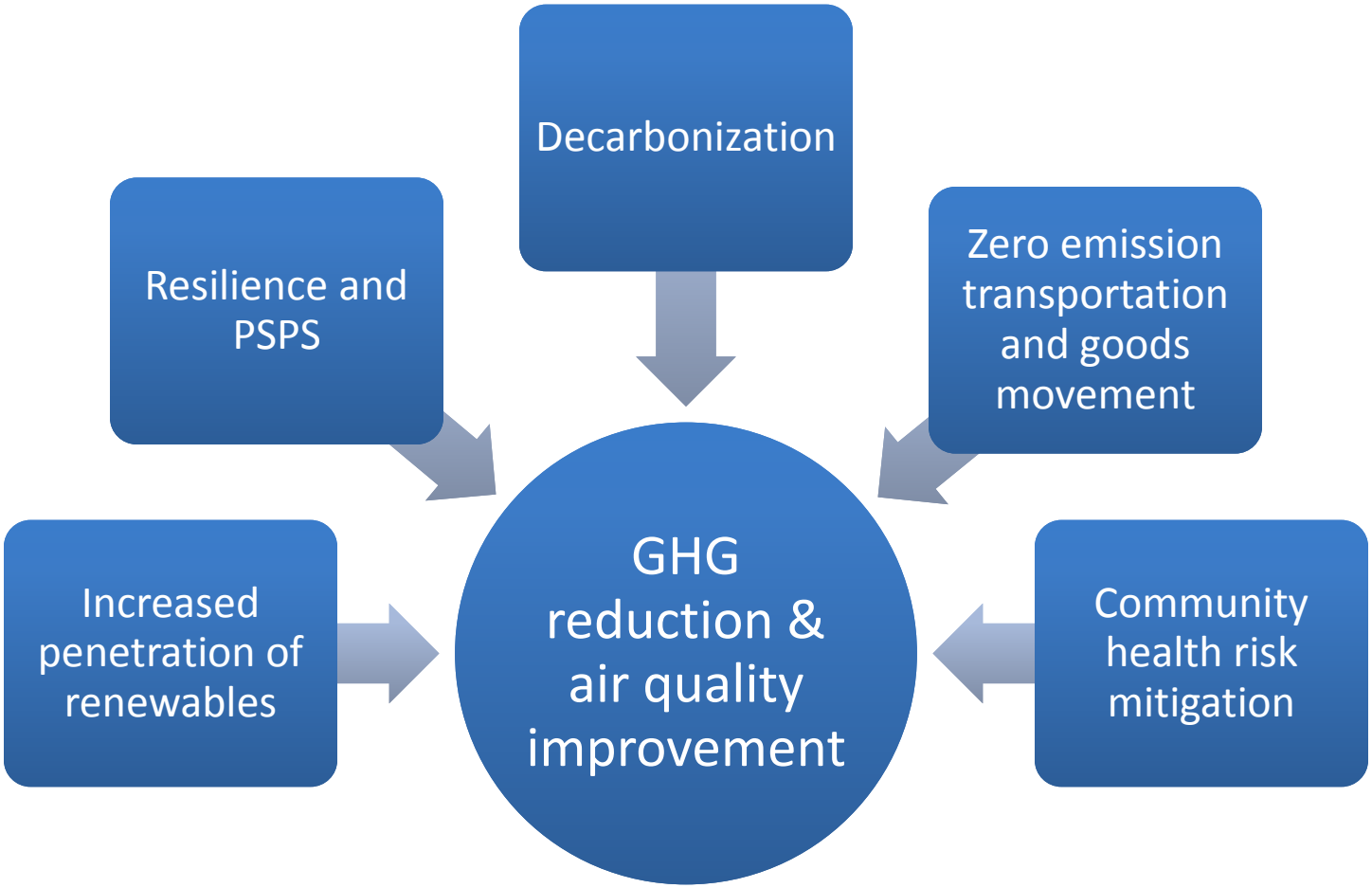
California Air Resources Board Briefing

December 9, 2019

California Policy Priorities Met with Fuel Cells



Stationary Fuel Cells

- No pollutant emissions
- Increased resilience with local backup power and load management
- High efficiency for GHG reduction
- Connect or island from central grid
- Balance intermittent resources
- Power purchase agreements eliminate end user risk
- Reduce operating costs and avoid T&D investment

