	
	Federal loan guarantee, waivers		Unknown		
	Subsidies (state)		Unknown		
Renewable Portfolio Standard (State)			Unknown		
	Cap & Trade		Unknown		
	Land, lease, royalty cost		Unknown		
	Carbon tax		Unknown		
	Unmarketable power		Unknown		
	Opportunity cost		Unknown		
	Reduced reliability, short lifetime		Unknown		
	Social, health, environmental cost		Unknown		
TRUE COST OF WIND ENERGY HERE>			UNKNOWN	Unkn. + 0.388	
or 1,000 kw-hours					
*True cost of e	energy: Wind: Inst. of Political Economy, R. Simmon	s et al, Uta	ah St. Univ., <u>www.</u>	strata.org	

ssessing wind power estimates: Inst. for energy research, M. Gilberson, Texas Tech. Univ.

GREEN NEW DEAL & AVISTA'S RESPONSE TO 100% RENEWABLE ENERGY

GREEN NEW DEAL ELECTRICITY MODEL

Load vs. Supply, 4 days, 1591 gigawatts "RoadMap" (after Jacobsen et al 2015) - *M. Jacobsen et al.:* "100% clean, renewable wind, water, and solar energy roadmap for the 50 United States"



Clack et al PNAS (2015); Conley and Maloney (2017) list criticisms, deficiencies, errors: "ROADMAP" involves errors, inappropriate methods & assumptions and it lacks credible evidence to reject other energy options, is impossible (Fatal Flaws.

Fatal flaws of "ROADMAP"

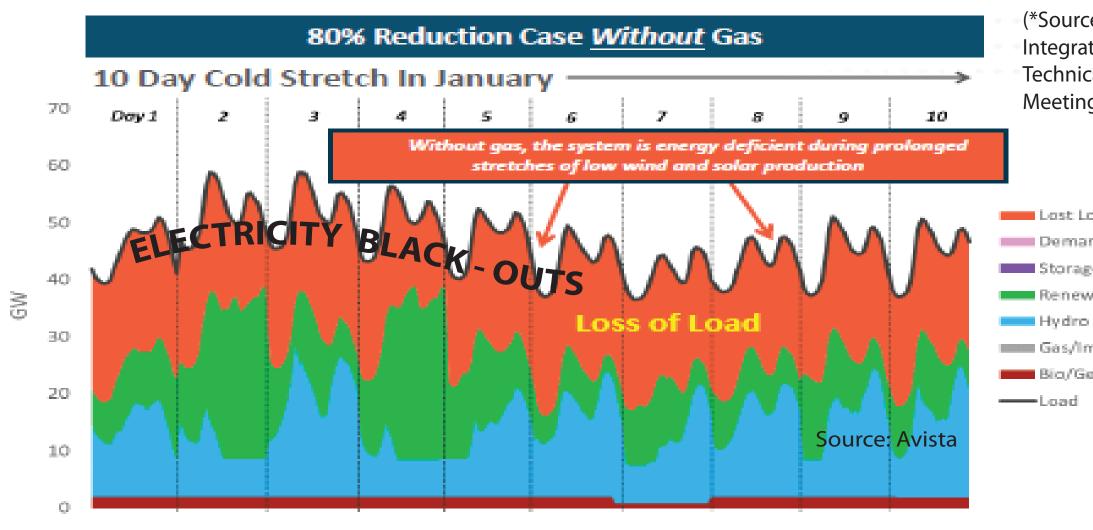
- 1. Hydro supply is 90% deficient
- 2. Wind 80% undersize;
- 3. Solar undersize by 50%;
- 4. Solar packing too dense;
- 5. Feasibility not demonstrated 6. Reserve is "hope" and "pray";
- 7. Mineral supply to build is unavailable
- 8. HVDC AC-to-DC seamless conversio not available:

Fatal Flaw of ROADMAP (continued)

