**Prepared By:**
KEMA Inc.
Karin Corfee, Project Manager
David Korinek, Task Manager

Bates-White, LLC
Nicolas Puga, Consultant
Contract No:  600-05-011

**Prepared For:**
California Energy Commission

Alan Argentine
*Contract Manager*

Albert Estrada
*Program Manager*

John Sugar
*Office Manager*
SPECIAL PROJECTS OFFICE

Michael Smith
*Deputy Director*
FUELS AND TRANSPORTATION DIVISION

Melissa Jones
*Executive Director*

---

**DISCLAIMER**

This report was prepared as the result of work sponsored by the California Energy Commission. It does not necessarily represent the views of the Energy Commission, its employees or the State of California. The Energy Commission, the State of California, its employees, contractors and subcontractors make no warrant, express or implied, and assume no legal liability for the information in this report; nor does any party represent that the uses of this information will not infringe upon privately owned rights. This report has not been approved or disapproved by the California Energy Commission nor has the California Energy Commission passed upon the accuracy or adequacy of the information in this report.
Please cite this report as follows:

# Table of Contents

ABSTRACT .......................................................................................................................... v  
EXECUTIVE SUMMARY ...................................................................................................... 1  
CHAPTER 1: Demand-Resource Zones in the California/Mexico Border Region .................. 3  
CHAPTER 2: Electricity Supply Demand Balance by Zone .................................................. 5  
  San Diego Zone Supply and Demand .................................................................................. 5  
  Southeastern California Zone Supply and Demand ......................................................... 7  
  Northern Baja California Zone Supply and Demand ...................................................... 8  
  Northwestern Baja California Zone Demand and Resources ........................................ 9  
  Northeastern Baja California Zone Supply and Demand .............................................. 10  

CHAPTER 3: Current and Planned Bulk Electric Transmission Infrastructure in the  
California/Mexico Border Region ...................................................................................... 13  
  Electric Interfaces in the Border Area ............................................................................ 14  
  Transmission in Baja California ................................................................................... 16  
  Planned Electric Transmission Upgrades ..................................................................... 17  
    Southeastern California: .............................................................................................. 17  
  Northern Baja California Transmission System Expansion ........................................ 23  
    Planned Electric Generation Additions and Retirements ............................................ 23  

CHAPTER 4: Current and Planned Natural Gas Pipelines and Infrastructure in the  
California/Mexico Border Region ..................................................................................... 27  
  Natural Gas Transmission Pipelines ............................................................................. 27  
  Southeastern California Zone ....................................................................................... 28  
  San Diego Zone ........................................................................................................... 29  
  Baja California Zone(s) ............................................................................................... 29  

CHAPTER 5: Natural Gas Supply-Demand Balance, Flows and  
Flow Limits Between Zones .............................................................................................. 33  
  San Diego Zone ........................................................................................................... 33  
    Supply Capacity ......................................................................................................... 33  
    Demand ..................................................................................................................... 34  
  Planned and Potential Changes to the SDG&E Natural Gas System  
    (Before Costa Azul LNG) ........................................................................................... 36  
  Potential Impacts of the Costa Azul Liquefied Natural Gas Project on SDG&E .............. 37  
  Southeastern California Zone ....................................................................................... 38  
    Supply Capacity ......................................................................................................... 38  
    Gas Demand ............................................................................................................. 38  
    North Baja Pipeline Expansion in the Imperial Valley .............................................. 39  
  Baja California ............................................................................................................ 39  
  Northeastern Baja California ....................................................................................... 41  
    Supply Capacity ......................................................................................................... 41  
    Gas Demand ............................................................................................................. 41  
  Northwestern Baja California ..................................................................................... 42  
    Supply Capacity ......................................................................................................... 42
CHAPTER 6: Planned LNG Facilities and Transmission Pipeline Additions in Northern Baja California

LNG Facilities in Northern Baja California
Sempra’s Costa Azul LNG Regasification Terminal
Chevron’s Proposed Mar Adentro LNG Project
Planned New Pipeline Capacity in Northern Baja
Gasoducto Baja Norte Expansion
North Baja Pipeline

Gas Constraints and Limitations

CHAPTER 7: Regulatory Proposals and Government Directives That Could Stimulate or Facilitate Infrastructure Expansion in the Border Region

National Interest Electric Transmission Corridors
Effects of FERC Order 890
United States and Mexican Regulations Regarding Energy Export
Future Regulatory Proposals and Governmental Options

CHAPTER 8: Conclusions and Action Items

For Natural Gas Facilities:
Conclusion:
Action Items:

For Electric Transmission:
Conclusion:
Action Items:
Regarding Pending Investigation

GLOSSARY

APPENDIX A: Supplemental Information on Renewable Resources in Northern Baja California

Geothermal Resources
Hydro Resources
List of Figures

Figure 1. Baja California Supply and Demand Zones
Figure 2. Major Electric Transmission Facilities in the Border Region
Figure 3. Baja California Transmission System
Figure 4. Simplified Diagram of Sunrise Powerlink
Figure 5. Green Path Project (North and South)
Figure 6. Electric Transmission Expansion for Otay Mesa
Figure 7. Simplified Interconnection Diagram for LEAPS
Figure 8. Border Region Natural Gas Facilities
Figure 9. SDG&E Natural Gas Transmission System
Figure 10. Natural Gas Pipelines Serving Baja California
Figure 11. Moreno-Rainbow Corridor vs. San Diego, Existing System
Figure 12. Moreno-Rainbow Corridor vs. San Diego, with 50 MMcfd Supply from Otay Mesa
Figure 13. NBP Proposed IID Interconnect
Figure 14. Gasoducto Baja Norte Expansion
Figure 15. Draft Southwest Area National Corridor
List of Tables

Table 1. Electric Supply-Demand Balance (San Diego Zone) (Excluding Import Capability)........ 6
Table 2. Adjusted Supply-Demand Balance (San Diego Zone) (Including Import Capacity and California ISO “G-1, N-1” Requirement) ........................................................................ 7
Table 3. Electric Supply-Demand Balance (Southeastern California Zone) ............................ 8
Table 4. Electric Supply-Demand Balance (Baja California) .................................................... 9
Table 5. Electric Supply-Demand Balance (Northwestern Baja California) ............................ 10
Table 6. Electric Supply-Demand Balance (Northeastern Baja California) ............................. 11
Table 7. SDG&E Forecasted Peak Demand ............................................................................ 35
Table 8. Baja California Natural Gas Demand (2005-2015) .................................................. 40
Table 9. North Baja Pipeline Precedent Agreements ............................................................... 47
Abstract

The report describes the current status and expansion plans for gas-fired power plants, bulk electric transmission, and natural gas transmission pipelines in the California/Mexico border region. Existing and forecasted supply-demand balance for both electric and gas capacity are described for specified zones on both sides of the border, along with flow constraints between the zones. Natural gas flow constraints and pipeline projects discussed in the report include the path between Erhenberg/Blythe and Baja California, pipeline capacity across northern Baja California, the delivery constraint south of Moreno in the Southern California Gas system, and pipeline capacity between San Diego Gas & Electric (SDG&E) and Baja at Otay Mesa. Impacts of Sempra Energy’s Costa Azul LNG terminal project on pipeline constraints is also described. A description of electric transmission constraints and proposed projects is provided including Western Electricity Coordinating Council (WECC) Path 45 between Baja California and the California Independent System Operator (California ISO). Also included is the existing and proposed electric transmission capacity from the Imperial Valley to the west and north, and the impact of the proposed Sunrise Powerlink and Green Path North transmission projects.

Keywords: Power plants, gas-fired generation, electric transmission, natural gas transmission, pipelines, demand forecasts, supply forecasts, LNG terminals, California/Mexico border region, Baja California, Southern California, electric infrastructure expansion, natural gas infrastructure expansion, pipeline precedent agreements
Executive Summary

This report addresses existing energy (gas and electric) infrastructure, expansion plans, and growth projections in the California/Mexico Border region. This investigation was initiated as a result of the 2005 Integrated Energy Policy Report (IEPR). In conjunction with IEPR, the California Energy Commission sponsored an introductory report on energy infrastructure, demand, and supply in the California/Mexico border region.¹ The IEPR highlighted the potential for significant growth in demand and the need for additional energy resources in the border region, in both the gas and electric sectors, and recommended that the State of California work to establish a cross-border bi-national energy planning and development effort.

To facilitate bi-national dialogue regarding energy infrastructure in the border region, the Energy Commission commissioned an expanded study of the region in 2007 and selected KEMA Incorporated as the lead consultant for this work. Initially, KEMA examined the potential for development of wind renewable energy resources in northern Baja California and the export of these resources to California. The results of this analysis were provided in an earlier report.² A subsequent report will identify and compare possible longer-term scenarios for energy infrastructure development in Baja California, Southeastern California, and the San Diego area. This series of reports may provide a common framework through which regulators, utilities, energy resource developers, and other stakeholders can examine infrastructure needs and options. The reports may also assist policy makers and regulators in both Mexico and California to implement policies and strategies that will stimulate the type of infrastructure additions that offer the greatest benefits to the border region as a whole.

CHAPTER 1: Demand-Resource Zones in the California/Mexico Border Region

The Baja California Peninsula encompasses two separate sovereign Mexican states: Baja California (the northernmost portion of Baja) and Baja California Sur. Comisión Federal de Electricidad’s (CFE’s) Baja California (BC) electric control area serves the state of Baja California, the northernmost of the two. CFE’s Baja California Sur electric system is electrically isolated from the BC system and is outside the scope of the current investigation.

For this report, the border region was separated into the following four zones: Southeastern California, San Diego, Northwestern Baja California, and Northeastern Baja California. These zones are used for both the electricity and natural gas assessments. The boundaries of each zone are as follows:

- **Southeastern California.** The zone overlays Imperial County, which is bounded on the west by San Diego County, on the south by Northeastern Baja California, on the east by the Colorado River and on the north by Riverside County. Retail electric service in the zone is provided by Imperial Irrigation District (IID). Retail gas service is provided by Southern California Gas Company, a subdivision of Sempra Utilities.

- **San Diego.** The zone is the service area of San Diego Gas & Electric (SDG&E), which includes San Diego County and roughly the southern third of Orange County. The zone is bounded on the south by western Baja California del Norte, on the east by Imperial County, and on the north by the electric service area of Southern California Edison (SCE).

- **Northwestern Baja California.** The zone covers roughly the western half of CFE’s Baja California del Norte control area, typically referred to as CFE’s Coastal System. It includes the Tijuana metropolitan area, as well as Ensenada, Rosarito Beach, Puerto Nuevo and Tecate. The zone is bounded on the north by the San Diego Zone.

- **Northeastern Baja California.** The zone covers roughly the eastern half of CFE’s Baja California control area, typically referred to as CFE’s Valley System. It includes the Mexicali metropolitan area and extends south to the San Felipe area. The zone is bounded on the north by the Southeastern California Zone.

CFE’s BC electric power system serves two distinct geographic areas with distinct demand patterns driven by customer demographics and different climates as illustrated in Figure 1.
The Northwestern BC Zone, or Coastal Area, is located west of the Juarez Mountains and encompasses the Tijuana-Rosarito metropolitan area and the cities of Ensenada and Tecate. The area enjoys the cooling effect of the Pacific Ocean breezes. The Northeastern Zone, or Valley Area, lies to the west of the Juarez Mountains and has a desert-like climate with very high summer temperatures and low humidity, which drive the demand for electricity for air conditioning and irrigation.
CHAPTER 2: Electricity Supply Demand Balance by Zone

This section provides a zone-by-zone assessment of the current and projected electricity supply-demand balance for the Border region. The current and future year forecasts go through 2015-2017 timeframe, depending on the extent that forecast data is available in the later years. The resource data includes both utility-owned resources and independently owned resources. For the Southeastern California Zone adjustments are made in the tabulation of resources to net out the long-term firm export contracts from Imperial Irrigation District to SCE.

Only peak demand conditions and firm resource capacity are reflected in Tables 1-4. Firm resources include existing and planned geothermal generation in Baja, as well as solar generation projects currently under development in the Imperial Valley. Since wind resources cannot be scheduled to run at peak, they are not shown in these tables. However, projections of wind energy potential in northern Baja California are discussed in Challenges and Opportunities to Deliver Renewable Energy From Baja California Norte to California, California Energy Commission Publication No. CEC-600-2008-004. Additional information on renewable generation in BC is provided in Appendix A.

San Diego Zone Supply and Demand

Historically, the San Diego Zone has been resource deficient, and this appears unlikely to change in the planning horizon. Two approaches are used to tabulate the San Diego demand-resource balance. In Table 1, only those resources physically located within the zone are included. In Table 2, SDG&E’s import capability is included in the resource category. This comparison demonstrates the extent to which the zone is dependent on imports to serve its peak demand. It should be noted that the resource (capacity) data in these two tables is SDG&E filed forecast data, which excluded intermittent renewable resources and other proposed resource additions listed in the California ISO interconnection queue but not yet considered firm capacity plans at the time of the forecast.

