CALIFORNIA
ENERGY
COMMISSION

ECONOMIC DEVELOPMENT OPPORTUNITIES AND CHALLENGES IN THE CALIFORNIA-MEXICO BORDER REGION: A Context for Energy Efficiency and Renewable Energy Project Development

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Introduction

The rapid economic and population growth occurring at the California-Baja California, Mexico border region is projected to continue and result in equally rapid growth in demand for fuels and electricity. This paper is intended to provide a context for energy efficiency and renewable energy project development in the border region.

Expansion of industrial activity and associated commerce at the border are the main drivers for the region's growth in electricity demand. The annual electricity demand growth in the San Diego Gas and Electric (SDG&E) and Imperial Irrigation District (IID) service territories has been relatively unchanged since 2001, and is actually expected to drop by a fourth of the current growth rate after 2010. In contrast, the electric energy and peak demand growth rates of Northern Baja California are expected to be more than three times higher than those on the U.S. side of the border over the same period.

While the Comisión Federal de Electricidad (CFE) utility in Mexico continues to develop the necessary new generation and transmission capacity to meet its rapidly rising load, not much excess generation or transmission capacity remains available to either export to SDG&E or IID or provide additional supply reserves to SDG&E. Further, CFE has no firm plans to increase the transmission capacity across the border with the U.S. There are also no plans to build additional East-West Mexicali-Tijuana transmission, which will severely constrain the development of renewable resources (e.g., wind, solar, geothermal) in the northeast section of Baja California.

The development of two or more liquefied natural gas (LNG) gasification terminals in Northern Baja California will not only help fuel CFE's new generation capacity but will also provide fuel for power plants in Southern California. These LNG terminals may also accelerate the introduction of natural gas to Northern Baja industry located near existing natural gas pipelines. The potential availability of new natural gas for industries opens the possibility of combined heat and power as an alternative to high electricity tariffs and higher polluting process heat fuels. In any case, the switch from residual oil and diesel to natural gas will undoubtedly reduce emissions into the border region's shared air basins.

The convergence of explosive regional industrial growth, the introduction of LNG gas, and the existence of high-quality renewable energy potential in the region may provide an ideal opportunity to improve air and water quality through the development of untapped energy efficiency and renewable energy potential on both sides of the border. This type of development will require creative leverage of U.S. technical knowledge, technology, and capital. More importantly, it will require proactive removal of policy and regulatory barriers by both California and Mexican agencies. Once these barriers are removed, it will be easier to develop energy projects that are economically feasible and beneficial to stakeholders on both sides of the border.

Fortunately, the interdependence that characterizes the border region, including shared concerns for air and water quality and the transboundary water supply, continues to provide ample opportunity for cross-border partnerships that produce economic and environmental benefits. Many examples of these partnerships already exist. Some precedent has been set in Mexico for state-sponsored energy efficiency programs for the public and private sectors, and some bi-lateral energy efficiency programs already exist between the U.S. and Mexico. There are also many trans-border projects, such as the connection between Mexicali and the U.S. natural gas distribution network, with similar connections under consideration in Tijuana and Rosarito. Another example is Baja California's (CFE) efforts to export its surplus to California when San Diego could not meet its energy demands with local generation capacity.

This paper mainly reports on development opportunities in Mexico, which has been the focus of the Energy Commission's Energy Technology Export program for several years.

San Diego

Energy Efficiency and Demand Response

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

Opportunities for Enhanced Energy Efficiency and Renewable Energy Development

Opportunities for renewable energy, energy efficiency, and combined heat and power projects in SDG&E's service territory are heavily influenced by California state government laws and regulatory actions. The state's Renewables Portfolio Standard requires each investor-owned utility to supply 20 percent of its electricity from renewable energy resources by 2017. SDG&E anticipates meeting this goal by 2010 by securing power sales agreements with renewable energy suppliers outside of San Diego County. By the summer of 2005, San Diego Regional Energy Office will complete an

assessment of renewable energy sources in San Diego and Imperial Counties and Baja California, highlighting the technically feasible potential in these areas.

