PG&E Program Advisory Committee Meeting #2
Handout 7: High Potential Markets

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Analysis Assumptions:

• The matrix is a visual representation of data extracted from various sources including: Xnergy Market Potential Study (2002), CEC’s Agricultural Electric Rates Study (2001) & Nexant’s Peak Load Reduction Study (2003).
• The matrix is helpful as a guide in breaking down market sectors that align with energy efficiency, demand response & self generation opportunities.
• The Matrix could with further analysis of underlying primary research and data sources be used as a tool to develop a marketing strategy.
Integrated DSM Model

- Business Operations
  - Analysis
  - Energy Conservation
  - Energy Efficiency
  - TOU Management
  - Demand Response
  - Self Generation

- Price
- Reliability
Integrating PG&E’s Portfolio of Energy Management Programs

**KEY**
- **Energy Efficiency (Large)**
- **Energy Efficiency (Medium)**
- **Self-Generation**
- **Demand Response (Price)**
- **Demand Response (Reliability)**

**Facilities > 500 kW**
- Self-Generation
- Demand Response
- Energy Efficiency

**Facilities < 500 kW**
- Self-Generation
- Demand Response
- Energy Efficiency

**Agric. Process.**
- 130 GWh

**Schools/Colleges**
- 130 GWh

**Retail Stores**
- 500 GWh

**Food Mfg. & Process.**
- 1,515 GWh

**Heavy Industry**
- 230 GWh

**Fabrication Industries**
- 280 GWh

**Medical Facilities**
- 525 GWh

**Office Bldgs.**
- 1,510 GWh

**Process Industries**
- 360 GWh

**Lodging Facilities**
- 95 GWh

**Hi-Tech Facilities**
- 210 GWh

Note: Size of circle is illustrative of potential market for each program within a given sector. See market segment sheets for background and market potential data on each C&I category.
Agricultural Processing

Market Segment Composition: Crops, livestock, fruits/nuts, fishing/forestry, canned fruit & vegetables, dry fruit & vegetables, frozen fruit & vegetables, grain mill producers, associated refrigerated warehouses, and wineries

Energy Savings Potential: 130 GWh.(1) Most of potential savings derive from pumping-related measures (pumping accounts for > 90% of total electricity use in the agricultural sector in CA).(2)

Key Measures (3)

### Facilities > 500 kW

- **Refrigeration projects**: Range of projects including control systems (e.g., floating head pressure, compressor sequencing, fan controls, and suction temperature controls) and high efficiency condensers/evaporative tower related measures
- **Process improvements**: Compressed air system improvements, high efficiency motors (e.g., VSDs on motors and pumping systems), and right-sizing of pumps
- **Lighting measures**: Changing HID systems to T5s, changing T12s to T8s, installing CFL systems, deploying lighting controls, and implementing day-lighting measures
- **Self-generation**: Potential for combined heat and power units that utilize biomass or other alternative heat sources as well as pumping-related self-generation applications (e.g., gas engine driven units)
- **Demand response**: Potential DR measures include shifting pumping load to off-peak periods, using fly wheel refrigeration systems, and curtailing the use of fans/motors/lighting systems

### Facilities < 500 kW

- Customers in the under 500 kW segment have the potential to implement measures similar to those listed above, with the exception of larger refrigeration-based and self-generation projects.
- Majority of projects would involve the installation of standardized/pre-packaged systems that address pumping and refrigeration applications in the agricultural sector.

Notes:

1) Savings estimate assumes that it is possible to save 2% of annual electricity use in the agricultural sector (assumed 6,500 GWh/year consumption level was used, based on CEC data).


3) Potential measures listed above are consistent with the findings of Nexant’s CEC Peak Load Reduction Programs, Fourth Quarter 2002 Report, 06/20/03.
Schools & Colleges

Market Segment Composition: Primary schools, middle schools, high schools, colleges, and universities

Energy Savings Potential: 130 GWh(1)

Key Measures

Facilities > 500 kW

- HVAC projects: Use of high efficiency cooling equipment, installation of VSDs on air handlers, use of programmable thermostats, and installation of an EMS
- Lighting measures: Implementation of projects that utilize high efficiency T8 and electronic ballasts as well as CFLs; deployment of lighting controls (e.g., occupancy sensors and dimming systems); adoption of scheduling measures
- Plug load: Power management of PCs, PC monitors, copiers, and laser printers (e.g., library facilities)(2)
- Self-generation: Development of cogeneration projects that utilize waste heat to help meet a facility's hot water and heating demands; self-generation projects that provide an alternative source of power (e.g., solar units)
- Demand response: Curtailment measures, including automated increases in set-points for thermostats, fan speed reductions, thermal energy storage, and closing of cooling (chilled water) valves(3)

Facilities < 500 kW

- Customers would have the potential to implement measures similar to those listed above, with the exception of larger HVAC and self-generation-based projects.
- Potential measures for end-users in this size range will likely focus on right-sizing HVAC systems, installing lighting control systems, optimizing the number of light fixtures in a room, and maximizing day-lighting options.

