ENERGY SUPPLY AND DEMAND ASSESSMENT FOR THE BORDER REGION

CONSULTANT REPORT

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Introduction

Annual electricity demand growth has exceeded six percent in Baja California for the last 5 years and will continue at this rate for 5 to 10 years in the future. San Diego's electricity demand growth is driven by residential population increases, resulting in 2-3 percent annual increases. To meet the growing demand for electricity and natural gas, the energy sectors of both California and Baja California are becoming increasingly integrated. The production and use of energy within the California-Mexico border region is interconnected by the cross-border transfer of significant amounts of electricity and natural gas.

San Diego has relatively few local power plants and buys power from other parts of California, Mexico and other states in the United States (U.S.). Options for importing additional power are constrained by existing transmission lines. Additional options for meeting future demand growth include increased energy efficiency and development of local resources.

Baja California is geographically isolated from the rest of Mexico and has developed an interdependent energy relationship with California. Cross-border electricity sales, transmission lines and natural gas pipelines accentuate the interdependence. Baja California offers the potential to supply energy resources to address energy needs in the border region and the western United States. Baja California anticipates several new natural gas-fueled power plants, renewable energy projects, and two liquefied natural gas terminals that can supply electricity and fuel to Mexico and potentially to California and the western United States.

This paper describes the interregional supply-demand relationship and the energy infrastructure on both sides of the border, including anticipated future changes. Background information is first provided about the historical context for energy exchange between California and Mexico and the agencies and industries involved. The existing and projected demand for energy is described for the border region of California and Mexico, followed by descriptions of the existing and planned electricity and natural gas infrastructure on both sides of the border, including renewable resources. Additionally, some opportunities for increasing energy efficiency and demand response in the region are discussed. Finally, constraints and opportunities for transborder energy exchange are discussed with policy options for improving energy resource planning and development in the California-Mexico border region.

Background

Historical Context

Transborder energy exchange between the U.S. and Mexico began in 1905. Privately operated electric utilities in the U.S. and Mexico constructed low voltage

transmission lines to serve sparsely populated areas across the border near towns in their service areas. These initially small energy transactions between the two countries grew steadily over the following decades as economic interdependence increased. In 1984, electricity exchange between California and Mexico increased significantly with the signing of a 220 megawatt (MW) firm power purchase agreement between Comisión Federal de Electricidad (CFE), the state-owned electricity monopoly in Mexico, and San Diego Gas & Electric Company (SDG&E) and Southern California Edison (SCE). Nine transmission lines now connect California with Mexico.[1]

In 1998, Mexico's natural gas trade with the U.S. was enhanced by a 10-year agreement between CFE and Sempra Energy, a U.S.-owned firm, to supply up to 300 million cubic feet per day (MMcfd) of gas to power plants in Baja.[2] The agreement resulted in construction of the 220-mile Baja Norte pipeline from Arizona to Tijuana, completed in December 2002.

Agencies and Industries Involved

California

Energy production and distribution is largely decentralized within the U.S., with energy infrastructure mostly owned and operated by private industry. Within the California-Mexico border region, major providers of electricity and natural gas are Sempra Energy and the Imperial Irrigation District.

Sempra Energy, based in San Diego, is an energy services company that develops energy infrastructure, operates utilities, and provides related products and services in the United States, Europe, Canada, Mexico, South America, and Asia. The following is a description of SEMPRA-owned companies that operate within the California-Mexico border region:

- San Diego Gas & Electric Company (SDG&E) is a regulated utility that owns and operates electricity transmission and distribution and natural gas distribution infrastructure within San Diego County and portions of Orange County.
- Southern California Gas Company (SoCalGas) is the nation’s largest natural gas distribution utility.
- Sempra Generation is a subsidiary of Sempra Global, the umbrella for Sempra Energy’s growth businesses. Sempra Generation develops, acquires, operates, and maintains power plants and energy infrastructure for the non-regulated market. Within the California-Mexico border area, it operates a 600 MW plant near Mexicali, Baja California, and is constructing a 550 MW plant in Escondido that will be owned by SDG&E upon completion.

- Sempra Pipelines & Storage operates interstate pipelines that connect major natural gas supply basins in the northern Mexico, Gulf Coast, and mid-continent areas with rapidly growing markets in the southwestern and southeastern United States. Within the California-Mexico border region, it is in the process of developing more than 150 miles of pipelines in Mexico and the United States.
- Sempra LNG is developing three liquefied natural gas (LNG) receiving terminals in North America, including the Costa Azul project near Ensenada that will deliver one billion cubic feet per day of natural gas.

Imperial Irrigation District (IID) is a community-owned utility that provides irrigation water and electricity in southeastern California. IID was established in 1911 under the California Irrigation Act and is governed by a five-member publicly elected board of directors. The district extends from the California-Arizona border on the east to the SDG&E service area on the west, from the U.S.-Mexico border on the south to the SCE service area on the north. IID is now the largest irrigation district in the nation and the sixth largest power utility in California based on power consumption, serving 92,000 connections in Imperial County and parts of Riverside and San Diego counties.[3] IID entered the power industry in 1936 after discovering its potential for low cost hydroelectric energy along the All-American Canal. As demand for energy increased, IID expanded its sources of electricity with the construction of several steam and gas turbine generating units and the purchase of interests in the Palo Verde Nuclear Generating Plant and San Juan Generating Station Unit 3.

Mexico

Several Mexican federal, state, and municipal government agencies are involved in the permitting and regulation of U.S.-Mexico cross-border energy trade.

- Comisión Federal de Electricidad (CFE) is the government enterprise tasked with the ownership and operation of the public utility electric system infrastructure that is involved if government electric power infrastructure is used or proposed for development or enhancement.
- The Comision Reguladora de Energia (CRE), an independent regulatory agency with jurisdiction over the electrical and gas industries, regulates the importation and exportation of electricity by private sector entities. Upon establishing compliance with its requirements, the CRE issues import or export permits for electricity. No CRE permit is required to import or export natural gas.
- Secretaria del Medio Ambiente y Recursos Naturales (SEMARNAT), the Secretariat of the Environment and Natural Resources, is the agency to which any party interested in building a cross-border transmission line or pipeline must submit an environmental impact assessment and a risk analysis of the project. SEMARNAT, upon determining compliance with the law, will issue an

environmental impact license and a risk license. Under SEMARNAT's jurisdiction, the following agencies are responsible for specific aspects of the permitting process and for the enforcement of regulations: Comisión Nacional del Agua (the National Water Commission) for water rights and use; Instituto Nacional de Ecologia (the National Institute of Ecology) for review of adequacy of environmental reviews and grants approval of environmental impact assessments; and Procuradoria de la Proteccion del Ambiente, or PROFEPA, (the Federal Solicitor for the Protection of the Environment), charged with the enforcement of environmental laws and regulations for management and disposal of hazardous waste and air emissions.

Additionally, a cross-border transmission project sponsor (gas or electric) will have to comply with all municipal regulations, including obtaining a land use license and, if applicable, a construction license.

The following private sector firms are currently involved in cross-border energy transfer activities:

- Energia Azteca X S. de R.L. de C.V. (EAX), a subsidiary of Intergen, owns and operates part of the natural gas-fired combined cycle facilities at the La Rosita Power Complex (LRPC). EAX's unit (LR-1) consists of three 160-MW gas turbines and one 270-MW steam turbine, for a total generating capacity of 750 MW of which 660 MW are contracted by CFE under a power purchase agreement and 90 MW are exported to California. Energia de Baja California (EBC) S. de R.L. de C.V. owns the other combined cycle unit in LRPC (LR-2) consisting of one 160-MW gas turbine and one 150-MW steam turbine, for a total generating capacity of 310 MW exclusively dedicated to export.
- Termoeléctrica de Mexicali (TDM), a Sempra subsidiary, owns and operates a 650-MW combined cycle generating facility consisting of two 170-MW gas turbines and one 310-MW steam turbine. The power plant produces electricity exclusively for export to the United States, transmitted over a transmission line not connected to the CFE transmission system.
- Transportadora de Gas Natural de Baja California, a joint venture of Enova International, Pacific International, and Sempra Energy de Mexico, operates the Gasoducto Rosarito 30-inch pipeline from San Diego to Rosarito, Baja California.
- Gasoducto Baja Norte owns and operates the 30-inch pipeline by the same name from Algodones to Tijuana, Baja California.

In addition to these major players, 19 firms, listed in Appendix A, hold current electric importation permits.

Energy Demand

Electricity

In 2001, total electricity consumption in California was 265,000 gigawatt-hours (GWh), about 34 times more than Baja California.[4] The following sections summarize the projected demand growth within the California-Mexico border region.

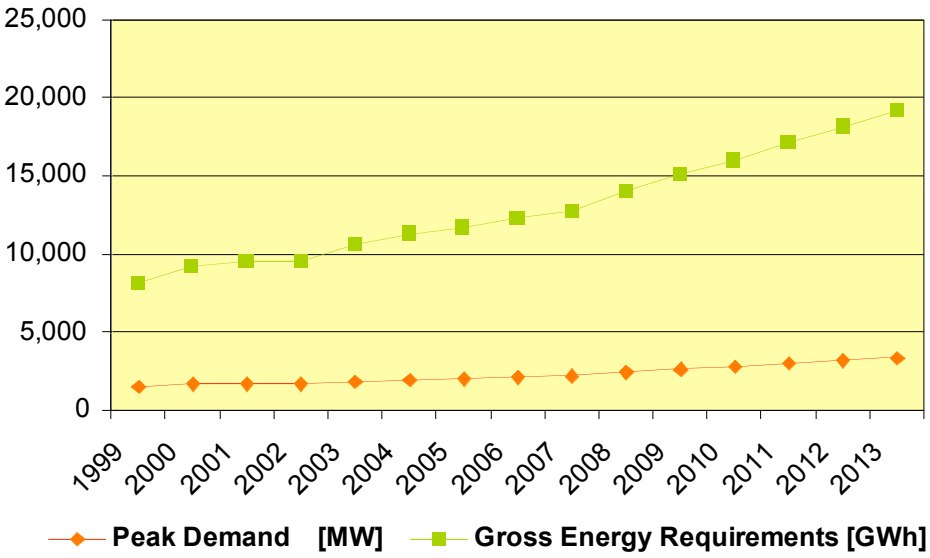
San Diego/Imperial Counties

In 2001, total electricity consumption within the SDG&E service area was 17,908 GWh, about 7 percent of the statewide total.5 During summer 2004, peak energy demand reached record levels at 4065 MW.6 Current demand growth rate forecasts are much lower because of a variety of factors including higher electric rates, new conservation programs, and new appliance efficiency standards. For the years 2004-2009, the California Energy Commission (Energy Commission) and SDG&E estimate the average annual electricity demand growth rate to be 2.1 percent and 2.0 percent, respectively; both forecast system peak load to grow 2.0 percent annually during this period.7 The Energy Commission and SDG&E estimate growth rates in system load in 2010 and beyond to be about 1.5 percent annually. Non-coincident peak demand (that is, peak demand in southern California not coinciding with peak demand in northern California) is forecast to grow to 4,855 MW in 2013.8 In 2002, IID peak electricity demand was 740 MW.9 Peak system demand is forecast to increase to about 1000 MW by 2013.[10]

Baja California

In 2001, total electricity consumption in Baja California was 7,800 GWh.[11] In its official 2004-2013 electricity demand forecast, CFE expects the demand growth for the Baja California Norte to continue, albeit at a slightly lower pace than in prior years. Energy sales in Baja California Norte are expected to grow at an average 7.0 percent for the 2004-2013 planning horizon, versus 7.5 percent for the prior 10 years, but peak demand is expected to continue growth at 6.3 percent, the same rate experienced from 1993-2003. Figure 1 illustrates the growth in energy sales and peak demand.