As shown, the San Diego Zone has a significant resource deficiency based on a straightforward comparison of peak demand versus resources located in the zone. This deficiency is compounded by the retirement of the Southbay Generating Plant, which SDG&E anticipates will occur in November 2009 under terms of the plant’s property lease agreement. Retiring the plant will cause a 702 megawatt (MW) reduction for the San Diego Zone. Fortunately, this will

---

be offset to a large extent by the addition of new generation at Otay Mesa and Lake Hodges scheduled to come on-line in 2008.

Table 1: Electric Supply-Demand Balance (San Diego Zone) (Excluding Import Capability)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>In Operation /1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retirements</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>South Bay</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-702</td>
</tr>
<tr>
<td>New Entrants</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Otay Mesa CC</td>
<td>561</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lake Hodges Hydro</td>
<td>40</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Capacity</td>
<td>2,938</td>
<td>3,539</td>
<td>3,539</td>
<td>2,837</td>
<td>2,837</td>
<td>2,837</td>
<td>2,837</td>
<td>2,837</td>
<td>2,837</td>
<td>2,837</td>
<td>2,837</td>
</tr>
<tr>
<td>Peak Demand (90/10)</td>
<td>4,742</td>
<td>4,849</td>
<td>4,947</td>
<td>5,038</td>
<td>5,129</td>
<td>5,223</td>
<td>5,316</td>
<td>5,413</td>
<td>5,513</td>
<td>5,604</td>
<td></td>
</tr>
<tr>
<td>Resource Margin</td>
<td>-38%</td>
<td>-27%</td>
<td>-28%</td>
<td>-44%</td>
<td>-45%</td>
<td>-46%</td>
<td>-47%</td>
<td>-48%</td>
<td>-49%</td>
<td>-49%</td>
<td></td>
</tr>
</tbody>
</table>

/1 Includes Encina, Southbay, Palomar Energy Project and various peaker plants.

Source: CPUC A.05-12-014, Supplement to Application for the Sunrise Powerlink, Dec. 14, 2005

Another perspective for evaluating the electric supply-demand balance of the San Diego Zone is provided by including firm import capacity on the resource side of the equation as shown in Table 2. In fact, SDG&E uses this approach for the purpose of determining its “reliability requirements” (local resource needs vs. import capability). As shown in Table 2, SDG&E also takes into account the California ISO’s “G-1, N-1” criterion in calculating its “reliability margin.”5 Due to these differences, the final row of Table 2 (“Reliability Margin”) cannot be compared directly to the “Resource Margin” row(s) in the other Electric Supply-Demand Balance tables presented in this report.

---

5 California Independent System Operator’s “G-1, N-1” reliability planning criteria stipulates that San Diego Gas & Electric must be able to serve its 1-in-10-year peak demand forecast during the loss of both its largest internal generating resource and the worst case transmission import facility outage.
**Table 2: Adjusted Supply-Demand Balance (San Diego Zone) (Including Imports and California ISO “G-1” Requirement)**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>In Operation</strong></td>
<td>2,938</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Retirements</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>South Bay</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>New Entrants</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Otay Mesa CC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lake Hodges Hydro</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Firm Import Capacity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Existing SIL /1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sunrise Powerlink</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Reduction for California ISO “G-1”</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Palomar Energy Proj CC /2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Otay Mesa CC /3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total Capacity</strong></td>
<td>4,897</td>
<td>5,478</td>
<td>5,478</td>
<td>5,776</td>
<td>5,776</td>
<td>5,776</td>
<td>5,776</td>
<td>5,776</td>
<td>5,776</td>
<td>5,776</td>
<td>5,776</td>
</tr>
</tbody>
</table>

**Peak Demand (90/10)**

|                  | 4,742| 4,849| 4,947| 5,038| 5,129| 5,223| 5,316| 5,413| 5,513| 5,604|      |

**Reliability Margin /4**

|                  | 3%   | 13%  | 11%  | 15%  | 13%  | 11%  | 9%   | 7%   | 5%   | 3%   |      |

1. SDG&E’s Simultaneous Import Limit ("SIL") represents the maximum import capability that will meet NERC/WECC criteria for an outage of SWPL.
2. California ISO “G-1” criteria for combined-cycle plants assumes outage of the entire facility.
3. Otay Mesa plant capacity is 20 MW larger than Palomar and thereby increases the “G-1” outage.
4. California ISO reliability planning criteria requires that SDG&E serve its full 90/10 load forecast during an outage of the largest power plant “G-1” in its system.


**Southeastern California Zone Supply and Demand**

The supply-demand balance for Southeastern California is shown in Table 3. It is important to note that this tabulation includes merchant generation connected at SDG&E’s Imperial Valley (IV) Substation, which is physically within the Southeastern California Zone as defined for this study. Conversely, even though SDG&E owns the IV Substation, the resources connected there are not included in Tables 1 or 2 since they are neither within the San Diego Zone nor contracted to SDG&E.
### Table 3: Electric Supply-Demand Balance (Southeastern California Zone)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>In Operation /1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retirements/Removals /2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>El Centro Unit #3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>New Entrants</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RFP #484 Products</td>
<td>150</td>
<td>90</td>
<td>117</td>
<td>-100</td>
<td>300</td>
<td>300</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sterling Energy Systems /3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less Firm Exports to SCE</td>
<td>-552</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total Southeast CA Capacity</strong></td>
<td>2,248</td>
<td>2,338</td>
<td>2,338</td>
<td>2,713</td>
<td>2,713</td>
<td>2,913</td>
<td>2,913</td>
<td>2,913</td>
<td>2,913</td>
<td>2,913</td>
<td>2,863</td>
</tr>
<tr>
<td><strong>Gross Peak Demand (IID)</strong></td>
<td>1,025</td>
<td>1,078</td>
<td>1,123</td>
<td>1,166</td>
<td>1,209</td>
<td>1,253</td>
<td>1,300</td>
<td>1,348</td>
<td>1,397</td>
<td>1,449</td>
<td>1,503</td>
</tr>
<tr>
<td><strong>Capacity Reserve Margin /4</strong></td>
<td>119%</td>
<td>117%</td>
<td>108%</td>
<td>133%</td>
<td>124%</td>
<td>132%</td>
<td>124%</td>
<td>116%</td>
<td>109%</td>
<td>101%</td>
<td>90%</td>
</tr>
</tbody>
</table>

/1 Includes IID firm resources & contracts (978 MW), Termoelectrico de Mexicali (650 MW), Baja California Power (470MW) & geothermal gen (552 MW).
/2 El Centro Unit 3 will be removed from service in order to be reconfigured as a combined-cycle plant.
/3 SES solar generation capacity may be partially phased in in preceding years. A third block of 300MW may be added from 2012-2015.
/4 Figures shown represent the zonal reserve margin (IID’s projected control area reserve margins are approximately 15-16% of IID’s peak demand).

Table 3 reflects Imperial Irrigation District’s (IID) plans to remove Unit no. 3 at its El Centro generating plant in 2010 as part of a repowering project. The unit would become part of a new combined-cycle configuration, resulting in the 117-MW increment shown in the Request For Proposals (RFP) No. 484 line of Table 3. Although Table 3 shows this increment in 2010, IID recently advised that the project will be postponed at least a year.  

**Northern Baja California Zone Supply and Demand**

In an effort to curb emissions, CFE plans to reduce the use of oil as a power plant fuel and become increasingly reliant on natural gas-fired generation in BC. Between 2009 and 2016, CFE plans to build an additional 1,568 MW of new generating capacity in Baja California as reflected in Table 4. Abundant fuel will be available to support this large-scale power plant expansion as a result of the construction of liquefied natural gas (LNG) terminal facilities, storage, and natural gas pipeline capacity in northern BC. Table 4 aggregates the Northwestern and Northeastern Baja California zones, which are then disaggregated in Tables 5 and 6.

---

6 Personal communication with Noe Gutierrez, Imperial Irrigation District, on September 19, 2007.
Table 4: Electric Supply-Demand Balance (Baja California)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>In Operation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baja California (Presidente Juarez)</td>
<td>252</td>
<td>252</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baja California II (SLRC)</td>
<td>220</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pte. Juarez GCT/CC Conversion</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cierro Prieto V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baja California III (Ensenada)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baja California IV (Tijuana)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baja California V (SLRC) /1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baja California VI (Mexicali) /1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total Capacity</strong></td>
<td>2,352</td>
<td>2,352</td>
<td>2,352</td>
<td>2,024</td>
<td>2,936</td>
<td>3,218</td>
<td>3,218</td>
<td>3,498</td>
<td>3,498</td>
<td>3,769</td>
<td>3,920</td>
</tr>
<tr>
<td><strong>Gross Peak Demand</strong></td>
<td>2,037</td>
<td>2,097</td>
<td>2,223</td>
<td>2,334</td>
<td>2,479</td>
<td>2,624</td>
<td>2,769</td>
<td>2,921</td>
<td>3,086</td>
<td>3,251</td>
<td>3,425</td>
</tr>
<tr>
<td><strong>Reserve Margin /2</strong></td>
<td>17%</td>
<td>12%</td>
<td>6%</td>
<td>21%</td>
<td>19%</td>
<td>23%</td>
<td>16%</td>
<td>20%</td>
<td>13%</td>
<td>16%</td>
<td>14%</td>
</tr>
</tbody>
</table>

1 Either new generating plant or FPA
2 Minimum reserve margin for BC - after planned outages - the larger of the largest gen unit or 15% of peak demand

Source: CFE, Programa de Obras e Inversiones del Sector Eléctrico 2007-2016

As shown in Table 4, electric resources in Baja California are keeping pace with demand, but as CFE’s reserve margin declines in 2014-2016 CFE-owned resources may be supplemented with power purchases. However, the purchased power option is contingent upon the interconnection of the Baja California system to the rest of CFE via a high-voltage direct current (DC) line. This line is still under evaluation.

The following section describes the generation expansion and retirement plans for the northwestern (coastal) and northeastern (valley) areas of northern Baja California. To reduce seasonal transmission congestion between these two zones, CFE plans to locate new generation closer to the load centers. Table 4 shows this generation expansion plan through plants scheduled for construction near the growth areas of Tijuana-Rosarito, Mexicali, and San Luis Rio Colorado.

**Northwestern Baja California Zone Demand and Resources**

The current generation capacity in this area consists of several residual oil-fired units at the Presidente Juarez site near Tijuana: two 160-MW steam-cycle units, three combustion turbines with 210-MW capacity and two 248-MW natural gas-fired combined-cycle units. There is also a 55-MW oil-fired combustion turbine at the Ciprés site.

CFE generation plant additions and retirements in Northwestern Baja California, as shown in Table 5, include:
- The construction of a new 252-MW natural gas-fired combined-cycle facility at the Presidente Juarez site near Tijuana-Rosarito scheduled to go on-line on March 2009.
- The conversion of one of the existing units at Presidente Juarez to natural gas combined-cycle, yielding an additional 90 MW in capacity in April 2010.
- A not-yet-defined technology or fuel 279-MW facility in Ensenada in April 2011.
- An additional 280-MW plant, with undefined technology or fuel, is scheduled near Tijuana for April 2013. According to an earlier CFE report\(^7\) this plant was to be located near Mexicali.

As Table 5 shows, the Northwestern zone has an abundance of capacity resulting in large reserve margins.

### Table 5: Electric Supply-Demand Balance (Northwestern Baja California)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>In Operation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Presidente Juarez - Steam</td>
<td>320</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Presidente Juarez - CC</td>
<td>496</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Presidente Juarez</td>
<td>210</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cipres - GCT</td>
<td>55</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Retirements</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N.A.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>New Entrants</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baja California (Presidente Juarez)</td>
<td>252</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pte. Juarez GCT/CC Conversion</td>
<td>90</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baja California III (Ensenada)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baja California IV (Tijuana)</td>
<td>279</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total Capacity</strong></td>
<td>1,081</td>
<td>1,081</td>
<td>1,081</td>
<td>1,333</td>
<td>1,423</td>
<td>1,702</td>
<td>1,702</td>
<td>1,982</td>
<td>1,982</td>
<td>1,982</td>
<td>1,982</td>
</tr>
<tr>
<td><strong>Gross Peak Demand</strong></td>
<td>849</td>
<td>887</td>
<td>941</td>
<td>988</td>
<td>1,049</td>
<td>1,110</td>
<td>1,172</td>
<td>1,236</td>
<td>1,306</td>
<td>1,376</td>
<td>1,449</td>
</tr>
<tr>
<td><strong>Reserve Margin /3</strong></td>
<td>27%</td>
<td>22%</td>
<td>15%</td>
<td>35%</td>
<td>36%</td>
<td>53%</td>
<td>45%</td>
<td>60%</td>
<td>52%</td>
<td>44%</td>
<td>37%</td>
</tr>
</tbody>
</table>

\(^1\) Either new generating plant or PPA

\(^3\) Western Baja California is not a control area, thus these figures only indicate the extent to which the area is capacity rich.

Source: CFE, POISE 2007-2016

---

**Northeastern Baja California Zone Supply and Demand**

The existing generation capacity in Northeastern BC is predominantly geothermal. CFE’s 11 geothermal steam turbines have capacity of 720 MW. CFE also purchases the output of a 489-MW natural gas-fired combined-cycle plant at La Rosita generating complex under a long-term power purchase agreement (PPA). Lastly, a 62-MW oil-fired combustion turbine in Mexicali is used during the summer months.