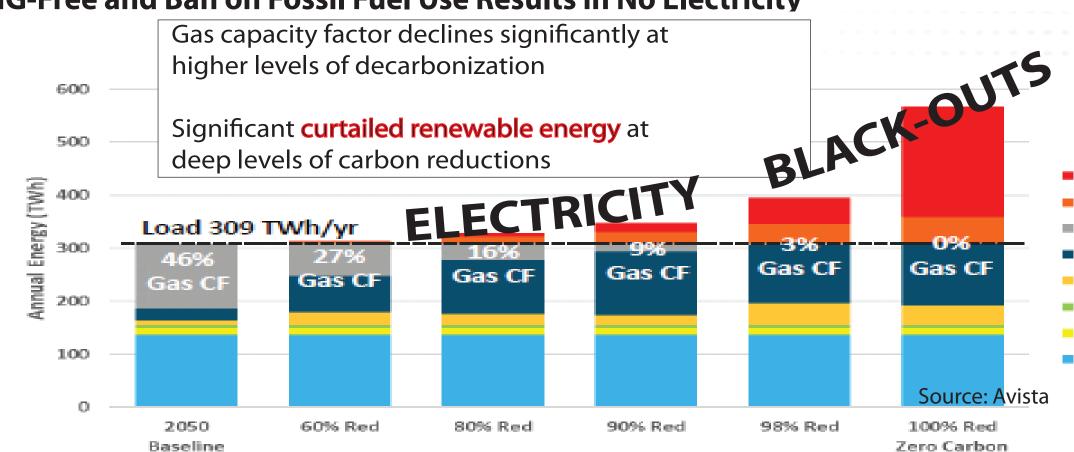
- 9.35 years to construct; 10. Useful life of wind and solar facilities is 10-15 years; replacements adds cost;
- 11. RoadMap is uncompetitive because new technologies available at 2% of
- RoadMap's cost that emits less CO2; 12. Erecting threatens food supplies, eminent domain threatens private lands;
- 13. Wind turbine noise is a serious health hazard to humans;
- 14. Area requirement is unreasonably immense;
- 15. Wind and solar generation are intermittent, mis-aligned with demand;
- 16. A battery technology is not available to balance generation with demand.

*AVISTA: RELYING ON RENEWABLES LEADS TO REGULAR ELECTRICITY SHORTAGES, **BLACK-OUTS**

1. Impossible Mission: Renewables at 80% GHG Reduction Cannot Provide Supply (Primary reasons for shortfall: intermittent supply; supply mis-aligns with demand)

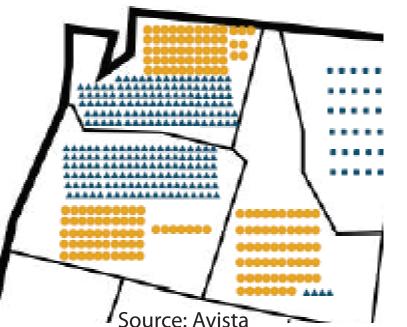


2. Curtailments Imminent: Renewables Inability to Provide Supply, Need for 100% GHG-Free and Ban on Fossil Fuel Use Results in No Electricity



Avista's \$\$ Cost of CO2 reductions is so extreme rendering 80% to 100% GHG-free an unreasonable goal (in \$/ton CO2): --> 80%to98% GHG-free is \$800;

3. Renewable Land Use (100%)



--> 100% GHG-free is \$16,000

(each dot represents 200 MW) Total Nameplate Renewable Needs in WA-ID-OR: - 47 GW (wind, black): 46 GW (solar, vellow) **Total Land area required:**

- @80% GHG-free 5.3 million acres
- @100% GHG-free 13.7 million acres - 100%-GHG-free land use is 100 X the
- areas of Portland and Seattle, combined; (Portland 85,000 acres, Seattle 56,000 acres)

Deficiency (90%)

