Northwest **Power** and
Conservation Council

April 4, 2017

MEMORANDUM

TO: **Council members**

FROM: **Ben Kujala, Power Division Director**

SUBJECT: **Hydro and Market Conditions and Recent Oversupply Curtailment by Bonneville**

BACKGROUND:

Presenter: Ben Kujala

Summary: Four water years have passed by without requiring Bonneville to use its Oversupply Management Protocol (OMP) since the last oversupply event in 2012. This year in Mid-march, this protocol had to be used again to curtail third-party generation in Bonneville's balancing authority. While this is a developing story this presentation will provide an early view on the hydro and market conditions that have developed to require generation curtailment. More information will likely be available in retrospective analyses later this year.

Relevance: The Council played a role in the previous oversupply evens in 2011 and 2012 through the Wind Integration Forum. The 7th Plan also has an action item directed toward Bonneville on oversupply conditions (BPA-9).

Background: The Wind Integration Forum was jointly formed with Bonneville lead to the Wind Integration Action Plan in 2007. In 2011, the Oversupply Technical Oversight Committee was formed to further explore recommendations in the original Wind Integration Action Plan related to Long-Term Physical Solutions to Oversupply.

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In June of 2010 in an otherwise low to average water year, a late spring runoff caused oversupply conditions where BPA had to curtail more than 50,000 megawatt-hours of electricity from third-party generators in its balancing authority to avoid high levels of dissolved gas in the Columbia and Snake rivers.
This year by April 2nd, Bonneville has curtailed almost 60,000 MWh according to the posted retrospective reports. The curtailments, starting in March have been earlier in the spring than any of the previous events. The amount of curtailment has already exceeded what was seen in 2010 and 2012 and is on track to exceed the amount of curtailment in 2011. Prior to this year, the last curtailment of generation for oversupply conditions by Bonneville was in July of 2012.

More Info: Wind Integration Forum:
https://www.nwcouncil.org/energy/wind/home/

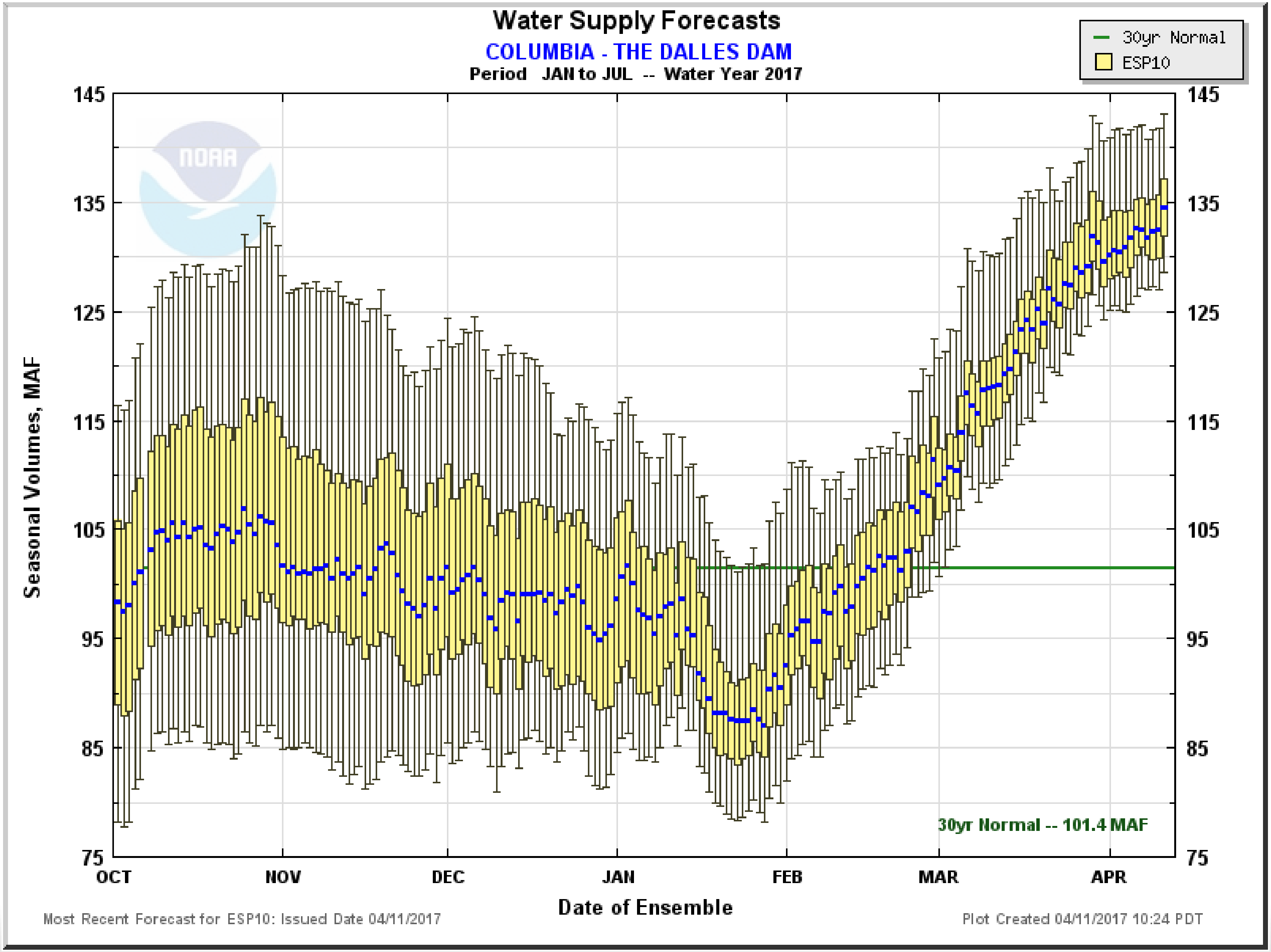
Previous oversupply event media coverage:
http://www.forbes.com/sites/jonbruner/2011/10/20/the-high-stakes-math-behind-the-wests-greatest-river/#c24125e222b8

