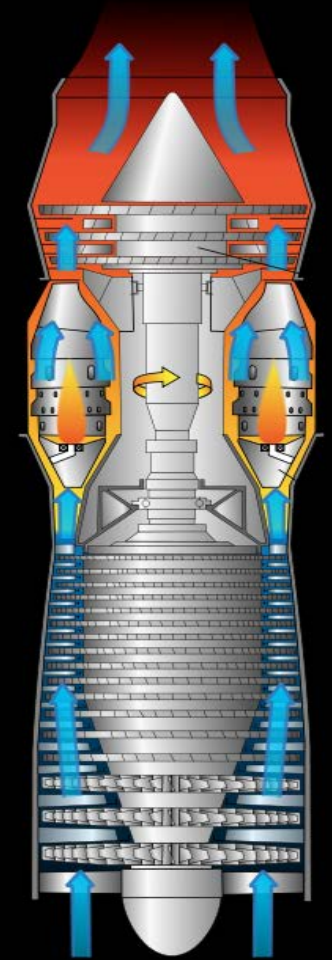


# South Coast AQMD's Gas Turbine Experience Regulations and Operations

2012 University Turbine  
System Research Workshop  
October 2-4, 2012  
Irvine, CA

Mohsen Nazemi, P.E.  
Deputy Executive Officer  
South Coast Air Quality Management District



# What is South Coast Air Quality Management District?

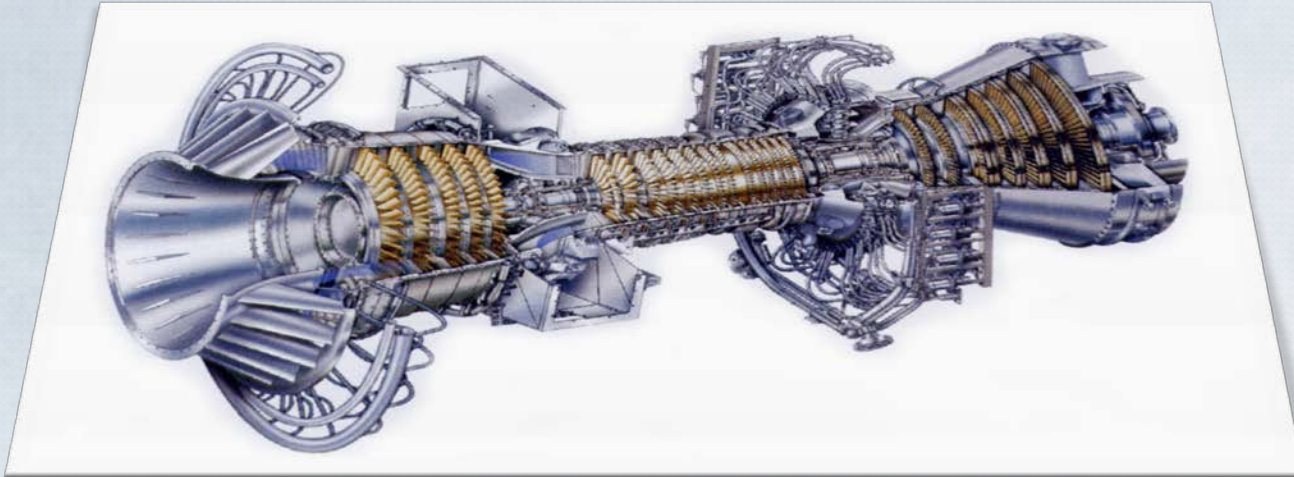


- Local Air Pollution Control Agency in Southern California (All of Orange & Non-Desert Portions of LA, Riverside & San Bernardino Counties)
- Population of 17 million (about half of State's population)
- Worst air quality in the nation (Ozone & PM 2.5)
- Receives and Processes about 10,000 permit applications annually
- Regulates over 27,000 stationary sources





# Gas Turbines in SCAQMD



- Rules and Regulations
- Permitting and Emissions
- Installation and Operations

# Gas Turbine Rules & Regulations

## Federal Requirements



- 40 CFR Part 60 Subpart GG (NSPS)



Pollutant	Existing Natural Gas Turbines
NO <sub>x</sub>	0.0075[14.4/(KJ/watt-hr)]
SO <sub>2</sub>	150 ppm or 0.8% fuel sulfur

- 40 CFR Part 60 Subpart KKKK (NSPS)

Pollutant	New Natural Gas Turbines		
	Less than 50 mmbtu/hr	Between 50 to 850 mmbtu/hr	Greater than 850 mmbtu/hr
NO <sub>x</sub>	42	25	15
SO <sub>2</sub>	0.90 lbs/MWh or 0.06 lbs/MMBTU fuel sulfur		



# Gas Turbine Rules & Regulations

## Federal Requirements



- 40CFR 60 Subpart TTTT (NSPS)
  - Proposed on 3/27/2012
  - Would apply to new combined cycle electric generating units > 25 MWs
  - Would set a 1,000 lb CO<sub>2</sub>/MW-hr standard
- 40CFR 63 Subpart YYYY (NESHAPS)
  - Requires 91 ppbd formaldehyde
  - Does not apply to gas-fired turbines at this time (stay of standards)

