San Diego
Smart Energy 2020

THE 21ST CENTURY ALTERNATIVE

PREPARED BY

E-Tech International, Santa Fe, New Mexico

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Cover photo: San Diego Education Center equipped with a high efficiency cool roof and 100 kW of rooftop solar photovoltaic panels (photo provided by Solar Integrated Technologies)

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Don Wood: Senior Policy Advisor, Pacific Energy and Policy Center, La Mesa

About the author:

Bill Powers, P.E., is an expert on regional power provision, with extensive knowledge and experience in the fields of energy and mechanical engineering, air monitoring and control equipment, and pollution and public health. He is internationally renowned for his work in the energy field, providing expert testimony and analysis, project management, strategic planning, and equipment testing and monitoring for private energy project developers throughout the world, including the United States, Mexico, Peru, Venezuela, Panama, and Chile.

Mr. Powers has served as the U.S. co-chair of the San Diego-Tijuana EPA/SEMARNAT Border 2012 Air Work Group, a federal initiative which develops programs to reduce air pollution along the international border. He is also co-chair of the Border Power Plant Working Group, a binational organization which advocates for sustainable energy projects in the border region. In addition, he is a member of San Diego Association of Governments Regional Energy Working Group.

Mr. Powers has authored numerous technical reports on a variety of energy-related topics, including gas turbine air emission controls, power plant cooling systems, integrating strategic energy and environmental planning in the California – Baja California border region, and use of integrated gasification combined cycle power generation to facilitate carbon dioxide capture and sequestration in Midwestern coal-burning states. He received his Bachelor of Science in Mechanical Engineering from Duke University and Masters of Public Health – Environmental Sciences from the University of North Carolina. Mr. Powers has been a registered professional engineer in California since 1986.

1. Executive Summary

The San Diego region is poised on the brink of a new energy future, and the path it charts now will determine in large part the success of its people, its economy, and its ability to provide a cleaner, more secure energy supply for generations to come.

San Diego Smart Energy 2020 paves the way for a shift from reliance on fossil fuels and imported power to an array of local solutions that include energy efficiency measures with emphasis on high efficiency air conditioning systems; common-sense weatherization and conservation; the proven technology of solar photovoltaic (PV) panels, for large commercial use as well as on homes; small, highly efficient natural gas-fired power plants that generate both power and heating/cooling; adoption of smart grid procedures that improve the efficiency of the grid by monitoring and controlling the flow of electricity on a continuous basis; and the widespread institution of green building design principles.

San Diego Smart Energy 2020, the strategic energy plan for San Diego County described in this report, provides a working blueprint of realistic methods to reduce greenhouse gases from power generation by 50 percent over current levels by 2020 while increasing the total electricity supply from renewable energy resources and maximizing locally generated power. The plan is economically feasible for residents and businesses alike.

Finding 1: Climate Change Must Drive Strategic Energy Planning

The *Global Warming Solutions Act* (AB 32, September 2006) commits California to reducing greenhouse gases by 25 percent to 1990 levels by 2020, and by 80 percent by 2050.

San Diego Gas & Electric (SDG&E) is currently projecting a 20 percent reduction in greenhouse gas emissions over the next decade as part of its strategic plan. This reduction will principally be achieved by meeting the state mandate of 20 percent renewable energy generation by 2010. However, SDG&E's parent company, Sempra Energy, will begin shipping liquefied natural gas north through SDG&E's pipeline system from its Baja California liquefied natural gas terminal in 2009. The lifecycle greenhouse gas burden of liquefied natural gas, including processing, liquefying, transport, and regasification, is approximately 25 percent greater than that of the domestic natural gas SDG&E is currently supplying. The SDG&E greenhouse gas projection, provided in SDG&E's 2007-2016 Long-Term Procurement Plan, does not take into account the generation of additional greenhouse gases associated with the conversion from domestic natural gas to imported liquefied natural gas. This conversion will nullify the greenhouse gas reductions projected by SDG&E over the next decade.

A much more significant shift from fossil fuel to renewable energy sources will be required if the San Diego region is to reduce its greenhouse gas emissions at the maximum rate that is cost-effectively achievable.

