

Air Quality Impacts of Liquefied Natural Gas in the South Coast Air Basin of California

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Supplemental Material

1. Modeling LNG Distribution

This pipeline gas flow modeling was performed by Sempra based upon the following parameters:

a) Total LNG Output from Energia Costa Azul (ECA) Terminal

The overall fraction of gasified LNG in the SoCalGas and in the San Diego Gas and Electric Company (SDG&E) system is a function of the total capacity of the ECA terminal. With a higher capacity of ECA higher concentrations of gasified LNG will appear in the system. Typical output from the ECA terminal is expected to be 23 normal million cubic meters per day (Nm³/day), with a projected maximum capacity of 27 million Nm³/day. Part of the LNG

from the ECA terminal is supplied to the gas system in Baja California (Mexico), and the remaining LNG enters the SoCalGas system through the Otay Mesa and Blythe receipt points. Under typical ECA output conditions, the estimated volume of gasified LNG through Otay Mesa and Blythe is 9 million Nm³/day and 3 million Nm³/day, respectively. Under maximum ECA output conditions, the estimated gasified LNG flow is 11 million Nm³/day and 2 million Nm³/day, respectively. These volumes contribute to the total natural gas supply to the SoCalGas/SDG&E system of 76 million Nm³/day for a typical summer demand in 2023, and 91 million Nm³/day for the estimated maximum demand.

b) Natural Gas Receipts at Blythe from the El Paso Delivery Point

The domestic natural gas receipts at Blythe coming from El Paso determine the fraction of gasified LNG in the natural gas stream entering the SoCalGas system through Blythe. The higher the domestic natural gas receipts at El Paso, the lower the LNG fraction at Blythe. Hence, the fraction of LNG in the SoCalGas system increases as the domestic natural gas coming from El Paso decreases. Typical volumes of domestic natural gas at Blythe coming from El Paso are 14 million Nm³/day, but they can be as low as 3 million Nm³/day and still provide enough natural gas needed to meet the demand of the system.

c) In-basin Forecasted Summer Demand

In general, an increase in natural gas demand implies a reduction in the total fraction of LNG in the gas stream that will reach Los Angeles due to increased consumption upstream. Future impacts of LNG use in the SoCAB are investigated for the year 2023. SoCalGas projections for the year 2023 estimate that a typical demand in a summer month will be 76 million Nm³/day for the entire system. Maximum demand is projected at 91 million Nm³/day due to an expected increase in natural gas consumption for electricity generation.

2. LNG Zones-of-Influence Projected Scenarios

Sempra developed a set of eight realistic LNG delivery scenarios that span the three parameters described in Section 2. The scenarios are designed to evaluate how the fraction of gasified LNG changes due to changes in ECA output, domestic gas supply and natural gas demand in the SoCalGas and San Diego Gas and Electric (SDG&E) system. The highest expected LNG fraction results from maximizing the output from ECA, minimizing the receipts of natural gas from El Paso and minimizing the in-basin natural gas demand.

Although all scenarios presented here are technically possible, some of them might not be as economically sound. Nevertheless, the scenarios were designed to analyze the range of changes in the Wobbe index of the natural gas in the system without any economic constraints. The list of scenarios is presented in Table 1.

The parameters described above are a set of inputs for the natural gas system model described above. The model simulations produce a spatial distribution of the Wobbe index based on the fraction of gasified LNG in that area of the SoCalGas distribution network. In this model, the lower limit for Wobbe index is 1335 BTU/scf; this occurs when there is no LNG introduced into the system. The upper limit for an area receiving only LNG is 1385 BTU/scf, which is the maximum allowable Wobbe index according to current gas tariffs. The resulting spatially-resolved Zones-of-Influence for all scenarios are presented in Figure 1 through Figure 8.

As expected, maximal ECA output (scenarios 5 through 8) leads to higher penetration of gasified LNG in the system, and in particular, in the air quality modeling domain (shown as a red line in the figures). Maximizing the natural gas demand reduces the penetration of LNG

into the modeling domain with respect to a case with typical demand (e.g., comparing scenario 5 and 6). Minimizing domestic deliveries at Blythe increases the penetration of LNG around Riverside, but decreases the LNG penetration in Los Angeles County, because additional natural gas supply coming from the north is required to balance the lower supply of natural gas at Blythe.

