

Lysander Data Center Advisory Committee Meeting

September 25th, 2026

Electricity Concerns

Electricity Concerns from the spreadsheet

- Electricity overall priority: 2.4
 - Electricity Usage/Brown Outs/Capacity 2.8
 - Battery Storage 1.8
 - Nuclear Power generation onsite 2.1
 - Generator Usage 2.4
- also covered in other areas
 - Who pays for Infrastructure upgrades? 3.0



Background:

- We already recommend that any water infrastructure upgrades for the project be paid for by the developer
- The planning board typically requires developers to pay for any required infrastructure additions
- The town does not manage or maintain the electric grid or electricity prices in any way
- The town has an existing moratorium on Battery Energy Storage Systems (BESS)
- The town is actively working on updating its BESS ordinance



Background:

- The town can designate that any on-site or “behind the meter” electrical power generation over a specific threshold (say 5 Megawatts) is a separate, or prohibited land use
- The town can explicitly limit on-site electrical power generation to emergency battery storage and generators meant solely for temporary use during blackouts
- The town can mandate security perimeters for high voltage generation or specialized fuel systems
- The town may be able to restrict high voltage transmission switch yards within the zone
- Existing town code (320-51) "There shall be no activities which emit radioactivity dangerous to health or adversely affecting the operation of any equipment."



Town vs Others Responsibilities

- New York Independent System Operator (NYISO) operates New York's high-voltage electric grid, runs competitive wholesale electricity markets, and plans for the state's future power needs
- New York Power Authority and companies like Constellation Energy own and operate the actual power generation plants
- National Grid owns the wires and delivers power to the end users, they do not generate the power
- The Public Service Commission (PSC) sets delivery charges, Service Classifications, and demand caps
- NYISO sets the supply charges



Town vs Others Responsibilities

- The town has no say in power delivery or rates
- The DEC has the authority to regulate generator air emissions, fuel types, and fuel storage
- The town can regulate the use of generators, including size, operating hours (outside of emergencies), setbacks, noise, etc. through code
- While the DEC regulates generator emissions, the town can influence generator types and pollution through the Planning Board SEQRA process



On-Site Power

On-Site Backup Power and Generation

- Generators
 - Diesel
 - Natural Gas
 - bi-fuel
- Gas Turbines
- Battery Energy Storage System (BESS)
- Fuel Cells
- Nuclear, or Small Modular Reactor (SMR)



Background:

- There are two separate major power transmission lines crossing at the site
 - The second transmission line may mitigate the need for additional back up power, but that is unlikely
- There is a large Natural Gas main running beneath the proposed data center site
- NRC guidelines for population density would prevent a large scale nuclear reactor at this site based on the combined population of Lysander, Van Buren, Salina, and Clay



Battery Energy Storage Systems (BESS)

- BESS (in general)
 - PROs
 - Far less Air Pollution than generators
 - Can help stabilize the grid
 - Provides an additional revenue source
 - CONs
 - Cooling fans generate constant sound
 - Electrical components generate a low frequency hum (60 Hz)
 - Too expensive to run as a backup only solution
 - 2-4 Hour backup capacity
 - Requires an Energy Management System (EMS)



Image source: azom.com



Battery Energy Storage Systems (BESS)

- **Lithium Iron Phosphate**

- PROs

- Industry Standard for BESS at this scale
 - Can handle a high number of charge/discharge cycles
 - Low risk of thermal runaway
 - Lower cost than other BESS options
 - 6000 cycles

- CONs

- Lithium fires are poisonous and cannot be easily extinguished
 - Would require about 4 acres for 270MW backup system
 - Requires active cooling (fans)
 - Temperature Sensitive
 - Less efficient in freezing weather



Image source: azom.com



Battery Energy Storage Systems (BESS)

- **Nickel Manganese Cobalt (NMC)** - Also a Lithium Ion Battery

- PROs

- Higher power to energy density
- Takes up less space (1-2 acres)
- Less affected by cold temperatures

- CONs

- Higher risk of thermal runaway
- Requires better fire suppression due to internal oxygen release
- These fires cannot be smothered
- These fires are very difficult to contain to a single cell
 - Fires release explosive and deadly toxic chemicals (H₂, CO, and HF) to the atmosphere
 - Batteries last about 1/3 as long as Lithium Iron Phosphate batteries
 - Requires active cooling (fans)
 - Temperature Sensitive
- High heat accelerates battery degradation even more



Image source: azom.com



Battery Energy Storage Systems (BESS)