Finding 2: A Secure Energy Future Requires an Increase in Local Power Generation and a Decreased Dependence on Natural Gas

Approximately two-thirds of the electric power used in the San Diego region is currently generated by coal-fired (12 percent) and natural gas-fired (53 percent) combustion sources. The power is imported along existing transmission lines as well as being generated by local power plants.

Virtually all local power generation sources burn natural gas. The price of natural gas has nearly tripled since 2002, and remains highly volatile. The high price of natural gas has made renewable energy sources more-cost effective when compared to natural gas-fired power generation sources.

San Diego's political, business, environmental, and community leaders have a history of innovative thinking in planning for the region's energy future. In 2003, the San Diego Association of Governments (SANDAG) adopted the *San Diego Regional Energy Strategy 2030.* The document places strong emphasize on expanded local power generation, including both renewable energy sources and highly efficient combined heat and power (CHP) projects for large businesses and government facilities. Enhanced energy efficiency and energy conservation efforts, and modernization of the region's natural gas-fired power plants to reduce natural gas consumption, are also key elements of *San Diego Regional Energy Strategy 2030.*

Finding 3: A San Diego Energy Future Focused on Photovoltaics Is Cost-Competitive

In 2006, Governor Schwarzenegger signed into law Senate Bill 1, an amended version of the "million solar roofs" California Solar Initiative, to provide incentives for commercial PV applications up to one megawatt (MW) as well as residential systems. The amended California Solar Initiative will rely on $3.35 billion in incentives to add 3,000 MW of rooftop PV in California by 2017. It is anticipated that approximately 300 MW of PV will be added in the San Diego area as a result of this solar legislation.

A core element of *San Diego Smart Energy 2020* is adding over 2,000 MW of PV locally by 2020. This ambitious solar program, the *San Diego Solar Initiative*, will use an incentive structure similar to that of the California Solar Initiative. Power generated from PV systems, when combined with sufficient solar incentives, current federal tax credits, and current accelerated depreciation, is less expensive than conventional power purchased directly from the utility. For example, the City of San Diego pays $0.12 per kilowatt-hour (kWh) to a third party provider for the power generated by the 965 kilowatt PV array at the City's Alvarado Water Treatment Plant under a long-term power purchase agreement. In contrast, the City pays approximately $0.17 per kWh to SDG&E for conventional purchased power.

The capital cost PV is expected to drop 40 percent by 2010 due to an increase in manufacturing capacity worldwide. SDG&E will install electronic "smart" electric meters throughout the San Diego area by 2011. PV systems generate power during the day when electricity prices are highest. These smart meters will precisely track when PV systems are sending power to the grid. This in turn will enable fair compensation for the high value electricity being produced, further enhancing the economics of PV power generation.

Finding 4: Current State Policies Do Not Provide Utilities with Incentives to Prioritize Energy Efficiency, Renewable Energy, and Distributed Generation

California utilities earn a fixed profit based on the value of the property the utility owns. Examples of such property are utility-owned power plants, transmission and distribution lines, and electric and gas meters. The more a utility invests in these types of infrastructure, the more money is earned.

However, in 2003, the California Public Utilities Commission (CPUC) and the California Energy Commission adopted the *Energy Action Plan* and its associated power generation priorities or "loading order." The *Energy Action Plan* provides a roadmap for meeting California's future energy needs. The top priority listed in the *Plan* is energy efficiency to minimize increases in electricity and natural gas demand. Demand response, or reducing electricity demand during periods of peak usage, is next, followed by renewable energy resources and clean natural gas-fired CHP projects. Conventional power plant resources are identified as the last generation priority, to be considered only after maximum development of energy efficiency, renewable energy, and distributed generation has been realized.

A major hurdle to implementing the *Energy Action Plan* is the traditional utility revenue system. This system does not provide California utilities with a financial incentive to invest in energy efficiency, renewable resources, or distributed generation. However, a September 2007 ruling by the CPUC established incentives and penalties to motivate the utilities to pursue energy efficiency more aggressively. This is an important first step toward adapting the utility revenue system to reflect the priorities of the loading order.

