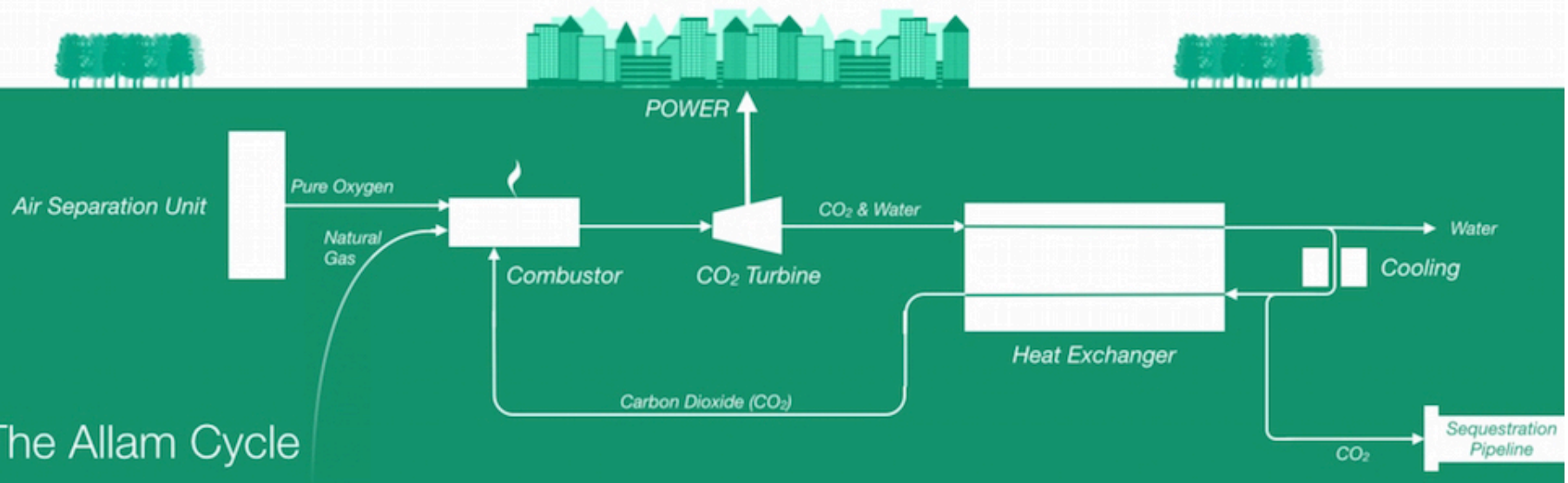


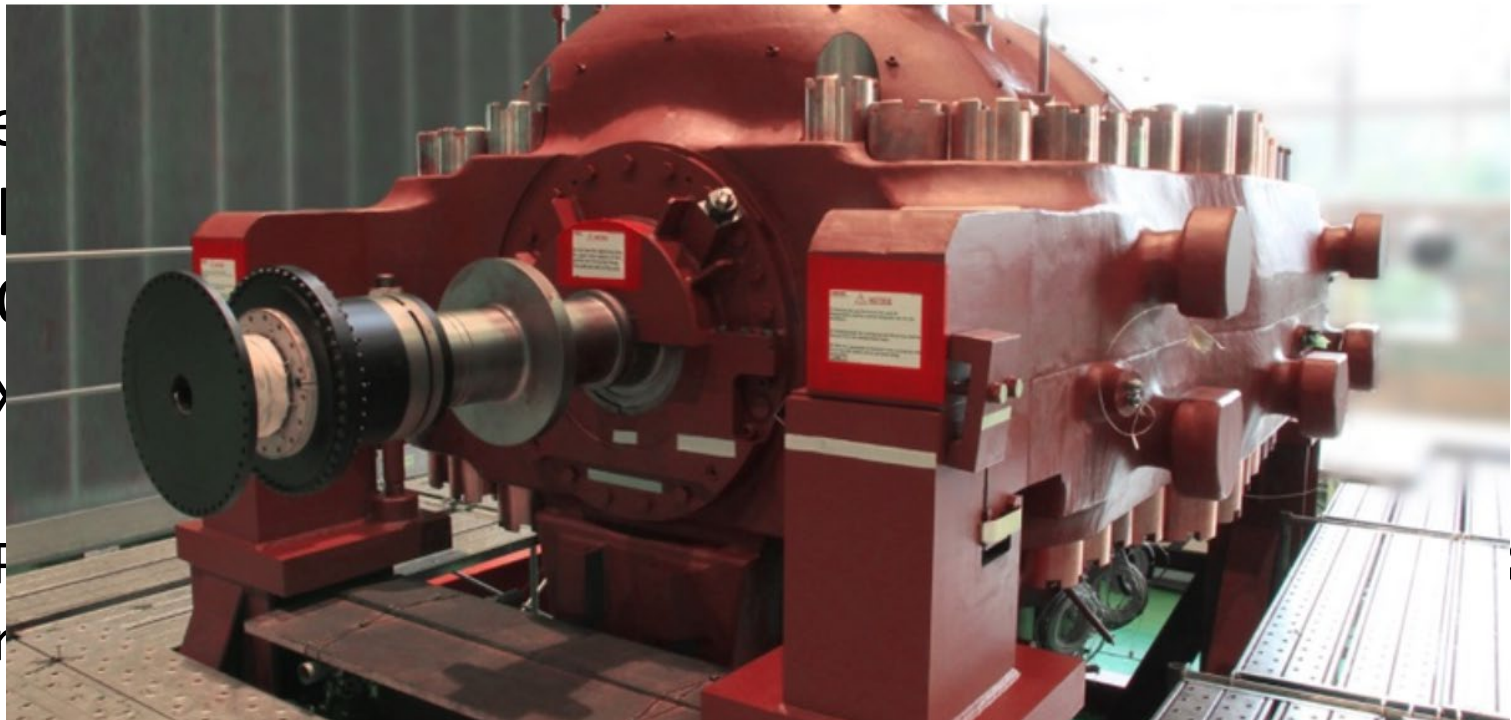
## The Allam Cycle



Base

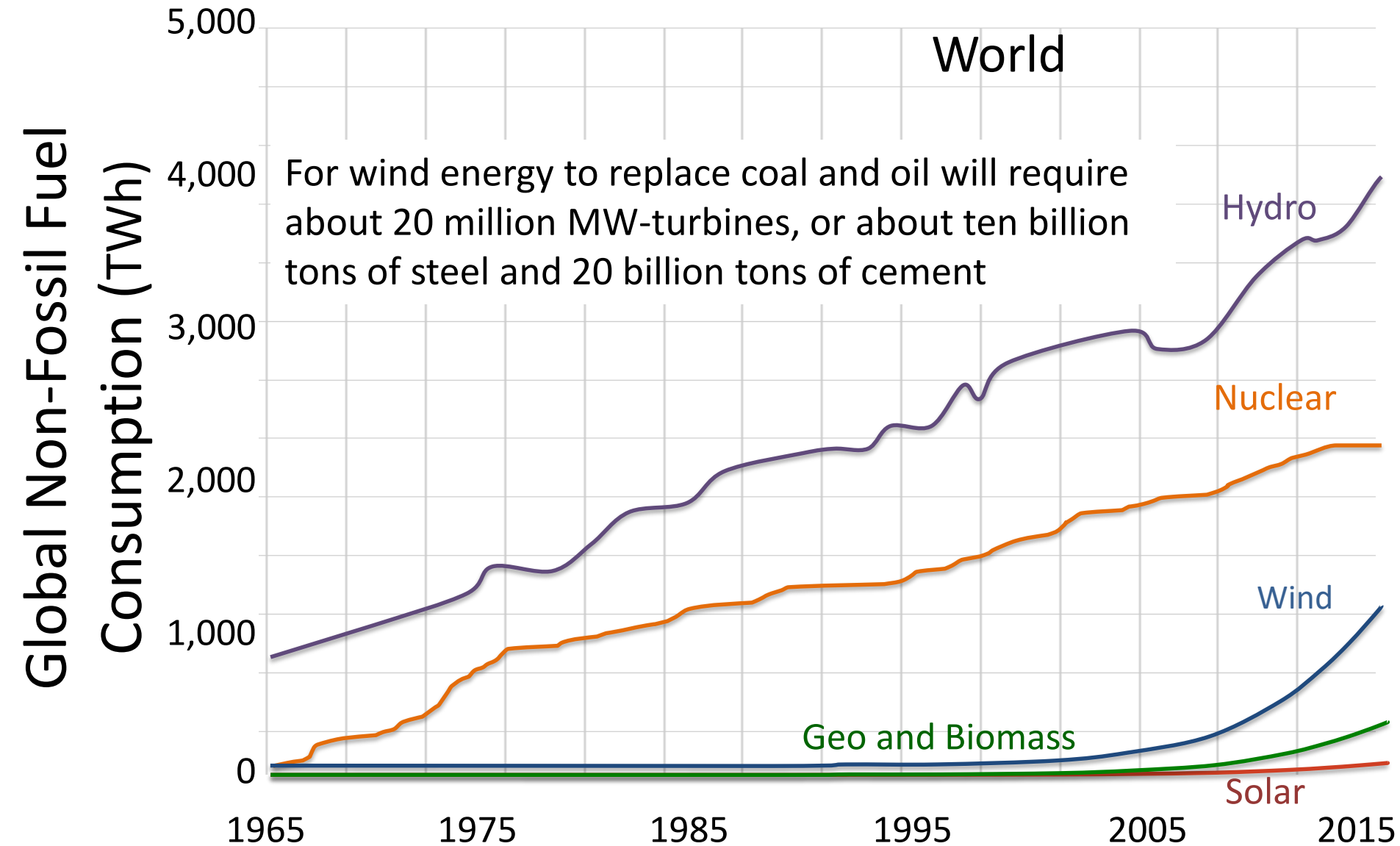
- C
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Net P  
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What are the fastest growing energy sources in the world?

