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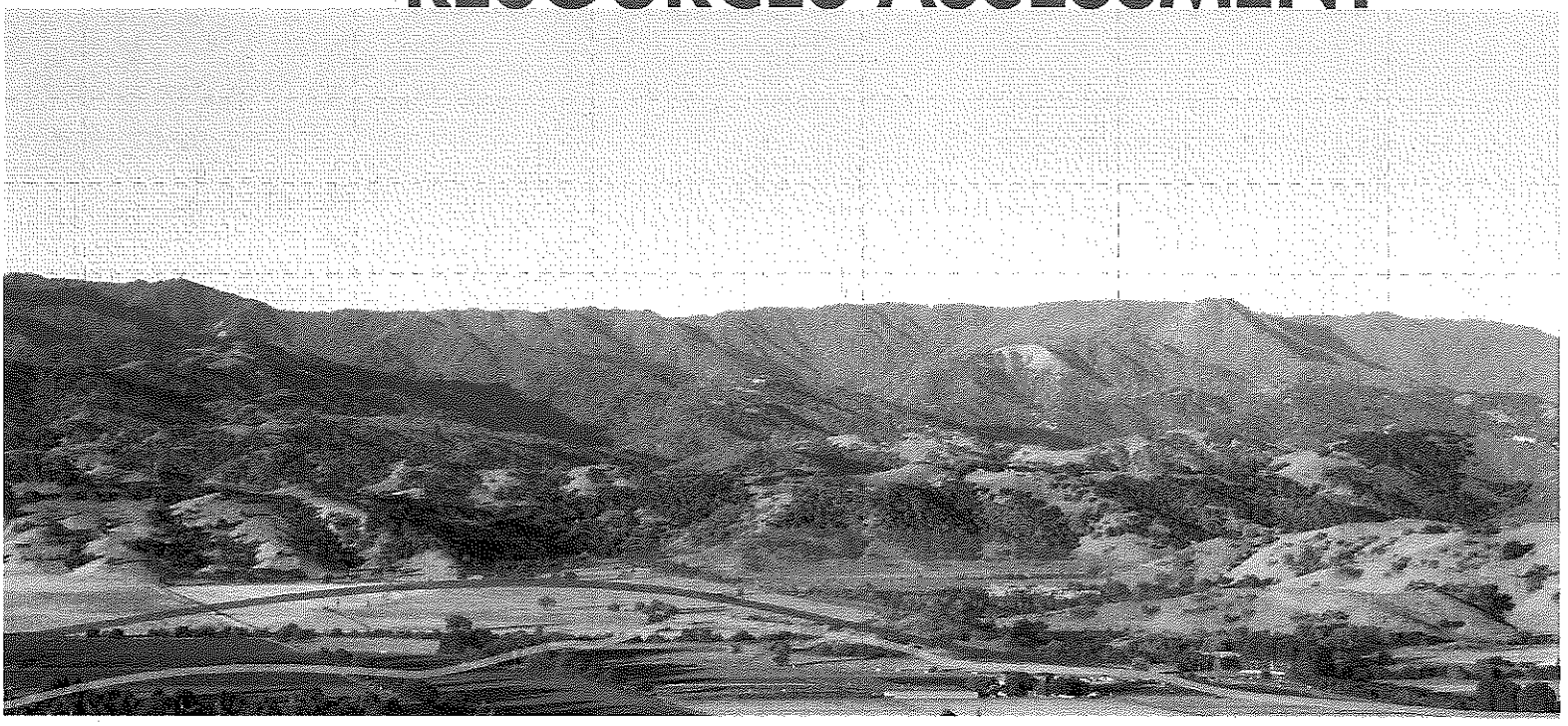
Attachment 9

2015 SUMMER LOADS & RESOURCES ASSESSMENT



California ISO

May 7, 2015

Prepared by: Infrastructure Development

Table of Contents

I. EXECUTIVE SUMMARY

The *2015 Summer Loads and Resources Assessment* provides an analysis of the upcoming summer supply and demand outlook in the California Independent System Operator (CAISO) balancing authority area. The CAISO works with state agencies, generation and transmission owners, load serving entities, and other balancing authorities to formulate the summer forecast and identify any issues regarding upcoming operating conditions. The loads and resources assessment considers the conditions across the entire CAISO balancing authority area (representing about 80 percent of California), and then further considers separately the conditions in the Northern California zone (North of Path 26 or NP26) and the Southern California zone (South of Path 26 or SP26). The decrease in hydro power supply from the continuing drought in California is of particular interest in 2015 and addressed in this report.

California Ongoing Drought Reduces Hydro Power Supply

Although California severe drought significantly reduces hydro power supply, the hydro generation reduction will not materially impact the reliability of the CAISO system this summer due to significant renewable generation additions, sufficient imports, and moderate peak demand growth.

The impacts of the continuing drought are increasing in severity as California moves into the drought's fourth year. As of April 16, 2015, the statewide hydrologic conditions were summarized as: 58 percent of average precipitation; 4 percent of April 1 average snowpack water content; and 60 percent of average reservoir storage according to California Department of Water Resources. The detailed hydrologic information is described on pages 16-18. Low snowmelt run-off and reservoir water storage will limit the capability of the state's hydroelectric resources.

- **Hydro generation reduction**

  The Final Net Qualifying Capacity (NQC) Report for Compliance Year 2015 indicates that CAISO hydro NQC available for peak demand in August is 7,428 MW.[1-2] NQC is the maximum capacity eligible and available for meeting the CPUC and CAISO resource adequacy requirements. The CAISO determines the NQC by applying performance criteria and deliverability restrictions as outlined in the CAISO tariff and the applicable business practice manual. However, under 2015's severe drought conditions, and based on discussions with Pacific Gas and Electric and Southern California Edison, the two largest hydro capacity owner/operators in the CAISO, the overall hydro derate for 2015 is projected to be 1,511 MW to 2,733 MW (base case and extreme scenarios respectively). These derates have been applied to the 2015 total CAISO hydro NQC of 7,428 MW.

[1] *Net Qualifying Capacity (NQC).* Retrieved from CAISO Reliability Requirements website – under header "Net qualifying capacity (NQC) and Effective Flexible Capacity (EFC)"
[2] *Master Control Area Generating Capability List* from CAISO Participating generator website – under header "New resource implementation process"

- **Potential thermal restriction**

  In considering the drought impact on thermal generation for summer 2015, the CAISO is tracking the thermal power plants potential to be out-of-service due to water supply curtailments. Among the thermal units greater than 20 MW, four natural gas-fired power plants that were identified to have water supply concerns during 2014 have addressed the issues by establishing alternatives or by monitoring and managing groundwater supply.

Renewable Additions and Imports Offset Hydro Power Reduction

Significant renewable generation additions, sufficient imports, and moderate peak demand growth have offset the impacts of reduced hydro generation availability.

- **Renewable generation additions**

  From June 1, 2014, to June 1, 2015, a total of 2,328 MW of additional generation is expected to reach commercial operation, with 1,350 MW in SP26 and 978 MW in NP26. As of April 15, 2015, 2,050 MW of this additional generation was in commercial operation with an additional 278 MW expected by June 1, 2015. Of the 2,328 MW, approximately 96 percent is solar, 3.4 percent is wind, and 0.6 percent is biogas.

- **Imports from outside California**

  The ISO is projecting system net-imports of 9,500 MW under normal summer peak conditions, compared to 9,000 MW 2014. As of April 16, 2015, the Northwest River Forecast Center projected the April to August reservoir storage in Columbia - Dalles Dam to be 80 percent of average.[3] Although current water supply for Pacific Northwest in 2015 is lower than that in 2014, the Bonneville Power Administration does not indicate concerns with Pacific Northwest hydroelectric generation and the CAISO is projected to have sufficient internal generation without relying on import levels from the Pacific Northwest that are beyond 2015 hydro generation expectations.

  The current reservoir elevation at Hoover Dam of 1,084 feet above sea level is the second lowest level since 1938.[4] This elevation is not expected to drop materially lower through the year and no material impacts in capability of Hoover hydro generation are anticipated for summer 2015.

  With lower hydro output in California there may be a need for increased imports during peak load conditions; however if certain transmission facilities are out of service, the California – Oregon Intertie (COI) thermal limit could be a limiting condition on imports from the Pacific Northwest during these outage conditions. Nevertheless, it is anticipated that dynamically scheduled and other generation from the Four Corners will be available for surplus energy sales into the CAISO during the peak hours.

[3] http://www.nwrfc.noaa.gov/water_supply/ws_forecasts.php?id=TDAO3
[4] http://www.usbr.gov/lc/region/g4000/hourly/mead-elv.html

Local Reliability Concerns and the Ongoing Drought

Hydro generation reductions may impact power supply in the San Joaquin Valley area. Under the extreme low hydro generation and high load scenario, this area may be subject to potential overloads under various contingencies. A procedure has been put in place to manage water resources to ensure that there is sufficient power supply during the peak hours. Although Orange County and San Diego are susceptible to reliability concerns due to the loss of the San Onofre Nuclear Generating Station, new online transmission facilities and system upgrades in the area are expected to be completed this summer and will improve the overall power supply reliability.

The unusually dry conditions across the state may create a heightened risk of wildfires. Fire in the vicinity of major transmission lines may cause line outages. This is a particular concern in the Orange County, Riverside County, San Bernardino County, and Los Angeles County local areas during higher summer peak load conditions, which could result in low voltage levels that could trigger localized customer outages. It is likely under such conditions that both demand response programs and Flex Alert conservation appeals would be used to lessen the strain on the grid.

Overall CAISO System-wide and Zonal Reliability

Even with the ongoing drought concerns, the *2015 Loads and Resources Assessment* projects adequate supply during 2015 peak demand conditions at the system wide level and for the NP26 and SP26 regions when considered independently. This projection is based on examining the operating reserve margins under normal and extreme scenarios with both deterministic and more sophisticated probabilistic approaches.

The summer 2015 supply and demand outlook for the entire CAISO system, NP26 and SP26 is shown in tables 1 through 3. Planning reserve margins under the normal peak demand scenario are projected to be 39.1 percent for the CAISO system, 35.3 percent for SP26, and 44.4 percent for NP26 (*Table 1)*.

Operating reserve margins, which represent planning reserve margins adjusted for generation outages and hydro derates, under the normal summer conditions are expected to be 25.3 percent for the CAISO system, 25.0 percent for SP26, and 26.4 percent for NP26 (*Table 2* and *Figure 1)*.

Both the planning reserve margin and the normal operating reserve margin are projected to be greater than the California Public Utility Commission's 15 percent resource adequacy requirement for planning reserve margin.

Projected operating reserve margins under the normal scenario from 2005 to 2015 are shown in *Figure 2*. The operating reserve margins are trending upward and the projected margin for 2015 is the second largest in the past ten years. This is primarily due to the significant amounts of new renewable generation going into commercial operation to meet the 2020 33 percent Renewable Portfolio Standard. Projected retirements of gas-fired generation relying on coastal waters for once-through cooling will not materialize until the 2018-2020 timeframe. The normal scenario for operating reserves is defined for system and zonal conditions as moderate net imports, 1-in-2 generation outages, and 1-in-2 peak demand. A 1-in-2 event means the event has an equal probability of the outcome falling below the forecast value or exceeding the forecast value.

Under an extreme scenario, operating reserve margins are projected to drop to 11.5 percent for the CAISO system, 9.5 percent for SP26 and 8.7 percent for NP26 (*Table 3* and *Figure 1*), which are well above the firm load shedding threshold of 3 percent. The extreme scenario is defined as low net imports, 1-in-10 generation outages, and 1-in-10 peak demand – a very low probability event. A 1-in-10 event means the event has a 90 percent probability of the outcome being less than or equal to the forecast value, or conversely, a 10 percent probability of the outcome being greater than or equal to the forecast value.

The projected probability of experiencing involuntary load curtailments from low operating reserve margins in summer 2015 is 0.12 percent for CAISO system, 0.00 percent for SP26 and 0.06 percent for NP26, which assumes moderate imports and a high hydro derate scenario. These projected probabilities are based on historical generating resource availabilities taking into account generation outages and the forecast range of weather driven peak demand levels and does not attempt to determine potential load curtailment risks due to transmission line outages.

The CAISO peak demand for summer 2015 is projected to reach 47,188 MW under 1-in-2 weather conditions, which is 959 MW more than the 2014 weather normalized peak of 46,229 MW. The weather normalized peak is an estimate of what the peak would have been under normal weather conditions. The increase in the CAISO peak demand forecast is a result of a moderate economic growth forecast from Moody's Analytics.

The CAISO projects that 54,322 MW of net qualifying capacity (NQC) will be available for summer 2015 (Table 7). A total of 2,328 MW of additional generation added since last year's report is made up of 2,050 MW of new generation that reached commercial operation between June 1, 2014 and April 15, 2015, as well as an additional 278 MW that is expected to go into commercial operation during the April 16, 2015 to June 1, 2015 timeframe.

An estimated 1,839 MW of demand response and interruptible load programs will be available for deployment during summer 2015. Demand response can reduce summer peak demands and provide grid operators with additional system flexibility during periods of limited supply. Demand response can also provide economic day-ahead and real-time energy and ancillary service.

The 2015 summer imports during peak load conditions are projected to vary from 8,300 MW to 10,100 MW for the CAISO, 8,500 MW to 9,800 MW for SP26, and 1,100 MW to 2,500 MW for NP26. The projected 2015 moderate imports for the CAISO is 9,500 MW. Having sufficient imports are essential in maintaining system reliability under extreme conditions.

Table 1

Planning Reserve Margins

Summer 2015 Supply & Demand Outlook (Planning Reserve Margins)			
Resource Adequacy Planning Conventions	**ISO**	**SP26**	**NP26**
Existing Generation[5]	54,044	26,660	27,384
Retirement	0	0	0
High Probability Addition[6]	278	117	161
Net Interchange (Moderate)[7]	9,500	8,700	2,000
Total Net Supply (MW)[8]	63,822	35,477	29,545
DR & Interruptible Programs[9]	1,840	1,297	543
Demand (1-in-2 Summer Temperature)[10]	47,188	27,183	20,832
Planning Reserve Margin[11]	**39.1%**	**35.3%**	**44.4%**

Table 2

Normal Scenario Operating Reserve Margins

Summer 2015 Outlook - Normal Scenario 1-in-2 Demand, 1-in-2 Generation Outage and Moderate Imports			
Resource Adequacy Conventions	**ISO**	**SP26**	**NP26**
Existing Generation	54,044	26,660	27,384
Retirement	0	0	0
High Probability Additions	278	117	161
Hydro Derate	(1,511)	(634)	(878)
Outages (1-in-2 Generation)[12]	(5,028)	(2,163)	(2,882)
Net Interchange (Moderate)	9,500	8,700	2,000
Total Net Supply (MW)[13]	57,283	32,680	25,785
DR & Interruptible Programs	1,840	1,297	543
Demand (1-in-2 Summer Temperature)	47,188	27,183	20,832
Operating Reserve Margin[14]	**25.3%**	**25.0%**	**26.4%**

[5] Refer to Table 7. Conventional 72%, Renewable 28%.
[6] Refer to Table 6.
[7] Refer to Table 8. Net Interchanges of CAISO, SP26 and NP26 are not coincident.
[8] Total Net Supply = Existing Generation + High Probability Additions – Hydro Derate – Retirements + Net Interchange
[9] Refer to Table 9.
[10] Refer to Table 10.
[11] Planning Reserve Margin = [(Total Net Supply + Demand Response + Interruptible) / Demand] – 1
[12] Refer to Table 8. Outages of CAISO, SP26 and NP26 are not coincident.
[13] Total Net Supply = Existing Generation + High Probability Additions – Hydro Derate – Retirements – Outages + Net Interchange
[14] Operating Reserve Margin =[(Total Net Supply + Demand Response + Interruptible)] / Demand -1

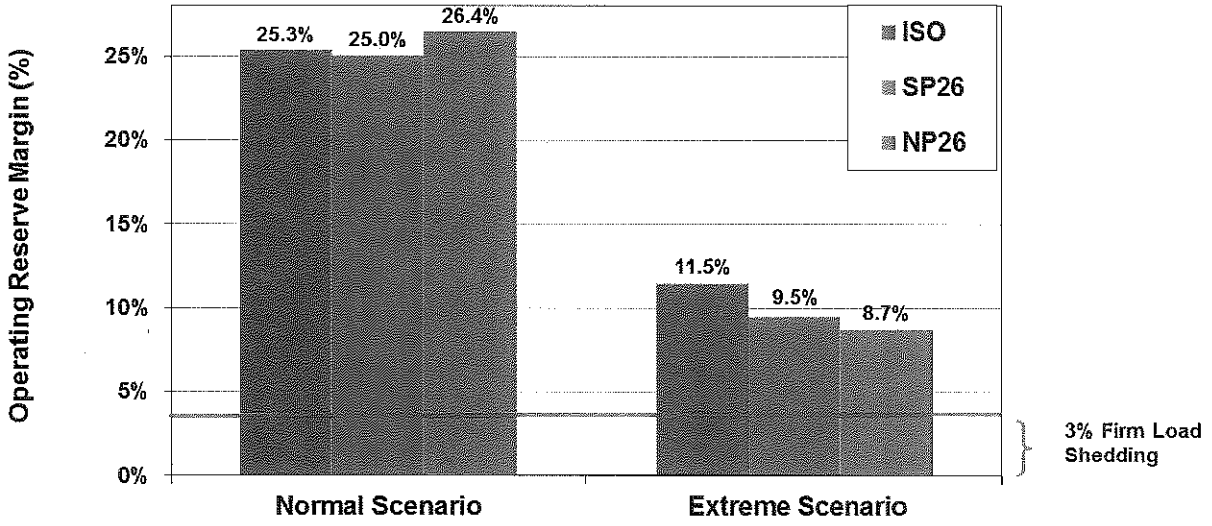
Table 3

Extreme Scenario Operating Reserve Margins

Summer 2015 Outlook - Extreme Scenario 1-in-10 Demand, 1-in-10 Generation Outage and Low Imports			
Resource Adequacy Conventions	**ISO**	**SP26**	**NP26**
Existing Generation	54,044	26,660	27,384
Retirement	0	0	0
High Probability Additions	278	117	161
Hydro Derate	(2,733)	(1,336)	(1,397)
High Outages (1-in-10 Generation)	(6,704)	(3,478)	(4,165)
Net Interchange (Low)	8,300	8,500	1,100
Total Net Supply (MW)	53,185	30,463	23,083
DR & Interruptible Programs	1,840	1,297	543
High Demand (1-in-10 Summer Temperature)	49,370	29,006	21,735
Operating Reserve Margin	**11.5%**	**9.5%**	**8.7%**

Figure 1

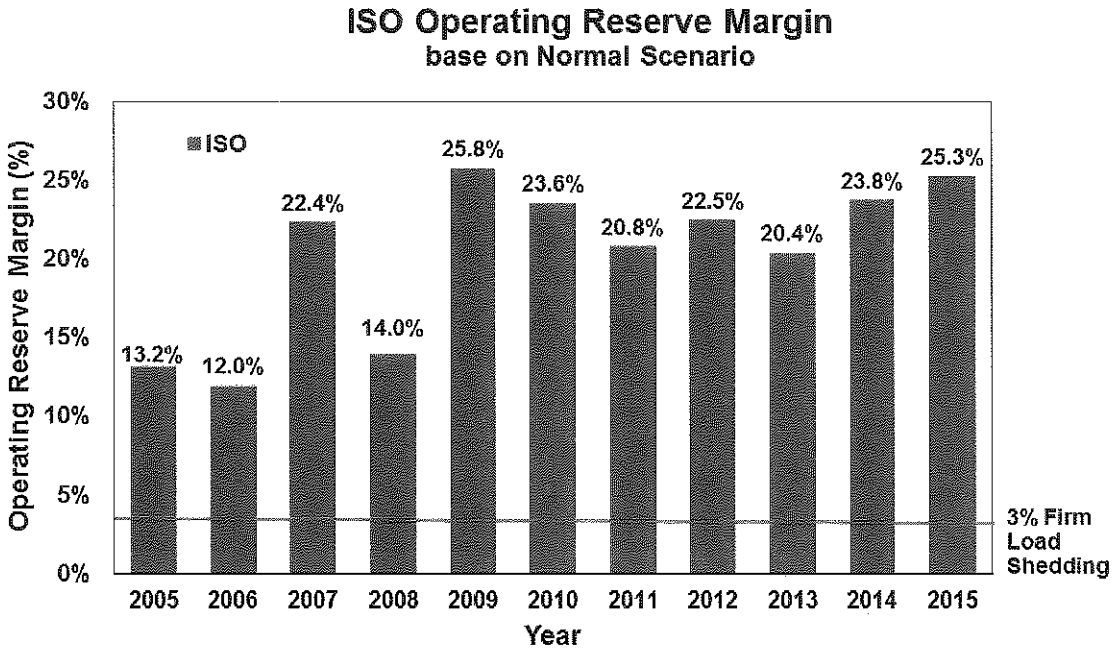
ISO, SP26 and NP26 Operating Reserve Margins at 2015 Summer Peak



Notes:
- Demand based on 1-in-2, or 1-in-10 Weather.
- Outages based on 1-in-2, or 1-in-10 Generation curtailments.
- All Demand Response and Interruptible Load has been utilized.

Figure 1 shows adequate operating reserve forecast margins under the normal and extreme scenarios. The operating reserve margins for CAISO, SP26 and NP26 are projected to be well above the 3% firm load shedding threshold in all scenarios.

Figure 2



Note: Operating Reserve Margin in this report were projected prior to each summer

Figure 2 shows forecasts of normal operating reserve margins have remained ample and fairly consistent since 2009.

Preparation for Summer Operation

Producing this report and publicizing its results is one of many activities the CAISO undertakes each year to prepare for summer operations. Other activities include coordinating meetings on summer preparedness with the Western Electricity Coordinating Council (WECC), California Department of Forestry and Fire Protection (Cal Fire), natural gas providers and neighboring balancing areas. The CAISO's ongoing relationships with these entities help to ensure everyone is prepared during times of system stress.

Future Trends

Significant amounts of new renewable generation has reached commercial operation and this trend is expected to continue as new renewable generation comes on line to meet the state's 33 percent Renewables Portfolio Standard (RPS). A certain amount of flexible and fast responding resources must be maintained on the system to ensure reliable operation while meeting RPS goals.

The roughly 10,517 MW of natural gas fired capacity subject to the once-through-cooling regulation, which requires coastal power plants that use ocean water for cooling to be retired, retrofitted or repowered, is a continuing issue that ongoing plans are seeking to address. As noted earlier, the bulk of the generation retirements forecast to occur as a result of this requirement are not anticipated until the 2018-2020 time frame. However, the CAISO is working closely with state agencies and plant owners as they develop and implement plans to for complying with these regulations in a manner that ensures electric grid reliability is maintained throughout the transition.

II. SUMMER 2014 REVIEW

Demand

The recorded 2014 summer peak demand reached 44,703 MW on September 15, 2014. Adjusting for the normalized weather conditions, this translates into a peak load of 46,229 MW for CAISO in 2014, which is an increase of only 0.4 percent from the 2013 summer weather normalized peak demand of 46,063 MW. The low load growth is the result of slow economic recovery from the recession and the increasing trend of behind the meter solar photovoltaic installations. The SP26 summer peak demand was 27,747 MW and NP26 peak demand reached 19,516 MW. The annual peaks for NP26, SP26 and CAISO happened in July and September, respectively. The annual peaks did not occur coincidently due to weather diversity between northern and southern California.

Figure 3 shows CAISO, SP26 and NP26 actual monthly peak demand from 2006 to 2014. The CAISO summer peak dropped each year from 50,085 MW in 2006, which was high because of extreme weather conditions and a stronger economy, to 45,809 MW in 2009 as demand moderated during the recession. Demand has fluctuated since 2009 based on changing economic, demographic and weather conditions. The CAISO, SP26 and NP26 daily peaks from June to September 2014 are shown in *Appendix A: 2014 Summer Supply and Demand Summary Graphs.*

Figure 3

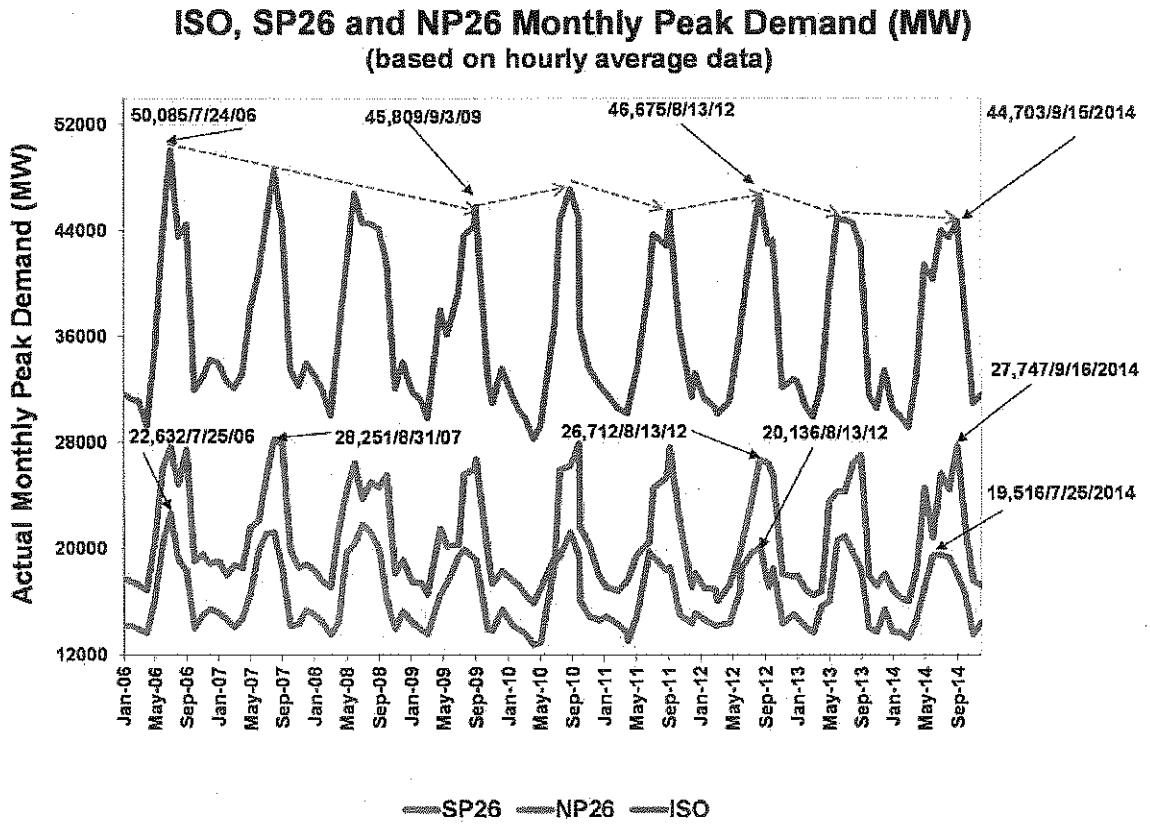


Figure 3 shows the CAISO balancing authority system peak as well as peaks for Northern and Southern California (2006-2014).

