

Bloomenergy®



ALWAYON MICROGRIDS

# ENABLING WWTPS TO LEAD AIR POLLUTION REDUCITON & DECARBONIZATION

OUR MISSION

# MAKE CLEAN, RELIABLE ENERGY AFFORDABLE FOR EVERYONE IN THE WORLD

Bloomenergy®

## World Leader in Fuel Cell Technology with scale and experience

~\$1bn

2021 Revenue.  
More than all other fuel cell companies combined

30% CAGR

Over last decade

~\$5bn

In project financing raised

~650MW

Installed Base  
Across 700 sites in 4 countries

>\$650mm

Cumulative R&D with 364 patents

Select customers



Morgan Stanley



EQUINIX

Caltech



KAISER PERMANENTE

Select partners

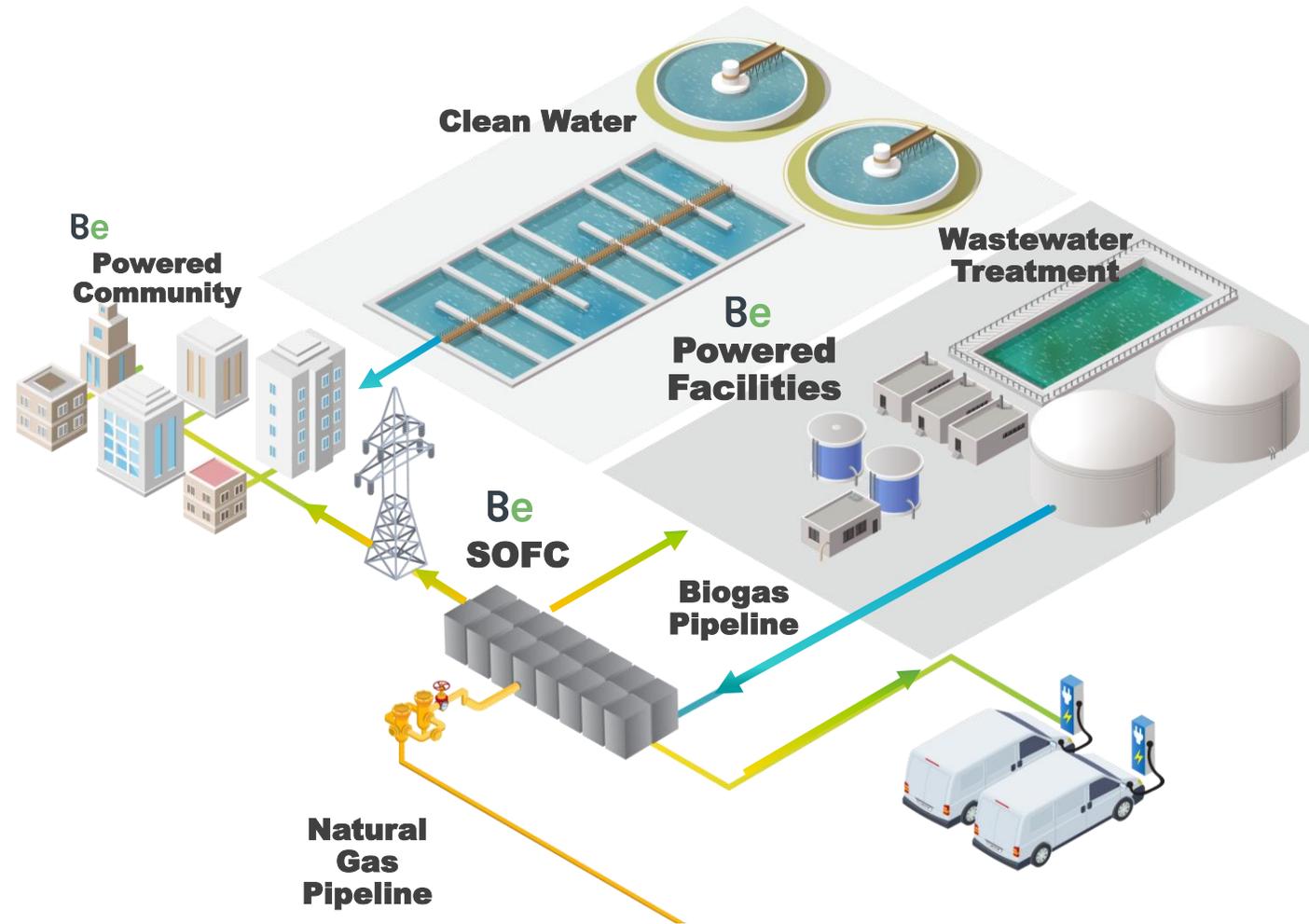


SAMSUNG HEAVY INDUSTRIES

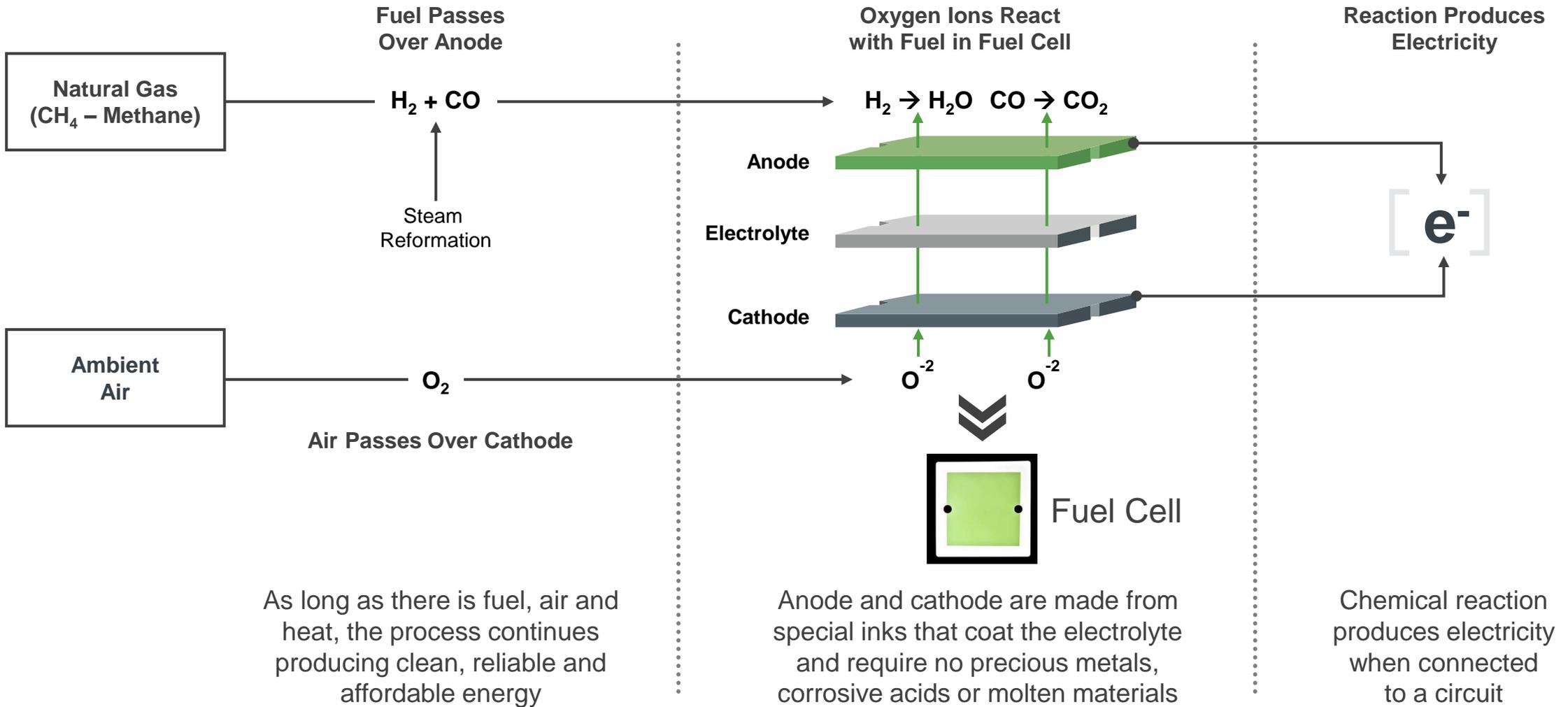


# SUMMARY

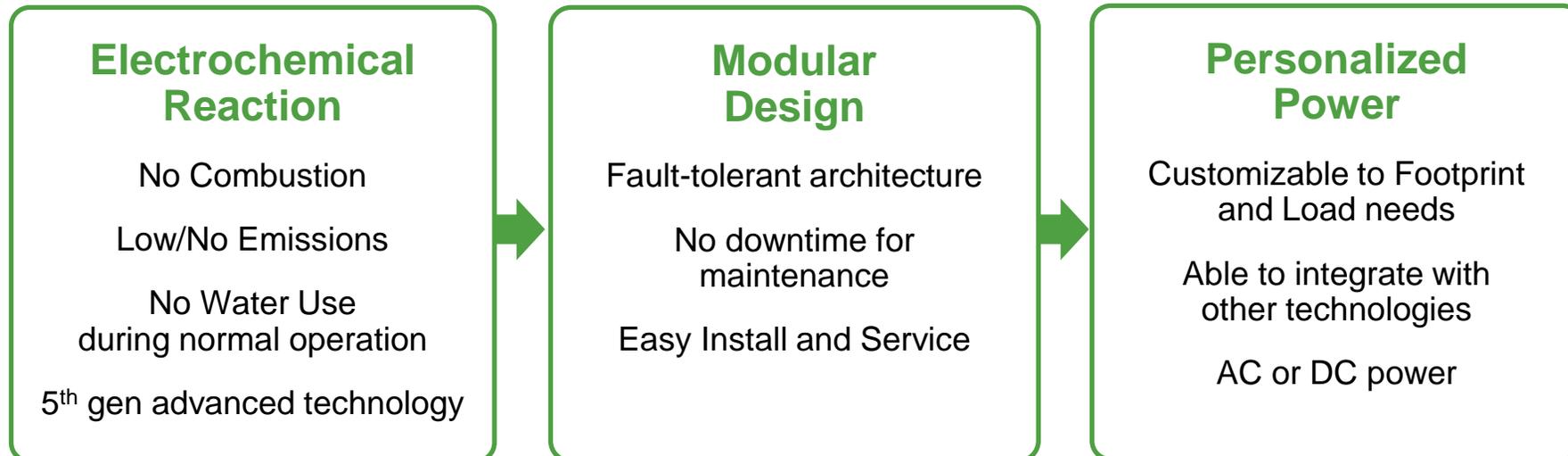
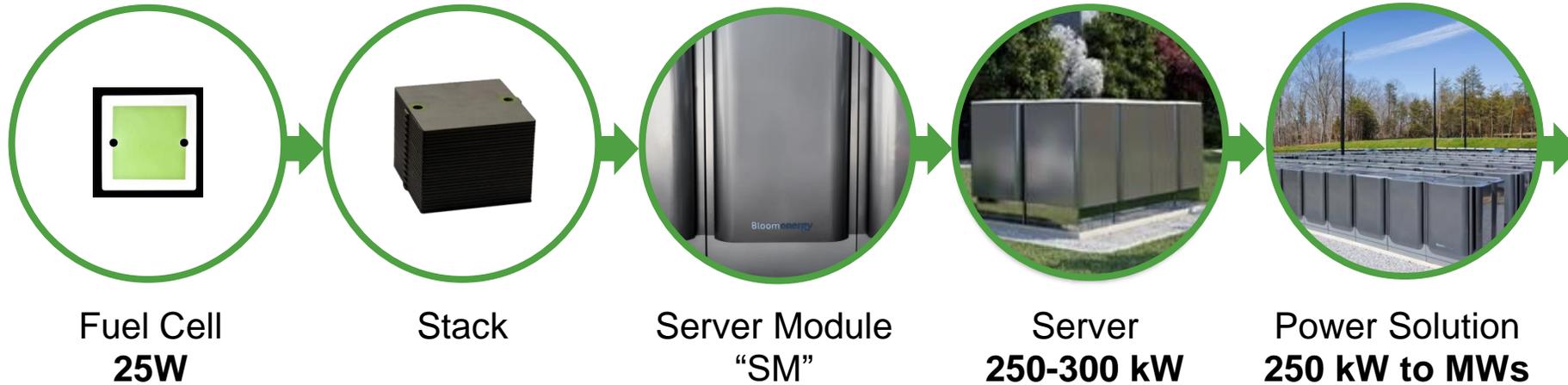
- Bloom's industry leading technology is the cleanest and most optimal way to use WWTP generated biogas – **eliminating local air pollution by 99%** vs flaring or combustion generation
- Bloom's industry leading efficiency can generate **~40% more electricity** from the WWTP biogas compared to conventional sources, potentially making the WWTP a **net exporter of zero carbon electricity**
- Bloom's AlwaysON Microgrids can **increase the energy resiliency** of the WWTP and the local community
- Attractive 20 year PPA offering at **~10c/kWh** (with 2% annual escalator) with **no technology risk** on the WWTP



