

# **Illustrative Example for DFS for a Wind Resource in Power PUD's Contract—includes Transmission Steps**

**Issued June 18, 2009**

## **Assumptions.**

### BPA Power Products

- All Resource Support Service (RSS) products are available for Load Following contract holders' Specified Resources. Secondary Crediting Service (SCS), however, is only available for customers' "existing" hydro resources that are already dedicated to load.
- Diurnal Flattening Service (DFS), in combination with the Resource Shaping Charge, converts the resource output to a flat annual block.
- Output of Specified Resources must be applied to the customer's Total Retail Load.
- BPA provides all transmission scheduling services via TSS for Load Following customers if DFS, SCS, or service at BPA's Tier 2 rate(s) is elected.

### Customer Details

- Power PUD is a LF PSC holder and an NT contract holder. It is also a directly-connected customer.
- Power PUD is interested in a non-federal resource: 10% of a 60 MW nameplate wind resource (producing 1.736 annual aMW) in another PUD's service territory with just one other PUD between them (Windy Wind Project)

THWM: ~80 aMW (actually 79.968 aMW)

Above-RHWM (ARHWM) load for FY 2012 = < 1 aMW

ARHWM load for FY 2013 = 1.736 aMW

Forecast ARHWM load for FY 2014 = 2.554 aMW

## **DFS Planning Process.**

### Step 1

By November 1, 2009, Power PUD sends BPA a letter electing to serve its FY 2012, 13 & 14 ARHWM load themselves, meaning no Tier 2 purchase from BPA for the 3-year period. In this letter, Power PUD also a) requests to add Windy Wind Project, a new Specified Resource, to its LF contract to meet its ARHWM load beginning in FY 2013; b) requests DFS for Windy; and c) elects to meet any ARHWM load not met by Windy with Unspecified Resource Amounts. Power PUD does not wish to provide those resource amounts in a shape other than the Flat Annual Shape and Flat Within-Month Shape, so no additional election is necessary in that regard.

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### Transmission Steps

Power PUD should notify BPA Transmission (BPAT) of its intent to serve Network Load from Windy with firm transmission by first updating its 10-year Load and Resource Forecast. Power PUD must then also submit a Transmission Service Request on OASIS as soon as possible and no later than 60 days prior to service commencement. Power PUD's request must include information describing the transmission request such as:

- The start and stop date of transmission service (may not be greater than the term of the power purchase agreement)
- MW value (6MW for Windy)
- Point of Receipt
- Point of Delivery

As part of the request on OASIS, Power PUD must also include the following:

- A signed statement attesting they have a Power Purchase Agreement with Windy Wind Project and that they are using the output to serve their load
- A description of the Windy Wind Project (e.g., Resource Name, Resource Capacity)

Power PUD may use a Reservation Agent to submit all transmission service requests. Alternatively, BPAT offers a Reservation Agent service for up to three long-term firm requests per year.

If Power PUD elects to not use firm transmission or is waiting for firm service to be granted, Power PUD may use secondary NT transmission to serve load from Windy. If Power PUD uses secondary NT, it does not need to:

- Update it's 10-year Load and Resource Forecast
- Submit a Transmission Service Request on OASIS

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**Step 2**

By March 31, 2010, Power PUD's contract is updated added to reflect the elections made in the letter referenced in Step 1.

- In section 2 of Exhibit A
  - (1) **Windy Wind Project**

(A) **Special Provisions**  
[blank]

(B) **Resource Profile**

Fuel Type	Date Resource Dedicated to Load	Date of Resource Removal	Percent of Resource Used to Serve Load	Nameplate Capability (MW)
Wind	October 1, 2012		10	60

Statutory Status		Resource Status		DFS or SCS?		Dispatchable?		PNCA?		If PNCA, PNCA Updates?	
5b1A	5b1B	Existing	New	Yes	No	Yes	No	Yes	No	Yes	No
	X		X	X			X		X		

Note: Fill in the table above with "X"s.

(C) **Specified Resource Amounts**

Specified Resource Amounts													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	annual aMW
Fiscal Year 2013													
<b>Total (MWh)</b>	1014	836	1498	1584	1506	1858	1610	1092	1604	962	1043	640	1.736
<b>HLH (MWh)</b>	528	435	776	906	858	1108	930	601	844	458	643	309	1.701
<b>LLH (MWh)</b>	486	401	722	678	648	750	680	491	760	504	400	331	1.783
<b>Peak (MW)</b>	6	6	6	6	6	6	6	6	6	6	6	6	

Repeat for all applicable years.