---

\(^7\) *Programa de Obras e Inversiones del Sector Eléctrico 2005-2014*, Comisión Federal de Electricidad.
The supply-demand balance presented in Table 6 shows that, under CFE’s latest generation expansion plan, the northeastern area is short of capacity in 2008 and again from 2012 through 2016; this deficit will require power from the coastal area to flow over the 230-kilovolt (kV) east-west transmission lines to meet the inland valley load. As shown by the projected plant additions in Table 6, CFE plans to locate new generation closer to the load centers to help ease seasonal electricity transfers between coastal and valley areas.

Table 6: Electric Supply-Demand Balance (Northeastern Baja California)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>In Operation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mexicali (IPP-LRPC) CC</td>
<td>489</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mexicali GCT</td>
<td>62</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cerro Prieto I Geo.</td>
<td>180</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cerro Prieto II Geo.</td>
<td>220</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cerro Prieto III Geo.</td>
<td>220</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cerro Prieto IV Geo.</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retirements</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(75)</td>
</tr>
<tr>
<td>New Entrants</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baja California II (SLRC)</td>
<td>220</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cerro Prieto V</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baja California V (SLRC) /1</td>
<td>271</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baja California VI (Mexicali) /1</td>
<td>151</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Capacity</td>
<td>1,271</td>
<td>1,271</td>
<td>1,271</td>
<td>1,491</td>
<td>1,516</td>
<td>1,516</td>
<td>1,516</td>
<td>1,516</td>
<td>1,787</td>
<td>1,938</td>
<td></td>
</tr>
<tr>
<td>Gross Peak Demand</td>
<td>1,158</td>
<td>1,210</td>
<td>1,282</td>
<td>1,346</td>
<td>1,430</td>
<td>1,514</td>
<td>1,597</td>
<td>1,685</td>
<td>1,780</td>
<td>1,875</td>
<td>1,976</td>
</tr>
<tr>
<td>Reserve Margin /3</td>
<td>10%</td>
<td>5%</td>
<td>-1%</td>
<td>11%</td>
<td>6%</td>
<td>0%</td>
<td>-5%</td>
<td>-10%</td>
<td>-15%</td>
<td>-5%</td>
<td>-2%</td>
</tr>
</tbody>
</table>

Source: CFE, POISE 2007-2016

As shown in Table 6, CFE plans to commission a new natural gas-fired combustion turbine plant in 2009 at San Luis Rio Colorado (SLRC), which is located in the Northeastern Baja Zone near the border with Arizona. This generating complex will be located close to a large industrial park and will serve the industrial park demand and surrounding loads, thereby minimizing the need for additional 230-kV transmission capacity into the SLRC area.

8 Programa de Obras e Inversiones del Sector Eléctrico 2006-2017, Comisión Federal de Electricidad.
CHAPTER 3:
Current and Planned Bulk Electric Transmission Infrastructure in the California/Mexico Border Region

A simplified diagram of the major 230-kV and 500-kV electric transmission lines and interconnections in the United States/Baja California Norte, Mexico border region is shown in Figure 2. The 500-kV lines include the Southwest Powerlink (SWPL) from Arizona through the Imperial Valley to San Diego, and parts of Western Electricity Coordinating Council (WECC) Path 46 and Path 49, shown in bold in Figure 2. All the remaining transmission lines shown in Figure 2 are 230 kV.

Figure 2: Major Electric Transmission Facilities in the Border Region

The largest single block of generation in the region is the San Onofre Nuclear Generating Station (SONGS), with two nuclear units totally approximately 2,150 MW (net). The plant is physically located within the SDG&E service area, but the high-side 230-kV switchyard for the plant actually serves as the point of electrical interconnection between the SDG&E and SCE systems. This interconnection point is defined as WECC Path 44. As a result of this electrical configuration, the SONGS plant is electrically outside of the San Diego Zone.
As discussed in more detail later in the report, existing generation within the San Diego Zone totals slightly less than 3,000 MW. The majority of this capacity is located at the Encina Generating complex in Carlsbad, and the Southbay Generating Station in Chula Vista. Both plants are owned and operated by merchant generators. The largest SDG&E-owned plant in the zone is the Palomar Energy Project located in Escondido. Remaining generation in the San Diego Zone consists of relatively small peaker units.

The **Southeastern California Zone** includes both the Imperial Valley (IV) Substation oval and the “IID” oval shown in Figure 2. The IV oval represents IV500/230kV Substation as well as the generating plants that connect radially into the substation, including the Termoeléctrica de Mexicali (TDM) plant and La Rosita, both located in Mexico. These two merchant plants have a combined capacity of 1,210 MW. Existing generation within the IID oval includes 372 MW of IID-owned plants (Brawley, Coachella, El Centro, and Rockwood) and more than 550 MW of merchant-owned plants (primarily geothermal).

The **Northeastern Baja Zone** is represented by the La Rosita (ROA) oval in Figure 1. Existing generation in the zone connected to the CFE system totals about 1,270 MW. CFE has 11 geothermal steam turbines with 720 MW capacity at Cerro Prieto in addition to buying the output of 489-MW natural gas-fired combined-cycle capacity at the ROA generating complex under a long-term PPA. Another 560 MW of ROA are dedicated to the Southern California market. 10 CFE also owns a 62-MW oil-fired combustion turbine in Mexicali used as a peaker during the summer months.

The **Northwestern Baja Zone**, represented by the Tijuana (TJ) oval in Figure 1, has existing generation of 1,081 MW. This includes the following CFE owned generation at the Presidente Juarez site in Rosarito Beach: two 160-MW steam-cycle residual oil-fired units, three residual oil-fired combustion turbines with 210-MW capacity, and two 248-MW natural gas-fired combined-cycle units. There is also a 55-MW oil-fired combustion turbine used for peaking at the Ciprés site near Tijuana.

**Electric Interfaces in the Border Area**

The important electrical interfaces in the border area are indicated by dashed lines (cut planes) in Figure 2 and include the interface between IID and SCE (WECC Path 42), the interface between SCE and SDG&E (WECC Path 44), and the interface between northern Baja California (BCN) and California (WECC Path 45).

WECC Path 42 is rated 600 MW in the westbound direction (it is not rated eastbound) and is almost fully utilized for firm, long-term deliveries to SCE of the output from geothermal

---

10 One generating unit at La Rosita can be disconnected from the plant and delivered through the Baja California Power plant switchyard (La Rosita 2), which is connected into the IV Substation.
generation physically located within IID’s system. Without further upgrades, it is unlikely that Path 42 can support any significant amount of additional firm power delivery out of the Southeastern California Zone.

WECC Path 44 represents the southbound delivery capability from SCE/SONGS into the San Diego Zone. The path has as a normal rating of 2,200 MW and an emergency rating of 2,500 MW when any segment of the SWPL is out of service. It is currently the only path for firm power deliveries into the San Diego Zone during an outage of the IV-Miguel (ML) 500-kV line section.

WECC Path 45 represents the interface between California and Mexico’s BCN system. It is a bifurcated path with one 230-kV line connecting the IV Substation 230-kV bus to the Northeastern BC Zone, and a second 230-kV line connecting the Miguel 230-kV bus to the Western BCN Zone. The “non-simultaneous” path ratings are 800 MW in the northbound direction and 408 MW in the southbound direction. The non-simultaneous designation means that the full path rating is only useable under certain system operating conditions such as during favorable simultaneous path flows and generation dispatch conditions. Therefore, schedules requested on Path 45 compete with other schedules on other paths for use of the available transmission infrastructure in the region such as northbound schedules on Path 45 often compete with generation schedules coming into the system at the IV 230-kV bus or import schedules from Arizona to California). Simultaneous flow conditions can cause congestion and/or operation of special protective systems (remedial action schemes) in either SDG&E or CFE systems. As a result, SDG&E assumes no firm deliveries across Path 45 in assessing its reliability needs.11

Because of the physics of power flow across the interconnected grid, two other major WECC paths shown in Figure 2 also affect power flows in the California-Baja border region. WECC Path 49 (east of the Colorado River), which defines the transmission interface from Arizona westward to Southern California and southern Nevada, includes the Hassayampa-North Gila 500-kV section of the SWPL along with numerous other EHV facilities further to the north. Secondly, WECC Path 46 (West of River) defines the interface westward from Arizona, southern Nevada and IID.12 Although Path 49 is rated for more than 8,000 MW and Path 46 is more than 10,000 MW, this bulk power transmission capacity does not provide a path for interchange between the four zones in the California/Mexico border region. In fact, power flows and outage events on Path 46 and 49 can cause significant “through-flows” across the electric transmission infrastructure the California/Baja California, Mexico border region, thus reducing the amount of power transfer capability available for use on the local systems.

12 Southern California Edison’s proposed Hassayampa-Devers 500kV (also known as the Devers-Palo Verde No. 2 “DPV2”) line, if constructed, would also become part of both Western Electricity Coordinating Council Paths 46 and 49 increasing the respective path transfer capabilities.
It should be noted that the interface between IV Substation and the San Diego Zone (the IV-Miguel 500-kV line) is not part of any WECC rated path.\(^\text{13}\) Power delivery over the IV-Miguel line is limited by the rating of substation facilities at both ends, as well as congestion on the SDG&\text{E} transmission system north of ML Substation. The transfer limit over the path is currently 1,750 MW.\(^\text{14}\)

Lastly, the interface between Eastern BCN and Western BCN zones is made up of an older double-circuit 230-kV transmission line between La Rosita in the east and the Tijuana area in the west. The path is about 100 miles long and has a firm rating of roughly 250 MW, which is quite low and creates a significant operating limitation. There are no plans to increase the overall rating of the path or install a new circuit (or circuits) in parallel. When necessary, CFE shifts the generation dispatch between these two zones to stay within this transmission path constraint.

**Transmission in Baja California**

The evolution of the Baja California transmission system, illustrated in Figure 3, has been determined by the differences in the seasonal peak demands of the Coastal and Valley areas. This also resulted in most generating capacity being clustered around Tijuana-Rosarito (Coastal Zone) and Mexicali (Valley).

As shown in Figure 3, there are essentially two clusters of electric transmission in Baja Norte—one in the east and one in the west. Each of these clusters has a separate 230-kV tie with the U.S. grid—at Imperial Valley Substation in the east and Miguel Substation in the west. The two clusters are also connected together by a single transmission corridor that runs from La Rosita Substation in the east to Metropoli Substation in the west. In its current configuration, this Valley to Coastal area transmission path is a double-circuit, 230-kV with intermediate load-serving substations. The path has a “nameplate” capacity limit of 520 MW, but the practical operating limit is somewhat lower when exposure to transmission contingencies is taken into account. Load taken off at the intermediate substations along the line also reduces the net delivery capacity that can be delivered over the full length of the line. 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, the flow reverses to 150 to 200 MW from the Coast to the Valley to meet summer air conditioning peak loads.

\(^{13}\) IV-Miguel 500kV is the westernmost segment of the Southwest Powerlink (SWPL), which originates at the Hassayampa 500kV switchyard in central Arizona. Segments of the line between Hassayampa and Imperial Valley Substation area jointly owned by San Diego Gas & Electric, Imperial Irrigation District and Arizona Public Service. The segment from IV to ML is wholly owned by San Diego Gas & Electric.

Planned Electric Transmission Upgrades

Southeastern California:
Sunrise Powerlink

- SDG&E proposes construction of a second major transmission line from IV Substation into San Diego, called the Sunrise Powerlink.\(^{15}\) This project is shown as a dashed red line in Figure 2 and would increase the import capability of the San Diego Zone approximately 1,000 MW. As shown in more detail in Figure 4, this proposed scope includes a new 500-kV line from IV Substation to a new substation in east central San Diego County (the solid black line represents two segments of the existing SWPL). From the new Central Substation, 230-kV facilities would extend further west and connect into other existing substations. SDG&E estimates the project cost about $1.3 billion (including allowance for funds used during construction)\(^{16}\). Their proposed in-service date for the project is summer 2010.

---

\(^{15}\) California Public Utilities Commission Proceeding A.06-08-010 (formerly A.05-12-014) for Certificate of Public Convenience and Necessity (“CPCN”) for the Sunrise Powerlink Transmission Line.

\(^{16}\) San Diego Gas & Electric Direct Testimony, A.05.12.014 (Vol. 2, pp I-4).
Figure 3: Baja California Transmission System

Source: CFE Planning Subdirectorate

Figure 4: Simplified Diagram of Sunrise Powerlink

Source: California ISO
The purported benefits of the project include:

- Increased access to renewable resources from the Imperial Valley and northern Mexico.
- Improved reliability for the SDG&E service area due to an increase in their system import capability.
- Economic benefits to ratepayers including savings from declining reliability must run contracts.

SDG&E posits that the Sunrise project would allow developers of renewables throughout the border region to consummate power sales contracts with SDG&E and other parties by augmenting bulk power transmission capacity in the region. In SDG&E’s view:

This will greatly facilitate financing for the (renewable) projects since it will both reduce a substantial development risk involving access to the grid and will increase the range and volume of financially viable projects that could be developed.\(^{17}\)

Although intervenors in the regulatory proceeding for the Sunrise project have challenged the extent to which Sunrise would produce these benefits, there is general agreement that such benefits will accrue from the proposed project. Intervenors have also suggested various alternatives including route options, a reduction in the 230-kV portion of the project, construction of new generation in the San Diego Zone and other concepts that might defer the need for Sunrise. Filed testimony in the proceeding was completed in June 2007. Evidentiary hearings on the project were scheduled in two phases. Phase 1, addressing the need, scope, and benefits, was held from July-September 2007. Phase 2, addressing routing and environmental issues, was conducted in April-May 2008. The outcome of this proceeding is yet to be determined and the California Public Utilities Commission (CPUC) is expected to issue a decision in late 2008.