Table 1: Parameters for the eight realistic LNG scenarios projected for the year 2023 in the Southern California Gas Company (SoCalGas) and San Diego Gas and Electric Company (SDG&E) system (gas volumes in MMcf/day)

	Scenarios							
	Base	Min Domestic Deliveries		Max ECA Deliveries		Max ECA & Min Domestic Deliveries		
	1	2	3	4	5	6	7	8
<u>SoCalGas/SDG&E</u>	Typical	Maximum	Typical	Maximum	Typical	Maximum	Typical	Maximum
Summer Demand	2679	3212	2679	3212	2679	3212	2679	3212
<u>ECA Supply</u>	Typical	Typical	Typical	Typical	Maximum	Maximum	Maximum	Maximum
Otay Mesa	312	312	312	312	400	400	400	400
Blythe	112	112	112	112	84	84	84	84
<u>Receipts from EI</u>	Typical	Typical	Minimized	Minimized	Typical	Typical	Minimized	Minimized
<u>Paso (EP) at Blythe</u>	508	508	140	220	478	478	140	220
<u>Other Supplies</u>	1747	2280	2115	2568	1717	2250	2055	2508

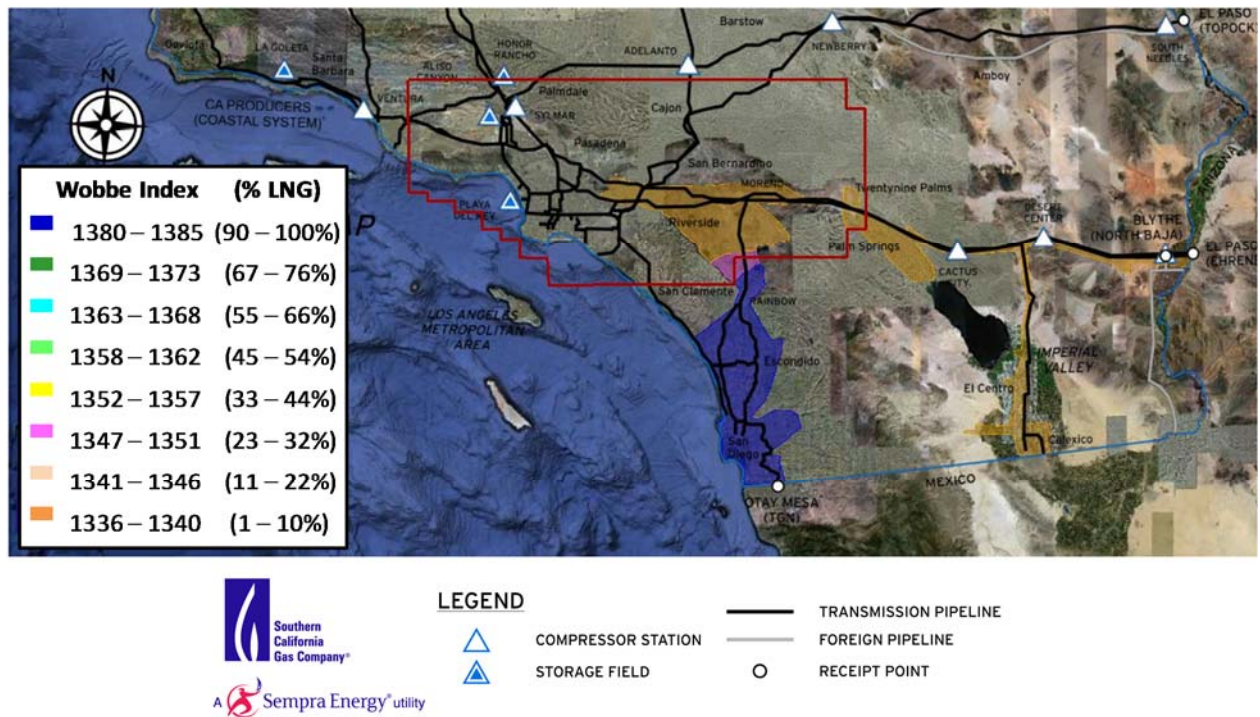


Figure 1: Zones of Influence in the SoCalGas/SDG&E system for Scenario 1: Typical summer demand, typical supply of LNG from ECA, and typical NG receipts of NG from El Paso at Blythe.

