PIMA COUNTY

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Date: July 2, 2015

To: C.H. Huckelberry, County Administrator

From: Julie Robinson, Manager of Sustainability Programs
Linda Mayro, Director of Office of Sustainability & Conservation

Subject: Ajo Corridor Solar Project & Impact on SAPCO Targets

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Michael Kirk, Facilities Management Director, requested that we provide further explanation as to why the County's energy consumption baseline in the 2008 Sustainable Action Plan differs from the updated 2014 plan and an update on where the County will stand in terms of meeting its renewable energy targets once installation of the Ajo Corridor Solar Project is complete. The report below responds to these questions in three sections: 1) an explanation of how the FY 2008/09 baseline was calculated and updated in FY 2013/14; 2) a projection of where the County's energy consumption will be in five years relative to meeting the County's renewable energy targets inclusive of the Ajo Corridor Solar Project, but absent any additional renewable energy or efficiency projects; and 3) an explanation for the increase in the County's electricity consumption in FY 2013/14.

Summary of Findings:

1.) Explanation of FY 2008/09 Baseline Calculations and FY 2013/14 Update

a. Prior to the availability of EnergyCap data, the FY 2008/09 baseline was calculated using historical cost data of **$11,052,356** of purchased power that was provided by Finance. This is admittedly a less precise method than we use now, and we acknowledge the 2008/09 baseline provided only an estimate of power consumption.
b. The methodology used in the baseline for FY2008/09 assumed a cost of $0.11/kWh. Estimated electricity consumption of **100,327,840 kWh** was then divided by 2,000,000 kWh/MW (a rough conversion factor) to estimate the baseline annual demand (100,327,840 kWh/ 2,000,000 kWh/MW= **50.16 MW**). (Note: This estimate does not include consumption of self-generated electrical power at the Roger or Ina Rd. facilities from biogas or solar power generation, which would increase the baseline had this data been included in the FY 2008/09 calculation).
c. Given that megawatts (MW) are a measure of power (maximum instantanious energy production i.e. installed capacity) rather than a measure of energy and the target is a function of energy use (%kWh/year), the calculation method was revised during the update process to improve accuracy in the 2014 Action Plan.
d. Annual performance is now calculated with actual consumption data from EnergyCap using the following equation:

Annual kWh from Renewable Energy / Annual kWh consumed (kWh grid electricity + kWh R.E.) = % Renewable Energy

2.) Meeting Renewable Energy Targets Inclusive of the Ajo Corridor, absent additional Renewable Energy or Energy Efficiency Projects

e. The Ajo Corridor Solar Project will bring the County's installed generation capacity to 14.7 MW, enough to generate more than 25,000,000 kWh per year.
    - In the context of FY 2014/15, this would be sufficient to generate almost 16% of the County's electricity needs.

f. However, the County's electricity consumption has been on an upward trend for the past several years irrespective of the 38% increase in FY 2013/14 (discussed below).
    - If this trend continues, by the end of FY 2015/16 the percentage of electricity generated by renewable sources will fall to 14.67%. If no additional renewable energy projects are installed and no attempts are made to curb the County's consumption through efficiency, this figure will fall to 12% by the end of FY 2018/19.

3.) Explanation for the Electricity Consumption Increase in FY 2013/14

g. Given that there was no appreciable change in the number of County facilities and office square footage in FY 2013/14, the most likely explanation for the 38% increase in electricity consumption is related to the very signficant upgrades to the County's wastewater treatment system, increased purchase of electrical power and the decommissioning of the biogas combined heating and power plant at the Ina Road WRF.
    - Increased electricity consumption in FY 2013/14 of 29,134,096 kWh by RWRD for its treatment facility and capacity expansion can account for much of the increase of 35,291,717 kWh in the County's overall electricity consumption in FY 2013/14.
    - This increase is the result of the very significant facility upgrades and capacity expansion to the County's wastewater treatment system, which according to RWRD will allow for an additional 160,000 residential connections to be made in the future without further investment.

Expanded Analysis:

1). FY 2008/09 Energy Baseline Calculations and FY 2013/14 Baseline Update

The 50.16 MW baseline for annual electricity demand, established in the FY 2008/09 Sustainable Action Plan for County Operations (SAPCO) Report Card, was generated using expense data for electricity consumption provided by Finance.

