

ENERGY WHITE PAPER

Energy suppliers in Southern California will face enormous, and perhaps impossible, challenges to meet their supply obligations to end users. The intent of this paper is to educate legislators and other decision makers to assist in developing practical and effective public energy policy.

The Southern California region holds twenty four million people, and is projected to add the equivalent of two new cities the size of Chicago to the population base in less than two decades. However transportation fuels, natural gas, and electricity are all facing supply disruption now. The result will be dramatically higher prices, and energy shortages for residential, commercial and industrial users.

This white paper discusses:

- Gasoline, Diesel and Jet Fuel Supply
- Natural Gas Supply
- Liquefied Natural Gas (LNG) Supply
- Electrical Energy Supply
- Renewable Energy Expected Contribution to Supply

Gasoline, Diesel and Jet Fuel Supply

California is called an “Energy Island” because of geography, ultra-clean product specifications, and diminished petroleum refining capacity. There is minimal crude oil or petroleum products pipeline capacity entering California to deliver supplies from other regions. Therefore, 3.5 million barrels per day of imported gasoline and additives, and 1.1 million barrels (42 gallons/barrel) of crude oil arrive here every day in ships. Statewide, demand for transportation fuels (gasoline, diesel and jet fuel) in California has grown by 50 percent over the past 20 years. Californians today use 44 to 45 million gallons of gasoline and approximately 10 million gallons of diesel fuel every day. Much more than half of all the petroleum products mentioned in this paper are used in Southern California. These numbers are not expected to change substantially, even with an increase in hybrid vehicles. In addition, modern engines have been proven in Europe and other locations to function well with ultra low sulfur diesel, which is increasingly competitive with alternative fuels in automobiles.

Most of these products are produced by the [California petroleum](#) refining industry, which provides many important jobs. This industry is under increasing pressure from ultra-stringent regulations related to operations and fuel specifications (greenhouse gas regulations from AB 32, and low carbon fuel specifications) and significant increases to electrical power through rate hikes to cover the cost of a utilities commitment to expensive renewable energy. Consequently, this industry is facing declines in profitability, and may have to decrease local refining capacity. While still the nation's 4th largest producer of crude oil, California domestic crude oil production has declined by nearly 40 percent since its peak in 1986. Only 38% of California's crude oil is produced in the state, and further declines are projected as progressively less profitable due to high electricity costs, maintenance of older equipment, and increased State oil production taxes. Consequently, for the last three decades, Southern California has relied on daily crude oil and gasoline tanker deliveries.

The California Energy Commission (CEC) has forecasted that California can expect to import around 560 million barrels of crude oil annually by the year 2025. That's about a 40 percent increase in imports over the current level and more than 1.5 million barrels every day. The delivery facilities in Southern

California are at the Ports of Los Angeles and Long Beach, and the Chevron marine terminal in El Segundo. These are the only marine terminals in the region, and are nowhere near large enough to meet future demands. According to the State Lands Commission the average age of the petroleum marine terminal docks is 50 years. The newest is 30 years old (BP Berth 121) in the San Pedro Bay ports. While these berths are being modernized, there is still dangerous risk of supply shortages from earthquake damage to marine terminals, such as occurred recently in Haiti. But instead of increasing and improving this terminal capacity, existing and planned petroleum marine terminals have experienced multi-year project delays. This has increased construction costs by hundreds of millions of dollars, and now chokes our fuel delivery capacity at a time of ever-expanding need.

The California Energy Commission has developed energy projections for a scenario that assumes the success of significant greenhouse gas and petroleum demand reduction strategies. Under that scenario, California's demand for imported gasoline and diesel "only" grows to about 100 million barrels of oil in 2025. That's still an increase of 250 percent - all of it entering through our ports. Therefore, an ever-growing, transportation-dependent population will have to compete for progressively less available, higher cost, petroleum products, supplied through our Los Angeles area ports from overseas markets. This is a grave risk to our economy.

Natural Gas Supply

Natural gas has become the fuel of choice for consumers, and for the generation of electricity in the Los Angeles region. More than 27% of natural gas was used for power generation alone in the region in 2005. Only 13% of this gas was produced locally in 2005. The remainder, 87% was imported by pipeline from Canada, the San Juan Basin of New Mexico, Permian Basin of Texas and gas fields in Wyoming. Crude oil, which used to be used for power generation, was discontinued in the 1970s due to air emissions concerns. Gas will also increasingly be also imported from Mexico. Therefore, natural gas, like crude oil, is no longer a local resource. We are dependent upon long supply lines to provide this mainstay commodity for our society, whether heating, cooking, manufacturing or power generation.