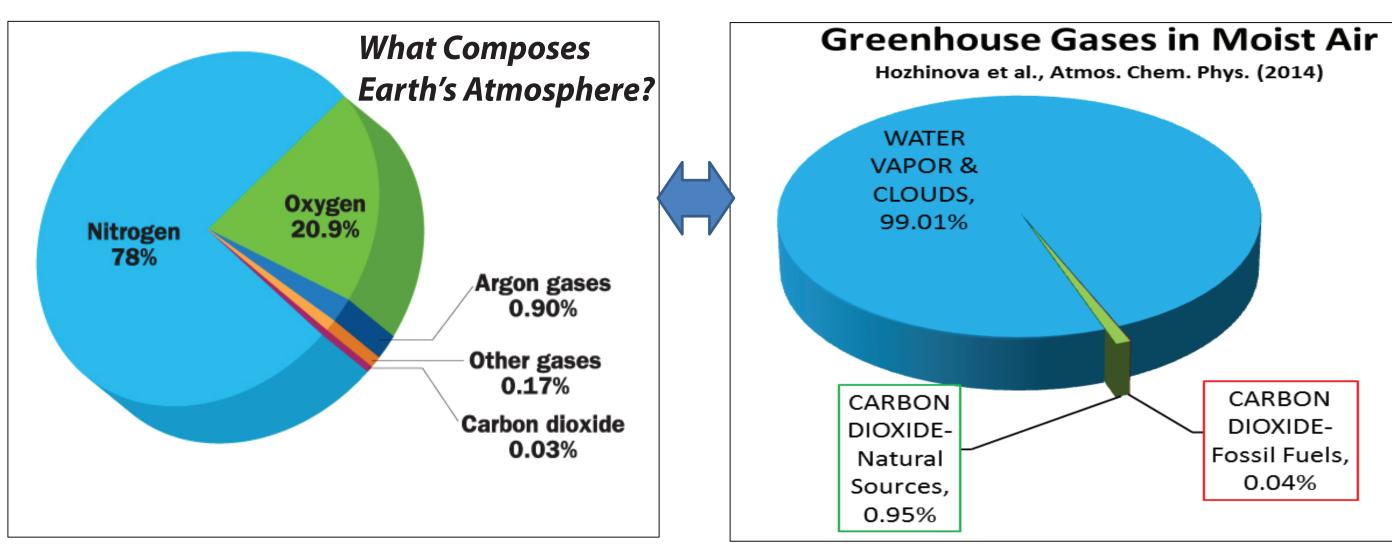
*Source: Avista 2020 Electric Integrated Resource Plan, Technical Advisotry Comm Meeting, April 16, 2019)

Gas/Imports Bio/Geo/Nuclea

Curtailment Exports Gas/Imports

HOW WE HAVE BEEN DECEIVED!

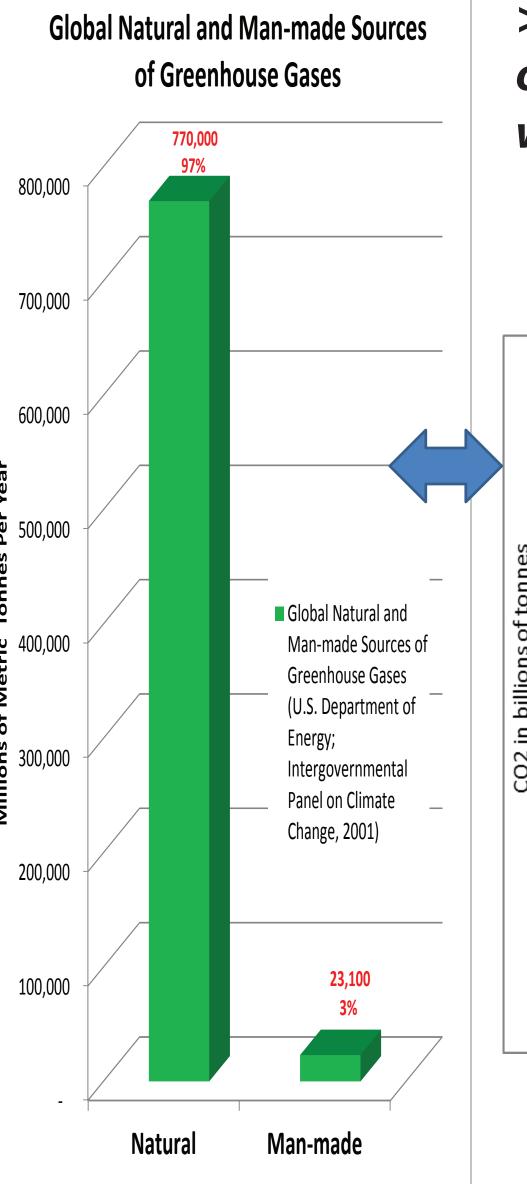
WHAT is a GREENHOUSE GAS and WHAT it is NOT.