- Sodium Ion
- PROs
 - Uses readily available chemicals (Salt)
 - No thermal runaway
 - Does not require active cooling – no cooling fans
 - 90+% efficient in freezing weather
 - Same cost as Lithium Ion
- CONS
 - Factories have no capacity available until late 2027
 - Would require about 6 acres
 - Cells require faster replacement (4000 cycles vs 6000)
 - May contain some PFAs, depending on brand



Image source: azom.com



Battery Energy Storage Systems (BESS)

- Nickel Hydrogen

- PROs

- No toxic chemicals
 - 100% fireproof
 - 30,000+ cycles
 - Passive cooling (no fans)
 - Unaffected by cold temperatures
 - Requires 4-5 acres

- CONS

- Only 75-80% efficient (Lithium Ion is 90+% efficient)
 - Very Long Lead Times
 - 44% higher startup costs than lithium ion



Image source: azom.com



Battery Energy Storage Systems (BESS)

- **Flow Batteries**

- **PROs**

- Thermal runaway cannot happen because of water based reagents
- Iron chloride poses “zero chemical toxicity” to local flora and fauna
- 15,000+ cycles

- **CONs**

- Requires large tanks holding millions of gallons of liquid electrolyte (Iron chloride is most common, but Vanadium Pentoxide is sometimes used)
- Requires secondary holding tanks in case of system leaks
- Takes up about 25 acres, so significantly more than other battery solutions
- Significantly more expensive than other battery solutions
- Slow startup times (must pump the liquids to start the reaction)
- Very long lead times for these systems



Hybrid Backup Power Solutions

- Generators with BESS

- PROs

- Reduces the number of generators required
 - Reduces overall noise
 - Reduces emissions
 - Lowers Fuel costs
 - The number of natural gas generators are reduced by about 20%
 - Reduces generator testing time and frequency of tests (50%-75% reduction)
 - BESS eliminates the need to perform “emergency transient” testing, which is the primary driver for frequent generator testing

- CONS

- ***Highly dependent on EMS to perform flawlessly***
 - Higher up front costs since there are two separate systems



Image source: PowerLink Energy US



Fuel Cells

- Fuel cells all work the same way
 - Fuel is pumped to the negative side of the cell (the Anode)
 - The Anode is coated with a catalyst to chemically separate the fuel into a positively charged ion and a negatively charged electron
 - The ions pass through the middle layer (the Electrolyte) to the positive side of the cell (the Cathode)
 - The electrons can't make it through the electrolyte, so they take an alternate path through a wire, creating the electric current
 - At the other end of the wire the electrons hit the cathode which is coated with a different catalyst. That catalyst allows the electrons to re-join with the ions and oxygen from the atmosphere, making water and heat as byproducts (and CO₂ depending on the fuel type)

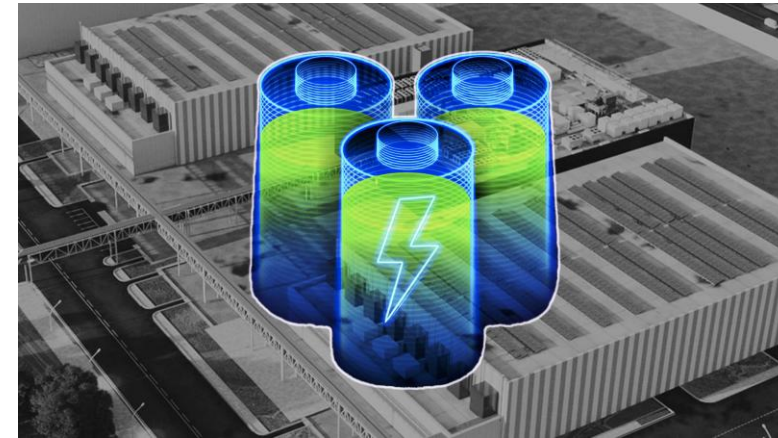


Image source: DataCenterKnowledge.com



Fuel Cells

- Solid Oxide Fuel Cells (SOFC)
- Molten Carbonate Fuel Cells (MCFC)
- Proton Exchange Membrane (PEM)
- Linear Generators (not a fuel cell)
- PROs
 - Near-Silent power solutions
 - No combustion, so reduced emissions concerns
 - Heat output can be used to cool the data center (absorption chiller loop)*
- CONs
 - 3 to 5 times the upfront costs compared to diesel generators
 - Slow to react to electricity demand spikes, most require BESS
 - 5 to 7 year replacement cycle
 - Highly susceptible to impurities in the natural gas supply
- Requires extensive filtration and pretreatment of natural gas supply
- Adds another ½ acre of equipment
 - Only 50 – 55% efficient electricity generation*