3.1.2 **Unspecified Resource Amounts**

**Power PUD** does not have any Unspecified Resource Amounts at this time.

**FYI:** The above will be replaced with the table below after the **RHWM Process** for WP-14 has concluded if, based on the calculations in that process, Power PUD has Unspecified Resource Amounts to apply to load. Power PUD does not have any ARHWM load in FY 2012 and its new non-federal resource covers its ARHWM load in FY 2013, so it has no Unspecified Resource Amounts at this time. It is included here for illustrative purposes.

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Power PUD’s Unspecified Resource Amounts are listed in the table below.

<b>Unspecified Resource Amounts</b>													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	annual aMW
<b>Fiscal Year 2014</b>													
<b>Total (MWh)</b>													
<b>HLH (MWh)</b>													
<b>LLH (MWh)</b>													
<b>Fiscal Year 2015</b>													
<b>Total (MWh)</b>													
<b>HLH (MWh)</b>													
<b>LLH (MWh)</b>													

Note: Fill in the table above with megawatt-hours rounded to whole megawatt-hours and with annual Average Megawatts rounded to three decimal places.

- Section 2.1 of Exhibit C

<b>Zero Tier 2</b>	<b>Purchase Period</b>
X	FY 2012 - FY 2014
	FY 2015 - FY 2019
	FY 2020 - FY 2024
	FY 2025 - FY 2028

- Exhibit D: DFS language is added. Certain specific sections are shown below:

**2.3.6.1 List of Specified Resources**

<b>Resource Name</b>	<b>Resource Location</b>	<b>Resource Transmission</b>
Windy Wind Project	BPA BAA	Secondary NT

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2.3.6.2 Monthly Operating Minimums and Planned  
Amounts**

<b>«Windy Wind Project»'S OPERATING MINIMUMS</b>												
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Rate Period Year 1												
HLH MW												
LLH MW												
Rate Period Year 2												
HLH MW	0	0	0	0	0	0	0	0	0	0	0	0
LLH MW	0	0	0	0	0	0	0	0	0	0	0	0
Note: The amounts in the table above shall be rounded down to the nearest whole megawatts.												

<b>« Windy Wind Project »'S PLANNED AMOUNTS</b>													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual aMW
Rate Period Year 1													
HLH aMW													
LLH aMW													
Total aMW													
Rate Period Year 2													
HLH aMW	1.222	1.133	1.865	2.178	2.145	2.663	2.236	1.445	2.110	1.101	1.546	0.773	1.701
LLH aMW	1.558	1.190	2.201	2.067	2.189	2.294	2.237	1.497	2.375	1.537	1.220	1.034	1.783
Total aMW	1.363	1.160	2.013	2.129	2.164	2.501	2.236	1.468	2.228	1.293	1.402	0.889	1.736
Note: The amounts in the table above shall be rounded to the nearest three decimal places													

**Step 3**

Prior to October 31 of the Rate Case Year for WP-12, Power PUD provides any updates to the resource information used to develop the resource amounts in Exhibit D listed above.

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**Step 4**

Prior to September 30 of the Rate Case Year (Sep 2011) for the FY 2012/13 Rate Period BPA updates section 2.3.6.2 if necessary and fills in the section 2.3.6.3 of Exhibit D:

**2.3.6.3 DFS Charges and Rates**

<b>DFS CAPACITY CHARGE</b>	
<b>Rate Period</b>	<b>\$/month</b>
2012 – 2013	15,309
2014 – 2015	
2016 – 2017	
2018 – 2019	
2020 – 2021	
2022 – 2023	
2024 – 2025	
2026 – 2027	
2028	
<b>DFS ENERGY RATE</b>	
<b>Rate Period</b>	<b>\$/MWh</b>
2012 – 2013	6.01
2014 – 2015	
2016 – 2017	
2018 – 2019	
2020 – 2021	
2022 – 2023	
2024 – 2025	
2026 – 2027	
2028	

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*Calculating the DFS Capacity Charge.*

Recall, the planned approach for calculating the DFS Capacity Charge is as follows (subject to each 7(i) Process): BPA shall calculate the DFS Capacity Charge by looking at the monthly (or annual) capacity needs of each resource. The monthly (or annual) look involves multiplying the monthly Demand Rates by the calculated difference between planned average HLH energy amounts listed in section 2.3.6.2 above for each month (or annually) and the HLH Operating Minimum amounts in section 2.3.6.2 above of the resource(s) for that particular month (or for the year, depending on the methodology adopted in a future 7(i) Process).