Independent of the CPUC proceeding, the Energy Commission had previously concluded that the Sunrise Powerlink would increase access to renewable power in the Imperial Valley as well as greater access to lower cost out-of-state generation (including Baja California).\(^ {18}\) The California ISO agrees that the line would increase access to renewable power, particularly from the Imperial Valley.\(^ {19}\) SDG&E has already executed at least one power purchase agreement for 300 MW of solar generation from the Imperial Valley beginning in June 2010 with Sterling Energy Systems (SES), increasing to 600 MW by 2012. This initial 600-MW purchase has been approved by the CPUC. The contract is expandable to 900 MW from 2012-2016, if SDG&E elects to do so, subject to CPUC approval.\(^ {20}\) SDG&E says delivery of SES plant output hinges upon successful expansion of the electric transmission infrastructure from the Imperial Valley to the

\(^{17}\) San Diego Gas & Electric Rebuttal Testimony, A.06-08-010, Linda Brown (50:1-12).


\(^{19}\) California Independent System Operator Initial Testimony, A.06-08-010, Part 1, January 26, 2007 (pp. 6).

\(^{20}\) San Diego Gas & Electric Direct Testimony, A.05-12-014 (Vol. 2, pp III-11).
west but admits that the initial phase may be deliverable without the Sunrise Powerlink.\(^{21}\) Although far short of the estimates of resource potential for the valley, the California ISO concludes that up to 500–700 MW of new renewable power could be added in the Imperial Valley in the absence of the Sunrise Powerlink.\(^{22}\)

In its Sunrise Powerlink filings, SDG&E also acknowledged looking into a lengthier “full loop” concept that would go beyond the current Sunrise project scope by completing a full 500-kV loop through the SDG&E service area and connecting into SCE in the greater Los Angeles area. Without such an additional 500-kV section between Sunrise and SCE, flows over Sunrise would have to flow through SDG&E’s lower voltage transmission facilities to reach the SCE system, thus limiting the value of Sunrise to the overall California ISO controlled grid. SDG&E has testified that based on joint studies of transmission expansion alternatives done in conjunction with the California ISO and numerous stakeholders:

The full loop alternative provided the highest economic benefit and had the largest California ISO ratepayer benefit. Also, like the Sunrise Powerlink (which essentially comprises a portion of the full loop option), the full loop alternative would provide some of the best access to renewable resources.\(^{23}\)

SDG&E testified that it may propose completing the full loop concept in the future, but doesn’t think it is needed for reliability purposes until at least 2020.\(^{24}\) However, at this time, SDG&E has filed solely for an Imperial Valley to Central Substation 500-kV line in its proposed plan of service for Sunrise (along with lower voltage upgrades internal to its service area). SDG&E’s decision in this regard may be short-sighted since it ignores potentially greater benefits of the Full Loop approach that could accrue between 2010-2020.

**SDG&E 500/230kV Substation for Wind Generation**

In the Sunrise hearings SDG&E also disclosed plans to build a new 500/230-kV substation in southeastern San Diego County for the purpose of interconnecting wind renewable resources. This substation, which is independent of the Sunrise Powerlink proposal, will tie into SDG&E’s existing Imperial Valley–Miguel 500-kV line.\(^{25}\) The exact location, timing, and licensing status of the substation were unclear from SDG&E’s testimony, but if a Certificate of Public Convenience and Necessity (CPCN) application is filed in a timely manner it should be possible to license the


substation and have it built in the 2010 timeframe. It is important to note that the proximity of this substation to the La Rumorosa area of Baja California would make it an excellent point of interconnection for Mexican wind renewables in that region, as well as any future gas-fired generation projects that may develop in the area.

Green Path Project

A second major 500-kV transmission proposal in Southeastern California is Green Path North, sponsored by the Los Angeles Department of Water and Power (LADWP). This project is shown as the dashed line in Figure 5 that runs between Hesperia Substation (near the top of the figure) to a new substation (Devers 2) to be built near SCE’s existing Devers Substation.

The projected in-service date for Green Path North is 2010-2011. The dashed line between Hassayampa-Devers-Valley in Figure 5 is a separate 500-kV project proposed by SCE (Devers-Palo Verde No. 2 project). The dashed lines from Devers 2 to Coachella Valley and further to the south are additional lower voltage upgrades sponsored by IID. According to IID, the earliest possible in-service date for its Indian Hills-Coachella-Devers 2 (500-kV) line is 2011. Due to IID’s concern about the potential of stranded assets, other IID area upgrades shown in the figure will be staged to coincide with development of new renewable resources in the Imperial Valley.

LADWP has filed path rating studies with the WECC that support a non-simultaneous northbound rating of 1,200 MW for the Green Path North line. Their analysis also found that an additional 400 MW of path rating would be available if the existing Lugo – Rancho Vista 500-kV line is looped into Hesperia Sub, and a second 500-kV link is built from Lugo to Hesperia. The specific design(s) and rating(s) of the IID upgrades to the south of Devers 2 are yet to be determined, and the transfer limit between Devers 2 and the existing Devers Substation is also undetermined at this time.

Closing a 230-kV path from IV Substation northward through the IID system to Devers, as indicated in Figure 5, could increase the simultaneous delivery capability out of Baja California and the IV area. However, simultaneous rating sensitivities have not yet been conducted to quantify this potential benefit.

A previous stakeholder study has concluded that the Sunrise Powerlink, in conjunction with internal IID area upgrades, would permit export of up to 2,200 MW of renewable resources from the Imperial Valley. This represents an increase of 1,375 MW over the current (825 MW) export capability from IID to the California ISO controlled grid. The California ISO concludes

---

26 The eastern terminus of the proposed Devers-Palo Verde No. 2 (DPV2) line is actually the Hassayampa Substation, which is adjacent to Palo Verde Substation. Hassayampa and Palo Verde are connected by 500-kV bus ties and are treated as a “common bus” for delivery purposes.

27 Personal communication with Juan Sandoval, Imperial Irrigation District, July 2007.

28 Western Electricity Coordinating Council Path Rating Study for Green Path North, June 2007.

that export of IV renewable power over the Green Path North project (absent Sunrise) would be only 500 MW.  

Neither the Sunrise Powerlink nor the Green Path project would increase the export limit from Baja California, Mexico to California, which is limited by WECC Path 45. Since none of the proposed facilities associated with Sunrise or Green Path cross the United States/Mexico border, the configuration of Path 45 would remain unchanged. However, the SDG&E and LADWP projects could indirectly affect Path 45 as follows:

- The Sunrise Powerlink should reduce congestion on SDG&E’s transmission facilities west of IV, thus allowing more energy to be scheduled northbound on Path 45.
- Increased scheduling capability and infrastructure on the north side of the border may provide additional incentive to upgrade the capacity of Path 45.

**Figure 5: Green Path Project (North and South)**

![Green Path Project Diagram](source: Los Angeles Department of Water and Power)

---

Northern Baja California Transmission System Expansion

As the electric demand of both its Valley and Coastal areas continues to grow, CFE has planned for new generating capacity close to each load center in an effort to reduce the need for additional east-west transmission capacity.

Except for plans to add transformer capacity at several substations, CFE is planning two transmission system additions CFE for Baja California between 2007 and 2016. One is a second 230-kV circuit between the Metropoli Potencia and Tijuana I substations, linked to the new 252-MW Baja California combined-cycle generating facility at Rosarito’s Presidente Juarez (site slated to begin service in 2009). The other project includes a number of 230-kV line additions in the Valley system: a double-circuit line connecting Parque Industrial San Luis-Cerro Prieto I-Hidalgo (mid-2007), a four-circuit line connecting Ejido San Luis-Cerro Prieto II-Parque Industrial San Luis, and a double-circuit line between Cerro Prieto II and Parque Industrial San Luis (October 2008). This could facilitate exports of geothermal power to California, if CFE elects to market any of this energy.

Planned Electric Generation Additions and Retirements

Following are descriptions of the new generation plants that are being proposed in the border region. This discussion also includes the effect of these plants on the transmission capacity of the border area.

Otay Mesa Generating Plant

A major combined-cycle generating plant is currently being built at Otay Mesa along the southern border of the San Diego Zone, about one mile north of the United States/Mexico border. The Energy Commission granted siting approval for this generation project in April 2001. The plant is being built by Calpine and, per its contract requirements with SDG&E, has commercial operation date before the summer of 2009.31

When the Energy Commission licensed the plant, the only transmission to be built was a loop-in of the existing Tijuana-Miguel 230-kV line into the plant switchyard along with converting the existing 230-kV line section between the Otay plant site and Miguel Substation from a single-circuit line into a double-circuit line. In 2003, SDG&E determined that additional 230-kV transmission would be needed to allow firm dispatch of Otay Mesa and to ensure delivery of the output to load centers in the San Diego Zone. On this basis SDG&E proposed, and the

CPUC approved a 230-kV transmission expansion.\textsuperscript{32} Figure 6 shows a diagram of this revised transmission plan.

The expanded Otay Mesa transmission plan includes a new 230-kV circuit from the Miguel area to Sycamore Canyon Substation in the east and a second 230-kV circuit from Miguel to Old Town Substation near the coast. Both circuits pass by Miguel Substation, but under normal operation when the Otay Mesa Generating Plant is in service both lines will bypass Miguel electrically to avoid congestion and operating problems in the area. SDG&E recently completed construction of these two transmission circuits: the double-circuit segment from the Miguel area to the new Otay Mesa plant switchyard remains to be built.

Even though the Otay Mesa plant site is close to the border with Baja California, the transmission plan for the project does not expand the transmission capability from Baja California into the San Diego Zone. There are currently no plans to upgrade the single existing 230-kV circuit between the Otay Mesa site and Tijuana (not shown in Figure 6). Therefore, the Otay Mesa transmission plan will not increase of the rating of WECC Path 45.

\textsuperscript{32} Decision in A.04-03-008, June 30, 2005.
LEAPS Pumped-Storage Project

Nevada Hydro has proposed a major generating plant to interconnect into the north side of the San Diego Zone. The project includes a 500-MW pumped-storage generating facility located at Lake Elsinore, just north of the SDG&E service area in the Cleveland National Forest. The proposal is known as the Lake Elsinore Advanced Pumped Storage (LEAPS) project and includes a new 500-kV transmission corridor along a north-south alignment that would connect the generating plant to both SCE and SDG&E as shown in Figure 7.
Nevada Hydro has filed with the United States Federal Energy Regulatory Commission (FERC) for a license to build the project. They have also petitioned the FERC for approval to build the transmission tie between SCE and SDG&E, referred to as the Talega-Escondido/Valley-Serrano 500-kV interconnect project (TE/VS Interconnect) in advance of the generating plant. Interconnection studies have been completed for the project by SCE and SDG&E, in conjunction with the California ISO, but they are confidential and therefore not available for review or discussion. A limited amount of transmission system technical analysis has been performed and published by the California ISO for the LEAPS project. An interim California ISO assessment of done for LEAPS assumed both the Sunrise Powerlink and Green Path lines (Sun Path Project) were in service. The California ISO concluded that a TE/VS line could deliver about 1,000 MW into SDG&E, as long as the Sun Path facilities were in service. Without the Sun Path upgrades, the California ISO estimates the delivery capability into SDG&E on a TE/VS line would be 500 MW.

34 California Independent System Operator refers collectively to the Sunrise Powerlink and Green Path lines as the “Sun Path.” The California Independent System Operator Board has granted its approval for both lines.
CHAPTER 4: Current and Planned Natural Gas Pipelines and Infrastructure in the California/Mexico Border Region

Natural Gas Transmission Pipelines

California receives natural gas supplies from diverse sources including Canada, the Southwestern United States (Permian, Anadarko, and San Juan Basins), the Rocky Mountains, and sources within California. Interstate pipelines currently serving California include El Paso Natural Gas Company, Kern River Transmission Company, Mojave Pipeline Company, Gas Transmission-Northwest, Transwestern Pipeline Company, Questar Southern Trails Pipeline, and Tuscarora Pipeline. Supplies are transported to the California border and are redelivered primarily via intrastate transmission lines to ultimate natural gas consumers. The historical peak send-out to customers in California is approximately 5.2 billion cubic feet per day (Bcfd).

Figure 8 is a map of the of the natural gas transmission facilities, both interstate and intrastate, serving the California/Baja California Norte border region extending approximately 60 miles to the north and south of the California/Mexico border. The main east-west gas pipeline corridor on the California side of the border, from Blythe to Moreno Station, is actually just north of the Southeastern California and San Diego zones. The North Baja Pipeline, which originates in western Arizona, passes through southeastern California en route to Mexico. However, it currently does not serve any customers in California.