Figure 1. Peak Demand and Energy – Baja California Norte

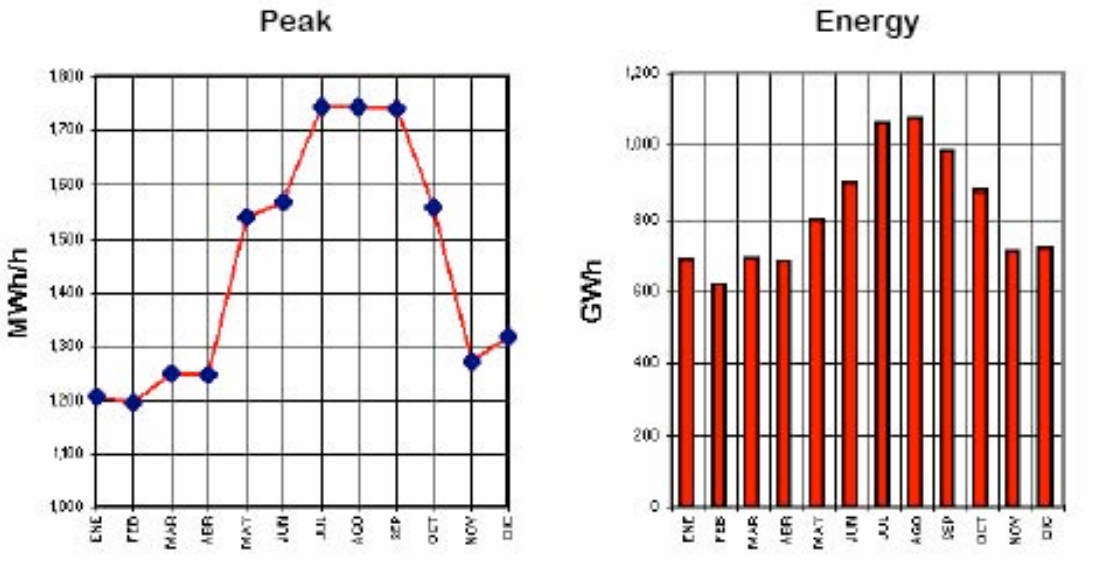


Source: Comisión Federal de Electricidad, Mexico, 2005, Programa de Obras e Inversiones del Sector Eléctrico 2004-2013, Tables 1.7 and 1.8.

In 2003, 52 percent of sales went to commercial and small to medium industrial establishments, 11 percent of all accounts. Residential sales accounted for 32 percent of all sales and 89 percent of all accounts. The remainder (11 percent) was sold to large industry, municipal service, and agricultural users. In 2003, energy sales increased by 5.0 percent, mainly as a result of residential and commercial growth.

Sales are centered on the Tijuana and Mexicali urban and suburban areas, known as the Coast and Valley Zones. While overall demand in Baja California Norte peaks in August (1,940 MW in 2004), the Coast and the Valley peak at different times of the year: the Coast peaks in the winter (550 MW), while the Valley peaks in the summer (1,100 MW).[12] This seasonality and the location of the Baja California Norte generation resources dictate to a large extent the load flow patterns in the Baja California Norte transmission system: Valley to Coast in the winter (250-280 MW) and Coast to Valley in the summer (150-200 MW).[13] Figure 2 illustrates the Baja California Norte monthly load pattern for 2003.

Figure 2. Energy Load Pattern - Baja California Norte (2003)



Source: CFE-CENACE – 2003 load data

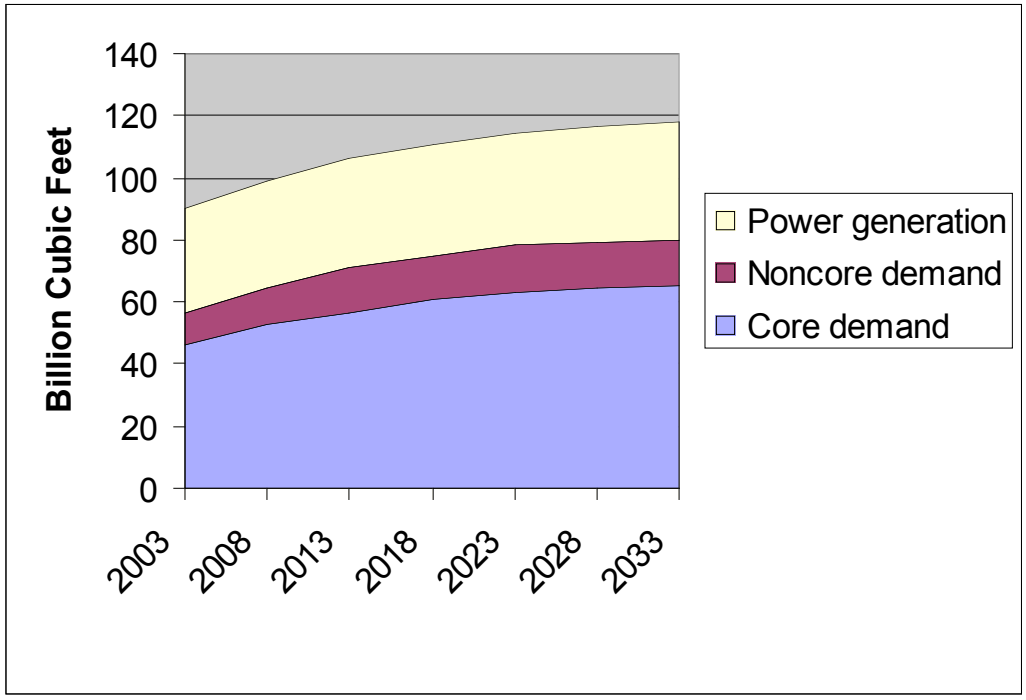
Natural Gas

San Diego/Imperial Counties

In 2003, total annual natural gas demand within the area served by SDG&E was about 90 billion cubic feet (Bcf). Approximately 52 percent of demand was from core customers (residential and small commercial/industrial), 11 percent from non-core customers, and 37 percent from power generation.

Natural gas demand within the SDG&E service area, which includes Imperial County, is forecast to grow between 1.2 and 1.6 percent annually.[14] The primary driver for gas demand in the near-term growth is power plant demand. While new electric generation plants brought on line during this period will significantly increase demand, older plants that are re-powered could produce a net reduction in demand due to higher plant efficiencies. Another driver for growth is the anticipated increase in the use of natural gas for cogeneration. Figure 3 shows the forecast growth in annual natural gas demand within the SDG&E service area over the period 2003-2038.

Figure 3. Natural Gas Demand Forecasts - SDG&E (2003-2038)



Source: California Energy Commission, August 2003, *Natural Gas Market Assessment*, California Energy Commission, Sacramento, CA, Pub number, 100-03-006, Appendix C.

Total projected SDG&E peak-day natural gas demand in 2006 and 2016 in million cubic feet per day (MMcfd) is shown in Table 1 under various scenarios. The California Public Utility Commission's (CPUC's) current adopted peak-day criteria for service reliability is 1-in-35 cold year for core service (that is, all core demand is served and all non-core service is curtailed), and 1-in-10 cold year for firm non-core service (that is, all core demand and firm non-core demand is served).[15]

Table 1. Forecast Peak-Day Natural Gas Demand - SDG&E

Scenarios	PEAK-DAY (MMcfd) 2006	2016
a. Average Year		
i. Average year	538	604
ii. Average year + 10%	592	664
iii. Average year + 20%	645	724
b. Abnormally Cold Year		
i. 1 in 10 yrs	588	661
ii. 1 in 10 yrs + 10%	647	727
iii. 1 in 35 yrs	615	691
iv. 1 in 35 yrs + 10%	676	760
c. Abnormally Dry Year		
i. 1 in 10 yrs	548	648
ii. 1 in 10 yrs + 10%	603	712
iii. 1 in 35 yrs	550	638
iv. 1 in 35 yrs + 10%	605	702
d. Abnormally Cold and Dry Year		
i. 1 in 10 yrs	599	705
ii. 1 in 10 yrs + 10%	659	776
iii. 1 in 35 yrs	627	726
iv. 1 in 35 yrs + 10%	689	798

Source: San Diego Gas & Electric Co., November 2003, *Responses to CPUC Data Requests, OIR to Establish Policies and Rules to Ensure Reliable, Long-Term Supplies of Natural Gas to California*, R.04-01-025, Table Q.1.

Baja California

Demand for natural gas in Baja California Norte is driven mainly by power generation. After a failed auction for the Tijuana LDC franchise, the only local distribution of natural gas can be found in Mexicali. Based on 2003 sales data, the Mexicali LDC sold an average 10.8 MMcfd to all its customers. This represents roughly 4.8 percent of the overall average natural gas demand for the Baja California Norte region. Power generation for the public sector (CFE) by CFE's own plants and independent power production under contract with CFE amounted to 140.6 MMcfd or 63 percent of the average demand for the region. Intergen's LRPC export-dedicated capacity plus Sempra's Thermoelectrica de Mexicali accounted for the remaining 72.0 MMcfd or 32.2 percent of natural gas demand in Baja California Norte.