Table 4 shows the difference between 2014 actual peak demands and 2014 1-in-2 peak demand forecasts. The actual peak demand in 2014 equated to a 1-in-1.43 temperature event. The weather normalized peak load for CAISO in 2014 was 46,229 MW.

The actual peak demand in Northern California was 1,936 MW lower than 1-in-2 forecast peak demand for NP26. The weather at the time of the actual NP26 peak demand was a 1-in-1 temperature event. A combination of a mild weather pattern, demand response, and an actual economic growth slower than that forecasted by Moody's was the main contributor to the actual peak demands being lower than 1-in-2 forecast peak demands for CAISO and NP26.

However, the actual peak demand in Southern California was 753 MW higher than the 1-in-2 forecast peak demand for SP26, The weather at the time of the SP26 peak demand was a 1-in-5 temperature event.

Table 4

2014 ISO Actual Peak Demand vs. Forecasts				
	1-in-2 Forecast (MW)	Actual (MW)	Difference from 1-in-2 Forecast (MW)	Difference from 1-in-2 Forecast (%)
ISO	47,351	44,703	-2,648	-5.6%
SP26	26,994	27,747	753	2.8%
NP26	21,452	19,516	-1,936	-9.0%

Generation

Actual daily generation levels during June through September 2014 for the CAISO system, the SP26 and NP26 zones are shown in *Appendix A: 2014 Summer Supply and Demand Summary Graphs.*

Generation Outages

The CAISO average weekday generation outage amount from June 2014 to September 2014 was 4,659 MW, which was lower than the 5,104 MW average in 2013. The SP26 average weekday outage amount was 2,082 MW, which was lower than the 2,927 MW average in 2013. The NP26 average weekday outage amount was 2,577 MW, which was higher than the 2,178 MW average in 2013. Graphs in *Appendix C: 2012 – 2014 Summer Generation Outage Graphs* show the weekday hour-ending 16:00 forced and planned outage amounts during the summer peak days from June 15 through September 30 for 2012, 2013, and 2014 (excluding holidays). The graphs recognize forced and planned generation outages, but do not include ambient and normal outages as these amounts were accounted for in the NQC listing and based on most likely summer peak weather conditions.

A forced outage is where the equipment is unavailable for use and includes removing from service the availability of a generating unit, transmission line or other facility. A planned outage is the outage where the shutdown of a generating unit, transmission line, or other facility, is for inspection or maintenance, in accordance with an advance schedule. An

ambient outage is a special type of outage where the cause is due to ambient conditions outside of the resource operator's control. The ambient conditions include high ambient temperatures, exceeding air emission limits, lack of fuel, short of water, low steam pressure, geomagnetic disturbance, earthquake, or catastrophe. Normal outage is the outage when the unit cannot response to a dispatch due to designed operations.

Imports

Figure 4 shows the 2014 CAISO peak and the net interchange over the weekday summer peak load period. There are numerous factors that determine to the level of interchange between the CAISO and other balancing authorities at any given point in time (refer to the Imports section on page 19).

The imports at the 2014 summer peak for CAISO and NP26 dropped from 2013. The CAISO imports at the peak reduced from 8,780 MW in 2013 to 7,329 MW in 2014 and NP26 imports at its peak decreased from 2,331 MW in 2013 to 1,114 MW in 2014. These decreases were due in part to higher in-state generation dispatch in Southern California in 2014 and low loads due to mild weather. However, the SP26 imports at its peak increased from 8,306 MW in 2013 to 9,126 MW in 2014 due to higher peak demand than 2013. *(Appendix D: 2012 – 2014 Summer Imports Summary Graph)*

Figure 4

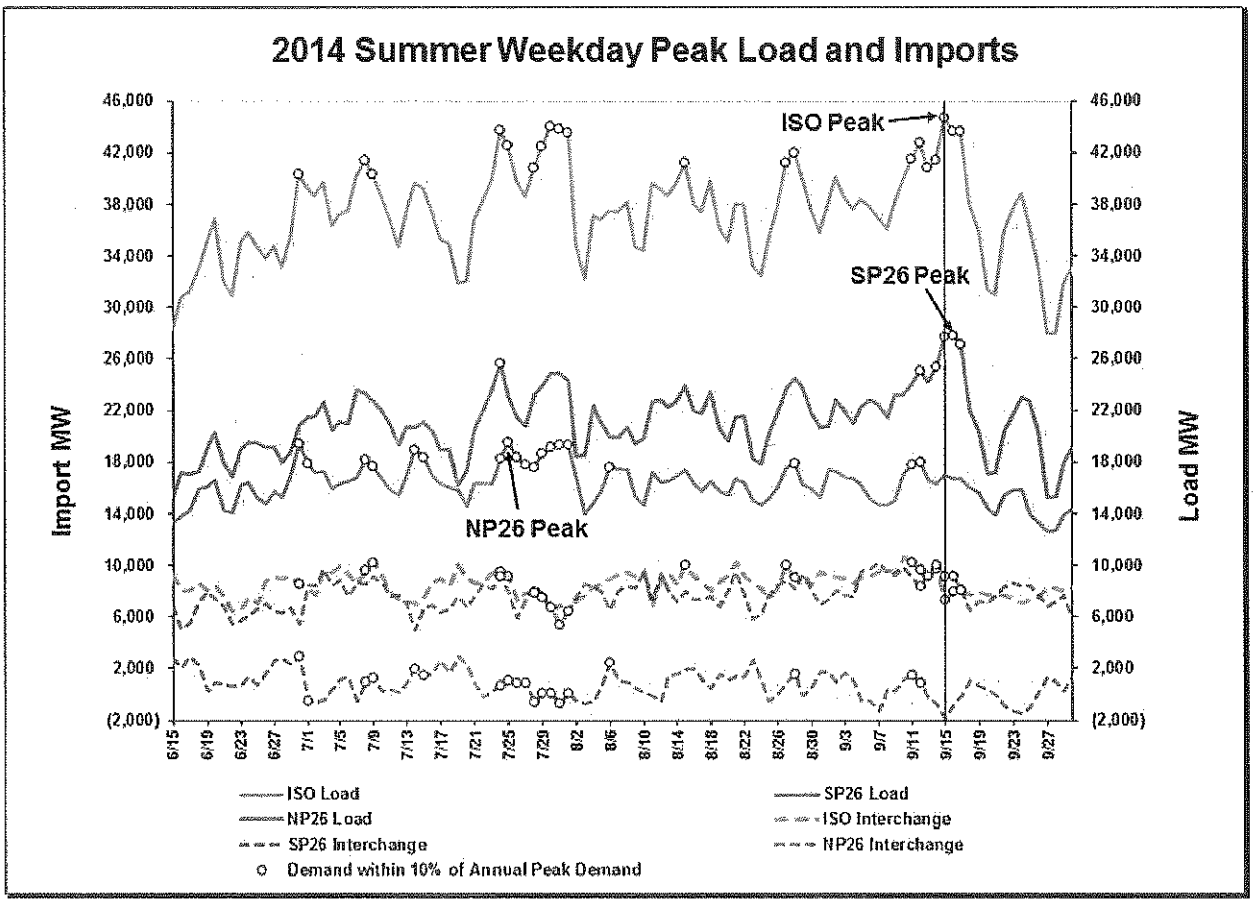


Figure 4 shows the amount of imports at CAISO daily system peaks.

III. SUMMER 2015 ASSESSMENT

Generation net dependable capacity

As of April 15, 2015, the net dependable capacity (NDC) of the ISO balancing area was 65,288 MW, including 32,590 MW in SP26 and 32,698 MW in NP26. The NDC is the maximum capacity of a unit during typical seasonal peak conditions less the unit's capability used for station service or auxiliaries. It includes the capability of a unit that may be temporarily inoperable because of maintenance (e.g. planned outages), forced outage, or other reasons, or only operable at less than full output (such as the ambient or normal outages discussed above). This excludes power required for plant operation and emergency power for unit startup and shutdown. The net dependable capacity of the ISO balancing area is shown in Appendix B 2015 ISO NDC and RPS by Fuel Type.

Generation in the ISO balancing authority is primarily fueled by natural gas (58.8 percent), followed by 24.3 percent renewables portfolio standard resources, 12.5 percent large hydro, 3.5 percent nuclear units and 0.9 percent of oil and coal. The ISO used the California Public Utilities Commission methodology for determining the components of the renewables portfolio standard generation.[15]

The 24.3 percent of the CAISO's 65,288 MW net dependable capacity, or 15,843 MW that is renewable generation is composed of 38.6 percent wind, 37.0 percent solar, 9.9 percent geothermal, 7.9 percent small hydro, 4.0 percent biomass, and 2.6 percent biogas. The addition of large amounts of renewable generation provides greater fuel diversity and will help to offset California's historical heavy reliance on natural gas for electrical energy generation.

Generation net qualifying capacity

The ISO bases its summer planning and operating reserves on the total net qualifying capacity (NQC) of its resource fleet. Total CAISO generation NQC (before hydro derates) for the 2015 summer peak is estimated to be 54,322 MW, a 2,328 MW increase from June 1, 2014. This additional amount will help meet expected load growth and offset the hydro derate for this summer. Each year, California Public Utilities Commission (CPUC), the California Energy Commission (CEC) and the CAISO work together to publish an NQC list, which describes the amount of capacity that can be counted from each resource to meet Resource Adequacy requirements in the CPUC's and CAISO's RA programs. To account for the variable output of intermittent resources, the NQC calculation process uses a three-year rolling average of historical production data to determine the NQC for each wind, solar, or other non-dispatchable resource. The NQC for dispatchable resources depends on its availability and deliverability – the ability of the grid to deliver the generation to load centers. The CAISO determines the net qualifying capacity by testing and verification as outlined in the CAISO tariff and the applicable business practice manual.

The largest available generation resource type is natural gas generation accounting for 66.2 percent and the second largest generation type is non-hydro renewables including geothermal, biogas, biomass, wind and solar units that make up about 15.1 percent. Hydro accounts for 13.7 percent. Nuclear generation accounts for 4.2 percent while coal and oil

[15] Renewable Energy and RPS Eligibility; website: http://www.cpuc.ca.gov/PUC/energy/Renewables/FAQs/01REandRPSeligibility.htm

generation provide 0.9 percent. To illustrate the overall contribution of hydro resources, the NQC amount for hydro is combined into one category regardless of a hydro unit's ability to qualify as a renewables portfolio standard resource. On-peak NQC by fuel type is shown in *Appendix E: 2015 CAISO Summer On-Peak NQC Fuel Type.*

Generation additions

Table 5 shows the total net qualifying capacity generation of 2,050 MW of new generation interconnected to the CAISO balancing authority that came on line in the period from 6/1/2014 to 4/15/2015. This new NQC included 1,233 MW in SP26 and 817 MW in NP26. After 4/16/2015, 278 MW of additional NQC is expected to come on line by June 1, 2015 as shown in *Table 6*, with 117 MW in SP26 and 161 MW in NP26. New generation with zero NQC are not listed in *Tables 5* and *6*.

Table 7 shows the total generation capacity changes within the CAISO since 6/1/2014 and expected by 6/1/2015. A total of 2,238 MW of generation additions are expected to enter commercial operation for this summer, 1,291 MW in SP26 and 947 MW in NP26. This table was developed using the final NQC list that was used for the California Public Utilities Commission's and CAISO's resource adequacy program for compliance year 2015, which the CAISO posted to its website. Generators who chose not to participate in the NQC process were added using the CAISO Master Control Area Generating Capability List, which is also posted on the CAISO website.[16]

[16] *Master Control Area Generating Capability List* website : http://www.caiso.com/participate/Pages/Generation/Default.aspx

Table 5

New Generating Capacity (MW)
(Generation that achieved commercial operation from 6/1/ 2014 to 4/15/2015)

Resource ID	COD	NDC	NQC (est)	Fuel Type	Area
MIDWD_6_WNDLND	03-Jun-14	7.5	1.6	WIND	SCE
AGUCAL_5_SOLAR1	10-Jun-14	290.0	198.5	SUN	SCE
HOLSTR_1_SOLAR	16-Jun-14	1.5	1.0	SUN	PGAE
REEDLY_6_SOLAR	17-Jun-14	1.2	0.8	SUN	PGAE
AVSOLR_2_SOLAR	19-Jun-14	241.5	165.3	SUN	PGAE
ARVINN_6_ORION1	26-Jun-14	12.0	8.2	SUN	PGAE
ARVINN_6_ORION2	26-Jun-14	8.0	5.5	SUN	PGAE
CLOVDL_1_SOLAR	26-Jun-14	1.5	1.0	SUN	SCE
CNTNLA_2_SOLAR1	30-Jul-14	127.0	86.9	SUN	SCE
VICTOR_1_SLRHES	08-Aug-14	1.5	1.0	SUN	PGAE
CNTNLA_2_SOLAR2	15-Aug-14	45.6	31.2	SUN	PGAE
SUNSHN_2_LNDFL	01-Sep-14	20.0	12.2	LANDFILL GAS	PGAE
OLIVEP_1_SOLAR2	01-Oct-14	19.8	13.5	SUN	PGAE
SLSTR1_2_SOLAR1	22-Oct-14 COM	177.0	121.1	SUN	SDGE
TOPAZ_2_SOLAR	27-Oct-14	550.0	376.4	SUN	PGAE
PLAINV_6_BSOLAR	07-Nov-14	20.0	13.7	SUN	PGAE
LAMONT_1_SOLAR1	11-Nov-14	60.0	41.1	SUN	PGAE
ACACIA_6_SOLAR	13-Nov-14	20.0	13.7	SUN	PGAE
DELSUR_6_DRYFRB	14-Nov-14	5.0	3.4	SUN	PGAE
VICTOR_1_LVSLR1	19-Nov-14	10.0	6.8	SUN	PGAE
VICTOR_1_LVSLR2	20-Nov-14	20.0	13.7	SUN	SCE
BREGGO_6_DEGRSL	26-Nov-14	6.5	4.4	SUN	PGAE
LIVEOK_6_SOLAR	27-Nov-14	1.3	0.9	SUN	SDGE
SANDLT_2_SUNITS	04-Dec-14	250.0	171.1	SUN	SDGE
DSRTSN_2_SOLAR1	05-Dec-14	300.0	205.3	SUN	SDGE
DSRTSN_2_SOLAR2	05-Dec-14	250.0	171.1	SUN	SCE
CAMLOT_2_SOLAR2	10-Dec-14	15.0	10.3	SUN	PGAE
CAMLOT_2_SOLAR1	11-Dec-14	45.0	30.8	SUN	SDGE
ADMEST_6_SOLAR	13-Dec-14	19.0	13.0	SUN	SCE
LEPRFD_1_KANSAS	18-Dec-14	20.0	13.7	SUN	PGAE
SLSTR2_2_SOLAR2	18-Dec-14 COM	235.5	161.2	SUN	SCE
PUTHCR_1_SOLAR1	19-Dec-14	2.0	1.4	SUN	SCE
GARNET_1_SOLAR2	23-Dec-14	4.0	2.7	SUN	SCE
KNTSTH_6_SOLAR	24-Dec-14	20.0	13.7	SUN	SCE
OLDRV1_6_SOLAR	30-Dec-14	20.0	13.7	SUN	PGAE
CORCAN_1_SOLAR1	09-Jan-15	20.0	13.7	SUN	SCE
RTREE_2_WIND1	12-Jan-15	79.2	17.3	WIND	SCE
RTREE_2_WIND2	12-Jan-15	19.8	4.3	WIND	SCE
LITLRK_6_SOLAR1	17-Jan-15	5.0	3.4	SUN	SCE
GARNET_2_WIND1	26-Jan-15	11.2	2.5	WIND	PGAE
PMPJCK_1_SOLAR1	27-Jan-15	19.5	13.3	SUN	PGAE
WLDWD_1_SOLAR1	19-Feb-15	20.0	13.7	SUN	PGAE
VEGA_6_SOLAR1	23-Mar-15	20.0	13.7	SUN	PGAE
LHILLS_6_SOLAR1	02-Apr-15	20.0	13.7	SUN	PGAE
SKERN_6_SOLAR1	07-Apr-15	20.0	13.7	SUN	PGAE
BLCKWL_6_SOLAR1	10-Apr-15	12.0	8.2	SUN	PGAE
CHINO_2_SOLAR2	13-Apr-15	1.5	1.0	SUN	PGAE
VALLEY_5_SOLAR1	13-Apr-15	1.5	1.0	SUN	PGAE
Total		3,077	2,050		ISO
		1,874	1,233		SP26
		1,203	817		NP26

Note: COM means commercial operations for markets

Table 6

ISO Generation Addition from 6/1/2014 to 6/1/2015 (MW)				
Generation Addition NQC	Solar	Wind	Biogas	Total
from 6/1/2014 to 4/15/2015	2012	26	12	2050
from 4/16/2015 to 6/1/2015	222	56	1	278
from 6/1/2014 to 6/1/2015	2234	82	13	2328

Table 7

Total Expected Generation Change from June 1, 2014 to June 1, 2015 (MW)						
	from 6/1/2014 to 4/15/2015	As of 4/15/ 2015	from 4/16/2015 to 6/1/2015	from 4/16/2015 to 6/1/2015	for 2015 Summer	for 2015 summer
	Additions COD	Existing	High Probability Additions	Retirement	Total Expected Change	Total Expected
ISO	2,050	54,044	278	0	2,328	54,322
SP26	1,233	26,660	117	0	1,350	26,777
NP26	817	27,384	161	0	978	27,545

This assessment uses all capacity available within the CAISO balancing authority regardless of contractual arrangements to evaluate resource adequacy in order to understand how the system will respond under contingencies. While some resources may not receive contracts under the resource adequacy program, and may contract with entities outside the CAISO for scheduled short-term exports, these resources are still considered available to the CAISO ISO for the purposes of this report.

The NQC values for wind and solar are determined and annually adjusted based on actual output during peak hours over a three-year period. If the CAISO balancing authority experiences extreme weather conditions beyond what is considered by the NQC calculation process, it is possible that not all of the capacity accounted for will be available because the unit ratings of combustion turbines and some other resources are impacted by high ambient temperatures. However, no adjustments for extreme high temperature impacts to NQC values were made in this report.

Generation unavailability

The estimated 1-in-2 generation outages during the 2015 summer peak demand periods for the CAISO, SP26 and NP26 are 5,028 MW, 2,163 MW and 2,882 MW, respectively. The estimated 1-in-10 generation outages for the CAISO, SP26 and NP26 are 6,704 MW, 3,478 MW and 4,165 MW, respectively (*Table 8*). The last three years of generation outages during the peak demand period were used to develop a range of outages for the probabilistic analysis and to determine the 1-in-2 and 1-in-10 outage levels for the deterministic analysis.

Table 8

Generation Outages for Summer 2015 (MW)			
	ISO	SP26	NP26
1-in-2	5,028	2,163	2,882
1-in-10	6,704	3,478	4,165

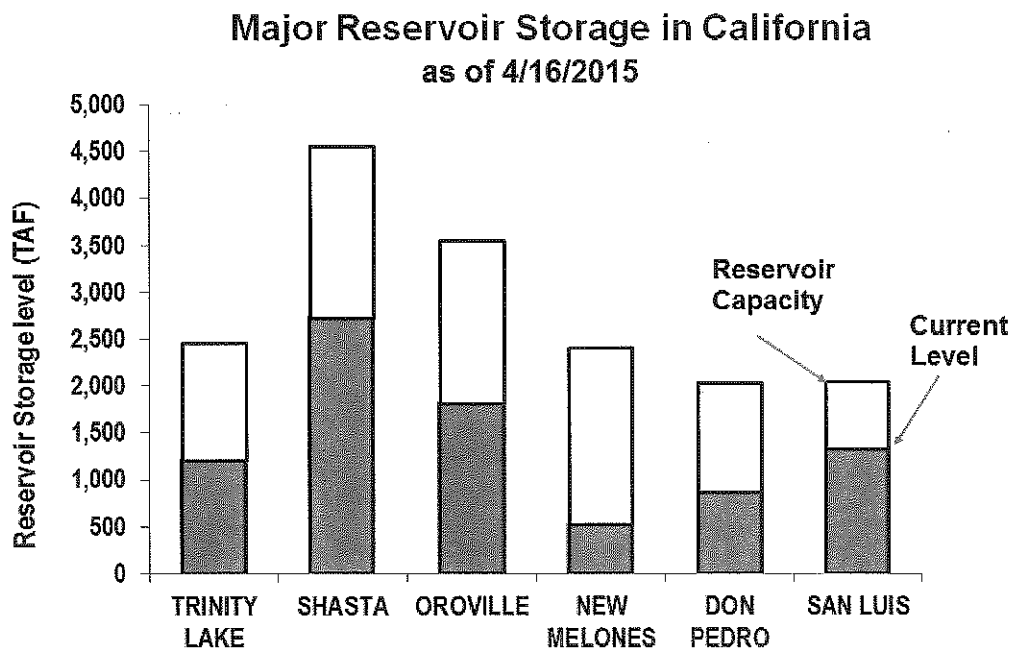
Hydrologic conditions

California continues to experience a severe drought with the 2015 water year being the worst one on record, according to California Department of Water Resources.[17] *Figure 5* shows the water storage of major reservoirs in California for the date, April 16, which is 48 percent of capacity, 60 percent of average, and 96 percent of last year. *Figure 6* shows the California snow water content as of April 15, 2015 and indicates that statewide snowpack was 4% of the April 1 average, 4% in the north, 5% in the central, and 4% in the south. April 1 is the date that snowpack is typically at its peak level and the snow water content for that date was 5 percent statewide and in the northern, central, and southern areas.

The northern Sierra precipitation was 75 percent of the average, and southern San Joaquin was 41 percent of the average (*Figure 7* and *8)*. Snow melt runoff is not expected to significantly impact reservoirs levels and the outlook for additional precipitation and snowpack does not project improvements to the drought situation.

The CAISO hydro generation in August from the 2015 Resource Adequacy Net Qualifying Capacity List is 7,428 MW, the lowest in the past 10 years. Hydro generation accounts for almost 14 percent on-peak power supply. The hydro derate for 2015 is estimated to be 1,511 MW for the base case scenario based on the utilities' estimation of hydro capacity during heat waves this summer. In addition, the CAISO further reduced hydro capacity sourced by snow pack and precipitation by 10 percent and projected the hydro derate to be 2,733 MW to reflect the conditions as of the date of the release of this report. The extreme hydro generation deterministic scenario was used for the probabilistic analyses to encompass the worst case conditions.

Figure 5
California Daily Major Reservoir Storage Summary



[17] http://www.water.ca.gov/waterconditions/

Figure 6
California Snow Water Content, April 1, 2015

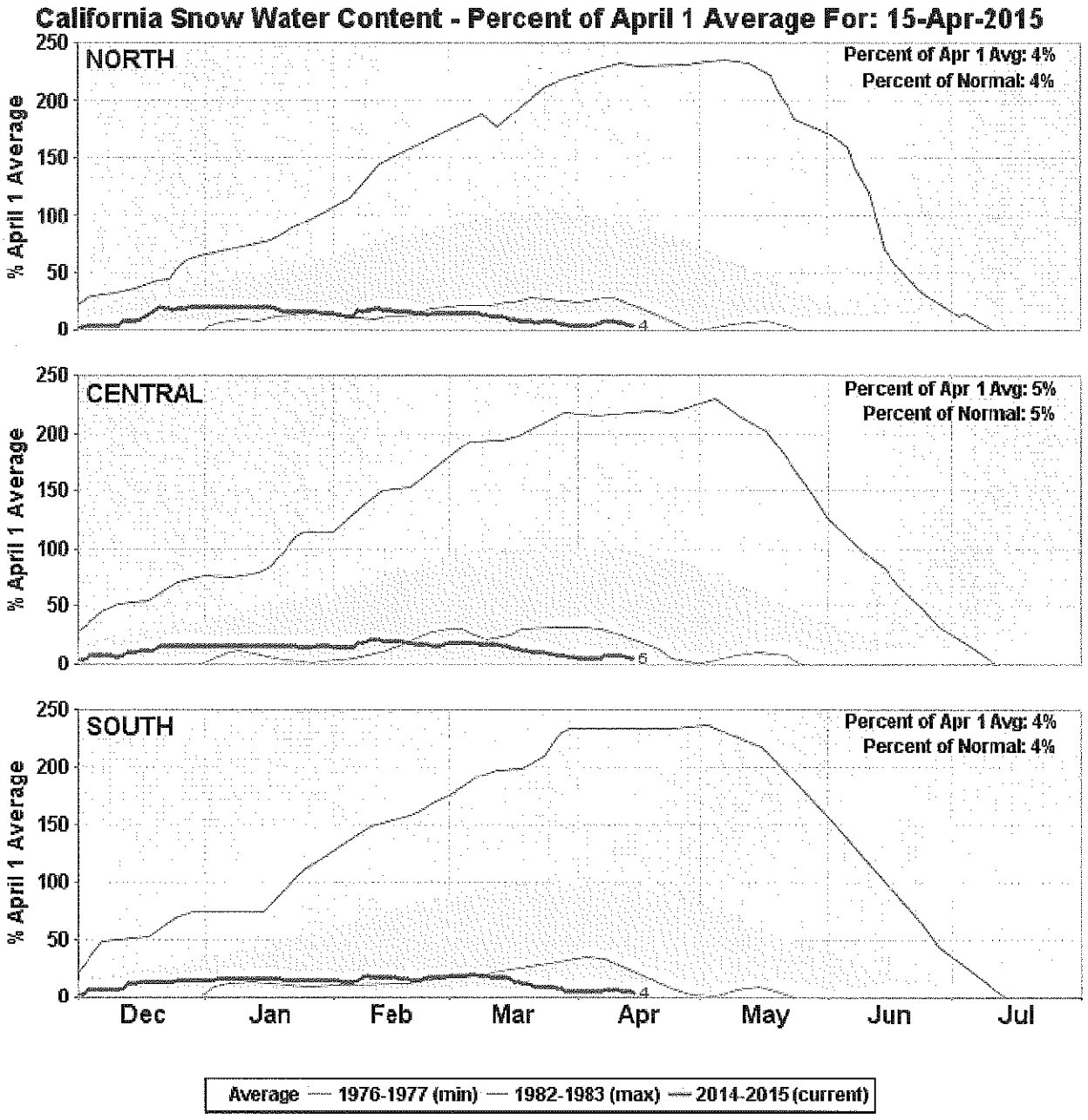


Figure 5 shows that the current snow water content is well below average in all areas.