Collectively, in 2005, the region as a whole used 2,483 million cubic feet per day (MMcfd), including for power generation, home heating, industrial processes and other uses. This can increase to more than 4,000 MMCFD in cold weather. Currently, prices for natural gas are relatively low, which is fortunate for end users. However, this will vary from year to year, and must be taken into account by policymakers. Prices spiked in 2008 and plummeted in 2009. Nationally, the recession has played a role in the price of NG in that supply portfolios are high and demand has tapered off.

In Southern California, the supplier of most natural gas is the Southern California Gas Company. Gas is blended by the Gas Company with natural gas from many sources. Each of these sources individually meets all specifications for natural gas, including how much energy it contains, as mandated by the California Public Utilities Commission. To ensure the interchangeability of these different types of gas in pipelines and at end use, a standard quality measure (Wobbe Number) was established. The Wobbe Index (WI) or Wobbe number is an indicator of the interchangeability of fuel gases such as natural gas, liquefied petroleum gas (LPG), and Town Gas and is frequently defined in the specifications of gas supply and transport utilities. The Wobbe Index is used to compare the combustion energy output of different composition fuel gases in an appliance (fire, cooker etc.). If two fuels have identical Wobbe Indices then for given pressure and valve settings the energy output will also be identical. The Wobbe Index is a critical factor to minimize the impact of the changeover when analyzing the use of *substitute natural gas* (SNG) fuels such as propane-air mixtures.

In California, the maximum Wobbe number for natural gas is set by the California Public Utilities Commission (CPUC). Currently, that index number is 1385, which was set in a two year process to which the state's natural gas utilities have agreed. However, the South Coast Air Quality Management District

has sued unsuccessfully to contest the statewide setting of Wobbe Numbers, and to establish the authority of local air districts to regulate pipeline quality specifications for natural gas on the local level. The difficulty with their position is; 1) the CPUC has jurisdiction over gas quality and, 2) that gas supplier pipeline systems are not separated by air quality districts. Fuel sources are blended from many qualified sources to meet the standard for pipeline quality gas for all their consumers. It would be near impossible for a gas utility to modify its gas supply to accommodate air districts if each district became regulatory agencies and set standards below the currently approved level. For example, within the Southern California Gas Company service territory, there are nine air quality districts. It would be impossible, or extremely expensive, to address gas quality specifications in a given district if all nine became regulatory agencies and set standards. Such regulation will force customers to purchase higher priced limited supply.

Two types of gas products which are frequently discussed as clean fuels are Liquefied Natural Gas (LNG) and Compressed Natural Gas, or CNG.

Liquefied Natural Gas (LNG). LNG is natural gas cooled to very low temperatures. The ports of Los Angeles and Long Beach originally selected LNG as a priority fuel for cargo equipment in their \$2 billion Clean Air Action Plan. LNG trucks have been promoted for Port hauling and off-road (on-dock) functions. One firm, Clean Energy, has established LNG truck fueling facilities, and is building an LNG manufacturing plant in Mojave, California. There were previous plans to build an LNG terminal in California, to deliver large volumes of LNG by ship. This is a common type of facility in many other areas of the world. However, all the LNG projects were defeated. Therefore, LNG will continue to be supplied by truck into Southern California. It will also be unloaded at Sempra Energy's Baja California LNG terminal, regasified, and could be transported via pipeline into California. However, it is anticipated that local air quality districts will fight such projects, claiming that the LNG will generate increased air emissions due to the slightly richer energy content of Pacific Rim LNG.

Compressed Natural Gas (CNG) is made by compressing natural gas to less than 1% of its volume at standard atmospheric pressure. It is stored and distributed in hard containers. Natural gas vehicles are increasingly used in Europe and South America due to rising gasoline prices and are currently present in shuttle and taxi fleets in California. CNG, as a motor vehicle fuel, is currently (2010) selling for \$2.00 - \$2.50 per gallon equivalent at Southern California refueling stations. Southern California Gas Company has a CNG alternative truck tractor specifically targeting local port drayage hauls with a range of 400 miles/day. Results of that demonstration project should be available this summer. This vehicle is promising green port operation because it addresses 65% of port trucking operations.

Electrical Generation Capacity

Electricity is viewed as the ideal, "clean energy" source. The Ports of Los Angeles and Long Beach and their tenants are spending many millions of dollars to construct on-dock electrical supply ("cold ironing") to power ships in port. In this way, the ships avoid running their shipboard engines, which generate considerable air pollution. Cold ironing will add considerably to regional electrical demand. Insufficient electricity for cold ironing will jeopardize the Ports' clean air plans and obligations. As another example, much of our region's water is pumped in over the Tehachapi Mountains. Without sufficient electricity, our water supply may be sharply reduced, while twenty four million regional residents expect it to be available, on demand, at every minute of the day or night, as it always has been.