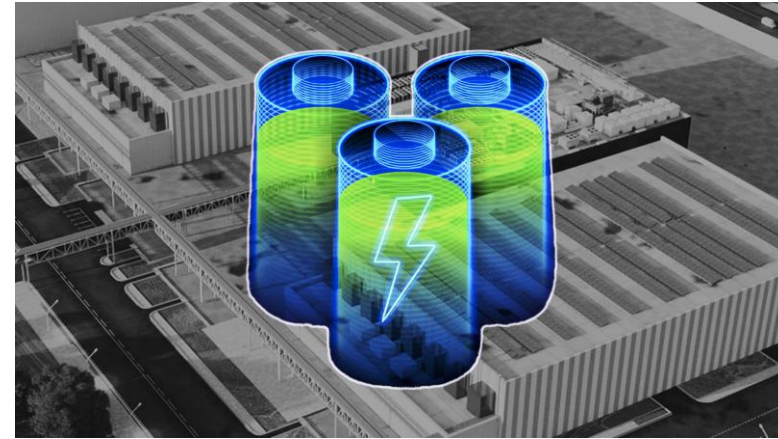


Image source: DataCenterKnowledge.com



Absorption Chiller Loop (powered by fuel cell waste heat)

- Generally, they run on water and a Lithium Bromide solution
- Just like other cooling solutions, they work on the principle that heat is taken from the system as water evaporates
 - Cold water takes heat from the data center and becomes water vapor (in a vacuum chamber to reduce the boiling point)
 - Lithium bromide absorbs the water vapor
 - Heat from the fuel cell is used to release the water from the lithium bromide
 - The released water vapor goes through radiators with fans to be cooled and condensed to liquid
 - The process repeats
- This solution assumes a behind the meter deployment of fuel cells
- This solution increases overall Fuel Cell efficiency up to 75% or 85%
- This solution moves the cooling fans from the data center roof to the ground near the fuel cells

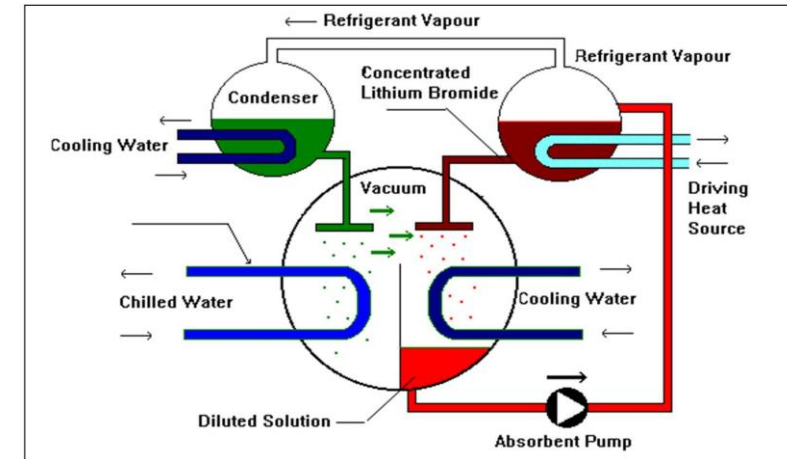


Image source: thermaxcooling.wordpress.com



Fuel Cells

- **Solid Oxide Fuel Cells (SOFC)**
- PROs
 - Only requires 3-5 acres
 - Direct DC power, no rectifier circuit required
 - Does not contain acids, corrosive fluids, or PFAs
 - Zero risk of leaks or spills
- CONS
 - Contains trace amounts of heavy metals and other hazardous elements bound to the ceramic cores (these are solids)
 - Not a backup power solution



Image source: bloomenergy.com



Fuel Cells

- **Molten Carbonate Fuel Cells (MCFC)**
 - PROs
 - Direct DC power, no rectifier circuit required
 - Somewhat more tolerant of Natural Gas impurities
 - Consumes CO₂ leading to reduced carbon emissions
 - A more mature technology
 - CONS
 - Requires 6 – 8 acres
 - Prone to pipe corrosion and fluid loss
 - Requires a source of CO₂ to maintain the reaction
 - Very slow to react to demand spikes
 - Not a backup power solution



Image source: fuelcellenergy.com



Fuel Cells

- **Proton Exchange Membrane (PEM)**

- PROs

- Works best as an on-demand energy source
- Direct DC power, no rectifier circuit required
- Designed for frequent start/stop cycles
- Emissions are warm water vapor only
- This can be a backup power solution