In this example, we applied the annual approach and assumed a Demand Rate of \$8.82/kW-month. So the monthly charge is derived from the following equation:

$$(1.736-0.00) * 8.82 * 1000 = \$15,259 \approx \$15,309$$

The model used to derive the values in the tables above produced slightly different values than this equation due to rounding and an error in leap year hours.

*Calculating the DFS Energy Rate.*

Recall, the planned approach for calculating the DFS Energy Charge as follows (subject to each 7(i) Process): BPA shall calculate the DFS Energy Charge by first calculating a DFS Energy Rate (either as a separate rate for each year of the rate period or a single rate for the rate period). BPA does so by first summing the MWhs of the historical hourly resource generation (historical data from the resource or similar resource hourly data if no history exists) that is above the planned average diurnal energy amounts listed in section 2.3.6.2 above. This would be calculated separately for each Monthly/Diurnal period of the year. Second, BPA would multiply these MWh amounts by 25 percent (the assumed efficiency loss factor for a pumped storage resource) and then again by the applicable Resource Shaping Rates. Third, BPA would sum the Monthly/Diurnal dollar amounts resulting from the calculation done in step two and divide it by the sum of the monthly total planned aMW energy amounts (converted to MWhs by multiplying by the number of hours in the year) listed in section 2.3.6.2 above.

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	Market HLH (\$/MWh)	Market LLH (\$/MWh)	Sum HLH Above average	Sum LLH above Average	Cost at 25% Losses HLH	Cost at 25% Losses LLH
Oct	52.49	42.59	320	246	\$ 4,202	\$ 2,624
Nov	52.00	45.17	277	250	\$ 3,607	\$ 2,818
Dec	53.24	46.32	313	295	\$ 4,162	\$ 3,421
Jan	58.61	47.68	443	319	\$ 6,494	\$ 3,800
Feb	57.50	46.76	411	315	\$ 5,914	\$ 3,679
Mar	55.11	45.11	475	333	\$ 6,539	\$ 3,753
Apr	50.83	41.29	414	300	\$ 5,266	\$ 3,097
May	50.85	33.60	334	273	\$ 4,244	\$ 2,292
Jun	49.27	34.36	378	325	\$ 4,655	\$ 2,789
Jul	52.40	43.72	248	236	\$ 3,249	\$ 2,585
Aug	58.49	50.57	334	215	\$ 4,887	\$ 2,714
Sep	57.32	50.89	197	161	\$ 2,823	\$ 2,055
Average	\$ 54.01	\$ 44.01			\$ 56,042	\$ 35,626
					\$ 91,667	
					\$ 6.01	per MWh cost

The quotient of the calculation done in step three would be the dollar per MWh rate that is applied each month to either the amounts measured by the meters, as listed in Exhibit E, for the resources listed in section 2.3.6.1 above, or if such resources are scheduled then, the scheduled amounts, as provided to BPA in accordance with section 2.3.4.2 above to arrive at the monthly DFS Energy Charge. This is a rate because it is applied to actual scheduled or metered generation to determine the charge. An example of how this is done can be found on the bill at the end of this paper.

**Step 5**

- Prior to September 30, 2011, BPA updates Exhibit F with the Transmission Scheduling Service (TSS) provisions.

**Hourly Scheduling & Delivery.**

Power PUD provides Windy generation forecasts to BPA through a computer-based customer portal in accordance with Exhibit F. Subsections of that exhibit follow:

**4.1 Prescheduling**

**Power PUD** shall submit a delivery schedule to Power Services for its Dedicated Resources for delivery to its Total Retail Load which shall include information such as the source, the point of receipt, any OASIS reservation reference numbers needed for the delivery of non-federal power, the daily megawatt profile and all purchasing selling entities in the path. This delivery schedule shall be submitted to Power Services before the earliest of:

- (1) 0800 hours Pacific Prevailing Time (PPT) on preschedule day,  
or

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- (2) one hour prior to the earliest of the transmission prescheduling deadlines associated with **Power PUD's** transmission agreement(s) delivery of power to **Power PUD's** Total Retail Load.

