CALIFORNIA
ENERGY
COMMISSION

NET SYSTEM POWER: A SMALL SHARE OF CALIFORNIA'S POWER MIX IN 2005

STAFF REPORT

April 2006
CEC-300-2006-009-D

Arnold Schwarzenegger, *Governor*

CALIFORNIA ENERGY COMMISSION

Joseph Desmond
Chairman

Jackalyne Pfannenstiel
Vice Chair

Commissioners:
Arthur H. Rosenfeld
James D. Boyd
John L. Geesman

B.B Blevins
Executive Director

Terrence O'Brien
Deputy Director
SYSTEMS ASSESSMENT AND FACILITIES SITING DIVISION

David Ashuckian
Manager
ELECTRICITY ANALYSIS OFFICE

Mignon Marks
Al Alvarado
Principal Authors

Adam Pan
Terry Ewing
Jason Orta
Major Contributors

Introduction

This report provides the California Energy Commission's annual calculation of net system power as required by state law (Public Utilities Code, § 398.1 - 398.5). The report also defines net system power and explains how it was calculated and allocated to different fuel types and renewable energy technologies.

In addition to generating electricity within the state, California imports electricity from a vast network of power plants and transmission lines called the Western Interconnection. The net system power calculation includes imports, which are separated into two geographical regions: the Pacific Northwest (NW) and the Desert Southwest (SW).[1]

Consumers receive quarterly information about the fuel mix of net system power in a power content label provided to them by their electric utility company or energy service provider (ESP) if they are "direct-access" customers. The power content label may be particularly meaningful for customers purchasing electric service under a "green energy" program. Such programs usually charge a premium price per kilowatt-hour in exchange for assurances from the retailer that all or a large amount of renewable energy sources were used to provide their electrical service. Auditing provisions of the Energy Commission's Power Source Disclosure Program aim to ensure that the fuel-mix claims on the power content labels are true.

Calculation Methodology

California's power supply is identified by the types of fuel and renewable energy technologies used to generate it. Fuel types include coal, natural gas, nuclear, and other fuels, such as distillate fuel oil. Renewable energy technologies include biomass and waste, geothermal, solar, wind, and small hydroelectricity. This report uses the same definition for small hydroelectric facilities, 30 megawatts or less, as is used under the state's Renewable Portfolio Standard,. Electricity from large hydroelectric facilities is reported separately. Renewable energy facilities that use more than 25 percent natural gas as a supplemental fuel source are ineligible to be counted as renewable energy sources.

Specific purchases are defined by law as "electricity transactions which are traceable to *specific generation sources* by an auditable contract trail or equivalent, such as a tradable commodity system, that provides commercial verification that the electricity source claimed has been sold once and only once to a retail consumer [emphasis added]."[2] Specific purchases also include generation obtained from a utility's own power plants.

---

[1] The Pacific Northwest includes British Columbia, Idaho, Montana, Oregon, Washington, and Wyoming. The Desert Southwest states are Arizona, Colorado, New Mexico, Nevada, Texas (small portion only), and Utah.
[2] Chapter 796, Statutes of 1997, Article 14, PUC, Section 398.2 (b). See http://www.leginfo.ca.gov/pub/97-98/bill/sen/sb_1301-1350/sb_1305_bill_19971009_chaptered.pdf.

Gross system power is the sum of all in-state generation and electricity imports by fuel type. Each year, the gross-system-power mix changes, because NW hydroelectric energy varies from year to year and because the power plant fleet within the Western Interconnection continues to change as new facilities come on line and as existing facilities are "mothballed" or retired permanently.

Net system power represents the electricity generated in California or imported to serve California customers that no retailer has specifically identified and is calculated by totaling California's gross system power mix and then subtracting from this total the following amounts:

- Electricity procured by electricity retailers that they reported to the Energy Commission under the Power Source Disclosure Program as "specific purchases,"

- Electricity generated in California for use on-site rather than for retail sales

Figure 1, below, shows that as specific-purchase reporting by California's investor-owned and publicly owned utilities has increased over time, the amount of electricity defined as net system power has decreased. In 1998, net system power represented 94 percent of retail electricity sales, but in 2005, it was less than 30 percent of the total.