The California Public Utilities Commission (CPUC) has directed SDG&E to maximize demand-side management goals in its service area, and efforts are underway to evaluate cost-effective actions to achieve these goals. Additional recommendations may emerge from the Energy Commission's "loading order" analysis of statewide energy efficiency, demand reduction, renewable energy and combined heat and power options by mid 2005. A more in-depth analysis of these options may be needed in San Diego and Imperial Counties.

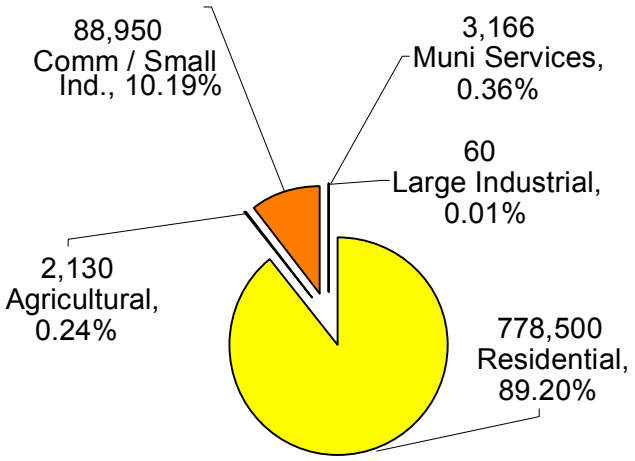
Baja California

Current Energy Demand

Based on CFE sales figures, the energy consumption in the border states (Sonora, Chihuahua, Coahuila, Nuevo Leon, and Tamaulipas) in 2001 was about 52,800 gigawatt hours (GWh). Based on CFE's total sales in the year 2001, annual electricity consumption in Baja California is about 7,800 GWh.

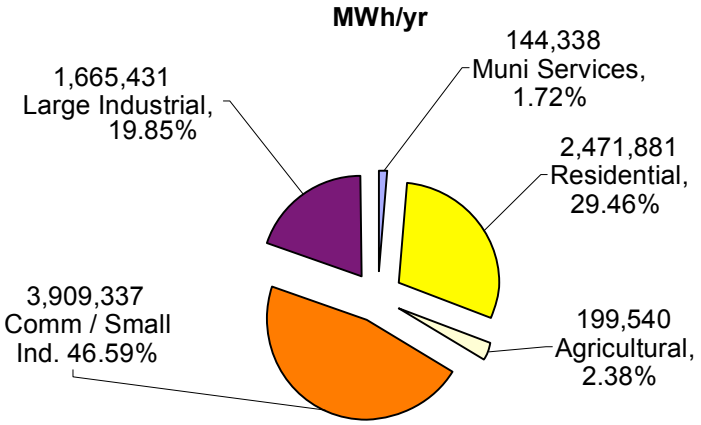
In 2004 CFE reported serving 872,806 electricity customers across all classes. Almost 90 percent of CFE's customers are residential, but the commercial and small industrial sectors consumed 46.59 percent of the electricity, while representing only 10.19 percent of CFE's customers. Along with the largest industrial consumers, who consumed 19.85 percent of electricity sold in 2004, commercial and small industrial customers consume approximately two-thirds of CFE's electricity.

Figure 1
Number of Electricity Consumers – Baja California



Source: Comisión Federal de Electricidad, 2004, Electricity Statistics, CFE's Website: www.cfe.gob.mx

