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To:
The New Jersey 2019 Energy Master Plan
Clean and Renewable Power Sub-Committee
N.J. Board of Public Utilities
401 State Street
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NJ 2019 Energy Master Plan Clean and Renewable Power Sub-Committee

Questions:

1. For the purposes of the Energy Master Plan (EMP) and reaching Governor Murphy's goal of 100% clean energy usage in New Jersey by 2050, how should clean energy be defined?

Answer:

A meaningful definition would be:

Clean energy is Heat or Power whose combined CO₂ emissions from both its production and use is net-zero (or negative).

So defined,

the use of clean energy having net-zero CO₂ emission signature does not intrinsically cause global warming,

while

the use of clean energy having negative CO₂ emission signature helps reduce global warming.

Examples of public utility-delivered **energy that is not clean** are:

- (a) grid electricity produced by combustion of fossil fuels (NG, coal, oil, etc) .
- (b) grid electricity produced by combustion of municipal hydrocarbon waste.
- (c) heat produced by burning of pipeline-delivered fossil natural gas.

while examples of public utility-delivered energy **that is clean** are:

- (a) grid electricity produced via natural gas (CH₄) dissociation to hydrogen (H₂) + carbon (C), whereby
 - i. the gaseous H₂ powers internal combustion engines (ICE) and turbines to generate electricity with no companion CO₂ emissions, and
 - ii. solid carbon is
 - collected and deposited in local soils for improved plant yield, or
 - collected and sold as precursor feedstock for advanced carbon-based materials.
- (b) heat produced by burning of pipeline-delivered renewable natural gas (RNG).

This energy is clean since the CO₂ emitted during combustion equals the CO₂ extracted from the atmosphere (or oceans) by living plants to produce this RNG.

2. Should the definition of clean energy contain flexibility between now and 2050 to allow for transitional fuels to be used and phased out over time?

Answer:

We have no choice.

We must use low CO₂-emission transitional fuels to meet mankind's heat and power needs (with companion global warming consequences) until replacement clean energy solutions are identified and broadly implemented over the next several decades,

This is why, for instance, NJ State has recently legislated Nuclear Diversity Credits, now paid by EDC ratepayers to NJ nuclear power plant owners, to continue to operate their low CO₂ emission nuclear plants, despite the longer term goal to close these plants down.

The fact that natural gas, when combusted, produces less CO₂ emissions/Kw-hr of generated electricity than other power plant (coal, oil) and transportation (oil) fossil fuels, together with its

- widespread abundance, and
- low unit cost

make natural gas an important transition fuel for use during our 2018-2050 transition to clean heat and power.

However, it is important to realize that NG (CH₄), when properly dissociated within an anaerobic environment (rather than combusted in air), produces clean heat and electricity (and valuable solid carbon by-product for manufacturing advanced carbon materials), without companion global warming damage.

Consequently,

Fossil NG is a longer term (multi-century) candidate transition fuel¹ for meeting mankind's upcoming energy and advanced structural material needs.

3. What is the most significant obstacle to getting to 100% clean energy by 2050?

Answer:

Past investments, and existing energy stakeholder revenue streams.

Mankind is wired to resist losses (i.e., "loss aversion"), more than to seek gains, even if it's to society's long-term best interest to do so.²

Neither the State nor the Federal Government should use government policy and tax incentives to discriminate between competing technology solutions. Such actions, although intended for the greater societal good, in reality, stack the deck against private financial investment and pursuit of

¹ which can be replaced gradually by renewable natural gas (RNG) and synthetic methane.

²Steven Johnson, *Farsighted - How We Make Decisions That Matter the Most*, New York, River Head Books, 2018, pg 40.

viable, potentially superior solutions that otherwise become unachievable if excluded from free market competition and dynamics.

4. How can the State address it?

Answer:

Adequate State Societal Benefit funds should be awarded each year to enable one or more applicant teams of university researchers, scientists, professional engineers, and project administrators to

complete the R&D and system integration tasks needed to prototype and field-trial specific high CO₂ emission reduction solutions having 2030 (or earlier) NJ roll-out potential,

regardless of whether success will jeopardize the future revenue streams of existing higher CO₂ emission energy assets.

The State should likewise assist interested parties in these validated solutions to seek the private equity and additional partners necessary for its successful commercialization and NJ roll-out.