



# **Southern California Gas Company and San Diego Gas & Electric Gas Quality Update**

**Platts Interchangeability and Quality Forum  
November 19-20, 2008**



# Agenda Topics

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- ❑ Changing California Natural Gas Supplies
- ❑ Energia Costa Azul (ECA) LNG Terminal Start-Up
- ❑ SoCalGas ECA Rollout Project Review

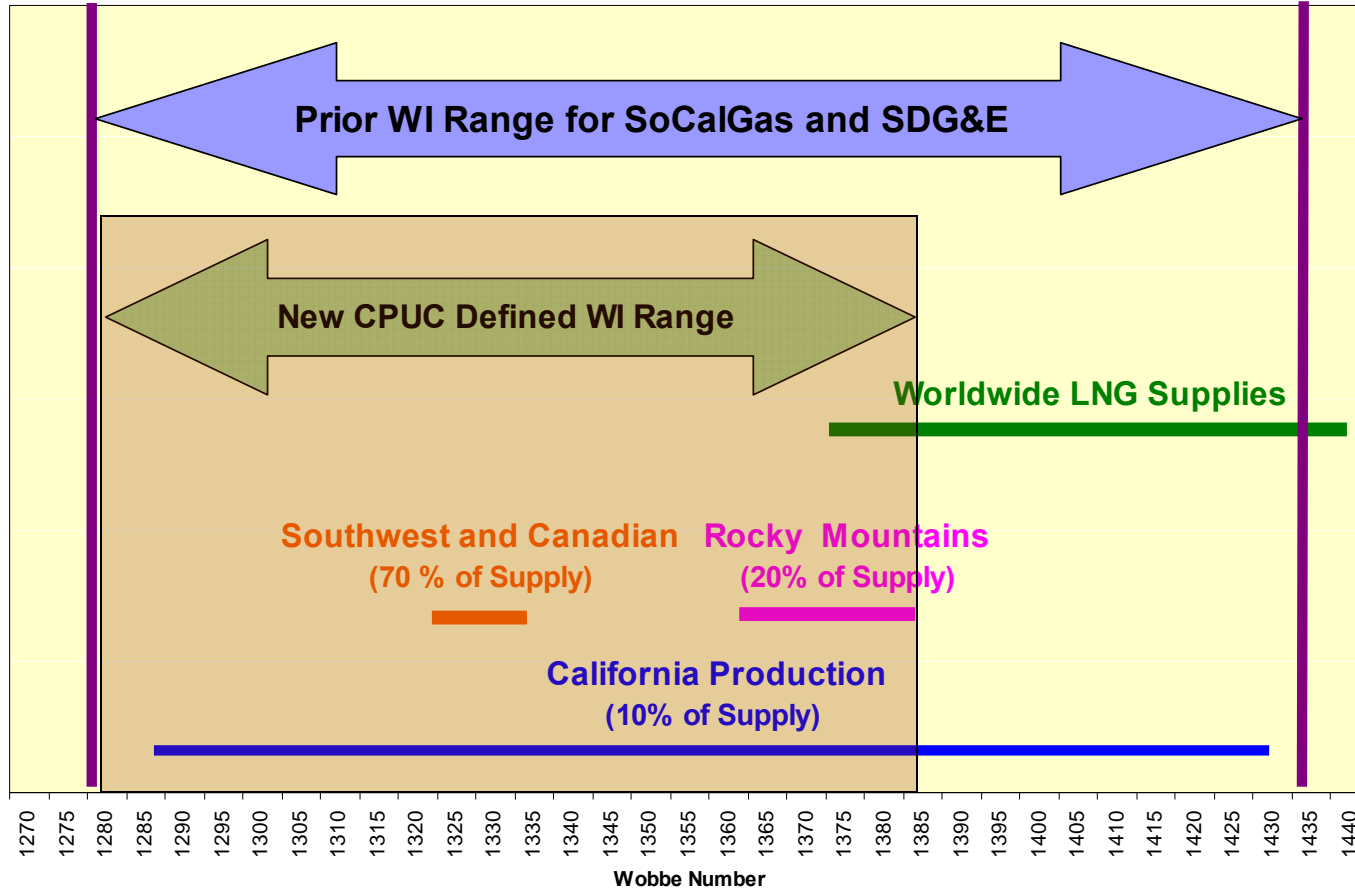
# California faces inevitable changes in its natural gas supply mix: the Wobbe Index is increasing