# Gas Turbine Rules & Regulations

## State Requirements



- Distributed Generation/ CARB Certification (Micro Turbines)
- Renewable Portfolio Standards (Power Plants)
- AB32 – GHG Cap & Trade Program (Large Facilities)
- GHG Reporting Requirements (Large Facilities)
- Energy Efficiency & Co-Benefits Audit (Power Plants, Cement Plants & Refineries)



# Gas Turbine Rules & Regulations

## Local/ SCAQMD Requirements



- Permitting Requirements
- Source Specific Rules (Rule 1134)
- RECLAIM Program

# Permitting of Gas Turbines



- California Energy Commission (CEC) Licensing
  - Thermal Power Plant (>50 MWs)
  - Small Power Plant Exemption (50-100 MWs)
  - Equivalent to California Environmental Analysis (CEQA)
  - Still requires SCAQMD Permits
- SCAQMD Permitting (All Sizes)
  - New Source Review Rule
    - Best Available Control Technology (BACT)
    - Emission Offsets
    - Air Quality Modeling/ Health Risk Assessment
  - Public Notice/ EPA Review/ CEC License





# Current BACT Standards for Natural Gas Fired Turbines



Pollutant	Simple Cycle	Combined Cycle
NOx	2.5 ppm	2.0 ppm
CO	4.0 ppm	2.0 ppm
VOC	2.0 ppm	2.0 ppm
PM10	Natural gas or equivalent with < 1 gr/100 scf. sulfur*	Natural gas or equivalent with < 1 gr/100 scf. sulfur*
SOx	Natural gas or equivalent with < 1 gr/100 scf. sulfur*	Natural gas or equivalent with < 1 gr/100 scf. sulfur*
NH3	5.0 ppm	5.0 ppm

\* Clean Fuels Policy

# Current BACT Standards for Digester/Landfill Gas Fired Turbines



Pollutant	Minor Sources	Major Sources
NOx	25 ppm	15 ppm
CO	130 ppm	25 ppm
VOC	20 ppm as hexane @ 3% O2 or 98% destruction	20 ppm as hexane @ 3% O2 or 98% destruction
PM10	Fuel Gas Treatment	0.015 lb/mmBTU
SOx	16 ppm fuel sulfur	0.15 lb/mmBTU