Table 2 contains a simplified natural gas demand forecast using 2003 CFE sales as the forecasts baseline, CFE's generation expansion schedule,[16] and economic growth factors found in the Prospectiva del Mercado para el Gas Natural 2004-2013.[17]

Table 2. Forecast Natural Gas Demand – Baja California Norte (2003-2010)

Rosarito Load (CFE)	2003	2004	2005	2006	2007	2008	2009	2010
2x CC Units (496 MW) Units 7&8	53	62	62	65	66	66	68	68
2x Dual Units (320 MW) Units 5&6	24	13	53	55	56	56	58	58
Total Rosarito	**77**	**75**	**115**	**121**	**122**	**122**	**126**	**126**
			MMCFD					
Mexicali Load	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
InterGen Azteca 500 MW CC for CFE	74	65	63.1	74.3	74.3	74.3	74.3	74.3
InterGen Azteca 290 MW CC for SoCal (Mexicali II in 2008)	na	19	19.4	25.4	27.9	30.4	43.1	43.1
InterGen Azteca 310 MW CT for SoCal (BC II in 2010)	na	na	2.0	3.8	11.3	15.0	15.0	15.0
Total InterGen Azteca	**74**	**84**	**84.5**	**103.4**	**113.4**	**119.7**	**132.4**	**132.4**
		72.0						
Sempra Termoelectrica de Mexicali (600 MW)	**0**	**53**	**57.6**	**62.6**	**67.9**	**73.1**	**78.3**	**83.5**
Mexicali LDC (DGNM)		**11**	**11.0**	**11.5**	**11.9**	**12.4**	**12.9**	**13.4**
Total Mexicali		**148**	**153.2**	**177.5**	**193.2**	**205.2**	**223.6**	**229.4**
Total Baja Demand		**223**	**268.5**	**298.0**	**315.5**	**327.4**	**349.3**	**355.0**

Energy Supply and Capacity

Electricity

San Diego/Imperial Counties

Generating Stations

SDG&E consumes 3.5 times more power than Baja California but does not meet customer demand with local generating capacity, importing about 60 percent of its electricity from outside the region.[18] Based on the Energy Commission's 2004 Power Plant Database, SDG&E has an on-system generating capacity of about 2570 MW. Most of this generating capacity is from two aging, base load facilities: the 965 MW Encina Power Plant, owned jointly by NRG Energy and Dynergy, and the 690-MW South Bay Power Plant, owned by the Port of San Diego and operated by Duke Energy. Both could be retired by the end of 2008. The remaining on-system generating capacity is from small- and medium-sized peaking plants and on-site generators. In addition, SDG&E holds a 20 percent interest (430 MW) in the 2150-MW San Onofre Nuclear Generating Station (SONGS), which is licensed to operate until 2022.

Currently, two energy facility projects in San Diego County are approved and under construction: Palomar Escondido Energy Project and Otay Mesa Power Plant Project. The Palomar Escondido Energy Project is a natural gas-fired combined cycle power plant with a nominal electrical output of 546 MW. The project includes a new
230-kilovolt (kV) switchyard connecting with an existing SDG&E electric transmission line located immediately adjacent to the project site. The project is located in the City of Escondido and is expected to be on line in 2006.[19]

The Otay Mesa Power Plant Project will be a 510 MW, natural gas-fired combined cycle power plant located in the Otay Mesa area in western San Diego County. The project will include a new 230 kV switchyard and a 0.1-mile connection to SDG&E's existing 230 kV Miguel-Tijuana transmission line that passes near the eastern boundary of the Otay Mesa site. A new two-mile natural gas pipeline will be built by SDG&E to provide fuel for the project. The gas pipeline will connect to SDG&E's Pipeline 2000, which is currently under construction. The Otay Mesa Power Plant is expected to be on line in 2008.[20]

In contrast to SDG&E, IID has typically been a net exporter of electricity. The following is a list of the IID-owned generating plants:[21]

	MW
El Centro Steam Units	241.5
Yucca Steam Unit	96.6
Gas Turbine Units	142.5
Hydroelectric Units (at minimum flow)	85.0
Total IIL-Owned	565.5

IID augments its generated power during maintenance periods and low water flows with purchases of power from the Western Area Power Administration. It also participates in sales and purchases of electricity through the Western Systems Power Pool and has an interest in the Palo Verde/San Diego 500 kV transmission line. Total IID resources were 835 MW in 2002, compared to peak demand of 740 MW.[22]

Renewable Sources

Although Senate Bill (SB) 1078 mandates a 20 percent renewable portfolio mix by 2017, SDG&E has committed to achieving this goal by 2010 and a 24 percent mix by 2014. This represents the "resource stack" that SDG&E believes it will likely be able to procure in the future:[23]

1. Biomass or biogas resources in its service area.
2. Wind resources in its service area.

3. Biomass or biogas resources outside its service area.
4. Geothermal resources outside its service area.
5. Solar resources in its service area.
6. Wind resources outside its service area.
7. Solar resources outside its service area.

In order to achieve the 20 percent renewable generation goal by 2010, SDG&E indicates that it will have to procure 3,488 GWh of renewable energy. Currently, SDG&E has 992 GWh of renewable energy under contract through 2010, which equates to a 5.69 percent baseline retail energy supply, and must procure an additional 2,496 GWh to achieve the 20 percent renewable energy procurement goal by 2010.[24] This amount is equivalent to about 552 MW of renewable resources based on assumed capacity factors for each resource technology type in SDG&E's mix.

Table 3 is a summary of SDG&E's Renewable Procurement Plan for the years 2010 and 2014. A key feature of SDG&E's plan is the addition of significant geothermal resources from the Salton Sea area after 2010, contingent on its ability to upgrade transmission capacity from Imperial Valley to the SDG&E service area.

Table 3. SDG&E Renewable Procurement Plan

	2010			2014		
Technology	**MW**	**GWh**	**%**	**MW**	**GWh**	**%**
Biogas	72	517	15%	66	466	10%
Biomass	120	930	26%	120	930	21%
Wind	379	1,181	34%	409	1,273	28%
Hydro	32	69	2%	37	80	2%
Solar	101	218	6%	106	228	5%
Geothermal	73	573	17%	194	1,519	34%
Total	777	3,488	100%	932	4,496	100%

Source: San Diego Gas & Electric Company, July 9, 2004, *Long-Term Resource Plan of San Diego Gas & Electric Company (U 902 E)*, direct testimony of Vincent D. Bartolomucci, California Public Utilities Commission, pp 11, 14.

Facilities in Imperial County currently produce a total of 635 MW of renewable energy. Of this energy, 552 MW is generated from geothermal energy, 18 MW from biomass energy, and 65 MW from small hydroelectric facilities.[25] Another 270 MW from geothermal energy (215 MW would come from the proposed Salton Sea Geothermal Plant) and 80 MW from biomass energy are proposed for development in Imperial County. The remaining MW would come from smaller renewable projects.

The Salton Sea Geothermal Power Plant Project has been proposed for a site located six miles northwest of Calipatria, within the unincorporated area of Imperial County, California. The new geothermal power facility would generate approximately 215 MW and include a 161-kV switchyard and two electrical transmission lines.[26]

Transmission Lines

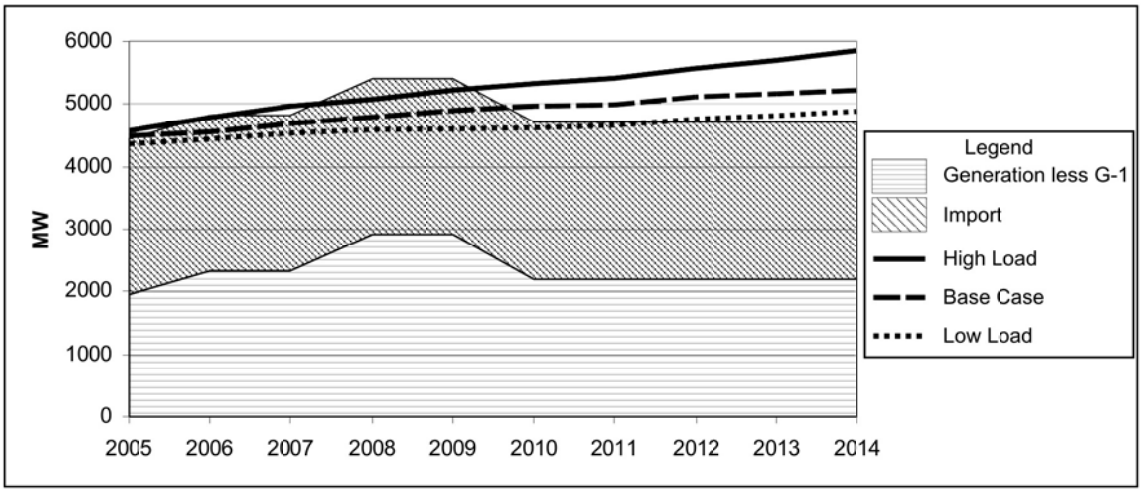
Figure 4 is SDG&E's electric transmission system. SDG&E's customer demand is satisfied through a combination of on-system generation and electricity delivered into the local reliability area by imports through the Miguel Substation from the east and south and the San Onofre switchyard to the north. SDG&E has no 500-kV interconnections with the rest of California but is interconnected with the California independent service operator-controlled (Cal-ISO) electricity transmission system through SCE by five 230-kV lines (Path 44/south of SONGS). It can import electricity from out of state through the 500-kV Southwest Power Link (SWPL) transmission line and from Mexico through two 230-kV transmission lines (Path 45).[27]

Figure 4. SDG&E Electric Transmission System

Source: San Diego Gas & Electric Company, October 1, 2004, *SDG&E's Comparison Study*, presentation to Stakeholder Meeting, p. 22.

SDG&E uses two transmission system constraints to define its ability to import off-system power: the simultaneous import limit (SIL) applies when all transmission facilities are open, while the non-simultaneous import limit (NSIL) is its ability to import power when the SWPL transmission line is out of operation. Based on technical studies, SDG&E currently uses 2500 MW and 2850 MW for NSIL and SIL limits, respectively.[28]Figure 5 is a summary of projections used by SDG&E for its grid reliability planning under three system peak load scenarios. For planning purposes, available resources to serve peak load assume the largest on-system generator is out of service and the importation of off-system power is at the NSIL limit. These scenarios suggest a narrowing of operational reserve margins in the near-term and a major grid reliability deficiency possibly occurring as early as 2010 due to the assumed retirement of the Encina and South Bay base load facilities.

Figure 5. SDG&E Grid Reliability Forecasts



Source: San Diego Gas & Electric Company, July 9, 2004, *Long-Term Resource Plan of San Diego Gas & Electric Company (U 902 E)*, California Public Utilities Commission, direct testimony of Linda P. Brown, p 10.