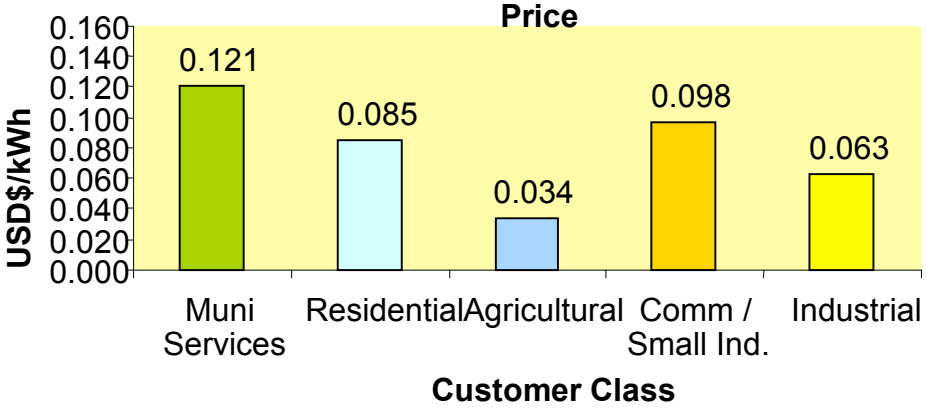
Figure 2
Electric Energy Sales – Baja California



Source: Comisión Federal de Electricidad, 2004, Electricity Statistics, CFE's Website: www.cfe.gob.mx

In addition to consuming the largest share of electricity, the commercial and small industrial consumers pay the highest electricity tariffs, second only to municipal public lighting and water pumping, as shown in Figure 3. The prices shown were calculated by adding all revenue under several tariff classes and dividing by the energy sold under those tariffs.

Figure 3
Average 2004 Baja California Electricity Price



Source: Comisión Federal de Electricidad, 2004, Electricity Statistics, CFE's Website: www.cfe.gob.mx, Sectoral Price Analysis: Navigant Consulting Inc.

A 10 percent reduction in the summer peak demand of CFE's coastal Baja California for small/medium commercial/industrial customers would represent at least 85 MW and 100

GWH per month. This reduction would relieve the load on CFE's East-to-West transmission lines (Path 45), opening capacity to wheel renewable resources located in the Valley area of Northern Baja California.

Energy demand in the Baja California is forecast to grow between 5.7 and 6.5 percent annually, doubling the region's annual energy consumption in 12 years. However, new electricity generating capacity is only expected to meet the increased industrial demand and population growth through the next three years. In addition, domestic fuel supplies for electricity generating facilities are not keeping pace with demand. Although the initiation of utility reform in both the electricity and natural gas sectors is expected in the region, lag time exists for construction of new power plants and development of new natural gas sources and LNG facilities.

The industrial sector alone is responsible for 59 percent of Mexico's electricity consumption nationwide. The manufacturing sub-sector is among the fastest growing energy users and is located primarily along the border, particularly in Tijuana and Mexicali in the state of Baja California; Ciudad Juarez in Chihuahua; Matamoros and Reynosa in Tamaulipas; and Nogales in Sonora. This sub-sector includes manufacturing facilities that produce machinery, domestic appliances, office machines, computers, electric generators, electric lamps and lighting equipment, electronic components, televisions, radios, and recording devices. Energy use by manufacturing facilities increased by an average of 15 percent annually between 1994 and 1999. During a similar period, manufacturing of motor vehicles, including car bodies, parts, and accessories, also experienced a significant growth in energy use, increasing an average of 9 percent annually.

Maquiladoras, a critical element of Mexico's economy, are Mexican companies whose goods are manufactured for export and who operate under programs approved by the Mexican government allowing up to 100 percent foreign investment and management. About 71 percent of Mexico's maquiladoras are located in the border region. Manufacturing maquiladoras alone represent one-third of the border area's electricity consumption and provide 33 percent of the employment in Tijuana; 46 percent in Cuidad Juarez; and 40 percent in Matamoros. Production and assembly of electronic, electrical, and automotive products is predominant in all three cities.

According to the National Statistics Agency Instituto Nacional de Estadística, Geografía de Informática, the number of maquiladora plants making products for export markets has risen steadily during the past few months. At the end of March 2005, there were 984 maquiladoras registered for business in Northern Baja California.

Current Energy Supply

Local energy resources in this region are few. Except for the geothermal resources in Mexicali Valley, almost all of the energy used in the region is imported in the form of gasoline, diesel, jet fuel, liquefied petroleum, fuel oil, natural gas, uranium, and

electricity from other states. Although Mexicali is connected to the U.S. natural gas distribution network and similar connections are under consideration in Tijuana and Rosarito, Baja California, as a whole, lacks a natural gas pipeline system.