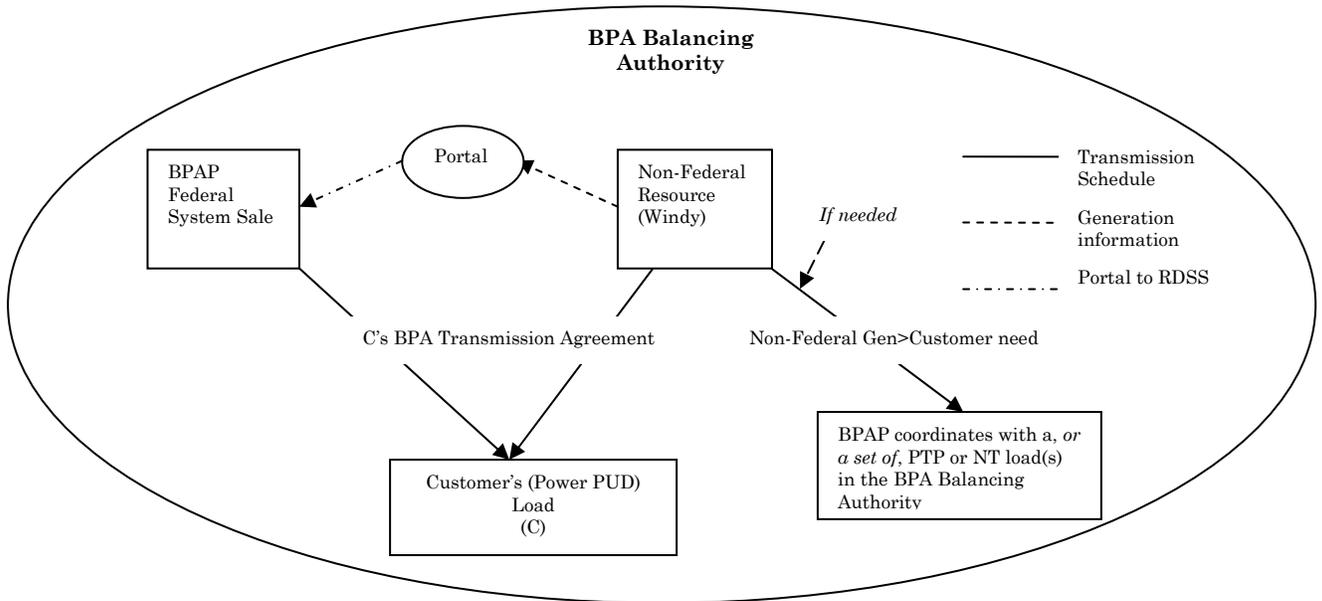
### 4.2 Real-Time Scheduling

Power Services shall accept megawatt adjustments to **Power PUD's** Dedicated Resource schedule(s) up to the earliest of 45 minutes prior to the hour of delivery or 25 minutes prior to the earliest of the transmission real-time scheduling deadlines associated with delivery of power to **Power PUD's** Total Retail Load.

**Power PUD** shall submit all required real-time scheduling information in a format specified by Power Services.

### Illustration

Load Following customers located in the BPA Balancing Authority Area acquiring a non-federal resource sourced within the BPA Balancing Authority Area, purchasing BPA's DFS. Assumes customer is taking TSS (which includes TCMS).



- Customer enters non-federal generation forecast through Regional Dialogue Scheduling System (RDSS) portal
- Load forecast entered by customer through RDSS portal or received from other, internal BPA load forecasting system
- Existing transmission, if any, from OASIS is stored in RDSS/TSS database

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- Resource profile stored in RDSS database would include type, generation peak, POR; and load profile stored in database would include PODs

Transmission Considerations

- If Power PUD has designated Windy as a Network Resource (i.e., acquired firm transmission), BPAP will schedule Windy output to Power PUD's load using firm transmission.
- If Power PUD uses secondary NT to deliver Windy to load, BPAP will schedule Windy output to Power PUD's load on secondary transmission.

**Rates and Billing.**

The associated RSS charges for the provision of DFS in this example will include a variable DFS Energy Charge and Resource Shaping Charge Adjustment based on actual power generation. They will also include the DFS Capacity Charge and Resource Shaping Charge based on the planned generation.