Notes:
2) UCSB participated in a LBNL pilot project and shed over 0.3 watts per sq. ft. of energy use at the school library using remote monitoring of an energy management control system (EMCS).
3) Results of a LBNL analysis of Niagara Mohawk's real-time pricing (RTP) DR program reveal that educational facilities can be highly price responsive.
Retail Stores

Market Segment Composition: Department stores, groceries, restaurants, as well as “large box” retail facilities that typically occupy > 50,000 square feet\(^1\)

Energy Savings Potential: 500 GWh\(^2\)

Key Measures

### Facilities > 500 kW

- **Lighting measures**: Indoor lighting improvements (e.g., use of T8 lamps, electronic ballasts, and CFLs) and use of lighting controls (e.g., occupancy sensors/dimming systems); scheduling measures; and outdoor lighting measures (perimeter dimming)
- **HVAC projects**: Installation of high efficiency chillers and packaged units; HVAC equipment tune-ups, and VSDs on air handlers
- **Refrigeration projects**: Strip curtains for walk-in coolers, night covers for refrigerator display cases, glass doors on refrigerated cases, and high efficiency fan motors
- **Plug load**: Power management of office PCs, PC monitors, copiers, and laser printers
- **Demand response**: Range of actions such as common-area lighting sheds, dimming overhead lights, and turning off anti-sweat heaters.\(^3\) Statewide, this sector has 4,000 GWh of eligible accounts for DR programs.\(^4\)
- **Self-generation**: Opportunity for photovoltaic installation where solar “access” and roof space are available

### Facilities < 500 kW

- Customers with demands below the 500 kW threshold have the potential to implement measures similar to those listed above, with the exception of larger refrigeration and HVAC projects.
- End-users in this size range generally consist of grocery stores, restaurants, and small retail facilities with the potential for pre-packaged energy efficiency measures that address lighting and cooling needs.

Notes:

1) Large box retail facilities typically range from 90,000 to 200,000 sq. ft. Columbia Graduate School of Architecture.
3) For example, as part of a recent LBNL DR pilot project, Albertsons in Oakland, CA shed almost 1 watt per sq. ft. during a simulated DR program event.
## Food Manufacturing & Processing

**Market Segment Composition:** Bread/oil/drinks, meat products, dairy products, misc. food products, associated refrigerated warehouses, and sugar products

**Energy Savings Potential:** 1,515 GWh\(^1\); significant savings potential from high efficiency motors and compressed air systems

### Key Measures

#### Facilities > 500 kW

- **Refrigeration:** Control systems (e.g., floating head pressure, compressor sequencing, fan controls, and suction temperature), high efficiency condensers/evaporative tower measures, refrigeration commissioning, and high-efficiency compressors
- **Process improvements:** Broad-based measures, including compressed air system improvements, installation of high efficiency pumping systems, and optimizing pump size to load
- **Lighting:** Changing HIDs to T5s, changing T12s to T8s, installing CFLs, use of lighting controls, and day-lighting measures
- **HVAC:** Installation of high efficiency cooling equipment, use of air handlers with VSDs, and installation of an EMS
- **Self-generation:** Opportunities for both self-generation as well as cogeneration utilizing waste heat/steam for production processes such as for pasteurization, cooking, and heating
- **Demand response:** Potential DR measures include shifting non-critical production to off-peak periods, changing HVAC set points to lower cooling loads, day-lighting actions, and installation of lighting controls\(^2\)

#### Facilities < 500 kW

- Customers with demands below 500 kW have the potential to implement measures similar to those listed above, with the exception of larger refrigeration and HVAC projects.
- Majority of end-users in this size range consist of bakeries, meat processing facilities, and manufacturers of specialty food products (e.g., jams) that can capture energy savings through lighting and process improvements.

### Notes:

1) Estimated potential in PG&E service territory for SIC 20 as well as food storage/refrigeration facilities based on data from the *CA Industrial Energy Efficiency Market Characterization Study* as well as the *CA Statewide Commercial Sector Energy Efficiency Potential Study*. Final Reports. XENERGY, December 2000.