Total capacity in Baja California is 1.4 gigawatts (GW), as compared to 2.5 GW in San Diego. San Diego consumes 3.5 times more power than Baja California and does not meet its demand with local generation capacity. Until recently, Baja California met its own electricity needs and exported its surplus to California. Baja California has two electrical interconnections to California's power grid, but is not connected to Mexico's main power grid.

Electricity generation is fueled by oil (44 percent), geothermal resources (44 percent), and diesel (12 percent). Generation facilities consist of a large plant near Rosarito that uses fuel oil, and a large plant near Mexicali and Ensenada that is fueled by diesel.

Past and Current Energy Efficiency Programs

While some awareness and interest in energy efficiency and load management already exist in the Baja California border region, particularly in Tijuana/Ensenada and Mexicali, energy efficiency technical and financial assistance programs have been limited in scope and currently lack sufficient technical and financial resources to have a significant overall impact on the supply-demand balance of the region.

The following summaries describe the various programmatic energy efficiency efforts in the area and illustrate the relatively modest impact of these efforts:

- Residential building envelope efficiency improvements in Baja California are promoted and financed by Fideicomiso para el Aislamiento Térmico (FIPATERM), a trust fund established in 1990 in Mexicali, to finance the insulation of roofs in existing high-demand (greater than 1000 kilowatt hours [kWh] per month) residential buildings. FIPATERM has financed the insulation of over 60,000 roofs. In 1996 the financing program was expanded to inefficient air conditioner replacement and incandescent lamp substitution with compact fluorescent lights (CFLs). To date, the program has replaced over 45,000 air conditioning units and financed over 400,000 CFLs. In 2002, the financing was extended to refrigerator replacements. Over 5,000 energy efficient refrigerators have been financed to date. Residents of Mexicali, San Luis Colorado and Tijuana (as well as the rest of Baja) are now eligible. These efforts are quantified in Table 1.

- Commercial and industrial energy efficiency technical assistance and finance support activities in Baja California are the responsibility of the Fideicomiso para el Ahorro de Energía (FIDE), a trust fund established by the government of Mexico to promote the efficient use of energy in the power sector. FIDE is funded by the private sector through a 0.2 percent surcharge on all purchases made by CFE. FIDE has recently started an energy efficiency financing program for small and medium

enterprises which has so far signed up 50 participants in Baja California (500 nationwide). The program currently focuses primarily on air conditioning improvements. While FIDE doesn't lack funding—it submitted a budget request for almost 35 million U.S. Dollars ($USD) in 2005—its program for small and medium enterprise lacks outreach capacity because of limited staffing and technical resources. These efforts are quantified in Table 2.

Table 1

RESIDENTIAL PROGRAMS	
Residential Energy Efficient Lighting	
CFLs Introduced by FIDE	411,390
CFLs Introduced by FIPATERM	418,093
Thermal Insulation	
Homes Retrofitted	83,097
Energy Efficient Air Conditioning Units Substitution (FIPATERM)	
Window	27,626
Packaged	11,511
Mini-Split	916
Multi-Split	682
Domestic Energy Efficient Refrigerator Replacement (FIPATERM)	
Units	414
Financing of Design/Build Energy Efficient Homes (FIPATERM)	
Homes Built and Delivered	225
Homes Committed in 2004	2,449

- CFE does not conduct any energy efficiency programs beyond customer education programs. However, CFE customer representatives inform customers of the availability of technical and financial assistance through FIPATERM, FIDE, and the Comission Nacional Para El Ahorro de Energía. In the area of demand management, CFE offers interruptible service tariffs to its large customers, and direct air conditioning cycling to its residential and small commercial customers.

- FIDE, in cooperation with the Federal Government housing development authority Instituto Para El Fomento Nacional de la Vivienda del Trabajador, has recently offered a new residential construction pilot program through some of major residential developers in the Northern Baja California region. At present, approximately 600 new energy efficient homes are being offered in the Mexicali area by the participating builders.