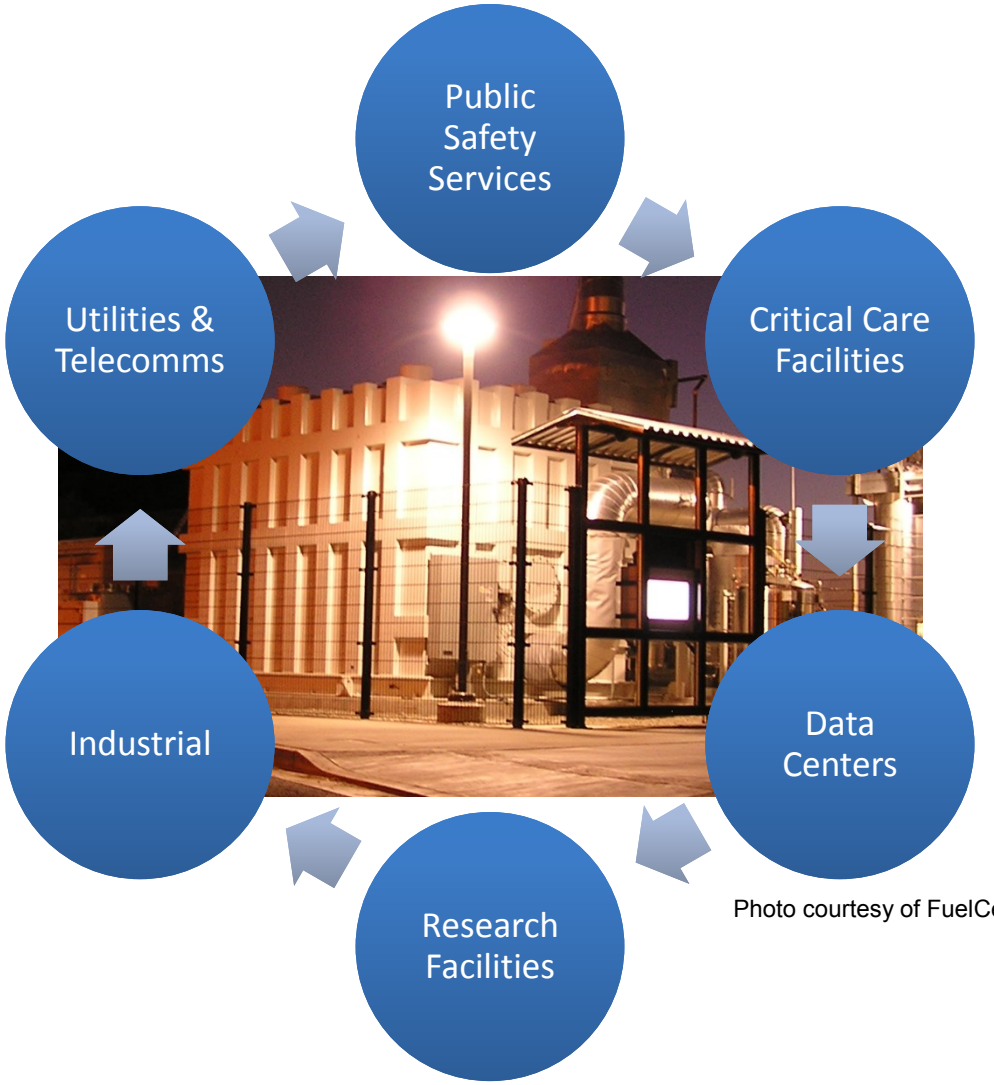
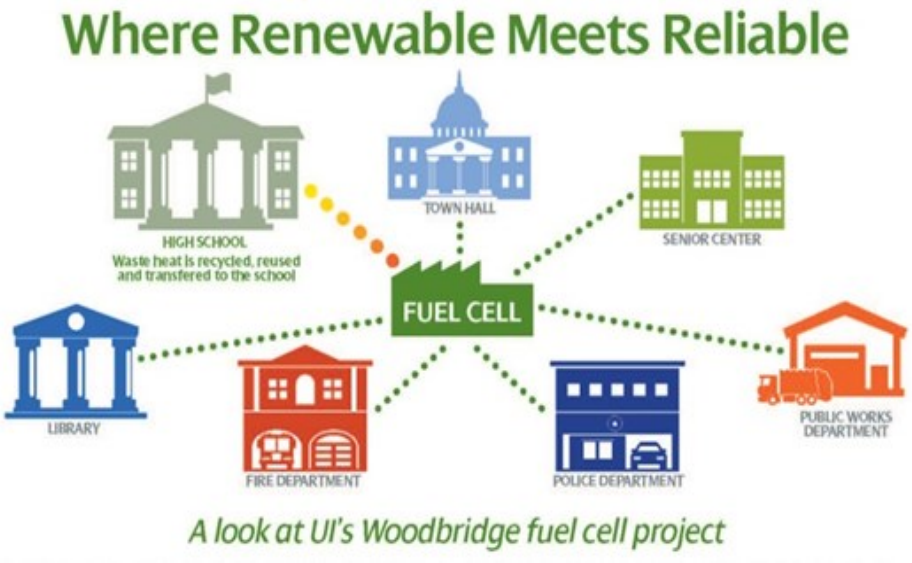