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- ❑ Most traditional supply sources to the western U.S. are in decline
  - This includes the largest single supply source to the Southwestern U.S., a supply source with the lowest Wobbe Index of gas imported to California (San Juan Basin)
  - All potential alternative supply sources have a Wobbe Index above 1332
  - The one source of California supply that is experiencing a production *increase* is the Rockies, but this gas has a Wobbe Index that ranges from 1338 to 1380
    - California produced gas has a Wobbe Index that can be as high as 1431
  - The Average Wobbe Index has already increased from 1332 to 1342 just since 1997
  - We cannot predict future market conditions with certainty, particularly in light of the rapidly changing conditions we are currently facing, but if the recent trend towards increased reliance on Rockies supplies continues, the Wobbe Index in southern California will continue to increase - - with or without LNG.
  
- ❑ A higher Wobbe Index is not just an “LNG issue”



# Potential Gas Supplies – Wobbe Index (WI) Range



# Gas Quality Impact on Stationary Source Emissions

- ❑ Comprehensive gas quality studies conducted by SoCalGas from 2003 to 2007 to assess how residential, small commercial end use equipment and stationary gas engines respond to changes in gas quality\*
  - In depth discussions with electric generation stakeholders (SCE, SDG&E, Solar, Calpine, GE, Siemens)
  - CEC, SCAQMD, CARB and others served on the industry advisory committee
  - Participation in federal and state studies (NGC+, CEC studies)
- ❑ Key conclusions:
  - Residential equipment is very tolerant
  - Electric generation equipment have sufficient controls and after-treatment
  - Stationary I.C. engines w/controls manage performance and emissions
  - Low NOx burners w/o controls show sensitivity. Periodic re-tuning may be required to ensure compliance and peak performance
  - Permitted equipment in southern California currently meet APCD requirements with higher Wobbe natural gas