2) Results from Nexant’s analysis of a PG&E survey of more than 2,000 customers reveal that food manufacturing firms have a high level of interest in the demand bidding program (DBP) compared to other DR programs.
### Heavy Industry

**Market Segment Composition:** Transportation manufacturing, machinery, missiles, oil/gas extraction, and mining

**Energy Savings Potential:** 230 GWh\(^{(1)}\)

#### Key Measures

<table>
<thead>
<tr>
<th>Facilities &gt; 500 kW</th>
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<tbody>
<tr>
<td><strong>Process improvements:</strong> High efficiency machine-drive applications for pumping systems (e.g., ASDs and replacement of old equipment) and motor efficiency upgrades</td>
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<tr>
<td><strong>Process support systems:</strong> Optimization of compressed air systems, vacuum, cooling, and exhaust air applications</td>
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<tr>
<td><strong>Lighting:</strong> Moderate potential savings from lighting projects (primarily changing HIDs to T5s and T8s and installing CFLs)</td>
</tr>
<tr>
<td><strong>Self-generation:</strong> Cogeneration opportunities at facilities with coincident thermal and electric demand (e.g., power generation plus utilization of waste heat for production processes and hot water needs); self-generation potential to meet on-site power demand at a facility as well as to ensure power reliability</td>
</tr>
<tr>
<td><strong>Demand response:</strong> Shifting non-critical production processes (e.g., some pumping load) to off-peak periods as well as implementing lighting measures such as dimming features or use of lighting controls(^{(2)})</td>
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<thead>
<tr>
<th>Facilities &lt; 500 kW</th>
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<tbody>
<tr>
<td><strong>Given the energy intensive nature of this segment, few customers will have a demand below 500 kW (with the potential exception of satellite facilities that provide inputs to an affiliated larger sized facility).</strong></td>
</tr>
</tbody>
</table>

**Notes:**


2) Results from Nexant’s analysis of a PG&E survey of more than 2,000 customers indicate that heavy industry end-users have a high level of interest in the CPP program compared to other C&I market segments.
Fabrication Industries

Market Segment Composition: Fabricated metal products, wood & paper products, cement, saw mills, paper mills, stone/clay/glass, and gypsum products

Energy Savings Potential: 280 GWh\(^1\); large savings from high efficiency motor applications at stone, clay, and glass facilities

**Key Measures**

### Facilities > 500 kW

- **Process support systems**: Optimization of compressed air, vacuum, cooling, and exhaust air applications
- **Process improvements**: High efficiency machine drive applications for pumping systems (e.g., ASDs and replacement of old equipment), motor efficiency upgrades, and removing production bottlenecks that increase throughput
- **Lighting**: Moderate potential savings from lighting projects (primarily changing HIDs to T5s and T8s and installing CFLs)
- **HVAC**: Limited savings from the implementation of HVAC measures
- **Self-generation**: Cogeneration opportunities at facilities with coincident thermal and electric demand (e.g., power generation plus utilization of waste heat for production processes and hot water needs); potential to meet on-site power demand at a facility as well as to ensure power reliability
- **Demand response**: Shifting of non-critical production processes to off-peak periods, temporary production slow-downs, and the implementation of lighting measures (dimming of lights or use of lighting controls)

### Facilities < 500 kW

- End-users with a demand below 500 kW will have the potential to implement measures similar to those listed above with the exception of larger process improvements, HVAC, and self-generation projects.
- Customers in this segment will typically consist of small saw mills, metal/wood finishing facilities, and manufacturers of niche products that are candidates for pre-packaged HVAC and lighting measures.

**Notes:**

Medical Facilities

Market Segment Composition: Hospitals, clinics, and health services facilities

Energy Savings Potential: 525 GWh.⁴ Large share of estimated savings comes from indoor lighting measures and office equipment/plug load related projects.