Yet, where does this electricity come from? The State of California is now restricting the out-of-state purchase of electricity generated by coal and other greenhouse gas generating power sources that account for 63% of all of California greenhouse gases (GHG) - (Source - CARB survey 2009). Approximately 20% of California's electrical power is produced by out-of-state coal burning power plants. This decision affects every investor-owned electrical utility in Southern California, including Southern California Edison (SCE), which supplies the Port of Long Beach with electrical power. Local municipal power

agencies, such as the L.A. Department of Water and Power (LADWP), which is the electrical supplier to the Port of Los Angeles, and three major petroleum refineries, will comply with this guideline as well.

Therefore, this source of electricity will no longer be available within the region, but in the meantime the cost of electricity will rise exponentially during any transition period as we are experiencing with the recent LADWP rate hikes. It is estimated that the proposed AB 32 auction tax (operating permits) will cost LADWP 246 million per year or 2.5 billion over 10 years. This cost will have a severe cost impact on private business, all region consumers and ultimately southern California jobs.

Locally generated electricity is produced by burning natural gas, as mentioned above. However, more than 89% of the gas used in the region must be imported from Wyoming or other locations. Therefore, there is no guarantee that sufficient natural gas will be available in the future to generate our energy locally. This places much higher reliance on emerging, renewable energy generating capacity. However, renewable energy generation capacity, though mandated by electrical utilities, is unlikely to make up generation shortfalls for years to come. The systems (solar, wind, geothermal), are smaller, much more expensive, and less efficient than conventional supplies, with their own permitting challenges.

Renewable Energy Programs and Energy Supply

To augment electrical energy supply and reduce greenhouse gas production, many renewable energy projects are in the planning stages. These collectively generate approximately 15% of California's electrical energy needs. The other 85% is met by electricity from natural gas, nuclear, large hydroelectric and coal fired power plants.

Presently, electric power from renewable sources is several times more expensive than conventional sources (coal and natural gas). Of the renewable energy categories mentioned above, wind, solar and biomass systems hold the greatest potential for expansion in Southern California. Wind power systems currently account for 2.3% of California's overall electrical energy supply. Currently, solar supplies .2% of the electrical needs of California. In Southern California, many of these wind and solar power projects are located far from energy consumers, such as in the Tehachapi Mountains and near the Palm Springs area.

Therefore, they require the availability of major electrical transmissions systems to reach Los Angeles. These transmission systems are being upgraded and expanded by utility companies, but the process is very expensive, and requires complex regulatory approvals and project permitting. Therefore, the optimum renewable energy project is one which is installed at the location of the end user, such as a solar system at an industrial complex. Many of these systems are in the planning stages, but have yet to make an appreciable contribution to the California energy supply.

Under the Obama Administration, there has been a significantly expanded emphasis on planning, funding and approval of renewable energy projects. New technologies are also being developed by California's universities to improve their efficiency. Therefore, they are expected to make a continually increasing contribution to the energy supply of the region.

Summary Comments

In summary, the Southern California region could soon face:

- Shortages of gasoline, diesel fuel and jet fuel through lack of marine terminal capacity at the Ports of Los Angeles and Long Beach, combined with reduced statewide petroleum production, inadequate local petroleum refining capacity, and complex specialty fuel formulation requirements for air quality improvement.

- Shortages of natural gas due to the need to import 89% of required supply from out-of- state and international sources, and failure to permit new high capacity LNG facilities.
- Shortages of locally-generated electricity due to reduced availability of natural gas, elimination of out-of-state coal-fired power plants as a power source, and insufficient local renewable energy generation capacity to bridge this loss of capacity.
- Significant electrical rate hikes and costs to business, public agencies and individual consumers
- Given the high cost of alternative energy, one option should be to clean up and use proven supply sources vs. spending too much on early stage alternatives now, many of which will ultimately not prove commercially viable after enormous expense and permitting delays. Alternatives will come with time and as they become economically competitive.

While we still have the time, we should plan carefully, and then act forthrightly to ensure our present and future supply of these vital commodities, and the facilities which they require.

The Harbor Association of Industry and Commerce appreciates your interest in this Energy White Paper. We welcome inquiries from readers on any aspects of this material, and will direct readers to the technical experts within our membership. Please contact William F. Lyte, Board Member, HAIC, at (424) 477-7853 or wlyte@technoplexgroup.com.