The transmission lines extending from Mexico and the Imperial Valley into the SDG&E service area have experienced significant congestion. The following projects have been identified to relieve the congestion and improve the network to move power into the San Diego region:[29]

- The Miguel-Mission #2 230-kV Transmission Line was approved by the CPUC in 2004 and is expected to be operational by June 2006. Currently a 500-kV transmission line from Arizona terminates at the Miguel substation. The Miguel-Mission #2 line would connect the Miguel and Mission substations, bringing power much closer to San Diego's urban core. The project would relieve congestion over SDG&E's existing network and increase the system's ability to transfer electricity both from the two power plants in

Mexicali, Mexico, and from new generation in Arizona scheduled into the Cal-ISO control area in Palo Verde.[30]

- The Lake Elsinore Advanced Pumped Storage (LEAPS) Project, one of two alternatives to bring power into San Diego, is a 500-kV merchant-owned transmission project associated with a 500-MW pumped storage generation facility proposed for Lake Elsinore. The 30-mile transmission line would connect SCE's Valley-Serrano 500-kV line to a new substation in SDG&E's territory, increasing the transmission capacity from SCE into SDG&E by about 750 MW. The project is not subject to state regulation but is undergoing Federal Energy Regulatory Commission (FERC) licensing review.
- The Imperial Valley-San Diego Expansion Plan is the second of two alternatives to bring power into San Diego. It would consist of at least one 500-kV connection between the Imperial Valley Substation and a San Diego substation. The line would be between 84 miles and 188 miles in length, depending on its route and connection point to the San Diego system. This project could provide a third transmission corridor to San Diego and improve access to generation.
- The Otay Mesa Power Purchase Agreement Transmission Project (OMTP), intended to relieve congestion that would prevent power generated by the Otay Mesa Power Plant from reaching load centers in San Diego, consists of two new 230-kV transmission lines connecting the Otay Mesa power plant to the Sycamore Canyon and Old Town substations in San Diego. SDG&E filed an application for a Certificate of Public Convenience and Necessity (CPCN) in March 2004, and a decision is pending.

According to SDG&E,[31] a recently completed Cal-ISO study showed that a 500-MW increase in SDG&E's NSIL, from 2500 MW to 3000 MW, and a 750-MW increase in SDG&E's SIL, from 2850 MW to 3600 MW, could conservatively be achieved with the addition of either of the 500-kV lines associated with the LEAPS project or Imperial Valley-San Diego Expansion Plan project. These transmission projects together would meet Cal-ISO's long-term goal to further develop California's 500-kV backbone transmission system and provide additional import capacity to San Diego. They would also provide increased inter-regional transfer capabilities for on-system resources to off-system markets and may provide the best long-term alterative for ratepayers.

IID's transmission system is interconnected with SCE through the Valley and Devers substations, with SDG&E through the Miguel and Imperial Valley substations, and with the Palo Verde hub in Arizona. It is also interconnected with Mexico through the Miguel substation. It exports renewable electricity generated from geothermal sources over its 1,300-mile "Green Path" transmission network throughout the western U.S.; about 1000 MW currently flows through this system.

Additional delivery of renewable resources over IID's system is constrained by existing congestion at Imperial Valley and Blythe substations, points of

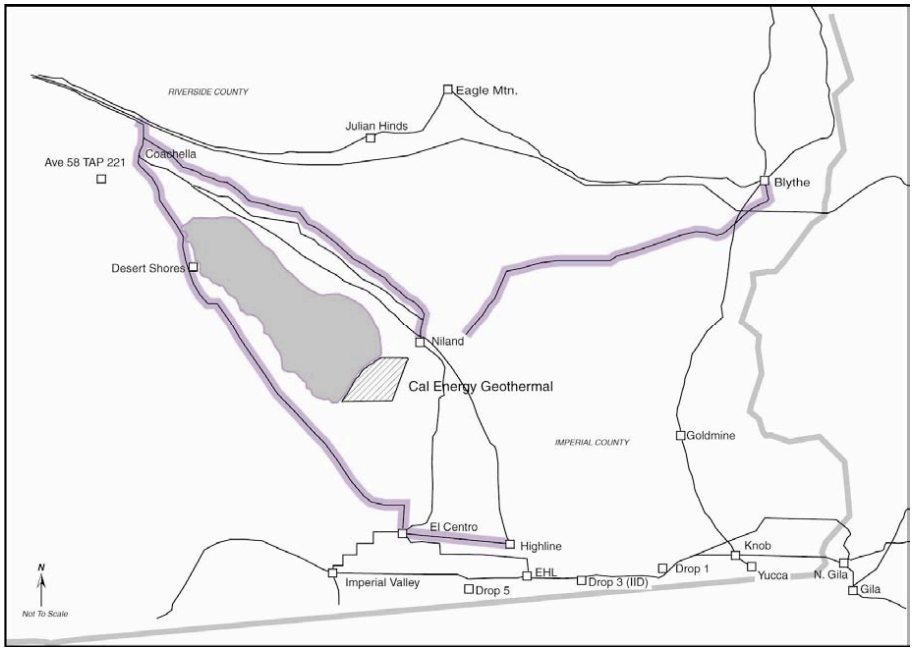
interconnection with the Cal-ISO control area. Although the pathways out of IID's network are congested, IID has a two-stage plan for accommodating new geothermal generation.[32] In the first stage, 600 MW of new geothermal generation near Salton Sea would be accommodated by the following projects (see Figure 6):

- Upgrading Path 42 to two conductors per phase.
- Connecting Coachella Valley Switching station to the 500-kV transmission network east of the Devers substation.
- Upgrading IID's existing 161-kV and 230-kV transmission lines.
- Building a 230-kV line between the El Centro Switching Station and the Highline substation.

The second stage would accommodate up to 2,200 MW of new geothermal generation and would include:

- Looping the proposed 500-kV line from IID to SDG&E into a substation near Salton Sea.
- Constructing a new 500-kV line from the Midway or Bannister substation to the Coachella Valley/Devers switching station.

Figure 6. Possible Salton Sea Upgrades Proposed by IID



Source: California Energy Commission, July 2004, *Upgrading California's Electric Transmission System: Issues and Actions for 2004 and Beyond*, draft staff report, California Energy Commission, Sacramento, CA, Pub number 100-04-004D, p. 72.

Baja California

Generating Stations

As of the end of 2004, the Baja California Norte power system had 3,862 MW of generation capacity in operation, of which 2,652 MW are dedicated to satisfy CFE's public service load and 1,210 MW are intended for export to the California market. Table 4 lists the installed generation capacity at the end of 2004.

Table 4. Existing Generating Capacity – Baja California Norte

Public Service					
Generating Station	**Location**	**Type**	**Generating Units**	**Fuel**	**Power Installed MW**
Presidente Juarez	Rosarito	Steam	4 x 75 and 2 x 160	Oil	620
Presidente Juarez	Rosarito	Combined Cycle	2 x 248	NG	496
Mexicali (IPP-LRPC)	Mexicali	Combined Cycle	1 x 489	NG	489
Tijuana	Tijuana	GCT	2 x 30 and 1 x 150	Oil	210
Mexicali	Mexicali	GCT	1 x 26 and 2 x 18	Oil	62
Cipres	Ensenada	GCT		Oil	55
Cerro Prieto I	Mexicali	Geothermal	4 x37.5 and 1 x 30	Renewable	180
Cerro Prieto II	Mexicali	Geothermal	2 x 110	Renewable	220
Cerro Prieto III	Mexicali	Geothermal	2 x 110	Renewable	220
Cerro Prieto IV	Mexicali	Geothermal	4 x 25	Renewable	100
Export Facilities					
La Rosita	Mexicali	Combined Cycle	2x60 + 1x150 + 90/3	NG	560
Termoeléctrica de Mexicali	Mexicali	Combined Cycle	2 x 170 and 1 x	NG	650

With 720 MW of geothermal generating capacity, Baja California Norte satisfies a significant portion of its energy needs with renewable energy, while the balance of its energy comes from natural gas-fired combined cycle facilities (985 MW), oil-fired steam cycle plants (620 MW), and oil-fired gas turbines (326.9 MW).

Between 2008 and 2013, CFE plans to build an additional 1,282 MW of generating capacity in Baja California Norte. The role of natural gas in generation will continue to grow as most planned generation capacity is likely to be natural gas-fired. Table 5 shows the most likely scenario for CFE's generation expansion plan schedule.

In order to address the current concentration of generation capacity in the Valley zone, CFE plans to locate a significant share of the new generation within the Coastal zone. Placing all new generating capacity through 2010 in Rosarito, Tijuana, and Ensenada will reduce east to west transmission load on the La Rosita 230-kV transmission corridor during the winter months.

Table 5. Electricity Supply/Demand Balance – Baja California Norte

Supply-Demand Balance - Baja California Norte

	2005	2006	2007	2008	2009	2010	2011	2012	2013
In Operation									
Retirements									
Presidente Juarez					(150)				
Presidente Juarez							(150)		
New Entrants									
Baja California (Mexicali II) Rosarito				220					
Pte. Juarez GCT/CC Conversion						81			
Baja California II GCT (Ensenada)						247			
Baja California III (w/25MW SLRC)							245		
Baja California IV GCT (Tijuana)								247	
Baja California V (Mexicali) /1									242
Total Capacity	2,652	2,652	2,652	2,872	2,722	3,050	3,145	3,392	3,634
Gross Demand	2,024	2,125	2,217	2,443	2,635	2,805	3,008	3,190	3,373
Reserve Margin /2	31%	25%	20%	18%	3%	9%	5%	6%	8%

/1 Either new generating plant or PPA

/2 Minimum reserve margin for Baja California, after planed outages, the larger of: the largest gen unit or 15 percent of peak demand

Source: Comisión Federal de Electricidad, Mexico, 2005, *Programa de Obras e Inversiones del Sector Eléctrico 2004-2013*.

Renewable Sources

Other than geothermal, Baja California Norte has seen limited use of renewable energy sources in the generation of electric power.

Hydroelectric Resources:

The desert climate conditions prevailing throughout most of Baja California Norte have precluded the development of any significant hydroelectric power. A notable exception, impossible to confirm at the time of this writing, is a 20-MW hydroelectric recovery unit proposed near Tecate to take advantage of water flows in the Colorado River to Tijuana aqueduct.

Geothermal:

CFE currently has 720 MW geothermal generating capacity at Cerro Prieto. No formal plans to further expand the installed capacity have been made by CFE for its current planning cycle (2004-2013). The potential for binary cycle heat recovery of the hot brine effluent from the Cerro Prieto generating facilities has been studied and the potential capacity has been estimated at 245 MW.

Outside of the Valley of Mexicali, only the prospect of geopressurized hydrothermal deposits under the Sea of Cortez show significant potential for additional geothermal electric generation for the Baja California Norte region.