Source: California Department of Water Resources

Figure 7

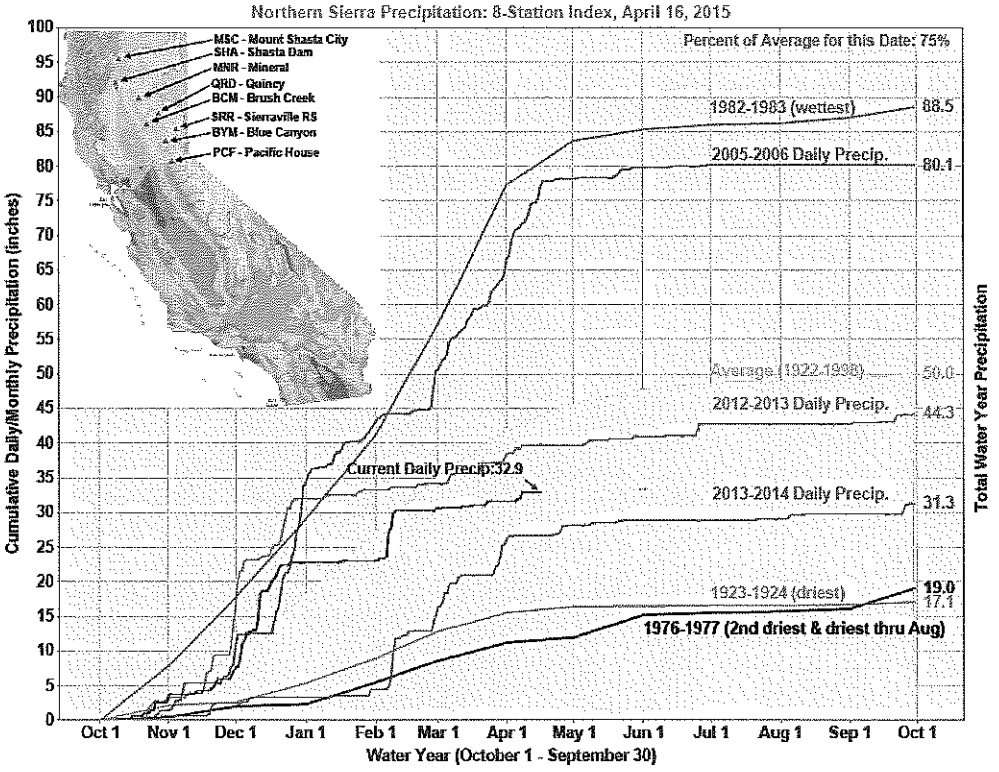
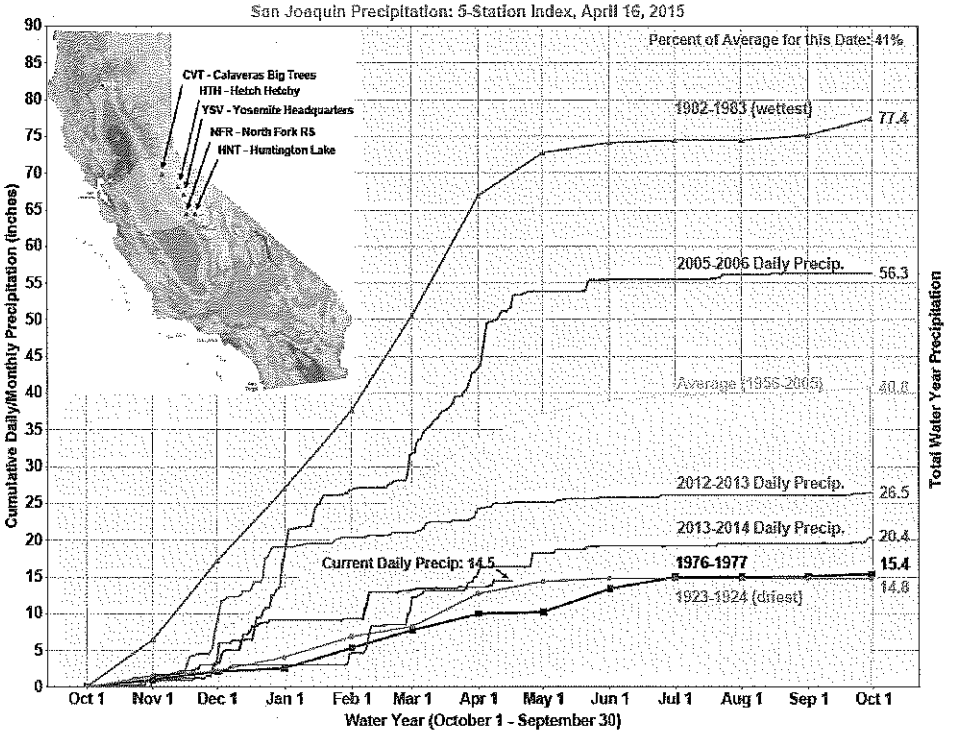


Figure 8



Source: California Department of Water Resources

Imports

Numerous factors contribute to the level of interchange between the CAISO and other balancing authorities. Conditions for any given year and on any given day can affect any area ranging from local, regional, or even the entire Western Interconnection. These factors typically include market dynamics, demand within various areas, day-ahead forecasts accuracy, generation availability, transmission congestion, hydro conditions, and more recently, levels of renewable generation. On any given day, the degree to which any one of these interrelated factors influence import levels can vary greatly.

Two types of contingencies may cause the system to rely on more than normal imports to meet peak demands. These are a weather event that is forecasted in advance, or a forced outage that extends over multiple days. Both of these allow system operators to plan ahead and line up needed imports.

Another type of contingency that does not enable increased use of imports is an event that occurs in real-time operation after running the day-ahead and real-time markets, such as loss of a significant amount of generation or transmission, or a significantly under-forecasted peak demand. Under these circumstances, it may be too late to use the capabilities of other balancing authorities to deal with these types of contingencies.

It is beyond the scope of this report to model the complex dynamics that lead to a given import level on any given day or for any given set of contingencies. There is no single import amount that can be used in these analyses that can represent every scenario. Consequently, three levels of imports are developed for the deterministic and probabilistic analysis: high, moderate and low.

Table 9 shows projected levels of imports for the 2015 assessment. Graphs of actual imports during summer 2011 to 2013 peak operating hours for the CAISO system and the SP26 and NP26 zones are included in *Appendix E: 2011 – 2013 Summer Imports Summary Graphs*. The sum of SP26 and NP26 is not equal to CAISO system because zonal analysis for SP26 and NP26 are on a non-coincidental basis.

Table 9

2015 Summer Outlook - Import Scenarios (MW)			
	ISO	**SP26**	**NP26**
High Net Interchange	10,100	9,800	2,500
Moderate Net Interchange	9,500	8,700	2,000
Low Net Interchange	8,300	8,500	1,100

Demand response and interruptible loads

Table 10 shows demand response and interruptible load programs for summer 2015 based on resource adequacy criteria for the month of August. Demand response and interruptible load programs reduce end-user loads in response to a high price, a financial incentive, an environmental condition or a reliability issue. They play an important role to offset the need

for more generation and provide system operators with additional flexibility in operating the system during periods of limited supply.

Demand response programs include critical peak pricing, demand bidding, capacity biding, demand response contract, and peak day pricing programs whereas interruptible load programs include interruptible rates and direct control programs. In 2014, demand response programs helped to reduce loads during a number of high peak demand periods. Other non-Flex Alert customer voluntary curtailment amounts or non-dispatchable demand response is embedded in the load forecast as natural load reductions.

The Flex Alert program is an energy conservation program funded by the investor-owned utilities and authorized by the California Public Utilities Commission. The alerts advise consumers about how and when to conserve energy. The Flex Alert program continues to be a vital tool for the CAISO during periods of high peak demand to maintain system reliability, using them as a signal that both voluntary and non-voluntary demand side resources are needed.

Table 10

Demand Response and Interruptible Load for Summer 2015
(based on summer amounts in August)

	Demand Response	Interruptible Load	Total Program Amounts
ISO	410	1430	1840
SP26	185	1112	1297
NP26	225	318	543

Demand

The CAISO's 47,188 MW 1-in-2 peak demand forecast for 2015 is 2.1 percent above the 2014 weather normalized peak demand of 46,229 MW. The increase represents a modest economic recovery over 2014 based on the economic base case forecast from Moody's Analytics.

The CAISO uses Itron's MetrixND to develop the CAISO, SP26 and NP26 regression load forecast models, which produce the peak load forecasts. The inputs to the models are historical peak loads, calendar information, economic and demographic data, and weather data. The weather data comes from 24 weather stations located throughout the large population centers within the CAISO balancing authority. Weather data used in the model includes maximum, minimum and average temperatures, cooling degree days, heat index, relative humidity, solar radiation indexes, as well as a 631 index as described below.

A cooling degree day is the average of a day's high and low temperature subtracting 65 degrees F. The heat index combines air temperature and relative humidity to determine the human-perceived equivalent temperature. The 631 index is a weighted average of a weather variable calculated as 60 percent of a given day, 30 percent of prior day and 10 percent of two days prior. The historical load data used was from January 1, 2003 through September 30, 2014.

Peak load data is based on 60-minute average peak demands. Water delivery pump loads were not included in the forecast models as they do not react to weather conditions in a similar fashion and are subject to interruption. Pump load is added back into the forecast based on a range of typical pump loads during summer peak conditions.

The forecast process involves developing seven different weather scenarios for each year of weather history so that each historical year has a scenario that starts on each of the seven days of the week. The model results for forecasting peak demand, particularly the highest of the peak load days, are significantly improved using parameters such as humidity that were not available for most stations prior to 1995. Consequently, 1995 through 2014 historical weather is used, which produces 140 weather scenarios. The scenarios result in a range of load forecasts for the probability analysis using a random number generation process. This distribution is used in developing the 1-in-2, 1-in-10, and other peak demand forecasts.

There are three main models representing three distinct areas — the CAISO, SP26 and NP26. Other models that forecast various sub-regions have similar weather characteristics. Each time a new forecast is made, the models are updated by adding in the latest historical load, weather and operational data. The models also use historical and forecasts of gross domestic product and population as independent inputs for growth trends and for base load levels. Furthermore, the models use gross domestic product as an indicator of weather driven cooling load levels.

A base case forecast model is developed using baseline economic forecast data. The models are then trained with these new data. Five load forecast scenarios are developed using five economic scenario forecasts that represents different outlooks of how the economy will perform based on different assumptions such as consumer confidence and household spending, labor markets and credit conditions. The CAISO uses gross domestic product developed by Moody's for the metropolitan statistical areas within the CAISO as the economic indicator for the models.

Figure 9 shows the historical and five gross domestic product forecasts that represent five different projections for how the current economics will play out. It is has been difficult to accurately forecast the future gross domestic product growth trend during the post-recession years. The economy continues to have a risk of a new downturn as shown in Moody's more pessimistic scenario forecasts.

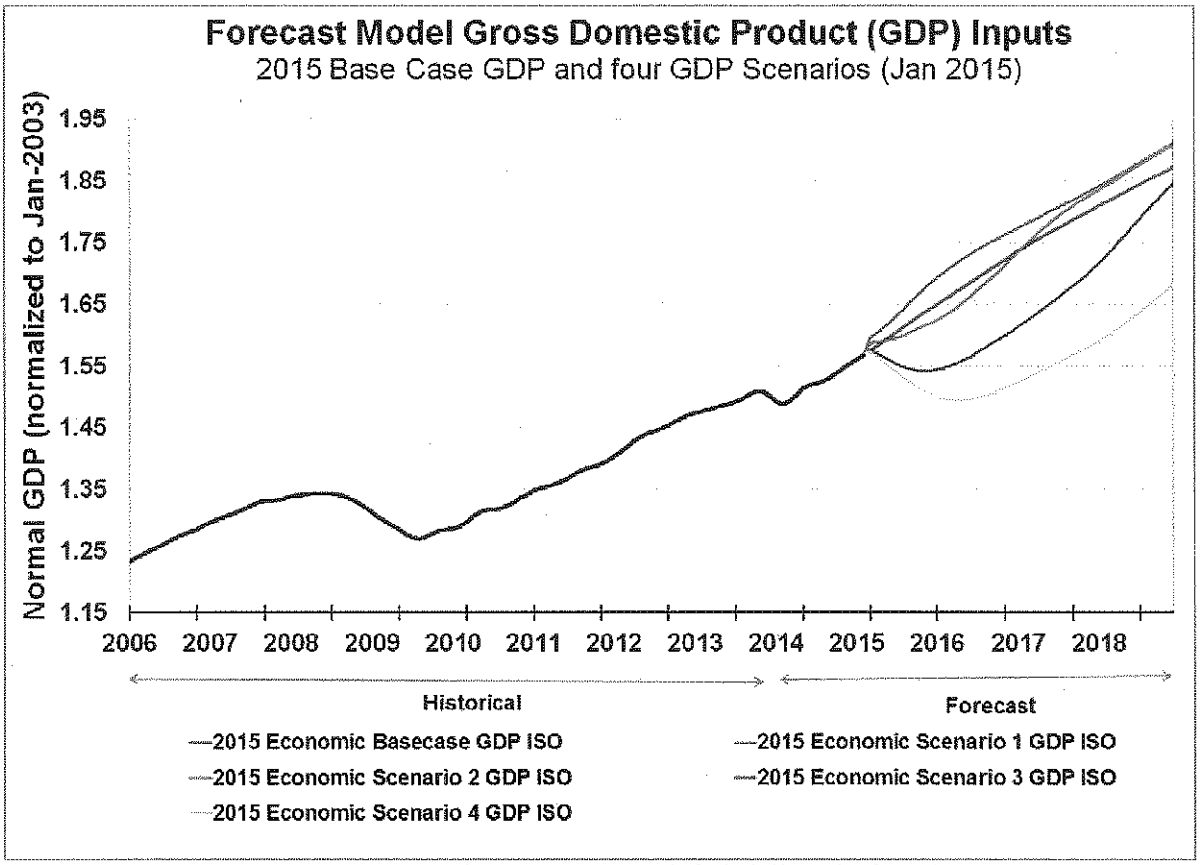
The baseline forecast is the median scenario wherein there is a 50 percent probability that the economy will perform better and a 50 percent probability that the economy will perform worse. The baseline and the four additional scenarios were all developed by Moody's Analytics.

- Scenario 1 is a Stronger Near-Term Rebound Scenario in which the economy rebounds. It is designed so that there is a 10 percent probability that the economy will perform better than this scenario, broadly speaking, and a 90 percent probability that it will perform worse.
- Scenario 2 is a Slower Near-Term Recovery Scenario in which a second, relatively mild, downturn develops. It is designed so that there is a 75 percent probability that economic conditions will be better than this scenario, broadly speaking, and a 25 percent probability that conditions will be worse.
- Scenario 3 is a Moderate Recession Scenario in which a more severe second downturn develops. It is designed so that there is a 90 percent probability that the economy will

perform better than this scenario, broadly speaking, and a 10 percent probability that it will perform worse.

- Scenario 4 is a Protracted Slump Scenario, it is designed so that there is a 96 percent probability that the economy will perform better than this scenario, broadly speaking, and a 4 percent probability that it will perform worse.

***Figure* 9**



Source: Macroeconomic Outlook Alternative Scenarios – Dec. 2014

Figure 9 shows that under the most likely scenario (base case) the economy will experience a modest recovery this year.

In *Figure 9,* scenario 1 is more optimistic than the base case forecast while scenarios 2 through 4 are progressively more pessimistic. The range of divergence between the various scenarios began Dec 31, 2014.

It is important to note that these forecasts are based on the Moody's gross domestic product forecasts released in December 2014. The gross domestic product forecasts are updated monthly and will change as the economic conditions evolves over the months ahead and new information becomes available. Currently, the gross domestic product data reflects actual historical data through 2013 (January 2014 and later historical data are estimates of actual GDP). Consequently, this forecast is based on data available at that time. *Figure 10* shows a comparison of Moody's 2015 GDP forecast to their 2014 GDP forecast. Moody's 2015 forecast is a more conservative economic recovery forecast as compared to their 2014

economic base case forecast where the forecast for August 2015 GDP decreased 3.2 percent from 2014 to 2015.

Figure 11 shows CAISO 1-in-2 peak demand forecasts based on the five economic scenarios from Moody's. The 2015 base case peak demand forecast and the scenario 1 forecasts by area are provided in *Table 11* and *Table 12*, respectively. The 2015 forecasted 2.1 percent increase over the CAISO 2014 normal weather peak demand represents a moderate level of economic recovery over 2014 assuming normal *weather* for the 2015 summer peak demand. The details of scenarios 2 through 4 load forecasts are not presented in this report as the operating risks associated with these lower load forecasts are of lesser concern than the operating risks associated with the higher loads related to the base case and scenario 1 forecasts.

Figure 10

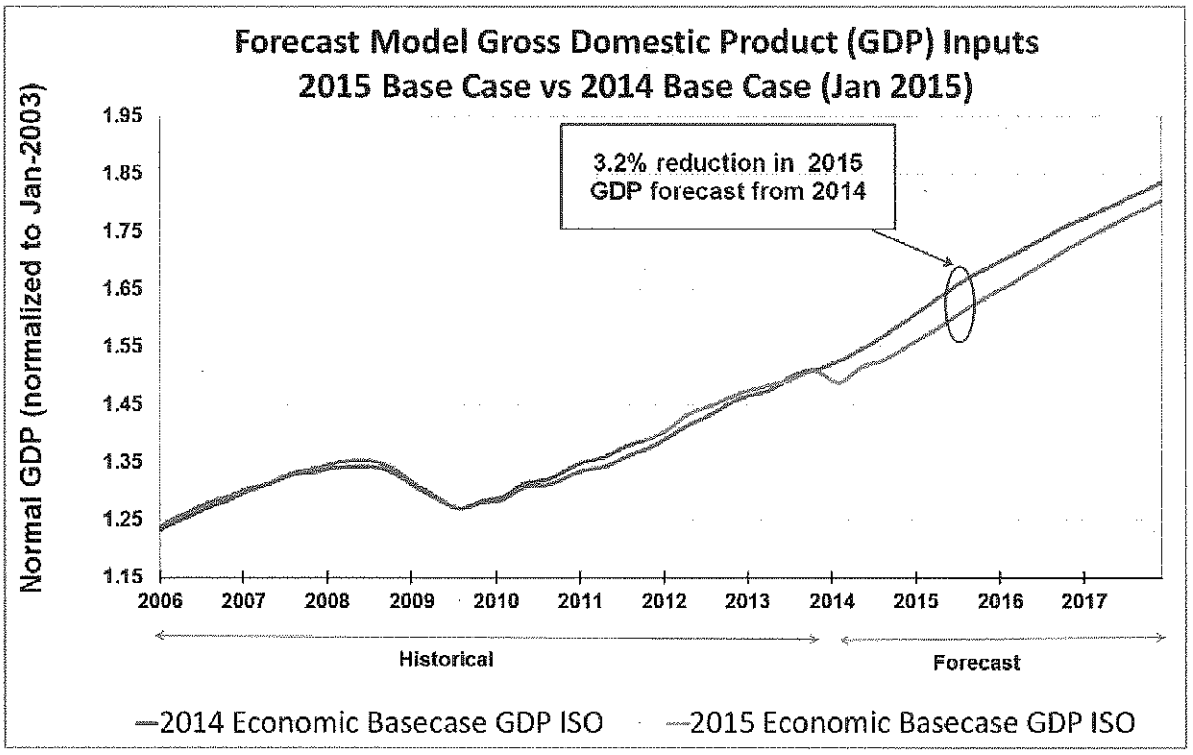


Figure 10 shows the difference between 2014 Economic base case GDP for the CAISO and 2015 Economic base case GDP for the CAISO.

Figure 11

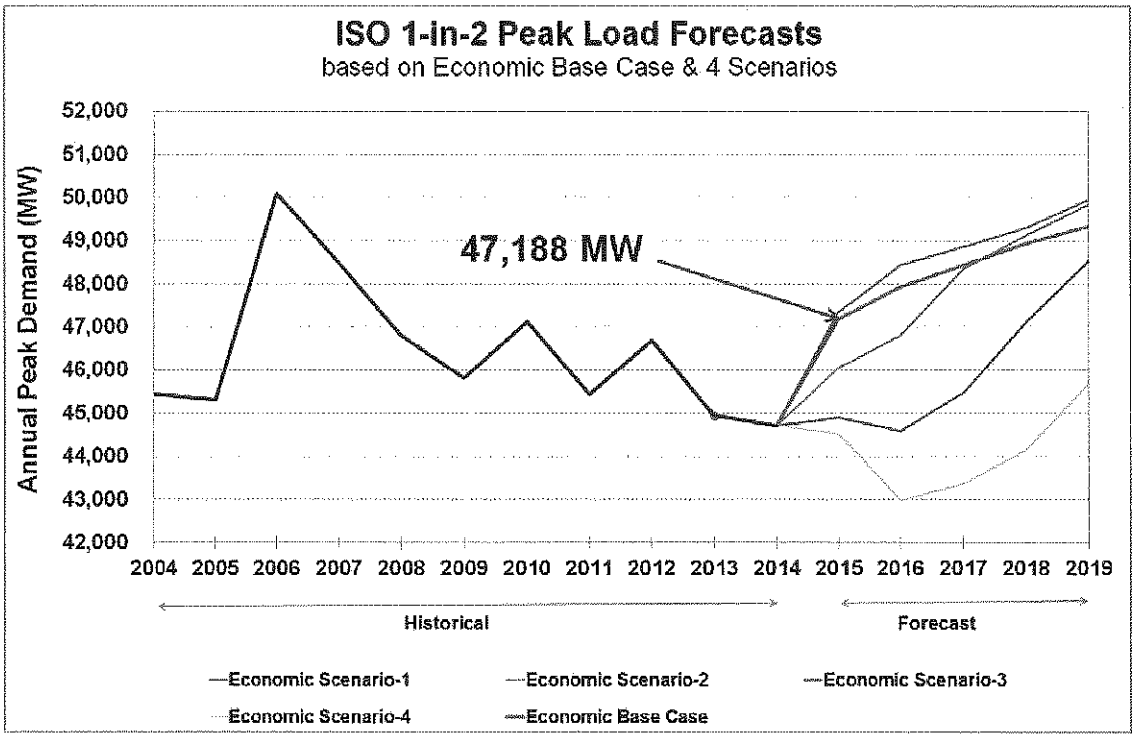


Figure 11 shows that as the economy improves in 2015 based on the base case Scenario (see *Figure 9*) the CAISO annual peak demand will increase in close parallel with base case economic growth.

Table 11

2015 Peak Demand Forecast vs. 2014 Actual Peak Demand 2015 Peak Demand Forecast based on 2015 economic base case					
	Probability	Percentile	2015 Forecast	2014 Actual	% Change
ISO	1-in-2	50th	47,188	44,703	5.6%
SP26	1-in-2	50th	27,183	27,747	-2.0%
NP26	1-in-2	50th	20,832	19,516	6.7%

Table 12 shows a comparison of 1-in-2, 1-in-10 and 1-in-20 probability peak demand forecasts between 2015 and 2014. Table 13 provides a comparison of 1-in-2, 1-in-10 and 1-in-20 probability peak demand forecasts based on the 2015 economic base case and the 2015 economic scenario 1, using the 2015 peak demand forecasts from the 2015 economic base case as a reference point.

Table 12

2015 Peak Demand Forecast vs. 2014 Peak Demand Forecast 2015 Peak Demand Forecast based on 2015 economic base case 2014 Peak Demand Forecast based on 2014 economic base case					
	Probability	Percentile	2015 Forecast	2014 Forecast	% Change
ISO	1-in-2	50th	47,188	47,413	-0.5%
	1-in-10	90th	49,370	49,168	0.4%
	1-in-20	95th	50,350	50,475	-0.2%
SP26	1-in-2	50th	27,183	27,253	-0.3%
	1-in-10	90th	29,006	29,519	-1.7%
	1-in-20	95th	29,429	30,067	-2.1%
NP26	1-in-2	50th	20,832	21,328	-2.3%
	1-in-10	90th	21,735	22,290	-2.5%
	1-in-20	95th	22,427	23,231	-3.5%

Table 13

2015 Peak Demand Forecasts Economic Base Case & Optimistic Economic Scenario (90th percentile)					
	Probability	Forecast Percentile	Base Case Forecast	Optimistic Scenario Forecast	Optimistic Scenario Increase
ISO	1-in-2	50th	47,188	47,917	1.5%
	1-in-10	90th	49,370	50,107	1.5%
	1-in-20	95th	50,350	51,961	3.2%
SP26	1-in-2	50th	27,183	27,573	1.4%
	1-in-10	90th	29,006	29,833	2.9%
	1-in-20	95th	29,429	30,471	3.5%
NP26	1-in-2	50th	20,832	21,449	3.0%
	1-in-10	90th	21,735	22,462	3.3%
	1-in-20	95th	22,427	23,420	4.4%

Transmission

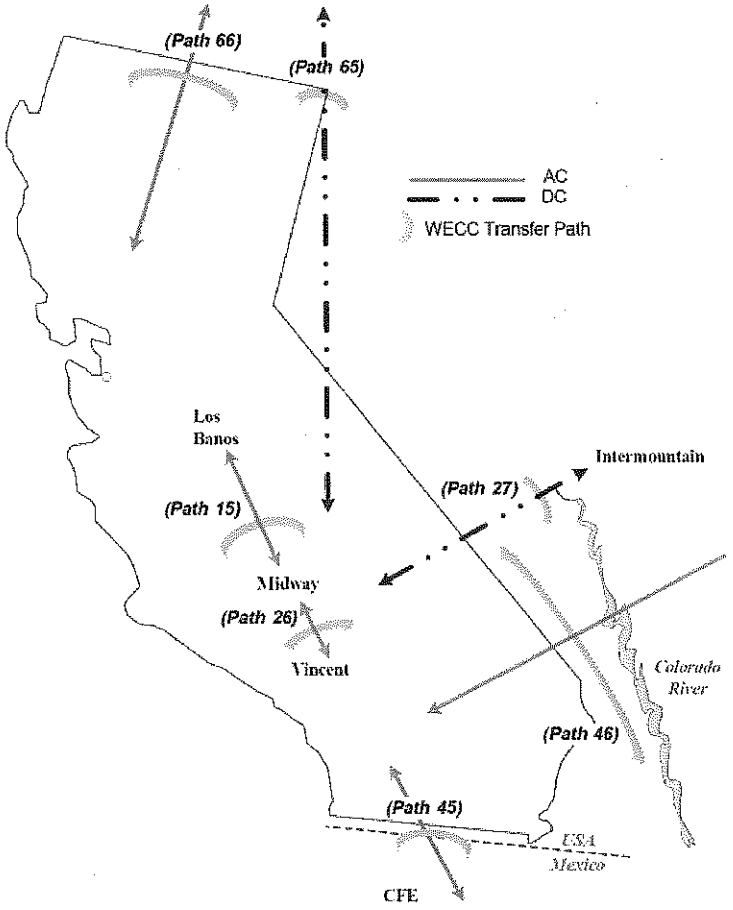
Operating transfer capability limits on transmission paths are set through WECC on a seasonal basis. *Figure 12* shows the main transmission paths for California ISO. The critical transmission paths are the following: Path 66 – California-Oregon Intertie (COI); Path 65 – Pacific Direct Current Intertie (PDCI); Path 15 – Midway-Los Banos; and Path 26 – Midway-Vincent. The Southern California Import Transmission (SCIT) is composed of five separate paths: Path 65 – PDCI; Path 26 – Midway-Vincent; Path 27 – Intermountain Power Project DC (IPP DC); Path 46 – West-of-River; and North-of-Lugo. The COI, PDCI and SCIT operating transfer capabilities govern import levels into the CAISO balancing authority. Path

45 defines import capability into SDG&E from Comisión Federal de Electricidad in Mexico. Path 15 delineates operating transfer capability of the flow within PG&E while the Path 26 defines operating transfer capability on the Midway-Vincent lines between SCE and PG&E areas.

