This presentation premiered at WaterSmart Innovations

watersmartinnovations.com
Taking the “if” out of Verification for Custom Water Efficiency Projects

WaterSmart Innovations 2019

Gary Tilkian
Metropolitan Water District
October 3, 2019
26 Member Agencies
Regional water wholesaler to 6 counties, 19 million people
Over 5,200 sq mi
Growth: >100,000 people/yr
$1 trillion regional economy
~50% of region’s retail water supply
Sources of Water for Southern California

- Sierra Nevada Mtns / Lake Oroville: ~20%
- State Water Project: ~30%
- LA Aqueduct (Local): ~40%
- Local: ~50%

Map showing water sources and aqueducts in Southern California.
Water Savings Incentive Program (WSIP)

- Program start: Sep 2012
- “Pay for performance”

Goals:
- Reach out to non-residential water users
- Incentives for custom projects
- Encourage long-term water management as a standard business practice
Eligible Projects

- Retrofit existing equipment
- Improve processes
- Improve agriculture & landscape irrigation systems
- Contract for water management services
**Incentives**

- Up to $0.60 / 1,000 gal saved per year (up to 10 yrs)
- Limited to 50% of eligible project costs
- Payments are phased
  - Final payment may be adjusted per monitored results
  - Some projects may qualify for single payment based on detailed engineering plans
Directly pertain to project installation or water management services

- Audit, engineering, software, hardware
- Construction, equipment, materials (incl plants),
- Freight shipping, 3rd party labor, contract water management services

Ineligible costs:

- Customer’s direct labor
- Sales tax
- Permitting
- Environmental compliance
- Land acquisition
# Large Landscape Project

<table>
<thead>
<tr>
<th>Project</th>
<th>Replacement &amp; upgrade of entire irrigation system, including “smart” irrigation controllers, drip and high-efficiency sprays, flow sensors, rain sensors, master valves, &amp; lateral lines.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated water savings</td>
<td>213M gallons over 10 years</td>
</tr>
<tr>
<td>Potential incentive</td>
<td>$141,069</td>
</tr>
</tbody>
</table>
CIMIS Monthly Average ETo Report

Rendered in ENGLISH Units. Printed on Thursday, June 02, 2016

Average ETo Values by Station

<table>
<thead>
<tr>
<th>Stn Id</th>
<th>Stn Name</th>
<th>CIMIS Region</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>159</td>
<td>Monrovia</td>
<td>LAB</td>
<td>2.19</td>
<td>2.42</td>
<td>3.76</td>
<td>4.37</td>
<td>5.18</td>
<td>5.75</td>
<td>6.33</td>
<td>6.26</td>
<td>4.88</td>
<td>3.4</td>
<td>2.42</td>
<td>1.92</td>
<td>48.9</td>
</tr>
</tbody>
</table>

https://cimis.water.ca.gov/Default.aspx
### Large Landscape Project

#### Weather Normalization

CIMIS Monthly Report

Rendered in ENGLISH Units.