# SDG&E/ SoCalGas Rollout Plan

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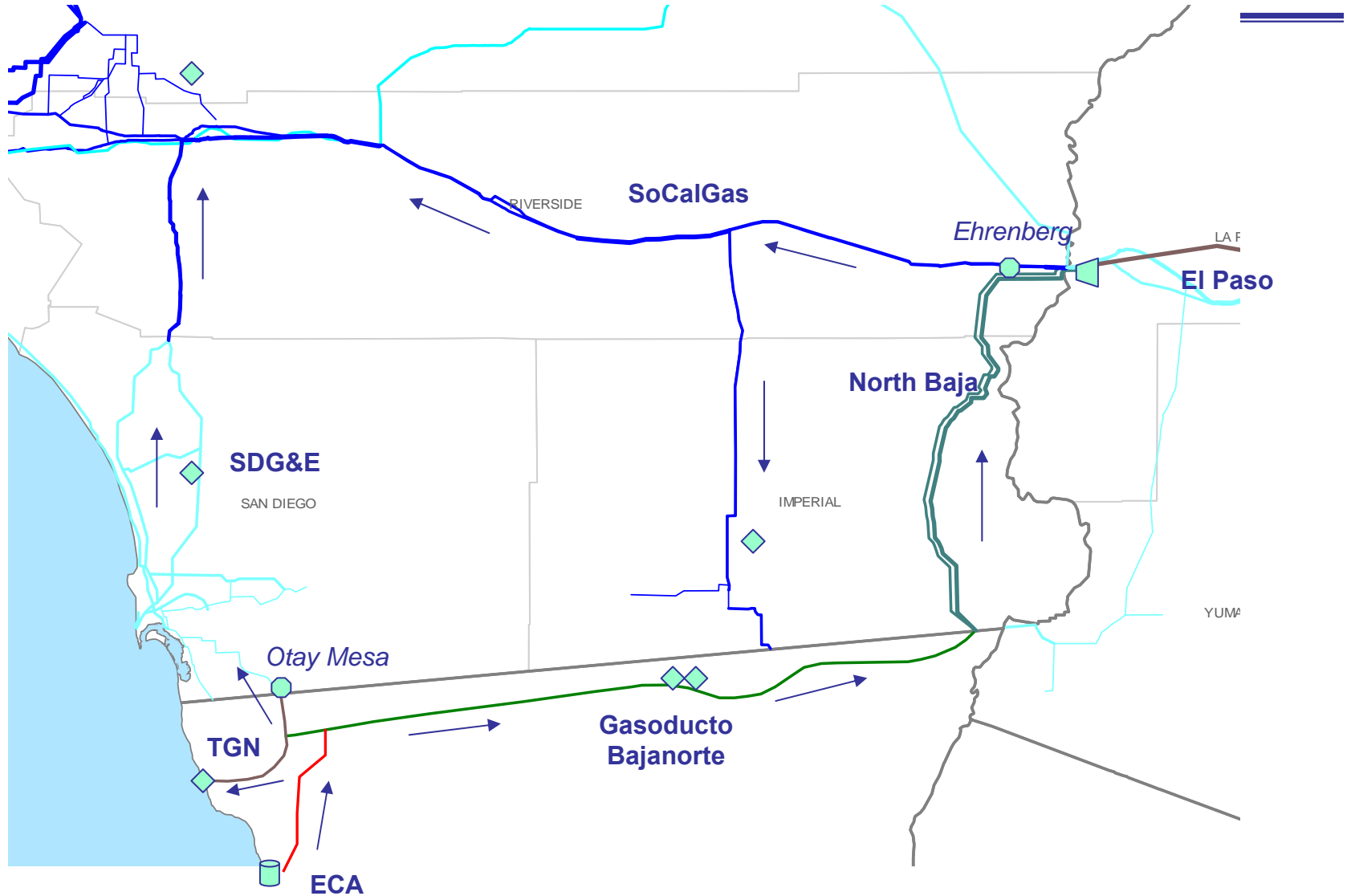
- ❑ The ***baseline surveys*** will be conducted prior to the introduction of significant quantities of new gas supplies from Energia Costa Azul.
  - The performance of equipment when operating on current supplies will be characterized.
  - Adjustment and maintenance practices will be documented.
  - Equipment types that are potentially sensitive to changing gas quality will be identified.
  
- ❑ ***On-Going monitoring surveys*** will be conducted.
  
- ❑ ***Customer Education & Resources***
  - Publish Customer Guide for Operating Equipment on new emerging natural gas supplies.
  - Direct Customer Efforts and Education for sensitive equipment
  
- ❑ ***ECA Start Up*** – Opportunity to collect data on Turbines and Large Equipment (Wobbe change from 1334 to 1383)

## ECA Start-Up Testing

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- Start-up testing of 1 Bcf/d Costa Azul LNG terminal occurred in early May and concluded on May 10th
  - Terminal had to complete performance test by running at 1 Bcf/d and peak 1.3 Bcf/d capacity
  - Costa Azul supplies delivered to SoCalGas/SDG&E system through new Otay Mesa receipt point and at Blythe through new North Baja pipeline
    - Otay Mesa received 200 MMcf of Costa Azul supplies
    - No LNG derived gas delivered at Blythe
    - ECA Supply into San Diego: Nominal Wobbe 1383
    - ECA supplies complied with applicable pipeline specifications (SoCalGas Rule 30)

# Flow Patterns During ECA Start-Up





# San Diego Gas & Electric ECA Start Up Flows – San Diego County



# ECA Start Up Monitoring Results

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## □ ECA Start Up Monitoring Project

- Validated Prior Studies and Testing
- SDCAPCD Issued Compliance Advisory
- SDG&E and SDCAPCD monitored and collected information for key end use equipment:
  - Electric Generation and Co-Generation
  - Gas Engines
  - Boilers
  - Residential Equipment (Monitoring)
- No significant issues were encountered; equipment performance met or exceeded expectations in all cases.