Finding 5: Quality of Life in San Diego Requires New Thinking for Energy Supply – San Diego Smart Energy 2020

The primary objective of the energy strategy described in this report is to achieve a 50 percent reduction in greenhouse gas emissions from power generation sources by 2020. *San Diego Smart Energy 2020* is designed to accelerate local, smart distributed generation, with an emphasis on energy efficiency, commercial PV systems, and CHP installations. Implementation of *Smart Energy 2020* will: 1) maximize greenhouse gas reduction, 2) enhance energy security by minimizing dependence on natural gas for power generation, and 3) greatly expand local clean peak generation capacity to minimize reliance on power imports during periods of high demand when competition for these power imports is greatest.

San Diego Smart Energy 2020 calls for the addition of 2,040 MW of rooftop solar, with an emphasis on large commercial installations. It also includes the addition of 700 MW of clean distributed generation from CHP sources. Under *Smart Energy 2020,* renewable energy resources will provide 50 percent of San Diego County's energy demand in 2020. *Smart Energy 2020* is outlined in Table 1-1. *The San Diego Solar Initiative* is a cornerstone of the *Smart Energy 2020* strategy. The *Initiative* will be funded by a $1.5 billion PV incentive budget. The 2,040 MW of PV capacity built under the *Initiative* will be equipped with sufficient battery storage to allow full use of this capacity during peak demand periods.

A more limited *San Diego Smart Energy 2020* with a reduced PV incentive budget of $700 million is outlined in Table 1-2. Under current cost allocation policy, SDG&E customers will be charged only 10 percent, or approximately $700 million, of the $7 billion lifecycle cost of the proposed Sunrise Powerlink (SPL) transmission project. A $700 million *San Diego Solar Initiative* will provide for 920 MW of PV capacity by 2020 equipped with sufficient battery storage for reliable peaking power duty. Under this more limited approach, renewable energy resources will provide 36 percent of San Diego County's energy demand in 2020.

San Diego Smart Energy 2020 increases local peak generation in 2020 by 2,670 MW beyond the level of new local peak generation achieved in SDG&E's long-term plan. The limited version of *Smart Energy 2020*, as outlined in Table 1-2, will increase local peak generation in 2020 by 1,550 MW beyond the new local peak generation achieved in the SDG&E plan. In comparison, the proposed SPL transmission line would add 1,000 MW of power import capability. The greatly increased amount of local peak power generation capacity installed under either *Smart Energy 2020* scenario will eliminate the need to build new transmission to provide reliability during periods of peak power demand.

New residential and commercial buildings would incorporate state-of-the-art green building principles and sufficient rooftop solar to address expected electric energy consumption under *San Diego Smart Energy 2020*. The objective is net zero energy consumption in new construction.

Recommendation: Implement *San Diego Smart Energy 2020*

Step 1: Realign SDG&E financial incentives to match *Energy Action Plan* priorities

Step 2: Achieve absolute reduction of 20 percent in annual energy consumption by 2020

Step 3: Achieve absolute reduction of 25 percent in peak demand by 2020

Step 4: Achieve 50 percent reduction in greenhouse gas emissions from power generation by 2020 through use of local PV and CHP distributed generation

Step 5: Prioritize modernization of the 1950s-vintage electrical distribution system to maximize potential benefits of smart grid

Step 6: Assure new construction in San Diego incorporates state-of-the-art green building principles and sufficient rooftop solar to meet own electricity demand

Each *San Diego Smart Energy 2020* scenario is compared side-by-side with the SDG&E 2016 strategic plan in Tables 1-1 and 1-2. The targets in Tables 1-1 and 1-2 are described in terms of annual electric energy usage and peak power demand. Annual energy usage is analogous to the total gallons of fuel used by an automobile over the course of a year. Peak power demand is analogous to the maximum horsepower required of the automobile when it is fully loaded and must maintain a high rate of speed while driving up a hill. Electricity planning in California is largely guided by peak power demand.