Photo courtesy of FuelCell Energy

CaSFCC California Stationary Fuel Cell Collaborative

Fuel Cells in Community Microgrids



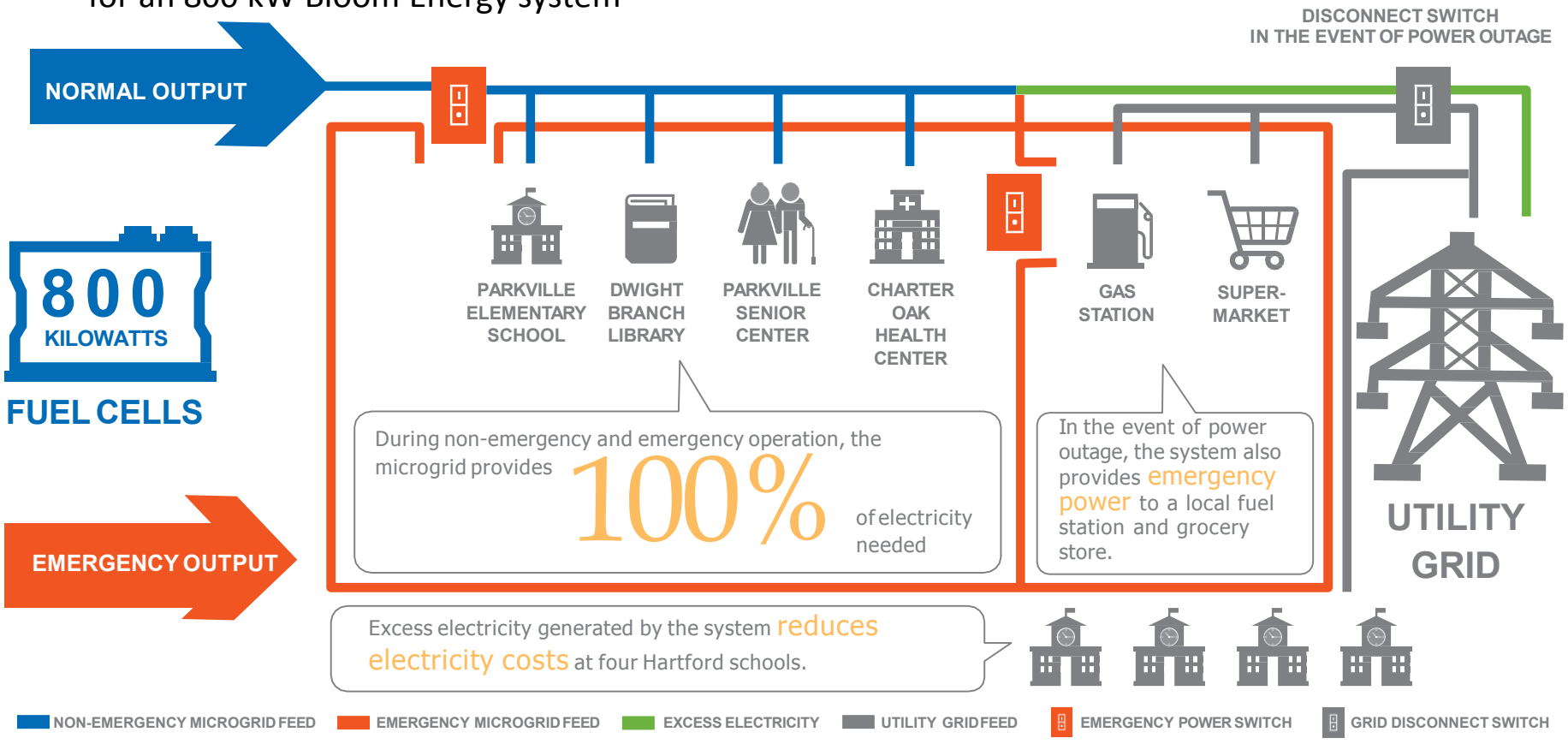
Town of Woodbridge, Connecticut

- Fuel cell microgrid supplies grid and maintains power during outage for 6 critical town buildings
- 2.8 MW FuelCell Energy system has blackstart capability and provides heat to a local high school
- Critical loads are sequenced by microgrid controller and inverter follows microgrid load

Fuel Cells for Municipal Microgrids

City of Hartford, Connecticut Fuel Cell-Only Microgrid

- Constellation Energy providing engineering, procurement, construction and operation services for an 800 kW Bloom Energy system



California Stationary Fuel Cell Collaborative

Marcus Garvey Village Microgrid for Air Quality

Solar + Storage + Fuel Cell Microgrid Reduces Emissions and Increases Resilience at Low-Income Housing Development in Brooklyn