# Non-Fossil Fuels



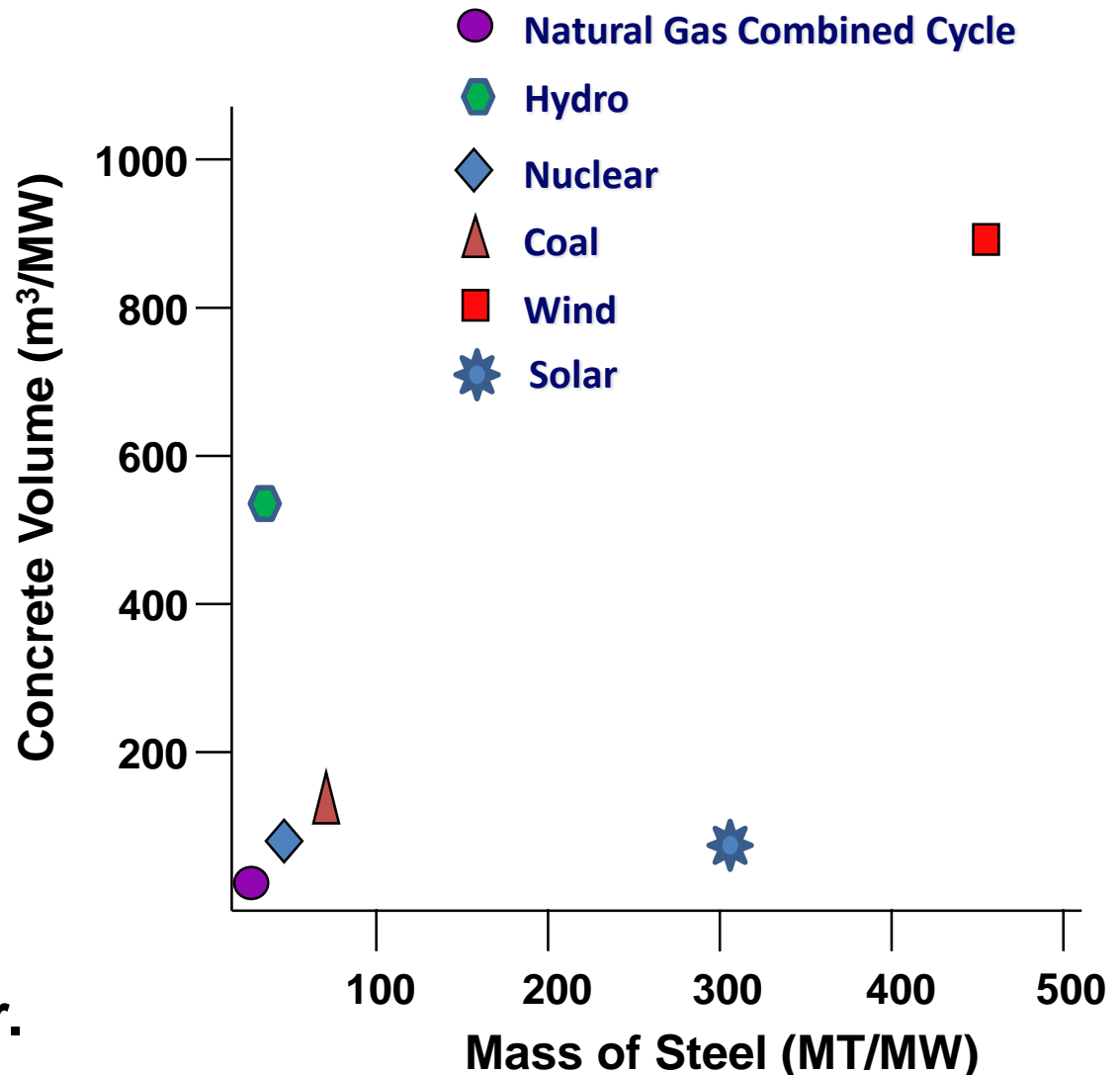
# Mundane Logistical Hurdles Rarely Discussed

Concrete + steel + copper are  $> 98\%$  of construction inputs, and become more expensive in a carbon-constrained economy