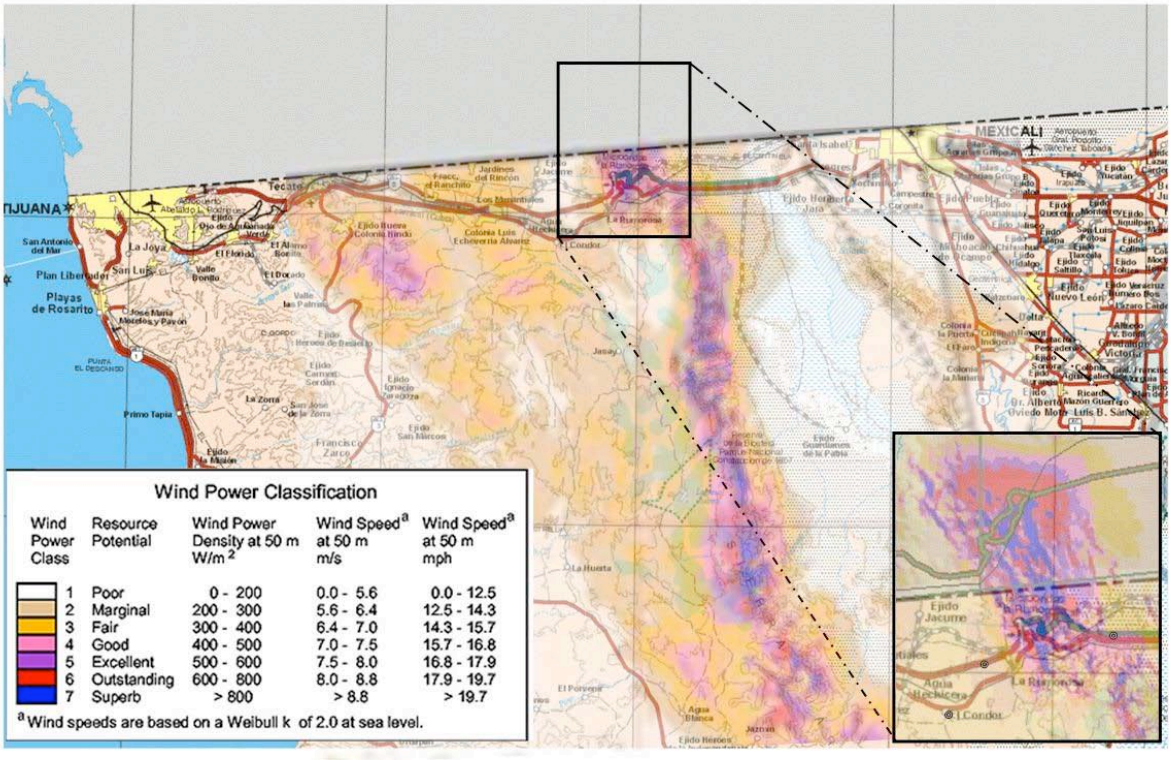
Wind:

Despite its current limited use, wind power is probably the most promising renewable resource in northern Baja California after geothermal energy. There are two successful utility scale wind electric projects in operation in Northern Baja: a 250-kW 90-foot Mitsubishi wind turbine owned and intermittently operated as part of the Exportadora de Sal S.A. de C.V. diesel power grid since 1985 and CFE's 600-kW 120-foot diameter generator in operation in the local power grid since 1998.[33]

In addition to having the potential to contribute to multiple isolated power grids throughout the Baja California, there is evidence of significant potential in the border area. The U.S. Department of Energy's National Renewable Energy Laboratory (NREL) has developed and published wind power maps of Baja California Norte based on limited historical surface data and proprietary modeling techniques. While not eliminating the need for specific site wind surveys, these maps can be used to identify the magnitude of the wind resource and its relative proximity to the transmission grid.[34]

Figure 7 shows the wind power densities along the Juarez Mountains and in the area of La Rumorosa, located between Mexicali and Tijuana. The two double circuit 230-kW CFE transmission lines connecting the Rosita to La Herradura substations follow in proximity to the road that traverses the area and offers the highest wind potential.

Figure 7. Wind Power Densities at 50 Meters – Baja California Norte



In addition to the anecdotal evidence of overturned vehicles on the roads traversing Rumorosa, there have been several attempts to carry out surface wind surveys in the area. In the mid-1990s, Cableados Industriales, a Mexican company currently affiliated with Gamesa Eolica, erected several anemometric towers in the area.[35] Other past surface wind speed measurement efforts include Kenetech Windpower (U.S. Windpower), the data for which is now kept at NREL[36] and heavily drawn upon for the preparation of the NREL Baja California Norte wind map, and Vestas Wind Systems A/S, which installed several anemometric towers in the La Rumorosa area in 2002-2003.[37]

Current (2005) efforts in the area include an on-going wind survey by Zemer, a small Mexican energy developer that has retained the services of the Instituto de Investigaciones Electricas (IIE) to analyze the data and prepare a wind power project feasibility study, and the early stages of development of a 300-MW wind power project for export initially proposed by Fuerza Eolica,[38]a company now affiliated with Clipper Windpower. It is reported that the land use rights agreements for this project have been finalized with the local community land leaders (ejido).

The rugged topography of the La Rumorosa area, with several canyons and many ravines, dictates extensive and highly site specific wind surveying in order to assess the overall wind power potential of the area. Given the reluctance of commercial

wind developers to share data, a complete assessment of the wind potential in this area will likely require a publicly funded study.

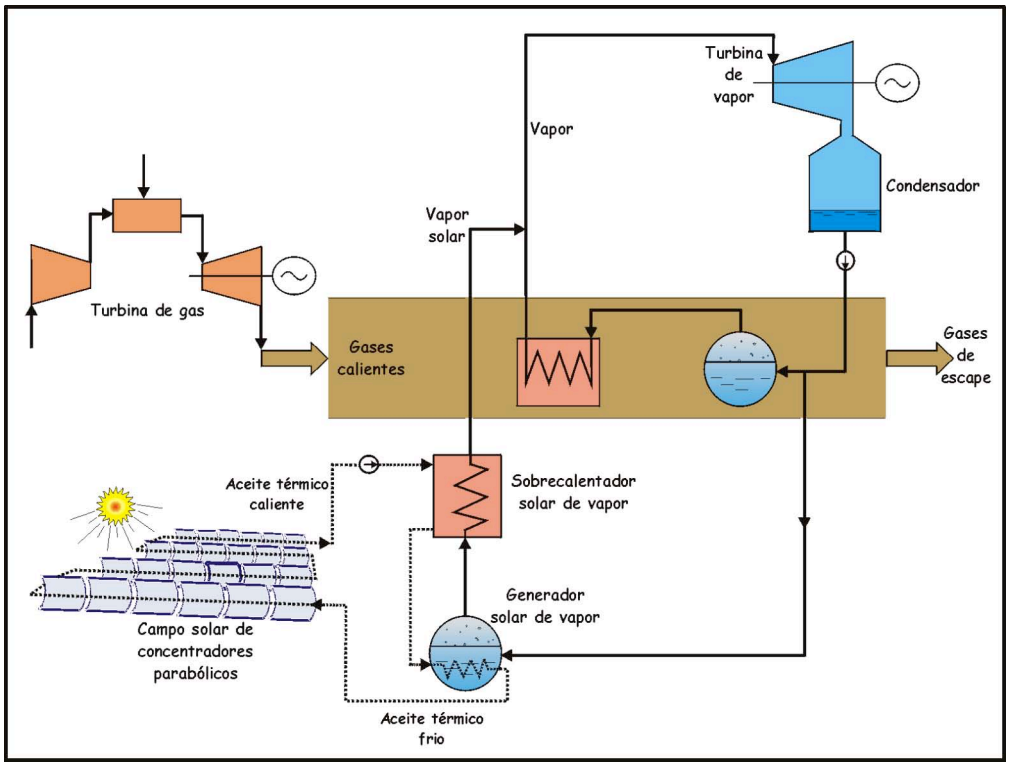
Solar:

Solar photovoltaic (PV) electricity is widely used throughout the peninsula in rural areas and small towns not connected to an electrical grid for lighting, communications, and appliances such as refrigerators. Some fishing cooperatives have also installed solar-based and hybrid solar-wind systems in isolated fishing camps. CFE in collaboration with the IIE has collected information on the maintenance requirements and long-term availability of solar PV systems. In the medium to long term, the CFE-IIE collaboration may be expanded to develop several hundreds of MW of solar electricity within the context of a distributed generation project. A shorter-term project will include the development of a grid-connected 1-MW photovoltaic array at a Mexicali substation.[39]

To take advantage of the excellent insolation in the Mexicali area, CFE studied the technical and economic feasibility of integrating a solar steam system to a conventional gas-fired combined cycle generating plant. A field of parabolic trough solar thermal collectors would be used to produce the steam as shown in Figure 8. The concept, known as the Integrated Solar Combined Cycle System (ISCCS),[40] was incorporated into the tender requirements issued by CFE on March 14, 2002, for the Mexicali II plant to be located near San Luis Colorado at the eastern side of the Mexicali Valley. The total output of the ISCCS plant was to generate between 198 MW and 242 MW at summer design conditions. The uniquely specialized expertise to design the solar component of the plant elicited complaints from the prospective bidders until CFE agreed to separate the bidding for the traditional and solar components. The tender for Mexicali II was subsequently postponed to be re-issued minus the solar component and relocated to the vicinity of Tijuana in an effort to reduce the east-west congestion on the Mexicali-Tijuana transmission corridor.