# HOW A BLOOM FUEL CELL WORKS?



# BLOOM ENERGY SERVER ARCHITECTURE



# PROVEN ACROSS MULTIPLE SIZE DEPLOYMENTS



Hwasung, Korea  
20MW Utility Scale



Kaiser Permanente, CA  
5MW Hospital



Delmarva Power, Red Lion DE  
27MW Transmission substation



The Home Depot, 200 - 250kW deployments  
across 100+ locations



Long Island Power Authority, Medford NY  
6MW "Power Tower"



Walmart, 300 – 600kW deployments across  
several locations

# A PLATFORM FOR RESILIENT POWER PROVEN IN THE FIELD



## HURRICANES



“Bloom Energy electrical project in New Castle was **unaffected** by Hurricane Sandy.”

–Delmarva, Regional President



## EARTHQUAKES



Magnitude: 6.0 Earthquake  
1 MW Bloom **Unaffected**



## UTILITY OUTAGES



Bloom **protects** against major utility fault



## PHYSICAL DAMAGE



Independent system architecture **continues operations** through disruptions



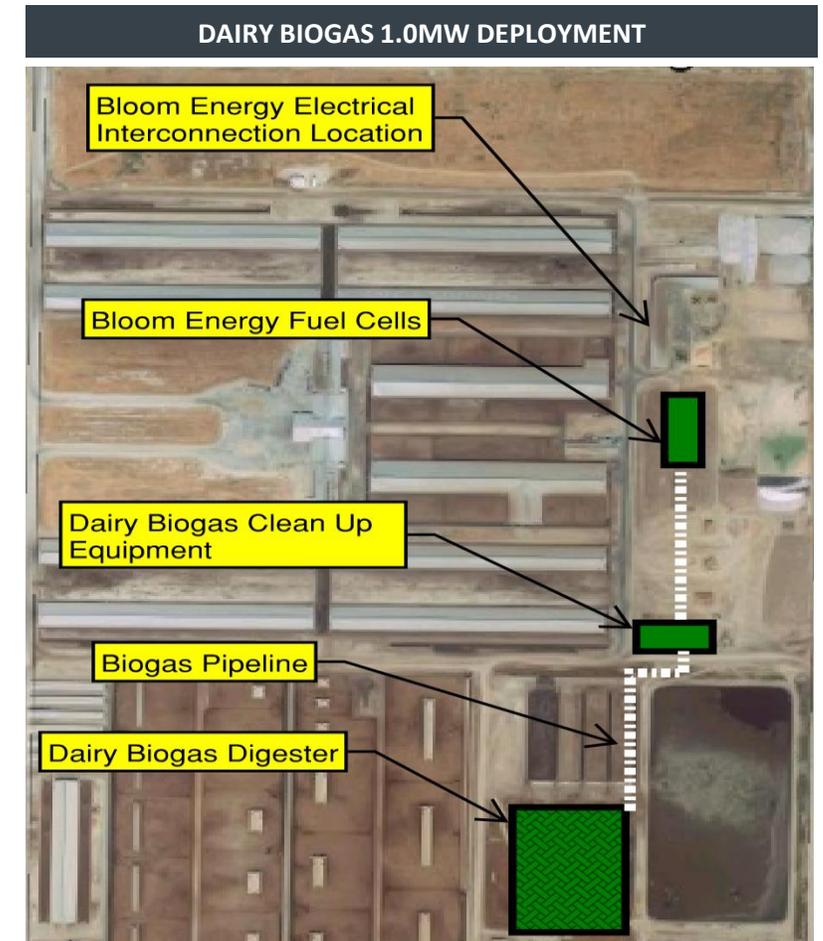
## FIRE DAMAGE



**Demonstrated resilience** through historic CA wildfire

**BLOOM'S PLATFORM HAS PROTECTED CUSTOMERS FROM THOUSANDS OF GRID EVENTS**

# ONSITE BIOGAS TO POWER: TWO COMMERCIAL PROJECTS COMPLETED WITH EXTREMELY LOW CARBON INTENSITY



- Dairy project generates **negative carbon power**
- Expected to have **the lowest carbon intensity score ever recorded**
- 3 new projects to be deployed over the next 12 – 18 months.

# BLOOM ADVANTAGE – COMPARISON TO COMBUSTION

	Combustion Engines	Bloom	Economics Perspective	
Emissions	<i>NO<sub>x</sub>, SO<sub>x</sub>, Particulates High CO<sub>2</sub></i>	<i>Negligible NO<sub>x</sub>, SO<sub>x</sub>, Particulates Low CO<sub>2</sub></i>	<b>99%</b>	Reduction in local air pollution. Achieves air permit compliance
Electrical Efficiency	<i>~35% LHV</i>	<i>&gt;50% LHV</i>	<b>40%</b>	More power from the biogas supply
Technology	<i>High-CO<sub>2</sub> fuels negatively impact performance</i>	<i>No performance impact from high-CO<sub>2</sub> fuels</i>	<b>More Flexible</b>	CO <sub>2</sub> content of LNG/biogas is not a key consideration
Sizing	<i>Fewer sizing options</i>	<i>50kW incremental sizing</i>	<b>Efficient</b>	System sizing relative to feedstock
OpEx	<i>Frequent outages, workovers</i>	<i>Flat service fee, reliable</i>	<b>Lower</b>	Or equal OpEx on \$ / kWh basis, with greater reliability