Table 2

FIDE COMMERCIAL AND INSTITUTIONAL PROJECTS				
Year	**PROJECT**	**INVESTMENT THOUSANDS MXP$**	**LOCATION**	**ACTIVITY**
1992	UNIV. AUTONOMA DE B.C.	231.10	MEXICALI	SCHOOL
1995	PLAZA LA CACHANILLA	424.20	MEXICALI	MALL
1996	TELEFONOS DEL NOROESTE	1,301.50	MEXICALI	OFFICE
1999	HOTEL PALACIO AZTECA	440.50	TIJUANA	HOTEL
2000	HOTEL CORONA PLAZA	537.50	ROSARITO	HOTEL
2001	COMERCIAL MEXICANA MEXICALI	392.80	MEXICALI	SUPERMARKET
2001	HOTEL PALACIO AZTECA (SEGUNDO PROYECTO)	993.00	TIJUANA	HOTEL
2001	RESTAURANTE SIRLOIN STOCKADE MEXICALI	243.60	MEXICALI	RESTAURANT
2002	UNIVERSIDAD CETYS	538.70	TIJUANA	SCHOOL
2003	HOTEL PALACIO AZTECA	2,665.50	TIJUANA	HOTEL

FIDE INDUSTRIAL PROJECTS				
Year	**PROJECT**	**INVESTMENT THOUSANDS MXP$**	**LOCATION**	**ACTIVITY**
1996	CINTAS VAC, S.A. DE C.V.	$247.86	TIJUANA	TEXTILES
1998	GANADERIA INTEGRAL EL CENTINELA	$96.75	ROSITA MEXICALI	FOOD
1999	PULIDOS INDUSTRIALES, S.A. DE C.V.	$153.40	TIJUANA	METAL FABRICATION
2002	FRUTAS FINAS TECOMAN S.A. DE C.V.	$221.43	MEXICALI	FOOD
2002	COLIMAN DISTRIBUIDORES S.A. DE C.V.	$230.31	TIJUANA	FOOD
2003	USA PLASTIC, S.A. DE C.V.	$993.16	MEXICALI	FOOD
2003	COMPAÑÍA PRODUCTORA DE HIELO, S.A. DE C.V.	$981.27	MEXICALI	FOOD

Opportunities for Enhanced Energy Efficiency Programs

A study conducted by the Western Governors' Association estimated energy efficiency savings for the key customer sectors in Baja California.[i] Among the key economic sectors, manufacturing facilities showed the highest potential for energy savings in the region. The study identified cost effective lighting, heating, ventilation and air conditioning (HVAC), and process improvements for all audited facilities in the manufacturing sector. Average energy savings were estimated at 26 percent, and projected payback periods range from 1.3 to 6.0 years.

Based on existing data, the Western Governors' Association report estimates a market potential for cost-effective energy efficiency projects with annual energy savings of approximately 434,600 megawatt hours (MWh) and cost savings of about $22.8 million in the industrial (manufacturing) sector; 101,200 MWh and cost savings of $5.4 million in the commercial (hospitality) sector; and 283,000 MWh and cost savings of about $15.4 million in the institutional (healthcare/hospitals, government, and education) sector in the border regions.

The estimates presented in the Western Governors' Association report, *Energy Efficiency in the Border Region – A Market Approach*, have been updated to reflect 2004 electricity sales figures and electricity tariffs. Tables 3 through 5 provide samples of these updates and illustrate potential energy efficiency savings.