The CAISO annually performs a seasonal transmission operations assessment using a variety of system operation scenarios. The scenarios include steady-state power flow analysis, time-domain transient stability analysis, post-transient analysis, and PV voltage stability analysis. The Intertie (COI) Operating Transfer Capability and the Southern California Import Transmission (SCIT) will not operate above its thermal limit for summer 2015 under normal operating condition. Power supply for the San Joaquin Valley area will improve with the expected completion of multiple reconductoring projects prior to and during summer 2015. However, because of the continued drought, the Fresno area could see some issues during summer peak periods.

Sensitivity analysis for low hydro generation and Helms pumping capability indicates that non-emergency work for transmission and generation be restricted in order to support peak load demand in San Joaquin Valley area. The Humboldt area remains limited by potential voltage stability. The seasonal study indicated that the transmission paths limits will not be exceeded under normal operation scenario during summer 2015 and no lines or equipment will operate above their normal thermal ratings.

Figure 12
California CAISO main transmission paths



System and zonal supply and demand deterministic analysis

Table 14 is the supply and demand outlook for the 2015 summer from a planning perspective. This table shows the planning reserves based on the 1-in-2 peak demand forecasts prior to accounting for any generation outages or transmission curtailments. The system and zonal planning reserve margins are robust because of generation additions and continued slow economic growth that has followed the recession resulting in low growth in electric loads. The generation shown is based on current generation in service along with the generation expected to go on line prior to summer 2015. The import amounts are based on the high, moderate and low import levels from *Table 9*.

Table 14

Planning Reserve Margins

Summer 2015 Supply & Demand Outlook (Planning Reserve Margins)			
Resource Adequacy Planning Conventions	**ISO**	**SP26**	**NP26**
Existing Generation	54,044	26,660	27,384
Retirement	0	0	0
High Probability Addition	278	117	161
Net Interchange (Moderate)	9,500	8,700	2,000
Total Net Supply (MW)	63,822	35,477	29,545
DR & Interruptible Programs	1,840	1,297	543
Demand (1-in-2 Summer Temperature)	47,188	27,183	20,832
Planning Reserve Margin	**39.1%**	**35.3%**	**44.4%**

Operating reserve margins transition from the planning perspective (*Table 14)* to a real-time perspective (*Table 15)* by adding in generation outages. *Table 15* demonstrates how the import assumption impacts system and zonal operating reserve margins using 1-in-2 level generation outage and curtailment levels. The middle section of this table representing moderate imports corresponds to the same conditions as *Table 14* but with 1-in-2 generation outage added.

Table 16 calculates system and zonal operating reserve margins under weather conditions that produce 1-in-10 peak demands, coincident with 1-in-10 level generation outage and curtailment. The scenarios portrayed in *Table 17* rarely happen. The CAISO is highly dependent on imports to meet peak demand, especially during the summer high load periods.

Table 15

Summer 2015 Loads and Resources Outlook
1-in-2 Demand, 1-in-2 Generation Outage

Summer 2015 Outlook - High Imports			
Resource Adequacy Conventions	**ISO**	**SP26**	**NP26**
Existing Generation	54,044	26,660	27,384
Retirement	0	0	0
High Probability Additions	278	117	161
Hydro Derate	(1,511)	(634)	(878)
Outages (1-in-2 Generation)	(5,028)	(2,163)	(2,882)
Net Interchange (High)	10,100	9,800	2,500
Total Net Supply (MW)	57,882	33,781	26,286
DR & Interruptible Programs	1,840	1,297	543
Demand (1-in-2 Summer Temperature)	47,188	27,183	20,832
Operating Reserve Margin	**26.6%**	**29.0%**	**28.8%**

Summer 2015 Outlook - Moderate Imports			
Resource Adequacy Conventions	**ISO**	**SP26**	**NP26**
Existing Generation	54,044	26,660	27,384
Retirement	0	0	0
High Probability Additions	278	117	161
Hydro Derate	(1,511)	(634)	(878)
Outages (1-in-2 Generation)	(5,028)	(2,163)	(2,882)
Net Interchange (Moderate)	9,500	8,700	2,000
Total Net Supply (MW)	57,282	32,681	25,786
DR & Interruptible Programs	1,840	1,297	543
Demand (1-in-2 Summer Temperature)	47,188	27,183	20,832
Operating Reserve Margin	**25.3%**	**25.0%**	**26.4%**

Summer 2015 Outlook - Low Imports			
Resource Adequacy Conventions	**ISO**	**SP26**	**NP26**
Existing Generation	54,044	26,660	27,384
Retirement	0	0	0
High Probability Additions	278	117	161
Hydro Derate	(1,511)	(634)	(878)
Outages (1-in-2 Generation)	(5,028)	(2,163)	(2,882)
Net Interchange (Low)	8,300	8,500	1,100
Total Net Supply (MW)	56,082	32,481	24,886
DR & Interruptible Programs	1,840	1,297	543
Demand (1-in-2 Summer Temperature)	47,188	27,183	20,832
Operating Reserve Margin	**22.7%**	**24.3%**	**22.1%**

Table 16

Summer 2015 Loads and Resources Outlook
1-in-10 Demand and 1-in-10 Generation Outage Scenarios

Summer 2015 Outlook - High Imports			
Resource Adequacy Conventions	**ISO**	**SP26**	**NP26**
Existing Generation	54,044	26,660	27,384
Retirement	0	0	0
High Probability Additions	278	117	161
Hydro Derate	(2,733)	(1,336)	(1,397)
High Outages (1-in-10 Generation)	(6,704)	(3,478)	(4,165)
Net Interchange (High)	10,100	9,800	2,500
Total Net Supply (MW)	54,985	31,764	24,483
DR & Interruptible Programs	1,840	1,297	543
High Demand (1-in-10 Summer Temperature)	49,370	29,006	21,735
Operating Reserve Margin	**15.1%**	**14.0%**	**15.1%**

Summer 2015 Outlook - Moderate Imports			
Resource Adequacy Conventions	**ISO**	**SP26**	**NP26**
Existing Generation	54,044	26,660	27,384
Retirement	0	0	0
High Probability Additions	278	117	161
Hydro Derate	(2,733)	(1,336)	(1,397)
High Outages (1-in-10 Generation)	(6,704)	(3,478)	(4,165)
Net Interchange (Moderate)	9,500	8,700	2,000
Total Net Supply (MW)	54,385	30,664	23,983
DR & Interruptible Programs	1,840	1,297	543
High Demand (1-in-10 Summer Temperature)	49,370	29,006	21,735
Operating Reserve Margin	**13.9%**	**10.2%**	**12.8%**

Summer 2015 Outlook - Low Imports			
Resource Adequacy Conventions	**ISO**	**SP26**	**NP26**
Existing Generation	54,044	26,660	27,384
Retirement	0	0	0
High Probability Additions	278	117	161
Hydro Derate	(2,733)	(1,336)	(1,397)
High Outages (1-in-10 Generation)	(6,704)	(3,478)	(4,165)
Net Interchange (Low)	8,300	8,500	1,100
Total Net Supply (MW)	53,185	30,463	23,083
DR & Interruptible Programs	1,840	1,297	543
High Demand (1-in-10 Summer Temperature)	49,370	29,006	21,735
Operating Reserve Margin	**11.5%**	**9.5%**	**8.7%**

Figures 13 and *14* provide graphical representations in percentage and MW, respectively, of the deterministic analysis results based on the inputs from *Tables 15* and *16*. *Figure 13* shows that the operating reserve margins for CAISO, SP26 and NP26 are projected to be well above the 3 percent firm load shedding threshold in the normal and extreme scenarios.

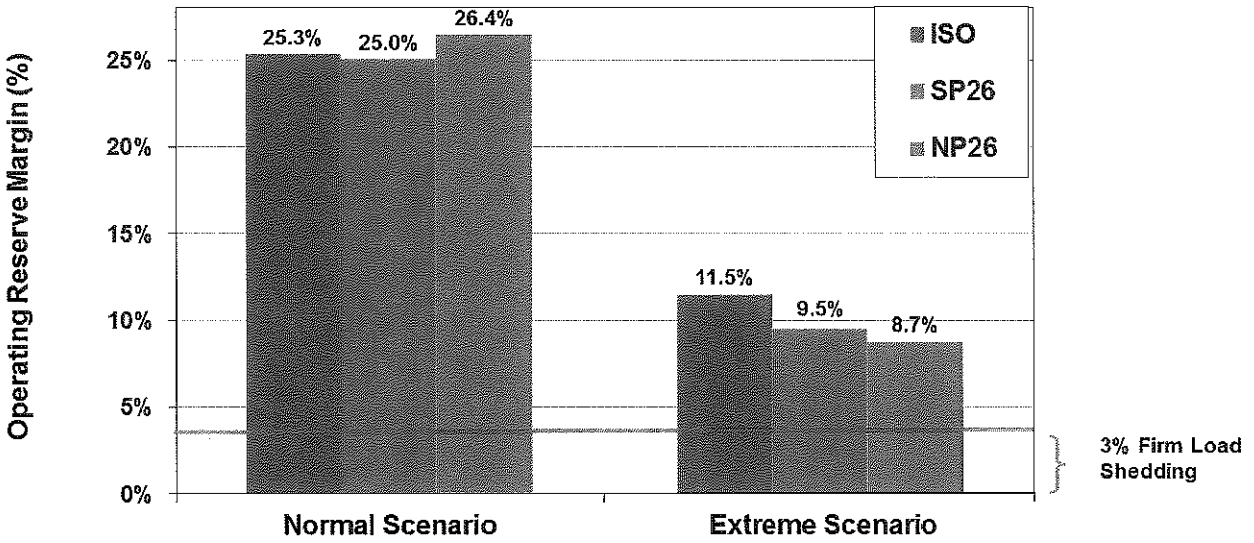
While operating reserves are not necessarily procured on a zonal basis, the information portrayed in Figure 13 is useful for preparing for contingency events. Even with these projected operating reserve margins the CAISO prepares contingency plans to deal with extreme events that could lead to firm load shedding.

These scenarios show the operating reserve margin after using all demand response programs. Analyzing the more extreme conditions frames the electric system challenges and identifies the magnitude of operating reserves during these conditions.

These *Figures* represent analyses of conditions for the CAISO system as a whole, and for the SP26 and NP26 zones analyzed on a stand-alone, non-coincident basis. These results do not account for transmission constraints within the CAISO system or within each zone. Based on this study methodology, no firm load shedding would be needed under normal and extreme scenarios.

Figure 13

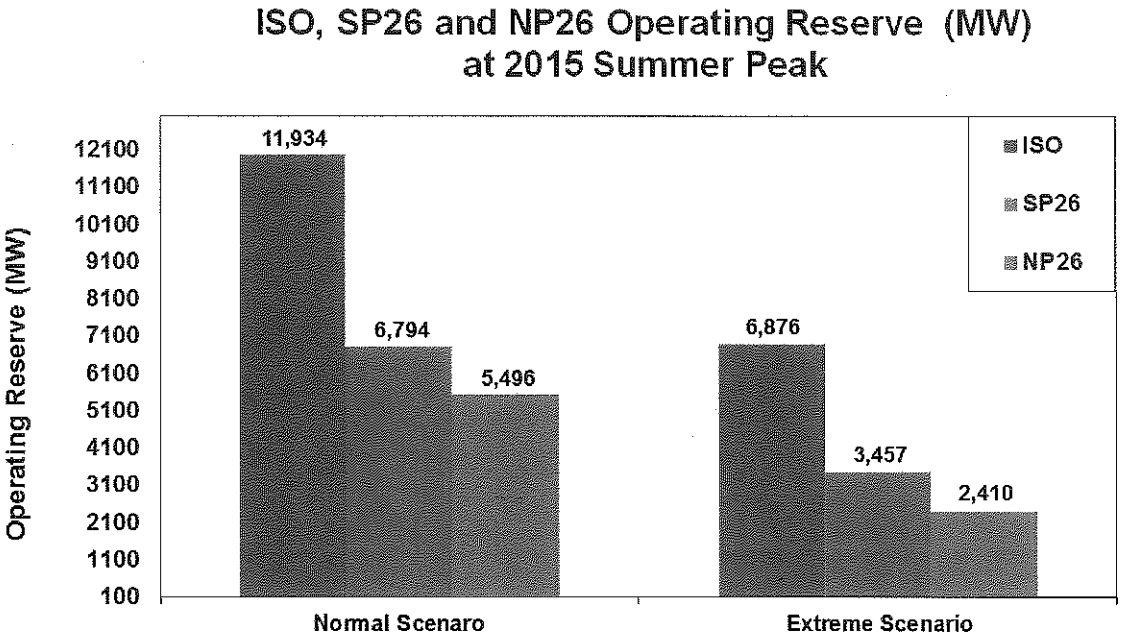
ISO, SP26 and NP26 Operating Reserve Margins at 2015 Summer Peak



Notes:
⇨Demand based on 1-in-2, or 1-in-10 Weather.
⇨Outages based on 1-in-2, or 1-in-10 .Generation curtailments.
⇨All Demand Response and Interruptible Load has been utilized.

Figure 13 shows adequate operating reserve forecast margins under the normal and extreme scenarios. The operating reserve margins for CAISO, SP26 and NP26 are projected to be above the 3 percent firm load shedding threshold in all scenarios.

Figure 14



Notes:
⇨Demand based on 1-in-2, or 1-in-10 Weather.
⇨Outages based on 1-in-2, or 1-in-10 Generation curtailments.
⇨All Demand Response and Interruptible Load has been utilized.

Figure 14 complements *Figure 13* and reflects operating reserve margins in megawatts.

System and zonal supply and demand probabilistic analysis

A probabilistic model is used to understand the likelihood of experiencing operating conditions when operating reserves drop to 3 percent or lower, which is the point where firm load shedding would begin. Existing generation, known retirements, high probability additions, demand response and interruptible load programs are fixed single value inputs to the model and are shown in the previous deterministic tables such as *Table 16.*

The randomly generated forced and planned generation outages and curtailments are based on actual occurrences as shown in graphs in *Appendix C: 2012 – 2014 Summer Generation Outage Graphs*. They were used to develop a range of inputs of probable generation outage amounts.

The range of demand inputs were developed using the process described in the *Demand* section. After the model develops the range of operating reserves, the analysis focuses on the lower operating reserve margin range where the probability of having operating reserves margin drop to 3 percent or less is determined.

The moderate import scenario associated with different demand ranges were studied in this assessment. Low probability events, such as low imports over the full range of high demand conditions, were not considered under this assessment.

The expected probability of experiencing involuntary load curtailments because of low operating reserve margins in summer 2015 is 0.1 percent for CAISO system, 0.0 percent for SP26 and 0.1 percent for NP26, assuming moderate imports, and the high hydro derate.

These system and zonal results do not capture the local issues because supply and demand within a particular zone with local transmission outages are beyond the scope of this assessment.

Status of Generation Subject to Once Through Cooling Regulations

Table 17 shows the power plants that are subject to the Statewide Water Quality Control Policy on the Use of Coastal and Estuarine Waters for power Plant Cooling. Of the OTC units' 17,792 MW of generating capability affected by the regulations, 5,370 MW are in compliance. The remaining 10,182 MW of generation will be required to repower or retire in by the end of 2020, many by the end of 2017. Compliance for Diablo Canyon is subject to a pending study by a Water Board Review Committee for Nuclear Fueled Power Plants.

Table 17

Generating Units Compliance with California Statewide Policy on the Use of Coastal and Estuarine Waters for Power Plant Cooling

Plant (Unit)	Owner	Final Compliance Date	Capacity (MW)	PTO Area
Compliance Plan Yet to be Implemented (Natural Gas Fired)				
El Segundo Units 4	NRG	12/31/2015	335	SCE
Encina Power Station Units 1-5	NRG	12/31/2017	946	SDG&E
Pittsburg Units 5 and 6	NRG	12/31/2017	629	PG&E
Moss Landing Units 1 and 2	Dynegy	12/31/2017	1,020	PG&E
Moss Landing Units 6 and 7	Dynegy	12/31/2017	1,500	PG&E
Huntington Beach Units 1-2	AES	12/31/2020	452	SCE
Redondo Beach Units 5-8	AES	12/31/2020	1,343	SCE
Alamitos Units 1-6	AES	12/31/2020	2,011	SCE
Mandalay Units 1 and 2	NRG	12/31/2020	430	SCE
Ormond Beach Units 1 and 2	NRG	12/31/2020	1,516	SCE
		Total MW	**10,182**	
In Compliance				
Huntington Beach Units 3-4[1]	AES	12/7/2012	452	SCE
Humboldt	PG&E	Sept. 2010	105	PG&E
Potrero Unit 3	GenOn	2/28/2011	206	PG&E
South Bay	Dynegy	1/1/2011	702	SDG&E
Contra Costa Units 6 and 7	NRG	5/1/2013	674	PG&E
San Onofre Unit 2 & 3	SCE	6/7/2013	2,246	SCE
El Segundo Units 3	NRG	12/31/2015	335	SCE
Morro Bay Units 3 and 4	Dynegy	2/5/2014	650	PG&E
		Total MW	**5,370**	
Compliance pending study by Water Board Review Committee for Nuclear Plants				
Diablo Canyon	PG&E	12/31/2024	2,240	PG&E
		Total MW	**2,240**	
		Total of all OTC Units	**17,792**	

Conclusions

The slowly improving economy, which resulted in moderate peak demand growth, combined with the availability of new power generation since June 2014 results in an overall adequate summer supply outlook for 2015 to meet a broad range of operating conditions despite the drought impacts on hydroelectric generation. Although the risk of power supply shortages increases under extreme load conditions, coupled with more extreme unavailability of hydro generation, the net addition since last summer of 2,328 MW of generation reaching commercial operation and out-of-state imports will help to moderate these risks. Furthermore, California hydro resources are primarily system resources, so the reduction in hydro generation will not impact local reliability areas. During periods of low energy production hydro resources are still able to provide ancillary services freeing up other generation for energy production.

However, the unusually dry conditions across the state do create a heightened risk of wildfires, which could impact the use of major transmission lines during periods of critical summer peak demand. Thus, major wildfires could create grid reliability challenges over the summer, particularly in southern Orange County and San Diego. These two area have more risk of localized customer outages as a result of the retirement of the San Onofre Nuclear Generating Station, albeit at a lower risk level from 2014 because of transmission upgrades in San Diego and Orange Counties beginning to come on line and providing an overall improvement in these local resource adequacy areas.

The CAISO annually trains its grid operators to be prepared for system events, and understand operating procedures and utility best practices. Furthermore, the CAISO meets with WECC, Cal Fire, gas companies, and neighboring balancing authorities to discuss and coordinate on key areas. The CAISO fosters ongoing relationships with these organizations to ensure reliable operation of the market and grid during normal and critical periods.

IV. APPENDICES

A. 2014 Summer Supply and Demand Summary Graphs

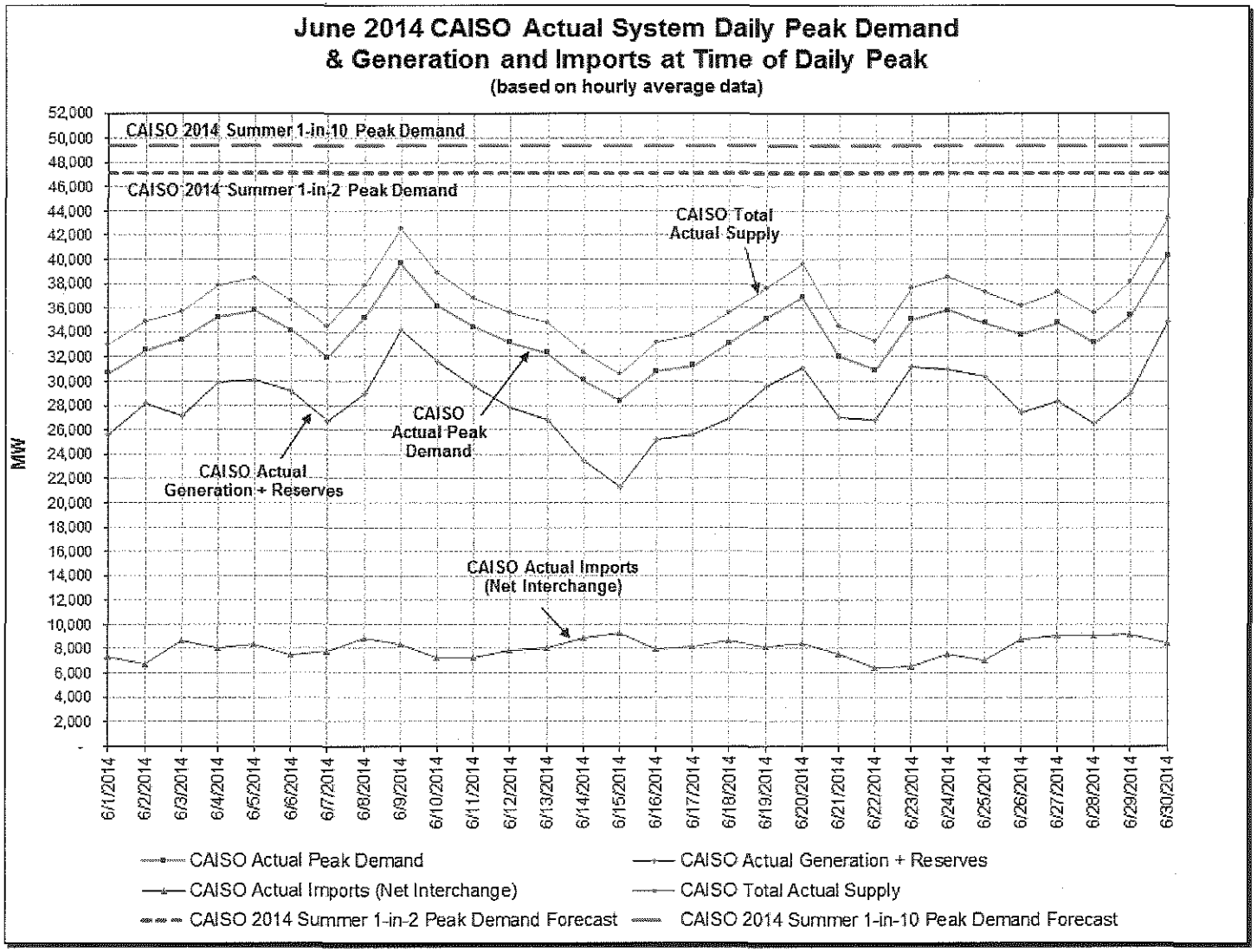
B. 2015 CAISO NDC and RPS by Fuel Type

C. 2012 – 2014 Summer Generation Outage Graphs

D. 2012 – 2014 Summer Imports Summary Graphs

E. 2015 CAISO Summer On-Peak NQC Fuel Type

Appendix A: 2014 Summer Supply and Demand Summary Graphs



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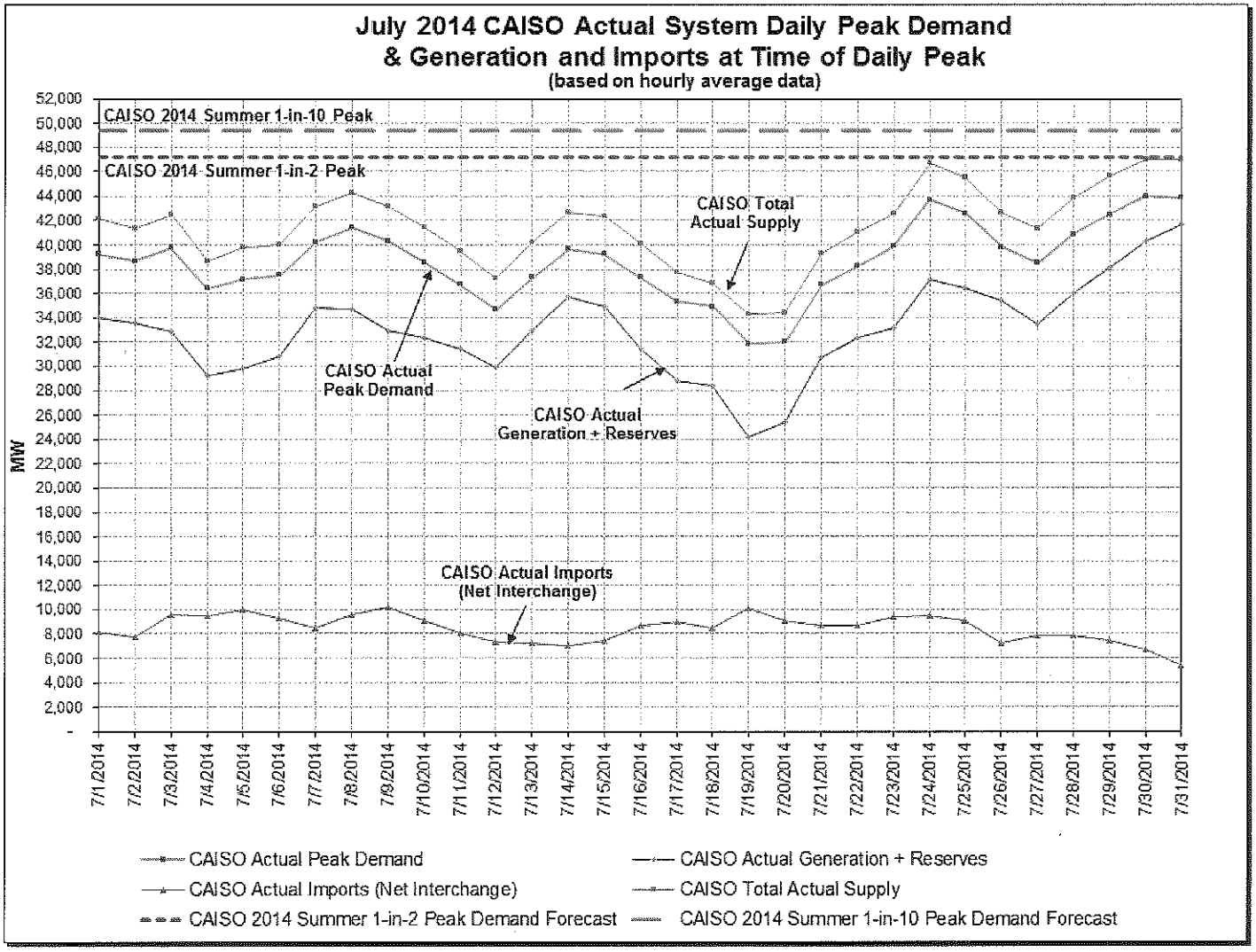