Project Overview

- 480 kW solar, Bloom Energy 400 kW fuel cell and 300 kW/1.2 MWh lithium battery
- Fuel cell serves as "anchor" generator for microgrid

Benefits

- Energy cost savings, resilient microgrid for Marcus Garvey residents
- Grid Benefits: Targeted load reduction, grid reliability, reduced emissions with ratepayer savings

Overall ConEd Initiative

- Saved Ratepayers Nearly $1 Billion while Reducing Emissions and Alleviating Grid Congestion
- 6.2MW of fuel cells deployed across six locations within targeted load relief area
- Brooklyn Queens Demand Management Portfolio of Fuel Cell Projects Eliminates 25,053 lbs of NOX from New York City annually

EMISSIONS REDUCTIONS

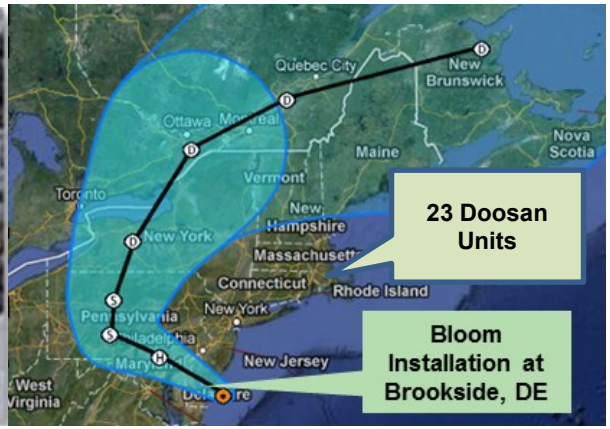
	Annual CO_2 Emissions Reductions	Annual NOx Emissions Reductions
400 kW Fuel Cell	1,077,854 lbs/year	1,643 lbs/year
400 kW Solar	522,496 lbs/year	233 lbs/year