Table 1-1. Comparison of San Diego Smart Energy 2020 ($1.5 billion incentives budget) and SDG&E Strategic Plan

	San Diego Smart Energy 2020 – $1.5 Billion Solar Incentive Expenditure			SDG&E Strategic Plan – 2016 $7 Billion Sunrise Powerlink Expenditure ($700 million allocated to SDG&E customers)		
Element	Action	Demand/ supply (GWh-yr)	Electricity cost impact	Action	Demand/ supply (GWh-yr)	Electricity cost impact
2003 baseline annual energy demand:		20,000			20,000	
1. Energy Efficiency (EE) /Demand Reduction (DR)	Reduce energy demand 20%, 4,000 GWh, compared to 2003 baseline of ~20,000 GWh thru EE. Maximize DR thru cooling system EE upgrades and "smart" meters to reduce peak 25% from 2007 peak of 4,636 MW to 3,500 MW.	(4,000)	neutral	Energy demand increases 4,679 GWh relative to 20,000 GWh baseline. Peak demand increases 560 MW to 5,060 MW from 4,500 MW baseline.	4,679	neutral
2020 annual energy demand:		16,000		2016 SDG&E:	24,679	
2020 sources of energy supply – San Diego Smart Energy 2020:				2016 SDG&E sources of energy:		
2.Renewable Energy	a. SB 107 - 20% renewable energy by 2010. b. Million solar roofs – 300 MW by 2017. c. San Diego Solar Initiative – 2,040 MW w/ battery storage for peaking duty at rated capacity, 3-6 pm (2,265 MW w/o storage).	3,500 600 3,900	existing existing $1.5 billion (lifecycle cost, 2007 dollars)	a. SB 107 - adjusted to 2016. b. 300 MW by 2017. c. None.	3,800 600 0	existing existing none
3. Combined heat and power	a. Existing – 350 MW b. New – 700 MW	2,500 5,000	existing neutral	a. Existing – 350 MW b. New – 40 MW	1,800 300	existing neutral
4. Conventional gas-fired power plants	a. Two existing local 550 MW combined-cycles (CC): nighttime and cloudy days. b. Existing local simple cycle peakers, 500 to 700 MW capacity: as needed to meet peak.	500 [net]	existing/ neutral existing/ neutral	a. Local and imported CC power, assume 40/60 split. b. Simple cycle peakers: as needed to meet peak.	14,729	power from existing generation
5. Nuclear and large hydro-electric imports.	Not necessary to implement strategy.	0	NA	Nuclear meets 14 percent of demand in 2016. No large hydro specifically identified.	3,450	existing
6. Transmission/ Distribution	a. 4 kV & 12 kV distribution system – modernize. b. 69 kV – reconductor as needed with high capacity lines if renewable energy park growth warrants. c. 230 kV/500 kV – add 550 MW total, 350 MW upgrade to existing 230 kV (north/south), 200 MW upgrade to existing 500 kV (east/west).	NA NA NA	unknown optional $740 million (lifecycle cost, 2007 dollars)	a. 4 kV & 12 kV distribution system – modernize. b. 69 kV – no action. c. 230 kV/500 kV – add new 1,000 MW capacity Sunrise Powerlink.	NA NA NA	unknown no action $7 billion (lifecycle cost, 2010 dollars)
7. Residential and commercial new growth	Use green building EE design principles to minimize energy demand, incorporate sufficient PV to meet projected annual energy demand.	No net change	Neutral	Growth in annual energy demand and peak demand is quantified in EE/DR line item.	see above	see above
Total annual energy requirement (GWh):		**16,000**			**24,679**	
Peak demand (MW):		**3,500**			**5,060**	
Percentage renewable energy:		**50**			**18**	
New post-2007 local power generation available at peak (MW):		**3,030**			**360**	
GHG emissions assuming domestic natural gas (in tons CO_2):		**2,600,000**			**7,100,000**	
GHG emissions assuming switch to LNG in 2009 (in tons CO_2):		**3,300,000**			**8,800,000**	

Table 1-2. Comparison of Limited San Diego Smart Energy 2020 ($700 million incentives budget) and SDG&E Strategic Plan

