SoCalGas RDD Clean Generation Program

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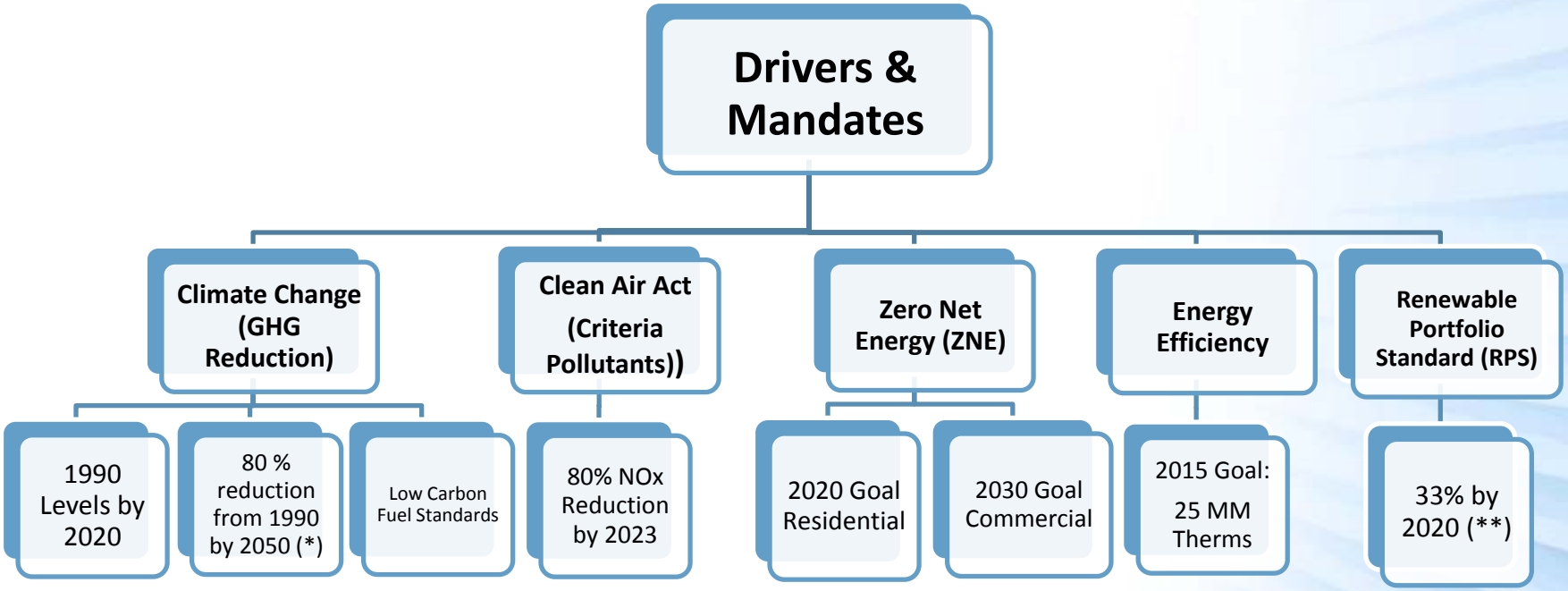
SoCalGas

A Sempra Energy utility

Topics to Discuss

- Key drivers for SCG RDD program
- CARB certification program
- Permitted Engine regulations in SCAQMD
- Overview of SCG RDD program
- Ongoing CHP projects for SCG RDD