As shown in Figure 8, the firm interstate pipeline delivery capability into Southern California at Blythe is more than 1,210 MMcfd (an additional 250 MMcfd available on a non-firm basis). SoCalGas has a total system-wide firm supply capacity from interstate and local sources of 3,875 MMcfd. In addition, it has approximately 130 billion cubic feet (Bcf) of on-system storage capacity with the ability to withdraw from storage up to 3.5 Bcf per day (Bcfd). However, none of these storage facilities are located in the border region.

---

38 Interview with SoCalGas, May 29, 2007.
As shown in Figure 8, the SoCalGas transmission system in the border region has drop-off points to the Imperial Valley and Moreno/San Diego. A portion of the interstate gas supply coming in at Blythe drops off at these points, and the rest continues on to the major load center(s) further to the west of Moreno.

**Southeastern California Zone**

The Southeastern California border zone is principally served by SoCalGas through its local transmission Line 6902 (Figure 8). The gas enters the SoCalGas backbone transmission system from El Paso at Blythe, travels west to Line 6902 and south through the Imperial Valley to the California/Mexico border. Natural gas is also delivered through that line to ECOGAS (formerly Distribuidora de Gas Natural de Mexicali), which distributes natural gas to retail customers in Mexicali, Mexico.

Southeastern California is a summer peaking system. The major customer on that system is the Imperial Irrigation District (IID), which uses natural gas to fuel its power plants. The capacity of
the system is currently 86 MMcfd. In addition to serving the Imperial Valley, SoCalGas provides up to 25,200 MMcfd of firm capacity to ECOGAS.

**San Diego Zone**

SoCalGas also delivers gas to three wholesale utility customers in the Southern California region including San Diego Gas & Electric Company (SDG&E), Southwest Gas Corporation and the City of Long Beach Energy Department. The San Diego Zone currently receives 100 percent of its gas supply from SoCalGas. The vast majority of its gas is delivered through the Moreno compressor station in Moreno Valley (see Figure 8), travels south along three high-pressure transmission lines to the Rainbow Station, where pressure is boosted again into the 16-inch transmission line (there is also a 30-inch high-pressure line from Rainbow Station to the SDG&E system) for ultimate delivery to SDG&E city-gate stations.

Given the current geographic configuration of natural gas customers, the SDG&E system has the capacity to serve 640 MMcfd of demand in the winter and 625 MMcfd of load in the summer. These figures do not include 45 MMcfd reserved for operating margin. Because of recent growth along the Rainbow Corridor, the capacity of the SDG&E transmission system has been reduced from the November 2006 estimate of 655 MMcfd in the winter and 635 MMcfd in the summer.

**Baja California Zone(s)**

Figure 10 shows the natural gas transmission facilities used to serve the northern Baja California zones. Although the North Baja Pipeline is located in Riverside and Imperial Counties of California, the pipeline currently only serves markets in Baja California. This region of Mexico is not physically connected to the Mexican natural gas pipeline system and must rely on gas imported through California to meet its growing natural gas needs. However, this dependency will change when the Costa Azul liquefied natural gas (LNG) receiving terminal is completed on the Baja California coast.

---

39 Advice Letter AL3474 filed June 1, 2007, with California Public Utilities Commission.
Figure 9: SDG&E Natural Gas Transmission System

Source: SDG&E
The North Baja Pipeline (NBP), Gasoducto Bajanorte (GB) and the Transportadora de Gas Natural de Baja California (TGN) systems comprise an approximately 245-mile transmission system that serves the growing natural gas demand in Baja California. The NBP system consists of a 30-inch and 36-inch pipeline approximately 80 miles long. The GB system consists of a 30-inch pipe approximately 140 miles in length. Natural gas enters the North Baja system from El Paso Gas Co. at Blythe/Ehrenberg and travels south to GB, where it moves west and connects to TGN. The North Baja and GB portions began service on September 1, 2002, with an initial capacity of 200 MMcf/d. Completion of the pipeline’s 21,000-horsepower compressor station in December 2002 brought the pipeline’s capacity to 500 million cubic feet per day in December 2002. The North Baja Pipeline is owned by TransCanada and the GB system is owned by Sempra Energy.

TGN’s natural gas transmission line, also owned by Sempra Energy, is 23 miles long and 30 inches in diameter and has the capacity to transport up to 300 million cubic feet of gas per day.
TGN began to supply natural gas from the United States/Mexico border near San Diego to the Presidente Juarez power plant in Rosarito, Baja California, in the summer of 2000. Under a 10-year agreement, Sempra Energy companies provide a complete energy supply package to the plant, including potentially buying up to 300 million cubic feet per day of natural gas in the United States and transporting it across the border to the plant (although Rosarito cannot currently use that much gas.) TGN starts at the interconnection with the GB system in the Tijuana area and terminates at the Presidente Juarez Thermoelectric CFE Central in Rosarito, Baja California.

---

42 The capacity should become bidirectional after Sempra completes planned upgrades.
CHAPTER 5:
Natural Gas Supply-Demand Balance, Flows, and Flow Limits Between Zones

Although surplus electric and gas resources exist in some of the zones studied, export of surpluses to adjacent zones is limited by the transmission infrastructure. This section of the report describes the existing interfaces and flow limits between the zones, as well as proposed infrastructure projects that may affect the flow limits in the future.

San Diego Zone

Supply Capacity
The SDG&E gas distribution system receives virtually all of its gas supply from SoCalGas along the Rainbow Corridor. The Rainbow Corridor consists of three high-pressure transmission lines between the Moreno and Rainbow compressor stations. The capacity of the SDG&E transmission system is currently 640 MMcfd in the winter and 625 MMcfd in the summer, plus an operating reserve of 45 MMcfd. This capacity is based on the current geographic configuration of customers and demands they place on the system. The transmission capacity of this system will change as the distribution of its customers’ demand changes. For example, if more customer demand were located in the southern portion of the SDG&E system, such as the San Diego metropolitan area, the capacity of the system would decrease even if overall customer demand didn’t change. This variability in the capacity of the transmission system is caused by the need to maintain increasingly higher pressures to push more gas further south to serve customers in the southern-most end of the SDG&E system.

In addition, demand on SoCalGas’ Rainbow Corridor also affects the capacity of the SDG&E system. SoCalGas’ Rainbow Corridor pipelines have the capacity to serve one Bcfd of demand located within Riverside County between the Moreno and Rainbow Stations. SDG&E’s higher-than-minimum pressure requirements, however, has the effect of reducing the capacity of that system as well. Pipeline pressure drops as gas is taken out of the pipe. As the minimum operating pressure requirement increases in the Rainbow Corridor, the amount of gas that can be taken off the pipe decreases. This relationship results in a lower pipe capacity.

Figure 11 shows a range of scenarios illustrating the relationship between SoCalGas’ capacity south of Moreno vs. demand on the SDG&E system, assuming the current SDG&E customer demand configuration. For each scenario shown in the graph the red bar represents SDG&E capacity.

---

43 Testimony of David M. Bisi of San Diego Gas & Electric in A.06-10-034 filed October 27, 2006, with California Public Utilities Commission. Rainbow is located just south of the Riverside County-San Diego County boundary.
demand and the blue bar represents the corresponding limit on deliveries to SoCalGas’ customers (existing and future) between Moreno and Rainbow. The sum of the red and blue bars in each scenario represents the aggregate delivery capability over the SoCalGas pipeline south of Moreno. As shown in Figure 11, when the demand on the SDG&E system exceeds 400 MMcf/d, the capacity of the total system begins to decline, dropping from 1,000 MMcf/d to 930 MMcf/d as SDG&E demand increases from 400 MMcf/d to 530 MMcf/d. Conversely, if customer demand increases on the SoCalGas system north of Rainbow, pressures at Rainbow Station will decline along with delivery capability into the SDG&E system.

**Figure 11: Moreno-Rainbow Corridor vs. San Diego, Existing System**

Source: Testimony of David Bisi of SoCalGas filed on October 27, 2007 before the CPUC

SDG&E estimates that if core demand along the Rainbow Corridor continues to grow at its current pace, SDG&E system capacity could decline to 630 MMcf/d in winter and 610 MMcf/d in summer if no system enhancements or other actions are implemented.44

**Demand**

In D.02-11-073, the CPUC affirmed peak-day design criteria of a 1-in-35-year cold day condition for firm core service, and established a new 1-in-10-year cold day condition requirement for non-core firm service. That is, SDG&E must maintain its system to be able to provide

continuous service to core customers on the coldest day expected to be experienced in its service territory in a 35-year period. It must also be able to meet its firm non-core daily requirements on the coldest day expected to be experienced in a 10-year period.

In D.02-11-073, the CPUC authorized SDG&E to conduct an open season for the allocation of capacity on its gas transmission system. In D.06-09-039, the CPUC authorized both SDG&E and SoCalGas to conduct open seasons for the allocation of capacity on any portion of its gas transmission system which is, or is expected to be, constrained. As of May 2007, SDG&E was in its open season process for the period June 2007 through May 31, 2009. SoCalGas is also in the process of conducting a capacity open season for customers served by its Rainbow Corridor pipelines for the same term as SDG&E’s open season.

Table 7 represents SDG&E’s most recent demand forecast under the planning criteria stipulated by the CPUC. SDG&E’s demand forecasts, however, do not typically distinguish between non-core firm and interruptible service. Consequently, for this capacity assessment, SDG&E has assumed all future non-core commercial and industrial (C&I) and electric generation customers will elect firm non-core service and that such customers would need to be curtailed for a 1-in-35 year cold day demand event. For electric generation, both the total expected peak-day electric generation demand, as well as the portion of that demand with firm entitlements is shown. The firm portion of the electric generation demand is based on the results of the most recent capacity open season, held constant beyond the open season term of 2011/2012.

Table 7: SDG&E Forecasted Peak Demand

<table>
<thead>
<tr>
<th>Operating Year</th>
<th>1-in-35 Year Cold Day Demand(MMCFD)</th>
<th>1-in-10 Day Cold Day Demand (MMCFD)</th>
<th>Total/Firm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Core Non-Core C&amp;I EG Total</td>
<td>Core Non-core C&amp;I EG total/firm</td>
<td>Total/Firm</td>
</tr>
<tr>
<td>2007/2008</td>
<td>441 0 0 441</td>
<td>418 74 157/110 649/602</td>
<td></td>
</tr>
<tr>
<td>2008/2009</td>
<td>447 0 0 447</td>
<td>423 75 154/110 652/608</td>
<td></td>
</tr>
<tr>
<td>2009/2010</td>
<td>451 0 0 451</td>
<td>427 75 172/110 674/612</td>
<td></td>
</tr>
<tr>
<td>2010/2011</td>
<td>457 0 0 457</td>
<td>433 75 169/61 677/569</td>
<td></td>
</tr>
<tr>
<td>2011/2012</td>
<td>463 0 0 463</td>
<td>438 76 164/61 678/575</td>
<td></td>
</tr>
<tr>
<td>2012/2013</td>
<td>467 0 0 467</td>
<td>442 76 175/61 693/579</td>
<td></td>
</tr>
<tr>
<td>2015/2016</td>
<td>482 0 0 482</td>
<td>457 77 151/61 685/595</td>
<td></td>
</tr>
</tbody>
</table>

Source: Gas Capacity Planning and Demand Forecast Semi-Annual Report filed with CPUC on May 4, 2007

For the forecast period, SDG&E has ample capacity to meet its core peak design day requirements. According to SDG&E, preliminary results of the open season for the Rainbow Corridor indicate SDG&E will have sufficient transmission capacity to meet the firm non-core demand at least through the 2008/09 operating season. After that timeframe, SDG&E does not have sufficient capacity to meet the 1-in-10-year peak design day criteria for its forecasted electric generation (EG) requirements.
Planned and Potential Changes to the SDG&E Natural Gas System (Before Costa Azul LNG)

In November 2006, SoCalGas filed testimony with the CPUC regarding capacity on the Rainbow Corridor. Currently, two customers are planning to construct new electric generation along the Rainbow Corridor. The Inland Empire Energy Center is under construction by GE and was scheduled to begin commercial operation in May 2008. Also along the Rainbow Corridor, a peaking plant is scheduled to begin operation in early 2008. If either one of these facilities elected to receive firm service, capacity along the Rainbow Corridor would be reduced to approximately 585 MMcfd. For the 2008/2009 winter season, this level of capacity would be insufficient to meet the 1-in-10-year peak design day criteria established by the CPUC. A preliminary analysis of SoCalGas’ most recent open season indicates this is no longer an immediate concern. There is an ongoing concern that any new request for non-core firm service by an electric generator along the Rainbow Corridor or on the SDG&E system will require system upgrades or operational changes to prevent the need to prorate firm service.

In R.04-01-025, SoCalGas and SDG&E identified that the capacity of the SDG&E system could be expanded by 50 MMcfd year-round by installing 25 miles of 36-inch-diameter pipe between Rainbow Station and Escondido. A preliminary estimate of the cost of this upgrade was $115 million. In addition, it may also be possible to construct an additional pipeline between Moreno Station and Rainbow Station. This option, however, will require additional rights of way and would likely be more expensive than a pipeline from Rainbow Station to Escondido.