	San Diego Smart Energy 2020 – $700 Million Solar Incentive Expenditure			SDG&E Strategic Plan – 2016 $700 Million of Sunrise Powerlink Cost Allocated to SDG&E Customers		
Element	Action	Demand/ supply (GWh-yr)	Electricity cost impact	Action	Demand/ supply (GWh-yr)	Electricity cost impact
2003 baseline annual energy demand:		20,000			20,000	
1. Energy Efficiency (EE) /Demand Reduction (DR)	Reduce energy demand 20%, 4,000 GWh, compared to 2003 baseline of ~20,000 GWh thru EE. Maximize DR thru cooling system EE upgrades and "smart" meters to reduce peak 25% from 2007 peak of 4,636 MW to 3,500 MW.	(4,000)	neutral	Energy demand increases 4,679 GWh relative to 20,000 GWh baseline. Peak demand increases 560 MW to 5,060 MW from 4,500 MW baseline.	4,679	neutral
2020 annual energy demand:		16,000		2016 SDG&E:	24,679	
2020 sources of energy supply – San Diego Smart Energy 2020:				2016 SDG&E sources of energy supply:		
2.Renewable Energy	a. SB 107 - 20% renewable energy by 2010. b. Million solar roofs – 300 MW by 2017. c. San Diego Solar Initiative – 920 MW w/ battery storage for peaking duty at rated capacity, 3-6 pm (1,030 MW w/o storage).	3,500 600 1,700	existing existing $700 million (lifecycle cost, 2007 dollars)	a. SB 107 - adjusted to 2016. b. 300 MW by 2017. c. None.	3,800 600 0	existing existing none
3. Combined heat and power	a. Existing – 350 MW b. New – 700 MW	2,500 5,000	existing neutral	a. Existing – 350 MW b. New – 40 MW	1,800 300	existing neutral
4. Conventional gas-fired power plants	a. Two existing local 550 MW combined-cycles (CC): nighttime and continuous load following. b. Existing local simple cycle peakers, 500 to 700 MW capacity: as needed to meet peak.	2,700 [net]	existing/ neutral existing/ neutral	a. Local and imported CC power, assume 40/60 split. b. Simple cycle peakers: as needed to meet peak.	14,729	power from existing generation
5. Nuclear and large hydro-electric imports	Not necessary to implement strategy.	0	NA	Nuclear meets 14 percent of demand in 2016. No large hydro specifically identified.	3,450	existing
6. Transmission/ Distribution	a. 4 kV & 12 kV distribution system – modernize. b. 69 kV – reconductor as needed with high capacity lines if renewable energy park growth warrants. c. 230 kV/500 kV – add 550 MW total, 350 MW upgrade to existing 230 kV (north/south), 200 MW upgrade to existing 500 kV (east/west).	NA NA NA	unknown optional $740 million (lifecycle cost, 2007 dollars)	a. 4 kV & 12 kV distribution system – modernize. b. 69 kV – no action. c. 230 kV/500 kV – add new 1,000 MW capacity Sunrise Powerlink.	NA NA NA	unknown no action $7 billion (lifecycle cost, 2010 dollars)
7. Residential and commercial new growth	Use green building EE design principles to minimize energy demand, incorporate sufficient PV to meet projected annual energy demand.	No net change	neutral	Growth in annual energy demand and peak demand is quantified in EE/DR line item.	see above	see above
Total annual energy requirement (GWh):		**16,000**			**24,679**	
Peak demand (MW):		**3,500**			**5,060**	
Percentage renewable energy:		**36**			**18**	
New post-2007 local power generation available at peak (MW):		**1,910**			**360**	
GHG emissions assuming domestic natural gas (in tons CO_2):		**3,500,000**			**7,100,000**	
GHG emissions assuming switch to LNG in 2009 (in tons CO_2):		**4,400,000**			**8,800,000**	