Key Measures

<table>
<thead>
<tr>
<th>Facilities &gt; 500 kW</th>
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<tbody>
<tr>
<td><strong>Lighting</strong>: Implementation of projects using efficient fluorescent lighting systems, installation of T8s and T5s to replace HID lighting systems, and use of occupancy sensors and lighting controls</td>
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<tr>
<td><strong>HVAC</strong>: Cooling measures such as high efficiency chillers, HVAC equipment tune-ups/replacement, right-sizing of equipment, installation of VSDs on air handlers, and installation of an EMS</td>
</tr>
<tr>
<td><strong>Plug load</strong>: Power management of office PCs, PC monitors, copiers, and laser printers</td>
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<tr>
<td><strong>Self-generation</strong>: Installation of self-generation units as alternative sources of power; cogeneration potential at facilities with large steam demands (e.g., for sterilization, cooking, and hot water/heating)</td>
</tr>
<tr>
<td><strong>Demand response</strong>: Potential for load shedding at non acute care facilities through HVAC and lighting measures (e.g., lighting sheds, lighting controls, and temperature resets)</td>
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<tr>
<th>Facilities &lt; 500 kW</th>
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<tbody>
<tr>
<td>Customers in this size range would have the potential to implement measures similar to those listed above, with the exception of larger cooling and self-generation-related projects.</td>
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<tr>
<td>End-users in this segment would likely consist of small clinics and health service facilities that could save energy by installing standardized cooling equipment packages and high efficiency lighting systems.</td>
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Notes:

Office Buildings

Market Segment Composition: Commercial office buildings

Energy Savings Potential: 1,510 GWh.\(^1\) Large portion of estimated savings comes from indoor lighting and plug load equipment measures.

Key Measures

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<thead>
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<th>Facilities &lt; 500 kW</th>
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| **Lighting**: Installation of T8s and T5s to replace T12 lighting systems, installation of occupancy sensors and lighting controls, use of CFLs, and the adoption of building commissioning related procedures.  
**HVAC**: Installation of high efficiency chillers, right-sizing of equipment, installation of VSDs on air handlers, installation of a new EMS or enhancements to an existing EMS, and adoption of building commissioning related procedures.  
**Plug load**: Power management of office PCs, copiers, and printers (e.g., programs that initiate low-power modes for equipment).  
**Demand response**: Load curtailment from HVAC and lighting systems (e.g., lighting sheds, chilled water temperature resets, and duct static pressure resets).\(^2\)  
**Self-generation**: Potential for self-generation projects that service the on-site demand of a facility; options for solar units at facilities with a large flat roof space; cogeneration potential exists at facilities with large hot water/heating demands.  
Facilities with a demand below 500 kW will have the potential to implement measures similar to those listed above, with the exception of larger cooling and self-generation-related projects.  
Office buildings in this category will likely be under 150,000 square feet in size and have the potential to save energy through the implementation of high efficiency lighting systems and packaged HVAC units. |

Notes:
2) Recent Working Group 2 evaluation results indicate that there are > 6,000 GWh of eligible office building accounts for DR-related programs in CA (CPP and DBP programs only).
Process Industries

Market Segment Composition: Chemicals, refineries, plastics, and primary metals

Energy Savings Potential: 360 GWh.\(^1\) Large share of potential savings comes from high efficiency motor applications in the petroleum sector.

Key Measures

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<tbody>
<tr>
<td>• Process improvements: High efficiency machine drive applications for pumping systems (using ASDs), heat recovery projects, and motor efficiency upgrades</td>
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<tr>
<td>• Furnaces/boilers: Upgrades to electric arc furnaces (metals sector) and metallurgical furnaces (steel sector) as well as use of boiler economizers</td>
</tr>
<tr>
<td>• Process support systems: Optimization of compressed air, vacuum, cooling, and exhaust air applications</td>
</tr>
<tr>
<td>• Lighting: Potential savings from lighting projects, such as changing HIDs to T5s and T8s and installing CFLs</td>
</tr>
<tr>
<td>• Self-generation: Cogeneration potential at facilities with large coincident demand for thermal and electric power (use of waste heat for production processes such as molding); self-generation potential to service on-site electricity demand</td>
</tr>
<tr>
<td>• Demand response: Potential shifting of non-critical production to off-peak as well as the adoption of load curtailment measures. In CA, this sector has &gt; 3,000 GWh of eligible accounts for DR programs.(^2)</td>
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<tbody>
<tr>
<td>• Customers with a demand under 500 kW will have the potential to implement measures similar to those listed above, with the exception of larger process improvement, waste heat, and self-generation projects.</td>
</tr>
<tr>
<td>• End-users in this size range will typically consist of firms that manufacture a low volume of specialty products in the pharmaceutical/chemical sector (e.g., pharmaceutical injection molding facilities).</td>
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Notes:


## Lodging Facilities

**Market Segment Composition:** Hotels and motels

**Energy Savings Potential:** 95 GWh.\(^{(1)}\) Large share of estimated savings comes from indoor & outdoor lighting projects.