# Emission Offsets

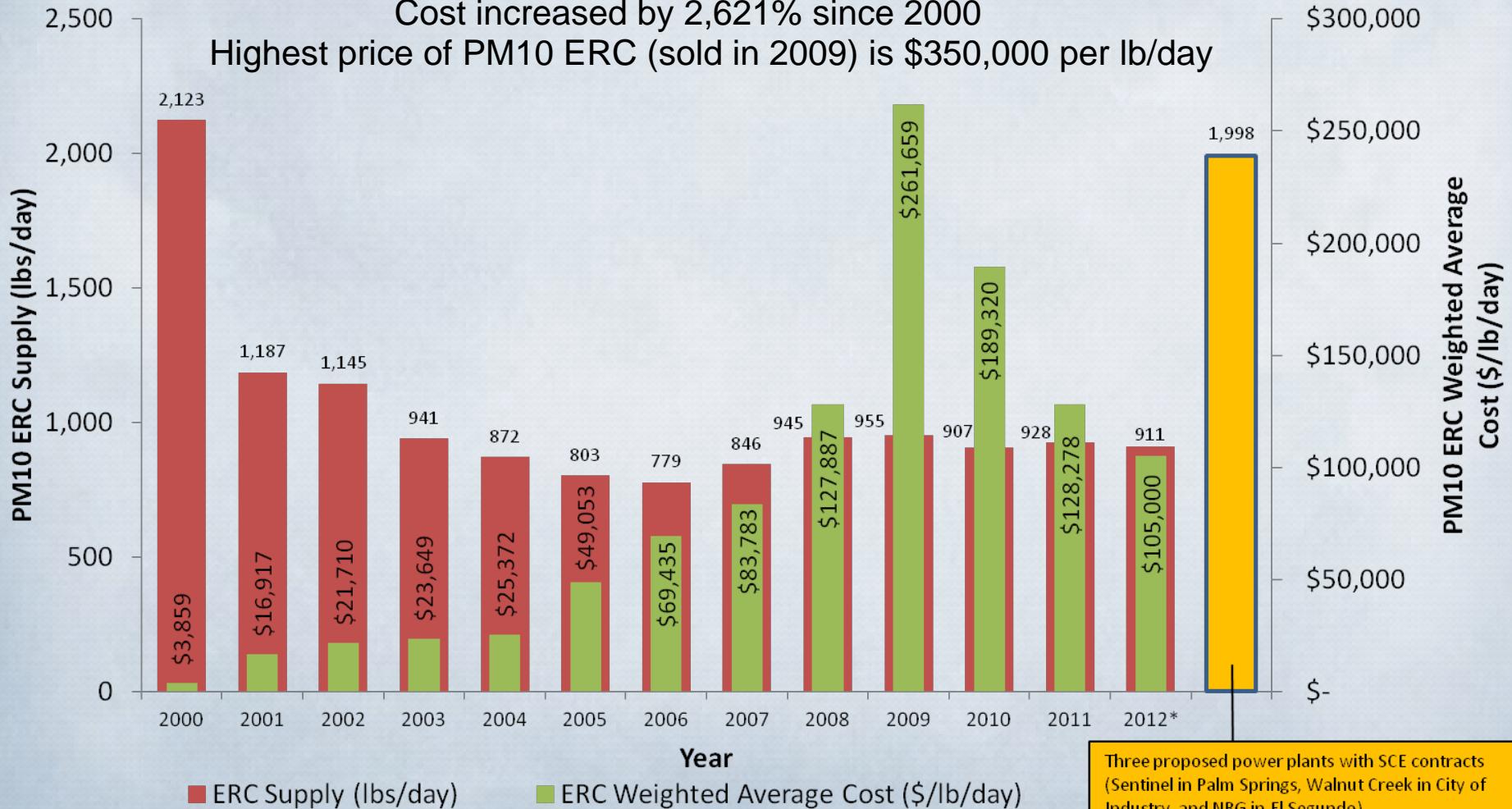


## PM10 ERC Supply & Cost 2000-2012\*

Supply decreased by 57% since 2000

Cost increased by 2,621% since 2000

Highest price of PM10 ERC (sold in 2009) is \$350,000 per lb/day



Three proposed power plants with SCE contracts (Sentinel in Palm Springs, Walnut Creek in City of Industry, and NRG in El Segundo)

\*Through September 2012

# Modeling/ Health Risk

- Ambient Air Quality Impacts
  - 1-Hr NO<sub>2</sub> Standard
- Visibility Impacts
- Toxics Health Risk (Acute, Chronic and Cancer)
  - Cancer Risk
  - Non-Cancer Risk



# PSD Permit

## Greenhouse Gas Sources (40 CFR Part 52.21)



- New Facilities
  - 100,000 tons per year CO<sub>2</sub>e
- Modifications
  - Facilities with 100,000 tpy CO<sub>2</sub>e or “anyway” PSD  
75,000 CO<sub>2</sub>e increase
- BACT Requirements for GTs
  - Thermal Efficiency Limit (1,000 lbs CO<sub>2</sub>e/MW-hr)