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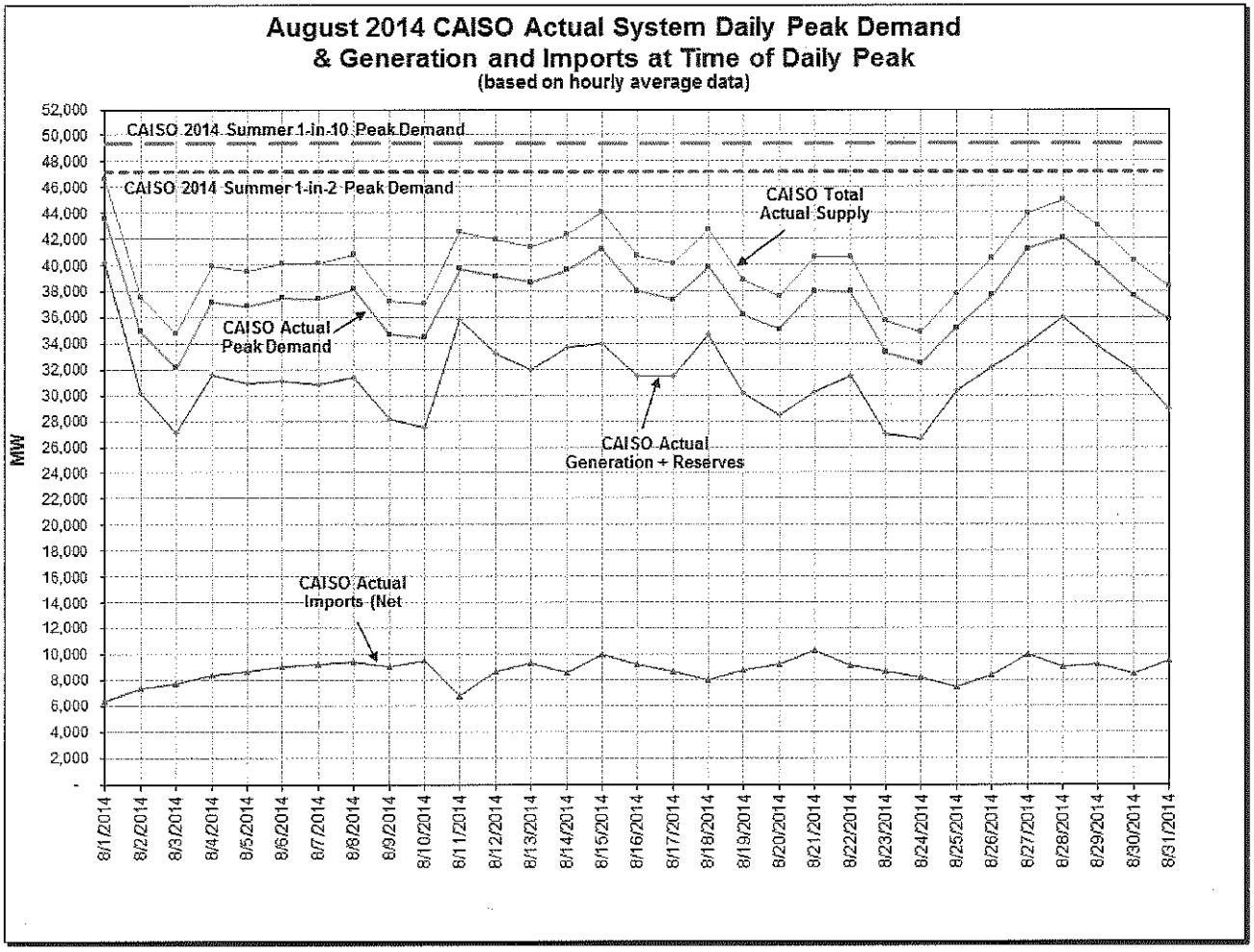

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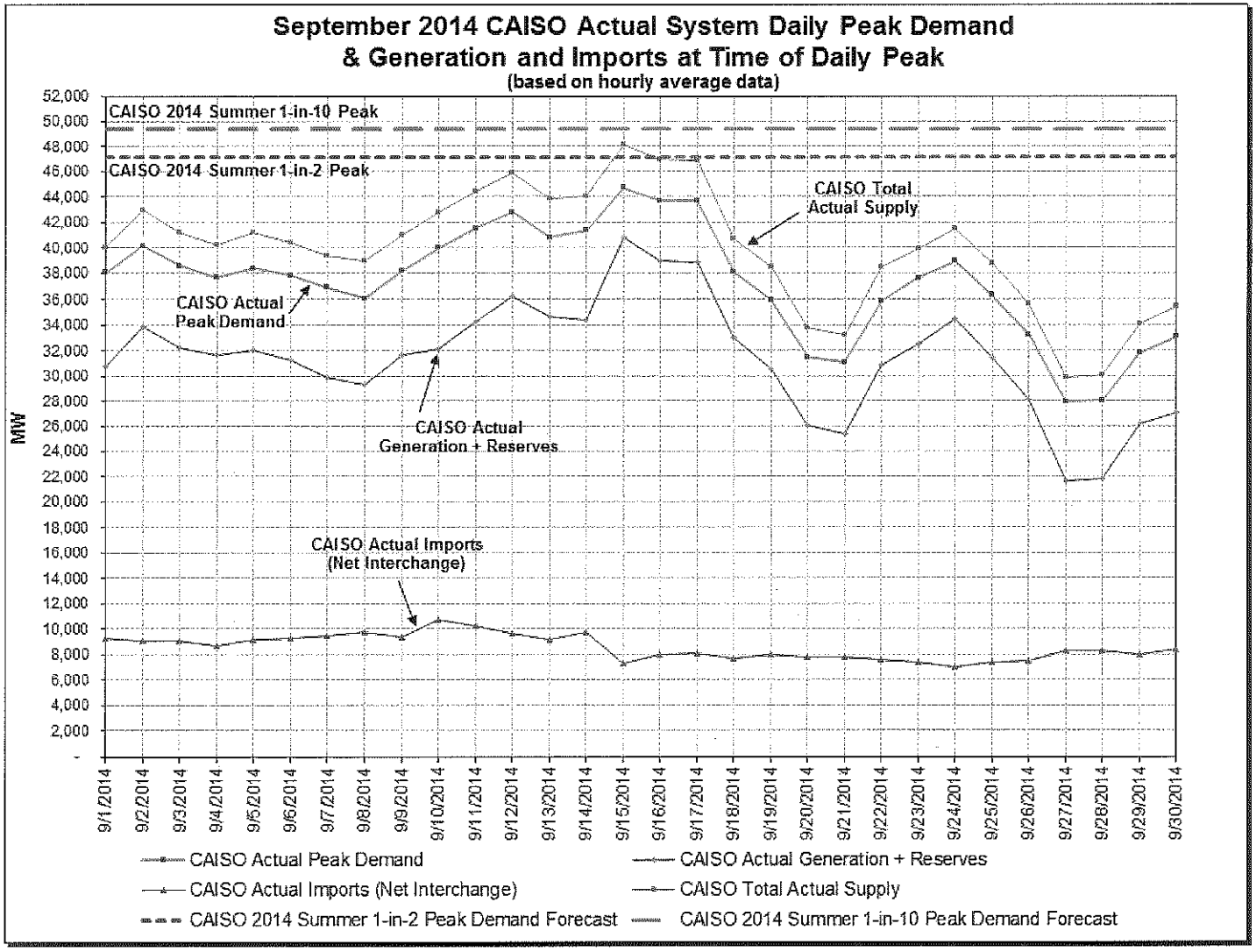

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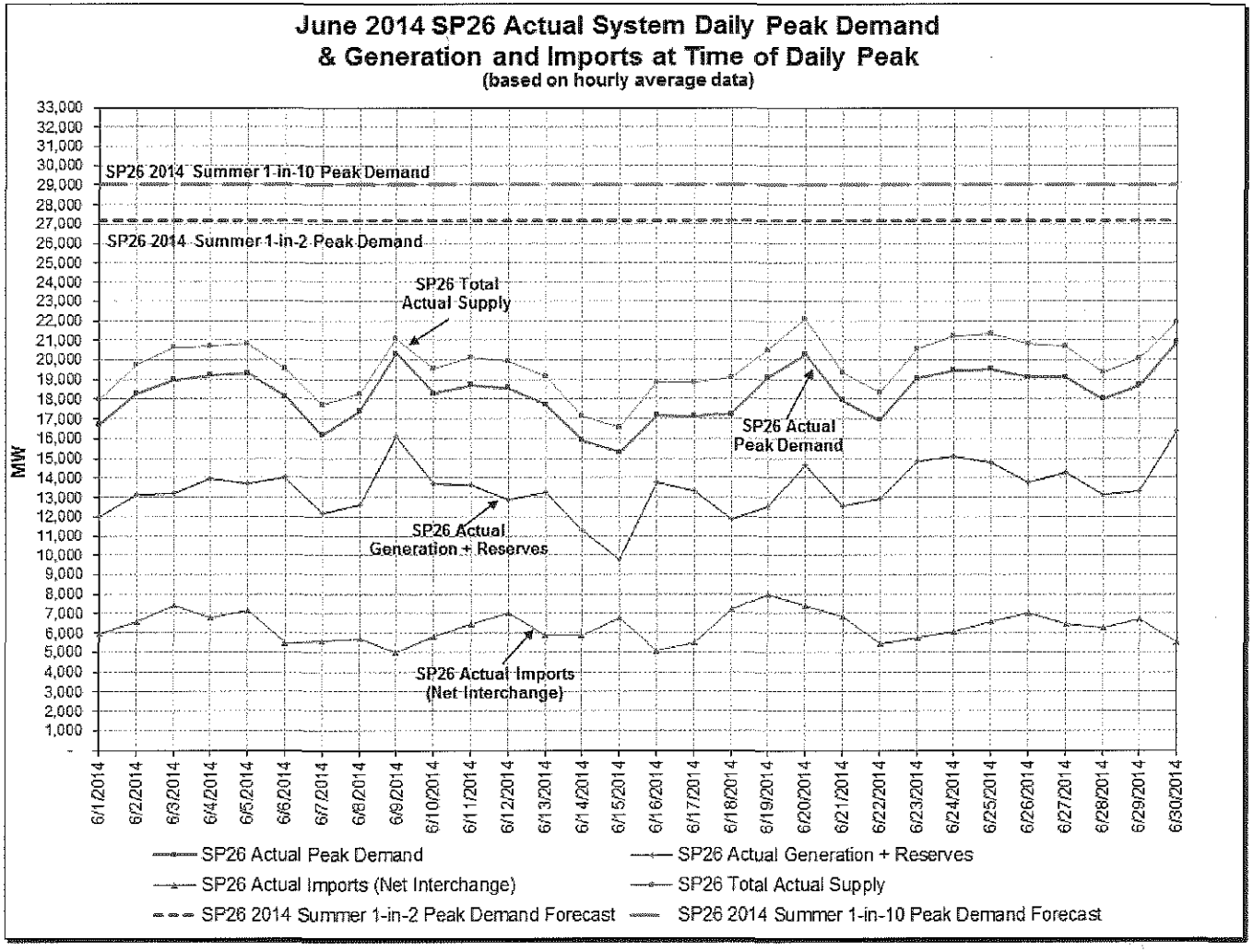

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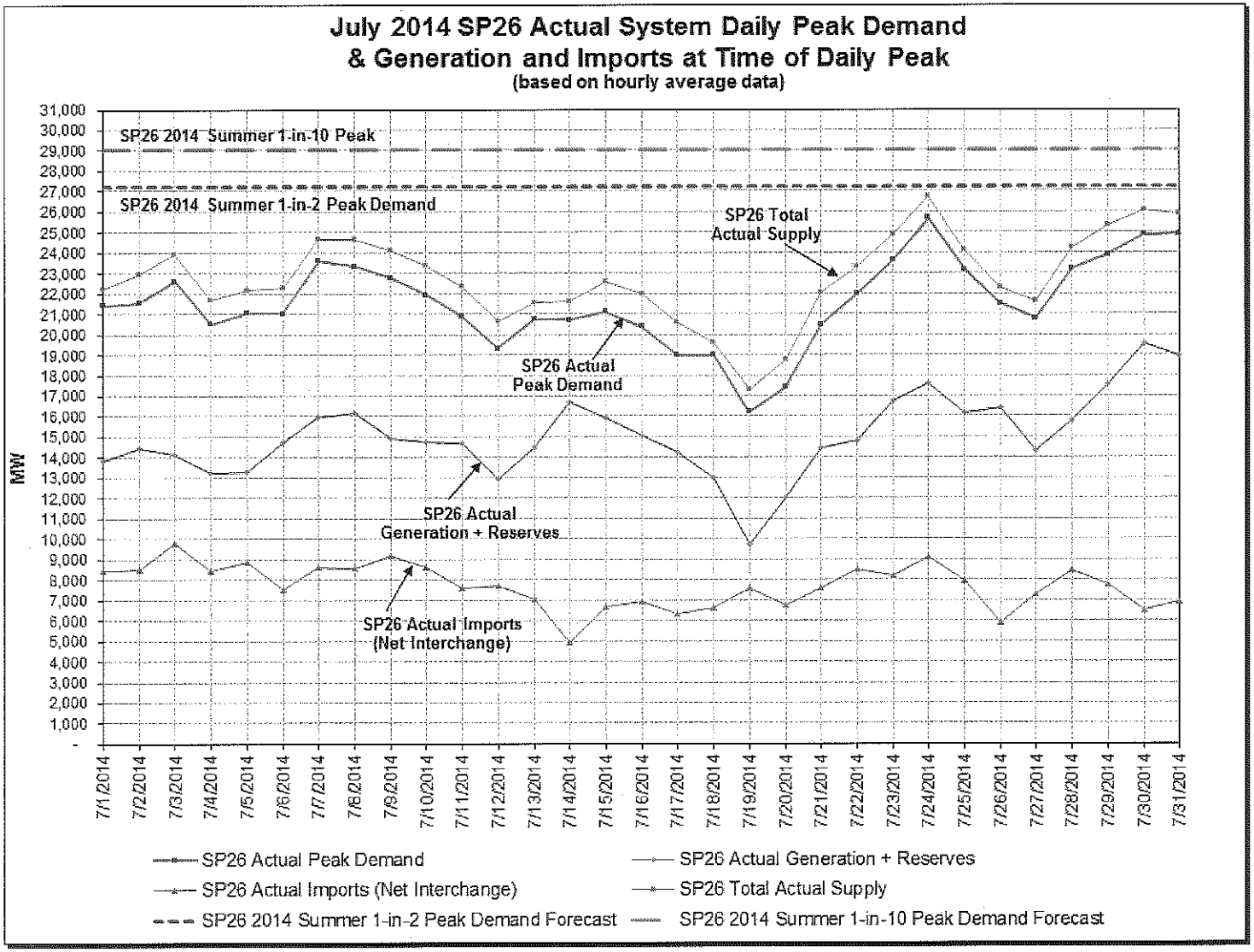

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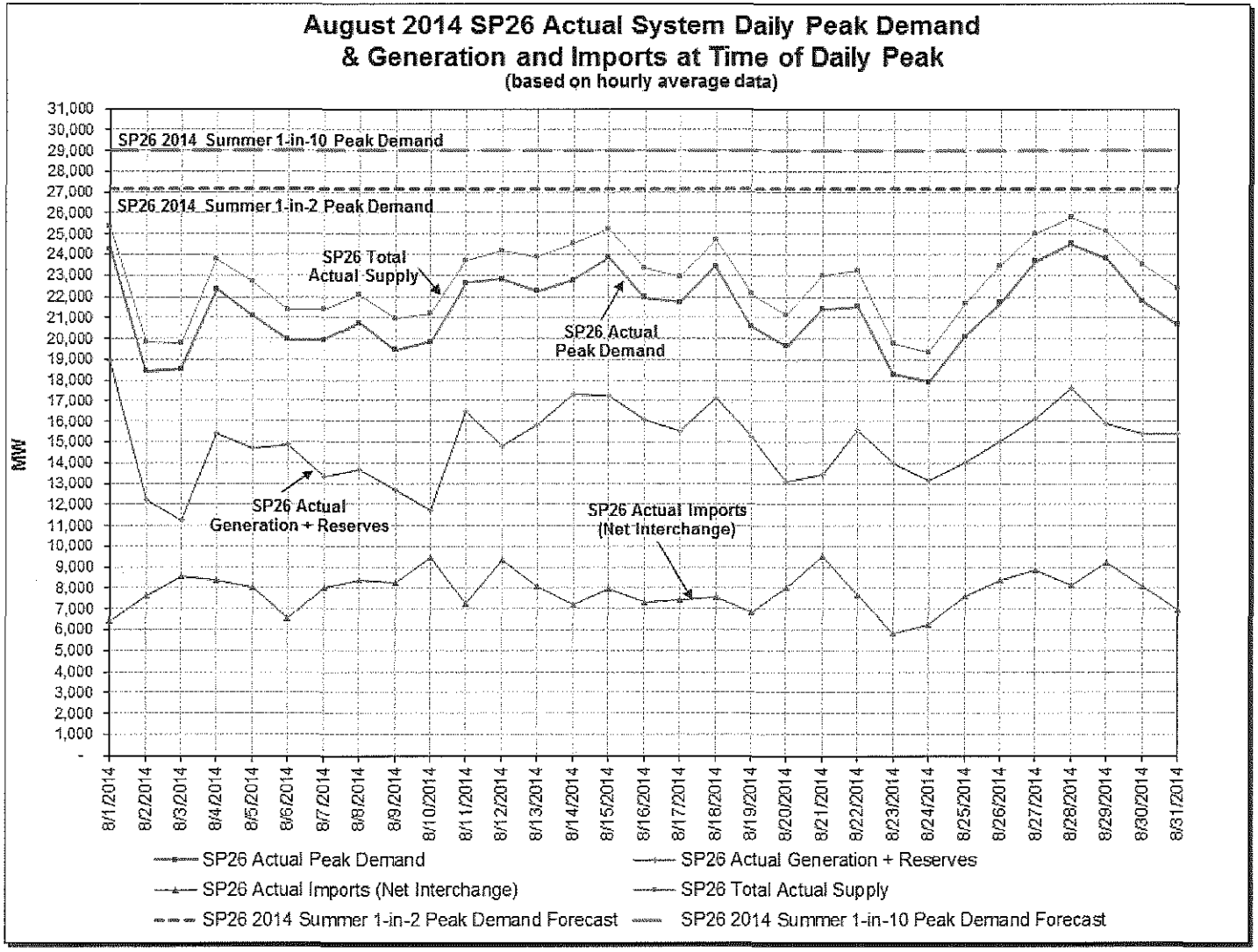

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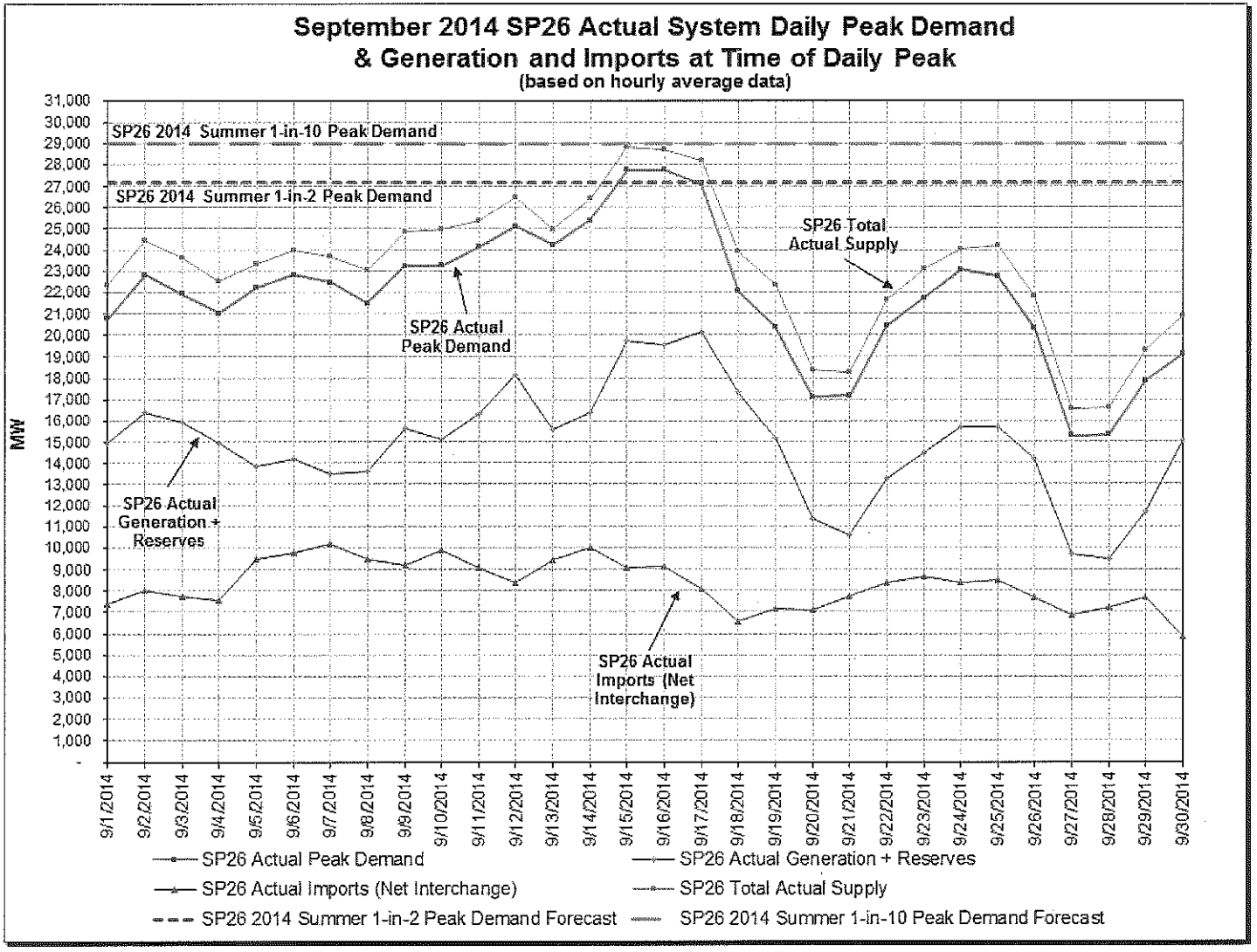

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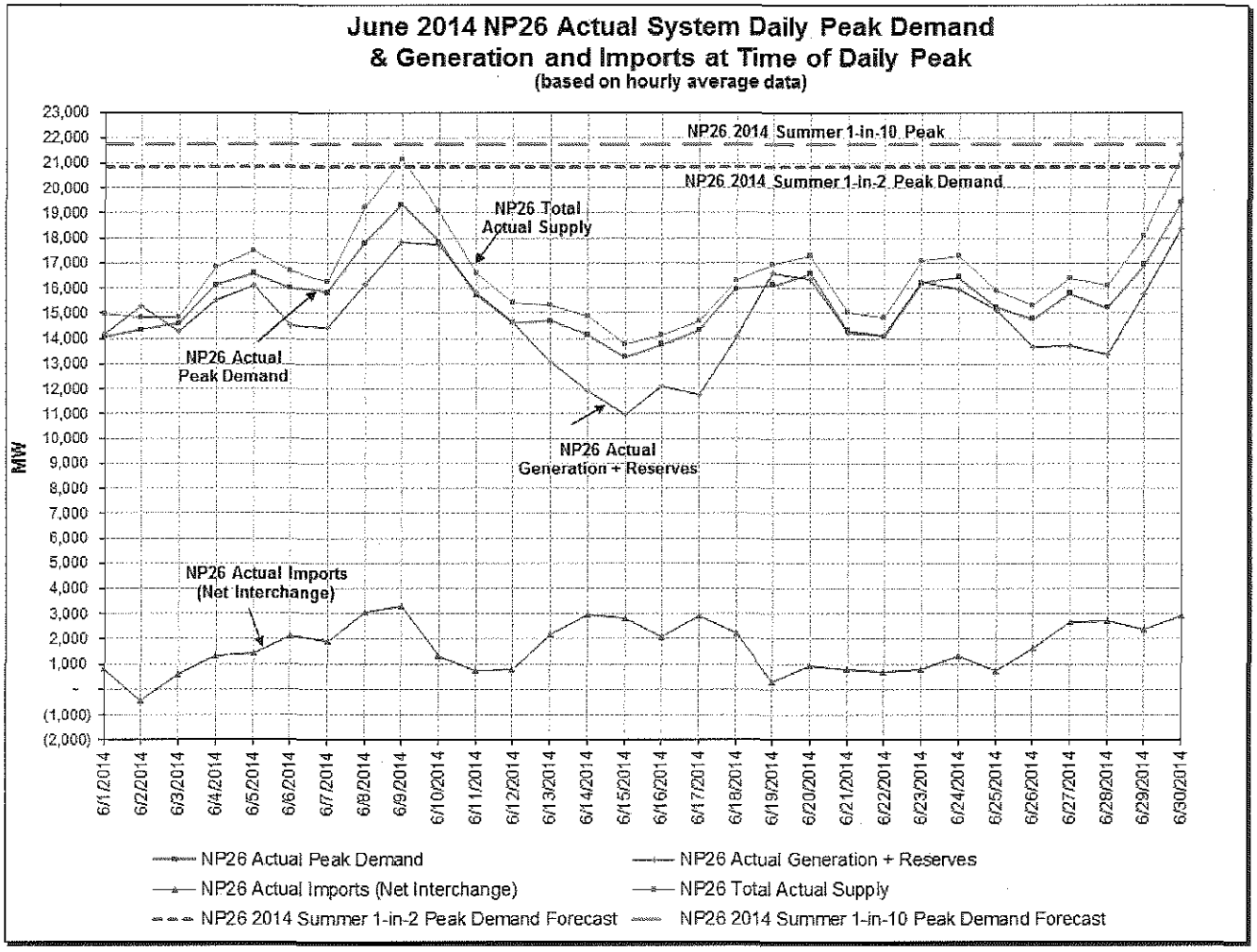

