

Critique of the Pickens Plan for U.S. Energy in the Next 10 Years

Dennis Silverman

U. C. Irvine

Physics and Astronomy

www.physics.uci.edu/~silverma/

Plan of the Talk

- Introduction to the Plan
 - Wind Power for 22% of Electricity
 - Natural Gas for Cars Replacing 1/3 of Imported Oil
 - Not Directly Addressing Climate Change
- Critique of Wind Power
 - Wind Locations Could be More Dispersed
 - Amount of Turbines is Vast and Will Take Time to Produce
 - Nuclear is Cheaper and More Reliable
 - Wind Power can Produce Electricity to Charge Electric Cars
 - Wind Power can be used to Replace Coal Power
 - Solar Power can also be used
 - Conservation is the most effective line of attack
- Critique of Natural Gas for Automobiles
 - Importation of Natural Gas Needed, with Similar Foreign Sources
 - Natural Gas can Replace Coal Power Instead to Reduce CO₂
 - New Car Emission Regulations for 2020 Will Lessen Use of Petroleum
 - The Plan Abandons Already Constructed Natural Gas Power Plants
 - Requires Natural Gas Distribution Network of Gas Stations

PickensPlan.com

- T. Boone Pickens has proposed a two part plan to help solve the dependence on foreign oil and the vast outflow of national wealth use to pay \$700 billion a year to import 70% of our petroleum.
- The first part of the plan is to use the natural gas which generates 22% of our electricity to instead power cars, and save 1/3 of our oil imports.
- The second related part is to replace that electricity with wind power, mostly from the middle of the US, for a cost of \$1 trillion. An additional \$200 million will be needed to build long distance power lines to appropriate locations.
- While the wind power is a good addition for non-CO2 power, the plan does not change the use of coal for power, nor focus on reducing the use of fossil fuel for transportation, which would accompany an attack directly on climate change.

Comparison of Wind Power with Nuclear Power

- The wind facilities are estimated to cost \$1 trillion for 20% of US electricity.
- This is the amount currently being produced by 100 nuclear power plants.
- Estimates for a standard new nuclear plant, with preapproved design and expedited site approval, is estimated to cost \$4 billion or less.
- Thus a set of 100 new nuclear reactors could only cost \$400 billion, less than half the cost of wind turbines.
- Wind turbines on average only deliver 1/3 of the maximum power for which they are rated at maximum, due to wind fluctuations, weather, and seasonal fluctuations.
- So a standard very large 3 megawatt turbine as described in their plan will only deliver 1 megawatt on average. Thus a gigawatt (1,000 megawatt) nuclear plant, serving about a million people, will require 1,000 of the 3 megawatt wind turbines as an equivalent.
- So the 20% of power produced by wind turbines will require 100,000 of them.
- The \$1 trillion cost estimate means they are estimated to cost \$10 million each.
- Since a megawatt average should serve a thousand households, this averages to \$10,000 per household.
- While nuclear plants operate 24/7 and are on over 90% of the time, wind power is not best for steady power, although the large arrays will help steady this. But wind power still has to be backed up by other power plants. Yet if they are used to charge electric cars, the power can be averaged over 8 hour charging periods.
- Nuclear plants can be built on coasts or rivers near the areas where the power will be used. Fewer than 50 new sites would be needed for the new 100 plants as older sites can be added to, or three reactors could be built at a site.

Production and Siting of New Wind Turbines

- Large 3 megawatt wind turbines contain 8,000 parts.
- US production for the next two years has already been bought by European countries who are ahead of us in wind power deployment.
- The 3 megawatt turbines are on towers 70 m high, with 90 m diameter rotors. That is the length of a football field.
- They need to be spaced 3-5 times in diameter side to side, and 5-10 times diameter in depth. That means each one requires 30-100 football fields (or acres) to itself.
- Two technicians are required to service 8 such turbines. So the 100,000 turbines would require training of 12,000 skilled turbine mechanics. Of course, training would be required for any new energy sources.
- Each gigawatt reactor or fossil fuel power plant equivalent of 1,000 turbines would require about 80 square miles.
- The entire array of 100,000 turbines will require 8,000 square miles.
- Of course, if they can coexist on farms or ranges, this is not that large, about a 100 mile by 100 mile array.
- While siting such large arrays would cause problems in developed coastal or mountain areas, siting on Midwest farms or range would be easier. However, the large, high voltage DC power lines needed to carry such power to the coasts would encounter nimby opposition.

Critique of Diversion of Natural Gas From Electricity Production

- By 2030, about 20% of US natural gas will need to be imported outside of North America, with similar foreign sources to oil and their associated instabilities and undesirable political regimes.
- Instead of using natural gas for autos, it can be used to replace coal power to reduce CO₂, since coal is twice as polluting as natural gas.
- The Pickens Plan abandons already constructed natural gas power plants that generate about 20% of the US power, especially in smog prone cities and states.
- The plan also requires a natural gas distribution network to gas stations, and compression machinery or tanker distribution and holding tanks for compressed natural gas.

A Multifold Approach to Automotive Fossil Fuel Reduction

- The new CAFE standards for 2030 will reduce gasoline usage by 30% in the new vehicle fleets with 35 mpg average, and this can be further improved with hybrid technology beyond that to a 50 mpg average.
- If petroleum remains highly priced, consumers will continue shunning large, wasteful vehicles.
- Consumers will reduce marginal driving as they are starting to do.
- Other approaches to reduce driving will be advancing:
 - public transportation,
 - van pooling,
 - car pooling,
 - working at home,
 - regional work centers,
 - building along public transportation corridors,
 - local shopping strips or centers, etc.
- The advancement of car batteries to make electric cars with sufficient commuting and shopping ranges will use the much more efficient natural gas or even coal generated electricity, or nuclear or renewable sources to lower pollution and displace gasoline.

Summary

- The addition of wind power is useful in reducing global warming, but so are solar and nuclear power as well.
- Replacements for coal plants have to be found also, and natural gas for electricity is still a good source.
- There are many other approaches to reduce petroleum needs in transportation, which can be simultaneously carried out.