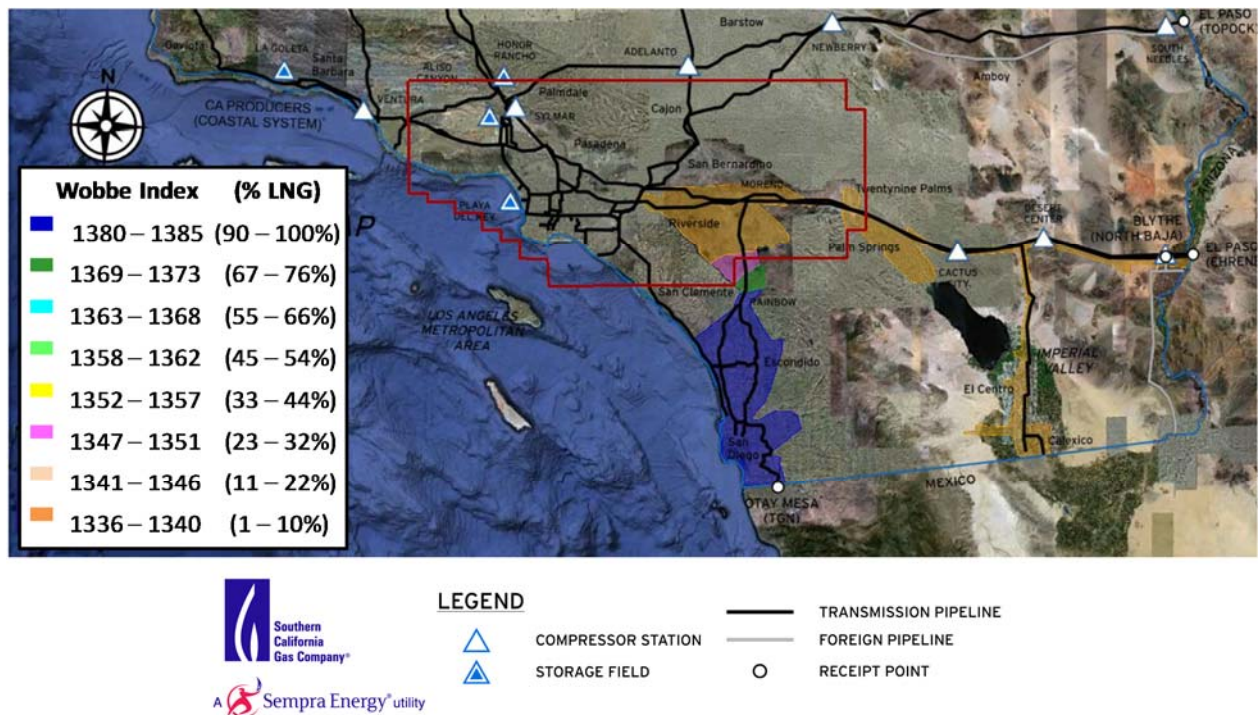


Figure 2: Zones of Influence in the SoCalGas/SDG&E system for Scenario 2: Maximum summer demand, typical supply of LNG from ECA, and typical NG receipts of NG from El Paso at Blythe.