A new ISCCS plant with a 25-MW solar component is now contemplated at the Rosalia III generating plant scheduled to enter service in April of 2011.[41]

Figure 8. Proposed ISCCS Plant

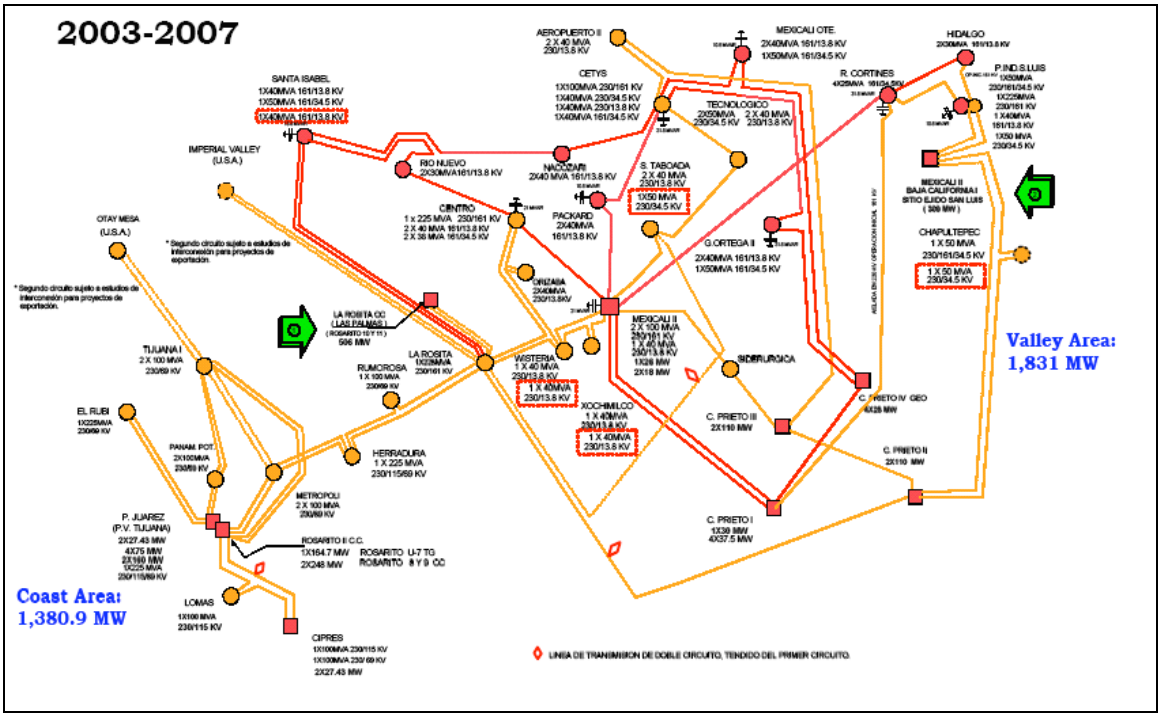


Transmission Lines

The backbone of the transmission system in the Baja California Norte area lies in the 230-kV east-west lines connecting the Coastal and Valley zones as illustrated in Figure 9. In its current configuration, the Coastal-Valley two-line, 230-kV transmission path has a capacity limit of 368 MW. During the winter months, east to west peak flows of 250 to 280 MW are a result of the excess geothermal generating capacity flowing to the Coastal areas to meet its winter peak. During the summer, 150 to 200 MW flow from the Coast to the Valley to meet summer air conditioning peak loads.

Except for additional transformer capacity at several substations, the only major transmission line addition planned between 2008 and 2013 is a second 230-kV circuit between the Metropoli Potencia and Tijuana I substation (2 x 1113 aluminum conducted steel supported [ACSS]). This line is linked to the new 220-MW combined cycle generating facility to begin service in 2008 at Rosarito to supply incremental energy needs of Tijuana and Ensenada.[42]

Figure 9. Transmission System – Baja California Norte



Source: CFE Planning Subdirection

Cross-Border Electricity Exchange

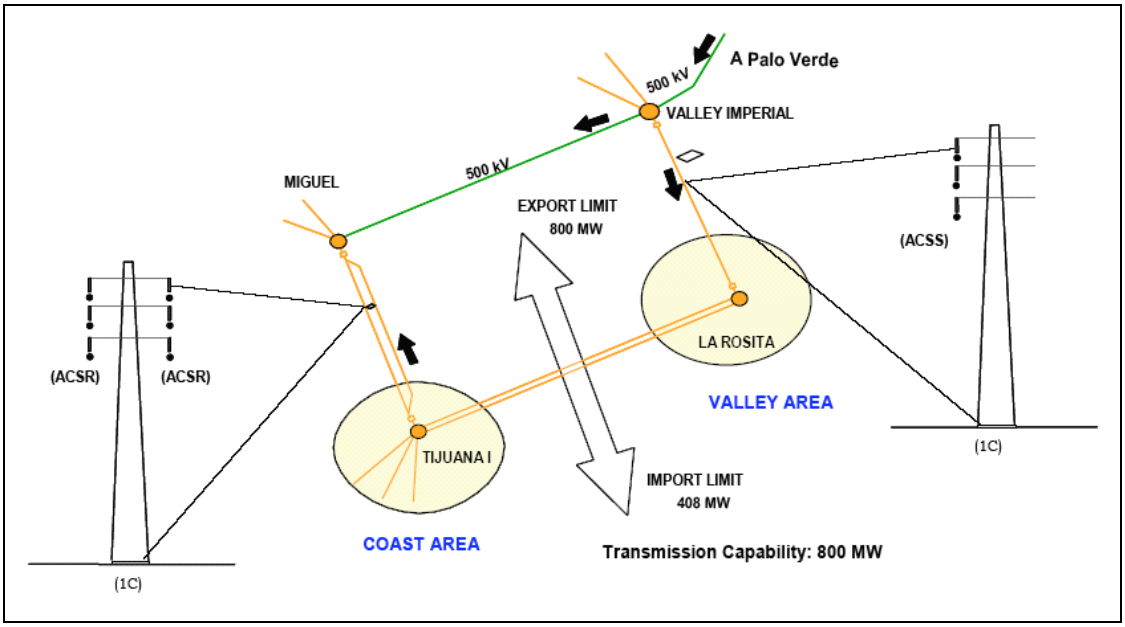
Several transmission lines connect California with Mexico. The Cerro Prieto Geothermal Plant in northern Baja California is connected to the U.S. grid at the Imperial Valley Substation. SDG&E is connected to Tijuana and Tecate, Mexico, by two 12-kV lines. In mid-2003, Sempra and Baja California Power began transmitting electricity generated from newly constructed natural gas-fired plants near Mexicali, Mexico, to California over two 230-kV lines terminating at the Imperial Valley Substation. Three 34.5-kV lines connect Calexico to Baja California.

Table 6 shows electricity exchange between California and Baja California during the period 1992 to 2003. As shown on Figure 10, current cross-border transmission capacity between Baja California and California on Path 45 is 800 MW in a northbound direction and 408 MW southbound. Due to recent withdrawals of merchant-generation applications to upgrade Path 45, SDG&E does not plan to increase path 45's northbound rating above 800 MW at this time.[43]

Table 6. Transborder Energy Exchange (1992-2003)

	GWh											
	1992	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
Mexico to California	2023	1995	1947	1920	1258	17	45	31	66	112	164	765
California to Mexico	24	44	166	228	355	406	480	646	927	82	311	45

Figure 10. Cross-Border Transmission Interconnections



Source: CFE Planning Subdirection

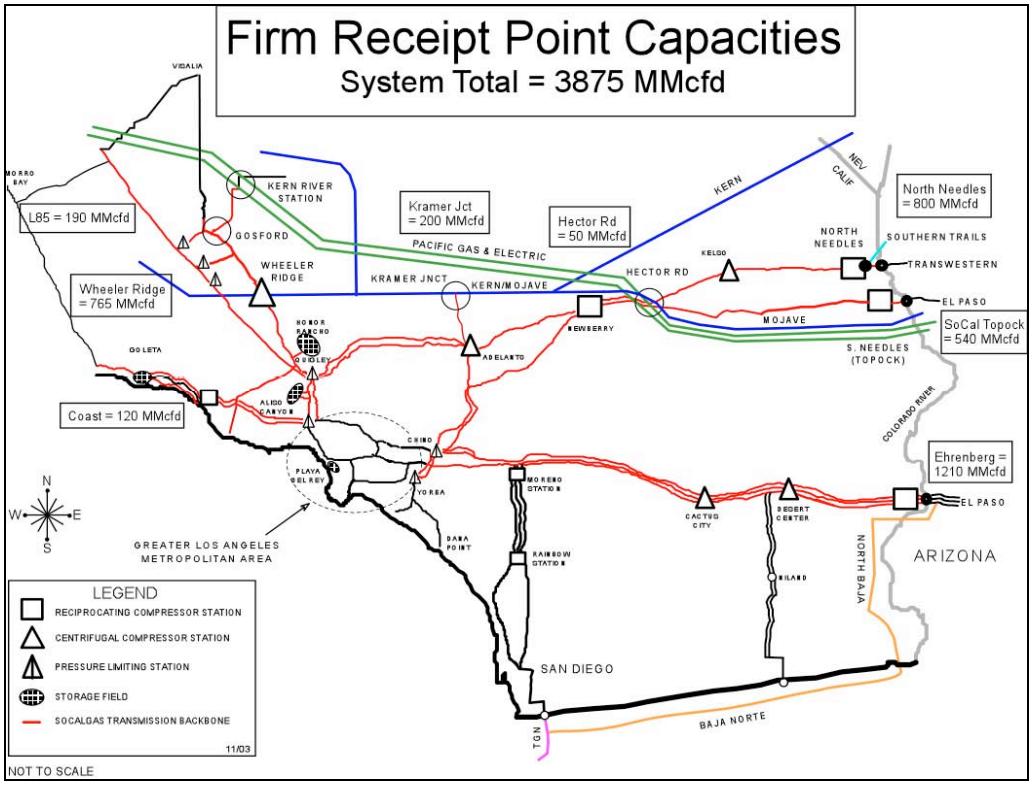
Natural Gas

San Diego/Imperial Counties

San Diego Gas & Electric (SDG&E) is the local distribution company for natural gas in San Diego and Imperial County. SDG&E receives gas service from SoCalGas on a wholesale customer basis. SoCalGas imports approximately 85 percent of its natural gas from basins outside the state; this gas is shipped to receipt points by major interstates pipelines (see Figure 11). SoCalGas' extensive pipeline network has

3,875 MMcfd of firm receipt point capacity, including recently installed 375 MMcfd of capacity.[44] SoCalGas also owns and operates four major underground gas fields that store105 Bcf, with a firm withdrawal rate of 3,200 MMcfd of natural gas.[45]

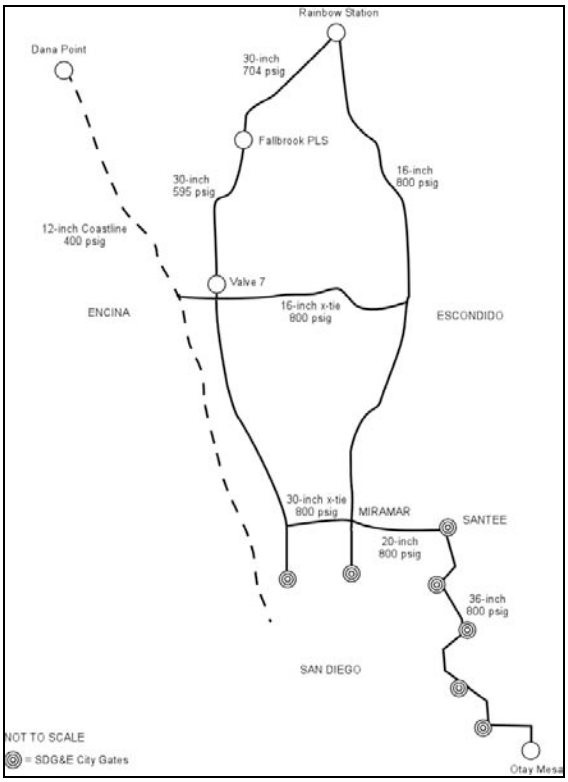
Figure 11. SoCalGas Natural Gas System



Source: San Diego Gas & Electric Co., November 2003, Responses to CPUC Data Requests, OIR to Establish Policies and Rules to Ensure Reliable, Long-Term Supplies of Natural Gas to California, R.04-01-025, Map Q.6.2.