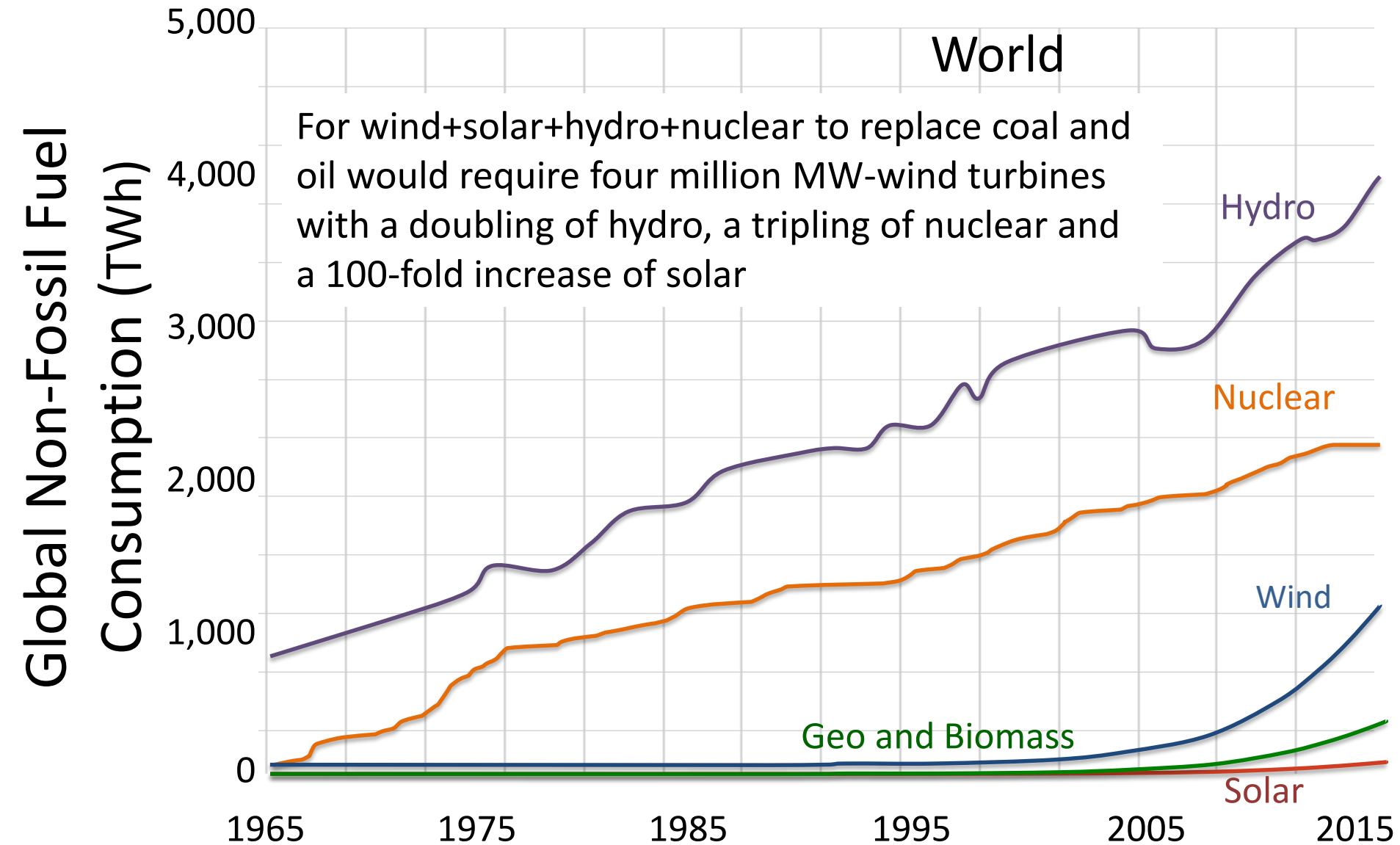
## What determines the cost of power?

- the price of oil
- the price of natural gas
- the price of steel
- the price of concrete
- the price of copper and rare metals like Li

The most sensitive to these prices is wind energy, followed by coal, then gas. The least affected is nuclear.



# Non-Fossil Fuels



The Green New Deal says all the right things:

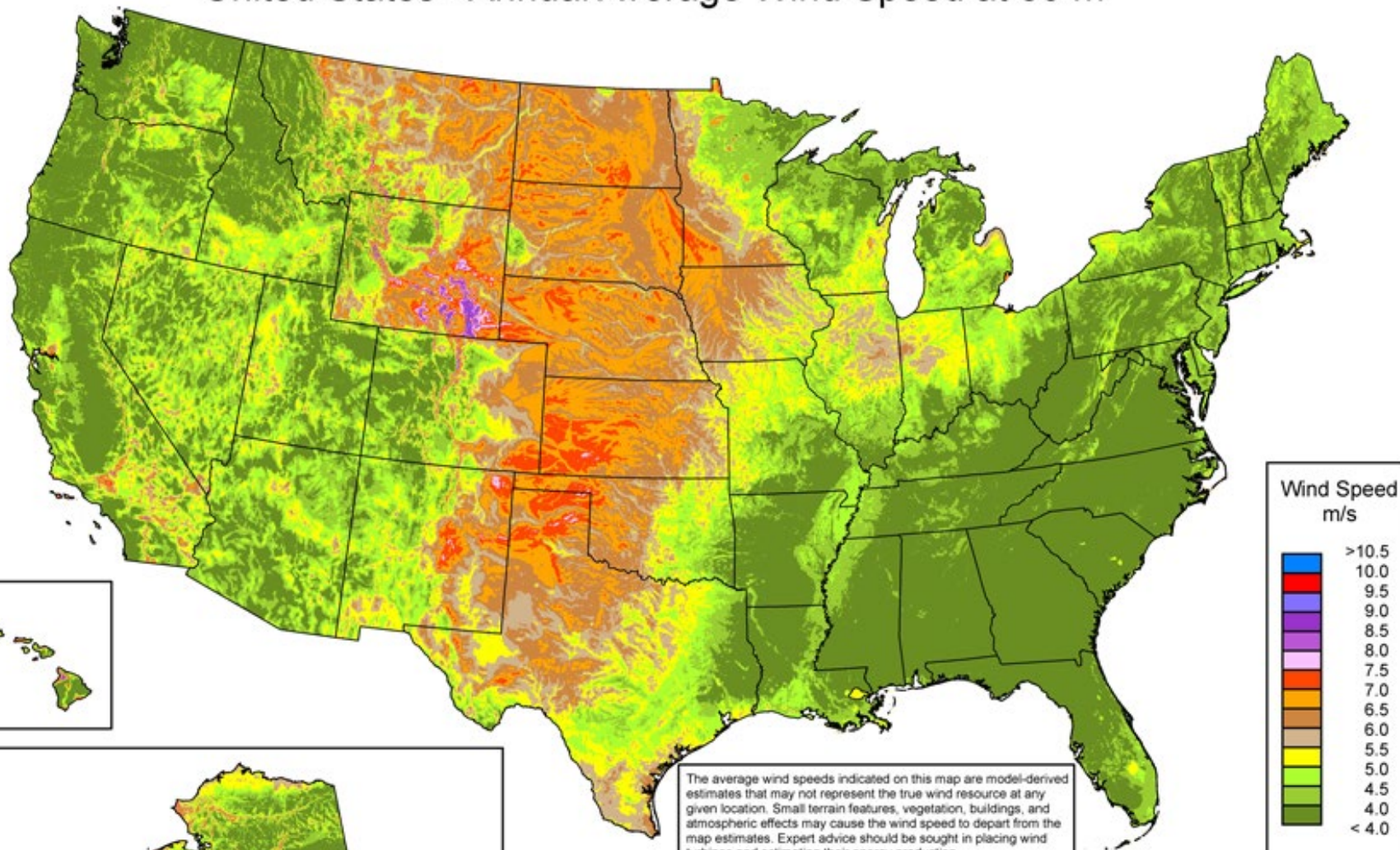
- upgrading all existing buildings in the country for energy efficiency
- working with farmers to eliminate pollution and greenhouse gas emissions as much as is technologically feasible, while supporting family farms and promoting universal access to healthy food
- overhauling transportation systems to reduce emissions including expanding electric car manufacturing, building charging stations everywhere, and expanding high-speed rail to a scale where air travel stops becoming necessary
- a guaranteed job with a family-sustaining wage, adequate family and medical leave, paid vacations and retirement security for every American
- high-quality health care for all Americans