http://www.nytimes.com/cwire/2011/02/25/25climatewire-bonneville-power-to-wind-generators-shut-dow-22723.html?pagewanted=all

Hydro and market conditions and recent oversupply curtailment actions by Bonneville Power Administration

BPA-9:

Bonneville should continue to evaluate methods for reducing or mitigating regional generation oversupply conditions. [Bonneville] Bonneville should work with its customers to create incentives that help mitigate generation oversupply conditions.


Water Supply Forecasts
COLUMBIA - THE DALLES DAM
Period JAN to JUL -- Water Year 2017
30yr Normal
ESP10
Seasonal Volumes, MAF
145
135
125
115
105
95
85
75
OCT
NOV
DEC
JAN
FEB
MAR
APR
30yr Normal -- 101.4 MAF
Date of Ensemble
Most Recent Forecast for ESP10: Issued Date 04/11/2017
Plot Created 04/11/2017 10:24 PDT

COLUMBIA - THE DALLES DAM (TDAO3)
Period Rankings - 1960 to 2017
JAN-JUL Normal -- 101368 (KAF)

Rank	Year	Period Volume (KAF)	Percent of Normal	Exceedance Probability*
1	1997	158756.82	157	1.724 %
2	1974	156201.01	154	3.448 %
3	1972	151636.45	150	5.172 %
4	2011	142617.00	141	6.897 %
5	1996	139562.56	138	8.621 %
6	1971	137404.91	136	10.345 %
7	1982	134765.46	133	12.069 %
8	2017	134546.06	133	13.793 %
9	2012	129440.00	128	15.517 %
10	1999	126618.29	125	17.241 %