Table 3

Industrial Sector	Tijuana
Average Consumption/Plant (kWh/year)	101,614 to1,348,361
Blended Electricity Price Per Customer, 2004 ($USD/kWh)	0.0836
Number of Manufacturing and Assembly Plants	641
Electricity Use for Subsector (MWh/year)	664,508
Electricity Cost for Subsector (USD/year)	$55,968,186
Average Electricity Savings Per Facility	26%
Potential Electricity Savings for Subsector (MWh/year)	172,772

Table 4

Commercial Sector (Hospitality)	Tijuana
Average Electricity/Hotel (kWh/year)	43,770 to 1,348,361
Blended Electricity Price Per Customer, 2004 ($USD/kWh)	0.11
Number of Hotels	221
Electricity Use for Subsector (MWh/year)	184,097
Electricity Cost for Subsector ($USD/year)	$20,542,612
Average Electricity Savings Per Hotel	30%
Potential Electricity Savings for Subsector (MWh/year)	55,229
Total Potential Electricity Cost Savings ($USD)	$6,162,784

Table 5

Institutional Sector	Tijuana
Average Electricity/Plant (kWh/year)	Health 366,527, Gov. (N.A.), Education 906,322
Blended Electricity Price Per Customer, 2004 ($USD/kWh)	0.11
Number of Hospitals, Government and Schools	440, ??, 1088
Electricity Use for Subsector (MWh/year)	184,097
Electricity Cost for Subsector ($USD/year)	$69,572,664
Average Electricity Savings Per Facility	21%
Potential Electricity Savings for Subsector (MWh/year)	Health 76,971, Gov. (N.A.), Education 190,328
Total Potential Electricity Cost Savings ($USD)	$14,610,259

Energy Efficiency Case Study

In 2001, the Energy Technology Export program provided funds to Energy and Power Solutions, an energy audit company located in Costa Mesa, California, to conduct audits at Tyco Adhesives CPG, In Tijuana, Mexico. The purpose of the audit was to identify energy conservation measures that may reduce the facility's energy consumption. In its initial work, Energy and Power Solutions identified energy conservation measures which, when implemented, can reduce the facility's energy consumption by 12.5 percent.

Facility Description

An adhesives manufacturing facility in Tijuana, Mexico is approximately 150,000 square feet in size with 50,000 square feet of storage, 80,000 square feet of manufacturing and assembly, and 20,000 square feet of office space. A single 13.2 kilovolt feeder supplies the site, which has experienced numerous outages each year.

The plant has nine separate manufacturing lines consisting of both extruders and laminators. The lines require a variety of support utilities to operate. Support utilities include chilled water, cooling water, compressed air, and steam. Other than these systems, electricity and gas usage is primarily for comfort cooling and lighting. The facility has a main utility yard that houses two Cleaver-Brooks boilers, two Ingersoll-Rand air compressors, and two Baltimore Air Coil cooling towers in addition to support pumping and storage tanks.

Case Study Recommendations

After a complete audit of the facility, the consulting firm recommended the implementation of several projects:

- Lighting; installation of T- 5 fixture, a high efficiency fluorescent lighting system
- Chiller control/free cooling
- Cooling water controls/VFD
- Boiler control upgrade
- Hot oil system replacement

When implemented, these projects will reduce annual energy consumption by 12.5 percent. The total cost of the projects is estimated at $174,365. The total electricity savings amounts to 949,501 KWh and a propane savings of 43,720 liters. The gross annual savings is estimated at $87,743 with a payback of 1.99 years. Net savings are estimated at $56,419 and the net present value at $774,676 with a pre-tax internal rate of return of 50 percent.

Energy Efficiency Implementation Challenges

Challenges to implement potential energy efficiency projects include the following:

- Lack of program funding for implementation agencies
- Lack of financing options for interested customers
- Lack of awareness and technical knowledge among potential customers
- Insufficient technical assistance for project identification and evaluation
- An underdeveloped energy services industry
- Insufficient market data to target services to appropriate sectors
- Difficulty in establishing project proponents within customer organizations
- A regulatory environment that hampers private energy projects

Energy Efficiency Recommendations

There are precedents in Mexico for state-sponsored energy efficiency programs for the public and private sectors. Bi-lateral energy efficiency programs between the United States and Mexico have also been established. However, to increase efforts in this area would require additional program financing options, a more favorable regulatory environment that facilitates participation in project development and investment from private sector, and further collaboration between potential program sponsors to promote the use of efficient energy practices and innovations.