An energy plan for power generation that has any hope of achieving any of the goals we need, in the time frame we need them - the Green part of the GND - must have some form of the following:

- stop building any new fossil fuel plants.
- stop closing existing nuclear power plants that have been relicensed as safe by the NRC, which is almost all remaining reactors in the United States. Crying that a penny a kWh is just too much for America to bear is insane under the urgent need to decarbonize. And every time we close nuclear, gas replaces it and carbon [emissions go up](#).
- build as many wind turbines as possible and site them along [Tornado Alley](#) first, where they produce the most power (cp = 45% instead of just 30%)



# United States - Annual Average Wind Speed at 30 m



The average wind speeds indicated on this map are model-derived estimates that may not represent the true wind resource at any given location. Small terrain features, vegetation, buildings, and atmospheric effects may cause the wind speed to depart from the map estimates. Expert advice should be sought in placing wind turbines and estimating their energy production.

Source: Wind resource estimates developed by AWS Truepower, LLC. Web: <http://www.awstruepower.com>. Map developed by NREL. Spatial resolution of wind resource data: 2.0 km. Projection: Albers Equal Area WGS84.



**AWS Truepower™**  
Where science delivers performance.



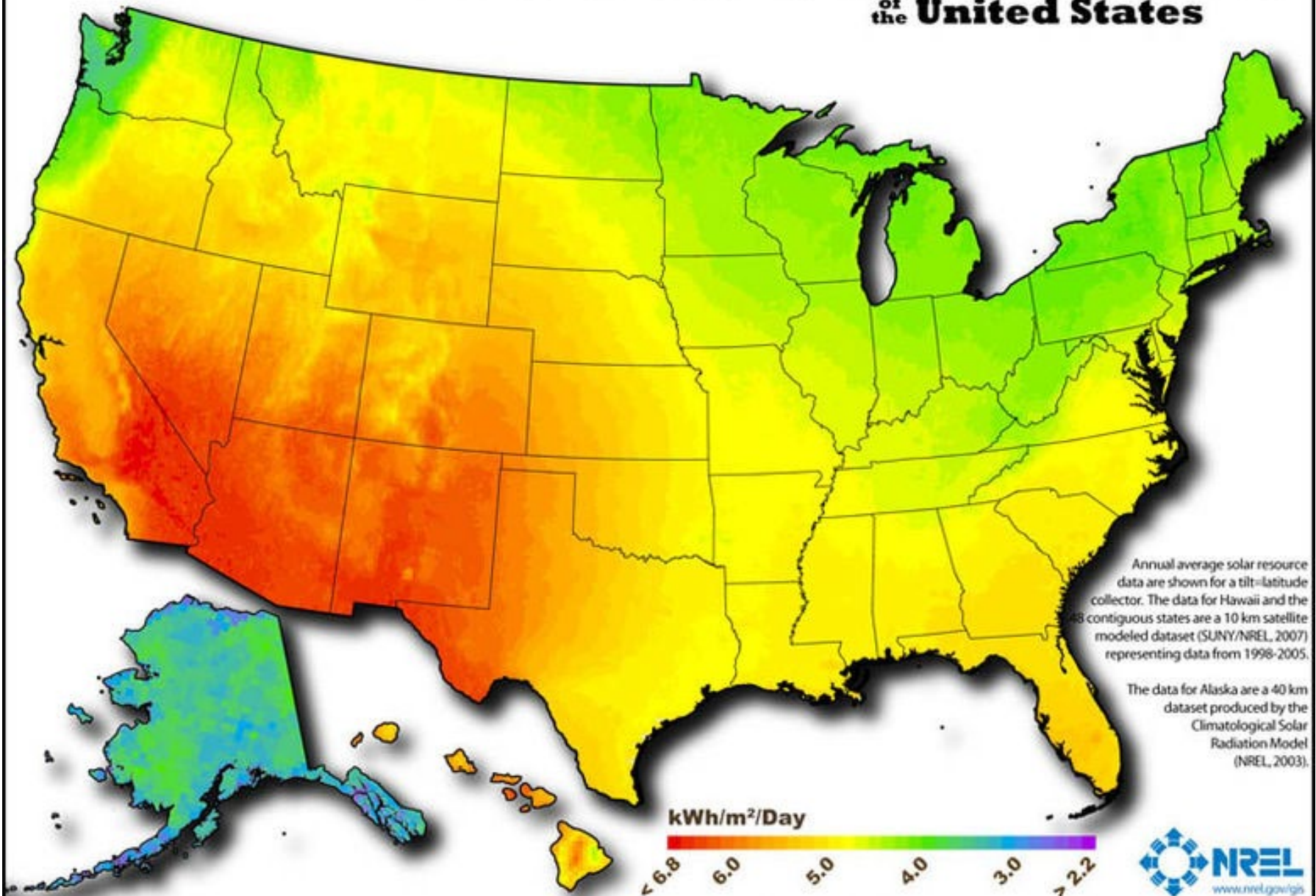
**NREL**  
NATIONAL RENEWABLE ENERGY LABORATORY