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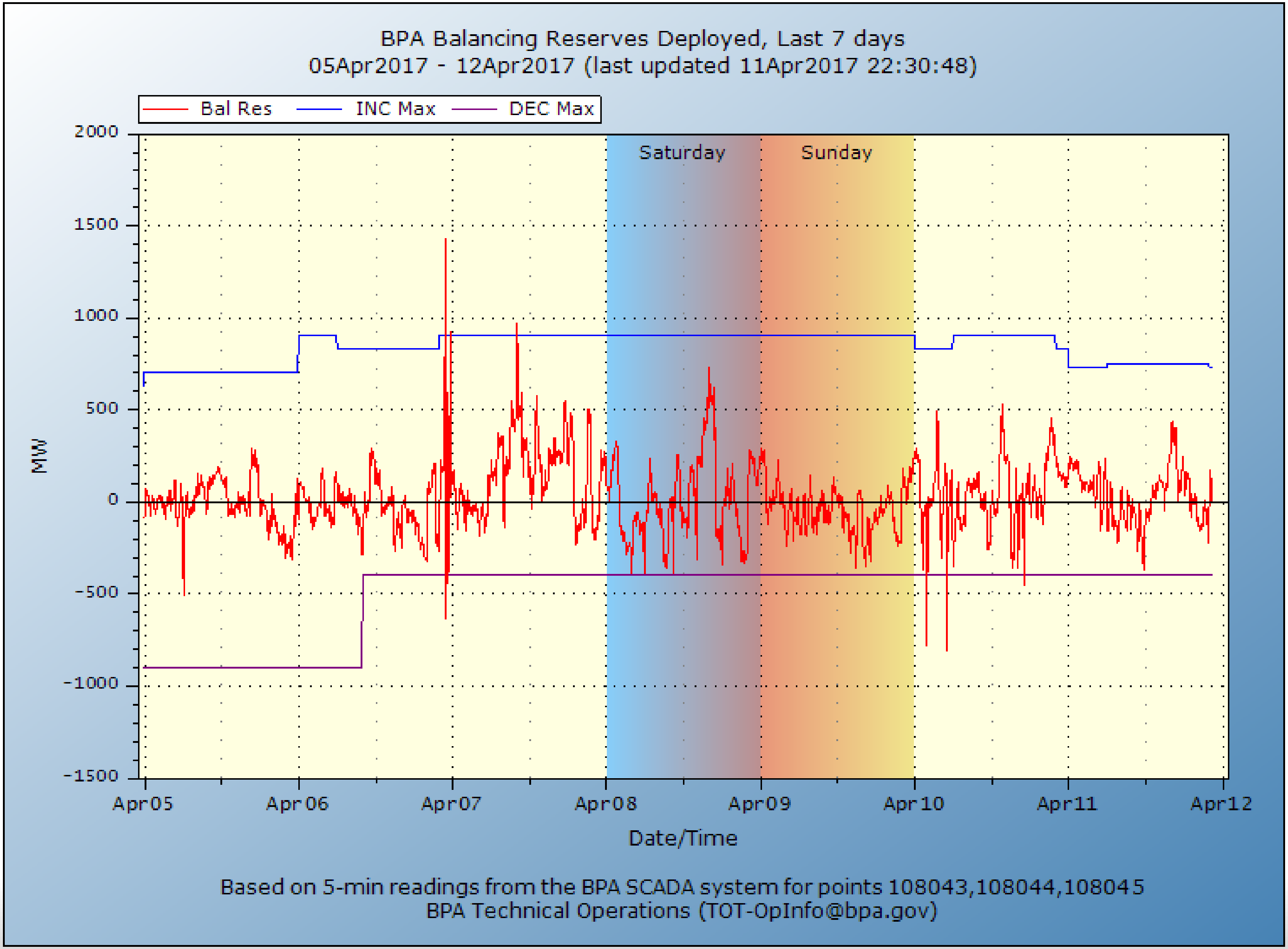
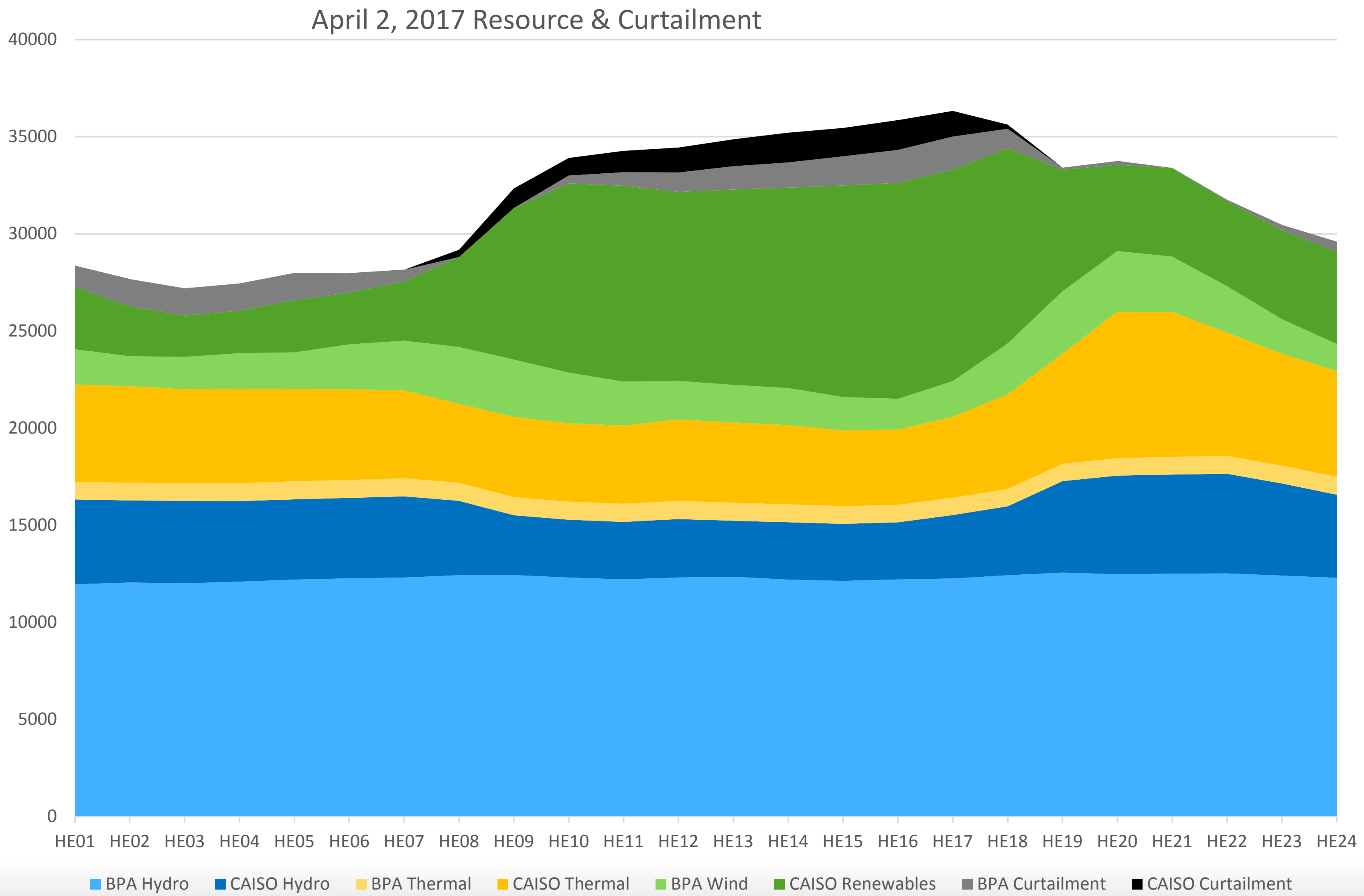