Another option identified by SDG&E is to deliver gas directly to the San Diego load center through Otay Mesa. The effect of such a delivery is captured in Figure 12, which is identical to Figure 11 except that a firm 50 MW delivery into SDG&E is assumed at Otay Mesa. Comparing similar scenarios from these two figures shows that firm delivery from Otay Mesa into SDG&E releases additional capacity on the SoCalGas system between Moreno and Rainbow Stations. The maximum benefit occurs at a SoCalGas delivery level of 700 MMcfd to SDG&E, where total deliverability south of Moreno increases to 950 MMcfd in Figure 12 as compared to 750 MMcfd in Figure 11. This 200 MMcfd increase in capacity would be enough to supply at least one of the new power plants currently under construction near Moreno. Furthermore, Figure 12 demonstrates that firm deliveries to SDG&E from Mexico at Otay Mesa can be leveraged to create additional benefits in Southern California. This is true whether the gas delivered to SDG&E at Otay Mesa originates at the Costa Azul LNG terminal, or is delivered by displacement from Blythe. For example, gas flowing to Blythe could flow into North Baja (NBP), then into the Gasoducto Baja Norte (GBN) system and, finally, to Transportadora de Gas Natural de Baja Norte (TGN) for delivery to SDG&E at Otay Mesa.

---

**Potential Impacts of the Costa Azul Liquefied Natural Gas Project on SDG&E**

The Costa Azul LNG terminal will provide a new source of gas originating in Mexico from the regasification terminal near Ensenada and, to the extent significant volumes are flowing out, will reverse the flow of gas on TGN, GBN, and NBP. Sempra LNG has contracted to pay for an upgrade of the TGN connection with SDG&E at Otay Mesa, MMcfd on a firm basis, and up to 400 MMcfd on an interruptible basis. Firm delivery volumes are based on SDG&E’s assessment of what can be used reliably under minimum demand and flow conditions on its system.

If 400 MMcfd were delivered to SDG&E at Otay Mesa during the peak winter period, then SoCalGas would likely have the full 1 Bcfd of capacity between Moreno and Rainbow Stations available on a firm basis without any additional pipeline facilities. In addition, the capacity of

---

46 Interviews with SoCalGas and Sempra LNG May 29, 2007.
the existing SDG&E transmission system would also be enhanced since a significant quantity of gas would be delivered by TGN directly to high-demand areas in the border region and San Diego.

Allocating firm capacity to customers created by delivering 400 MMcfd at Otay Mesa is, at this time, a high-risk strategy. It is unclear how much volume will be delivered to Costa Azul on a firm basis and how much will flow out on a firm basis. Presumably, CFE has assured that some or all the gas contracts for its current and future needs will be firm; however, the supplier (BP/Tangguh) has diversion rights, which means that it can divert LNG scheduled for delivery to Costa Azul to other higher value LNG markets. The portion subject to diversion is confidential, however, Sempra has stated that “some gas will always flow out of Costa Azul.”

Southeastern California Zone

Supply Capacity
SoCalGas serves the Imperial Valley through its Line 6902, which runs from their backbone transmission system in Riverside County, through Niland and terminates near the California/Mexico border at Line 6903. This extends to the border where gas is ultimately delivered into Mexico at Calexico. Line 6902 in the Imperial Valley is potentially a constrained area on the SoCalGas system. The Imperial Valley system is a summer peaking system, primarily from the Imperial Irrigation District’s (IID) gas-fired power generation. The system’s capacity is 86 MMcfd.

Gas Demand
SoCalGas conducted open season for Line 6902 for firm service commencing in April 2007. Bid packages were sent to 13 customers who are non-core, non-core eligible, or expected to be non-core eligible within the term of the 2007 open season. Four customers bid for non-core firm service, six elected firm service, two elected non-core interruptible service and one (ECOGAS) elected to amend its existing contract by reducing its maximum contract quantity from 25 MMcfd to 20 MMcfd.

Based on the results of the 2007 open season, summer firm demand is expected to exceed the hourly capacity by 10 percent in 2007 and increasing to 30 percent by 2012. As a result of this open season, SoCalGas is planning to expand the capacity of its Imperial Valley system by looping its Line 6902 north from El Centro toward Niland with 22 miles of 24-inch pipe. This

47 Ibid.
48 Advice Letter AL3474 filed June 1, 2007, with California Public Utilities Commission.
expansion will increase the capacity of that line to 150 MMcfd. This amount is expected to be sufficient to meet firm demand for the next 5 to 10 years.

**North Baja Pipeline Expansion in the Imperial Valley**

As part of the NBP planned expansion to deliver LNG volumes from Costa Azul, it has also applied for a certificate to construct a 46-mile lateral from its Ogilby Meter Station in the Imperial Valley to the IID El Centro Generating Station. This line will be capable of delivering 103 MMcfd. This plant currently receives its natural gas from SoCalGas through its Imperial Valley system. Figure 13 is a map of the proposed lateral expansion to serve the IID. Through constructing this lateral, IID would be able to receive deliveries of either LNG-sourced gas or domestic natural gas supplies from the El Paso system. Even if LNG-sourced gas is flowing north from NBP into the El Paso system, domestic supplies can be delivered to IDD through this lateral by displacement as long as sufficient LNG-sourced supply is being nominated for delivery to El Paso.

![Figure 13: NBP Proposed IID Interconnect](image)

Source: North Baja Pipeline filing at the FERC in CP06-61-000

**Baja California**

Table 8 shows the forecast of growth in average daily demand for natural gas in the Baja California region through 2015 (peak demand may run 400-500 MMcfd).

---

49 Advice Letter AL3474 filed June 1, 2007, with California Public Utilities Commission.

50 North Baja Pipeline filing with the United States Federal Energy Regulatory Commission CP06-61.
Table 8: Baja California Natural Gas Demand (2005-2015)

<table>
<thead>
<tr>
<th>Baja California Natural Gas Demand 2005-2015</th>
<th>MMCFD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric Generation</td>
<td></td>
</tr>
<tr>
<td>Industry, including self generation</td>
<td>237</td>
</tr>
<tr>
<td>Residential, service and transport</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>249</td>
</tr>
</tbody>
</table>

(*) Actual


The BCN region is served principally by the NBP-GB-TGN pipeline system. Growth in natural gas demand is expected to average 3.1 percent per year over this period, with more than 99 percent of that growth expected to be from industrial (including self-generation of electricity) and electric generation demand. Electric generation alone comprises more than 85 percent of the total expected gas demand growth in the region.

The BCN region is forecasted to add 1,543-MW natural gas-fired power generation through 2016. About 1,048 MW of this additional capacity is for peak day demand and the remaining 495 MW is intended to maintain CFE’s planning reserve. The 1,543 MW of new generation will result in additional gas demand of approximately 300-325 MMcf/d in the BCN region. Given the current direction of gas flows on these systems from the United States into Mexico, the NBP-GBN-TCN system would have to be expanded (and potentially pipelines feeding NBP) to support the planned electric generation growth in the region.

Currently, all of the gas supply for Baja California is U.S-sourced supply. The vast majority of supply entering Baja California is delivered via the NPB-GBN path. ECOGAS, the local distributor for Mexicali, received approximately 5 percent of the total supply delivered into Mexico in 2006. ECOGAS’ supply is delivered through the SoCalGas Imperial Valley system. Finally, an insignificant volume was also delivered to the TGN system at Otay Mesa by SDG&E.

The capacity of the NBP-GBN system is 500 MMcf/d while the capacity of the line serving Mexicali from Calexico is 29 MMcf/d. There is approximately 25 MMcf/d of unsubscribed capacity on the NBP-GBN system. The NBP-GBN-TGN system is a summer peaking system because of the proportionately high demand for gas-fired power generation. Demand on this system is highly weather sensitive. In 2006, peak day flow on this system was 430 MMcf, which represents approximately 86 percent of the system’s capacity. Average throughput was

51 This figure assumes a blended heat rate for planned new generation plants (combined cycle and combustion turbine) for the BCN region in the range of 8,200 – 8,800 Btu/kwh.
52 North Baja Pipeline – informational postings from website.
53 North Baja Pipeline “Operational Capacity Baja 2005-2007”
approximately 265 MMcfd. In 2005, peak day flow was 367 MMcf, and average throughput was approximately 235 MMcfd.

**Northeastern Baja California**

**Supply Capacity**

Natural gas delivery capacity in the Northeastern Baja California region is composed of the NBP-GBN system and a line from the SoCalGas system at Calexico to Mexicali. Capacity used on the NBP-GBN system for customers located in this region is approximately 357 MMcfd or 73 percent of the total contracted NBP-GBN capacity.

**Gas Demand**

Virtually 100 percent of the natural gas demand in the Northeastern Baja California region is located in the Mexicali area. ECOGAS is the local natural gas distribution company that provides service to residential and C&I customers in Mexicali. In addition, several large gas-fired power plants are located in the Mexicali area, which is served by the NBP-GPN pipeline.

Gas delivered by the NBP-GBN system to the Mexicali area is used primarily for power generation. There is almost 1,700 MW of installed gas-fired electric generation capacity in this region, with about 75 percent of the power generated by these plants exported to the United States. Based on seasonal load data for 2006, it is estimated that approximately 68 percent of the peak gas demand on the NBP-GBN system was used to serve markets located in this region, and the rest was used to supply generation for export to the United States. Growth in peak power demand for this region is expected to be 717 MW through 2016. It is expected that, during the forecast period, there will be 642 MW of gas-fired generation constructed in this region, increasing electric generation natural gas demand by as much as 110 MMcfd. Based on KEMA’s analysis, this amount of additional demand cannot be met reliably from increased Southwest sourced U.S. gas deliveries to GBN alone, and would require at least 60 MMcfd of LNG from Baja. In that case, it may be possible to meet the 110 MMcfd increase in electric generation demand through a combination of Baja LNG and Southwest sourced gas deliveries without any Phase II capacity expansion on GBN.

ECOGAS recently requested a reduction of its contract with SoCalGas. Since ECOGAS has not experienced a peak day anywhere close to its existing contract level of 25 MMcfd and given that small customer status would give ECOGAS somewhat more contracting flexibility, it requested that its contracted quantity be reduced to 20 MMcfd. Based on 2006 seasonal load data, it is estimated that ECOGAS’ peak day experienced in 2006 was in the vicinity of 16 MMc. With the planned expansion of SoCalGas’ Imperial Valley system, there should be sufficient capacity to serve ECOGAS demand through the forecast period.
Northwestern Baja California

Supply Capacity
Gas is delivered to the western Baja California region by the NBP-GBN-TGN pipelines principally for CFE power generation facilities in Rosarito and to several self-use pipelines that serve industrial and self-generation loads in the Tijuana area, including Toyota Motor Manufacturing de Baja California. Approximately 134 MMcf/d, or 27 percent of the total contracted capacity of the NBP-GBN is contracted to customers located in this region. The capacity of the TGN system, which interconnects with GBN at Tijuana, is 300 MMcf/d. The TGN system delivers gas to CFE’s Rosarito area generating facilities. Sempra’s current contract with CFE which runs from 2008-2022 calls for an average delivery of 130 MMcf/d, but allows CFE to take additional delivery if needed to support gas-fired generation expansion.54

Gas Demand
In 2006, approximately 32 percent of the peak gas demand on NBP-GBN was experienced in the western Baja California Norte region. Of the approximately 30.2 BCF of annual supply delivered to this region in 2006, all but a small portion was consumed by CFE power facilities in Rosarito. On average GBN delivered about 200 MMcf to self-generation customers and TGN delivered about 100 MMcf through the Otay Mesa interconnection with SDG&E.55

54 Interview and documents supplied by officials of Sempra LNG at meeting in San Diego on May 29, 2007.
CHAPTER 6: Planned LNG Facilities and Transmission Pipeline Additions in Northern Baja California

LNG Facilities in Northern Baja California

Sempra’s Costa Azul LNG Regasification Terminal

The Costa Azul terminal is a new LNG regasification terminal currently under construction and owned by Sempra LNG. The terminal is located on a 400-acre site about 14 miles north of Ensenada, Mexico, and will initially consist of two full-containment tanks and pads for two more. The initial send out capacity will be 1.0 Bcfd with the potential to increase it to 2.5 Bcfd. Sempra held a non-binding open season for additional service from Costa Azul and announced in May 2006 that it had received bids totaling 2.9 Bcfd, more than double the expandable capacity of 1.5 Bcfd. No new information regarding the status of the open season nominations has been made public.

Commercial operation is currently scheduled for 2008. Sempra has contracted for half (500 MMcfd) of the send out capacity and Shell has contracted for the other half. Sempra has also contracted with BP/Tangguh to supply its portion of capacity with LNG from Indonesia and has entered into a long-term contract with CFE to support its future energy requirements in northern Baja California, which includes the existing Presidente Juarez power plant in Rosarito. The contract with the CFE is a 15-year agreement that provides the CFE an average of 130 MMcfd of gas supply with a range of between 40 to 280 MMcfd. Sempra anticipates meeting this obligation with LNG delivered from the Costa Azul terminal.