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- build as many wind turbines as possible and site them along [Tornado Alley](#) first, where they produce the most power.
- put rooftop solar on all new buildings, and on many existing buildings, first in areas that average at least 200 sunny days/year (cp = 35% instead of just 20%)

# Photovoltaic Solar Resource of the United States





- build new small modular reactors as fast as possible to load-follow, or buffer, the renewables, instead of building new natural gas plants. [SMRs cannot melt down](#) and all the other scary things have been fixed. We haven't been idle in the last 30 years.

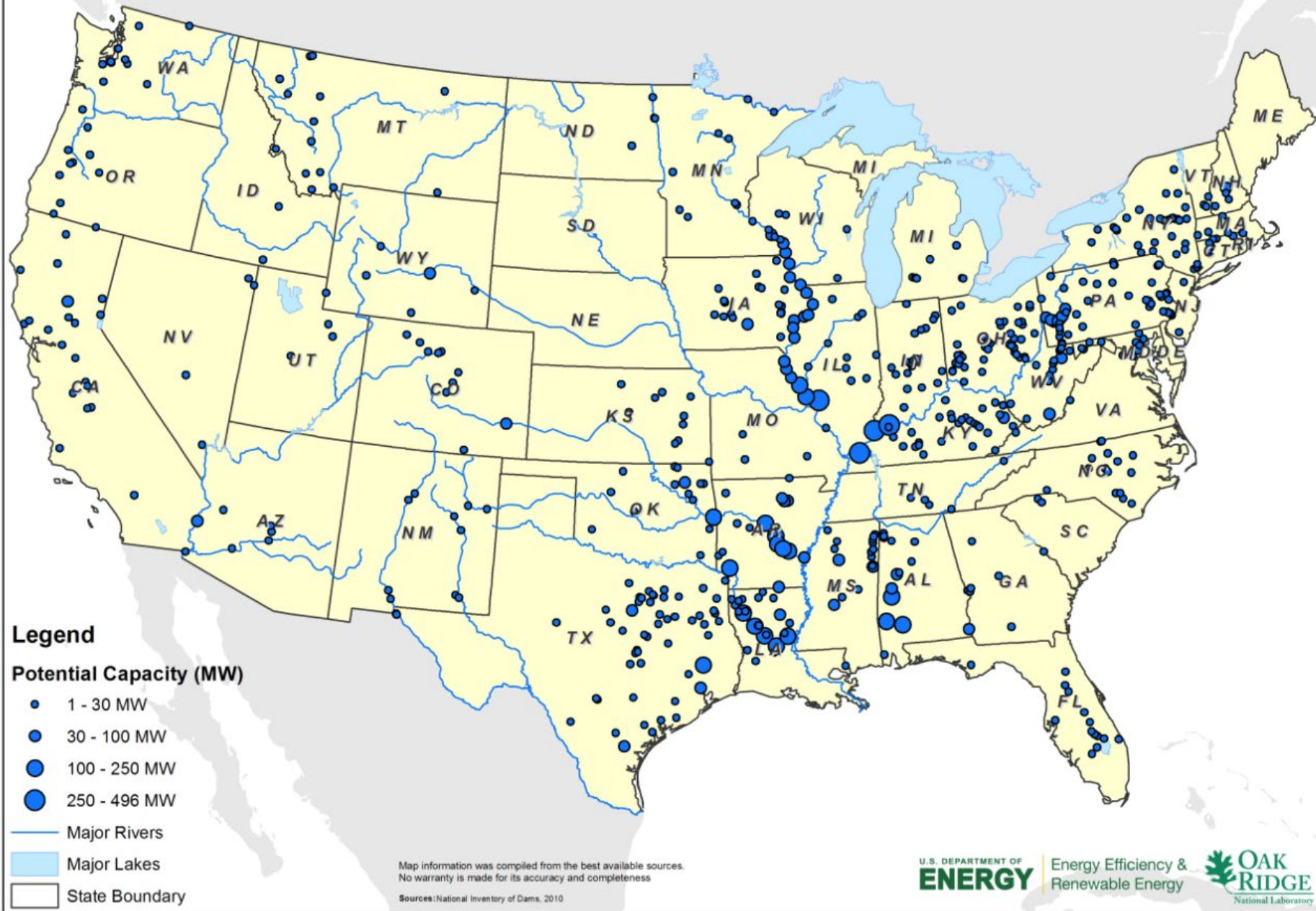