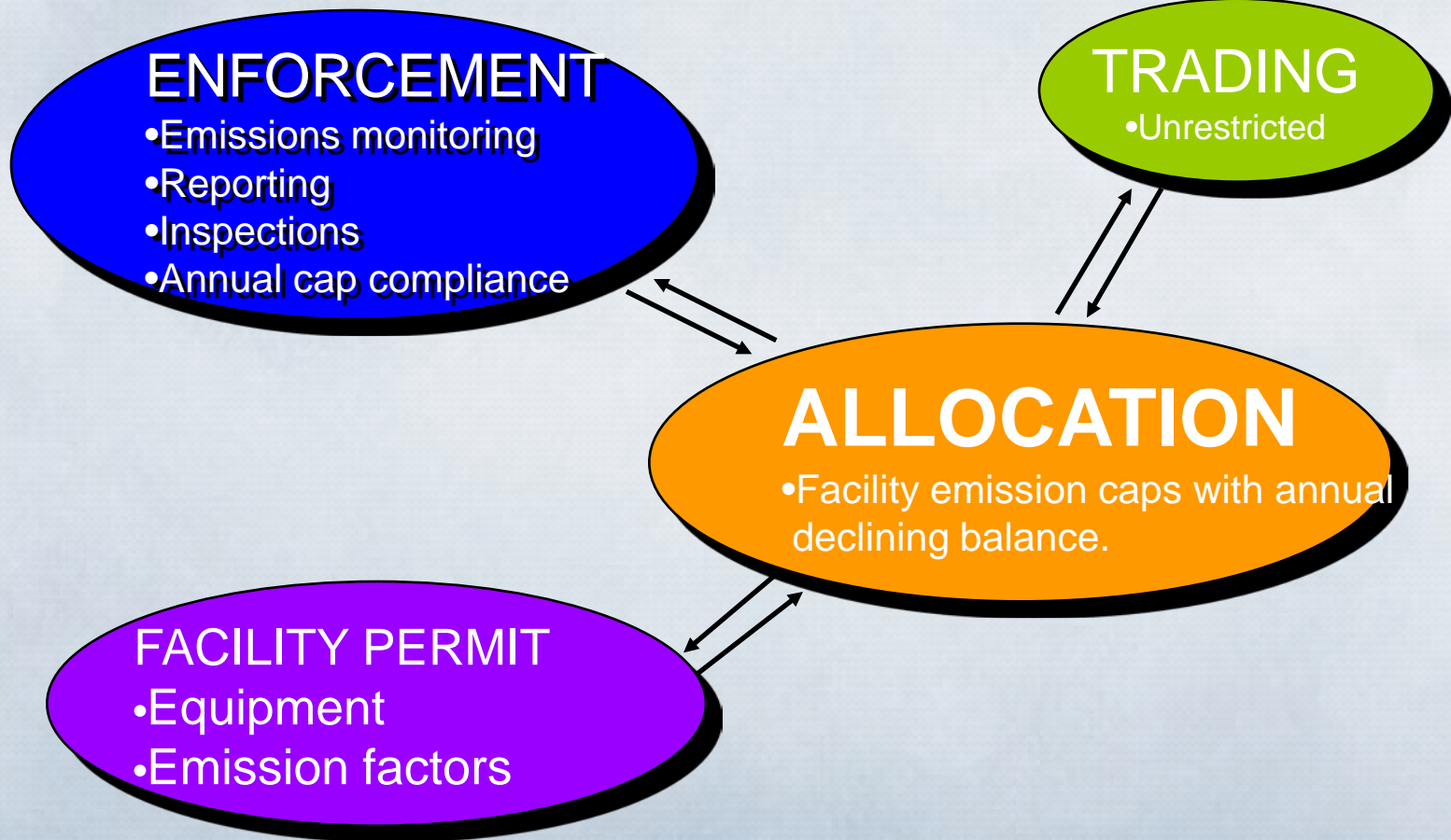
# Rule 1134



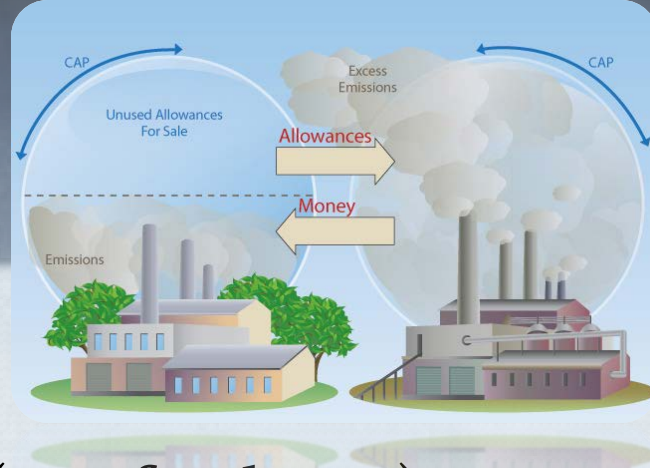
- Applies to gas turbines in operation as of 8/4/89
- Establishes NO<sub>x</sub> emission standards
  - 0.3 to <2.9 MWs = 25 ppm
  - 2.9 to <10.0 MWs = 9 - 15 ppm
  - > 10.0 MWs = 9 - 12 ppm
  - > 60.0 MWs (CC) = 9 - 15 ppm