- CONS

- Requires on-site storage of a million gallons of liquid hydrogen
- Significantly more expensive than diesel generators
- Requires about 40 acres
- The membrane for this type of fuel cell relies on fluoropolymer plastics (a source of PFAs)

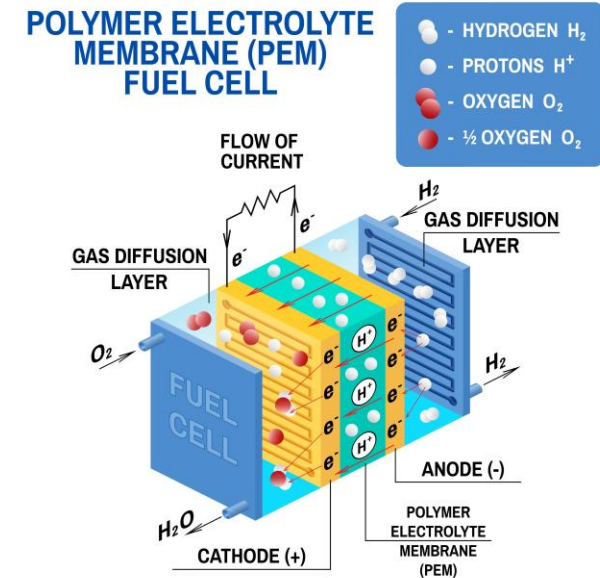


Image source: 123rf.com



Fuel Cells

- **Linear Generators (not actually fuel cells)**
 - Electricity is generated by magnets moving through coils
 - Fuel and air are compressed until the pressure causes a non-combustion chemical reaction that pushes a piston
 - Air Springs push the piston back to repeat the cycle
 - PROs
 - No combustion, so very few emissions
 - Very quick reaction times, BESS size can be reduced
 - This can be backup power solution
 - CONs
 - Only about 45% efficient
 - Not as good with absorption chillers
 - Outputs AC power, so a rectifier is required
 - Not as quiet as fuel cells
 - Requires 17 acres
 - Only one supplier for this technology



Image source: mainspringenergy.com



Fuel Cell Issues

- **Fuel Cells for backup power only**
 - This option does not allow for the heat to be used with absorption chillers
 - Only PEM and Linear Generators can be used as a backup power solution, but neither is ideal for this site
 - PEM takes up too much space and requires on site storage of a million gallons of liquid hydrogen
 - Linear generators also take up too much space and the 108 units required for a 270 MW data center would produce about 85 decibels
- **Fuel Cells for Behind the Meter power**
 - SOFC is the industry standard for this option
 - This option allows using the fuel cell heat to power absorption chillers
 - All of the fuel cell types using Natural Gas as their fuel don't meet NY state clean energy guidelines due to CO2 emissions.
 - Not an issue if Hydrogen gas is used, but the infrastructure doesn't exist for this.
 - A possible compromise is if National Grid does hydrogen blending in the future



Additional Recommendations

Battery Storage Recommendations

- Recommend approval of Sodium Ion or Nickel Hydrogen BESS, but not Lithium Ion systems
 - No risk of thermal runaway
 - No cooling fans required
 - They work better in CNY winters
- If generators are used, require them to be used with an adequately sized BESS system
 - The addition of a BESS reduces the testing time and cycles for the generators
 - The BESS reduces the overall number of generators required, reducing noise, air pollution, and fuel storage requirements



Fuel Cell Recommendations

- ***Recommend waiting until hydrogen blending is a reality before allowing fuel cells*** as a behind the meter solution. After that:
 - Recommend requiring carbon scrubbers for behind the meter applications
 - Recommend the use of Solid Oxide Fuel Cells instead of generators for new builds
 - No noise
 - No thermal runaway risk
 - No combustion emissions
 - No runoff risk
 - Recommend that Fuel Cell waste heat be used to cool the data center via Absorption Chillers (or equivalent) and a closed loop cooling system
 - Increases overall power efficiency
 - Reduces the overall waste heat emitted by the site
 - Moves cooling fans from the roof of the data center
 - Recommend SOFC Fuel Cells be used in combination with a Sodium Ion BESS
 - Allows fuel cells to run at optimum efficiency while BESS handles spikes in demand
 - This combination minimizes noise, pollution, and safety risks



Next Steps

Next Steps

- Begin talking about Environmental Concerns
 - What did we miss?
 - What needs clarification?



Thank You