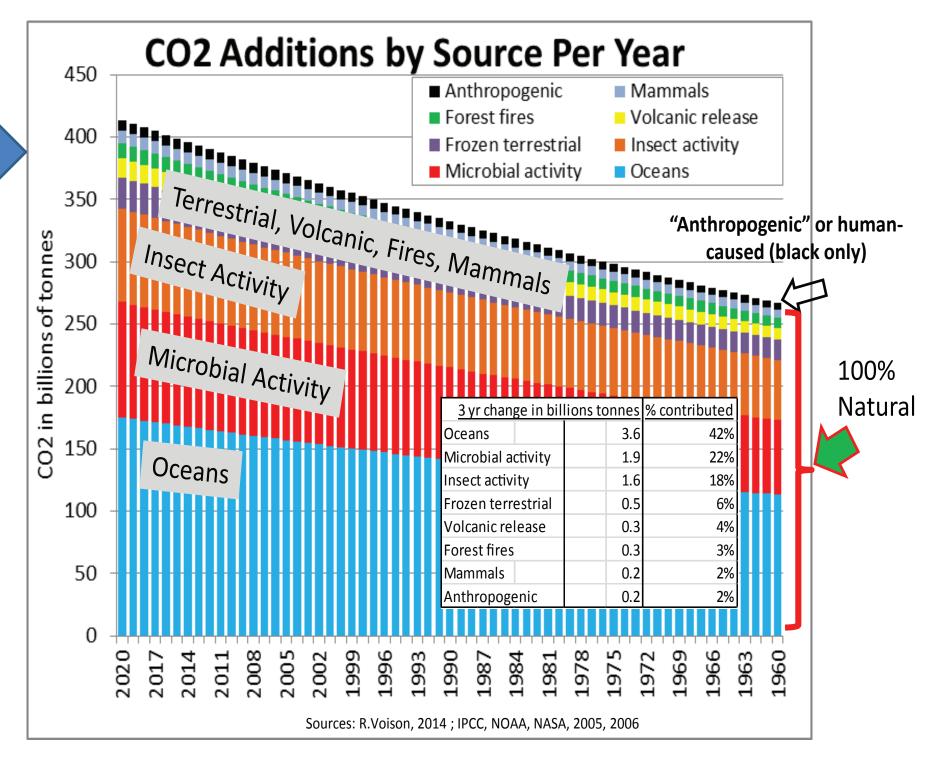
22 from fossil fuels = 8 ppm (.008%)

The deception: Water vapor has a larger influence on weather than CO

- The effect of water vapor on climate is 4,000 times larger than the effect of CO2 from fossil fuels

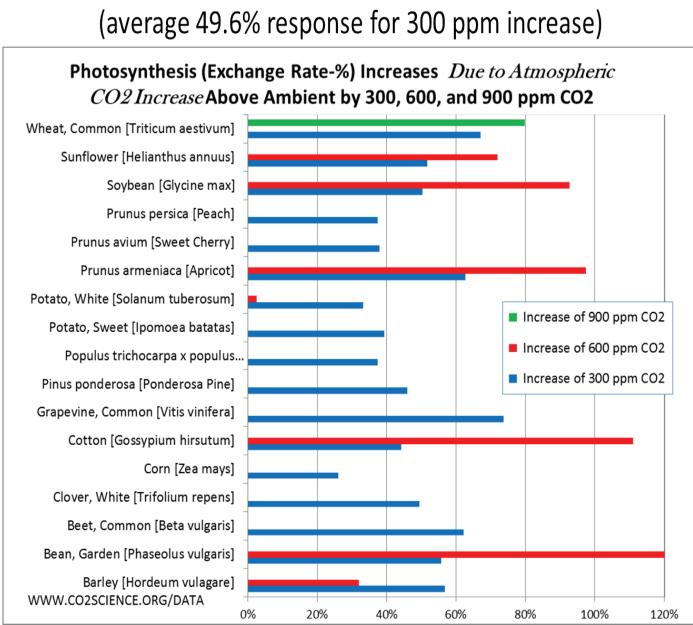


>97% of CO2 is Natural in origin, from oceans, microbes, insects, volcanoes.... while <3% is man-made, from fossil fuels



CO2 is plant food, necessary for photosynthesis and life of all plants and animals

1. Plant Weight Response to CO2 Increase



Is CO2 Plant Food? Here is what happens with more CO2