# RECLAIM Structure



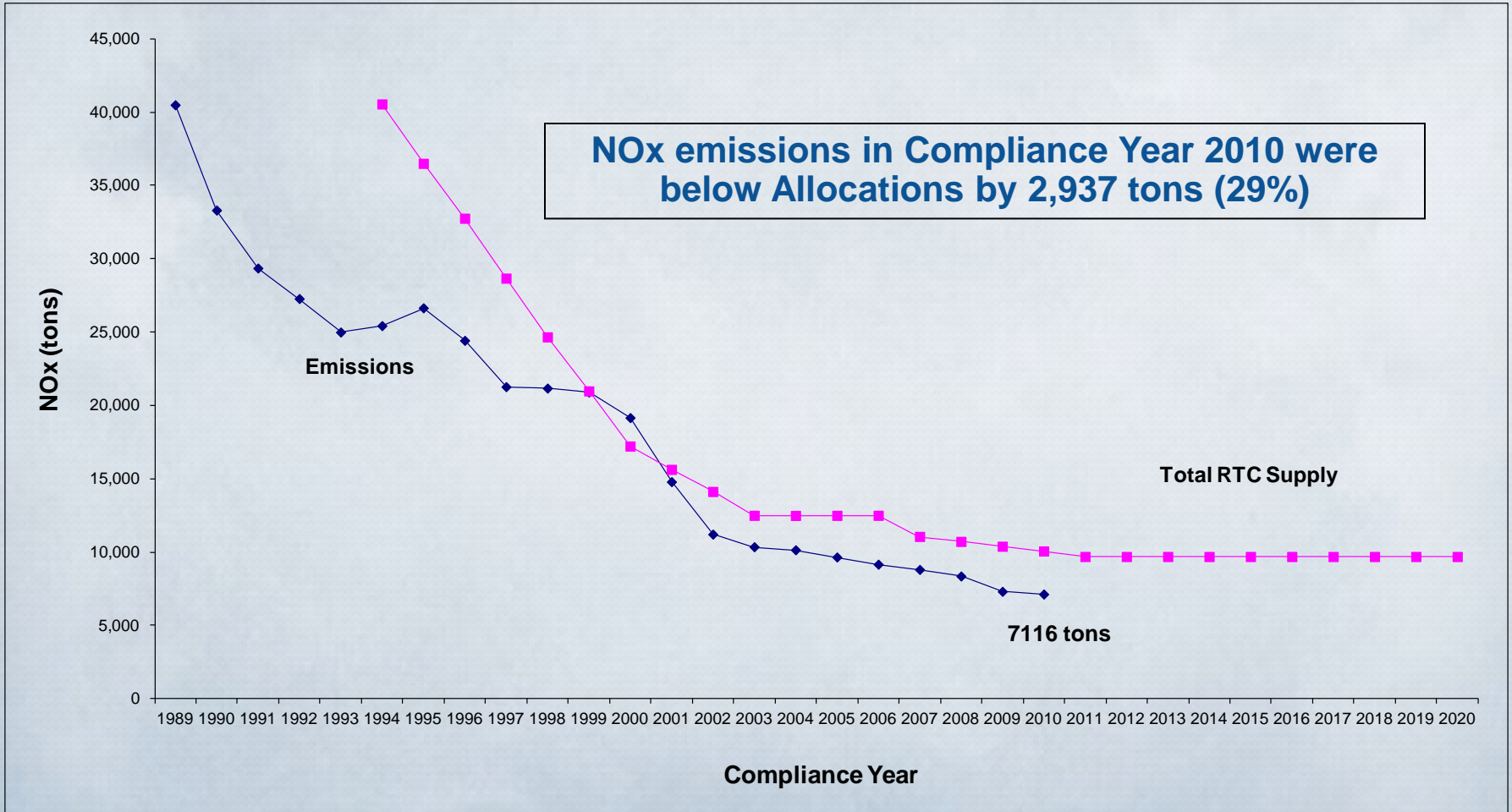
# RECLAIM Overview



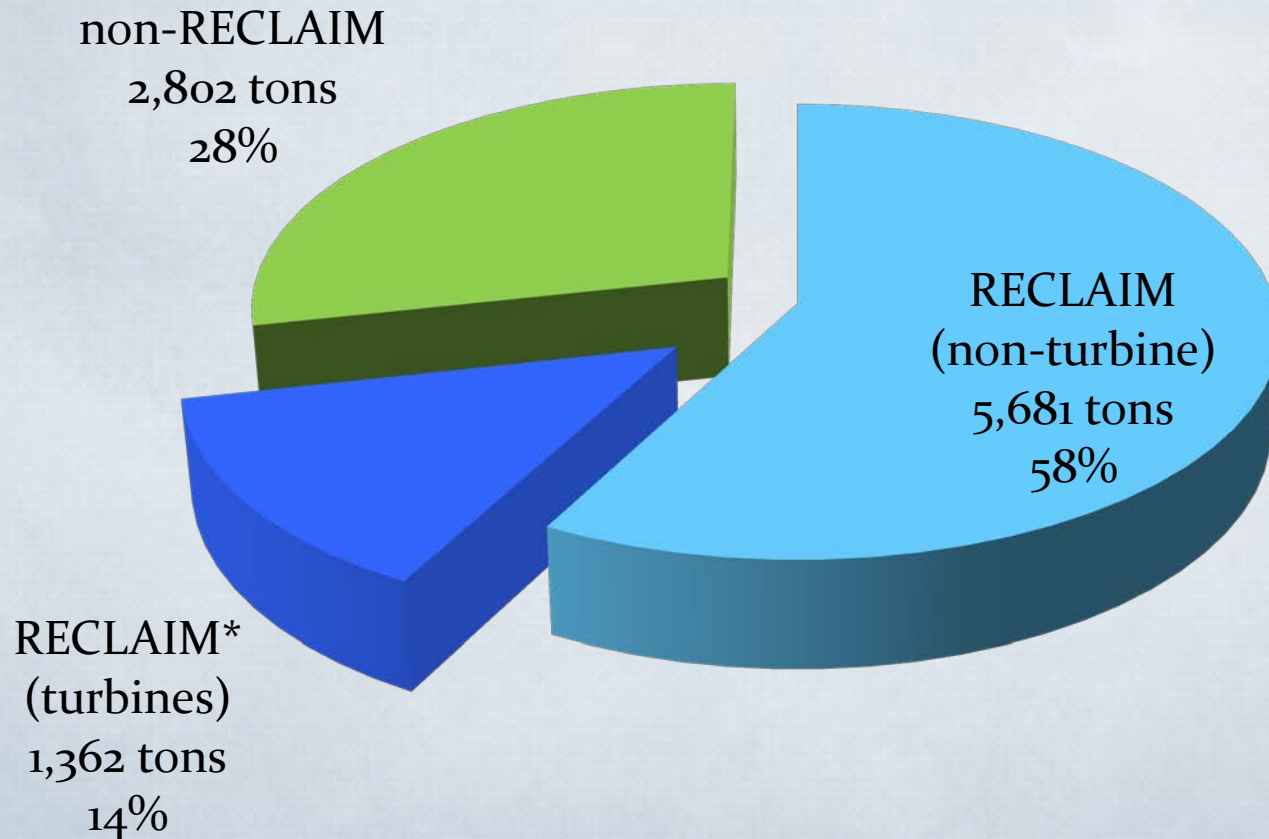
- Cap-and-Trade Program (281 facilities)
- Benefits For Facilities
  - Maximum Flexibility to Lower Compliance Costs
  - Replaces Source-Specific Rules
  - Certainty for Future Compliance Obligation
- Benefits For Environmental Quality
  - Equivalent or Better Emissions Reductions
  - Promotes Control Technology Development
  - Enhanced Accuracy in Emission Quantification