The number of dollars ($11,052,356) spent on electricity for FY 2008/09 was divided by $0.11/kWh[1] (based on TEP's Municipal Services Rate) to produce the estimated 100,327,840 kWh of electricty purchased and used by Pima County. The estimated number of kWh was then divided by 2,000,000 kWh/year/MW (as a rough estimate for the number of kWh/year generated by a 1MW solar array in Arizona) to generate the 50.16 MW baseline annual demand. Progress in achieving the County's renewable energy target was then gauged by dividing the current installed capacity by the 50.16 MW figure. This process is outlined in Table 1 below.

Table 1. FY 2008/09 Energy Baseline Calculations

County Baseline Electricity Consumption		
FY 2008/09 electricity cost/	**Estimated Average $/kWh =**	**Baseline FY 2008/09 Consumption**
$11,052,356	$0.11 /kWh	**100,327,840 kWh**

County Baseline Annual Demand		
Annual Electricity Consumption/	**kWh/ MW of Solar =**	**Baseline Annual Demand**
100,327,840 kWh	2,000,000 kWh/MW	**50.16 MW**

County Percent of Electricity Produced by Renewable Energy		
MW Installed Capacity/ (Example *FY 2014/15* data)	**Baseline Annual Demand=**	**Percent Renewable Energy**
9.6 MW	50.16 MW	**19.13%**

Table 1. Calculation for the FY 2008/09 baseline for annual electricity demand.

Given that megawatts are a measure of power (maximum instantanious energy production, i.e. installed capacity) rather than a measure of energy and the SAPCO Target is a function of energy use (%kWh/year), the calculation method was revised during the update process to improve accuracy in the 2014 Action Plan.

In keeping with the calculation methods used by the ACC, DOE, and other agencies; annual performance is now calculated using the formula below.

Annual kWh from Renewable Energy / Annual kWh consumed (kWh grid electricity + kWh R.E.) = % Renewable Energy

[1] This figure represents an estimated cost per kWh for 2008/2009. The estimate above was generated using historical cost data from 2008/2009. **$11,052,356/ 100,327,840 kWh = 0.1101624035761161 $/kWh**

2. Meeting Renewable Energy Targets Inclusive of the Ajo Corridor, absent Additional Renewable Energy or Energy Efficiency Upgrades

The ten sites in the Ajo Corridor Solar Project will have a significant impact on bringing Pima County closer to reaching the target of generating 15% of its electricity with renewable sources. The project will bring the County's installed generation capacity to 14.7 MW, enough to generate more than 25,000,000 kWh per year. In the context of FY 2014/15, this would be sufficient to generate almost 16% of the County's electricity needs. However, the County's electricity consumption has been trending generally upward about 8.48% since FY 2011/12, with an esceptionally large 38% increase in consumption in FY 2013/14 (see Figure 1 and Table 2). In FY 2014/15, the rate of increase dropped to 10.9 %, and Pima County continues to seek and implement increased efficiency measures.