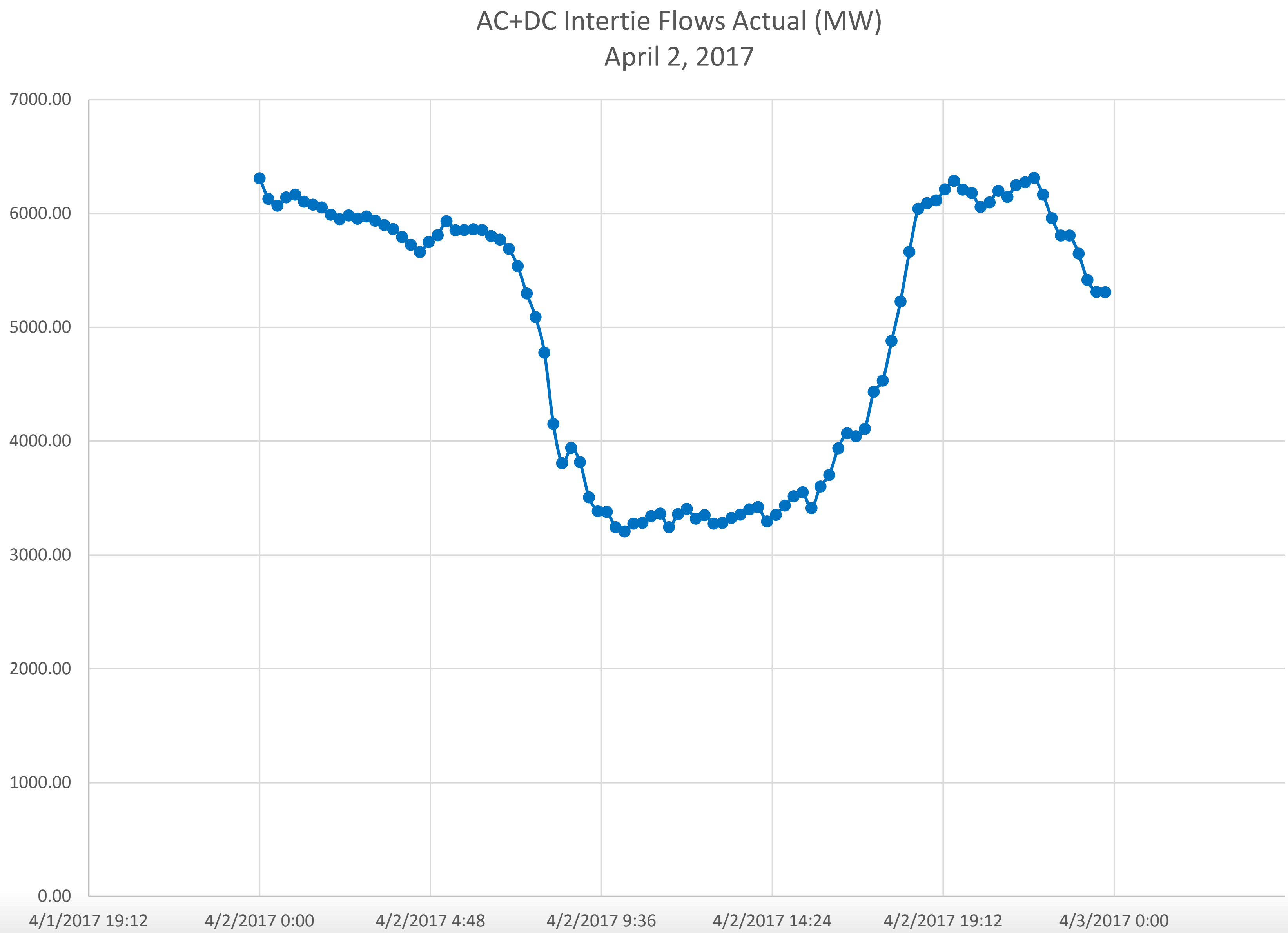
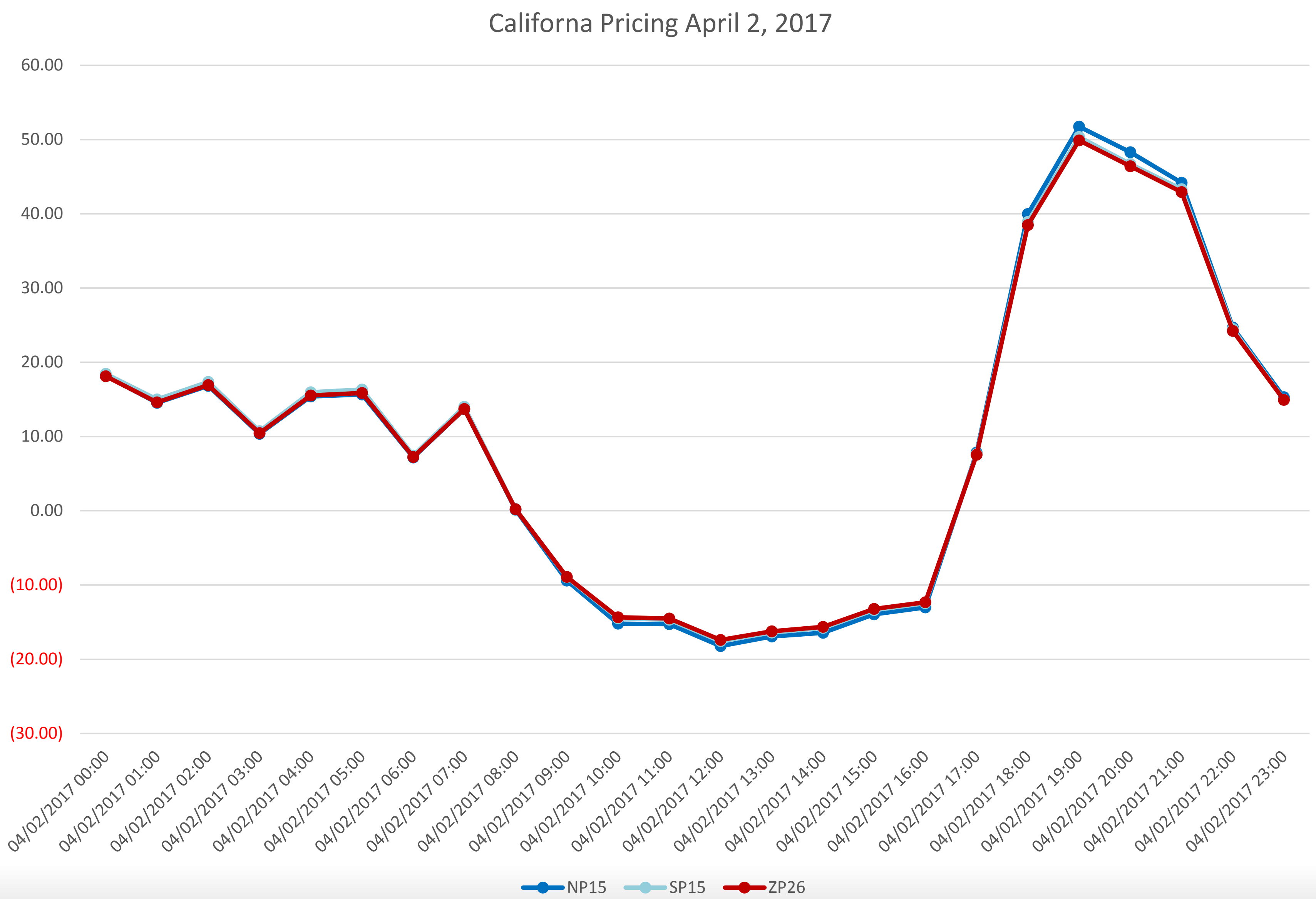