Supporting information for Tables 1-1 and 1-2:

a) Definitions: Neutral cost impact – net effect of action will result in no expected increase to customer electricity rates relative to the utility rate basecase; Existing – operational source.
b) All photovoltaic MW capacities are in alternating current - AC.
c) Energy Action Plan uses 2003 as baseline to measure the 20% absolute reduction by 2015 in energy usage at state government and commercial buildings.
d) California's three utilities, PG&E, SCE, and SDG&E, achieved a combined total of 6,200 GWh of energy efficiency savings through 2006. A May 2006 energy efficiency potential study prepared by Itron for California's three regulated utilities estimates that as much as 48,000 GWh of reduction is attainable in existing buildings statewide with cost-effective technologies. SDG&E represents about 10 percent of the California regulated utility load, or nearly 5,000 GWh of additional economic energy efficiency savings.
e) SDG&E assumes smart meters will reduce peak demand by 5 percent. Industry analysts (Brattle Group) estimate smart meters could reduce peak demand by more than 20 percent. Five (5) percent is used as the default assumption to establish a peak demand reduction target of 25 percent (20 percent through energy efficiency - EE, 5 percent through smart meter efficiencies).
f) SDG&E estimates energy demand in 2016 after employing EE measures at 24,679 GWh, and peak power demand in 2016 after employing EE measures at 5,060 MW.
g) All power generation used to meet the SDG&E projected demand increase of 4,679 GWh in 2016 relative to the 2003 baseline is assumed to be met with combined-cycle generation.
h) In order to achieve a 20% renewable generation mix by 2010 based on a 2009 forecast bundled customer retail sales benchmark of 17,418 GWh, SDG&E must obtain a total of approximately 3,484 GWh of renewable energy (8/4/06 application, p. III-9). SDG&E estimates 2015 bundled customer retail sales of 19,076 GWh. 20% of 19,076 GWh is 3,815 GWh.
i) Assume SB1 "million solar roof" PV systems are not equipped with battery storage to operate as afternoon peaking units.
j) *San Diego Solar Initiative* PV systems will be equipped with energy management/battery storage to operate as afternoon peaking units. The cost of energy management/battery storage is assumed to be 10 percent of the overall system cost.
k) Estimate of growth of CHP under SDG&E 2016 case is from SANDAG Energy Working Group Policy Subcommittee recommendations on CHP dated Nov. 16, 2006.
l) SDG&E estimates approximately 1,800 GWh generated from QF (large CHP) and CHP in 2016 (2007-2016 LTPP presented by SDG&E to SANDAG EWG, Jan. 25, 2007, p. 11 bar chart). SDG&E estimates installed QF + CHP capacity in 2015 of 390 MW. The production of 1,800 GWh-yr from 390 MW of capacity equals a capacity factor of 52 percent. CHP will have a primary baseload role in *San Diego Smart Energy 2020*. Average CHP capacity factor under *San Diego Smart Energy 2020* is assumed to be 80 to 85 percent.
m) Explanation of "net" 500 GWh of power from combined-cycle and conventional gas-fired generation: The output of 1 or 2 combined-cycle plants will be needed routinely under the *San Diego Smart Energy 2020* plan at night and during cloudy days, when there is little solar power generation. CHP alone will not be able to meet the nighttime or cloudy day demand. However, on clear days there will be net outflow of power from the San Diego region to neighboring utility areas as the combined solar and CHP output will often exceed local demand in the middle of the day. There will be power flowing in and out of the San Diego area on a continuous basis. The overall effect of this flow from a greenhouse gas calculation standpoint will be 500 GWh of net greenhouse gas emissions from combined-cycle power generation.
n) Nuclear power estimate in SDG&E 2016 case from SDG&E 2007-2016 Long-Term Procurement Plan, Vol. I, as shown in SDG&E presentation to SANDAG EWG, January 25, 2007, p. 11.
o) Estimate of cost to upgrade north/south 230 kV transmission line and 500 kV east/west transmission line to add 550 MW of additional capacity from D. Marcus, June 1, 2007 testimony, in CPUC proceeding A.05-12-014, SDG&E Sunrise Powerlink 8/4/06 application.
