

San Diego

Smart Energy 2020

THE 21ST CENTURY ALTERNATIVE



SANDAG Energy Working Group Meeting
November 29, 2007

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Drivers Behind Smart Energy 2020

- *“There’s an ongoing schizophrenia in state energy policy between what we say we want to do and what we actually allow to happen,”* CEC’s John Geesman, May 2007.
- AB 32, Global Warming Solutions Act: 25% reduction in CO₂ by 2020, 80% by 2050.
- CPUC/CEC Energy Action Plan: priority “loading” order – maximum energy efficiency, renewable energy, clean distributed energy first, only then conventional power plants and high voltage transmission.
- San Diego Regional Energy Strategy 2030: increase local power to 75% by 2020; 25% renewable energy by 2020 and 40% by 2030, at least 50% of renewables in-county; add 700 MW of combined heat and power by 2020.
- Sunrise Powerlink: \$7 billion (2010 dollars) over 40 years, more power imports, less in-county generation.

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Themes of San Diego Smart Energy 2020

- Global warming is the issue of our time - we must achieve the maximum economically feasible reduction of greenhouse gases as rapidly as we can.
- Energy independence – minimize reliance on power imports, natural gas, and liquefied natural gas (LNG).
- Stay within the known world – proven, achievable measures - in establishing specific Smart Energy 2020 targets.

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Implementing 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 combined heat and power generation.
- Step 5: Prioritize modernization of the 1950s-vintage electrical distribution system to maximize potential benefits of smart meters.
- Step 6: Assure new construction in San Diego incorporates state-of-the-art green building principles and sufficient solar PV to meet own electricity demand.

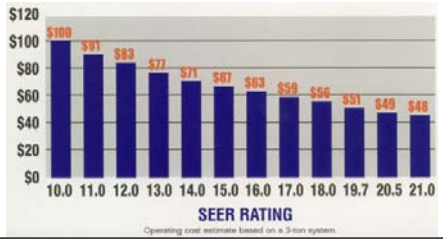
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20% reduction in energy demand below 2003 baseline via energy efficiency

- California utilities have achieved only 10% of economic energy efficiency reductions.
- *Energy Action Plan* requires state buildings to reduce grid power purchases to 20% below 2003 levels by 2015.
- City of San Diego has achieved average reduction of 20% on more than 50 projects.
- Full development of economic energy efficiency measures (air conditioning, insulation, lighting, refrigeration) would reduce annual energy demand by about 20% in SDG&E service territory.

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Energy savings potential of off-the-self, cost-effective equipment

Equipment	Action	Energy savings (%)																										
Air conditioning (average efficiency is SEER 10, commercially available at 20% cost premium is SEER 21)	 <table border="1"> <caption>Operating cost estimates based on a 3-ton system</caption> <thead> <tr> <th>SEER Rating</th> <th>Operating Cost Estimate (\$)</th> </tr> </thead> <tbody> <tr><td>10.0</td><td>\$100</td></tr> <tr><td>11.0</td><td>\$91</td></tr> <tr><td>12.0</td><td>\$83</td></tr> <tr><td>13.0</td><td>\$77</td></tr> <tr><td>14.0</td><td>\$71</td></tr> <tr><td>15.0</td><td>\$67</td></tr> <tr><td>16.0</td><td>\$63</td></tr> <tr><td>17.0</td><td>\$59</td></tr> <tr><td>18.0</td><td>\$56</td></tr> <tr><td>19.7</td><td>\$51</td></tr> <tr><td>20.5</td><td>\$49</td></tr> <tr><td>21.0</td><td>\$48</td></tr> </tbody> </table>	SEER Rating	Operating Cost Estimate (\$)	10.0	\$100	11.0	\$91	12.0	\$83	13.0	\$77	14.0	\$71	15.0	\$67	16.0	\$63	17.0	\$59	18.0	\$56	19.7	\$51	20.5	\$49	21.0	\$48	50+
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19.7	\$51																											
20.5	\$49																											
21.0	\$48																											
Lighting	Phase-out of incandescent bulbs by 2012 – proposed in AB 722 (Levine)	60																										
Refrigeration	Completely driven by federal efficiency standards – some high efficiency units for use with solar PV	20																										

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25% reduction in peak power demand through demand response actions

- Strategic energy planning is driving by peak power demand in California.
- All SDG&E customers will receive digital “smart meters” by 2011 – estimated 5% reduction in peak demand as a result of smart meters.
- Air conditioning load is 35% of total energy demand on hot summer days.
- No SDG&E efficiency incentives for workhouse central air conditioning units.
- State-of-art, off-the-shelf central A/C uses ½ the power but costs only 10 – 20% more than basic models.
- Utility incentives should be directed at ensuring all new central A/C in hot parts of San Diego County is state-of-the-art.