BPA Balancing Reserves Deployed, Last 7 days
05Apr2017 - 12Apr2017 (last updated 11Apr2017 22:30:48)
Bal Res
INC Max
DEC Max
Saturday
Sunday
2000
1500
1000
500
0
-500
-1000
-1500
MW
Apr05
Apr06
Apr07
Apr08
Apr09
Apr10
Apr11
Apr12
Date/Time
Based on 5-min readings from the BPA SCADA system for points 108043,108044,108045
BPA Technical Operations (TOT-OpInfo@bpa.gov)

BPA Cumulative Curtailment

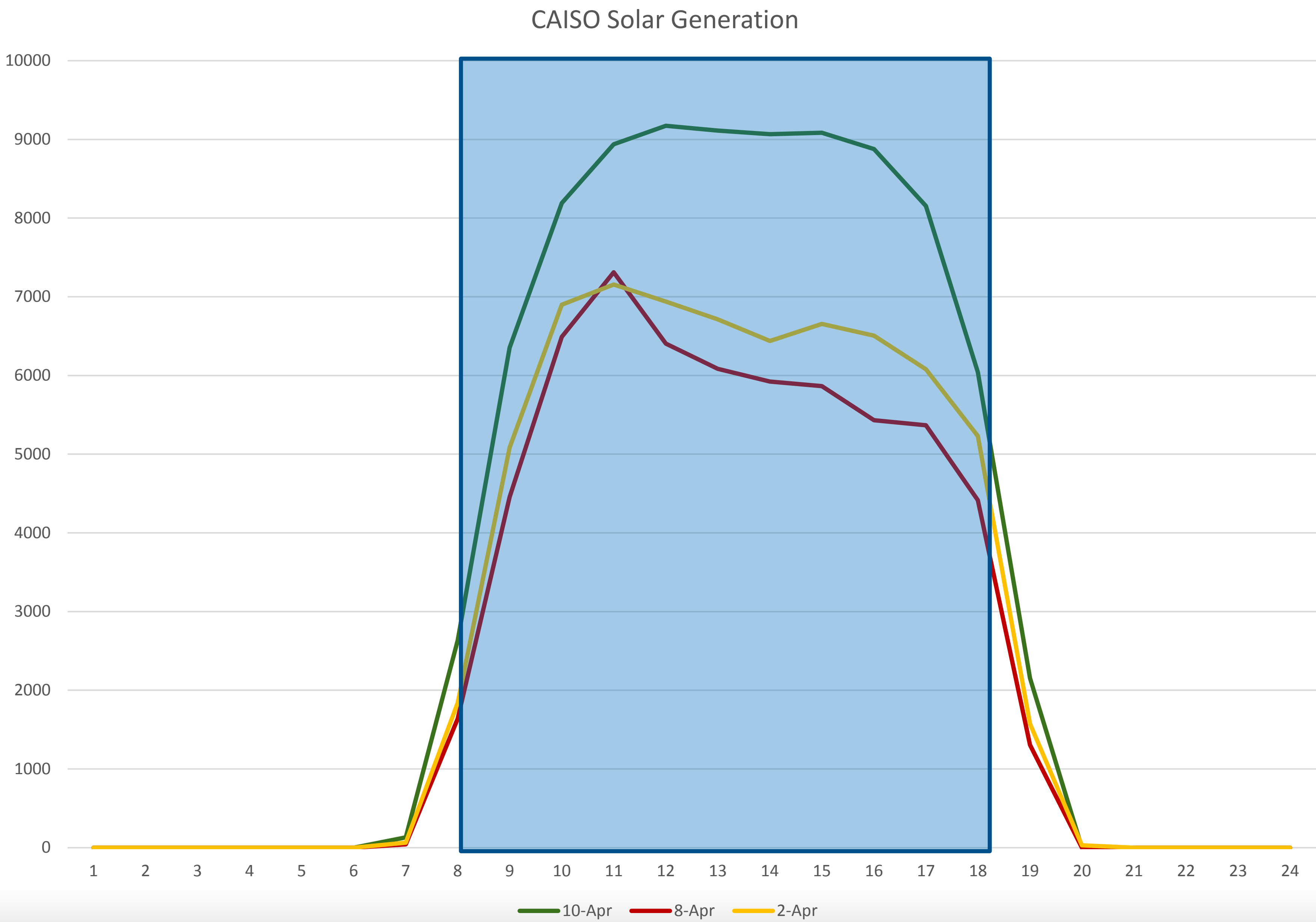
Fiscal Year	Cumulative Curtailment
2011	97,557
2012	49,654
2017 as of April 11	73,492