- build new small modular reactors as fast as possible to load-follow, or buffer, the renewables, instead of building new natural gas plants. [SMRs cannot melt down](#) and all the other scary things have been fixed. We haven't been idle in the last 30 years.
- follow the new plan by the National Hydropower Association and the Department of Energy, [to double hydropower](#) over the next few decades, adding 60 GW by 2030, [without building a single new dam](#).

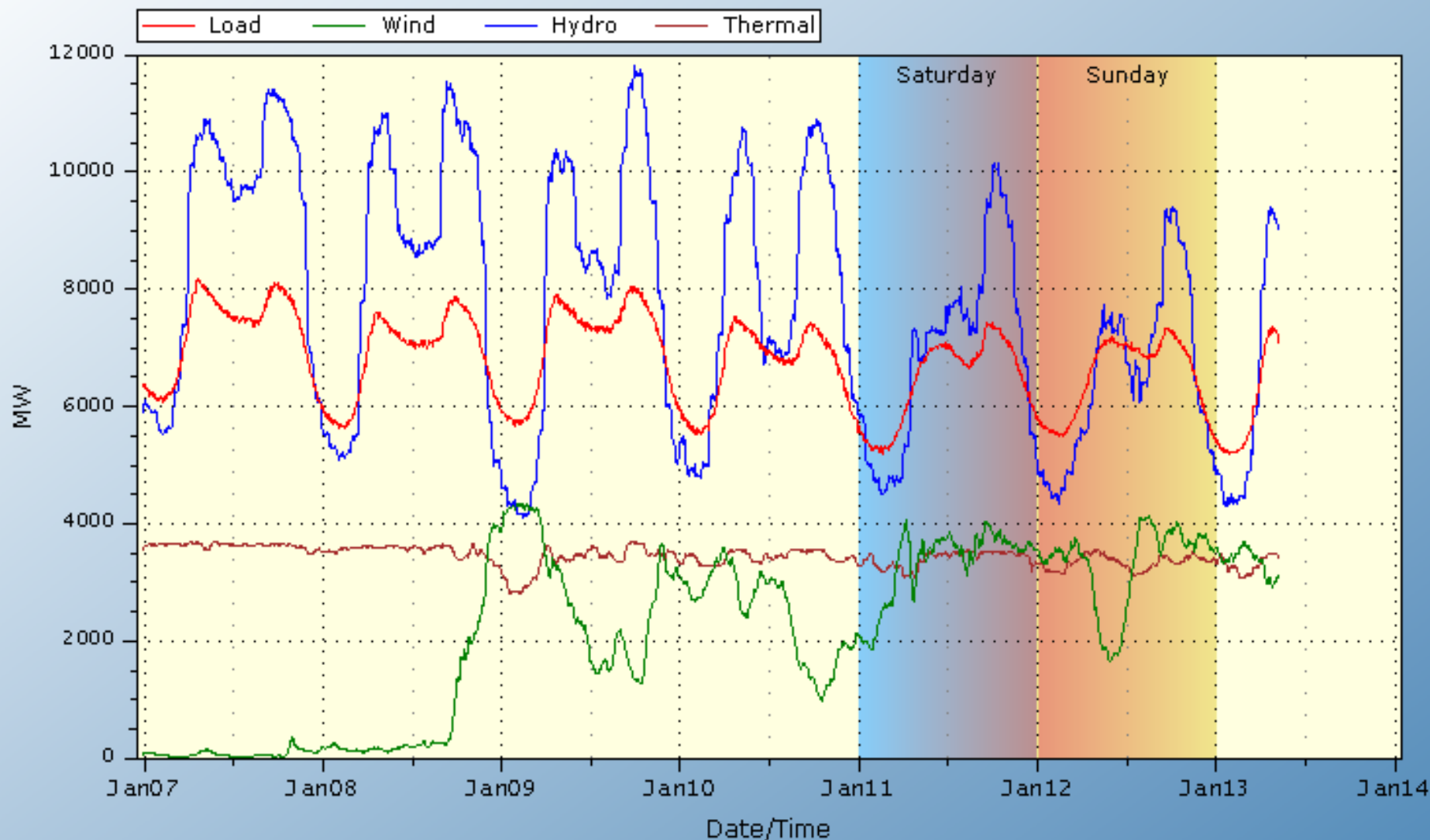
As it turns out, only 3% of American dams generate electricity, so [electrifying existing dams](#) that presently do not produce power, uprating the others to produce more power, and emplacing pumped-hydro storage, will do a lot.