p) Estimate of cost of Sunrise Powerlink, $1.265 billion capital cost and $174 million per year for 40 years in 2010 levelized dollars, a total of $6.96 billion, from SDG&E 8/4/06 application.
q) Central heat & power CO_2 emission factor per SDG&E: 639 lb CO_2 per MWh.
r) Combined-cycle CO_2 emission factor: 819 lb CO_2 per MWh (117 lb CO_2 per million Btu, 7 million Btu per MWh).
s) All gas-fired power generation other than CHP is assumed to be combined-cycle generation for greenhouse gas emissions calculation purposes.
t) A total of 14,729 GWh of combined cycle production is assumed for the SDG&E 2016 case (4,679 GWh of demand increase after EE + 10,050 GWh of conventional gas turbine CC power generation). The current combined-cycle capacity factor used by the CEC is 60%. A total of 1,100 MW of local combined-cycle capacity (542 MW Palomar and 561 MW Otay Mesa) will be online in 2016. The expected GWh of electricity production from these two plants in 2016 is projected to be 5,782 GWh at 60% capacity factor. Local generation represents approximately 40 percent of the 14,729 MW of combined-cycle production in 2016. The remaining combined-cycle power production in the SDG&E 2016 case, 8,947 GWh, is assumed to be imported.
u) The CEC assigns a 7.5 percent greenhouse gas penalty to power imported over transmission lines from out-of-state. A factor of 1.075 is applied to the CO_2 emission calculation for the estimated 8,947 GWh of imported combined-cycle power in the SDG&E 2016 case to account for the greenhouse gas penalty assigned to transmission of energy supplies from out-of-state.
v) New post-2007 generation available for peak demand periods: 1) *San Diego Smart Energy 2020* – 2,040 MW PV, 700 MW CHP, 150 MW CSI PV, 40 MW pumped hydroelectric, 133 MW gas-fired peaking turbines. SDG&E 2016 – 40 MW CHP, 150 MW CSI PV, 40 MW pumped hydro, 133 MW gas-fired peaking turbines (J-Power 86.5 MW and Wellhead Power 46.5 MW).
w) The capital cost estimate for the 230 kV and 500 kV transmission upgrades included in *San Diego Smart Energy 2020* is $135 million. The capital cost estimate for the Sunrise Powerlink is $1.265 billion. The lifecycle cost (in 2010 dollars) of Sunrise is estimates at $6.96 billion per SDG&E. The ratio of lifecycle cost to capital cost in the Sunrise case has been applied to the $135 million capital cost estimate for the 230 kV and 500 kV transmission upgrades to calculate an estimated lifecycle cost of $740 million.
x) All GWh annual totals and estimated CO_2 annual emissions are based on the entire electrical demand in SDG&E service territory, including "direct access" customers. *San Diego Smart Energy 2020* assumes all customers in SDG&E service territory participate, including current direct access customers. SDG&E forecasts that direct access customers will represent 23 percent, 5,603 GWh of 24,679 GWh, of the total demand in SDG&E service territory in 2016.
y) The natural gas used in the region that would be displaced by liquefied natural gas (LNG) is from Southwestern raw gas sources with very low (< 1%) CO_2 content in most cases. A few West Texas raw gas sources have significant levels of CO_2. However, this CO_2 is captured at the natural gas processing plant(s) and used in CO_2 enhanced oil recovery projects.
z) SDG&E parent company Sempra Energy will begin operation of its LNG import terminal in Baja California in 2009. At that time Sempra will reverse flow on the SDG&E pipeline network to move natural gas from the LNG terminal north into SDG&E and SoCalGas pipeline systems. 100% of the natural gas in the SDG&E pipeline system will be from the LNG terminal from 2009 forward. Sempra intends to import the LNG from the BP liquefaction plant in Tangguh, Indonesia. The lifecycle CO_2 burden of LNG from Tangguh, including raw gas CO_2 content, liquefaction, shipping, and regasification, is approximately 25 percent greater than that of domestic natural gas from the Southwest. The CO_2 emissions generated under the "domestic natural gas" scenario are multiplied by 1.25 to determine the additional lifecycle CO_2 burden associated with the regional switch to natural gas derived from imported LNG.