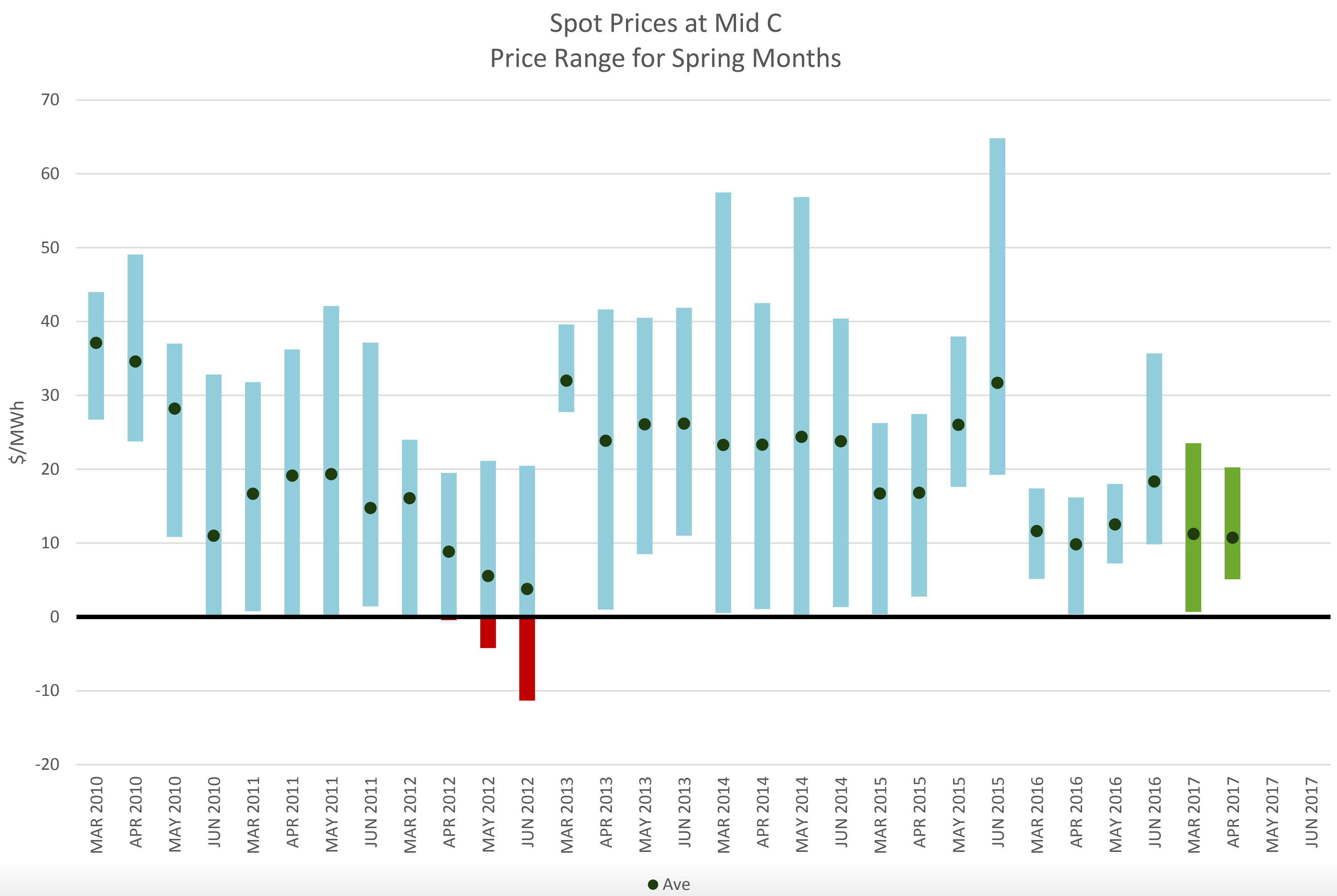

April 2, 2017 Resource & Curtailment
40000
35000
30000
25000
20000
15000
10000
5000
0
HE01 HE02 HE03 HE04 HE05 HE06 HE07 HE08 HE09 HE10 HE11 HE12 HE13 HE14 HE15 HE16 HE17 HE18 HE19 HE20 HE21 HE22 HE23 HE24
BPA Hydro
CAISO Hydro
BPA Thermal
CAISO Thermal
BPA Wind
CAISO Renewables
BPA Curtailment
CAISO Curtailment

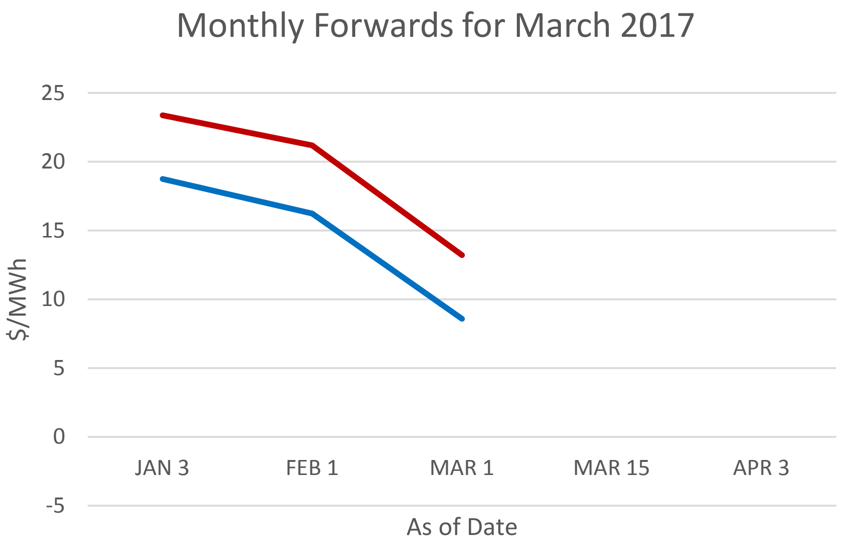

AC+DC Intertie Flows Actual (MW)
April 2, 2017
7000.00
6000.00
5000.00
4000.00
3000.00
2000.00
1000.00
0.00
4/1/2017 19:12
4/2/2017 0:00
4/2/2017 4:48
4/2/2017 9:36
4/2/2017 14:24
4/2/2017 19:12
4/3/2017 0:00