Drivers & Mandates



(*) Proposed 50% reduction by 2030
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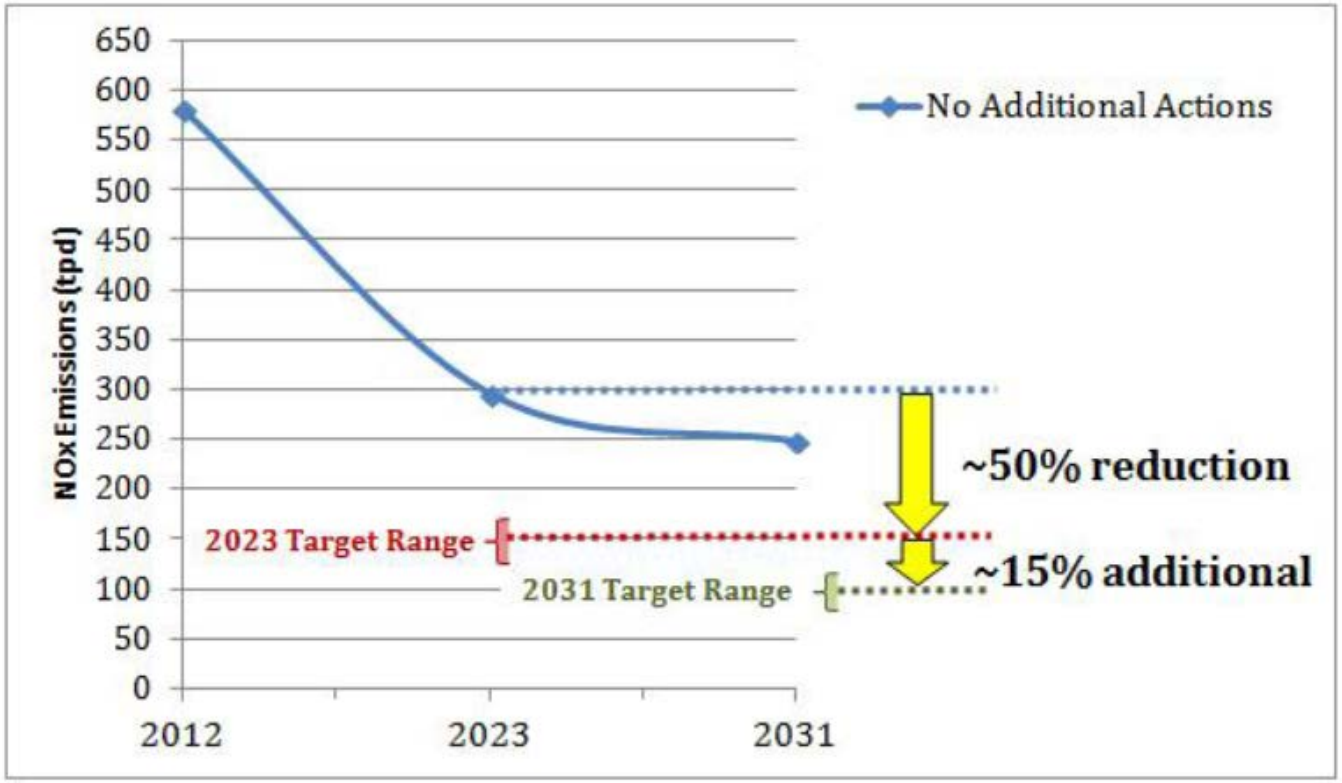
NOx Reductions Needed in SCAQMD