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San Diego Solar Initiative - 40% of new power added by 2020 is solar PV

- 2,000 MW, mostly large commercial PV systems with \$1.5 billion incentive budget. 900 MW with limited \$700 million budget.
- *San Diego Solar Initiative* incentive concept modeled on California Solar Initiative, 3,000 MW by 2017.
- Germany has installed as much as 800 MW per year of PV.
- PV systems would be equipped with limited battery storage to provide full output during afternoon peak.
- 3rd party long-term power purchase agreements using handful of large PV system providers.
- Example: City of San Diego's Alvarado Water Treatment Plant - 965 kW, City pays \$0.12/kWh for solar power to 3rd party, otherwise pays SDG&E \$0.17/kWh.



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How PV can compete with conventional natural gas-fired power in 2007

Large commercial PV, greater than 100 kW:

- \$8/watt installed (AC), 2007.
- 30% federal tax credit.
- Accelerated depreciation, equals 28% credit.
- Low cost public financing, 5% interest, 30 years.
- Assume no incentive (assume incentive if higher cost private financing used).
- No fuel cost.
- Power production: 1.5 kWh-yr per direct current watt.
- Average cost of electricity over 30 years in 2007 dollars: ~\$0.15/kWh.

Conventional natural gas-fired generation:

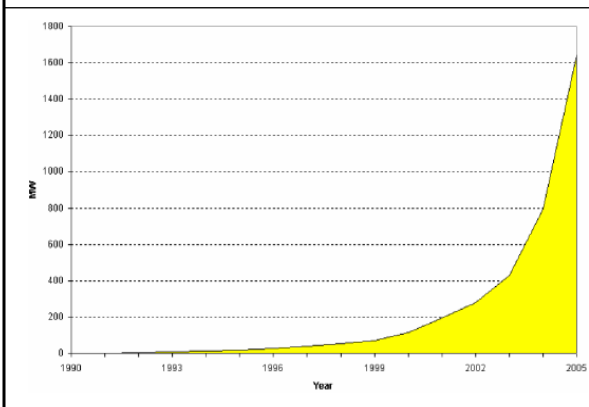
- Cost to build natural gas fired generation is low, \$1/watt in 2007.
- However, more than 75% of the cost of electricity from natural gas-fired generation is fuel cost.
- SDG&E energy tariff to commercial customers, 2007: ~0.17/kWh.

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Context of *San Diego Solar Initiative*

- Rapid expansion of PV has already been demonstrated in Germany at a rate much greater than what is proposed under the San Diego Solar Initiative.
- The San Diego Solar Initiative PV incentive budget assumes PV cost will decline 40% by 2017. Current industry and DOE projections are that PV cost will decline to one-half of current price levels by 2017.

Germany added more than 800 MW of rooftop photovoltaics in 2004 alone



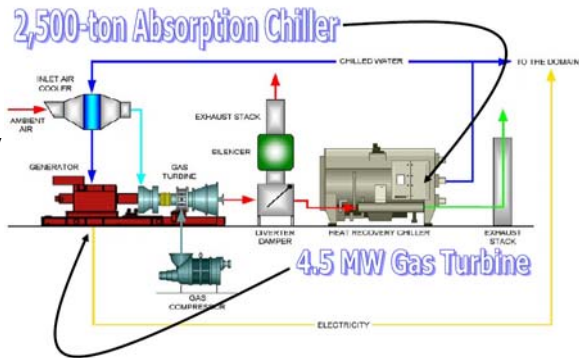
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60% of new power is combined heat & power (CHP) - add 700 MW by 2020

graphic source: Merrill Smith - DOE, presentation, SE CHP Application Center Partnership Meeting, July 6, 2005

- 25% less CO₂ emissions than combined-cycle plant like Palomar Energy or Otay Mesa.
- 2020 CEC target – 25% of peak demand met by CHP.
- San Diego area already has ~300 MW of existing CHP.
- CHP (and PV) must be able to sell excess power at fair rates to grid to maximize potential of local distributed generation.

