

1. I am advocating much more Storage investment
2. I am advocating Developing hydrogen generation on site at Wind and Solar farms
3. I am suggesting Keeping the gas infrastructure for heating

I am a physicist- engineer and not aligned with any energy interest corporations
But as a concerned citizen knowledgeable of the physics of energy I want to suggest the following:

Solar electricity is extremely intermittent on a best day and non existent for many days. Solar will only be competitive with Hydro electric and Nuclear power if it is supplemented with a large amount of storage such as batteries. The Climate Action Scoping Plan does not seem to address anywhere enough storage, short term and long term. I recommend that: the State support development maybe 100 times the recommended storage to really make solar a dispatchable electric resource.

I would also suggest that wind has a much longer cycle of energy lapse and as such needs a different kind of storage. The production of Hydrogen on site and stored on the field would provide an effective storage medium for long periods of time. Hydrogen can later be used to fire gas turbine generators during off times with low wind.

Another very inexpensive solution to the intermittency of solar and wind is to make available to ALL customers a daily Time-of-Use adjustable rate charged customers. This will cause many customers to adjust their time of use to the very times electricity is most available. With the widely availability of internet to homes and inexpensive thermostats and electronics all customers could easily be provided with the means to choose when the use the major portion of their electric load happens. Charging cars, drying cloths, even electric heat pumps and air conditioners. This is such a less expensive option that the rate structure might be exaggerated so as to optimise our grid.

The phasing out of gas service is, I really think, premature. It would be sufficient to require buildings to be heat pump ready. The reality is that in the next several decades we in New York will still be using close to 30% gas. To power our grid we are limited by the 2nd law of thermodynamics to efficiencies certainly not higher than 60% and probably less than 50% mostly. With the prevalence of high efficiency gas furnaces around 95% it should be clear that gas is best used for heating rather than generating electricity. If we transfer all our heating load in the next few decades we will be transferring the heating load from gas to gas fired electric generation. So, in the colder climates we can expect heat pumps to have a coefficient of performance less than 3 and possibly 2. So we trade 2 times 50% with 95% efficiency. It is not much of a trade advantage and it is much less of a tole on the overtaxed grid. The resiliency of a gas infrastructure which is continually being upgraded to plastic pipe already exists. This provides safety for extreme weather. It has been said that when electricity is out we can't run our furnaces but what is not generally realized is that to run a heat ounp would require a very large emergency generator but a typical gas furnace could

run on a fairly small home generator using few gallons of gasoline for the duration of the power outage.

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