*Based on Preliminary 2016 AQMP analysis; subject to change

Source: SCAQMD

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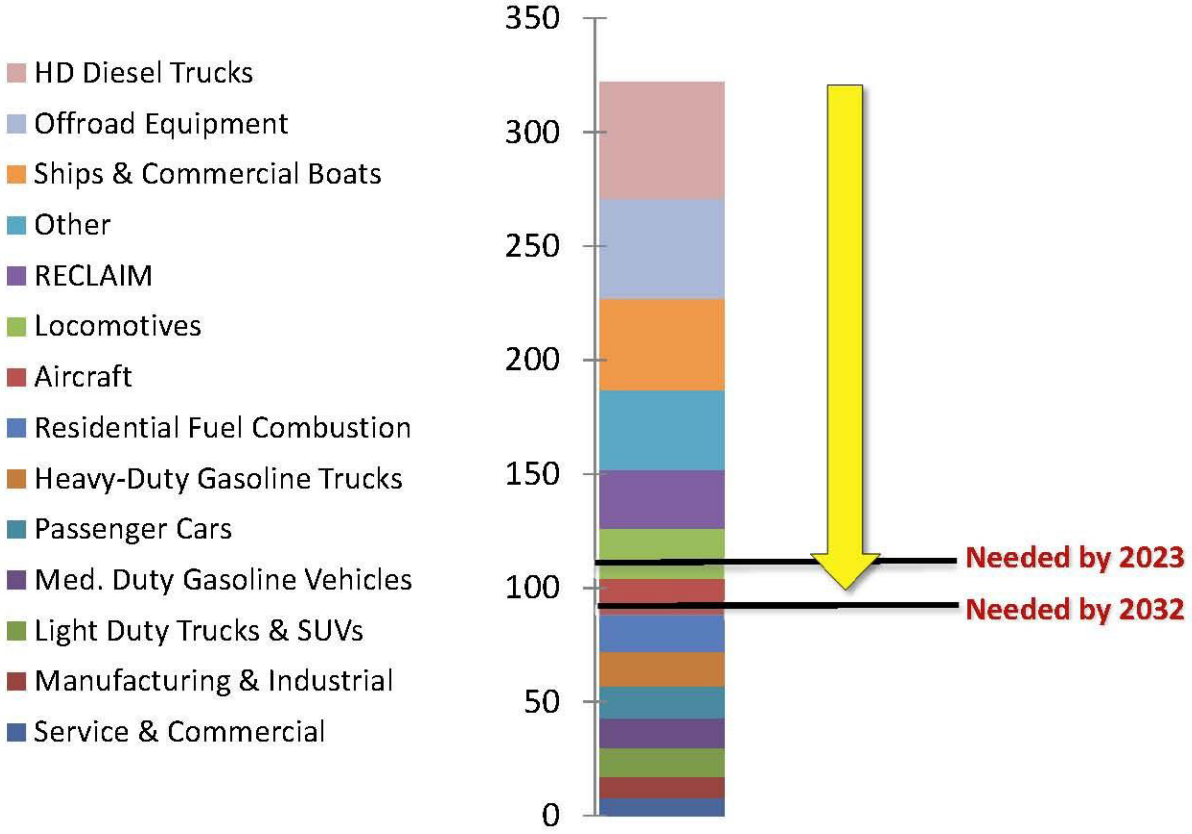
NOx Sources in SCAOMD



* Source: Ambient ozone modeling conducted by SCAQMD, 2012; draft data

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CARB Certification Requirements

- **After January 1, 2003, every DG unit must be certified by CARB or permitted by local air district**
- **Two sets of standards: 2003 and 2007 Applies to DG equipment manufacturers**
- **Affects permit-exempt equipment**
  - Engines (< 50 HP)
  - Microturbines (< 300 kW)
  - Fuel cells

CARB Certification Requirements

2007 Fossil Fuel Emission Standards

- **Pollutant** **Emission Standard (lb/MW-hr)**
  - **NO_x** **0.07**
  - **CO** **0.10**
  - **VOCs** **0.02**

DG Units that produce combined heat and power may take a credit to meet the emission standard above. Credit shall be at the rate of one MW- hr for each 3.4 million Btu's of heat recovered.

DG/CHP Air Permit Requirements

	NOx ppm @15%O2	CO ppm @ 15% O2
CARB Limit 0% HR	2	4
CARB limit 60% HR	4	8
SCAQMD Limit 0% HR	2	8
SCAQMD Limit 60% HR	4	16
BACT Limit	11	70
SCAQMD BARCT Limit	11	250

CARB Certification Program

What Has Been CARB Certified?