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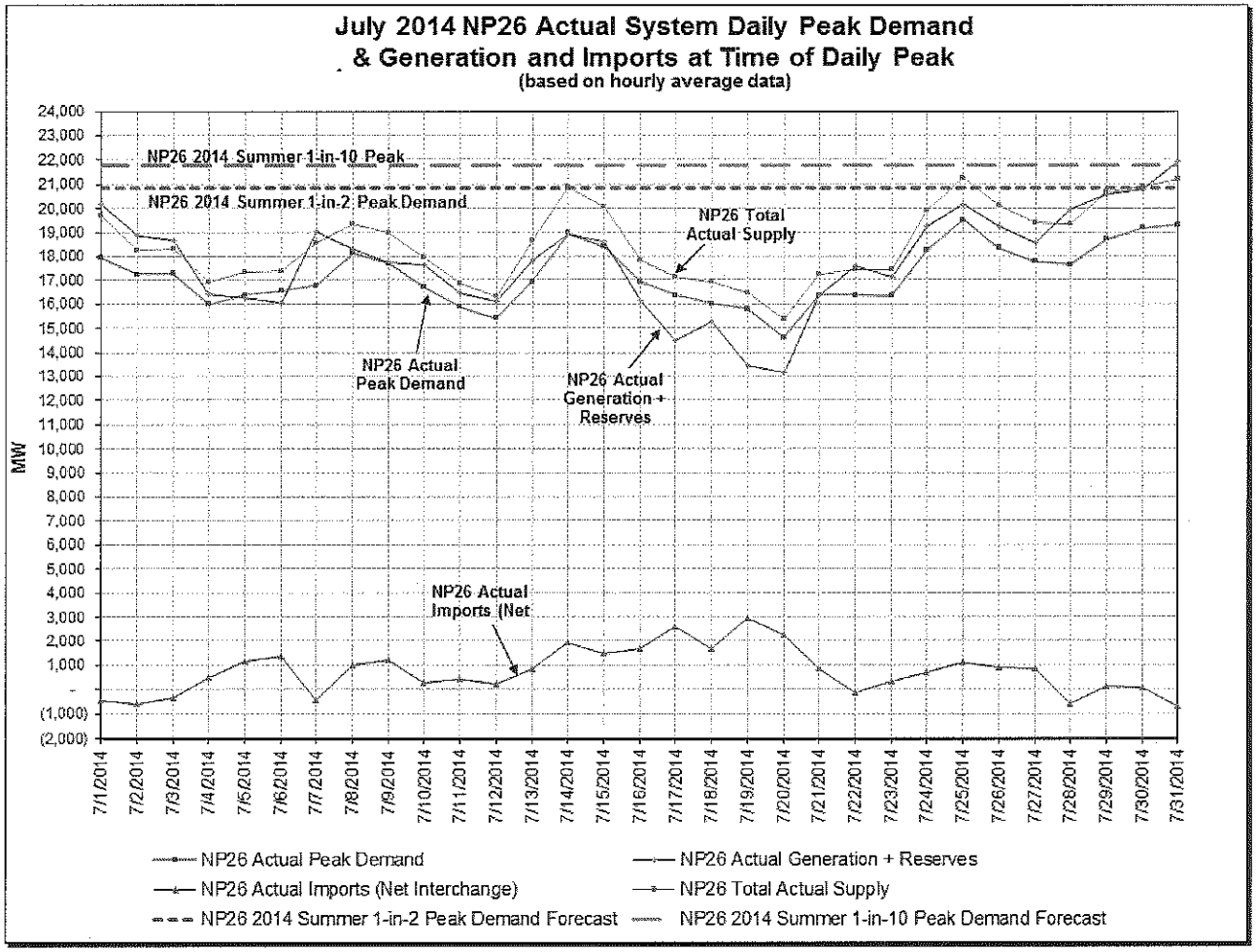

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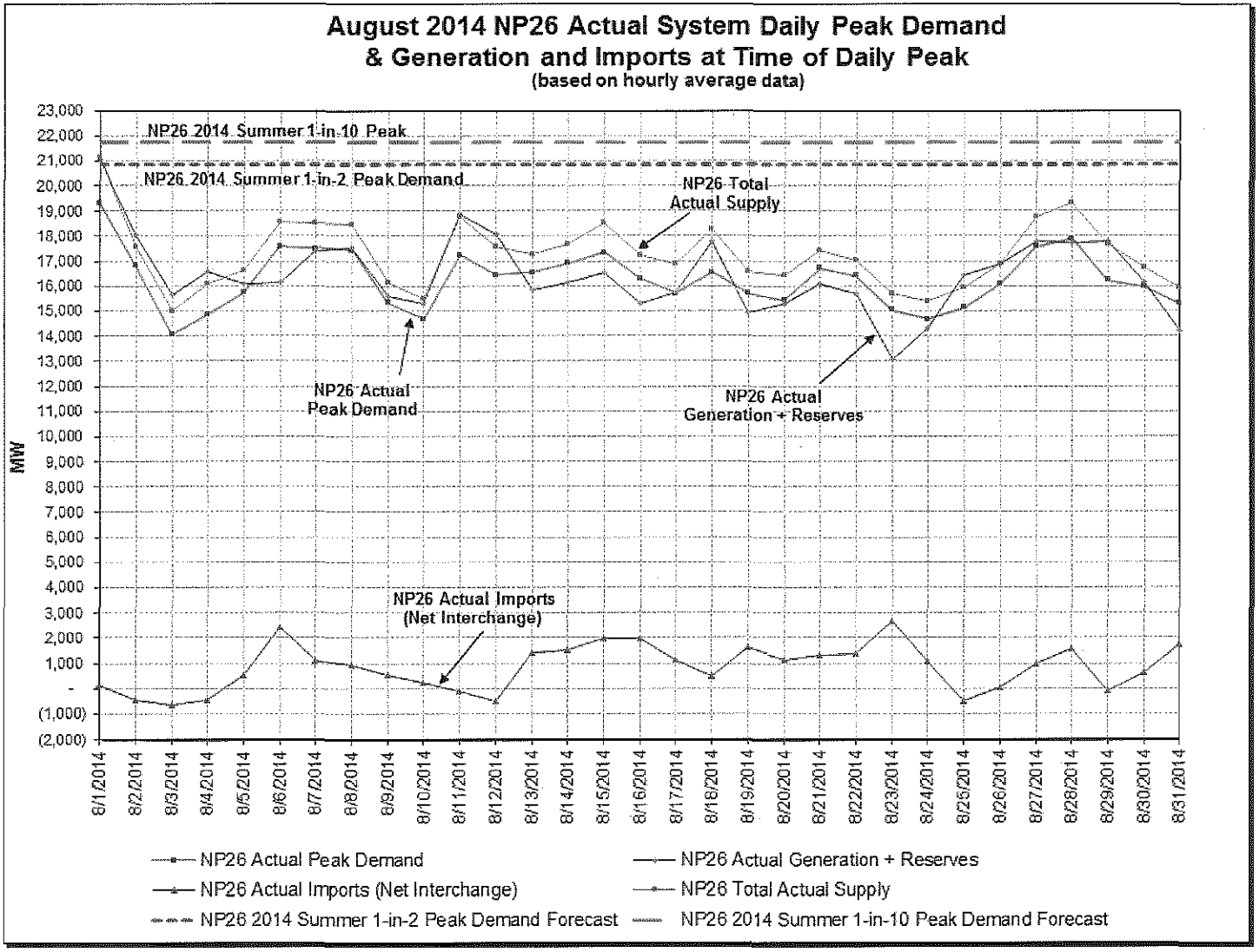

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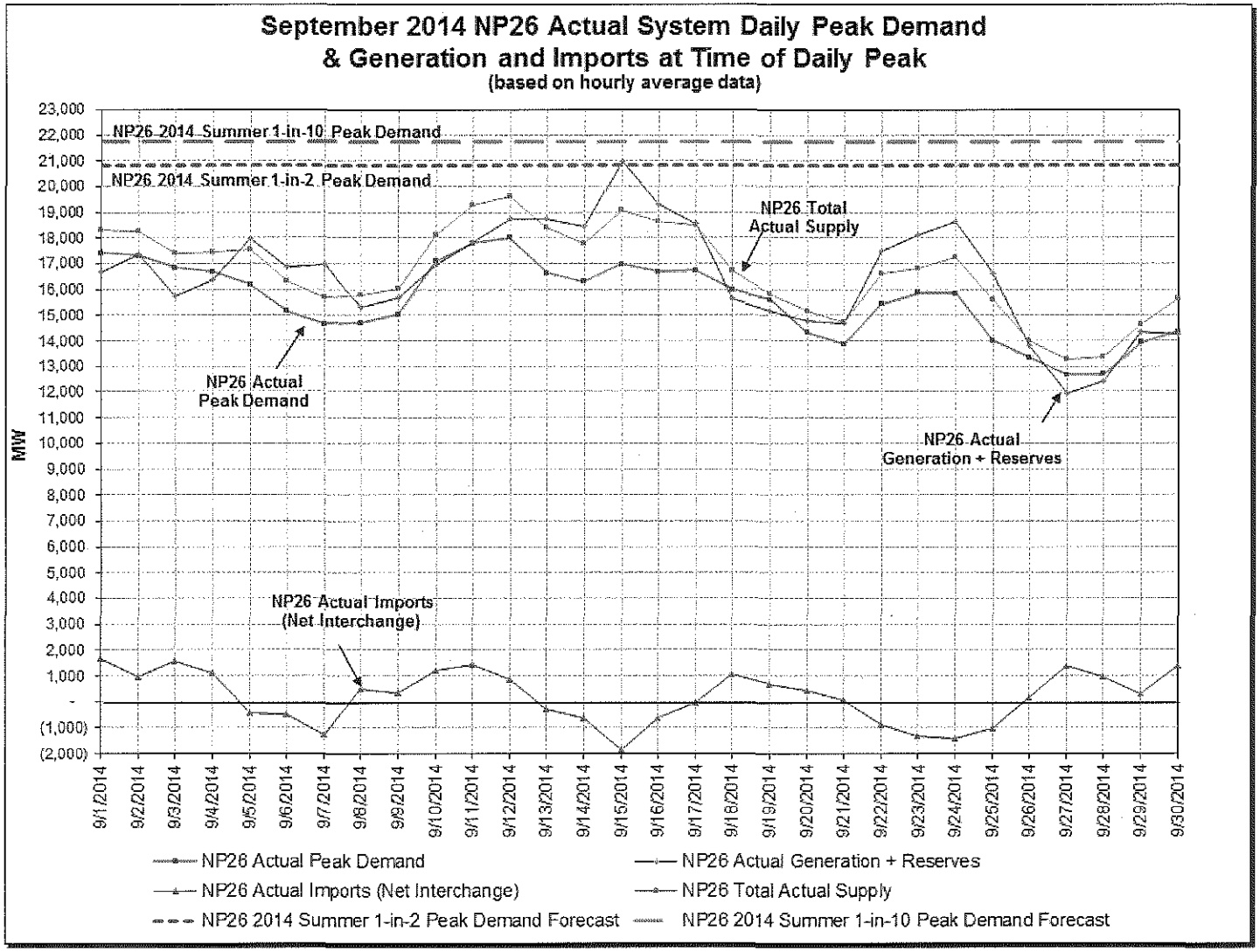
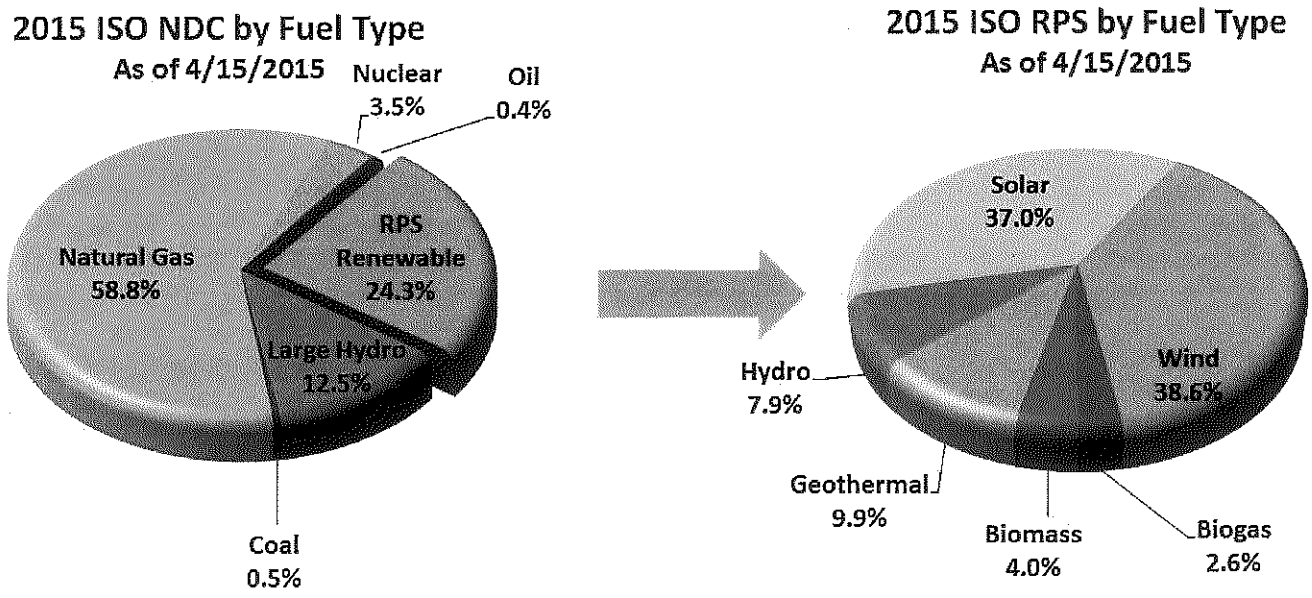
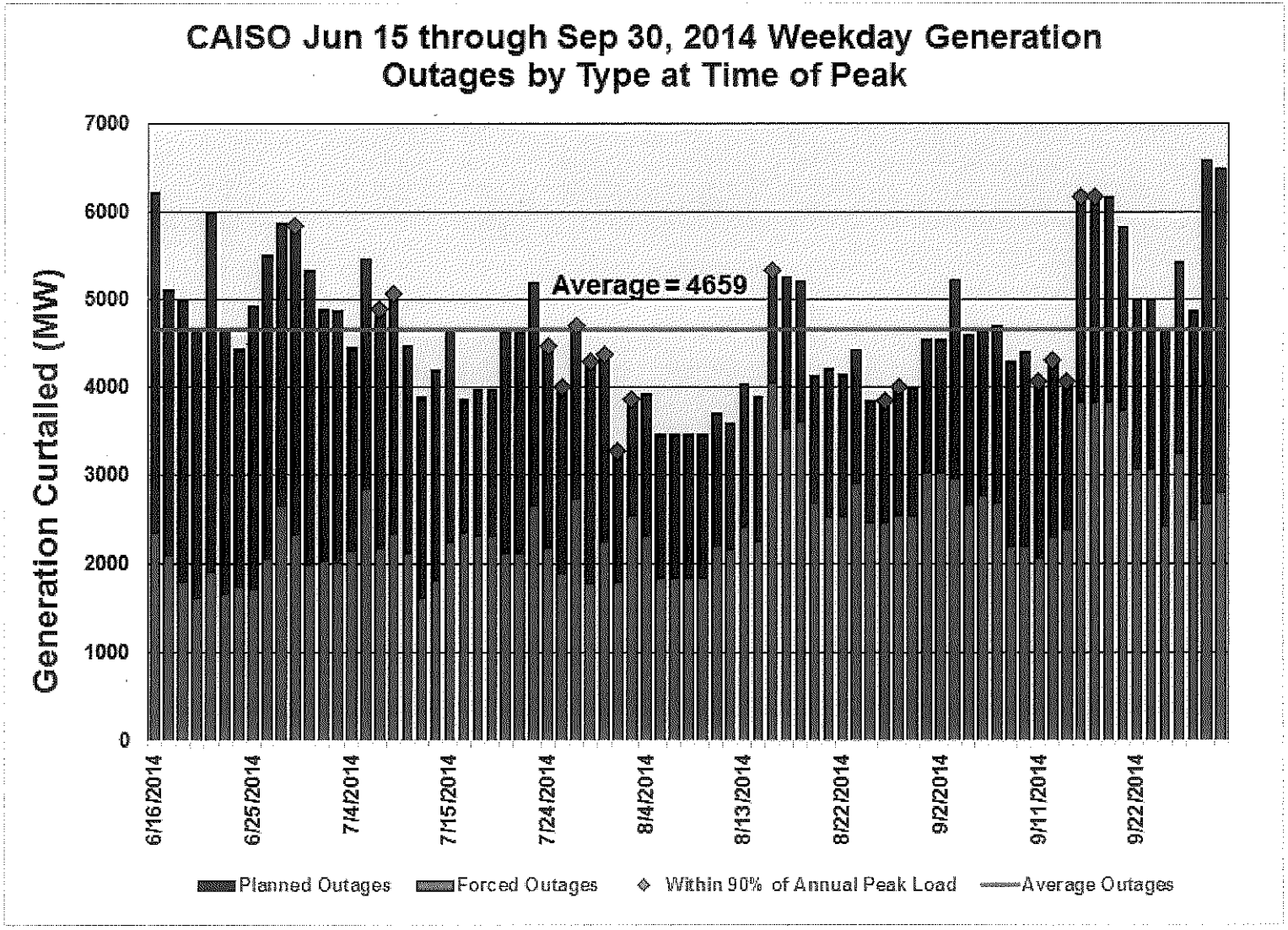


Appendix B: 2015 CAISO NDC and RPS by Fuel Type



Appendix C: 2012 – 2014 Summer Generation Outage Graphs



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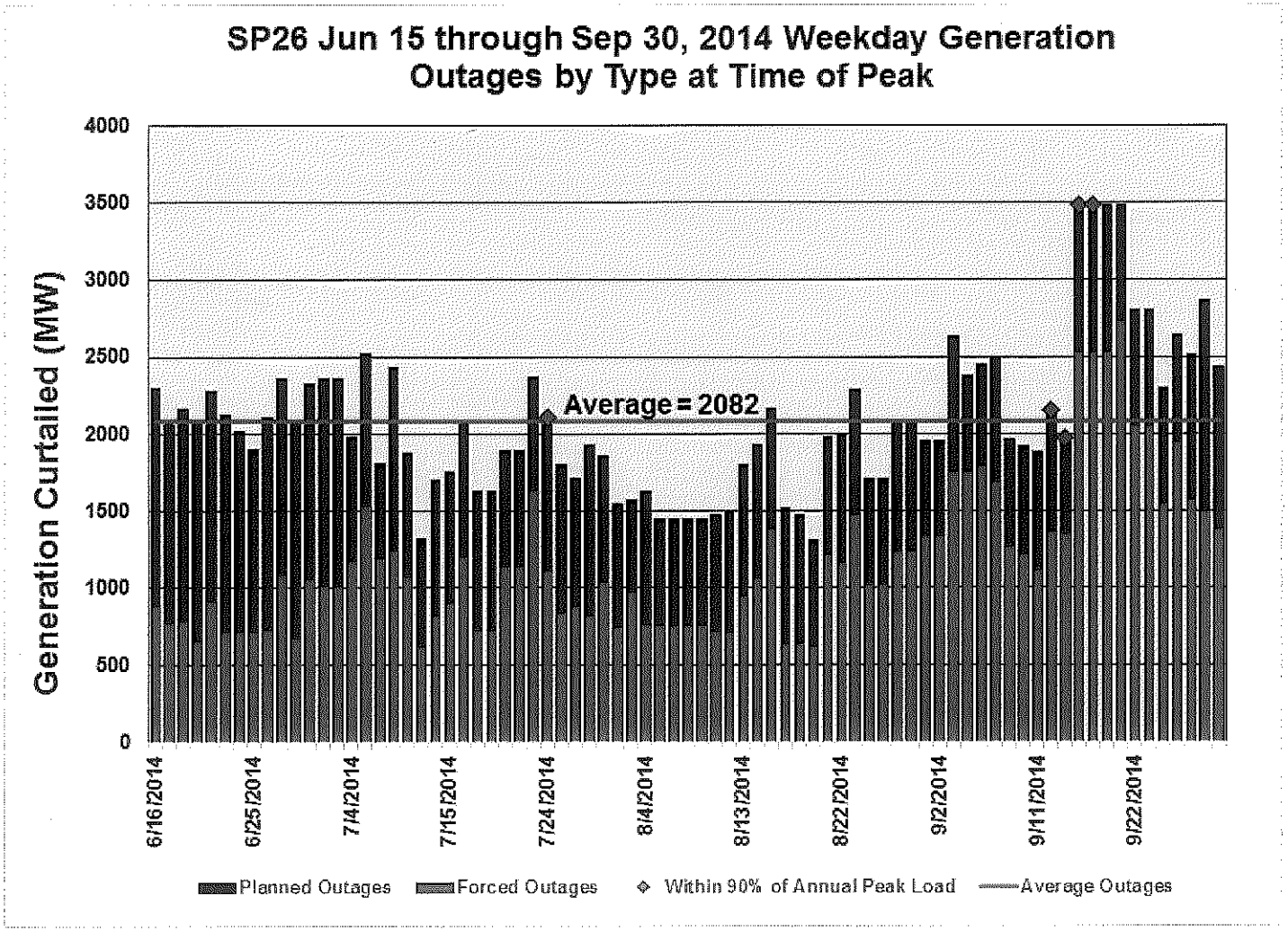

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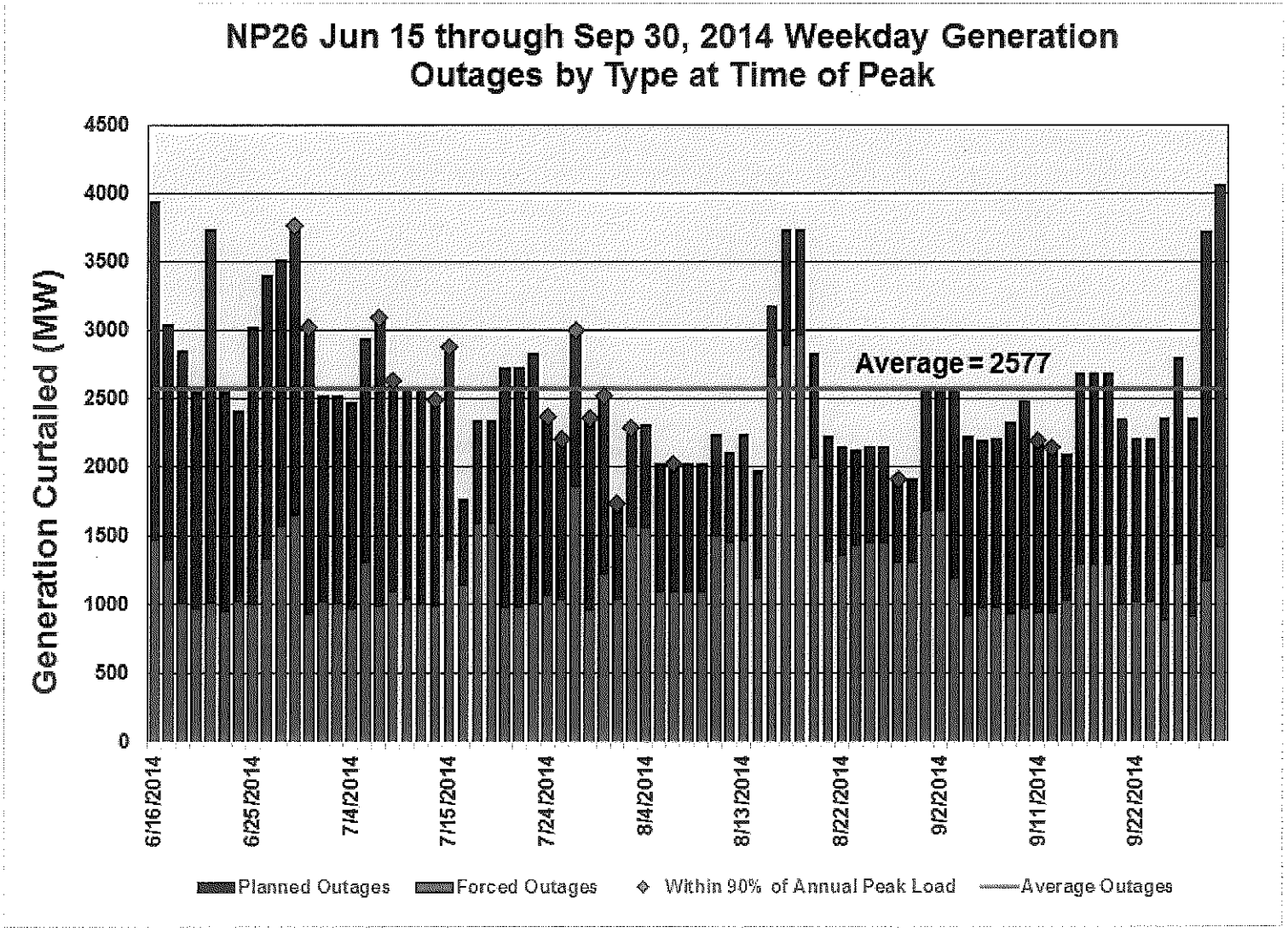

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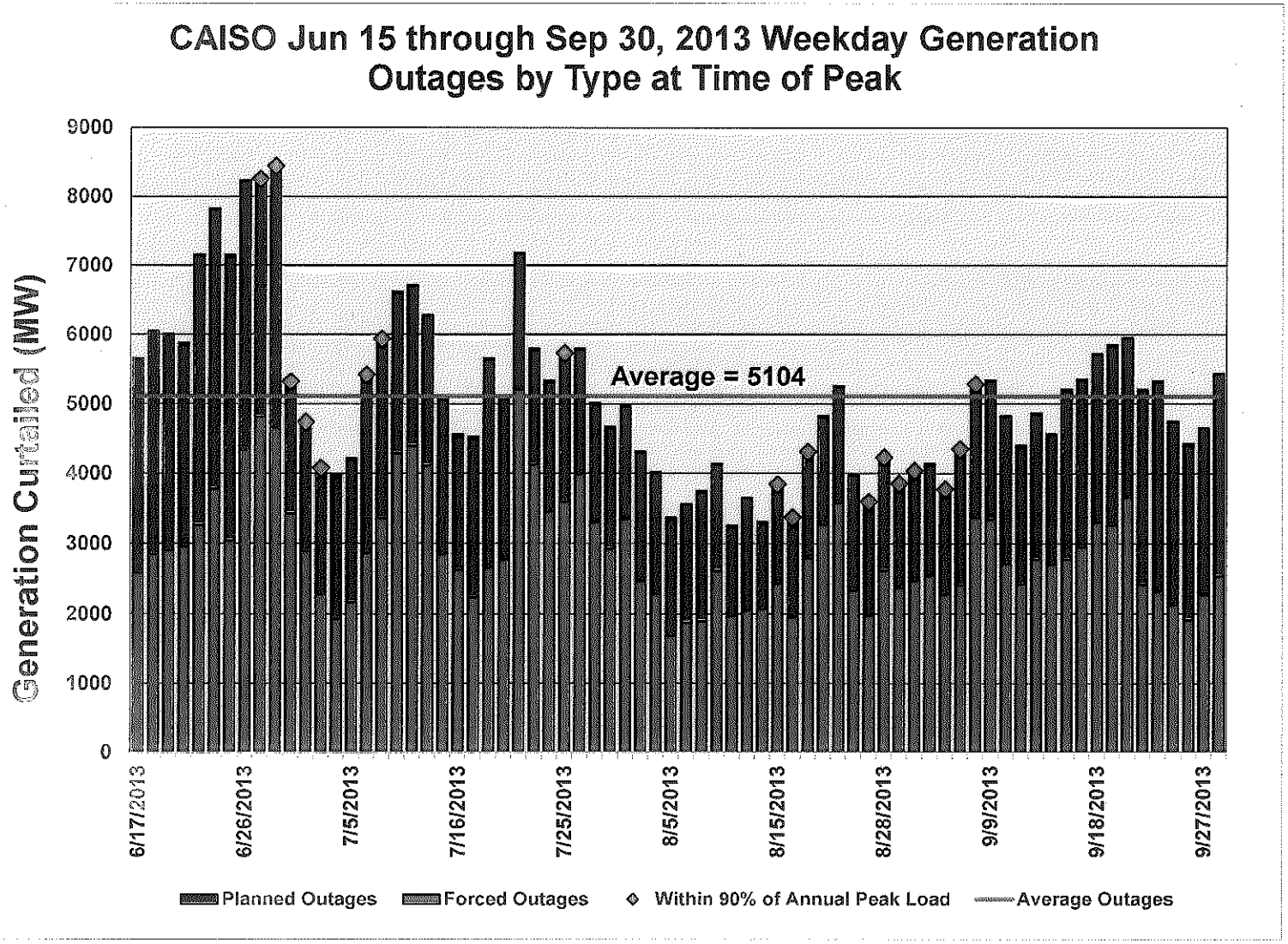