The DFS and RSC expected cost in \$/MWh for this customer's resource in FY 2013 are:

<b>DFS and RSC Expected Cost per MWh for Windy</b>	<b>\$/MWh</b>
DFS Capacity Rates	12.05
DFS Energy Rates	6.01
Resource Shaping Rate	0.27
<b>Total Price (\$/MWh)</b>	<b>18.34</b>

The **Expected DFS Capacity Cost per MWh** of \$12.05/MWh is the result of the following equation: (Monthly DFS Capacity Charge \* 12 months)/total annual MWh of planned generation, or  $(\$15,309.40 * 12)/15,154.8 = \$12.12/\text{MWh} \approx \$12.05/\text{MWh}$ . The model used to derive the values in the tables above produced slightly different values than this equation due to rounding and an error in leap year hours.

The **DFS Energy Rate** is the same as was calculated above and included in Exhibit D.

BPA plans on calculating the Resource Shaping Charge as follows (subject to each 7(i) Process): For the Specified Resources listed in section 2.3.6.1 above, BPA shall credit or charge the customer for the difference between the planned monthly diurnal average megawatt amounts listed below in section 2.3.6.2 and the sum of the annual average megawatt amounts listed in the Specified Resource Amounts tables in section 2 of Exhibit A for the applicable year. BPA shall calculate the customer's Resource Shaping Charge by multiplying such monthly differences (converted to megawatt-hours) for all months of the

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upcoming Rate Period by the applicable Resource Shaping Rate, as established in BPA's Wholesale Power Rate Schedules and GRSPs. BPA shall then divide the sum of the dollar amounts calculated above by 12 to calculate the fixed monthly Resource Shaping Charge.

Flat Bock Amount		HLH Average MW	LLH Average MW	HLH Delta to Flat Amount	LLH Delta to Flat Amount	RS HLH Rate (\$/MWh)	RS LLH Rate (\$/MWh)	HLH RSC	LLH RSC
1.736	Oct	1.222	1.558	0.514	0.178	52.49	42.59	\$ 11,645	\$ 2,366
	Nov	1.133	1.190	-1.133	-1.190	52.00	45.17	\$ 12,040	\$ 8,309
	Dec	1.865	2.201	-1.865	-2.201	53.24	46.32	\$ (2,871)	\$ (7,072)
	Jan	2.178	2.067	-2.178	-2.067	58.61	47.68	\$ (10,780)	\$ (5,181)
	Feb	2.145	2.189	-2.145	-2.189	57.50	46.76	\$ (9,412)	\$ (6,276)
	Mar	2.663	2.294	-2.663	-2.294	55.11	45.11	\$ (21,268)	\$ (8,228)
	Apr	2.236	2.237	-2.236	-2.237	50.83	41.29	\$ (10,569)	\$ (6,290)
	May	1.445	1.497	-1.445	-1.497	50.85	33.60	\$ 6,157	\$ 2,632
	Jun	2.110	2.375	-2.110	-2.375	49.27	34.36	\$ (7,375)	\$ (7,028)
	Jul	1.101	1.537	-1.101	-1.537	52.40	43.72	\$ 13,838	\$ 2,856
	Aug	1.546	1.220	-1.546	-1.220	58.49	50.57	\$ 4,625	\$ 8,563
	Sep	0.773	1.034	-0.773	-1.034	57.32	50.89	\$ 22,086	\$ 11,422
							Total	\$ 4,191	per year cost
								\$ 349	per month cost
								\$0.27	per MWh cost

The **Expected Resource Shaping Charge Cost per MWh**, shown above, is the result of dividing the annual total Resource Shaping Charge (\$4,191) by the total annual MWh of planned generation (15,154.8 MWh), or \$0.276/MWh. The model used to derive the values in the tables above produced slightly different values than this calculation due to rounding.

This customer does not pay Forced Outage Reserves for this wind resource because it is already paying for the capacity through DFS.

The customer's resource charges above were based on the planned generation in FY 2013. The resource actually performed differently and is captured below in total monthly/diurnal kWh amounts:

	Planned		Actual		Delta	
	LLH kWh	HLH kWh	LLH kWh	HLH kWh	LLH kWh	HLH kWh
Oct	486,000	528,000	321,000	654,000	165,000	(126,000)
Nov	401,000	435,000	589,000	418,000	(188,000)	17,000
Dec	722,000	776,000	622,000	665,000	100,000	111,000
Jan	678,000	906,000	655,000	942,000	23,000	(36,000)
Feb	648,000	858,000	712,000	871,000	(64,000)	(13,000)
Mar	750,000	1,108,000	862,000	1,006,000	(112,000)	102,000
Apr	680,000	930,000	456,000	945,000	224,000	(15,000)
May	491,000	601,000	665,000	456,000	(174,000)	145,000
Jun	760,000	844,000	654,000	734,000	106,000	110,000
Jul	504,000	458,000	444,000	566,000	60,000	(108,000)
Aug	400,000	643,000	668,000	786,000	(268,000)	(143,000)