SDG&E takes delivery of natural gas from the SoCalGas system at the Rainbow and San Onofre Metering Stations near Dana Point (see Figure 12). The maximum capacity at the Rainbow Station is 635 MMcfd in winter and 615 MMcfd in summer; the San Onofre Station's capacity is about 30 MMcfd. The difference in summer and winter capacities is due to factors such as gas temperature, engine operating conditions, customer load profiles, and customer load locations. The total capacity of the SDG&E natural gas transmission system is 620 MMcfd in winter and 600 MMcfd in summer.[46] These two operating capacities include a reserve margin of 45 MMcfd to account for various potential scenarios that could affect deliverability, including lower suction pressures at SoCalGas' Moreno compressing station, compressor outages at either Moreno or Rainbow compressor stations, or other system outages. The 45 MMcfd assumes any one of these could occur on a peak day.[47]

Figure 12. Current SDG&E Gas System



Source: San Diego Gas & Electric Co., November 2003, Responses to CPUC Data Requests, OIR to Establish Policies and Rules to Ensure Reliable, Long-Term Supplies of Natural Gas to California, R.04-01-025, Map Q.6.1.

SDG&E also contracts with SoCalGas for 5,900 million cubic feet (MMcf) of natural gas underground storage capacity, with 27.7 MMcfd of injection capacity and 222 MMcfd of withdrawal rights. However, these storage fields are not in the SDG&E area, which means that peak demand within its system must be met entirely via the transmission capacity of the San Onofre and Rainbow lines.[48] According to SDG&E, its current natural gas transmission system sendout capacity is 655 MMcfd in the winter operating system.[49]

During the winter of 2000-2001, significant gas curtailments were experienced on the SDG&E system because natural gas demand by large electric generation customers was significantly higher than in previous years, particularly the large new gas-fired power plant in Rosarito, Mexico, that came on line in the summer of 2000.[50] The likelihood of future curtailments in the SDG&E system has been reduced by the addition of 70 MMcfd of capacity to the SoCalGas pipeline that delivers most of the gas to the SDG&E system.

Under most scenarios (see Table 1), the CPUC expects SDG&E's existing natural gas transmission capacity to be more than adequate to serve demand in its service area in the near term.[51] However, under CPUC's currently adopted peak-day criteria for service reliability, SDG&E's transmission pipeline system could exceed capacity during a 1-in-10 or 1-in-35 cold year event. In its contingency planning, SDG&E has identified two projects that could expand its system capacity during the winter operating season if demand warranted: a 24-mile, 36-inch diameter transmission pipeline from Rainbow Station to Escondido, which would increase system capacity by 50 MMcfd, and a 26-mile, 36-inch diameter transmission pipeline from Escondido to Santee, which would add another 170 MMcfd of capacity.[52]

Baja California

The development of natural gas infrastructure in Northern Baja California has taken place relatively recently. Gas demand is driven by power generating plants, a handful of industrial customers, and one local distribution compact (LDC).

Sources

Baja California is not currently connected to Mexico's pipeline system. Not having any local sources of natural gas, it imports all its gas from the U.S. through two 30-inch pipelines connected to the SDG&E system at Otay Mesa, California, and to the El Paso Gas Company pipeline at Blythe/Ehrenberg.

The development of one or more proposed liquefied natural gas (LNG) gasification and storage facilities will diversify natural gas supply sources for the area and convert Baja California into a net exporter of gas to the U.S. Of the several projects proposed in recent years, two are still in active development: the Energia Costa Azul project located near Ensenada in Baja California, sponsored by Sempra, Pacific LNG Consortium, Shell Group; and the Terminal GNL Mar Adentro located off the coast of Tijuana near the Coronado Islands, sponsored by ChevronTexaco. Both of these projects have CRE-issued permits to operate.

Sempra's Energia Costa Azul LNG receiving terminal project will be located about 14 miles north of Ensenada, on the Costa Azul plateau. This project would include a land-based receiving facility and related port infrastructure. There would be two full 165,000 cubic meter (m^3) containment tanks, open rack seawater vaporizers, and a 42-mile, 36-inch to 42-inch diameter spur pipeline connecting the terminal to the Baja Norte Pipeline. As currently permitted, the facility will have an average natural gas production capacity of 1,000 MMcfd and a peak production capacity of 1,300 MMcfd. The site has space for two additional storage tanks and expansion capabilities to double the average production capacity of the facility to 2,000 MMcfd. Groundbreaking ceremonies were held on March 30, 2005. Production is slated to begin in 2007. ChevronTexaco's GNL Mar Adentro de Baja California LNG project

would be located eight miles off the coast of Tijuana, approximately six miles off the coast of Playas, and 600 meters east of South Coronado Island. This import facility would be a gravity-based structure including all utility systems required to support operations. Water depth at the proposed site is 65 feet. The terminal would be a fixed 980-foot-long concrete island with two regasification plants, storage tanks, a heliport, and a dock for LNG carriers. At this offshore terminal, the LNG would be regasified using seawater. A new underwater pipeline would connect with Baja California's existing gas pipeline system. The terminal would have an average production capacity of 700 MMcfd with peak production capabilities of 1,400 MMcfd and LNG storage capacity of 250,000 m^3. The project is scheduled to go on line in 2007.

The ChevronTexaco offshore LNG project has met with stiff opposition by some environmental groups, which have filed a formal motion with SEMARNAT for reconsideration of the issuance of the environmental impact and risk license for the project. The license is valid while the case is heard by a federal court (Tribunal Federal de Justicia), where a judge hears the opinions of experts for the parties in the case, but the license could be revoked if the judge rules in favor of the motion. The court must arrive at a decision within 4 to 8 months.[53]

A third LNG terminal has been proposed by Moss Maritime, a subsidiary of the Italian firm Saipem, which in turn is a subsidiary of Eni S.p.A. Moss filed for an environmental impact and risk license on January 17, 2005, through its Mexican affiliate, Terminales y Almacenes Maritimos de Mexico, S.A. de C.V. (TAMMSA). On that date, TAMMSA submitted a complete environmental impact statement to SEMARNAT in order to satisfy the requirements to obtain an environmental impact and risk license; a decision as to whether to grant the license is expected by April 8, 2005.

The Moss Maritime project will consist of a floating storage and regasification unit (FSRU) anchored 5.3 miles off the coast of Rosarito, Baja California. The FSRU will have storage capacity of 4.4 MMcf (125,000 m^3) and will be able to unload up to three LNG ships. The FSRU will have a gasification unit on board and pipe the gas to shore through an 18-inch submarine pipeline. The capacity of the unit is 297.3 MMcfd.

The EIS states that the FSRU will be based on the LNG ship, Khannur, with its six spherical LNG storage tanks. This will greatly reduce the cost of construction and shorten the start-up time to less than 24 months. The undersea pipeline will terminate at a regulation and metering station located near the PEMEX facilities in Rosarito's industrial zone. Although not specified in the environmental impact statement (EIS), the output of the metering station is likely to be connected to the Transportadora de Gas Natural (TGN) duct by an onshore pipeline to be built by a third party. As described in the EIS, the project does not include commercialization activities or transport, which will be carried out by a third, as yet undefined, party.[54]

Existing Pipelines

Figure 13 shows the natural gas transmission pipeline system in Baja California. Two high capacity pipelines run east of Tijuana and cross Baja California to feed the gas-fired plants near Tijuana and Mexicali. These pipelines are also accessible to most major industrial parks. Connection to these open access pipelines requires a self-use permit from Mexico's Comisión Reguladora de Energía.

Figure 13. Natural Gas Pipeline System – Baja California

Transportadora de Gas Natural (TGN) is a 30-inch diameter, 23-mile pipeline from Otay Mesa in Tijuana to Playas de Rosarito, where it supplies natural gas to CFE's Presidente Juarez generating plant. Under a 10-year agreement, Sempra Energy companies provide a complete energy supply package to the plant, including purchasing up to 300 MMcfd of natural gas in the U.S. and transporting it across the border to the plant.

Gasoducto Bajanorte is a 135-mile natural gas transportation pipeline that crosses Baja California, Mexico, connecting to the TGN Pipeline near Tijuana. The 30-inch pipeline has a capacity of approximately 500 MMcfd of natural gas and serves the La Rosita and Termoelectrica de Mexicali power plants in Mexicali and industrial customers in northern Baja California and Southern California. It began operating on September 1, 2002.

Distribution

ECOGAS Mexicali, formerly known as DGN Mexicali, was awarded the franchise to distribute natural gas in Mexico in 1996. The system, located in Mexicali,

Baja California, began operations in 1997, currently serving over 25,000 customers with average sales of 10.8 MMcfd.

Cross-Border Natural Gas Transfers

In July 1997, SoCalGas completed construction of a 25-MMcfd pipeline to deliver gas to the city of Mexicali. Additional capacity was placed into service in conjunction with the completion of the power plant near Rosarito. Given these two expansions, supplies delivered to northern Mexico through California will total 157 MMcfd.[55]

SDG&E has the capacity to deliver 500 MMcfd of natural gas to Baja California for electric generation facilities at the Presidente Juarez Power Plant in Rosarito at an interconnection with the Sempra-owned Transportacion de Gas Natural (TGN) Rosarito pipeline in Tijuana. In 1998, Mexico's natural gas trade with the U.S. was enhanced by a 10-year agreement between CFE and Sempra Energy to supply up to 300 MMcfd of gas to power plants in Baja.[56] The agreement resulted in construction of the Baja Norte Pipeline, a 215-mile pipeline from Arizona to Tijuana completed in 2002. The 80-mile segment in the U.S. (North Baja Pipeline) is owned by Pacific Gas and Electric, and the 135-mile segment in Mexico (Gasoducto Bajanorte) is controlled by Sempra Energy. The pipeline originates at an interconnection with El Paso Natural Gas Co in Ehrenberg, Arizona, runs southwest to cross the Mexican border near Yuma, then runs west through Mexicali before terminating at an interconnection with the Sempra-owned Transportacion de Gas Natural (TGN) Rosarito pipeline in Tijuana. Completion of the Baja Norte Pipeline allows reduction of deliveries to the Rosarito facility through the SDG&E system.