- 3 microturbines
- 10 fuel cells

Certification testing

- Initial fee of $7,500 for certification.
- Certification is good for 5 years and applies to all regions in California
- $2,500 for recertification.
- Testing conducted at 100 percent of generator net output.
- Periodic validation of emissions not required for installed units

Engine Regulations for Permitted DG in SCAQMD

- Regulation applies to permitted engines > 50 HP that are used full time
- DG emission limits: 2 ppm NOx and 8 ppm CO
- CHP emission limits: 4 ppm NOx and 16 ppm CO
- Requires NOx and CO CEMS for existing engines > 1,000 HP (750 HP for new engines)
- Requires weekly /monthly emission checks for engines < 1,000 HP using portable analyzer
- Source test every two years or 8760 hours of operation

RD&D & ET Funding Sources

	Natural Gas Ratepayers		
	CEC - PIER	SCG – RD&D	SCG - ETP
Annual Funding ($M)	$24*	$9.5	$1.3
Authorized by (Cycle)	CPUC (Annually)	CPUC - GRC (4 Years)	CPUC - Customer Program (3 Years)
Program Goals and Objectives	Drive innovation and advance science and technology	• Develop and demonstrate new technologies • Help customers use gas more efficiently • Comply with environmental regulation • Promote alternative fuels	Support development, assessment, and introduction of new and under-utilized energy efficiency (EE) products.
Program Area Focus:	• Renewables • Clean Generation • Environment • Energy Efficiency • Clean Transportation • Buildings & Ind/Ag/Water	• Customer Applications • Clean Generation & CHP • Clean Transportation • Renewable Energy • Gas Operations	Energy Efficiency for Customer Applications

Other Funding Sources

DOE	GTI	SCG- Customers	Equipment Manufacturers	SCAQMD, SJVAPCD, CARB, etc.,...

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*Collected by all CA Gas IOUs. SoCalGas annual share is approximately $12 million

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Specific Goals and Objectives

Coordinate with various entities to develop & demonstrate natural gas technologies to help attain California's environmental policy objectives

ACTION PLAN:

- **Develop new, natural gas technology & products**
- **Demonstrate increased efficiency**
- **Demonstrate feasibility & cost effectiveness**
- **Complete successful demonstrations**

Residential

- Demonstrate increased efficiency
- Develop & demonstrate gas heat pump technology
- Commercialization of 14ng/j central furnaces

Commercial & Industrial

- Demonstrate increased efficiency
- Evaluate new burner technology
- Demonstrate commercial cooking, boilers & processes technology
- Demonstrate solar thermal heating/cooling technology

Clean Generation

- Develop & Demonstrate microCHP product for the residential market
- Demonstrate new Pre-commercial CHP products and technologies
- Demonstrate waste heat recovery technologies

Renewable Natural Gas

- Assess current RNG conditioning equipment / processes
- Demonstrate new Pre-commercial RNG products and technologies

Transportation

- Develop Near-Zero Emission Heavy Duty Engines
- Demonstrate CNG Plug-In Hybrid Heavy Duty Vehicles
- Develop new technique for full fill of storage tank
- Evaluate new HRAs

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»Analysis shows that mixed-fuel designs provide lower incremental costs and higher TRC benefits to achieving ZNE.

