City of Phoenix
Lake Pleasant Solar Generation Facility

2017 Better Buildings Summit
Washington, DC
May 15-17, 2017

Andy Terrey
City of Phoenix
Water Services Department
Fast Facts

- 1.5 Million Water Customers
- 8 Water Treatment Plants
- 7,000 Miles of Water Lines
- 74 Pressure Zones
- 2.5 Million Wastewater Customers
- 3 Wastewater Treatment Facilities
- 5,000 Miles of Sewer Lines
- Energy
  - 254M kWh per Year
  - $22M Energy Budget
Solar Generation Facility

- 30 Acres
- 22,936 Solar Panels
- Power Generation
  - Tracking 6,500 kWp
  - Roof System 1,000 kWp
  - Total 7,500 kWp
- ~ 15M kWh per Year
- CO2 Offset of 9,000 Tons per Year
- $4.2M in Cost Savings over 20-Year Life of System
The Deal

- 20 year Agreement
- Phoenix leases land for $10.00 per year
- Solar provider constructs and maintains facility at its own expense
- Energy sold at $0.0674/kWh with a 1% annual escalation factor
- Phoenix purchases all of the kWh produced by the facility
- Solar provider gets the Renewable Energy Credits
Metering Arrangement Before Solar

Water Treatment Plant

WTP - SWG A

WTP - SWG B

APS Totalized Meter
Rate: E-34

APS Meter

APS Meter

APS Electric Utility

APS Electric Utility
Metering Arrangement After Solar

**APS Electric Utility**
- APS Net Meter

**Main BKR**
- WTP - SWG B
- Solar BKR
  - SunPower SSA Meter MTR2
  - APS Solar Production REC Meter 1

**Lake Pleasant WTP**
- SunPower Solar Billing Meters (2)
- Solar Services Agreement (SSA)
  - Lake Pleasant WTP
    - Solar Production Meters (2)
    - REC Incentives
    - Meter Data sent to APS

**SunPower Generator**
- Array A
  - Res# 18645

**Main BKR**
- WTP - SWG A
- Solar BKR
  - SunPower SSA Meter MTR1
  - APS Solar Production REC Meter 1

**SunPower Generator**
- Array B
  - Res# 18646

**Rate:** APS E-32L / EPR-6

**Lake Pleasant WTP Solar Production Sub Meters (3)**
- REC Incentives
- Meter Data sent to APS

**SunPower REC Sub-Meter**

**SunPower REC Sub-Meter**

**SunPower REC Sub-Meter**

**SunPower Generator**
- T-10 Roof Array
  - Res# 18644
Power Distribution Before Solar

- **APS Electric Utility**
  - Main BKR
    - WTP - SWG B
    - Solar BKR
  - B
  - L
  - Mixers
  - Pump 1
  - Pump 3
  - Pump 5
  - Pump 2
  - Building
  - Pump 4
  - Backwash
  - B
  - L
Power Distribution Before Solar

- APS Electric Utility
- Main BKR WTP - SWG B
- Solar BKR
- Tie Breaker “Racked Out”
- Main BKR WTP - SWG A
- Solar BKR

- SunPower Generator Array A
- SunPower Generator Array B
- SunPower Generator T-10 Roof Array

- Mixers
- Pump 1
- Pump 3
- Pump 5
- Pump 2
- Building
- Pump 4
- Backwash
Lake Pleasant WTP Electric Cost
Per-Unit Production

- Higher APS Rate (E-34 to E-32)
- Double fixed charges
- Disaggregated demand charges
- Surplus solar production

The chart depicts the electric cost per unit production for Lake Pleasant WTP from December 2011 to August 2015. The costs are divided into Pre-Solar and Post-Solar periods.

- Plant Offline:
  - December 2012
  - February 2013
  - March 2013
  - April 2013
  - May 2013
  - June 2013
  - July 2013
  - August 2013
  - September 2013
  - October 2013
  - November 2013
  - December 2013
  - January 2014
  - February 2014
  - March 2014
  - April 2014
  - May 2014
  - June 2014
  - July 2014
  - August 2014
  - September 2014
  - October 2014
  - November 2014
  - December 2014
  - January 2015
  - February 2015
  - March 2015
  - April 2015
  - May 2015
  - June 2015
  - July 2015
  - August 2015
### Surplus Energy Credits