# SDCAPCD

## Testing & Monitoring Results

Description	Rated Load								
Make Model	MMBtu/hr, kw, etc					Emission Changes, ppm			
		Description	Operational and Emission Controls (Permit Limits NOx)	Rated Load	Emissions Baseline / ECA Gas	NOx	CO	NMHC	VOC
Engine CAT Model # G3412 TA - Rich Burn TC, AC, AFRC	500 BHP	Engine, Rich Burn	Three-way Catalyst (25 ppm)	500 BHP	1.0 / 0.9	-0.1	20.93	5.42	-0.85
Turbine GE PG-5191, water injection	18.27 MW and 317 MMBtu/hr	Gas Turbine	Water Injection ( 42 ppm)	18.27 MW	30.8 / 28.9	-1.9	N/A	N/A	N/A
Turbine Solar Mars 100 SOLONOX, Coen Duct Burner DB ON during Test	GT - 9.175 MW and 101.2 MMBtu/hr (LHV) DB - 38 MMBtu/hr (LHV)	Gas Turbine with Duct Burner	GT-LNB, DB-LNB (28.6 ppm)	GT - 9.175 MW, DB - 38 MMBtu/hr (LHV)	15.2 / 16.7	1.6	-1.2	N/A	N/A
Boiler Cleaver Brooks Model DL76 LNB, FGR, O2 trim	72 MMBtu/hr	Boiler	LNB, FGR, O2 Trim (30 ppm)	72 MMBtu/hr	25.3 / 25.7	0.3	10.4	N/A	N/A
Turbine Solar Taurus Model 60-T7300S, John Zinc Low NOx Duct Burner DB OFF During Test	GT - 5.233 MW Net and 59.48 MMBtu/hr (LHV) DB - 20 MMBtu/hr (HHV)	Gas Turbine	LNB (15 ppm)	GT - 5.233 MW Net, DB - 20 MMBtu/hr (HHV)	11.5 - 11.7	0.2	0.0	N/A	N/A
Turbine Solar Taurus Model 60-T7300S, John Zinc Low NOx Duct Burner DB ON During Test	GT - 5.233 MW Net and 59.48 MMBtu/hr (LHV) DB - 20 MMBtu/hr (HHV)	Gas Turbine with Duct Burner	GT-LNB, DB-LNB (15 ppm)	GT - 5.233 MW Net, DB - 20 MMBtu/hr (HHV)	14.2 / 14.3	0.1	0.3	N/A	N/A
Boiler International Boiler Works Model BF-350C-W12X, LNB, FGR, O2 Trim	12.6 MMBtu/hr	Boiler	LNB, FGR, O2 Trim (30 ppm)	12.6 MMBtu/hr	24.2 / 25.4	1.2	2.4	N/A	N/A
Boiler Cleaver-Brooks Model D-34, LNB, FGR, O2 trim	23.8 MMBtu/hr	Boiler	LNB, FGR, O2 Trim (30 ppm)	23.8 MMBtu/hr	26.6 / 27.1	0.5	-1.2	N/A	N/A
Engine CAT Model G3612 SITA - Lean Burn, TC, AC, V-12 Fuel Inj	2400 BHP	Engine, Lean Burn	(59 ppm)	2400 BHP	45.1 / 36.4	-8.7	4.1	63.66	3.68
Engine CAT Model G3612 SITA - Lean Burn, TC, AC, V-12 Fuel Inj	2400 BHP	Engine, Lean Burn	(59 ppm)	2400 BHP	35.7 / 29.8	-5.9	1.0	N/A	N/A