### Key Measures

#### Facilities > 500 kW

- **Lighting:** Efficiency gains in indoor lighting from the installation of high efficiency measures (e.g., T8s, T5s, and CFLs) and the use of lighting controls/occupancy sensors
- **HVAC:** Cooling and ventilation measures such as the installation of high efficiency chillers and the use of VSDs on air handlers; performing HVAC equipment tune-ups
- **Controls:** Installation of an EMS (or upgrades to existing systems) and use of room control related measures
- **Self-generation:** Cogeneration potential at large facilities with sizeable thermal demand (e.g., hot water, heating, full-service kitchen, laundry, and swimming pools); potential for self-generation units that can help meet a facility's demand for power
- **Demand response:** DR actions include common area lighting measures and HVAC temperature resets. PG&E’s lodging customers may prefer the CPP program to DBP.\(^{(2)}\)

#### Facilities < 500 kW

- Lodging facilities in this size range have the potential to implement measures similar to those listed above, with the likely exception of larger HVAC and self-generation-related projects.
- End-users in this size range would typically consist of motels and small hotels that are likely to install standardized energy efficiency measures/equipment, such as packaged HVAC applications.

### Notes:

2) Based on the results of a market survey of more than 2,000 PG&E customers conducted by Nexant (information collected via account manager meetings with customers).
Hi-Tech Facilities

**Market Segment Composition:** Computers; electronic components, semiconductors, and instruments

**Energy Savings Potential:** 210 GWh.\(^1\) Almost 100 GWh of the estimated savings are from motor/process improvement projects; the remainder are from HVAC and lighting measures.

### Key Measures

#### Facilities > 500 kW

- **Process improvements:** Range of projects relating to compressed air system improvements and use of high efficiency motors
- **HVAC:** Installation of high-efficiency chillers, use of VSDs on air handlers, installation of an EMS, and performing tune-ups of HVAC equipment
- **Lighting:** Replacement of HID lighting systems with T8s and T5s and use of lighting controls
- **Demand response:** Potential for shifting some production elements to off-peak periods as well as load curtailments involving lighting (e.g., dimming and day-lighting) and HVAC (temperature reset) measures
- **Self-generation:** Back-up source of power to ensure reliability and power quality

#### Facilities < 500 kW

- Customers with a demand under 500 kW will often have the potential to implement measures similar to those listed above, with the likely exception of larger HVAC and self-generation-related projects.
- Hi-Tech operations in this size range will likely consist of small laboratory and research facilities that can benefit from the installation of pre-packaged HVAC systems, high efficiency lighting, and EMS systems.

Notes:

Further Analysis

- For each market, list potential by measure
- For each market, add number of customers
- Add gas potential
- For some broad markets, add potential by submarket, such as: 1. Schools and colleges, and 2. For “Retail Stores”, break out groceries and restaurants (high refrigeration load), which is different from big box retailers.
- In appendix, list what markets not included because of lower potential
- Get benchmarks on energy use for each segment
- Identify what high potential measures are “sloppy” vs. widget-based
- Identify what high potential measures/activities are “immediate” – one year or less, or require long lead time.
Further Data Mining: PG&E Customer Data

- Customer-specific data: includes demographic, billing, credit, usage, field activity, energy efficiency participation (rebates, measures installed, energy savings, etc.)
- Load Data: Interval metered data for sites equipped with interval metering @5, 15, 30 minute intervals (Inter Act II).
- Rate Class load shapes used in cost-of-service rate design
- Dynamic and static load profiles used for market settlement (Bundled and Direct Access)
- NOTE: PG&E has constraints on releasing customer data.
Further Data Mining: Survey Data

- Residential Appliance Saturation Survey (RASS) – 2003 – Statewide study with some PG&E specific data. Load shapes are not population weighted and represent the typical consumer in the sample.
- Demand Response Program
- Weather Data: ½ hourly temperature data from weather stations around the PG&E service territory.
- GIS data
- Energy Efficiency Potential studies
- What market assessment studies needed to understand future opportunities?
Further Data Mining: Non-PG&E Data

- 2000 Census data - e.g. MapInfo software
- Building Square footage data available through various databases including FW Dodge, Black’s Guide & County Tax records
- Federal and State publications and databases e.g. DOE, Energy Information Agency, CEC, etc.
- Various papers and publications through industry and affinity groups (AEIC, ACEEE, CEE, EPRI, GRI, etc.), academic institution publications associated with the industry.
- Databases available for purchase through private industry e.g. MAISY (Market Analysis and Information System), E-Source.