# NOx Emissions vs Allocations



# Stationary Source NOx Emissions in Calendar Year 2011



\* Reported Emissions from 94 turbines



# Distributed Generation (DG)

## Micro Turbines



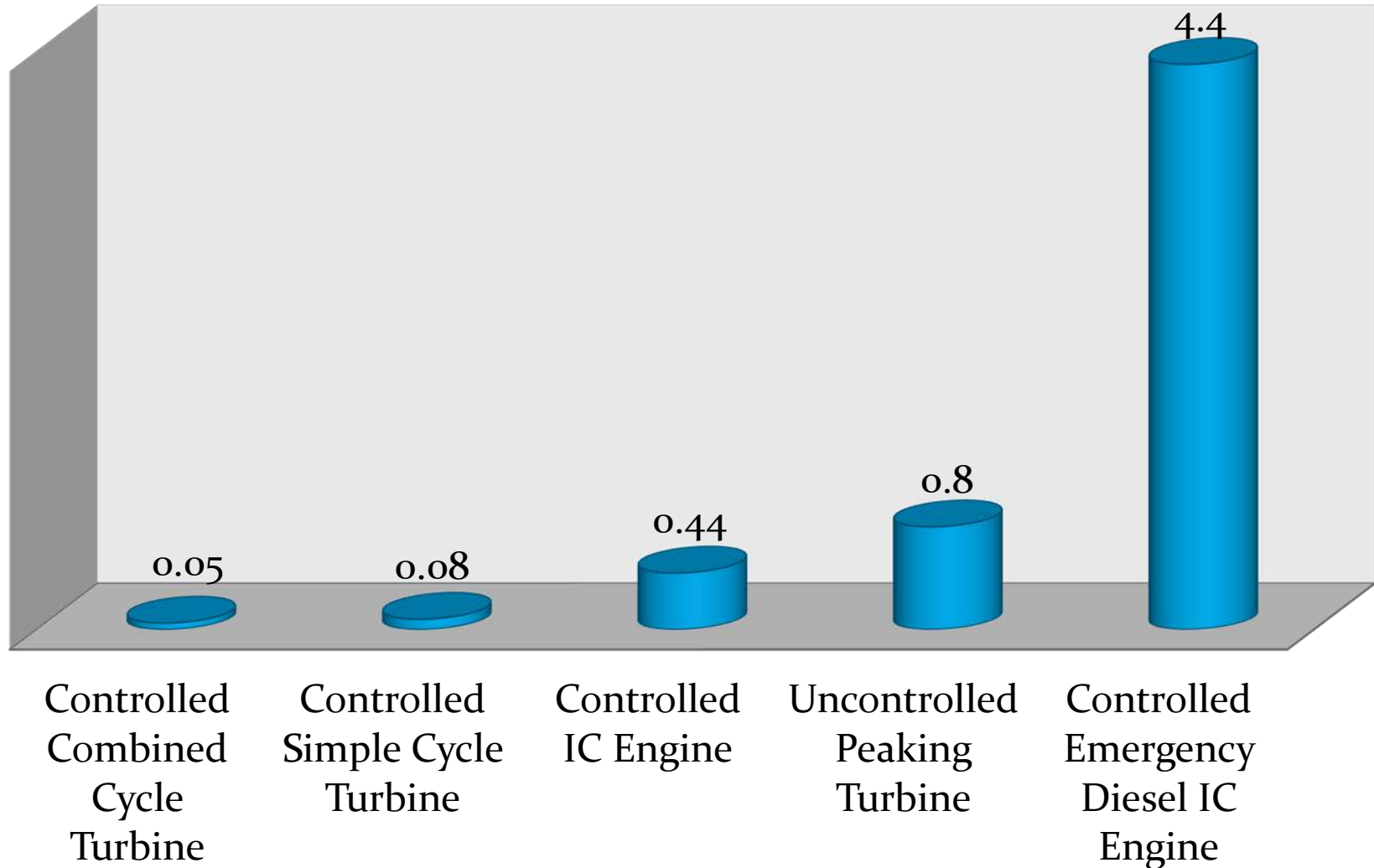
- Certification, if does not require a Permit

Pollutant	Emission Standard (lb/MW-hr)	
	Natural Gas	Waste Gas*
NO <sub>x</sub>	0.07	0.5
CO	0.10	6.0
VOC	0.02	1.0

- Micro Turbines need permit only if:
  - Configured differently as certified, and/or
  - Use a fuel different from the fuel they were certified under

\* Beginning 1/1/13, new waste gas fired turbines will be required to meet the same emissions standards as natural gas fired units

# Comparison of NOx Emissions from Power Generation Units (lb/MW-hr)





# Simple Cycle Power Plant





# New Simple Cycle NG- Fired Power Plants in the South Coast



Facility	City	Units	MWs
Indigo Wildflower	Palm Springs	3	135
SCE (4 Locations)	Etiwanda, Ontario, Stanton, Norwalk	4	188
City of Burbank	Burbank	1	46
City of Glendale	Glendale	1	50
Alliance (2 Locations)	Colton	8	84
City of Riverside	Riverside	4	200
City of Riverside	Riverside	4	42
Long Beach Power	Long Beach	4	260
Canyon Power	Anaheim	4	204
El Colton	Colton	1	48
Walnut Creek	Industry	5	500
CPV Sentinel	Palm Springs	8	800
LADWP Haynes	Long Beach		616
LADWP Harbor	Long Beach	5	235
LADWP Valley	Sun Valley	1	47
Total			3,455