Integrated Energy System supplies electricity and chilled water



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Combined heat & power – lowest CO₂ emissions, energy savings, good for local economy

source: Solar Turbines cogeneration project case studies - <http://mysolar.cat.com/cda/layout?m=411110&x=7>

26 MW UCSD CHP

- plant provides up to 90% of campus electricity and 75% of steam demand.
- UCSD saves nearly \$250,000 per month by producing its energy instead of purchasing from SDG&E.



5 MW Veteran's Hospital CHP

- contract guarantees \$1.3 million per year in savings.
- new turbine installed in same building that housed old turbines.



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Sufficient distributed generation – answer to blackouts during firestorms

- San Diego can not become an electrical “island,” meaning all major transmission lines are down and San Diego must rely on own internal generation, if firestorms causing the transmission outages and high electricity demand occur at same time without some level of blackouts.
- SDG&E does not have sufficient local generation to become an “island” under high demand conditions now.
- SDG&E long-term plan will rely on more imports and less local generation, increasing San Diego’s vulnerability during major fire events.
- The large increase in local distributed generation capacity under Smart Energy 2020 will maximize system reliability during major fire events, and will ensure sufficient internal generation to permit SDG&E to “island” without risking blackouts.

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Upgrade transmission and distribution system

- Replace 1950s era distribution system to reduce frequency of equipment failures, O&M, and to maximize benefits of smart meters.
- Emphasis on local generation reduces load on existing high voltage 230 kV and 500 kV transmission lines – frees lines for emergency use and renewable energy imports.
- Reinforce existing lines - capacity of existing high voltage transmission lines can be increased by 550 MW for 1/10th the cost of the 1,000 MW Sunrise Powerlink.



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New residential and commercial construction must meet own energy needs

- Use green building energy efficiency design principles to minimize energy demand.
- Incorporate sufficient solar PV to meet projected annual energy demand of structure.
- CPUC issued a energy efficiency draft decision on September 17, 2007 calling for:
 - All new residential construction will be net zero energy by 2020.
 - All new commercial construction will be net zero energy by 2030.
 - Heating, ventilation, and air conditioning industry must be reshaped for maximum efficiency.
- Motivation cited by CPUC for these proposed measures is the revolutionary impact of global warming.

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\$1.5 billion San Diego Smart Energy 2020 compared to SDG&E strategic plan

	San Diego Smart Energy 2020	SDG&E Strategic Plan
2020 annual energy need (GWh)	16,000	24,679
2020 peak demand (MW)	3,500	5,060
Percentage renewable energy (%)	50	18
Percentage of renewable energy (%) generated in San Diego County	62	25
New local generation available at peak demand (MW)	3,030	360
2020 GHG emissions assuming domestic natural gas (tons CO ₂)	2,600,000	7,100,000
2020 GHG emissions assuming liquefied natural gas (tons CO ₂)	3,300,000	8,800,000

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\$700 million San Diego Smart Energy 2020 compared to SDG&E strategic plan

	San Diego Smart Energy 2020	SDG&E Strategic Plan
2020 annual energy need (GWh)	16,000	24,679
2020 peak demand (MW)	3,500	5,060
Percentage renewable energy (%)	36	18
Percentage of renewable energy (%) generated in San Diego County	48	25
New local generation available at peak demand (MW)	1,910	360
2020 GHG emissions assuming domestic natural gas (tons CO ₂)	3,500,000	7,100,000
2020 GHG emissions assuming liquefied natural gas (tons CO ₂)	4,400,000	8,800,000

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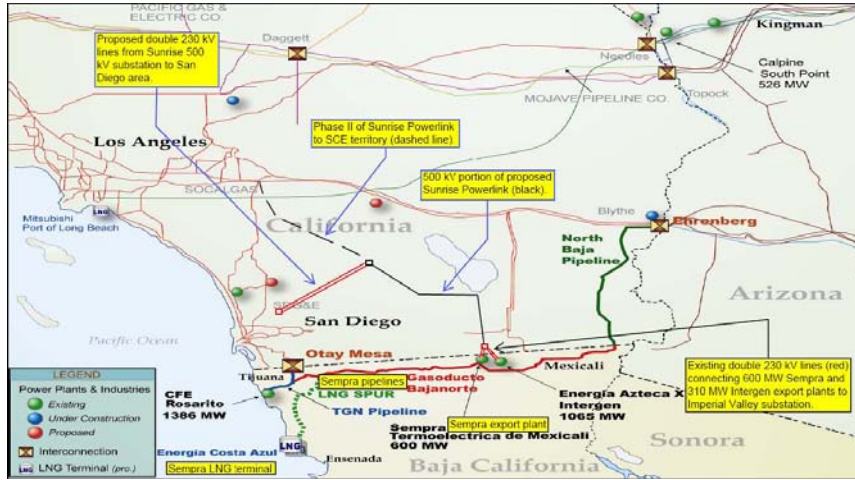
Obstacles to Implementation