<table>
<thead>
<tr>
<th>Month</th>
<th>kWh Metered</th>
<th>kWh Credited</th>
<th>Net kWh</th>
<th>kWh Metered</th>
<th>kWh Credited</th>
<th>Net kWh</th>
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<tbody>
<tr>
<td>Jan-14</td>
<td>716,000</td>
<td>142,000</td>
<td>574,000</td>
<td>39,000</td>
<td>274,000</td>
<td>(235,000)</td>
</tr>
<tr>
<td>Feb-14</td>
<td>618,000</td>
<td>180,000</td>
<td>438,000</td>
<td>45,000</td>
<td>326,000</td>
<td>(281,000)</td>
</tr>
<tr>
<td>Mar-14</td>
<td>14,000</td>
<td>595,000</td>
<td>(581,000)</td>
<td>620,000</td>
<td>196,000</td>
<td>424,000</td>
</tr>
<tr>
<td>Apr-14</td>
<td>16,000</td>
<td>661,000</td>
<td>(645,000)</td>
<td>621,000</td>
<td>201,000</td>
<td>420,000</td>
</tr>
<tr>
<td>May-14</td>
<td>517,000</td>
<td>426,000</td>
<td>91,000</td>
<td>232,000</td>
<td>553,000</td>
<td>(321,000)</td>
</tr>
<tr>
<td>Jun-14</td>
<td>523,000</td>
<td>439,000</td>
<td>84,000</td>
<td>12,000</td>
<td>586,000</td>
<td>(574,000)</td>
</tr>
<tr>
<td>Jul-14</td>
<td>547,000</td>
<td>324,000</td>
<td>223,000</td>
<td>4,000</td>
<td>1,808</td>
<td>2,192</td>
</tr>
<tr>
<td>Aug-14</td>
<td>338,000</td>
<td>452,000</td>
<td>(114,000)</td>
<td>250,000</td>
<td>1,750</td>
<td>248,250</td>
</tr>
<tr>
<td>Sep-14</td>
<td>9,000</td>
<td>529,000</td>
<td>(520,000)</td>
<td>675,000</td>
<td>1,770</td>
<td>673,230</td>
</tr>
<tr>
<td>Oct-14</td>
<td>23,000</td>
<td>469,000</td>
<td>(446,000)</td>
<td>666,000</td>
<td>1,740</td>
<td>664,260</td>
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<tr>
<td>Nov-14</td>
<td>47,000</td>
<td>406,000</td>
<td>(359,000)</td>
<td>809,000</td>
<td>1,740</td>
<td>807,260</td>
</tr>
<tr>
<td>Dec-14</td>
<td>48,000</td>
<td>224,000</td>
<td>(176,000)</td>
<td>770,000</td>
<td>1,650</td>
<td>768,350</td>
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<tr>
<td>Total</td>
<td>3,416,000</td>
<td>4,847,000</td>
<td>(1,431,000)</td>
<td>4,743,000</td>
<td>2,146,458</td>
<td>2,596,542</td>
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**Surplus Credits**

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<tbody>
<tr>
<td>Account 59467284</td>
<td>1,431,000</td>
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<tr>
<td>Account 900647284</td>
<td>0</td>
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**Purchased from SunPower @ $0.0681 / kWh**

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<td>$ 97,414</td>
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**Sold to APS @ $0.02895 / kWh**

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<td>$ 41,427</td>
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**Operating LOSS**

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<td>$ 55,986</td>
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Electricity Cost Adjusted for Production

- Sep-15
- Oct-15
- Nov-15
- Dec-15
- Jan-16
- Feb-16
- Mar-16
- Apr-16
- May-16
- Jun-16
- Jul-16
- Aug-16

$/MG

Meter Totalized
We’re Currently Upside Down
But the future is bright...

• We are continuing to offset our carbon footprint

• We are locked into a low rate of escalation in solar cost

• Water production (energy use) will eventually increase so all solar credits are used
It’s Not Easy Being Green

Lessons Learned

1. **Never every** have a solar generation system sized larger than what your facility needs on a monthly basis.
2. **Understand** how solar may impact how loads can be distributed within your facility.
3. **Understand** how solar may impact your electric bill
   1. May shift account(s) into a less attractive tariff
   2. May lose benefit of totalized metering
   3. Demand charges may not go down, but may in fact go up
4. **Be prepared** to spend time reviewing both solar and grid electric billing to ensure it is being done correctly.
5. **Get expert advice** from a third party before entering in a solar agreement.