Phase I of the Costa Azul terminal (and the associated spur to GBN) adds 1 Bcfd of capability to deliver gas into Baja California with only a limited need for pipeline upgrades. Addition of this 1 Bcfd gas supply at Costa Azul will eliminate the need for southbound gas deliveries from the United States to Baja California. In fact, on the basis of pipeline delivery agreements filed with FERC (see Table 10), about half of the Phase 1 gas capacity from Costa Azul will be exported from Baja California to serve the U.S. gas market. This leaves approximately 500 MMcfd of gas supply from Costa Azul for use within Baja California, which is more than sufficient to meet the 2015 forecasted additional summer peak electric demand in Baja California (approximately 300-325 MMcfd). After supplying this projected gas demand, another 175-200 MMcfd will be available during the peak summer months to serve new markets, including potential new power plants in Baja California for export to the United States electric market. Assuming a heat rate for new gas-fired generation in the range of 7500 Btu/kwh, this equates to roughly 1,100

---

56 Interview and documents supplied by officials of Sempra LNG at meeting in San Diego on May 29, 2007.
MW of electric generation. During the winter months when gas demand in Baja California is significantly lower, more capacity will be available to move gas (or electricity) into California and other U.S. markets.

It should also be noted that year-round availability of the full 1 Bcf/d of LNG is an unknown at this time. For example, the Sempra LNG supply contract includes supplier diversion rights which allow deliveries to be diverted to other higher value markets. (It’s likely similar provisions are in Shell’s LNG contracts.) This may be a disincentive to construction of additional power plants in Baja for export of electric power to U.S. markets using Phase 1 Costa Azul LNG capacity. However, even without the full LNG supply being available, the additional pipeline capacity created in Baja California provides the opportunity to deliver additional Southwest sourced gas supplies into SDG&E via the Baja pipeline system and then into SDG&E’s system at Otay Mesa as discussed in more detail below.

**Chevron’s Proposed Mar Adentro LNG Project**

Chevron had proposed a 700 MMcfd LNG terminal off the coast of Tijuana near the Coronado Islands. Although Chevron has issued no formal press release regarding the status of the project, a Chevron spokesperson had indicated that based on its business needs, three key permit applications required to develop the project have been withdrawn. The spokesperson further indicated that the project is no longer aligned with Chevron’s equity gas resources.

**Planned New Pipeline Capacity in Northern Baja**

**Gasoducto Baja Norte Expansion**

In addition to the Costa Azul terminal, a number of changes and additions to the existing pipeline system serving the Baja California region are being planned. Figure 14 shows the planned changes in the Baja California region. A 45-mile LNG spur will be constructed to deliver up to 2.6 Bcf/d of regasified LNG from the Costa Azul terminal to the GBN pipeline. This spur will be able to deliver the maximum send out capacity of the expanded LNG terminal. In addition, a second TGN line (the border loop) is planned that will be capable of delivering up to 940 MMcfd into the SDG&E system. As shown in Table 7, this significantly exceeds SDG&E’s currently forecasted demand. Unfortunately, the excess capacity available on TGN could not be sent farther north to SoCalGas without significant pipeline expansion through SDG&E.

The GBN system is also being modified to enable gas to flow east and north into the NBP system. Also, 30,000 hp of compression is being added at Algodones, Mexico, that will enable delivery of 540 MMcfd into the North Baja Pipeline. Construction is approximately 25 percent
complete on this $217 million expansion. This system will be expanded farther in conjunction with expansion of the Coast Azul send out capacity.

**Figure 14: Gasoducto Baja Norte Expansion**

![Figure 14: Gasoducto Baja Norte Expansion](image)

**North Baja Pipeline**

The NBP, owned by Trans-Canada, is located in the United States and will continue to operate in an integrated manner with GBN. NBP has filed with the FERC for approval to expand the capacity of the pipeline to deliver the full, expandable send-out capacity of the Costa Azul terminal. NBP proposes to construct this expansion in three phases. Phase I will consist of making the necessary changes to the existing system to allow the reversal of the current direction of flow. This phase will involve modifications to existing meter and compressor stations to enable gas to flow from south to north and be delivered into the El Paso system. In addition, a 2.1-mile lateral and new meter station (Arrowhead) will be constructed to connect with the SoCalGas system at Blythe.

Phase I-A involves construction of a 46-mile lateral from the NBP to the IID El Centro Generating station in El Centro that will be capable of delivering 103 MMcfd for power generation.

Phase II will require the construction of up to 79.8 miles of pipeline loop (B-Line) adjacent to North Baja’s existing system (A-Line) between Blythe and the United States/Mexico border. At

---

57 Presentation by George Liparidis, President & Chief Executive Officer Sempra Pipelines & Storage at Analyst Conference on March 29, 2007.
this date, it remains uncertain what the final Phase II volumes would be. Once the Phase I, Phase I-A, and Phase II expansions are completed, the total northbound capacity of the North Baja system could be as much as 2,753 MMcfd.

Table 10 lists North Baja’s shippers that have executed precedent agreements. They are listed by phase, contracted volumes, and delivery path. In addition to the new expansion shippers, several of North Baja’s existing shippers have elected to reverse the direction of their existing southbound capacity to northbound capacity. The initial volumes these shippers have elected to flow northbound is 283,570 Mcfd in 2007. In 2010, this volume is reduced to 255,400 Mcfd. Given the capacity of the North Baja Pipeline, it is assumed that only 500 MMcfd of the Phase 1 northbound precedent agreements shown in Table 10 call for firm delivery.

**Gas Constraints and Limitations**

The Costa Azul LNG facility will have the initial capacity to deliver 1 Bcf/d into the GBN, TGN, and NBP systems. Upgrades needed to enable gas to flow in an easterly direction on GBN and north along the NBP system, as well as the 45-mile spur from Costa Azul to GBN and the Border Loop, are expected to be ready when LNG-sourced gas is ready to flow out of the Costa Azul terminal. In addition, the facilities necessary to enable 400 MMcf/d of firm deliveries to SDG&E through Otay Mesa are also expected to be completed before Costa Azul commences commercial operation. The expected uses of the NBP system are indicated by the precedent agreements shown in Table 9, which reflects both the initial 2008 LNG capacity and the future Costa Azul LNG expansion phase, circa 2010.
Table 9: North Baja Pipeline Precedent Agreements

<table>
<thead>
<tr>
<th>Phase/Shipper</th>
<th>Quantity (MMcfd)</th>
<th>Delivery Path</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase I Northbound</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coral Energy Resources, LP</td>
<td>212,000</td>
<td>U.S.-Mexico border to El Paso Natural Gas Company (El Paso)</td>
</tr>
<tr>
<td>Sempra Energy LNG Marketing Corp.</td>
<td>100,000</td>
<td>U.S.-Mexico border to El Paso</td>
</tr>
<tr>
<td>Existing Shippers</td>
<td>302,000</td>
<td>U.S.-Mexico border to El Paso</td>
</tr>
<tr>
<td>Total Phase I Northbound</td>
<td>614,000</td>
<td></td>
</tr>
<tr>
<td>Phase II Northbound</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Imperial Irrigation District</td>
<td>110,000</td>
<td>Ongley Motor Station to El Centro Generating Station</td>
</tr>
<tr>
<td>Phase I-A IID Lateral</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chevron USA, Inc.</td>
<td>1,070,000</td>
<td>U.S.-Mexico border to El Paso</td>
</tr>
<tr>
<td>Coral Energy Resources, LP</td>
<td>530,000</td>
<td>U.S.-Mexico border to El Paso</td>
</tr>
<tr>
<td>Sempra Energy LNG Marketing Corp.</td>
<td>200,000</td>
<td>U.S.-Mexico border to El Paso</td>
</tr>
<tr>
<td>Total Phase II Northbound</td>
<td>1,800,000</td>
<td></td>
</tr>
<tr>
<td>Total Northbound Phases (2010)</td>
<td>2,384,000</td>
<td></td>
</tr>
<tr>
<td>Unsuscribed Northbound Capacity</td>
<td>548,000</td>
<td></td>
</tr>
</tbody>
</table>

Note: All precedent agreement terms are for 20 years.

Source: Final Environmental Impact Statement on North Baja Pipeline Expansion Project, Docket Nos. CP06-61-000 filed at the FERC on June 8, 2007

Given the location of the LNG-sourced supply relative to the gas markets in the region, these initial upgrades will provide a significant increase in the ability of the TGN-GBN system to serve existing and new gas markets in the northern Baja California region.

The new LNG spur that will receive gas directly from the Costa Azul terminal will have a capacity of 2.6 Bcfd. It will interconnect with the GB system just east of the Toyota manufacturing facility, where gas will flow both in an easterly direction toward Mexicali and in a westerly direction toward Rosarito. The initial upgrades on NPB, GB, and TGN are expected to enable full utilization of the 1 Bcfd of send-out capacity of the LNG terminal. Approximately 500-550 MMcfd will be able to flow eastward, with the remainder flowing westward for delivery to SDG&E, industrial customers, and the CFE power plants in Rosarito. In addition, a planned 279-MW power plant (with a peak natural gas demand of 45 to 50 MMcfd) in Ensenada, Mexico, which is close to Costa Azul, would most likely be served directly off the new LNG spur. This capacity is sufficient to serve the total projected natural gas demand for the region (including electric generation) through 2016.

Concerning sources of LNG supply to Costa Azul, Sempra has contracted with BP/Tangguh for an annual volume of 3.7 million tonnes (or more than 190 Bcf), which is the equivalent of about 530 MMcfd. The contract currently calls for delivery of these volumes starting in late 2008. The
supplier, however, has the right to divert some portion of that supply to other markets. The details of those diversion rights have not been made public. Presumably, all or a portion of the supply contract with CFE is a firm supply, but it is unclear what portion of the remaining supply, if any, will be delivered to Costa Azul on a firm basis.

Shell has contracted for the remaining 500 MMcf/d of send-out capacity at Costa Azul. For its portion of the capacity, Shell had announced that it planned to deliver LNG supply from its Sakhalin II project in Russia and from the Gorgon project in Australia. In October 2004, Shell announced an agreement to supply 37 million tons of LNG over a 20-year period to the Costa Azul terminal from the Sakhalin II project. Shell also announced in April 2005 that its Gorgon project would supply up to 2.5 million tons of LNG per year to Costa Azul. Recently, however, Gazprom, the Russian state natural gas company, has taken majority ownership of the project. This change in ownership occurred after reports of significant environmental violations by Shell and a suspension by Russia of its permits. At this time, it is unclear how (or if) this change in ownership, as well as the delays experienced, will affect the delivery of this supply to Costa Azul. The Gorgon project, originally scheduled to begin producing LNG by 2010, is now expected to produce LNG no earlier than 2012, with 2014 a more likely timeframe.

Market dynamics would suggest supply should always be available if the price offered is high enough. (Korea Gas Corporation of South Korea reportedly paid as much as $26 per Mmbtu in 2005 and 2006 when it faced steep competition for winter cargoes.) The long lead time and high capital cost to construct liquefaction facilities, the growing number of import terminals, and potential shipping issues create some risk of LNG supply shortages and/or unacceptably high prices. However, given the generally lower global demand for LNG during the summer, it is expected that adequate LNG will be available to meet or exceed Baja California’s summer peaking electric demand at reasonable cost.
CHAPTER 7: Regulatory Proposals and Government Directives That Could Stimulate or Facilitate Infrastructure Expansion in the Border Region

National Interest Electric Transmission Corridors

The Energy Policy Act of 2005 (EPAct) has for the first time given the United States Government the statutory authority to act on the siting and permitting of transmission projects that are deemed to be “in the national interest.” As the Edison Electric Institute states,…”(The) EPAct creates a new Section 216 of the Federal Power Act, providing a set of critically important siting and permitting provisions to support new transmission investments by improving the efficiency of the permitting process.”58

The new statute permits the United States Department of Energy (DOE) to identify a number of National Interest Electric Transmission Corridors (NIETCs) where the need for new transmission is critical. Based on the results of a mandated study of electric transmission congestion, the Secretary of Energy may designate “any geographic area experiencing electric energy transmission capacity constraints or congestion that adversely affects customers as a national interest electric transmission corridor.”59 Line permitting and certification would still begin at the state level but, in the case of lines located within such NIETC corridors, FERC can exercise its new authority for “projects where transmission capacity needs have been established, but lengthy litigation or federal permitting causes unreasonable and costly delays of formal approval.”60

In its 2006 Transmission Congestion Study, DOE identified Southern California as an area with critical transmission congestion and cited four transmission projects that it claims are needed in the near future, including:

- Palo Verde – Devers No.2.
- Sunrise Powerlink.
- Tehachapi Transmission Phase I.
- Imperial Valley Transmission Upgrade.

58 Edison Electric Institute’s letter to Kevin Kolevar, Director, Office of Energy Delivery and Electric Reliability, United States Department of Energy, October 10, 2006.
However, the 2006 study stopped short of defining a National Interest Electric Transmission Corridor in Southern California, or elsewhere.

Subsequently, in May 2007, the DOE proposed two NIETC corridors including the “Draft Southwest Area National Corridor.” The boundary of the Southwest Area National Corridor was finalized by DOE Order in October 2007. The area encompassed by the corridor is shown in Figure 15. This corridor was finalized by the Department of Energy on March 6, 2008. The southern boundary of this corridor follows the United States/Mexico border from a point south and west of Phoenix, Arizona, to the Pacific Ocean at the southern edge of San Diego, California. It includes seven counties within California (Imperial, Kern, Los Angeles, Orange, Riverside, San Bernardino, and San Diego) and three counties in Arizona (La Paz, Maricopa, and Yuma).