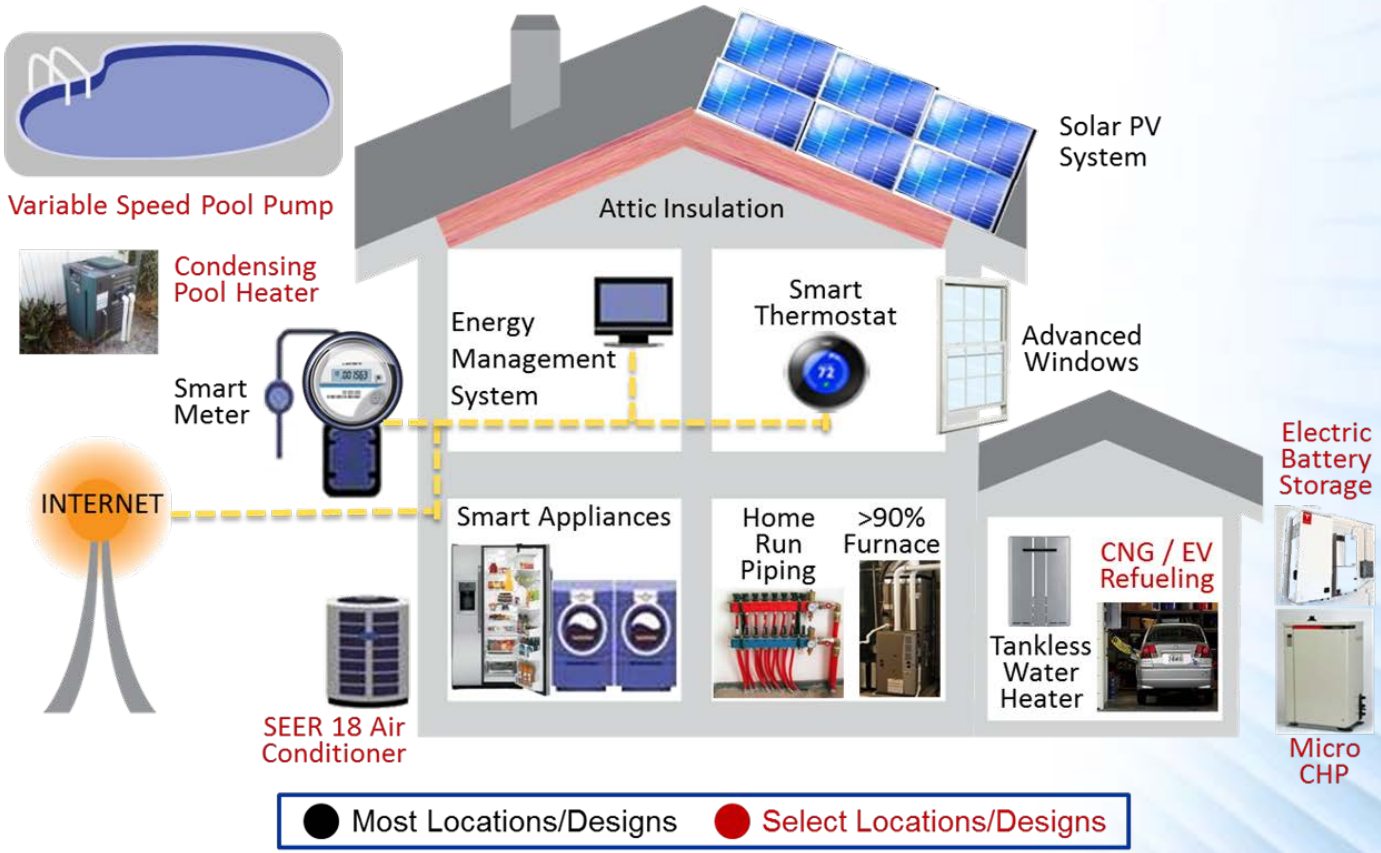
Characteristics to Meet Residential ZNE Goals

	Efficiency Measures	Solar PV System Size	Incremental Costs	Utility Costs	TRC Values	GHG Emissions
Mixed-Fuel ZNE Home	Building envelope, HVAC, and water heating measures.	3.5–4.3 kW	$20,500-$24,600	Monthly utility costs of $25 or less, and annual savings of $875-$1,950	Life-Cycle Cost (CEC): 0.42-0.46 Upfront Cost (Utility): 0.86–0.96	55-75% savings over baseline home
Electric-Only ZNE Home	Building envelope, and HVAC measures.	3.8–5.0 kW	$21,800-$28,000	Monthly utility costs of $20 or less, and annual savings of $950-$2,000	Life-Cycle Cost (CEC): 0.33-0.38 Upfront Cost (Utility): 0.57-0.74	78-87% savings over baseline home

Note – results presented for medium home size (2,500 sq.ft., two-story), but are generally consistent or scale by home size (e.g., larger Solar PV system for larger home).