# The Non-Powered Dams with Potential Capacity Greater than 1 MW



BPA Balancing Authority Load & Total Wind, Hydro, and Thermal Generation, Last 7 days  
07Jan2014 - 14Jan2014 (last updated 13Jan2014 08:36:45)



Based on 5-min readings from the BPA SCADA system for points 45583, 79687, 79682, and 79685  
Balancing Authority Load in Red, Wind Gen. in Green, Hydro Gen. in Blue, and Thermal Gen. in Brown  
Click chart for installed capacity info  
BPA Technical Operations (TOT-OpInfo@bpa.gov)

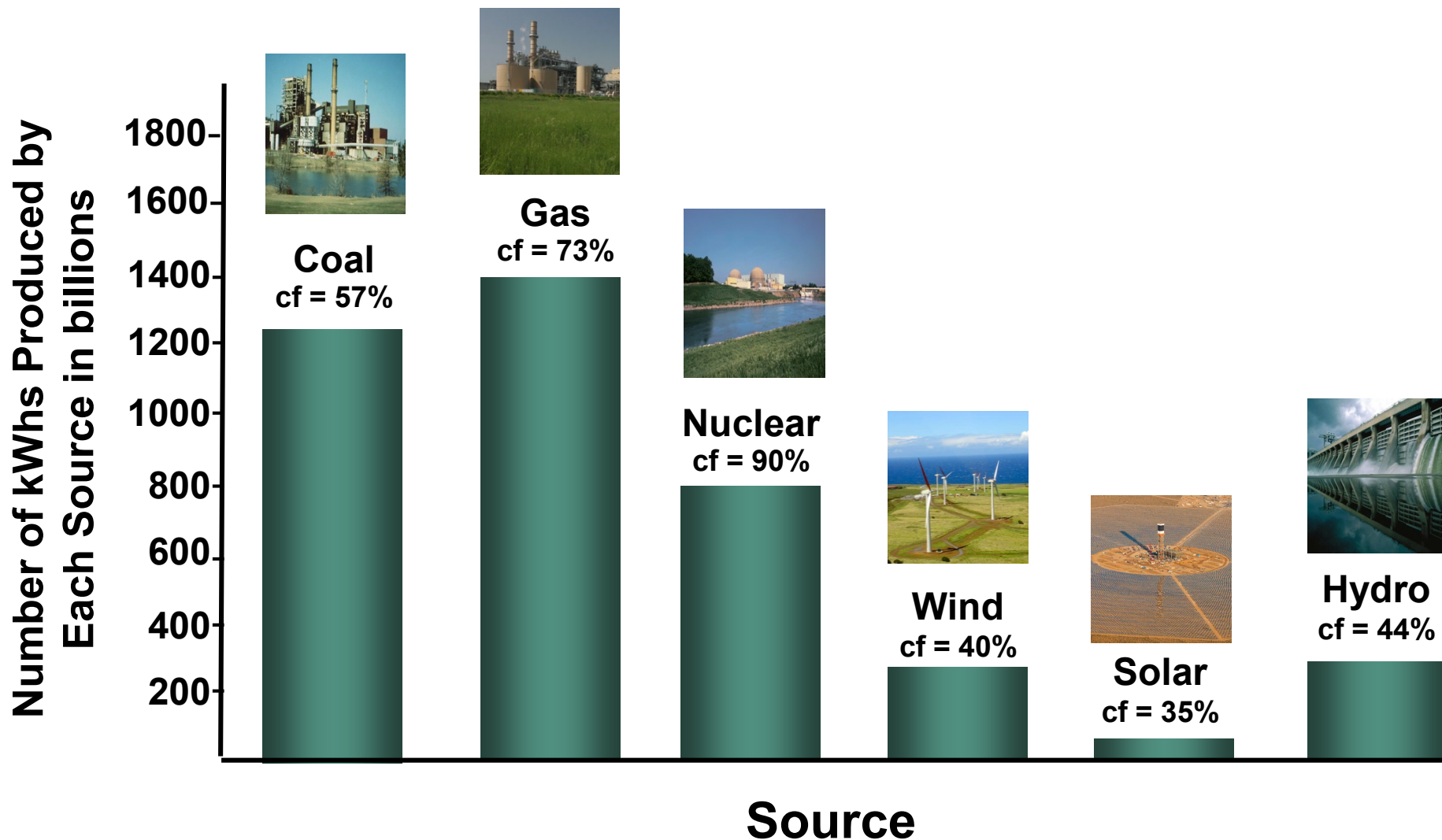


- secure sources of Li, Co, Fe and other metals needed to build the alternatives, especially to [build the batteries](#) for enough [fully electric vehicles](#) to replace oil.
- build a fleet of 150 million fully [electric vehicles by 2040](#) that will significantly reduce our use of oil - much fewer will not sufficiently drop our consumption – and place 100,000 charging stations along all roadways that will be able to service such a national fleet.
- streamline the process to site and approve [high-voltage transmission lines](#). We cannot install this many renewables without them. And make the grid “smart.” Simple but costly.

In America, this Green New Deal plan will require:

- 500,000 new MW of wind turbines (1.75 trillion kWhs/year)
- 200,000 MW new nuclear reactors that are especially [ideal for load-following renewables](#) (1.58 trillion kWhs/year)
- 300,000 new MW of new solar (0.92 trillion kWhs/year)
- 120,000 new MW of hydro w/80,000 MW existing (0.77 tr kWhs/yr)

# ***Present Energy Mix in the United States for a total of 4.2 trillion kWhs***



# ***An Achievable Green New Deal Energy Mix by 2040 in the United States for a total of 5 trillion kWhs***