Demonstrated Resilience

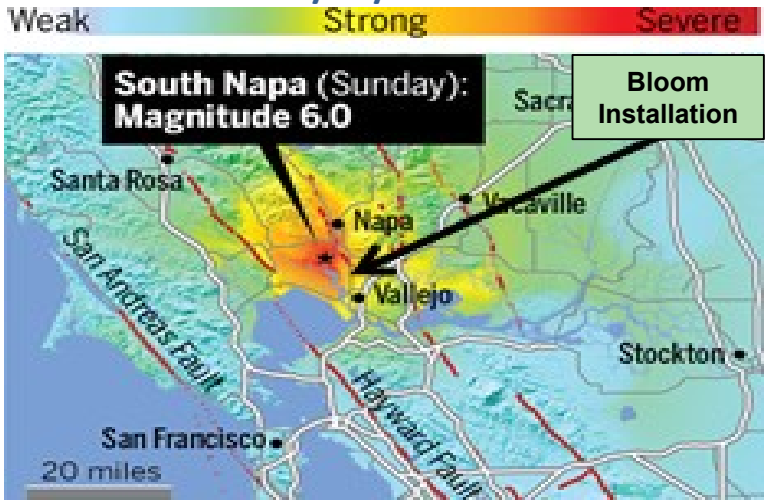
San Diego Blackout 9/28/11

Winter Storm Alfred 10/29/11

Hurricane Sandy 10/29/12



CA Earthquake 8/24/14



Data Center Utility Outage 4/16/15

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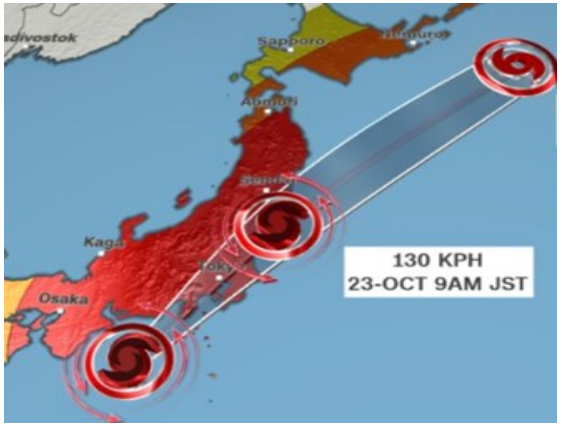
Demonstrated Resilience

Physical Damage
11/21/16

Napa Fire
10/9/17

Japanese Super-Typhoon
10/23/17



Ridgecrest Earthquakes
7/4-5/19

Manhattan Blackout
7/13/19

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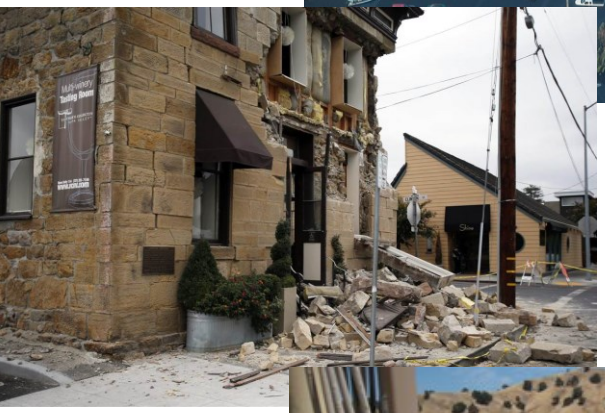
Demonstrated Resilience



Hurricanes Sandy, Joaquin and Irma

Sustained winds and storm surges tested Altergy's backup power systems, which ran continuously until local power was restored.

Napa Earthquake

Altergy's backup power systems powered through the earthquake and suffered no damage or interruptions to service after the earthquake.