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Sep	331,000	309,000	436,000	238,000	(105,000)	71,000
Total	6,851,000	8,396,000	7,084,000	8,281,000	(233,000)	115,000
	Grand Total	15,247,000	Grand Total	15,365,000		

The DFS Energy Rate for this resource will be applied to its *actual* total monthly generation (see shaded amounts above). The RSC Adjustment reflects the cost difference between the planned and actual average monthly HLH and LLH resource generation amount (see shaded amounts above). The example bill that follows is for the month of April.

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metered	April
CSP kW	121,444
Proxy GSP kW	109,300
HLH kWh	31,814,906
LLH kWh	19,218,112
Proxy CDQ kW	34,036

Purchaser -	xxxxxx
<b>Example Load Following Bill with RSS</b>	
Hours	416
	Net Req (aMW) = 82.149
	Min(NR,RHWM) (aMW) = 79.968
	above RHWM (aMW) = 1.736
	ΣRHWM aMW = 7,327.232
	TOCA = 1.09138%

**April Tiered Rate Bill**

Sched	Service Descriptor	Quantity	Unit	Rate	Amount
Tier 1	Composite Charge	1.09138	1% @	1,792,247	\$1,956,023
Tier 1	Non-Slice Charge	1.09138	1% @	-463,209	(\$505,537)
Tier 1 + Non Fed	Energy HLH	31,814,906			
Non-Fed	Energy HLH	-722,176			
Tier 1	Energy HLH	31,092,730			
Tier 1	HLH SSL	28,195,560			
Tier 1	HLH Load Shaping	2,897,170	kWh @	0.04716	\$136,631
Tier 1 + Non Fed	Energy LLH	19,218,112			
Non-Fed	Energy LLH	-527,744			
Tier 1	Energy LLH	18,690,368			
Tier 1	LLH SSL	20,445,274			
Tier 1	LLH Load Shaping	-1,754,906	kWh @	0.04056	(\$71,179)
Tier 1 + Non Fed	Demand CSP	121,444			
Non-Fed	Flat Block (per hour)	-1,736			
Tier 1	aHLH	-74,742			
Tier 1	CDQ	-34,036			
Tier 1	Demand Charge	10,930	kW @	7.41	\$80,990
RSS	DFS Energy Actual HLH + LLH	1,401,000	kWh @	0.00601	\$8,420
RSS	DFS Capacity		1 Mo @	15,309	\$ 15,309
RSS	RSC		1 Mo @	349	\$ 349
RSS	RC Forecast Non-Fed HLH	930,000			
RSS	Actual Non-Fed HLH	945,000			
RSS	HLH RSC Adjustment	-15,000	kWh @	0.04716	(\$707)
RSS	RC Forecast Non-Fed LLH	680,000			
RSS	Actual Non-Fed LLH	456,000			
RSS	LLH RSC Adjustment	224,000	kWh @	0.04056	\$9,085
Total					\$1,629,384

TRM April Rate Schedule	
Composite (\$ per 1%)	1,792,247
Non-Slice (\$ per 1%)	-463,209
T1SR HLH Gen (kWh)	2,583,477,791
LS HLH (mills/kWh)	47.16
System Shaped Load (SSL) is calculated by multiplying a customer's TOCA by the posted output of the Tier 1 System Resources (T1SR) for the corresponding monthly/diurnal period.	
T1SR LLH Gen (kWh)	1,873,341,468
LS LLH (mills/kWh)	40.56
Load Shaping (LS) billing determinant is calculated by subtracting SSL from Tier 1 energy.	
Contract Demand Quantity is found in contract.	
Demand (\$/kW-mo)	7.41
Variable DFS Energy (mills/kWh)	6.01
Fixed DFS Capacity (\$/month) \$	15,309
Fixed RSC (\$/month) \$	349
RSS charges are resource specific. The example here was created from a wind resource.	
RSC HLH (mills/kWh)	47.16
Resource Shaping Adj (RS) billing determinant is calculated by subtracting Actual generation from Forecast generation.	
RSC LLH (mills/kWh)	40.56

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