To resolve implementation challenges, program partners are encouraged to:

- Assist local agencies and customers to obtain alternative financing.

- Create a revolving loan fund for small projects.
- Initiate educational activities in collaboration with local groups.
- Provide third-party technical expertise to interested customers.
- Develop business models to deliver energy efficiency services to the private sector, and assist the development of energy service industry associations.
- Collaborate with national and local agencies to develop energy consumption data at the local level that is organized by sector and sub sector.
- Develop a coaching system to assist facility managers and aid in completing projects successfully.
- Participate in the utility reform process to support private energy projects.

Cogeneration Potential – Baja California

The general unavailability of natural gas distribution infrastructure has severely hampered the penetration of cogeneration systems in the Northern Baja region. The most common space heating fuels in the region are diesel and electricity. In the absence of a comprehensive baseline assessment cogeneration potential in the region, a preliminary analysis of available manufacturing facility economic activity data and electric load data was completed for this paper. The results of the analysis indicate that there are many large industrial facilities with high load factors in the border region encompassed by the Tijuana-Rosarito, Tecate and Mexicali corridor.

As part of the analysis, four separate large energy consumer datasets were obtained from CFE, Canacintra Tijuana, and the Tijuana Maquiladora Association and subsequently compared for scope and consistency. Additional analysis will be necessary to reconcile company names, premise/facility name, and doing-business-as records across data sets.

Between mid-2002 and mid-2003, CFE reported having 75 customers with annual peak demand in excess of 1 MW. During 2004, CFE reported 54 customers with annual peak demand in excess of 1MW. Figure 4 illustrates the size range of potential cogeneration projects that might be developed in facilities owned by the largest industrial energy consumers in Tijuana. Figure 5 illustrates the annual electric load factor of the same industrial energy users in Tijuana. More than half of these customers had load factors of almost 60 percent or higher. In general, a cogeneration facility with a higher load factor will yield a better economic performance than one with a lower load factor.

Figure 4
Distribution of the 141 Largest Tijuana Electricity Consumers by Peak Demand

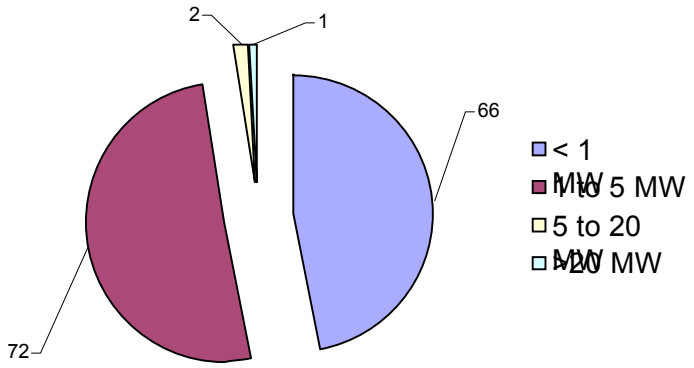
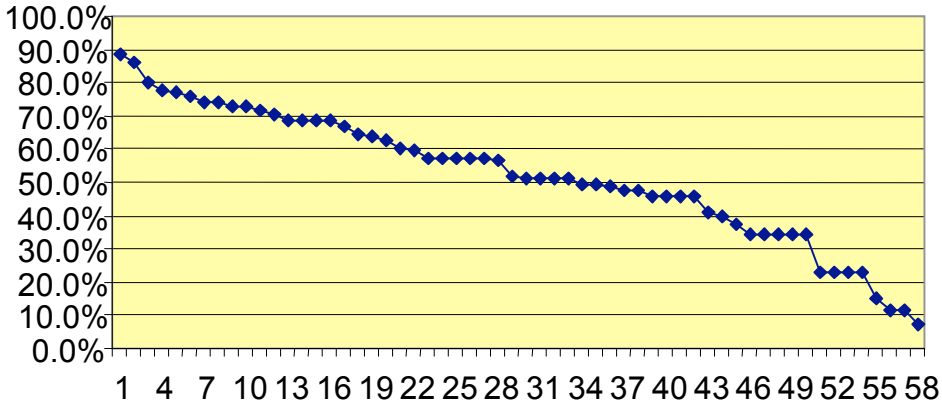