Health Impacts of Burning Diesel

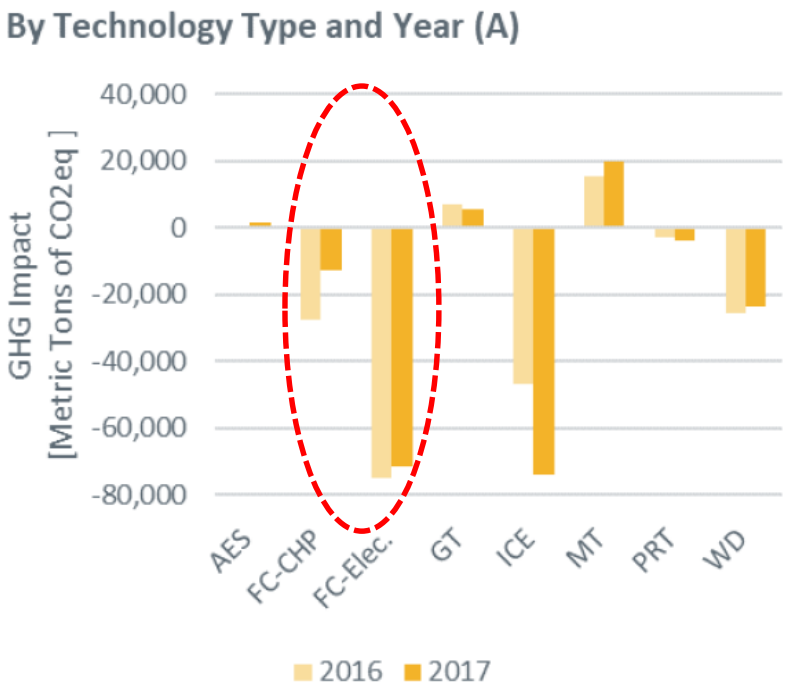
Operating an uncontrolled one-megawatt diesel engine for only 250 hours per year results in a 50 percent increase in cancer risk to residents within one city block.

-California Air Resources Board[1]

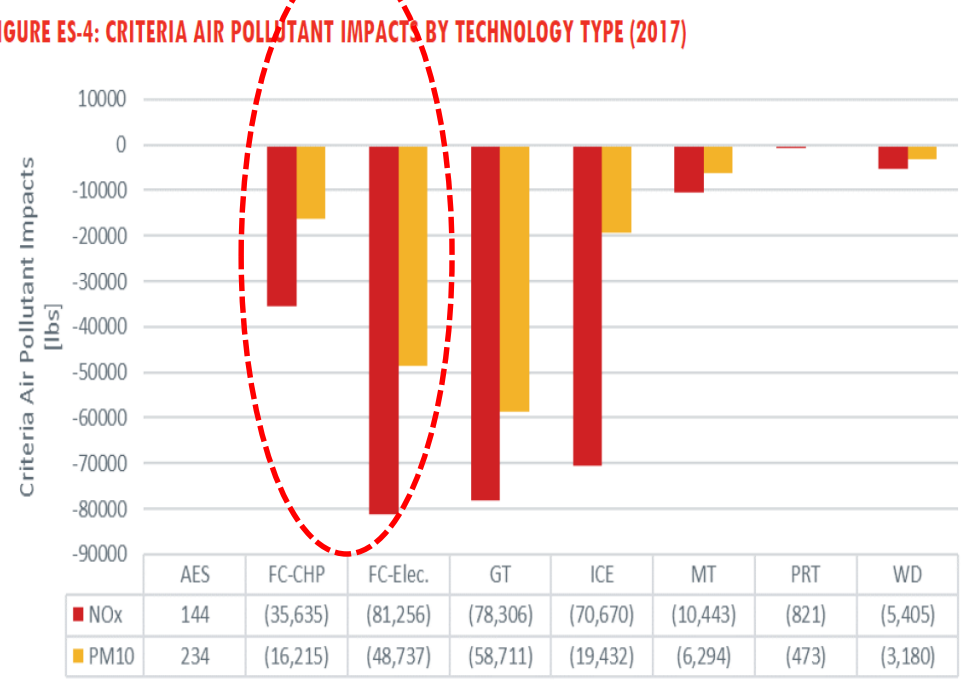
1: Santa Barbara County Air Pollution Control District: https://www.ourair.org/do-you-really-need-a-diesel-generator/
2: SFGate: https://www.sfgate.com/news/article/An-air-of-discontent-over-diesel-backups-2917172.php#photo-2249726

Fuel Cell Emissions Reduction Quantified

GHG Reductions



Criteria Air Pollution Reductions



	AES	FC-CHP	FC-Elec.	GT	ICE	MT	PRT	WD
NOx	144	(35,635)	(81,256)	(78,306)	(70,670)	(10,443)	(821)	(5,405)
PM10	234	(16,215)	(48,737)	(58,711)	(19,432)	(6,294)	(473)	(3,180)

Source: SGIP 2016-2017 Impact Report, Table ES-6: GHG Impacts by Technology Type and Year and Figure ES-4 Criteria Air Pollutant Impacts By Technology Type (2017)