»The ZNE home of the future will feature a wide range of energy efficiency, production, storage, and management technologies.

» Many natural gas technologies are cost-effective for ZNE homes today, while others require RD&D support from SCG and other stakeholders to reach performance and cost thresholds.



SoCalGas Clean Generation RDD
Top Priorities

Demonstrate microCHP product for the residential market

- 1-5 kW in size
- Identify / test new fuel cell products
- Identify / test small engines (must meet CARB certification)

Demonstrate new near-commercial CHP products and technologies

- Focus on demonstration of expanded sizes and product gaps
  - 20-70 kW
  - 500-2000 kW
- Increased electrical efficiency
- Novel emissions control technology for rich and lean burn engines

Demonstrate waste heat recovery technology

- Demonstrate ORC system

Continue to monitor / dialog with CHP manufacturers

- **fuel cells, ICE, Stirling engine, turbines**

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SGIP program

- The Self-Generation Incentive Program (SGIP) provides financial incentives for the installation of Distributed Energy Resources behind the customer meter. The SGIP is a ratepayer-funded program, overseen by the California Public Utilities Commission, and available to retail electric and gas customers of the four California investor-owned utilities.

Eligibility requirements:

- Host customer's facility must be a customer of SoCalGas.
- Equipment must be new, commercially available, and permanently installed.
- Equipment must be connected to the grid.
- Must offset a portion or a single facility's entire electric load.
- Electric load cannot be on interruptible rate schedules load management programs

SGIP Program

Technology Type	Incentive ($/W)
Renewable and Waste Energy Capture	
Wind Turbine	$1.07
Waste Heat to Power	$1.07
Pressure Reduction Turbine[1]	$1.07
Non-Renewable Conventional CHP	
Internal Combustion Engine — CHP	$0.44
Microturbine — CHP	$0.44
Gas Turbine — CHP	$0.44
Emerging technologies	
Advanced Energy Storage	$1.46
Biogas	$1.46
Fuel Cell — CHP or Electric Only	$1.65

Capacity	Incentive Rate (Percent of Base)
0 - 1 MW	100%
1 - 2 MW	50%
2 - 3 MW	25%

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List of R&D Projects

- Tecogen Low Emissions IC Engine
- Continental Controls Low Emissions IC Engine
- Flexible Hybrid CHP
- CCHP for Data Centers
- CHP with Thermal Storage for Greenhouses
- OC Sanitation District Fuel Cell Demonstration

Tecogen Low Emissions IC Engine

Technology Description

- Technology is based on an air or water cooled 3-way catalyst design to achieve ultra-low emissions

Potential Benefits

- Technology allows engine operators to maintain continuous compliance with permit limits
- Continuously achieve SCAQMD R1110.2 emissions requirements for new DG (0.07 Lbs/MWh NOx)
- Provides industry with an engine based DG/CHP solution

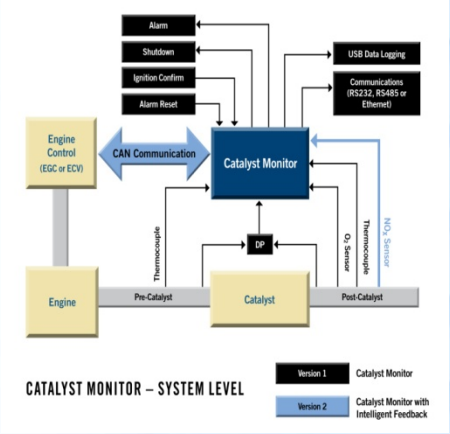
Demonstrations

- San Fernando Community Pool in CHP application
- EMWD in water pumping application
- Playa Vista Community Center in CHP application