Transborder Energy Exchange Constraints and Opportunities

Electricity

SDG&E has historically relied upon significant quantities of imported electricity to meet its service area needs, but its transmission system has a simultaneous import capability limitation of 2,850 MW.[57] For example, congestion around the Miguel Substation is caused by electricity flowing from new power plants just south of California’s Imperial County border with Mexico. Current transmission lines are not large enough to deliver all the new power to areas that need it, such as the San Diego region. This is a critical factor when analyzing grid reliability, siting of future generation resources, or expanding SDG&E’s transmission system to receive future imported electricity from either conventional or renewable resources.

By 2010, SDG&E's Long Term Resource Plan calls for an additional major transmission project to comply with Cal-ISO grid planning criteria, displace existing high-cost reliability-must-run (RMR) generation, provide for the potential retirement of aging local units, deliver additional conventional and renewable generation at lower costs, increase supply diversity, and replace a portion of the expiring California Department of Water Resources (CDWR) contracts. This transmission project is a key element in SDG&E's ability to meet its goal of achieving 20 percent of its energy supply from renewable resources by 2010.[58]

One potential source of renewable energy for SDG&E would be through a transmission line to the Salton Sea Geothermal Area in Imperial County. A second source could be geothermal or wind power imported from northern Mexico. Baja California Norte contains the Cerro Prieto geothermal field, with at least nine geothermal electric plants in operation, producing about 720 MW. However, the existing transmission system in this portion of Mexico is not configured to send large amounts of power across the international border and would need costly equipment upgrades.

Natural Gas

A key future scenario for energy planning is the availability of significant supplies of natural gas on the West Coast of California and/or Mexico from one or more LNG terminals. These could serve to meet projected demand for natural gas in Baja California and San Diego and deliver natural gas that could be used for combined cycle plants.

A major constraint to this scenario is the capacity of the SoCalGas and SDG&E gas transmission systems to handle transshipments of LNG supplies on the West Coast. SoCalGas' pipeline network has 3,875 MMcfd of firm receipt point capacity. Without expansion, transshipments of new supplies of LNG on the West Coast through the SoCalGas and SDG&E gas transmission systems would compete for existing pipeline delivery capacity and potentially displace current supplies for local customers.

In response to a query from the California Public Utilities Commission, SoCalGas and SDG&E identified three locations on the SoCalGas/SDG&E transmission system for receipt of new LNG supplies from ports onshore or offshore California and Mexico:

- Otay Mesa meter station on the SDG&E system near the California/Mexico border.
- Salt Works Station on the SoCalGas system near Long Beach.
- Center Road Station on the SoCalGas system near Oxnard.

The SDG&E transmission system is designed to receive gas supplies in the north from SoCalGas and move these supplies south to load centers, terminating at the Otay Mesa metering station. Accepting LNG supplies from Mexico at Otay Mesa will require a basic set of facility improvements to reverse the flow of the gas in the SDG&E system. Depending on the levels of LNG supplies delivered to Otay Mesa and whether that supply exceeds SoCalGas' system receipt and redelivery capacity of 3,875 MMcfd, other improvements will be necessary to the SDG&E system.[59] LNG supplies received at Otay Mesa from Mexico would be moved north through a single 36-inch diameter pipeline to Santee, where it would interconnect with a 20-inch diameter pipeline that supplies SDG&E's 30- and 16-inch diameter transmission mains running south from Rainbow Station. Depending on the volumes of LNG transported north from Otay Mesa, the 20-inch diameter pipeline could become a system constraint, requiring looping in the SDG&E system. On the SoCalGas system, looping west of Moreno Station could also be required.

Energy Efficiency and Demand Response

The results of the San Diego Regional Energy Infrastructure Study (2002) suggest that energy efficiency and demand response programs present a significant opportunity for reducing a portion of future demand in the region for expansion of energy infrastructure. During the summer of 2001, the San Diego region's peak electricity load requirements were reduced by as much as 2.2 percent or 81.7 MW through a combination of pricing, customer education, and demand response programs.[60] This suggests that programs targeting peak electricity demand reduction (for example, air-conditioning use, commercial lighting, and other miscellaneous commercial loads) could result in a cost effective approach to meeting regional electricity needs on both sides of the border through higher avoided costs that occur during peak periods. A modest amount of natural gas savings could be achieved through more efficient buildings, furnaces, boilers, and hot water heaters, as well as increased pipe insulation, efficient dishwashers, and flow restrictors.

Conclusions

California and Baja California have an energy relationship that is likely to become more interdependent in the future. Baja California is geographically isolated from mainland Mexico—its power grid is not connected to the Mexican national system, and it does not receive natural gas originating in Mexico. Over the next 10 years, CFE projects Baja California electricity demand to grow about 7 percent annually, the highest demand growth in Mexico, versus about 2 percent for SDG&E. This will result in the need for an almost doubling of capacity in Baja California to meet projected demand.

This increasing demand for electricity in Baja California is occurring simultaneously with existing high demand in SDG&E's service area. Although SDG&E electricity

demand growth is lower than across the border in Baja California, it begins at a base demand that is more than twice that in Baja California and cannot be met with local generating capacity, necessitating the importation of about 60 percent from outside the region. SDG&E projects a major grid reliability deficiency as early as 2010 without additional sources of electricity. SDG&E is attempting to meet the projected demand by achieving the goal of a 20 percent renewable resources portfolio by 2010 and a 24 percent mix by 2014. However, significant upgrades to transmission system capacity will be necessary to achieve this goal.

The growing demand for electricity in Baja California, coupled with demand for power in California, is spurring plans for new power plants in Baja California. However, if all planned power plants are completed in Baja California, installed electricity will just meet projected demand, leaving little potential for export. Existing transmission line capacity is limited to 800 MW northbound, which is an additional constraint to significant increases in cross-border electricity transfers. New transmission lines or upgrades and developing resources within its service area will be needed to deliver renewable energy to San Diego to help meet SDG&E's goal for the state's renewable portfolio standard.

SDG&E natural gas demand is forecast to grow between 1.2 and 1.6 percent annually, driven primarily in the near term by power plant demand. Simultaneously, Baja California natural gas demand is projected to grow by as much as 7 percent annually, primarily for electricity generation and industrial heat. To meet this growing natural gas demand in Baja California, significant pipeline infrastructure has been added to bring U.S. natural gas supplies to the region. More recently, several LNG projects have been proposed in Baja California that could also supply gas to meet demand on both sides of the border. However, the ability to import potential new supplies of natural gas from LNG facilities in Baja California to California is constrained by the capacities of the SoCalGas and SDG&E gas transmission systems. This will require facility improvements to reverse the flow of the gas in the SDG&E system and expand its capacity.

Several policy options follow for addressing the challenges of improving the efficiency of exchange of energy across the California-Mexico border:

1. Establish a bi-national energy planning agreement to:
    a. Exchange information about demand growth trends and forecasted energy needs.
    b. Coordinate resource and infrastructure planning and environmental impact reviews.
    c. Maintain authority of respective jurisdictions.
    d. Track the progress, capital investment, and implementation of approved or planned energy infrastructure projects.
2. Engage Mexican energy agencies to coordinate decision-making as members/participants in U.S. and California organizations such as the

California Independent System Operator (Cal-ISO), Western Electricity Coordinating Council (WECC), the Western Renewable Energy Generation Information System (WREGIS), and the Natural Gas Working Group.

3. Coordinate the development of renewable energy, combined heat and power, industrial efficiency projects, and transmission planning in San Diego/Imperial Counties and Baja California.
4. Investigate the feasibility of applying Transmission Access Charge monies to financing the construction of electric transmission facilities in Mexico (owned and operated by CFE as required by Mexican Law).
5. Develop an interregional framework to implement aggressive energy efficiency and demand management programs in California and Baja California.

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Appendix A – Current Electric Importation Permits – Baja California

Permit Holder	Permit Date	Authorized Capacity (MW)	Authorized Energy (GWh/yr)
TERMOELECTRICA DE MEXICALI, S. DE R.L. DE C.V.	01/06/01	12.00	2.00
ENERGIA DE BAJA CALIFORNIA, S. DE R.L. DE C.V.	22/04/02	20.00	6.00
ENERGIA AZTECA X, S. DE R.L. DE C.V.	05/06/03	20.00	5.00
DAEWOO ELECTRONICS DE MEXICO, S.A. DE C.V.	10/07/03	4.50	20.00
KENWORTH MEXICANA, S.A. DE C.V.	30/10/03	6.22	0.02
EMERMEX, S.A. DE C.V.	30/10/03	2.97	13.11
DISPLAY ORION MEXICANA, S.A. DE C.V.	30/10/03	9.82	8.50
COMPAÑIA PRODUCTORA DE HIELO, S.A. DE C.V.	30/10/03	1.71	1.50
AMP INDUSTRIAL MEXICANA, S.A. DE C.V.	30/10/03	2.50	2.40
INDUSTRIAS ZAHORI, S.A. DE C.V.	30/10/03	2.12	12.30
FABRICA DE PAPEL SAN FRANCISCO, S.A. DE C.V.	04/11/03	11.30	90.00
FEVISA INDUSTRIAL, S.A. DE C.V.	04/11/03	7.46	4.99
SONY DE MEXICALI, S.A. DE C.V.	04/11/03	3.24	17.00
PIMS, S.A. DE C.V.	04/11/03	4.50	23.00
RHEEM MEXICALI, S. DE R.L. DE C.V.	18/11/03	2.21	10.50
BIMBO, S.A. DE C.V., PLANTA MEXICALI	27/11/03	3.24	13.32
COMPAÑÍA SIDERURGICA DE CALIFORNIA, S.A. DE C.V.	27/11/03	7.50	5.67
WABASH TECHNOLOGIES DE MEXICO, S. DE R.L. DE C.V.	27/11/03	3.62	11.00
KWANG SUNG ELECTRONICS MEXICO, S.A. DE C.V.	27/11/03	2.83	8.53
THOMSON DISPLAYS MEXICANA, S.A. DE C.V.	27/11/03	19.00	120.00
SKYWORKS SOLUTIONS, S.A. DE C.V.	04/12/03	5.46	34.86
ACCURIDE INTERNATIONAL, S.A. DE C.V.	17/06/04	4.50	17.60