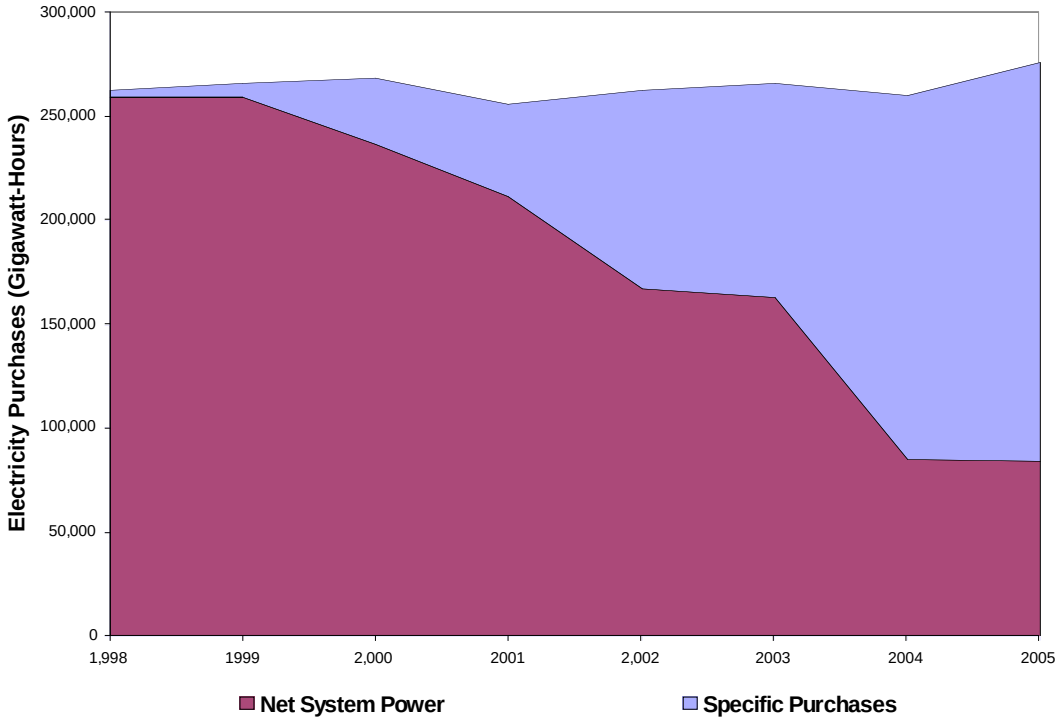
The statute and associated regulations defining the format and content of the power content label were implemented when net system power was expected to remain a high proportion of total electricity sales. Under those conditions, the power content label was envisioned as a means for reporting and comparing the "green" products offered by ESPs with the net system power procured by the state's investor-owned utilities. As a result, net system power is referred to in the power content label as the "California Power Mix," a designation which may mislead consumers to think that these values represent California's power mix as a whole. Starting with the *2002 Net System Power Report*, the Energy Commission began including a gross system power calculation to clarify the difference between net system power and California's power mix as a whole.

Retailers are required to participate in the Power Source Disclosure program, but they can choose to disclose specific purchases or use the California Power Mix percentages to represent their own power mix. By using the California Power Mix, a retailer avoids the annual requirement to report specific purchases. If a retailer makes a claim that its mix of power is different from the California Power Mix, however, then it is required to report specific purchases on its label and to submit annual reports to the Energy Commission.

By disclosing specific purchases, the retailer demonstrates to its customers how its power mix differs from the California Power Mix. By October of each year, the Energy Commission publishes a report entitled, "[Year] Reconciliation of Retailer

Claims." This report compares the sources of electricity that retailers have disclosed to their consumers to the actual energy generated for consumption by California consumers. This report also provides an appendix summarizing statewide participation in the Power Source Disclosure Program and listing the renewable power content for all retailers that made specific claims that year.

Figure 1
Net System Power Decreases as Reporting of Specific Purchases Increases



Findings

Table 1 is the Energy Commission's estimate of net system power for 2005.

Table 1
2005 California Net Power Mix

Fuel Type	
Coal	38.5%
Large Hydroelectric	23.5%
Natural Gas	33.3%
Nuclear	0%
Eligible Renewables	4.7%
Total:	**100%**

The following section explains why the California net power mix, as shown in Table 1, is not representative of California's actual power mix.