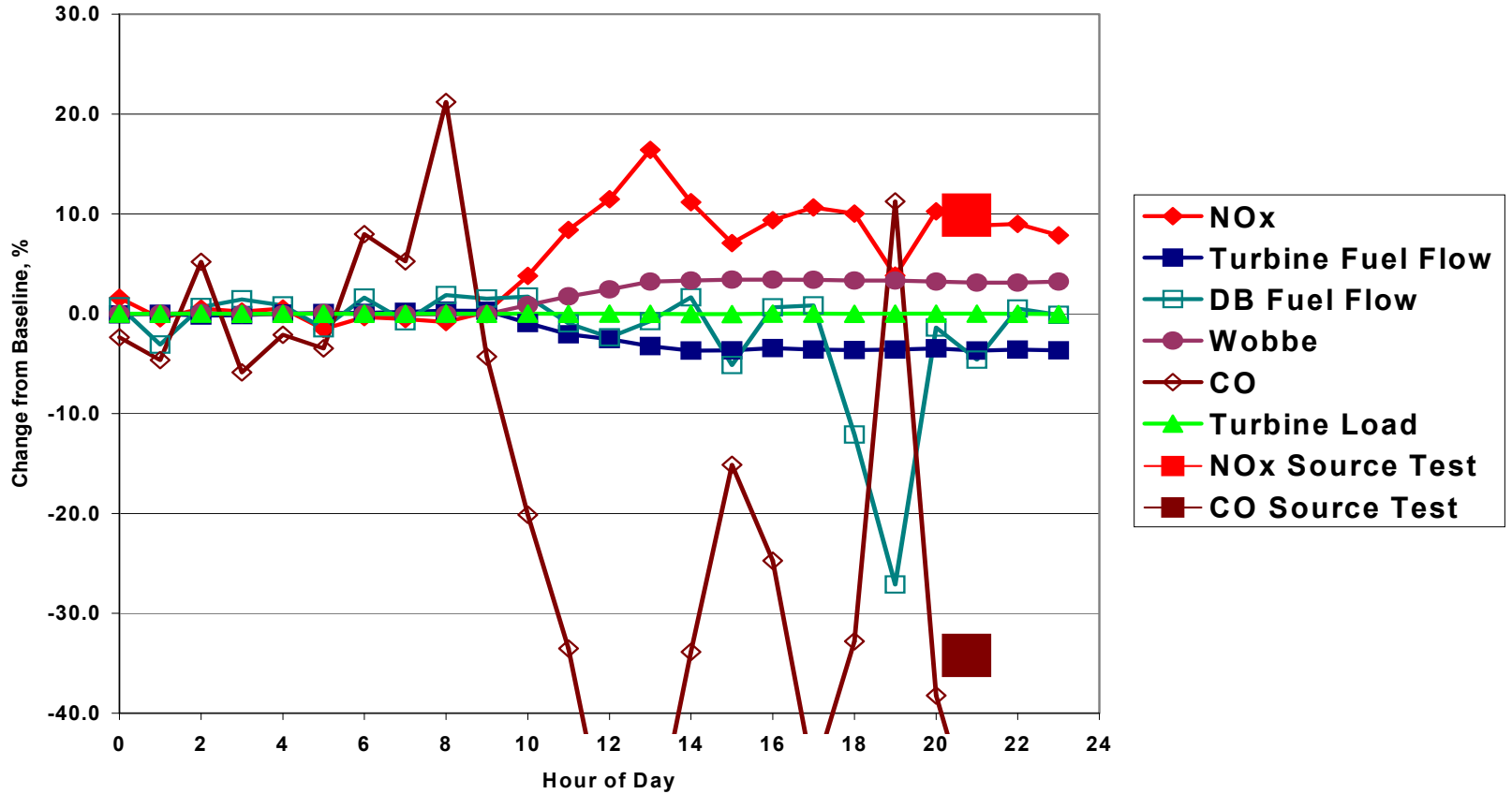
# SDG&E

## Testing & Monitoring Results

Description	Rated Load								
Make Model	MMBtu/hr, kw, etc					Emission Increase, ppm			
		Description	Operational and Emission Controls (Permit Limits NOx)	Rated Load	Emissions Baseline / ECA Gas	NOx	CO	NMHC	VOC
Powermaster / 3LG	16,800	Steam Boiler	( 30 ppm)		30.2 / 29.1	-1.1	-1.8	NA	NA
Geil Kilns / DLB30	374	Kiln for Pottery	Exempt		63 / 58	-5.0	17.0	NA	NA
Catepilliar / 3516 SITA	8,200	Gas Engine Co-Generation	No Controls (65 ppm)		62 / 66	4.0	6.0	NA	NA
Catepilliar / 3516 SITA - Manually Adjusted during test	8,200	Gas Engine Co-Generation	No Controls (65 ppm)		62 / 65	3.0	NA	NA	NA
RayPac Canada	4,000	Pool Heater	(Exempt)		171 / 183	12.0	3.0	NA	NA
Parker / T4600	4,600	Hot Water Boiler	(Exempt)		90 / 98	8.0	-105.0	NA	NA
Unilux / ZF700LS (Low Fire)	7,200	Low Pressure Steam Boiler	(30 ppm)		26 / 25	-1.0	-12.0	NA	NA
Unilux / ZF700LS (High Fire)	7,200	Low Pressure Steam Boiler	(30 ppm)		30 / 29	-1.0	-1.0	NA	NA
Solar / Satrun GC1-SB-MA	17,000	Gas Turbine Co-Generation	(Exempt)		61 / 64	3.0	-4.0	NA	NA
Babcock & Wilcox D type Water Tube (EQUIPMENT FAILURE)	27,800	Water Tube Boiler	O2 trim (30 ppm)		31 / 32	1.0	148.0	NA	NA
Cleaver Brooks CB200-600-150 ST	25,106	Steam Boiler	O2 trim (30 ppm)		20 / 21	1.0	-1.0	NA	NA