Figure 5
Baja California Norte Largest Electricity Consumers - Annual Load Factor



No source of data on the thermal loads of large electric customer facilities has been identified. However, a limited number of energy audits and cogeneration studies at manufacturing facilities, health facilities, hotels, and some commercial facilities have been carried out by various parties.[ii]

Once the four large customer databases are reconciled, and the economic activity of each facility has been normalized to North American Industry Classification System codes, it may be possible to apply the findings of those studies to the other facilities to establish “typical” thermal loads for facilities dedicated to each economic activity.

Many maquiladoras rely on multiple rooftop units to provide air conditioning and heating in the manufacturing plants. This arrangement complicates the use of waste heat from cogeneration units for space heating. Further, if no significant process heat is required

in the plant's manufacturing processes, the potential for cogeneration is low. Facilities with limited thermal process heat requirements, as is the case in many maquiladora assembly and packaging operations, are a poor fit for gas turbine cogeneration systems.

However, it could still be economically feasible for these facilities to use internal combustion engine-based systems, particularly in the under-1-MW class, because of the combination of high efficiency and competitive installed cost for this type of cogeneration technology. For those facilities with significant thermal load in the mid range (1-20 MW), turbines become more competitive, offering better economics for combined heat and power when most or all of the thermal output of the unit can be used. In the larger sizes (20-50 MW), turbines can have a better economic performance.

For facilities with electrical demand between 1 and 20 MW and significant thermal loads in their manufacturing processes, the potential for cogeneration is limited by access to natural gas. For facilities located along the Gasoducto Baja Norte and Transportadora de gas Natural natural gas pipelines, it may be feasible to build the necessary infrastructure to gain access to that fuel. To overcome financing scale and knowledge barriers, self-supply organizations could be established to build the access and distribution infrastructure as has been done in other parts of Mexico.

Renewable Energy

Although Mexico has substantial wind potential, little of it is developed. Wind currently contributes a modest amount to Mexico's electric grid, but proposals to expand wind generation capacity to 5000 MW by 2010 have been made (Comision Nacional de Actividades Espacials). A planned expansion from 1.6 MW to 54 MW in Oaxaca, Mexico, has identified many additional high-quality wind sites in Baja California: Tehuantepec and Yucatan, the central and northern regions, and along the coast. Electricity from some of these areas may be "wheeled" through CFE transmission lines to the Texas-Mexico border. Wind power prospects also exist at La Rumorosa near the California border and CFE transmission lines. Additional studies may be needed to explore commercial development of wind power in this region.

As noted in a companion report, "Energy Supply and Demand Assessment for the Border Region," CFE currently has 720 MW of geothermal capacity at Cerro Prieto. Prospects for additional geothermal power plants include binary cycle heat recovery and geopressurized hydrothermal reservoirs in northeastern Baja California.

In Mexico, solar energy is used mainly for water heating. There are currently about 50 manufacturers of solar panels in Mexico. Because of the successful maquiladoras manufacturing system, there is a potential for Mexico to expand this effort and become a major manufacturer of both solar thermal and photovoltaic systems. The lower labor costs and large amount of labor required per unit could provide Mexico with a significant

competitive advantage. Working in close cooperation with manufacturing these technologies in the United States and using the opportunities provided by North American Free Trade Agreement could prove beneficial to both countries, and to renewable energy.

Mexico has great potential for renewable energy development. Mexico's President, Vicente Fox, has set a goal to bring 1,000 MW of renewable energy on-line by 2006. However, obtaining financing for renewable energy projects remains a problem. There is a need to create a legal framework that gives investments for renewable technologies access to conventional financing. Renewables could also be encouraged through incentives such as tax benefits or a Renewables Portfolio Standard. Establishing long-term prices favoring renewables and the creation and certification of green energy markets would also stimulate both domestic and foreign investment in renewable energy.

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