2005 Gross System Power Findings and Methodology

Table 2 presents the Energy Commission's estimate of California's gross system power, in gigawatt-hours and by percentages for 2005. These gross system power values show California's power mix as a whole.

The data for Table 2 came from a mix of information sources. Power plant owners in California are required to report their generation output to the Energy Commission by February 15 of each year. A small number of owners, however, typically miss this due date. As a consequence, the Energy Commission must use data from other sources, such as the Energy Information Administration's Form EIA-906 database, or from the previous year, to fill in the gaps. Other data come from California's control area operators, who are required to report summary information to the Energy Commission about electricity imports and exports. Variations in output from NW hydroelectric facilities typically lead to commensurate changes in output by natural gas-fired generators located in California and the SW.

Table 2
2005 Gross System Power (GSP) in Gigawatt Hours

Fuel Type	In-State	NW	SW	GSP	GSP %
Coal	28,129	4,926	24,796	**57,851**	**20.1%**
Large Hydro	34,500	12,883	1,701	**49,084**	**17.0%**
Natural Gas	96,088	1,786	10,812	**108,686**	**37.7%**
Nuclear	36,155	691	4,861	**41,707**	**14.5%**
Renewables	30,916			**30,916**	**10.7%**
Biomass and Waste	6,045			**6,045**	**2.1%**
Geothermal	14,379			**14,379**	**5.0%**
Small Hydro	5,386			**5,386**	**1.9%**
Solar	660[3]			**660**	**0.2%**
Wind	4,446			**4,446**	**1.5%**
Total	225,788	20,286	42,170	**288,245**	**100%**

The staff believes that the numerical values presented in the gross system power table are a reasonable, fairly accurate snapshot of California's power mix in 2005. These values, however, are not precise, because the staff's data collection and accounting systems used to quantify electricity generation and imports are not perfect.

For example, electricity generated from small-scale (less than 1 MW) facilities is not included in the above gross system power calculation. The locations and volumes of electricity generated by many of these facilities are not reported to the Energy Commission. The staff, however, is currently examining ways to obtain this information to provide a more comprehensive report in future years. Additional flaws in the current estimating methodology are identified in the following section.

Estimating Resource Mix of Out-of-State Power Imports

Currently there is no public, western-wide system that tags deliveries of contracted generation sources and short-term market purchases to specific population centers in California. As a result, the Energy Commission has made estimates and used general assumptions to allocate the quantities of imported electricity to specific fuel

[3] This number only includes generator-reported electricity, not electricity produced by the many small-scale PV installations throughout the state. Based on Renewables Program records, the state has financed approximately 135,517 kilowatts (kW) of solar photovoltaic (PV) capacity. Assuming that each installed kW of PV generated 1,500 kWh in 2005, then the combined output of these PV generators would total approximately 203.3 GWh.

types. This section of the report explains the methodology used for allocating imports.

California control area operators are required to report to the Energy Commission the annual amounts of electricity crossing California's borders as imports and exports. The electricity imports are included in the gross system power calculation and are grouped into two source regions, the Pacific Northwest and Desert Southwest. For simplicity sake, it is assumed that the annual average power mix in each region represents the generation source mix for imports from each region. These average mixes were determined from generator output data reported annually to the U.S. Energy Information Administration (EIA) by state and fuel type.

The staff excerpted from the EIA database information on the amounts of electricity generated by individual power plants located in the Western U.S. Electricity data for the Mohave, Intermountain Power, and Dixie Valley power plants were removed from these data, because their production was already counted as in-state generation. The staff then consolidated the electricity production data by fuel type and supplemented it with Canadian generation data obtained from BC Hydro. The generation data were then allotted to either the NW or SW regions and the sum for each region determined. The average power mix percentages computed for each region were based on those totals.

The percentage of the electricity generated from a particular resource type was multiplied by the net import amounts from each region. These estimates were then added to the corresponding fuel types of the in-state generation to obtain the gross system power totals.

The method for allocating regional imports by fuel type can be improved to more accurately reflect the sources of electricity bought and sold in each region's wholesale power market. There is sufficient information to identify the electricity imports coming from generation facilities that are partially owned by California utilities and the amounts associated with firm contracts. A resource allocation methodology would then be needed for determining the fuel types of the remaining balance of electricity imports.