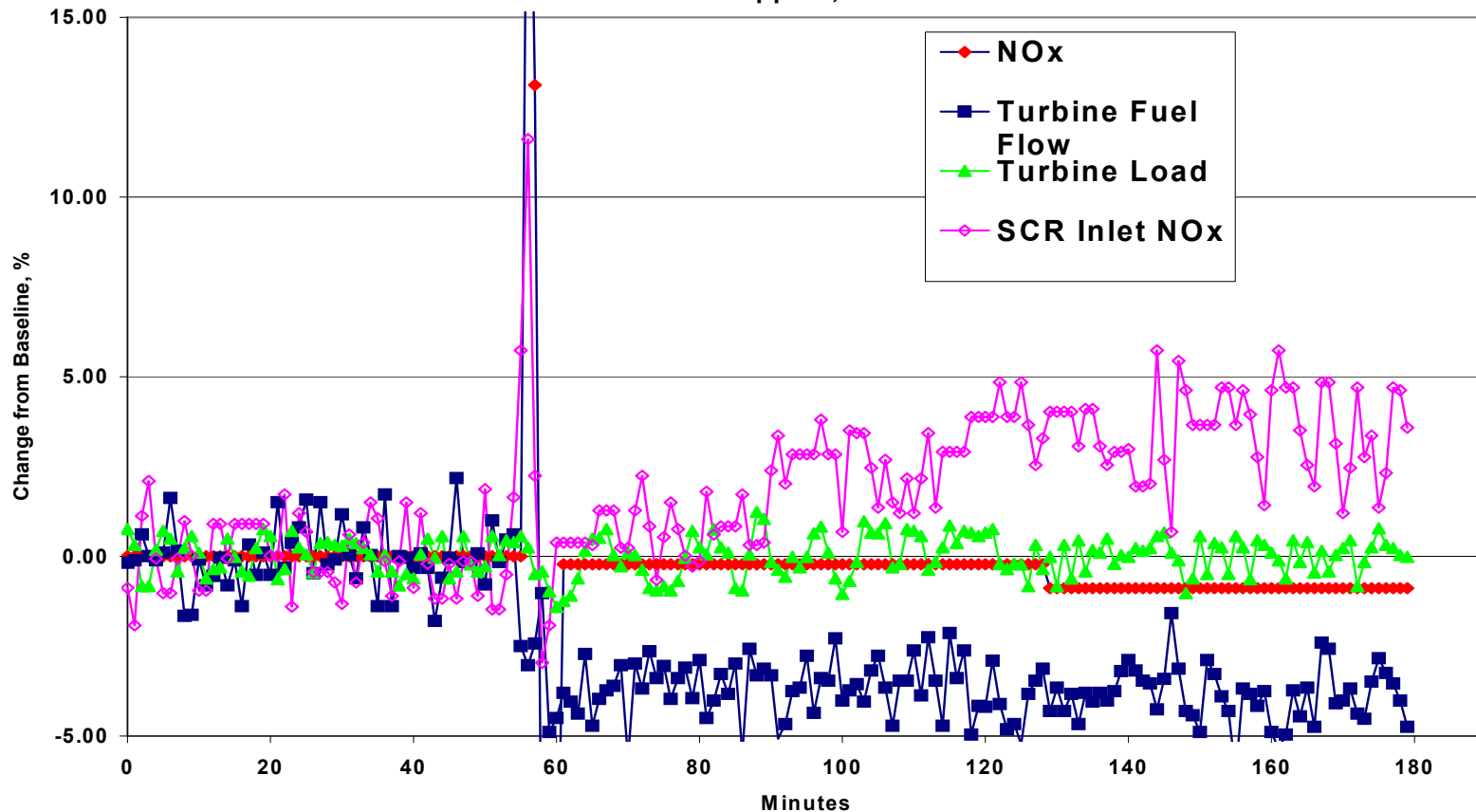
### LNG Event CEMS Data—Turbine, 9.2 MW, Duct Burner, 38 MMBtu/hr

Wobbe Index: 1336–1382, Baselines: NOx = 15.5 ppmv, CO = 2.1 ppm,  
Turbine Load = 8MW, Duct Burner Heat Input = 32.9 MMBtu/hr



