

Net Zero Carbon and the Silver Bullet

As facilities look to achieve their zero-carbon targets, there is no one easy solution. But a combination of on-site initiatives can make a difference.

Today, about a fifth of the world's largest companies have committed to net-zero <u>targets</u>. However, a <u>study</u> of 25 major corporations suggests that many are falling behind on their goals. Clearly, the challenge is formidable regardless of intentions.

For facilities looking to reduce their carbon emissions, there is no "silver bullet" solution.

No single technology can get a facility to net zero:

- Efficiency upgrades have only incremental impact
- Solar only produces electricity (and only during the day), doesn't reduce boiler usage, and requires significant space
- Solar plus batteries is still too expensive to be practical
- CHP and fuel cells still use natural gas as an input
- Hydrogen as a fuel has limited availability
- Carbon offsets don't impact site usage and are falling out of favor

These challenges certainly exist. However, just because there isn't a silver bullet doesn't mean it's not worth getting started. Unison Energy recommends taking a Kaizen or continuous improvement approach.

To start, efficiency improvements on site, such as VFDs, more efficient boilers, controls upgrades, and LED lighting, all have an impact. For a larger scale impact, it's worth looking at options like renewables, combined heat and power (CHP), and fuel cells. Depending on your facility type, <u>one or several of these technologies</u> can help you achieve your ESG goals.

Renewables: Zero emissions, but does not cover full electric load

Renewable technologies, most commonly on-site solar arrays, can typically supply about 15% of a facility's power and are helpful for covering peak electricity needs during the day. They can reduce on-site emissions by at least 10-20%.

Facility space constraints typically limit on-site solar capacity. Batteries can help extend solar capacity, but overcoming intermittency requires 8x the solar generation and 16x the battery supply. In addition, batteries rely on non-renewable lithium and are still too expensive to be a large-scale solution.

Another notable limiting factor is that renewables produce only electricity and can't help a facility reduce emissions associated with boiler usage and other <u>thermal needs</u>.

Cogeneration: Largest reduction in emissions, natural gas as a transition to alternative fuels

On-site cogeneration systems that use natural gas can directly cut a facility's emissions by 30-40%, especially for facilities with high thermal usage.

Cogeneration systems burn natural gas to produce electricity and thermal energy, making them up to 80% efficient. A CHP natural gas turbine or engine produces electricity while the system captures the waste heat from exhaust and coolant, providing the facility with hot water or steam.

By using the waste heat from the system, facilities reduce boiler usage and therefore natural gas consumption on site. Cogeneration systems run continuously to lower a site's grid usage. What's more, if a grid outage occurs the microgrid enters <u>island mode</u> to keep the power on and the facility operational.

Comparing Solutions for Reducing Emissions

	Solar / BEES	CHP	Fuel Cell	Carbon Offsets / Virtual PPAs
On-site CO ₂ Reductions	10 — 20% ¹	30 — 40% ²	Approx. 20% ³	NONE
Facility Energy Support	Dependent on space limitations Excludes boiler usage Best used to cover daytime usage peaks Intermittent depending on weather	Sizes to provide electricity and thermal Runs continuously to lower grid usage Supports 100% of site usage during grid outages	Sizes to provide electricity Runs continuously to lower grid usage Supports 100% of site usage during grid outages	NONE
Limitations	Overcoming intermittency requires 5 acres per MW To cover 1 MW for 24 hours requires 8 MW of solar and 16 MWh of battery ⁴ Batteries require expensive, non-renewable lithium	Utilizes natural gas Biofuels and hydrogen are alternative fuel sources but aren't widely available yet Carbon capture and sequestration emerging as viable option but technology is still evolving	Requires natural gas Biofuels and hydrogen are alternative fuel sources but aren't widely available yet Limited thermal application	Purely a financial transaction Does not address on-site energy usage

In combination with technologies like solar, a CHP-based microgrid could offer up to 40-60% CO_2 reductions. Cogeneration systems provide a path to further reductions since they can be configured to use <u>biofuels or hydrogen</u> instead of natural gas as these low-carbon alternatives become more accessible.

Additionally, the <u>Inflation Reduction Act</u> provides significant financial incentives for carbon capture and sequestration. Carbon capture technology has been used for decades (just think of the CO₂ in your favorite soft drink). These technologies are rapidly being modularized for use with CHP systems and will take facilities to almost zero carbon if they have access to sequestration sites or industrial usage.

Fuel Cells: High efficiency with no combustion, but uses natural gas

Fuel cells can typically cut a site's emissions by about 20% and are about 50% efficient. A fuel cell can run continuously to lower a facility's grid usage, and if sized correctly it can provide both electricity and thermal capabilities. While fuel cells don't *burn* natural gas, and therefore don't emit NOx, SOx, or other pollutants, they do utilize fossil fuels in a chemical reaction, and therefore do cause CO₂ emissions. However, it may be possible to incorporate alternative low-carbon fuel sources as they become more feasible.

Carbon Offsets and Virtual PPAs: Good publicity, but does not address on-site emissions

As purely financial transactions, these solutions do not support facility energy needs and don't allow for any on-site emission reductions. Nonetheless, these are popular options for facilities that want to get started quickly.

To get your money's worth, it's important to ensure that carbon offset vendors offer fully credible CO₂ reductions. Another popular option, virtual PPAs, are contracts where power buyers purchase the production of renewable energy, though they don't actually utilize this energy. This often looks good in announcements but papers over the hard changes required to make a real difference at the facility. Additionally, it is difficult to confirm that these offsets are truly having an impact, which is why these arrangements are falling out of favor. Our <u>recent article</u> outlines the challenges with virtual PPAs and carbon offsets, as highlighted in multiple <u>Wall Street Journal</u> pieces.

Taking Steps Toward Net Zero: No silver bullet exists, but there is a path forward

For facilities looking to take real steps toward their carbon pledges, there is no silver bullet solution. However, there are ways to make real, significant steps toward reducing emissions. To take meaningful action, a site can:



To read more about the five steps facilities can take to approach net zero, see our related article.

To learn more about how a cogeneration-based microgrid can help your facility reduce emissions, please contact our sales team at sales@unisonenergy.com or visit us at unisonenergy.com.