January 2011 - May 2016

Printed on Thursday, June 02, 2016

Monrovia - Los Angeles Basin - Station 159

<table>
<thead>
<tr>
<th>Month</th>
<th>Total ETo (in)</th>
<th>Total Precip (in)</th>
<th>Avg Sol Rad (Ly/day)</th>
<th>Avg Vap Pres (mBars)</th>
<th>Avg Max Air Temp (°F)</th>
<th>Avg Min Air Temp (°F)</th>
<th>Avg Air Temp (°F)</th>
<th>Avg Max Rel Hum (%)</th>
<th>Avg Min Rel Hum (%)</th>
<th>Avg Rel Hum (%)</th>
<th>Avg Dew Point (°F)</th>
<th>Avg Wind Speed (mph)</th>
<th>Avg Soil Temp (°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan-11</td>
<td>2.02</td>
<td>0.88</td>
<td>197</td>
<td>8</td>
<td>69.7</td>
<td>45.4</td>
<td>56.2</td>
<td>75</td>
<td>30</td>
<td>53</td>
<td>38</td>
<td>2.8</td>
<td>54.8</td>
</tr>
<tr>
<td>Feb-11</td>
<td>2.14</td>
<td>4.45</td>
<td>260</td>
<td>7.8</td>
<td>64.8</td>
<td>41</td>
<td>52.1</td>
<td>82</td>
<td>35</td>
<td>59</td>
<td>37.3</td>
<td>3.2</td>
<td>55.4</td>
</tr>
<tr>
<td>Mar-11</td>
<td>2.72</td>
<td>3.31</td>
<td>284</td>
<td>10.3</td>
<td>69.5</td>
<td>46.5</td>
<td>57.1</td>
<td>88</td>
<td>41</td>
<td>65</td>
<td>45</td>
<td>3.2</td>
<td>59.8</td>
</tr>
<tr>
<td>Apr-11</td>
<td>4.07</td>
<td>0.07</td>
<td>421</td>
<td>11.1</td>
<td>72.5</td>
<td>50.3</td>
<td>61.2</td>
<td>83</td>
<td>42</td>
<td>61</td>
<td>46.7</td>
<td>3.5</td>
<td>64.8</td>
</tr>
<tr>
<td>May-11</td>
<td>4.97</td>
<td>0.45</td>
<td>464</td>
<td>11</td>
<td>75.1</td>
<td>51.5</td>
<td>62.5</td>
<td>80</td>
<td>39</td>
<td>59</td>
<td>47</td>
<td>3.7</td>
<td>68</td>
</tr>
<tr>
<td>Jun-11</td>
<td>5.15</td>
<td>0.02</td>
<td>496</td>
<td>14.5</td>
<td>79.1</td>
<td>56.1</td>
<td>66.1</td>
<td>86</td>
<td>45</td>
<td>66</td>
<td>54.2</td>
<td>3.7</td>
<td>72.1</td>
</tr>
<tr>
<td>Jul-11</td>
<td>6.31</td>
<td>0</td>
<td>535</td>
<td>16.7</td>
<td>87.4</td>
<td>61.8</td>
<td>73.1</td>
<td>83</td>
<td>40</td>
<td>60</td>
<td>58.3</td>
<td>3.8</td>
<td>78.2</td>
</tr>
<tr>
<td>Aug-11</td>
<td>6.23</td>
<td>0</td>
<td>521</td>
<td>16.6</td>
<td>89.9</td>
<td>61</td>
<td>73.4</td>
<td>84</td>
<td>37</td>
<td>60</td>
<td>58.2</td>
<td>3.6</td>
<td>77.2</td>
</tr>
<tr>
<td>Sep-11</td>
<td>4.4</td>
<td>0.01</td>
<td>404</td>
<td>16.4</td>
<td>86.5</td>
<td>60</td>
<td>70.7</td>
<td>85</td>
<td>42</td>
<td>65</td>
<td>57.9</td>
<td>3.4</td>
<td>73.1</td>
</tr>
<tr>
<td>Oct-11</td>
<td>3.65</td>
<td>1.39</td>
<td>338</td>
<td>12.5</td>
<td>80.8</td>
<td>54.5</td>
<td>65.9</td>
<td>81</td>
<td>37</td>
<td>58</td>
<td>49.6</td>
<td>3</td>
<td>66.7</td>
</tr>
<tr>
<td>Nov-11</td>
<td>2.12</td>
<td>1.58</td>
<td>231</td>
<td>9.4</td>
<td>70</td>
<td>46.7</td>
<td>57.1</td>
<td>82</td>
<td>37</td>
<td>60</td>
<td>42.2</td>
<td>2.9</td>
<td>58.3</td>
</tr>
<tr>
<td>Dec-11</td>
<td>2.23</td>
<td>1.11</td>
<td>225</td>
<td>6.4</td>
<td>66.6</td>
<td>41.8</td>
<td>52.9</td>
<td>71</td>
<td>27</td>
<td>47</td>
<td>31.7</td>
<td>3.1</td>
<td>53.7</td>
</tr>
</tbody>
</table>

(You’ll need to create an account for this data [it’s free])
Large Landscape Project

Weather Normalization

((act ETo-(0.25*precip))/avg ETo)-1

Steps:
1. Add effective precipitation to Avg ETo
2. Compare to monthly actual ET (ratio or adjustment factor)
3. Apply adjustment to actual use
4. Compare adjusted monitored to adjusted baseline
<table>
<thead>
<tr>
<th>Month</th>
<th>3-Yr Prior Adjusted Use</th>
<th>2-Yr Prior Adjusted Use</th>
<th>1-Yr Prior Adjusted Use</th>
<th>Monitored Adjusted Use</th>
<th>Monitored Unadjusted Use</th>
<th>3-Yr Avg Adjusted Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan-Feb</td>
<td>12,930</td>
<td>12,045</td>
<td>19,814</td>
<td>15,476</td>
<td>13,700</td>
<td>14,930</td>
</tr>
<tr>
<td>Mar-Apr</td>
<td>15,580</td>
<td>18,502</td>
<td>21,412</td>
<td>17,151</td>
<td>18,654</td>
<td>18,498</td>
</tr>
<tr>
<td>May-Jun</td>
<td>28,497</td>
<td>28,334</td>
<td>37,343</td>
<td>27,932</td>
<td>22,985</td>
<td>31,392</td>
</tr>
<tr>
<td>Jul-Aug</td>
<td>35,675</td>
<td>42,381</td>
<td>42,459</td>
<td>21,331</td>
<td>22,126</td>
<td>40,172</td>
</tr>
<tr>
<td>Sep-Oct</td>
<td>28,835</td>
<td>30,133</td>
<td>26,850</td>
<td>15,424</td>
<td>15,276</td>
<td>28,606</td>
</tr>
<tr>
<td>Nov-Dec</td>
<td>26,701</td>
<td>13,894</td>
<td>13,421</td>
<td>6,851</td>
<td>8,253</td>
<td>18,005</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>148,218</strong></td>
<td><strong>145,290</strong></td>
<td><strong>161,299</strong></td>
<td><strong>104,164</strong></td>
<td><strong>100,994</strong></td>
<td><strong>151,602</strong></td>
</tr>
</tbody>
</table>