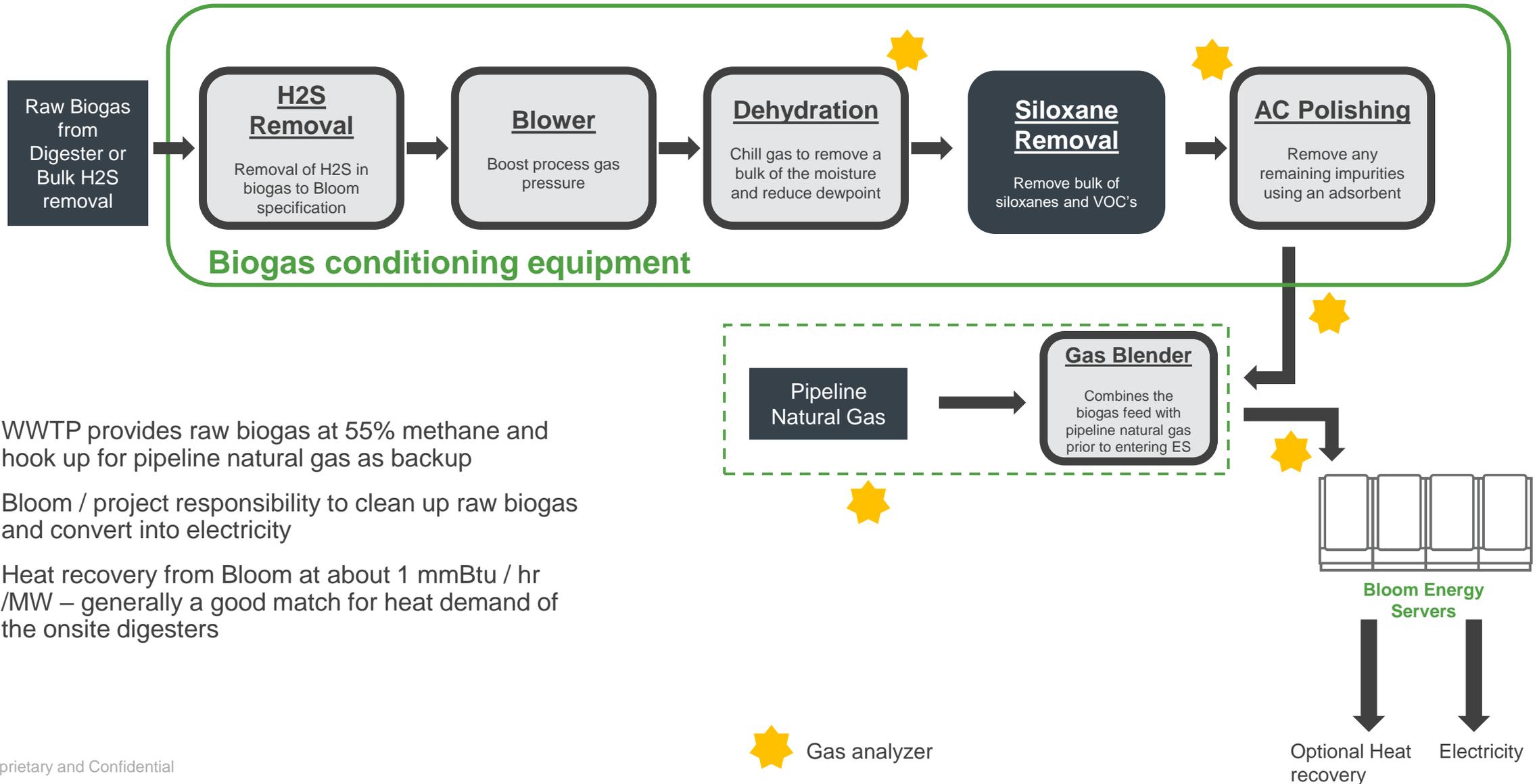
# SIGNIFICANT ENVIRONMENTAL BENEFITS VS STATUS QUO- CA WWTPS STATEWIDE EXAMPLE

Emissions Category	Flaring (MT/ year)	Combustion engines (MT / year)	Bloom (MT / year)	Bloom improvement Vs flaring	Bloom improvement Vs combustion
PM	17	255	0	100%	100%
SOX	3	3.1	0	100%	100%
NOX	324	4500	5	99%	99%
VOC	250	659	16	94%	98%
CO	436	2900	24	94%	99%
CO2e (biogenic)	635K	725K	617K	3%	15%
CO2 emissions from grid electricity use	552K	221K	0	100%	100%
CO2 emissions from diesel generator use	138K	138K	0	100%	100%

CA statewide example includes all WWTPs with 10 Million Gallons per Day (MGD) flow rate. Assumes all these plants are combusting the biogas via flaring or gas engines. Biogas generated from these CA WWTPs translates to 200MW of Bloom Energy Servers operating 24X7. Emissions from flaring and combustion engines is from GREET 3.0 model and AP-42

**Carbon reductions from 200MW of Bloom at CA WWTPs equivalent to 1GW of solar**  
**Health benefits from elimination of local air pollution represents ~\$35M\* (Vs flaring) and ~\$350M\* (Vs engines)**

# ILLUSTRATIVE SYSTEM SCHEMATIC



- WWTP provides raw biogas at 55% methane and hook up for pipeline natural gas as backup
- Bloom / project responsibility to clean up raw biogas and convert into electricity
- Heat recovery from Bloom at about 1 mmBtu / hr /MW – generally a good match for heat demand of the onsite digesters

# INDICATIVE ECONOMICS & KEY TERMS

Transaction Structure	PPA (Take or Pay)
Configuration	Onsite Bloom Energy Servers with microgrid capability And gas conditioning system
Project Term	20 years
Gas Supply	Raw biogas at min 55% methane from WWTP digester. Will use natural gas backup at WWTP cost if biogas unavailable or out of spec
Electrical Efficiency	50%+ LHV efficiency
Heat recovery	Optional heat recovery at 1 mmBtu/hr / 1MW (translates to ~15% thermal efficiency)
Project Owner	Investor owned project company
PPA rate	9 to 11 c/kWh at 2% annual escalator (individual site conditions may make certain projects fall outside range)

Terms are indicative and are subject to detailed site engineering and commercial review

Bloomenergy®

FUEL CELL MICROGRIDS

**THANK YOU**

