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Editorial

Conservation and Efficiency before Transition

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Energy efficiency typically entails modern equipment and investment, while energy conservation most of the times implies actions by individuals and groups without necessarily monetary investments. For example, when five neighbors decide to carpool to work instead of individually driving, it is an energy conservation measure. When homeowners replace their inefficient air-conditioners with ground-source units, and when building owners replace their incandescent bulbs with LEDs, they perform higher efficiency measures. Both types of measures result in energy demand drop, and when such measures are adopted by a large segment of the population, the energy demand decrease can be substantial.

I live in an energy-voracious state, Texas, where the average household consumes more than 13,000 kWh of electricity annually, 26% more than the USA average. And the USA average is almost four times more than the European average, and seven times higher than the Chinese average. The very low energy prices in Texas (and the entire USA) in the past, were disincentives for homeowners and industry to invest in energy efficiency and conservation measures.

The very high electricity demand in Texas (and the entire USA) presents a significant impediment for the transition to renewable electricity—primarily derived from wind and solar, the two renewable energy sources that are available to all nations. Solar energy is periodically variable (the sun does not shine at night) and wind is intermittent. Because of this, the required nominal power capacity of photovoltaics and wind turbines that would replace the current fossil fuel power plants is substantially higher than that of the replaced coal and natural gas units—roughly five times higher for photovoltaics, three times higher for wind turbines. The transition becomes more complicated because the electricity demand follows almost predictable patterns that are determined by the actions of the population. In most time periods the availability of renewable energy does not coincide with the consumers' demand. Energy storage—in very high quantities – is necessary to match the consumers' demand with the supply from wind and solar units. The availability of geothermal energy and hydropower would somehow help, but they are not available in all the parts of the globe. The proliferation of electric vehicles does not help, because they increase the overall electricity demand, and their batteries cannot supply all the energy needed.

A new infrastructure is needed for the transition to renewable electricity and very high investment must be made in solar energy units, wind turbines, and the required energy storage capacity (pumped-hydro, CAES, batteries, hydrogen, etc.) that would ensure the demand-supply balance. This is where energy conservation and efficiency measures can help substantially: The extensive adoption of energy conservation and energy efficiency measures in households and industry has the potential to substantially reduce the electric power demand in all countries with commensurate savings in investments for renewable energy power generation units and storage facilities. In the case of Texas, the adoption of such measures would decrease the investment in additional renewable energy generation units by a factor of 2.9 and the required energy storage capacity by a factor of 2.0. In our opinion, the message for the energy policy drivers should be "energy efficiency and conservation measures before transition".

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