- Utility profits come primarily from building major capital projects, like the Sunrise Powerlink, a major power plant, or the smart meter installation program.
- For example, the Sunrise Powerlink will cost \$7 billion over 40 years, of which over \$700 million is guaranteed profit.
- This profit will be received regardless of how much or how little the line is actually used.
- Utility parent company Sempra is also heavily invested in expanding liquefied natural gas consumption.

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Sempra/SDG&E regional energy infrastructure

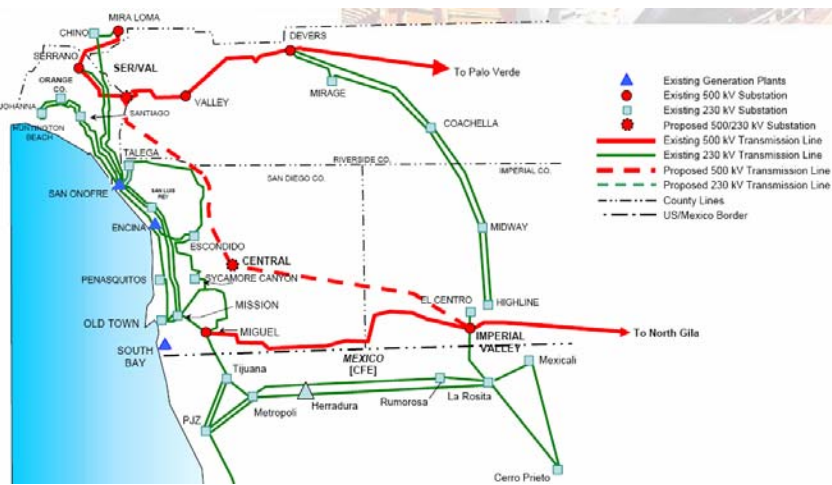
note: Sempra gas-fired power plants in western Arizona (1,250 MW), Las Vegas (480 MW), Kern County (550 MW) are not shown in graphic.



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Existing and proposed regional transmission infrastructure

cite: Robert Jackson, SDG&E Transmission Feasibility Study Status Report, STEP meeting, August 9, 2005.



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Level of SDG&E electricity imports is already high at 67 percent

Import source	Percentage of total SDG&E power sales, 2007 (%)
Natural gas – DWR long-term contracts	22
Coal	12
Nuclear (San Onofre)	20
Large hydroelectric	9
Renewable energy	4
Total 2007 imports:	67

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LNG - 25% increase in GHG emissions compared to domestic natural gas



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14% increase in domestic natural gas production projected by DOE for 2005-2020

cite: DOE Energy Information Administration 2007 Annual Energy Outlook with Projections to 2030, February 2007



Year	Domestic production (trillion ft ³)
2005	18.23
2010	19.35
2015	19.60
2020	20.79
2025	20.59

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Affect of LNG imports – no change in GHG emissions from power generation, 2007-2016

bar chart source: SDG&E PowerPoint presentation to SANDAG Energy Working Group on long-term plan, January 25, 2007. Red line and yellow tag added by B. Powers.



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Institutional steps necessary to implement San Diego Smart Energy 2020

- Within existing utility structure: Put energy efficiency, solar, and combined heat and power projects on higher profit footing than traditional utility infrastructure projects. Energy efficiency projects were put on equal footing in September 2007 by the CPUC.

OR,

- Form a public utility, as San Francisco and San Joaquin Valley cities have done under California's community choice aggregation legislation, and assume responsibility for power generation.

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Conclusions

- The challenge to successfully implementing San Diego Smart Energy 2020 is not technical or economic, it is institutional.
- Utility incentives must be aligned with the Energy Action Plan loading order. For example, with the PUC's new energy efficiency policy, SDG&E can make as much profit eliminating 1,000 MW of demand through energy efficiency programs as it can by building the 1,000 MW Sunrise Powerlink.
- A fraction of the \$7 billion Sunrise Powerlink will cost would convert San Diego County into a world leader in addressing climate change and dramatically reduce our dependence on natural gas for power generation.

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