**Relative Change** -31.29%

47,400 HCF / ~35M gallons of water annual savings

Un-Adjusted savings: -29.3% = undercount (~$25K swing)
# Large Commercial Laundry

<table>
<thead>
<tr>
<th>Project</th>
<th>Install wastewater treatment and recycling system to re-use up to 75% of process water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final Project Cost:</td>
<td>$1,080,000</td>
</tr>
<tr>
<td>Calculated water savings</td>
<td>196M gallons over 10 years (~40% reduction)</td>
</tr>
<tr>
<td>Paid incentive</td>
<td>$119,400</td>
</tr>
<tr>
<td>Project unit $/AF</td>
<td>$198 /AF</td>
</tr>
</tbody>
</table>

Also replaced older washers with larger “tunnel” washer, increasing wash capacity.
Excellent example of monitoring and data gathering:

<table>
<thead>
<tr>
<th>DATE</th>
<th>WATER 1 GAL</th>
<th>WATER 2 GAL</th>
<th>TOTAL GALS</th>
<th>BILLED LBS</th>
<th>Gal Per LB</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/1/2015</td>
<td>24123</td>
<td>5677</td>
<td>83,776</td>
<td>99,742</td>
<td>0.84</td>
</tr>
<tr>
<td>1/2/2015</td>
<td>24224</td>
<td>5686</td>
<td>82,280</td>
<td>116,050</td>
<td>0.71</td>
</tr>
<tr>
<td>1/3/2015</td>
<td>24336</td>
<td>5695</td>
<td>90,508</td>
<td>81,898</td>
<td>1.11</td>
</tr>
<tr>
<td>1/4/2015</td>
<td>24453</td>
<td>5704</td>
<td>94,248</td>
<td>90,919</td>
<td>1.04</td>
</tr>
<tr>
<td>1/5/2015</td>
<td>24554</td>
<td>5713</td>
<td>82,280</td>
<td>134,698</td>
<td>0.61</td>
</tr>
<tr>
<td>1/6/2015</td>
<td>24665</td>
<td>5722</td>
<td>89,760</td>
<td>123,284</td>
<td>0.73</td>
</tr>
<tr>
<td>1/7/2015</td>
<td>24780</td>
<td>5731</td>
<td>92,752</td>
<td>131,145</td>
<td>0.71</td>
</tr>
</tbody>
</table>
## Project

Install equipment to capture and treat RO reject from the existing primary RO units; return recovered permeate to the primary RO feed.

## Final Project Cost:

~$450,000 (Management)

## Calculated water savings

450M gallons over 10 years (~14% reduction)

## Paid incentive

$242,800

## Project unit $/AF

$177 /AF
H2 Process Water Requirement drives the system
Challenges:
- Water savings not evident from master meter
- Dynamic system uses, variable flows
- Challenging database
- Indirect measurements
- Extended monitoring due to equipment failures (faulty valves)

Solutions:
- Ask lots of questions, understand the system
- Conversions, assumptions and tweaks
- Sharpen your excel skills
- Plot graphs
- Does it make sense?
- Get others to review your analysis
- Can't just take the customer's word for it
# Ag: Avocado Farm Renovation

<table>
<thead>
<tr>
<th>Project</th>
<th>Replace old trees with new on “high density” planting (10’x10’); install new irrig. Equip. and soil moisture sensors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final Project Cost:</td>
<td>$425,000</td>
</tr>
<tr>
<td>Calculated water savings</td>
<td>345M gallons over 10 years</td>
</tr>
<tr>
<td>Paid incentive</td>
<td>$238,814 (contract max)</td>
</tr>
<tr>
<td>Project unit $/AF</td>
<td>??</td>
</tr>
</tbody>
</table>
Ag: Avocado Farm Renovation

“High density planting”

- Plant on 10ft X 10ft spacing
- Reduced water use
  - Smaller watering footprints
  - Reduced loss to deep percolation
  - Inhibited weed growth
  - Reduced ET loss through overgrown canopies
Challenges

- New techniques/management
- Difficult to establish baseline
  - Changes in grove management
  - Older 20’x20’ spacing is well documented, HD not so much
- Phased implementation
  - Stopped watering some portions
  - Planting new trees in phases over 10 years
  - Different water requirements for different aged trees
- Weather normalization also

**Ag: Avocado Farm Renovation**
**Ag: Avocado Farm Renovation**

Procedure:
- Baseline established from actual use records
- Assume 50% of savings from HD planting, and 50% from irrigation equipment
  - [Avocadosource.com](https://www.avocadosource.com) for irrig data
  - HD Irrigation need assumed to be about 40% of normal spacing requirement
- Multiple inspections
  - Following planting plan?
  - Equipment installation?
- Time will tell...
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