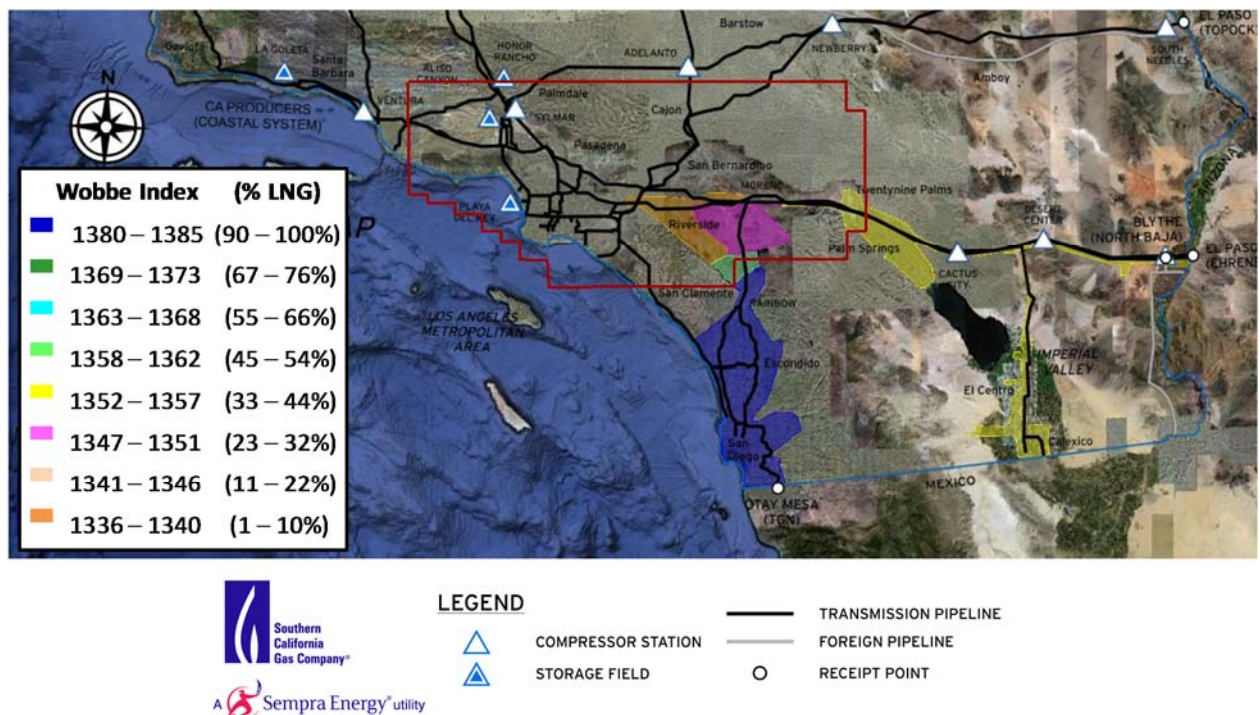


Figure 3: Zones of Influence in the SoCalGas/SDG&E system for Scenario 3: Typical summer demand, typical supply of LNG from ECA, and minimized NG receipts of NG from El Paso at Blythe.

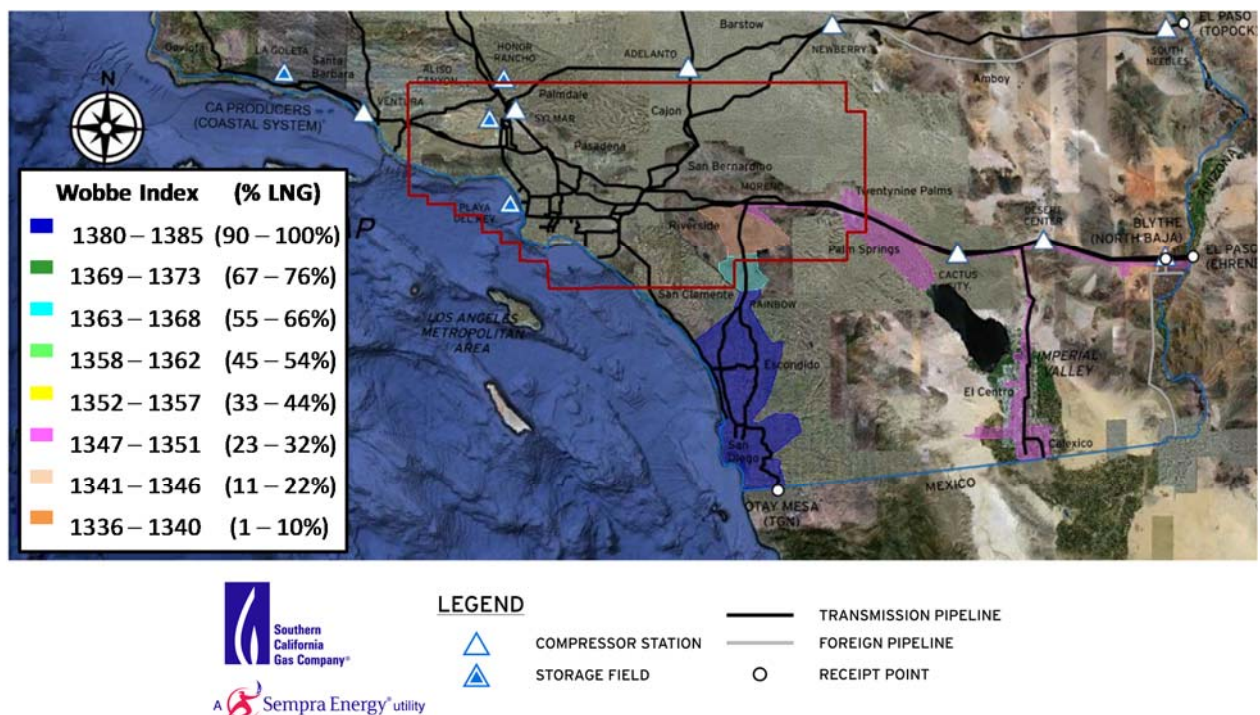


Figure 4: Zones of Influence in the SoCalGas/SDG&E system for Scenario 4: Maximum summer demand, typical supply of LNG from ECA, and minimized NG receipts of NG from El Paso at Blythe.