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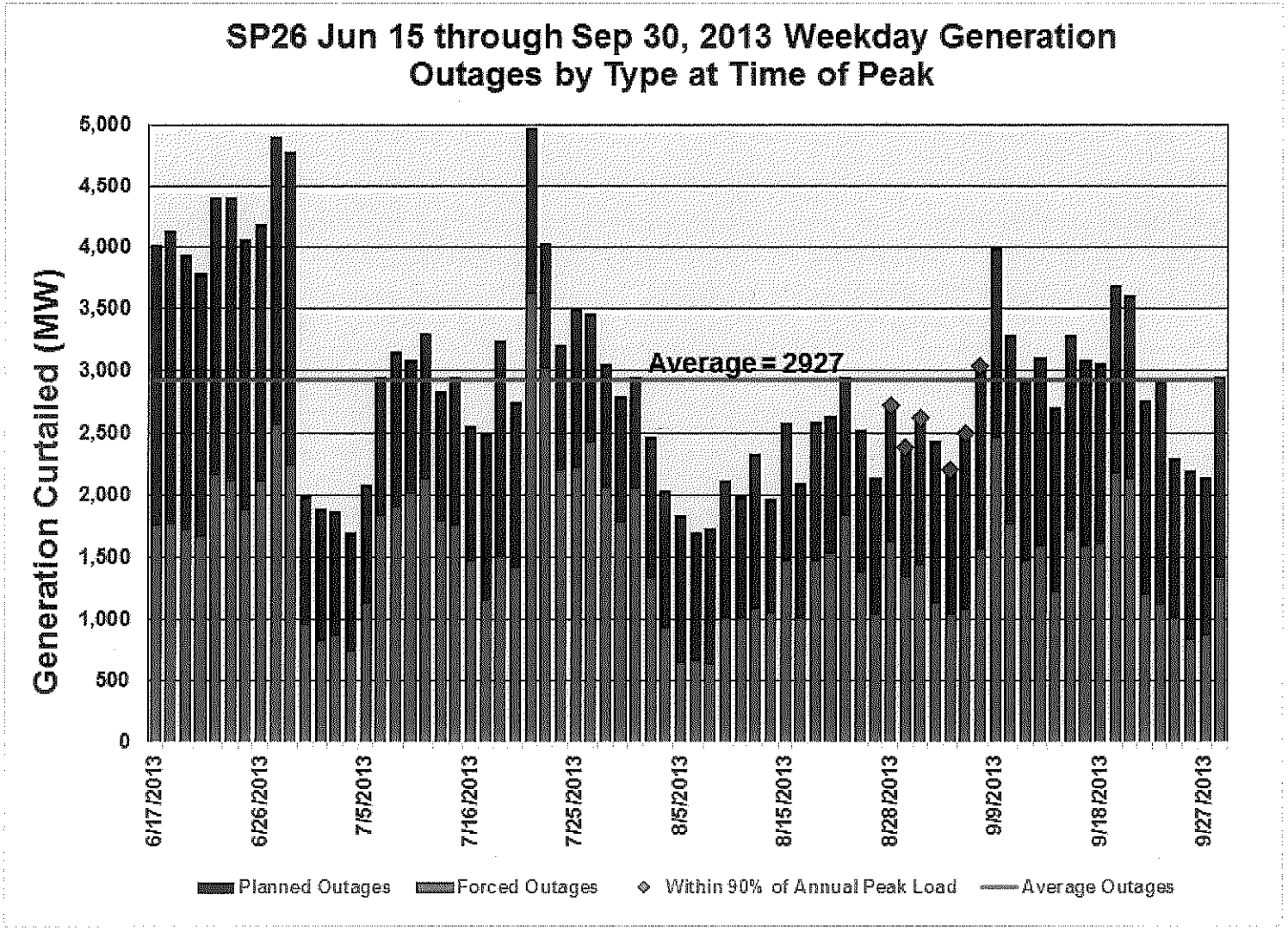

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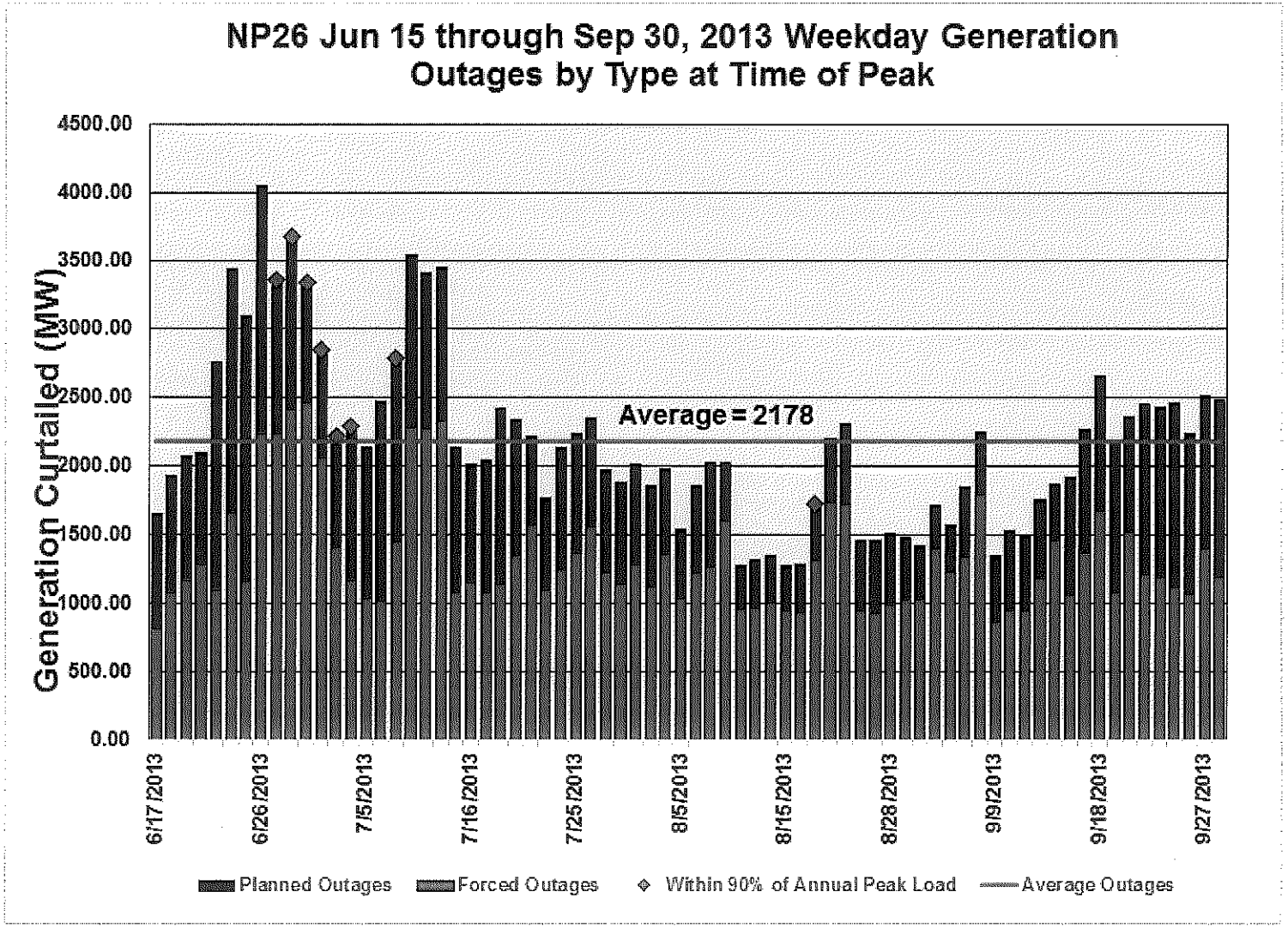

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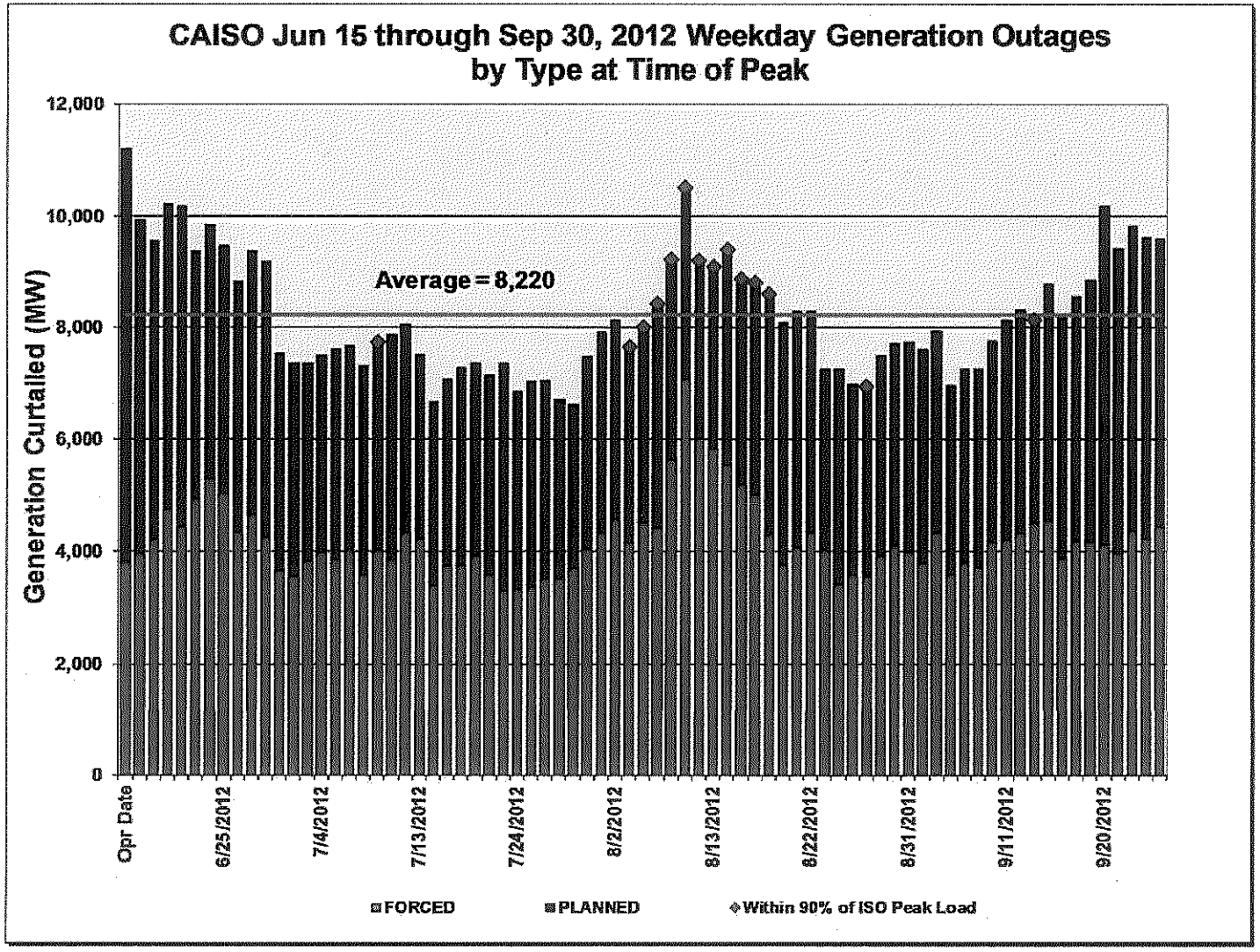

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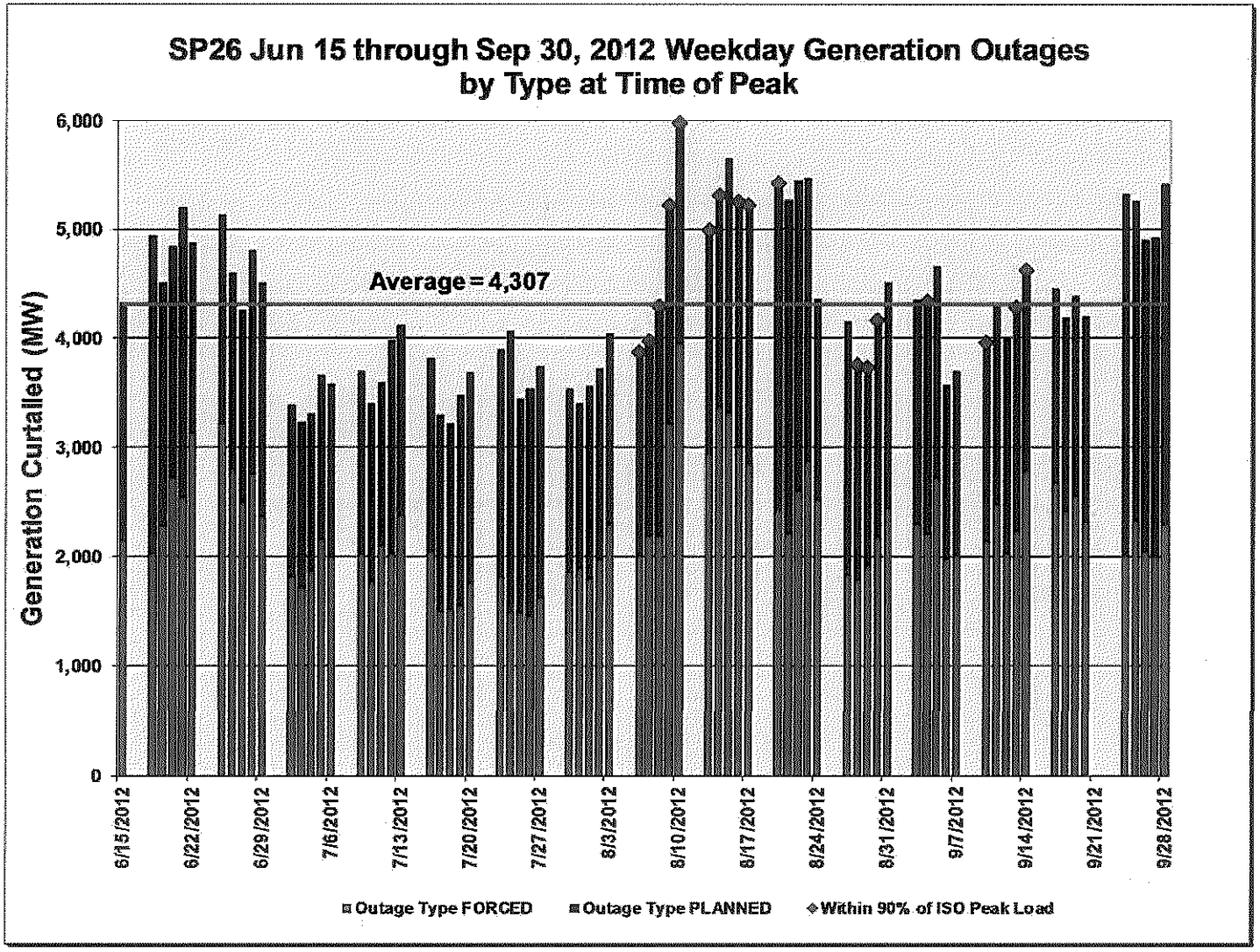

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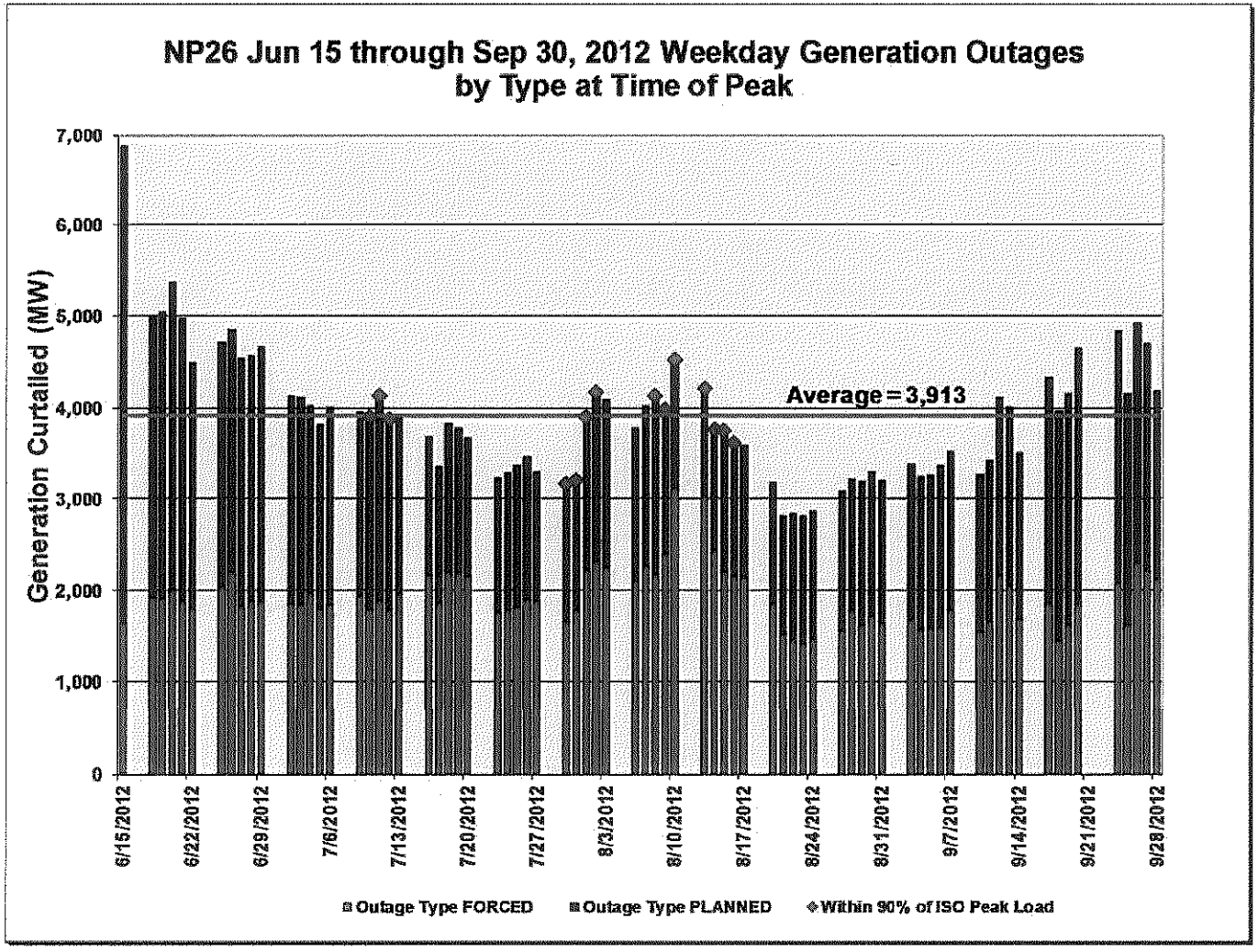
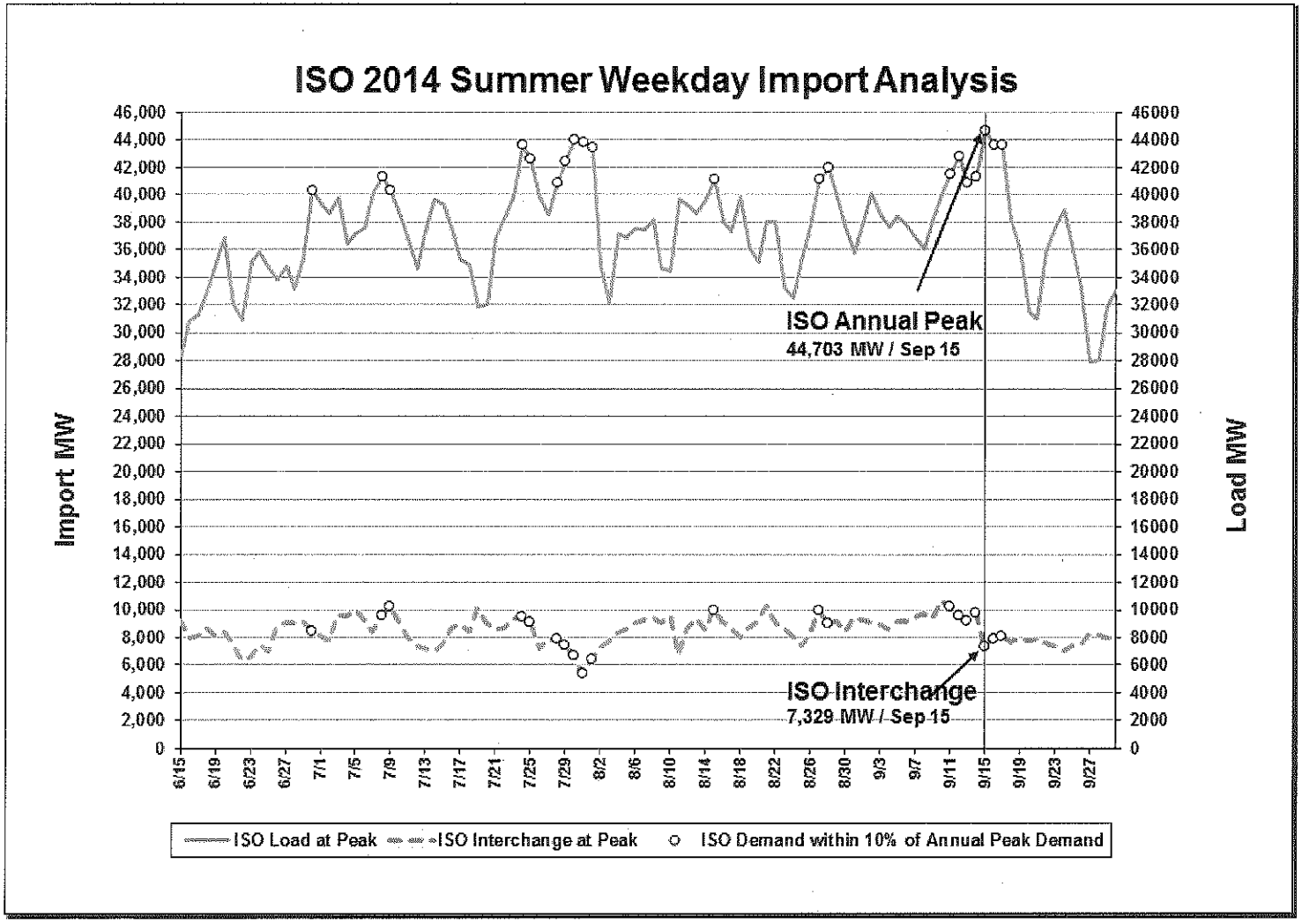


Appendix D: 2011 – 2013 Summer Imports Summary Graphs



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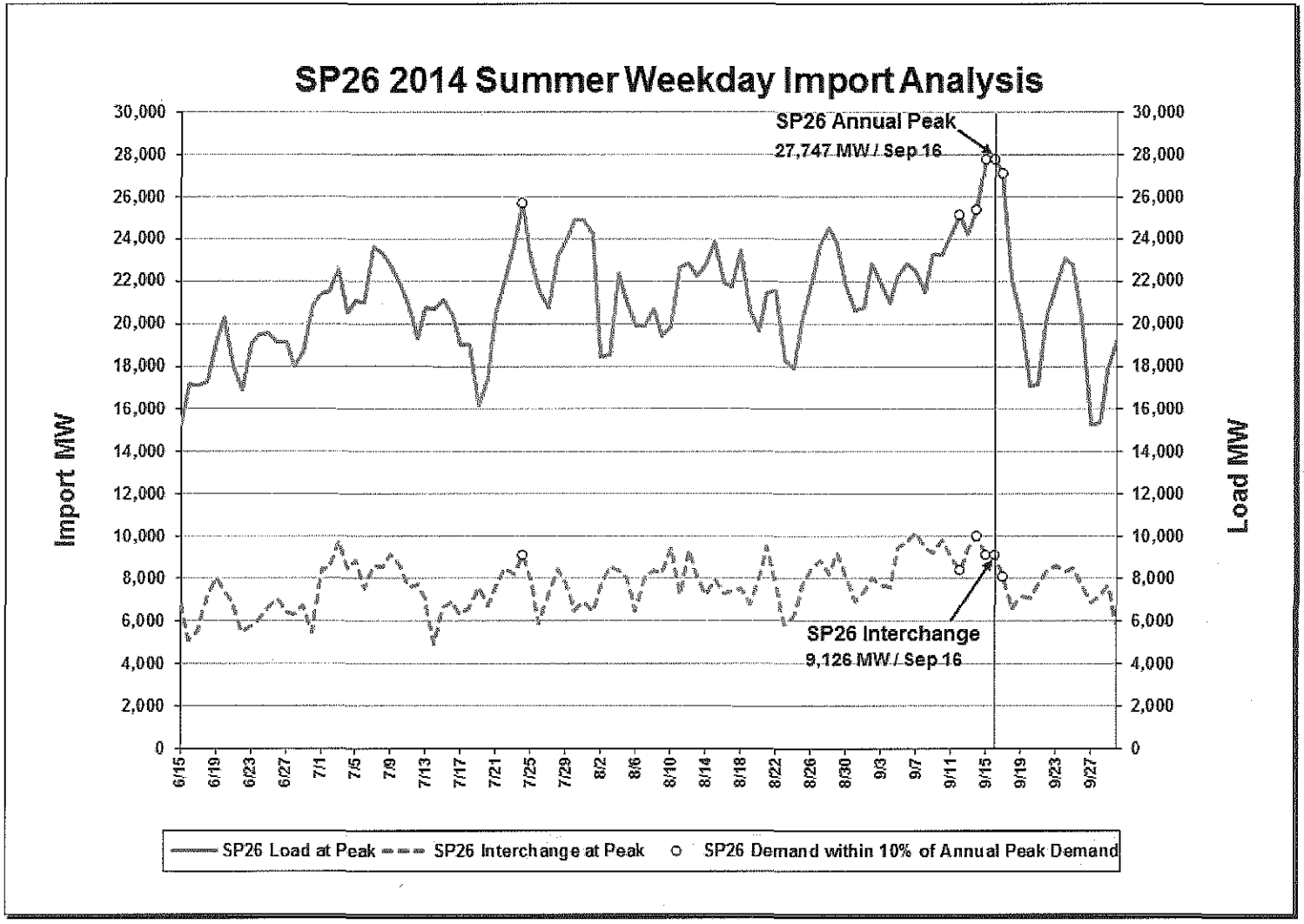