# CPV Sentinel, Palm Springs





# Walnut Creek, City of Industry





# Combined Cycle Power Plant with HRSG





# New Combined Cycle NG- Fired Power Plants in the South Coast



Facility	City	Units	MWs
Malburg Generating Station	Vernon	2	143
Mountainview	Redlands	4	1,056
Magnolia Power	Burbank	1	328
Inland Empire	Romoland	2	810
LADWP Valley	Sun Valley	2	580
El Segundo Power	El Segundo	2	572
LADWP Haynes	Long Beach	2	590
Total			4,079



# SCE's Mountainview Generating Station Redlands





LADWP  
Valley Generating Station  
Sun Valley

City of Vernon Light and Power  
Malburg Generating Station  
Vernon





# Existing Refinery Electrical Generation

Facility Name	City	No. of Turbine	MW's
BP	Carson	4	405.8
Chevron	El Segundo	4	186
ExxonMobil	Torrance	1	42.1
Paramount	Paramount	1	7.5
Phillips 66	Wilmington	1	58.5
Tesoro	Wilmington	2	60
Ultramar	Wilmington	1	34
Total			794

# Existing Biogas/ Digester Gas Electrical Generation



Facility Name	City	No. of Turbine	MW's
Ameresco Chiquita Energy LLC	Valencia	2	9.2
Bowerman Power LFG	Irvine	5	23
Brea Parent 2007 LLC	Brea	4	32.5
LACSD Calabasas	Calabasas	3	13.8
LACSD JWPCP Carson*	Carson	3	38.4
LACSD Puente Hills	Industry	1	2.8
MM West Covina	West Covina	1	5.7
Sunshine Gas Producers	Sylmar	5	24.5
Total			150

\* Digester Gas



# SCE's Pebbly Beach Generating Station

## Santa Catalina Island



# SCE's Pebbly Beach Generating Station



- 23 Micro Turbines, total of 1.4 MWs (60kW propane-fired Capstones)
- Began operation December 2011.
- Used to supplement power demand and offset peak loads on island.
- Existing diesel engines will no longer operate at low loads where emission controls are not effective



# SCE's Pebbly Beach Generating Station



# SCE's Pebbly Beach Generating Station





# SCAQMD Gas Turbine Test Program



# SCAQMD Gas Turbine Test Program



- Test for PM<sub>2.5</sub> and Ultrafine PM
- Use Data to develop Control Technologies for PM
- Test Methods
  - SCAQMD Method 5.1
  - EPA Method 202
  - Triplicate NH<sub>3</sub> and SO<sub>2</sub>/SO<sub>3</sub>



# Powerplants in AQMD



**Legend**

- Powerplants
- ▭ County Boundary
- ▭ AQMD Boundary



# San Onofre Nuclear Generating Stations (SONGS) Shutdown



- In January 2012, SCE found small leak of radioactive steam in SONGS Unit 3
- SONGS Unit 2 already offline for plant maintenance
- Total of 2,200 MWs lost - enough for 1.4 million homes.
- CAISO projected electricity shortfalls in San Diego, So. Orange and parts of LA Counties, during hot weather





# San Onofre Nuclear Generating Station News



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Published: Sept. 13, 2012 Updated: Sept. 14, 2012 9:47 p.m.

### NRC: San Onofre staying offline for 'months'

The San Onofre nuclear plant will not be restarting anytime soon, the chairwoman of the Nuclear Regulatory Commission assured a U.S. Senate committee this week, although a repair plan for the plant's troubled steam generators could be completed early next month.

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By PAT BRENNAN / ORANGE COUNTY REGISTER

The San Onofre nuclear plant will not be restarting anytime soon, the chairwoman of the Nuclear Regulatory Commission assured a U.S. Senate committee this week, although a repair plan for the plant's troubled steam generators could be completed early next month.

Under questioning from Sen. Barbara Boxer, D-Calif., who chairs the Committee on Environment and Public Works, NRC Chairwoman Allison Macfarlane said Wednesday that it would be "months" before a repair plan is cleared for San Onofre.

The plant operator, Southern California Edison, must have any restart plans approved by the NRC. And the NRC is still awaiting results from the...

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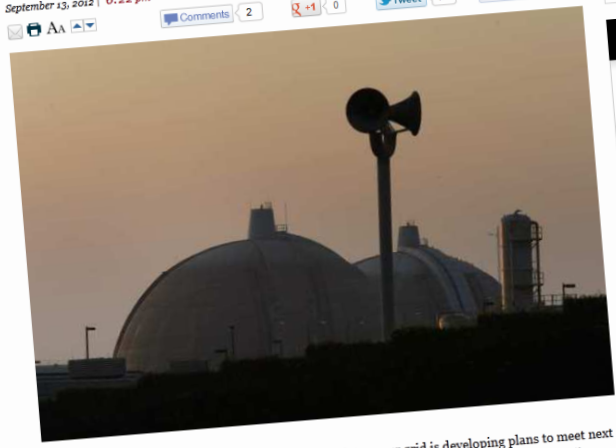
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### Plans being drawn up for another summer without San Onofre

September 13, 2012 | 6:22 pm

Comments 2 | +1 0 | Tweet 15 | Recommend 0



The organization responsible for overseeing California's power grid is developing plans to meet next summer's electricity needs in Southern California if the San Onofre nuclear plant remains offline. The plant's outage has already stretched for more than seven months, forcing energy officials to replace its 2200 megawatts of power -- enough to power about 1.4 million homes -- in the heat of the summer.