The current methodology, although relatively simple to apply, also overstates the amount of electricity imports from other out-of-state baseload generators. Using this average mix methodology ignores the likelihood that the output from low-cost baseload power plants that are owned by out-of-state utilities remains in each utility's service area to serve its own customers. The baseload generator is likely committed to serving the utility's own customers, because it is typically the lowest cost resource. Under the average power mix method, however, the out-of-state utility is assumed to export a portion of its share of baseload generation to serve California consumers.

Another problem with the current methodology is that retailers' claims of specific purchases of nuclear and biomass-fueled electricity exceeded this year's estimates of gross system power for those fuel types. As a result, neither nuclear nor biomass energy appears in the net system power mix. A precise portrayal of this problem would have shown negative numbers in the net system power mix for these fuel types. Two factors contribute to this problem: under-reporting of gross system power due to data gaps in in-state generation and imports, and use of regional power mix averages rather than a more precise method for determining which fuel types are used to supply imports other than those claimed as specific purchases.

In addition, the staff was unable to obtain timely information on total in-state wind electricity generation for 2005. The staff, therefore, assumed that the sum of wind energy reported as specific-purchase claims equaled the total amount of wind energy in the gross system power mix.

A new import accounting methodology is needed to more accurately characterize how different types of generation facilities are likely to participate in the electricity markets of each region. For example, baseload units have a lower operating cost, are slow to ramp-up output, and are much more capital-intensive than typical load-following units. Baseload power plant owners generally need a long-term and steady commitment for nearly all of their facilities' output to operate at highest efficiency and to recover costs. Surpluses from these facilities may be available for sale as non-firm energy on the short-term market, but only during off-peak periods after it is assured that native load can be served.

A new accounting methodology is being developed by the staff and will be discussed at a workshop(s) this spring as part of the Energy Commission's greenhouse gas inventory update process. The workshop(s) will provide an opportunity for interested parties to comment on the staff's methodology and suggest modifications, if appropriate. Once the methodology is finalized, it is the staff's intention to apply it to 2005 and preceding years so that the information can be placed in historical context and trends identified.

Calculation of Net System Power

Table 3 shows that net system power is simply gross system power minus the claims of specific purchases and self-generation. Only the percentages for major fuel types are used on the power content label.

Table 3
2005 Net System Power (NSP) in Gigawatt Hours

Fuel Type	GSP	Claims	Self-Gen	NSP	NSP %
Coal	57,851	(25,211)	(235)	**32,405**	**38.5%**
Large Hydro	49,084	(29,301)		**19,783**	**23.5%**
Natural Gas	108,686	(69,229)	(11,465)	**27,992**	**33.3%**
Nuclear	41,707	(42,323)		**0**	**0%**
Eligible Renewables	30,916	(26,533)	(597)	**3,969**	**4.7%**
Biomass and Waste	6,045	(5,631)	(597)	**0**	**0%**
Geothermal	14,379	(11,008)		**3,371**	**4.0%**
Small Hydro	5,386	(4,829)		**557**	**0.7%**
Solar	660	(619)		**41**	**0%**
Wind	4,446	(4,446)		**0**	**0%**
Total	288,245	(192,597)	(12,297)	**84,149**	**100%**

Because the staff "zeroed out" electricity generated by nuclear and biomass resources rather than indicate negative numbers in the above NSP column, the total for NSP (84,149 GWh) is higher than the difference between gross system power minus specific claims and self generation (83,351 GWh). The percentages indicated under NSP % are based on 84,149 GWh, rather than 83,351 GWh. These same percentages also appear in Table 1.

Summary

Retailers must disclose the sources of power that they purchase on behalf of their customers to their customers. Unless retailers make specific claims that they can verify, they must use the net system power values provided in this report for purposes of disclosure.

The Energy Commission is required to compute and report net system power annually. The Energy Commission relies on information from generators, control area operators, and electricity retailers, as well as staff expertise on the operation of the Western Interconnection, to develop its report. This report represents the results of data collected for electricity generation and specific purchases in 2005. To provide consumers with the most accurate and transparent information regarding the sources of electricity being deployed to serve them, retail providers should give their customers information on specific purchases to the best of their ability, thereby minimizing the use of net system power as the default power mix.