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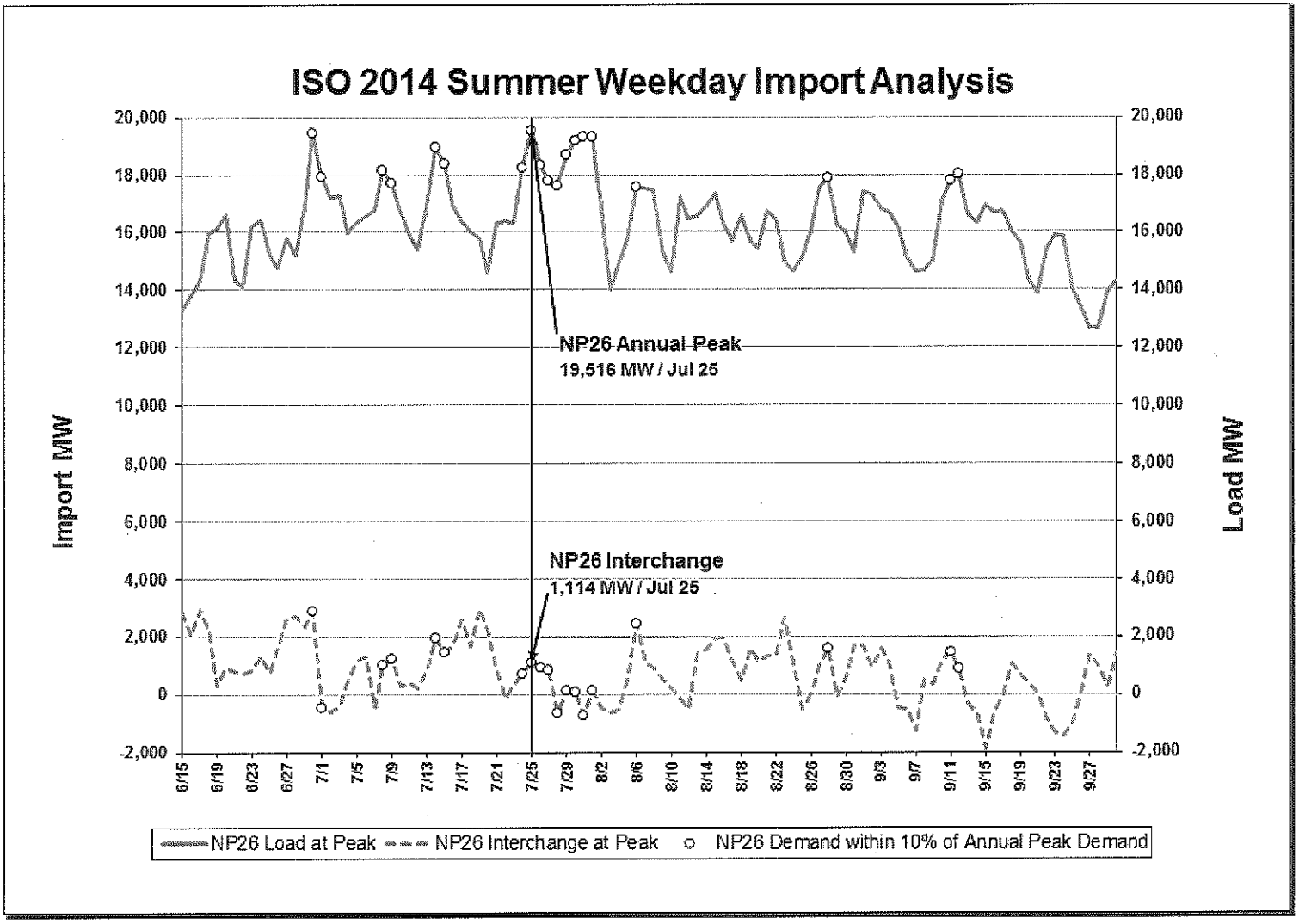

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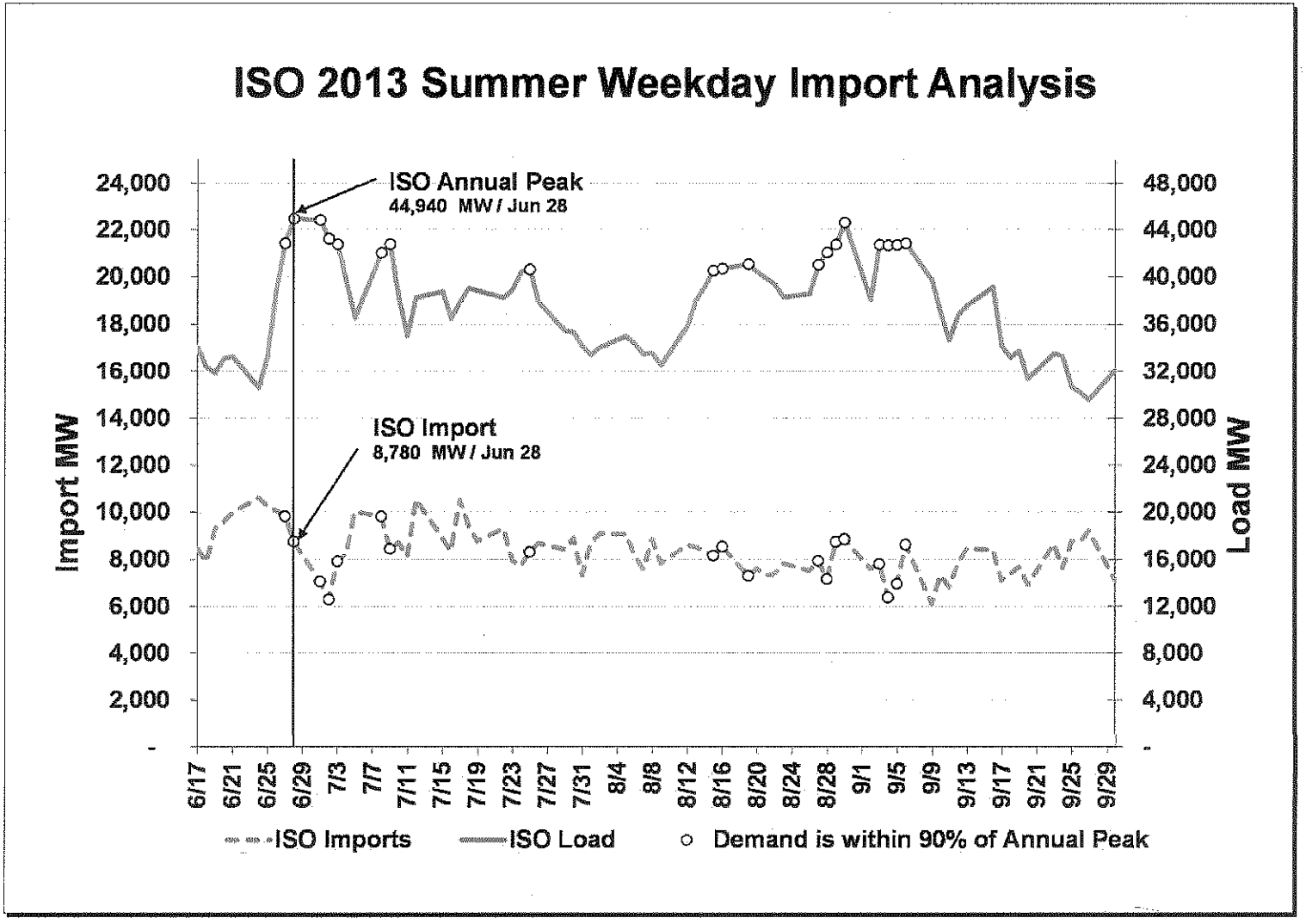

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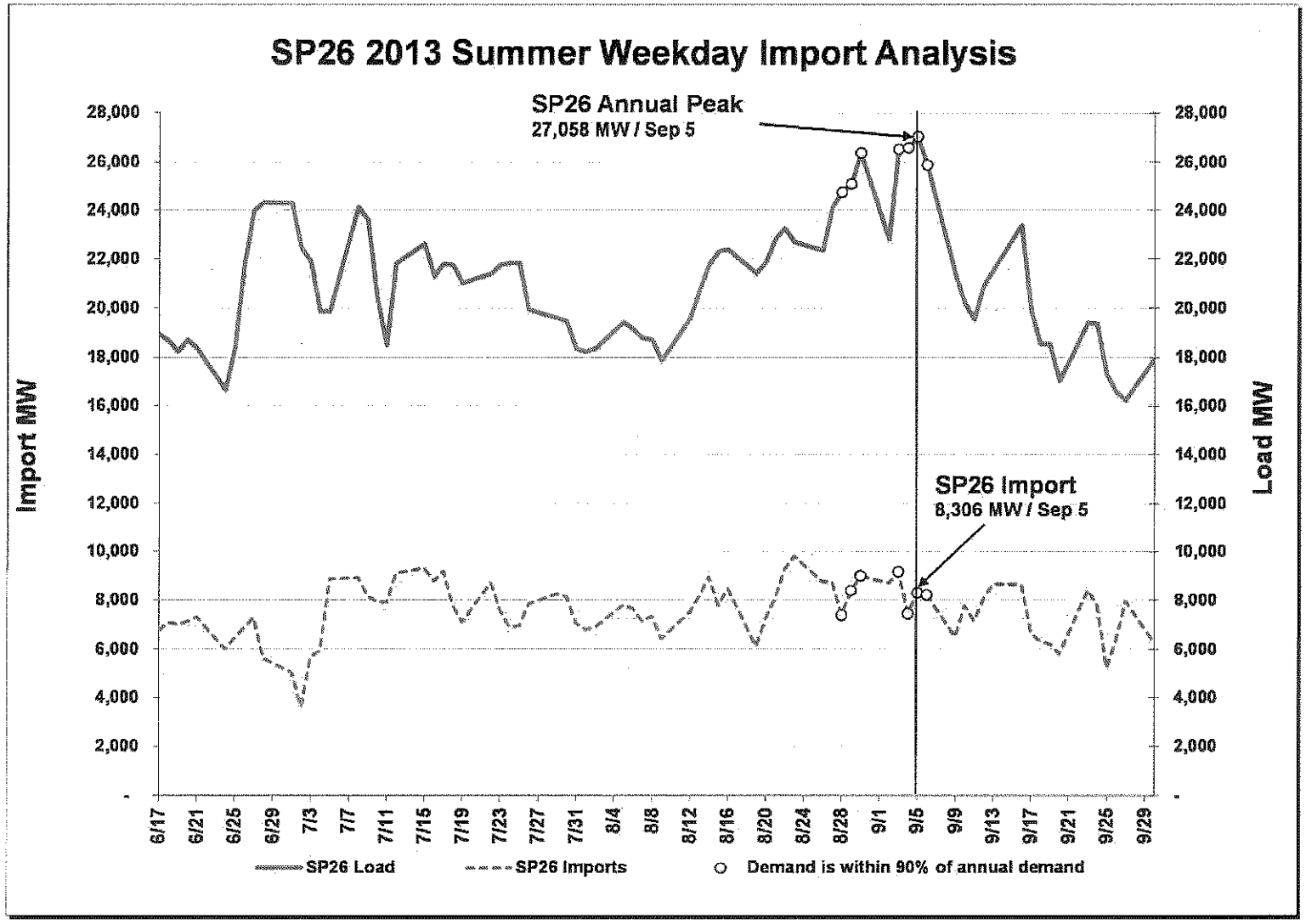

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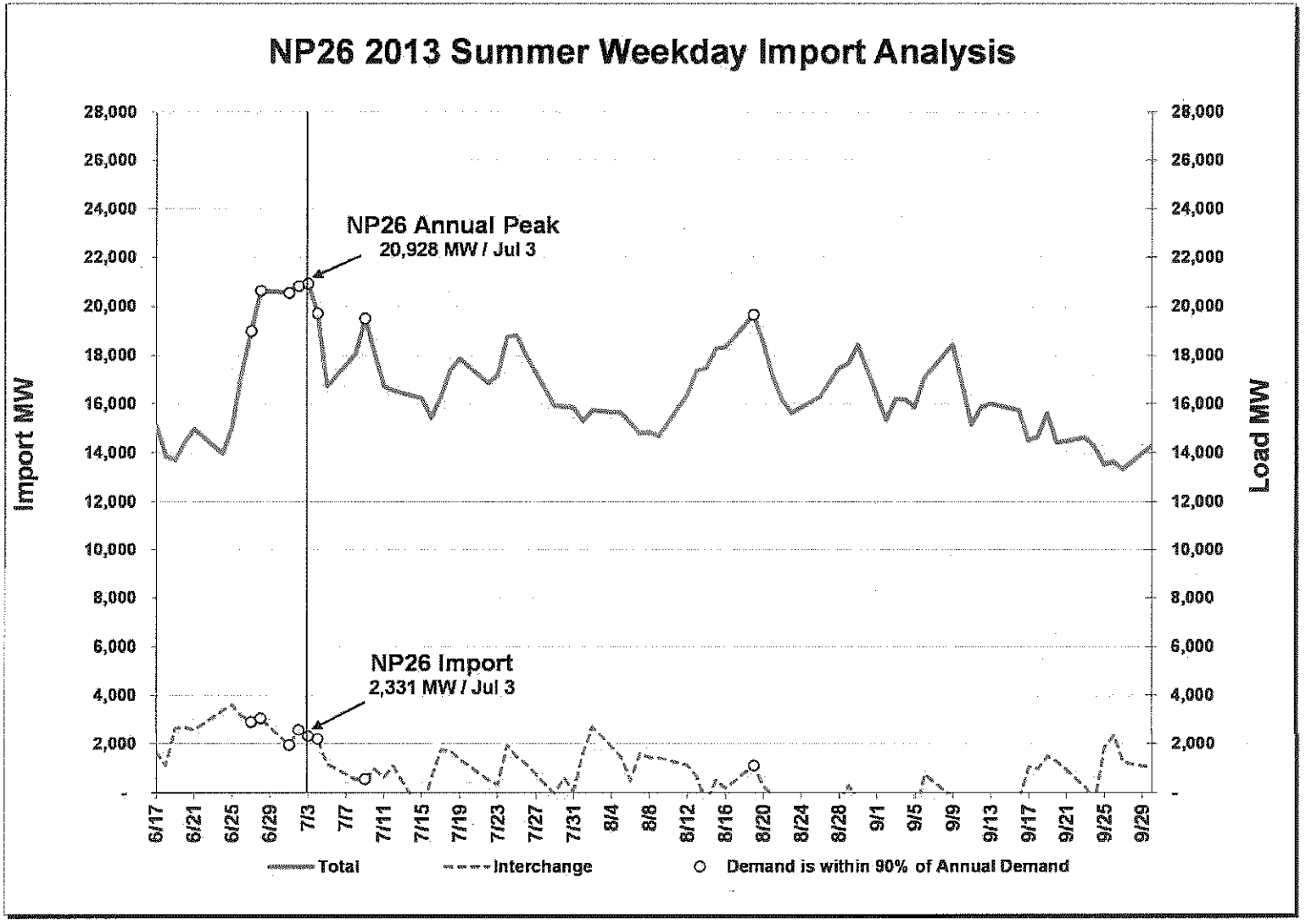

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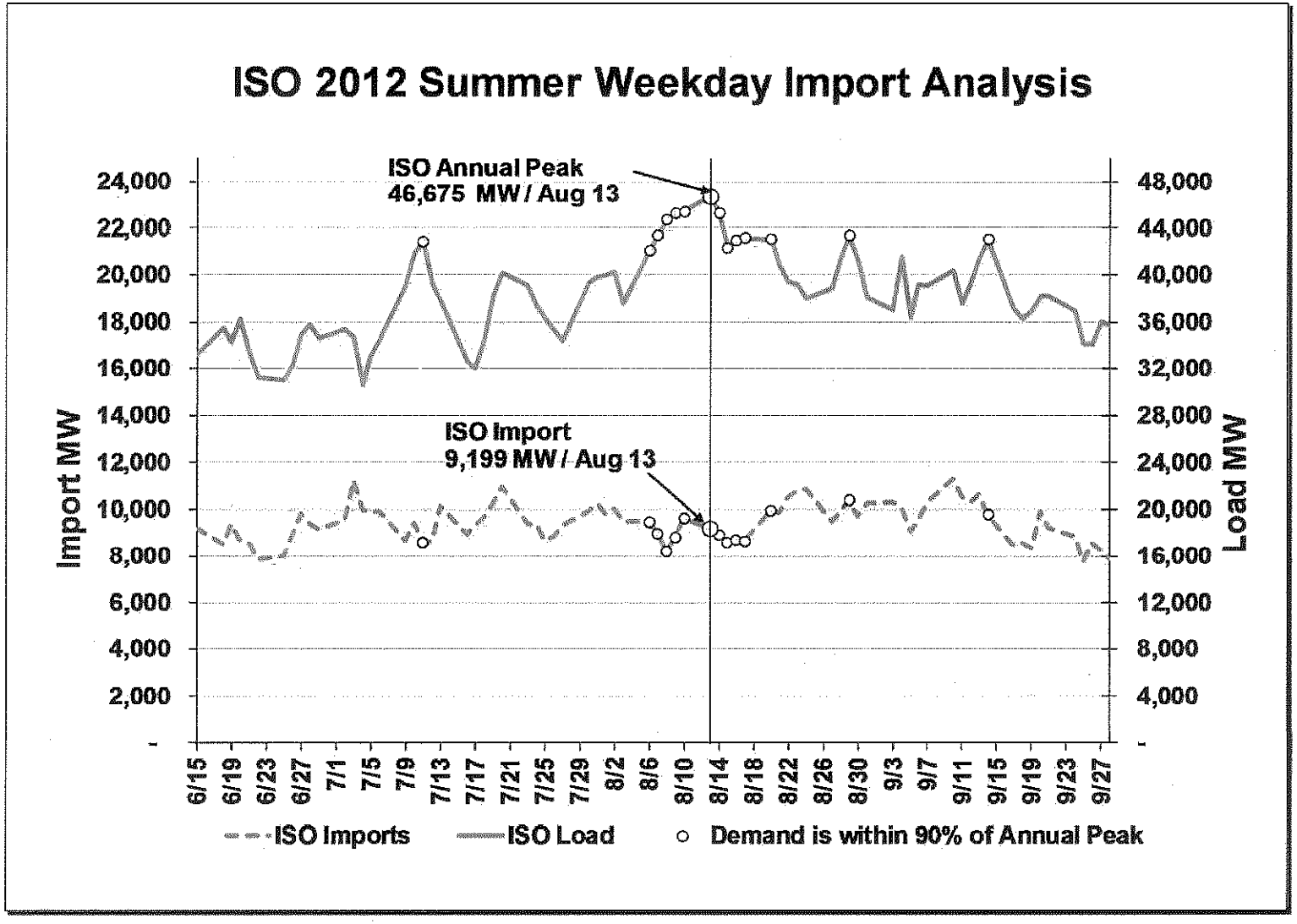

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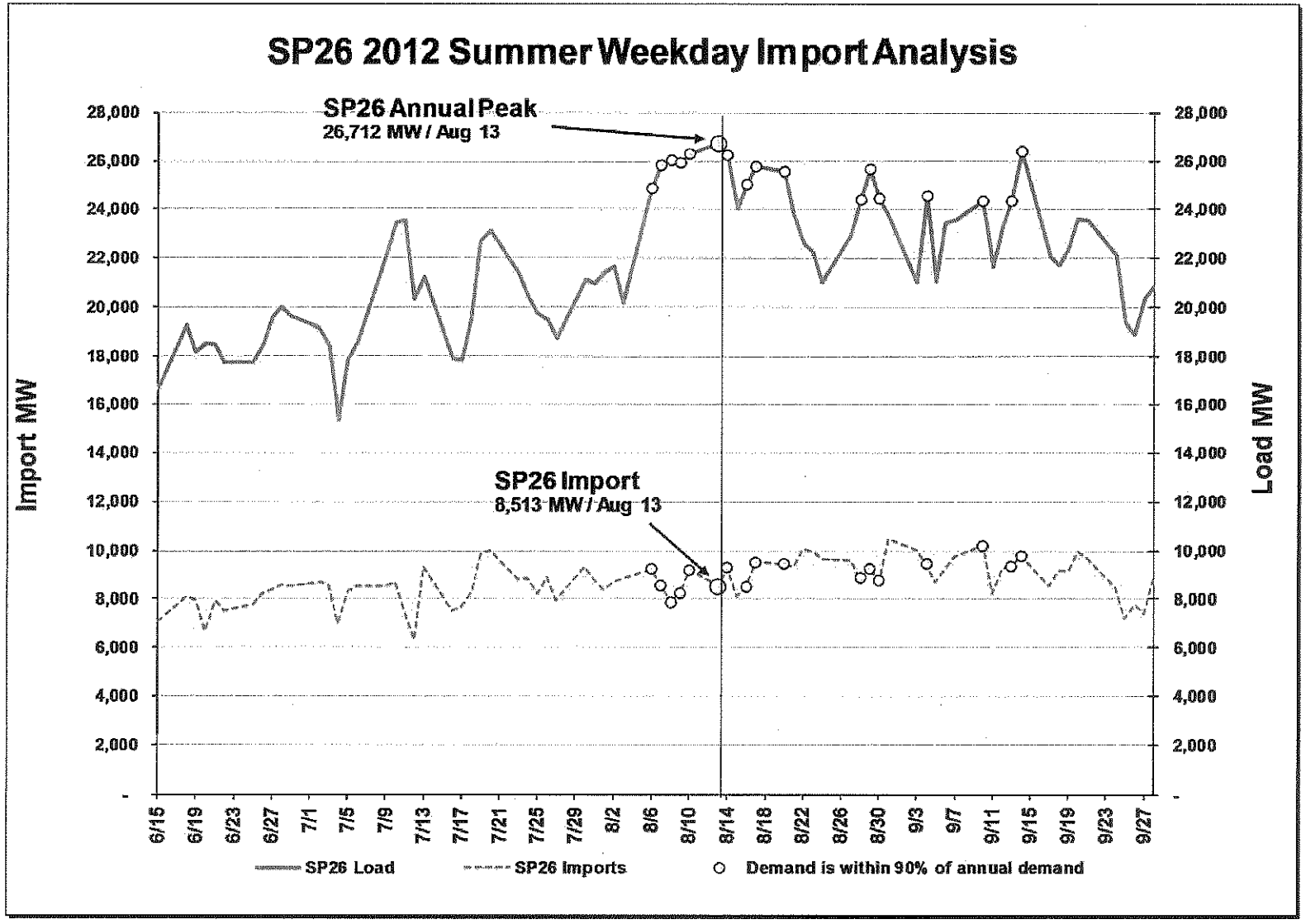

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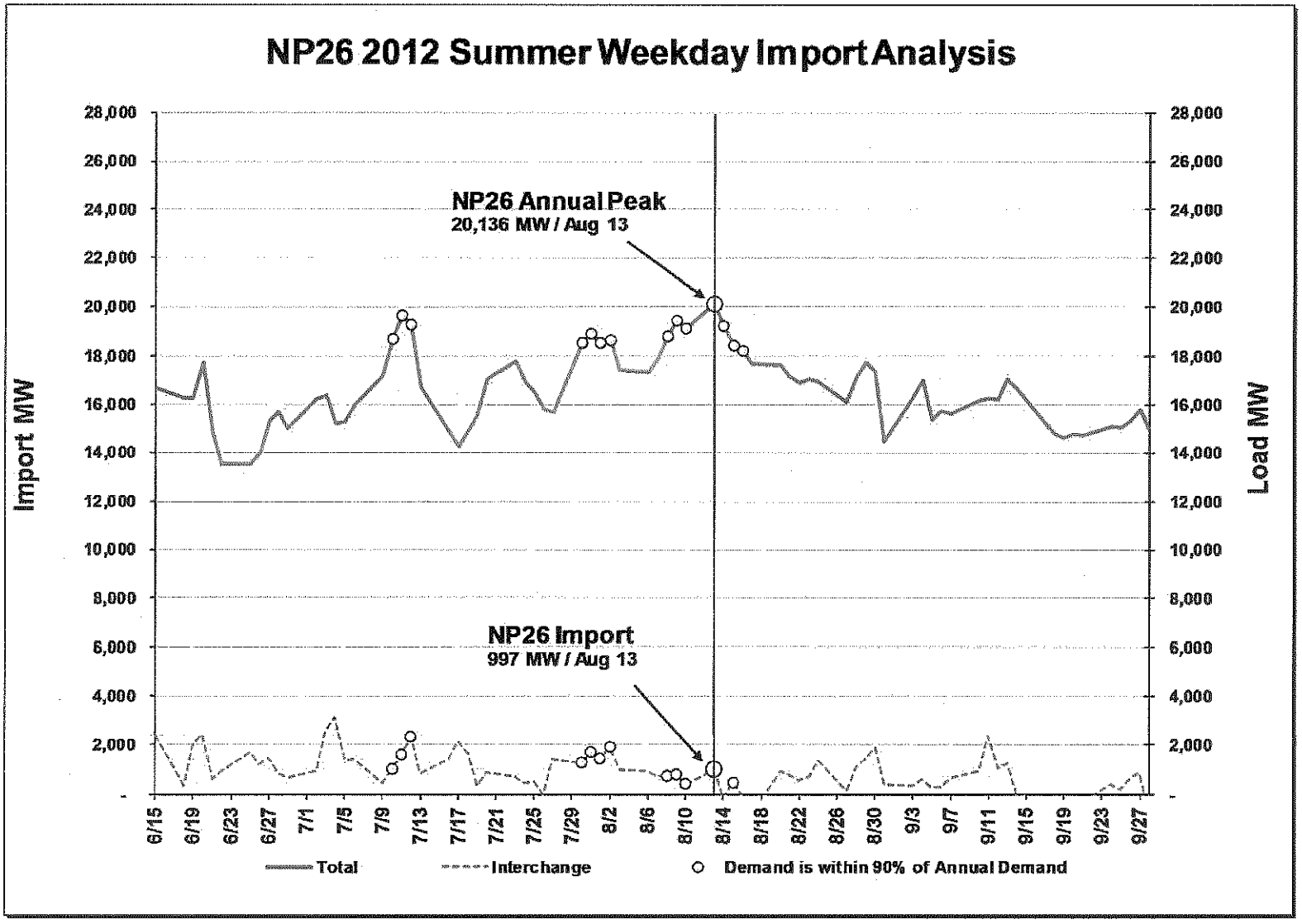

Appendix E: 2015 CAISO Summer On-Peak NQC Fuel Type