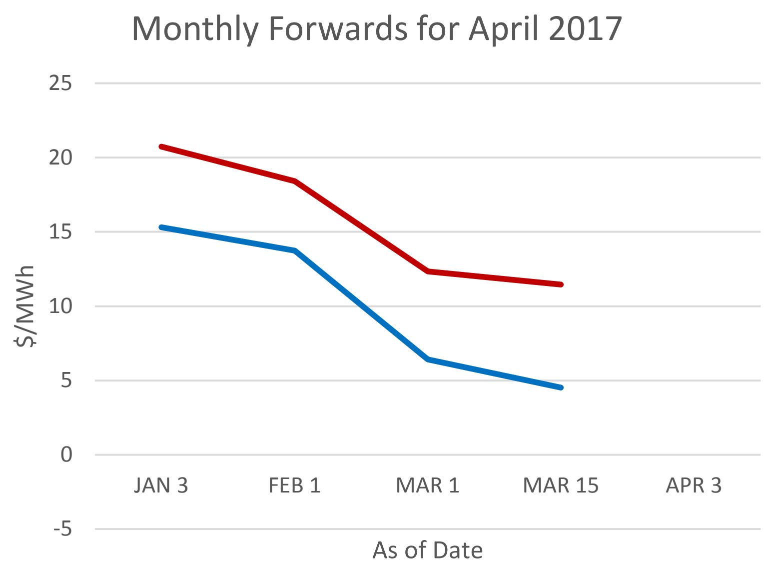


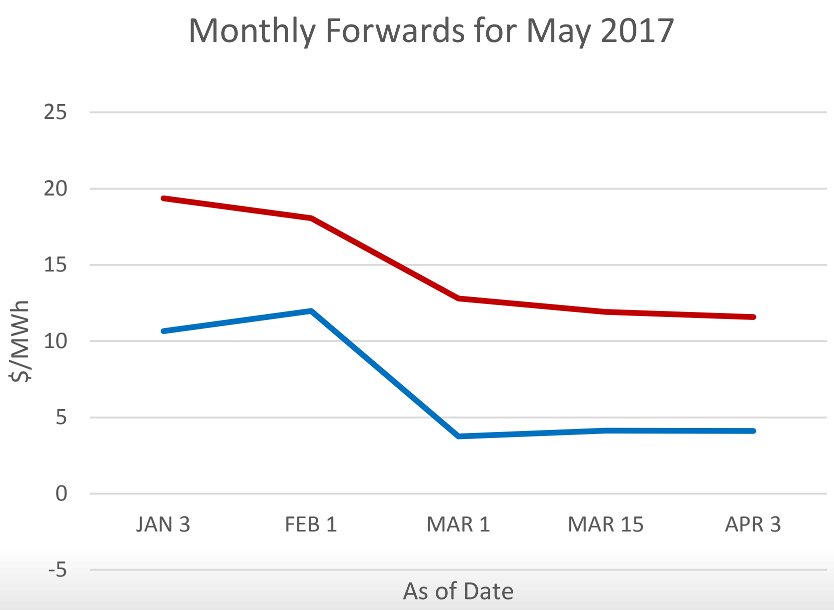
Californa Pricing April 2, 2017
60.00
50.00
40.00
30.00
20.00
10.00
0.00
(10.00)
(20.00)
(30.00)
04/02/2017 00:00
04/02/2017 01:00
04/02/2017 02:00
04/02/2017 03:00
04/02/2017 04:00
04/02/2017 05:00
04/02/2017 06:00
04/02/2017 07:00
04/02/2017 08:00
04/02/2017 09:00
04/02/2017 10:00
04/02/2017 11:00
04/02/2017 12:00
04/02/2017 13:00
04/02/2017 14:00
04/02/2017 15:00
04/02/2017 16:00
04/02/2017 17:00
04/02/2017 18:00
04/02/2017 19:00
04/02/2017 20:00
04/02/2017 21:00
04/02/2017 22:00
04/02/2017 23:00
NP15
SP15
ZP26

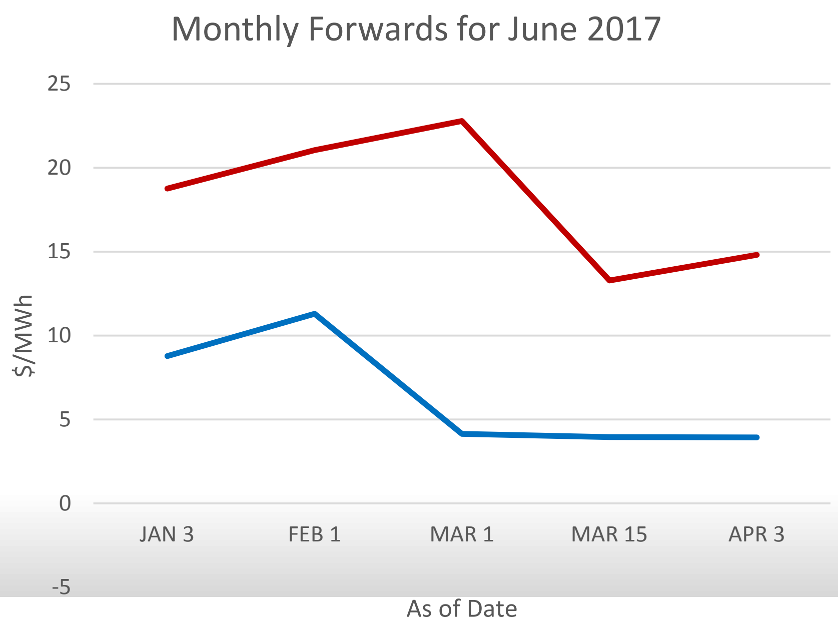

CAISO Solar Generation
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
10-Apr
8-Apr
2-Apr


Spot Prices at Mid C
Price Range for Spring Months
$/MWh
70
60
50
40
30
20
10
0
-10
-20
MAR 2010
APR 2010
MAY 2010
JUN 2010
MAR 2011
APR 2011
MAY 2011
JUN 2011
MAR 2012
APR 2012
MAY 2012
JUN 2012
MAR 2013
APR 2013
MAY 2013
JUN 2013
MAR 2014
APR 2014
MAY 2014
JUN 2014
MAR 2015
APR 2015
MAY 2015
JUN 2015
MAR 2016
APR 2016
MAY 2016
JUN 2016
MAR 2017
APR 2017
MAY 2017
JUN 2017
Ave


Monthly Forwards for March 2017
25
20
15
10
5
0
-5
$/MWh
JAN 3
FEB 1
MAR 1
MAR 15
APR 3
As of Date


Monthly Forwards for April 2017
25
20
15
10
5
0
-5
$/MWh
JAN 3
FEB 1
MAR 1
MAR 15
APR 3
As of Date


Monthly Forwards for May 2017
25
20
15
10
5
0
-5
$/MWh
JAN 3
FEB 1
MAR 1
MAR 15
APR 3
As of Date


Monthly Forwards for June 2017
25
20
15
10
5
0
-5
$/MWh
JAN 3
FEB 1
MAR 1
MAR 15
APR 3
As of Date