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# San Onofre Nuclear Generating Station News



September 20, 2012  
HUFF POST LOS ANGELES  
THE INTERNET NEWSPAPER: NEWS BLOGS VIDEO COMMUNITY

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## San Onofre Power Plant Layoffs: Troubled Utility To Let 730 Employees Go

Reuters | Posted: 08/21/2012 8:12 am

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Alamy

This screenshot shows a news article from the HuffPost Los Angeles website. The article is titled "San Onofre Power Plant Layoffs: Troubled Utility To Let 730 Employees Go" and is attributed to Reuters, dated August 21, 2012. The image shows the two large containment domes of the San Onofre Nuclear Generating Station at night, illuminated by site lights.

September 20, 2012  
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## San Onofre Power Plant To Empty Radioactive Fuel From One Reactor

By MICHAEL R. BLOOD 08/27/12 07:17 PM ET **AP**

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SAN CLEMENTE, Calif. -- The operator of the San Onofre nuclear power plant is preparing to empty the radioactive fuel from one of its twin reactors, a federal official said Monday, another sign the plant won't be operating at full capacity anytime soon, if

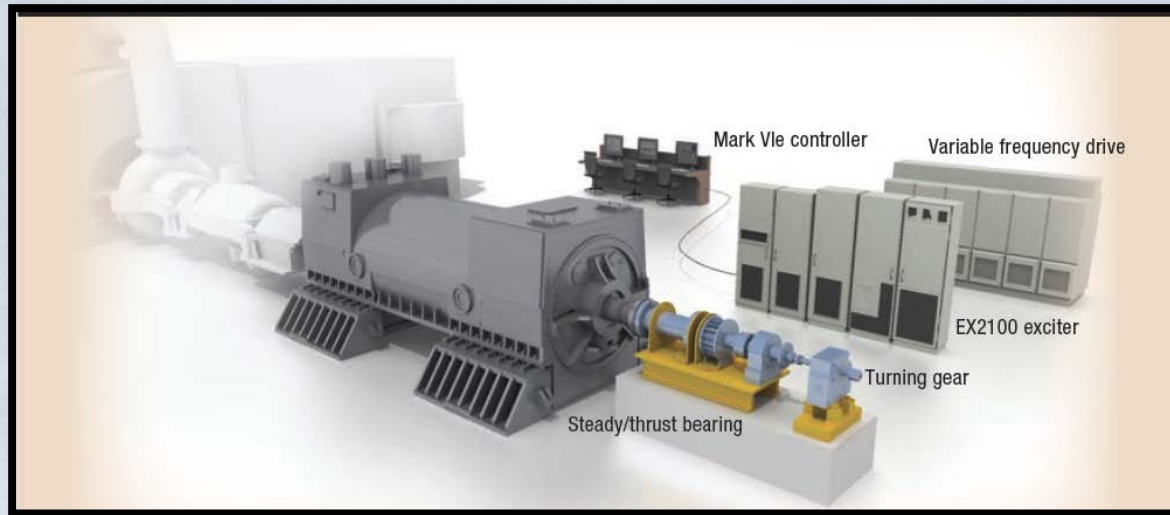
This screenshot shows a news article from the HuffPost Los Angeles website. The article is titled "San Onofre Power Plant To Empty Radioactive Fuel From One Reactor" and is attributed to Michael R. Blood, dated August 27, 2012. The image shows the two large containment domes of the San Onofre Nuclear Generating Station at night, illuminated by site lights.



# Location Matters - Walnut Creek, HB and San Onofre



# Converting Existing Synchronous Generators into Synchronous Condensers at Huntington Beach



- July 2012 EME/AES presented CEC discussion to convert the synchronous generators at Huntington Beach units 3 and 4 into synchronous condensers.
- Operation of synchronous condensers will increase grid reliability.
- Increased grid reliability is of current concern due to the non-operational status of SONGS.



# Once-Through-Cooling Generating Units in SCAQMD



Operator	Facility	Units	Total MW	OTC Replacement Date
AES	Alamitos	Boilers 1-6	1,950	2020
AES	Huntington Beach	Boilers 1-4	880	2020
AES	Redondo Beach	Boilers 5-8	1,310	2020
NRG	El Segundo	Boilers 3-4	670	2015
LADWP	Haynes	Boilers 1,2,5,6 Turbines 9,10	1,654	2029
LADWP	Harbor	Turbines 1,2	364	2029
LADWP	Scattergood	Boilers 1-3	818	2024
Total			7,646	