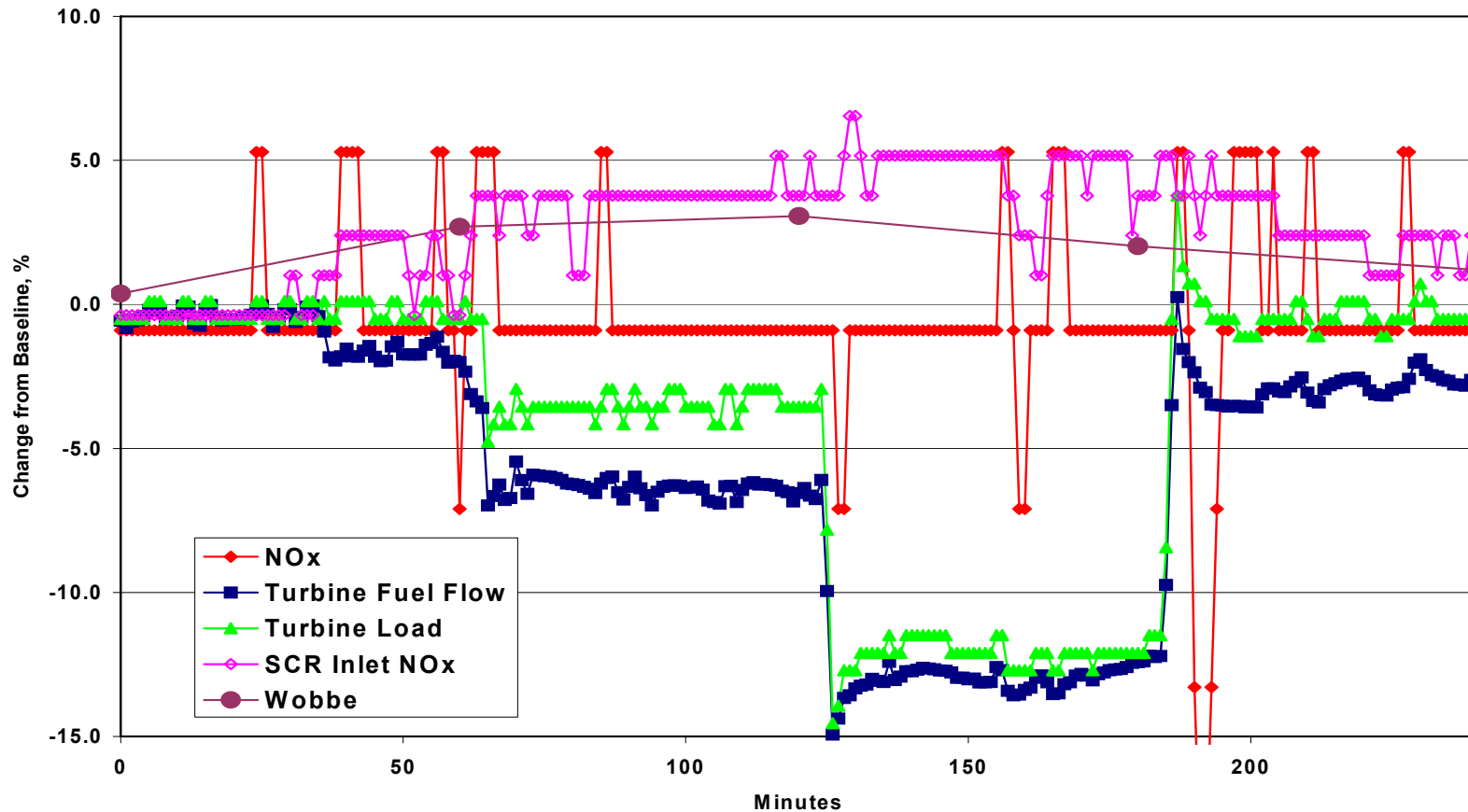
### LNG 5-9-08 Event CEMS Data—Turbine, WI, SCR, 42.4 MW

Wobbe Index: 1337–1383, Baselines: NO<sub>x</sub> = 4.5 ppmv,  
SCR Inlet NO<sub>x</sub> = 44.5 ppmv, Load = 41.6 MW



### LNG 5-9-08 Event CEMS Data—Combined Cycle Turbine, LNB, SCR, 170 MW

Wobbe Index: 1336–1377, Baselines: NOx = 1.6 ppmv, SCR Inlet NOx = 8.6 ppmv,  
Load = 163.8 MW



## SDG&E/SoCalGas Gas Quality - Next Steps

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SDG&E's Rollout Plan is progressing to Customer Phase. Objective is to help customers avoid potential emission increases through equipment maintenance, tuning and adjustments.

- ❑ Review Start Up results against installed equipment base in San Diego
  - Electric Generation
  - Commercial & Industrial Equipment: Boilers, Turbines and other
- ❑ Work with Air Quality Regulators on Emission Inventory Impacts Analysis – Address Concerns about Potential for Increases
- ❑ Update and Modify Customer Education and Rollout Programs based on Start Up Results and Analysis

\* <http://www.socalgas.com/business/gasQuality/>