**Figure 15: Southwest Area National Corridor Map**

![Map of the Southwest Area National Corridor](source: United States Department of Energy, 2007.)


Such designation of the Southwest Area as a National Interest Electric Transmission Corridor has the potential to significantly affect energy infrastructure expansion in the California/Mexico border region. While FERC has no authority to permit lines in Mexico, it could now have the authority to do so for the U.S. portions of any lines in the border region that it deems necessary to relieve the transmission congestion that exists in a broad area of Southwestern California. To the extent that such lines facilitate deliveries of low-cost electricity to the region and state regulators fail to license the project promptly, FERC could intervene to approve line siting and permitting. A potential candidate for such FERC intervention is the Devers – Palo Verde No. 2 (DPV2) line, which has a proposed corridor located within the geographic boundary of the Southwest Area National Corridor. DPV2 has already been approved by the California Public Utilities Commission, which also found it would increase transfer capability into California, but the line was denied a Certificate of Environmental Compatibility by the responsible Arizona regulator.\textsuperscript{64} In response to Arizona’s licensing decision, Southern California Edison advised the Arizona regulator in February 2008 that they were initiating a pre-filing process with the FERC under authority granted to the FERC under the siting provision of the EPAct for such interstate lines.\textsuperscript{65}

The California State Legislature has also addressed the corridor planning issue through Senate Bill 1059, which charges the Energy Commission with the task of identifying the long-term needs for electrical transmission corridor zones within the state and integrating corridor planning at the state and local levels. The Commission has been addressing this responsibility both in its preparation of the 2007 \textit{Integrated Energy Policy Report} (Docket No. 06-IEP-1F) and through formulating proposed regulations governing the transmission corridor designation process in California (Docket No. 07-OIR-1). Furthermore, the Commission is participating in the development of a West-Wide Energy Corridor Programmatic Environmental Impact Statement along with the Western Electricity Coordinating Council.

The current focus on electric corridor needs at the federal, state, and local levels is unprecedented and offers an exciting opportunity to provide for the future energy needs of the California/Baja California Norte border region. It is imperative that the Commission maximize this opportunity by establishing the corridor designations needed for long-term electric infrastructure expansion needs in the border region.

**Effects of FERC Order 890**

On February 16, 2007, FERC issued Order No. 890, requiring that “…transmission providers implement a coordinated, transparent and participatory transmission planning processes as a

\textsuperscript{64} Ibid., p. 87.

\textsuperscript{65} Letter from Ronald L. Litzinger, Senior Vice President, SCE to the Arizona Corporation Commission, dated February 25, 2008.
means to alleviate perceived opportunities for undue discrimination.” FERC considers these rules to be an amendment to its prior regulations and pro form open access transmission tariff (OATT) adopted in earlier Order Nos. 888 and 889. According to FERC, these orders “…encouraged utilities to engage in joint planning with other utilities and customers and to allow affected customers to participate in facilities studies to the extent practicable.”66 However, the prior orders “…did not, require that transmission providers coordinate with either their network or point-to-point customers in transmission planning or otherwise publish the criteria, assumptions, or data underlying their transmission plans. The Commission also did not require joint planning between transmission providers and their customers or between transmission providers in a given region.”67

Where ISOs and RTOs exist, they are required to participate in these processes, as well, but FERC explicitly stipulates that “…transmission customers and stakeholders must be able to participate in each underlying transmission owner’s planning process.” FERC clearly stated this point because it felt RTO planning processes tended to emphasize regional, rather than local, problems and solutions. Further, FERC noted that some participants in the rulemaking process felt that RTOs and ISOs did not carefully scrutinize individual transmission owner’s plans before including them in the regional plan.

The relation between FERC’s 890 provisions and California/Mexico border energy issues may not be evident on the surface. However, when one examines the types of participants FERC intends to involve more fully in the planning process, the relevance becomes clear. Specifically, FERC requires an active role for local and regional customers, competitors, and state commissions. These include load-serving entities, such as Southern California industrial customers, independent power producers, large electricity consumers, and other utilities. All of these entities are transmission users and may present quite different reactions to congestion on a given transmission owner’s system. Increased access to potentially lower-cost electric resources in the border region, whether renewable or conventional, is expected to be a common priority for stakeholders and regulators.

The California ISO and California utilities need to address FERC’s 890 requirements through compliance tariff filings demonstrating how they will meet the requirements for stakeholder participation in electric transmission planning processes. The Energy Commission and other stakeholders with a vested interest in the border region have the opportunity to take an active role in these proceedings in order to ensure their views on these processes are heard.

---


67 Ibid.
United States and Mexican Regulations Regarding Energy Export

The trajectory of the infrastructure scenarios envisioned in this study would increase the flow of energy from Mexico into California. In that regard, Mexican regulations regarding energy export have been addressed in some detail in a recent report.68

It is unclear at this time if the development of energy infrastructure in the California/Baja California Norte border region could also entail additional exports of electric energy from the United States to Mexico. The Federal Power Act, Section 202(e), Part II requires that no person may export electric energy from the United States to a foreign country without first obtaining authorization from the U.S. DOE. Part II, Section 202(e) states that exports of electric energy should be allowed unless the proposed export would impair the sufficiency of electric power supply within the United States or would impede or tend to impede the coordinated use of the U.S. power supply network. Based on these guidelines, DOE will grant authorization to export electric energy only if it is determined that:

- Sufficient generating resources exist such that the exporter could sustain the export while still maintaining adequate generating resources to meet all firm supply obligations.
- The export would not cause operating parameters on regional transmission systems to fall outside established industry criteria.

In addition, DOE must also comply with NEPA before granting authorization to export electric energy. However, in many instances DOE is able to cite a categorical exclusion (10 CFR 1021.410) for exports over existing international transmission lines. Ultimately, DOE will issue an export authorization to the last entity that holds title to electricity inside the United States to export the electricity using a specific transmission line or collection of lines.

Future Regulatory Proposals and Governmental Options

While regulators and government agencies cannot control the behavior of private investors, appropriate public policy and regulations can help to guide private investment in an appropriate direction and eliminate roadblocks to development of necessary infrastructure expansion. In that regard, it is expected that the next phase of KEMA’s current study for the Energy Commission will surface additional recommendations on regulatory and governmental options that could stimulate and/or promote beneficial infrastructure expansion in the border region.

CHAPTER 8: Conclusions and Action Items

For Natural Gas Facilities:

Conclusion:
The completion of liquefied natural gas (LNG) terminal and storage facilities currently under construction in coastal Baja California will facilitate the export of natural gas from Baja California, as well as expansion of natural gas-fired generation in Baja California. For example, the initial Costa Azul design capacity of 1 Bcfd will accommodate approximately 500 MMcfd of exports to the United States, as well as 500 MMcfd of deliverability into Baja California. This amount is sufficient to meet the 2015 forecasted summer peak demand in Baja California (approximately 300-325 MMcfd) and still leaves 175-200 MMcfd during the peak summer months to either support new generation development or serve other gas markets such as California. This 175-200 MMcfd surplus equates to roughly 1,000 MW of new power plant capacity.

Action Items:
A) Given the extent to which California and Baja California electric generating resources may rely on overseas LNG supplies in the future to meet peak electric demand, California and Mexico regulators may wish to consider the reliability and competitiveness of related fuel supply contracts during the licensing of future gas-fired power plants in the border region.
B) The State of California should consider potential benefits of expanding long-term corridor designation planning processes to include corridors for high-pressure gas pipelines, such as those that may be needed to support future electric generation expansion in the California/Baja border region.

For Electric Transmission:

Conclusion:
At present there is insufficient electric transmission on either side of the border to export as much as 1,000 MW of new electric generation from Baja California that could be fueled by Phase 1 of the LNG expansion. Some firm deliveries could be made northbound over the existing Path 45 facilities, but they would need to compete with other resources for delivery to load centers given the congestion constraints north of the border. The following actions would help to mitigate this transmission constraint.
**Action Items:**
The Energy Commission should include the following border region electric transmission projects in its 2007 Strategic Transmission Investment Plan:

- SDG&E’s “Sunrise Powerlink” Project.
- LADWP’s “Green Path North” Project.
- IID’s “Indian Hills – Devers 2” 500-kV line (including associated lower voltage upgrades).
- SDG&E’s Jacumba Area 500/230-kV Renewable Collector Substation.

A) The identification of essential electric transmission corridors in the border region is vital to future development of energy infrastructure in the region. All opportunities to achieve this strategic objective should be explored under DOE’s National Interest Electric Transmission Corridor initiative and California Senate Bill 1059. The current focus on electric corridor needs at the federal, state, and local levels is unprecedented and provides an opportunity to provide for the future energy needs of the California/Baja California Norte border region. The Commission can maximize this opportunity by establishing the corridor designations needed for long-term electric infrastructure expansion needs in the border region, possibly including a “Full Loop” 500-kV path through SDG&E connecting into SCE’s 500-kV system.

B) The Energy Commission and other stakeholders with a vested interest in the border region should consider taking an active role in the compliance filings by California ISO and California utilities regarding FERC 890 transmission planning processes to ensure their views on these processes are heard.

**Regarding Pending Investigation**

Further electric and gas transmission corridor needs can be expected to surface during the next phase of study work that KEMA is performing for the Commission. That investigation will consider further LNG expansion beyond Phase 1 of Costa Azul and will identify and compare possible options/scenarios for energy infrastructure development in the border region, including:

- Additional development of LNG in Baja California as a source for new gas-fired generating plants in the border region.
- Development of gas-fired electric generation in Baja with new electric transmission lines to export the energy to California.
- Development of gas-fired electric generation in the border region of California, with new cross-border gas pipelines to supply fuel for the plants.
GLOSSARY

BC - Baja California
Bcf(d) - Billion cubic feet (per day)
BCN - Northern Baja California
BCP - Baja California Power
California ISO - California Independent System Operator
CC - Combined-cycle
CFE - Comisión Federal de Electricidad
C&I - Commercial and industrial
CPCN - Certificate of Public Convenience and Necessity
CPUC - California Public Utilities Commission
DC - Direct current
DOE - Department of Energy
DPV2 - Devers-Palo Verde No. 2
Dthd - Dekatherms per day
EG - Electric Generation
FERC - Federal Energy Regulatory Commission
GB - Gasoducto Bajanorte
GCT - Gas combustion turbine
IID - Imperial Irrigation District
IV - Imperial Valley
kV - Kilovolt
LADWP - Los Angeles Department of Water and Power
LEAPS - Lake Elsinore Advanced Pumped Storage
LNG - Liquified natural gas
ML - Miguel
Mmbtu – Million British thermal units
MMcfd (MMscfd) - Million cubic feet per day
MW - Megawatt
NBP - North Baja Pipeline
NEPA - National Energy Policy Act
NIETC - National Interest Electric Transmission Corridor(s)
OATT - Open Access Transmission Tariff
POISE - Programa de Obras e Inversiones del Sector Eléctrico
PPA - Power purchase agreement
ROA - La Rosita
RTO - Regional transmission organization
SCE - Southern California Edison
SDG&E - San Diego Gas & Electric Company
SES - Sterling Energy Systems
SLRC - San Luis Rio Colorado
SoCalGas - Southern California Gas Company
SONGS - San Onofre Nuclear Generating Station
SWPL - Southwest Powerlink
TDM - Termoelectrico de Mexicali
TE/VS - Talega-Escondido/Valley-Serrano
TGN - Transportadora de Gas Natural de Baja California
TJ - Tijuana
WECC – Western Electricity Coordinating Council
APPENDIX A: Supplemental Information on Renewable Resources in Northern Baja California

Geothermal Resources

Geothermal capacity in Northeastern Baja California for the 2007-1016 CFE planning horizon is limited to the existing 720 MW plus the additional 25 MW scheduled to go online in 2010. Prior assessments for geothermal energy potential in the area carried out on behalf of the Commission indicate that additional short-term potential for this resource in Baja California may be limited to the binary cycle heat recovery of the hot brine effluent from Cierro Prieto generating facilities. This potential has been estimated at 245 MW.69

The electric demand-resource analysis for the Baja California control area, as discussed in the body of this report, indicates that peak capacity requirements and reserve margins will barely be met through the planning horizon. Even so, a preliminary annual load factor analysis of the planned natural-gas-fired plant additions in Baja California indicates that utilization of CFE’s combined-cycle generating facilities in the region will be lower than desirable. It may be possible to increase the load factor of these combined-cycle plants and free up some Cerro Prieto geothermal energy for export to California under the RPS program. The economics of such a concept would depend on to a large extent on natural gas prices and the amount of dissimilarity between load patterns and resulting dispatch prices in Baja California and California. As a minimum, the feasibility of this idea should be further explored.

Hydro Resources

While the Baja California climate is generally characterized by limited precipitation, its Northwestern zone has limited hydroelectric energy potential. CFE has identified two potential sites for pumped hydroelectric plants with a 1,200-MW capacity and 2,504-MWh annual average energy production.70 These projects have a capacity of 600 MW each, to be built on existing dams near Tijuana and Tecate. Both projects are in the pre-feasibility stage.

70 Programa de Obras e Inversiones del Sector Eléctrico 2007-2016, Cuadro 3.6, p. 3-12.