Funding / Partners

- Tecogen, CEC, SCG

Continental Controls Low Emission Control System



Technology Description

- Use of larger 3-way catalysts, improved wide band oxygen sensors, improved mixing with electronic valve and use of NOx sensor for feedback control

Potential Benefits

- Technology allows engine operators to maintain continuous compliance with permit limits
- Continuously achieve SCAQMD R1110.2 emission requirements for new DG. (0.07 Lbs/MWh NOx)
- Provides industry with an engine-based DG solution

Demonstrations

- Commercialized product cost ~ $17,000
- Fontana Wholesale Lumber in CHP application.
- SCG Honor Rancho in gas compression application

Funding / Partners

- SCG,CEC, CCC , GTI

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Microturbine FlexCHP Demonstration at a Food Processor

Technology Description

- Develop and demonstrate a new CHP system that integrates a microturbine (C65) and heat recovery boiler fitted with a new low NOx burner to produce both electricity and steam simultaneously

Potential Benefits

- Reduce electricity demand from the grid
- Mitigate GHG emissions
- NOx emissions below 10 ppm
- Approximately 7% fuel savings for the boiler

Demonstration

- Inland empire Foods

Funding / Partners

•, SCG, CEC, UTD, Capstone, Johnston Boiler, Integrated CHP Systems Corp., Inland Empire Foods

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CCHP for Data Centers at Monterey Park

Technology Description

- Hybrid UPS CCHP system consists of 3 Capstone microturbine units integrated with an advanced double-effect Thermax absorption chiller

Potential Benefits

- Higher energy efficiency with reduced emissions
- Reduced demand for grid electricity
- Functions as a UPS and back-up gen-set

Demonstrations

- SoCalGas Data Processing Center

Funding / Partners

- ICF, CEC, SCG, Regatta, Thermax

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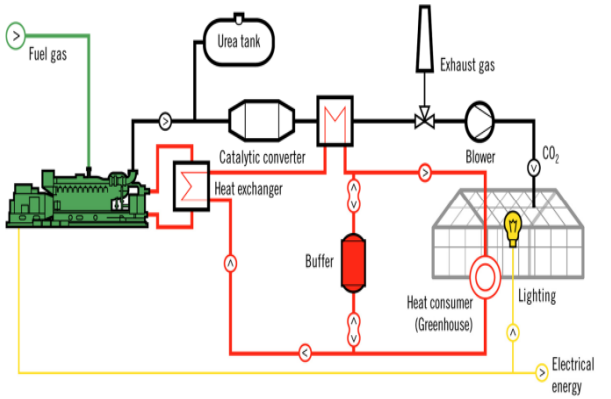
CHP with Thermal Storage for Greenhouses – Houweling's Tomatoes

Technology Description

- Engine based CHP system coupled with thermal energy storage
- Operate during daylight hours and inject condensed CO2 into the greenhouse to enrich CO2 levels to accelerate photosynthesis and plant growth
- Engine jacket and exhaust heat are recovered and stored in the thermal storage tank for use at night

Potential Benefits

- Energy Efficiency through tri-generation (Electricity, Heat, CO2)
- Reduced operating costs, cheaper produce



Demonstrations

- Houweling's Tomatoes in Oxnard

Partners

- SCG, Houweling's Tomatoes , CEC, Jenbacher, DE Solutions

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Fuel Cell – Orange County Sanitation District

Technology Description

- Installation Fuel Cell Energy 300 kW fuel cell
- Installed in a CHHP setting
- Utilizes biogas
- Provides H2 fuel for fleet operation

Potential Benefits

- Reduce criteria pollutants
- Increase overall efficiency
- Reduce operating costs
- H2 production

Demonstrations

- Orange County Sanitation District

Funding / Partners

- DOE, CARB, AQMD, Air Products, SCG