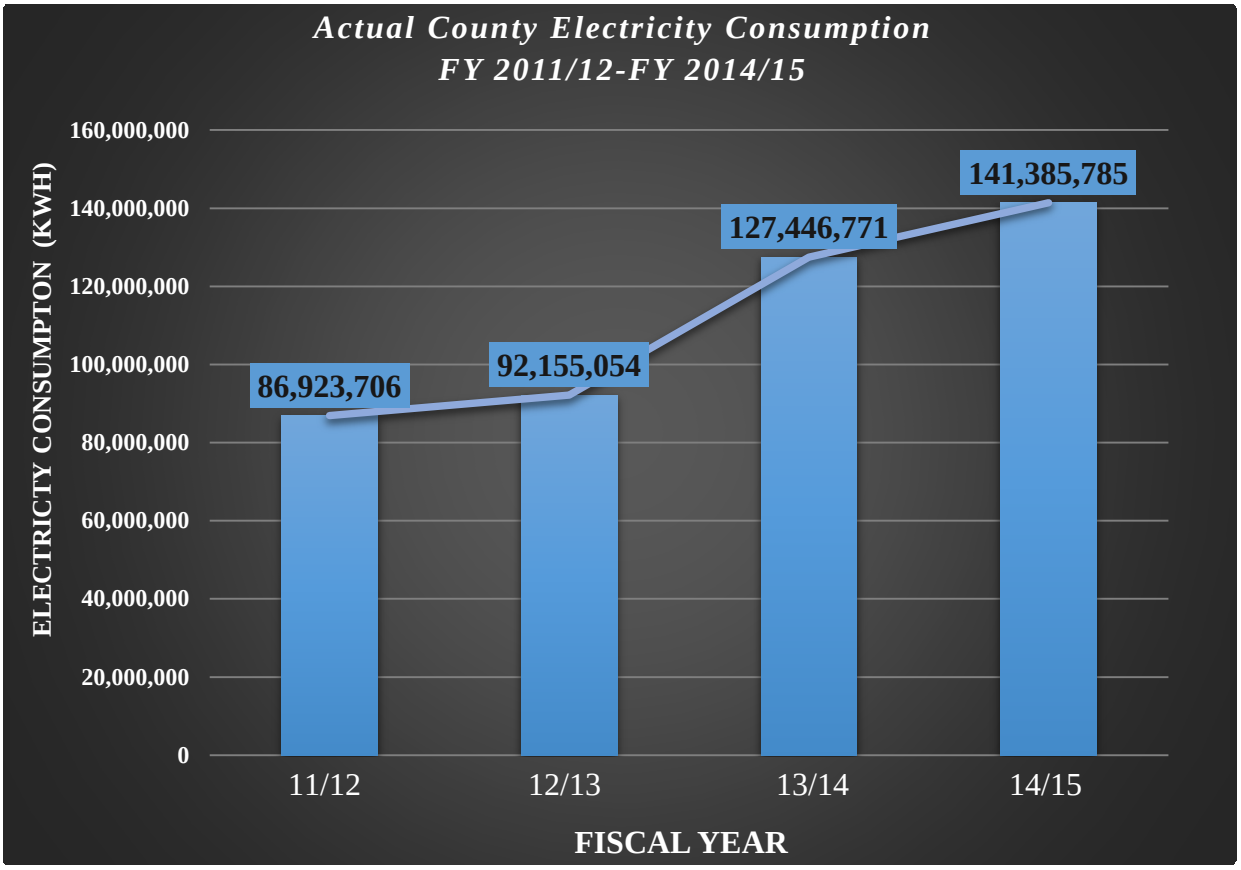

Figure 1. Actual Pima County Annual Electricity Consumption FY 2011/12-FY 2014/15.

Table 2. Actual County Electricity Consumption FY 2011/12-14/15 (kWh in EnergyCap)

Year	Grid kWh Consumption	Solar Production*	Total Consumption	Difference	% Change
11/12	82,281,035	4,642,671	86,923,706	N.A.	N.A.
12/13	87,587,538	4,567,516	92,155,054	5,231,348	6.02%
13/14	122,899,514	4,547,257	127,446,771	35,291,717	38.30%
14/15	135,140,023	6,245,762	141,385,785	13,939,014	10.94%
				Average% Δ	**8.48%**

Table 2. EnergyCap data for annual grid kWh consumed from FY 2011/12-2014/15. *Actual solar production data for FY 2012/13-2014/15 from SunEdison database. Production from solar sites not in the database was estimated using NREL modeling software. The Prairie Fire Solar Project is not included in the solar production total as it does not affect the total number of grid kWh purchased. **Note:** The FY 2014/15 Grid kWh Consumption figure is a projected total based on the percent increase in kWh for FY 2015 compared to FY 2013/14 through April (9.96%). The overall average annual change of 8.48% in the County's energy consumption is based on FY 2011/12, 2012/13, and 2014/15 data (FY 2013/14 is excluded as on outlier).

Assuming no additional renewable energy (RE) or efficiency projects are implemented and an estimated 8.48% annual increase in energy consumption is projected based on historical use since FY 2011/12, the gains made through the Ajo Corridor Solar Project will be nearly eroded by 2018/19 (end of the current SAPCO implementation period) (see Figure 2 and Table 3).

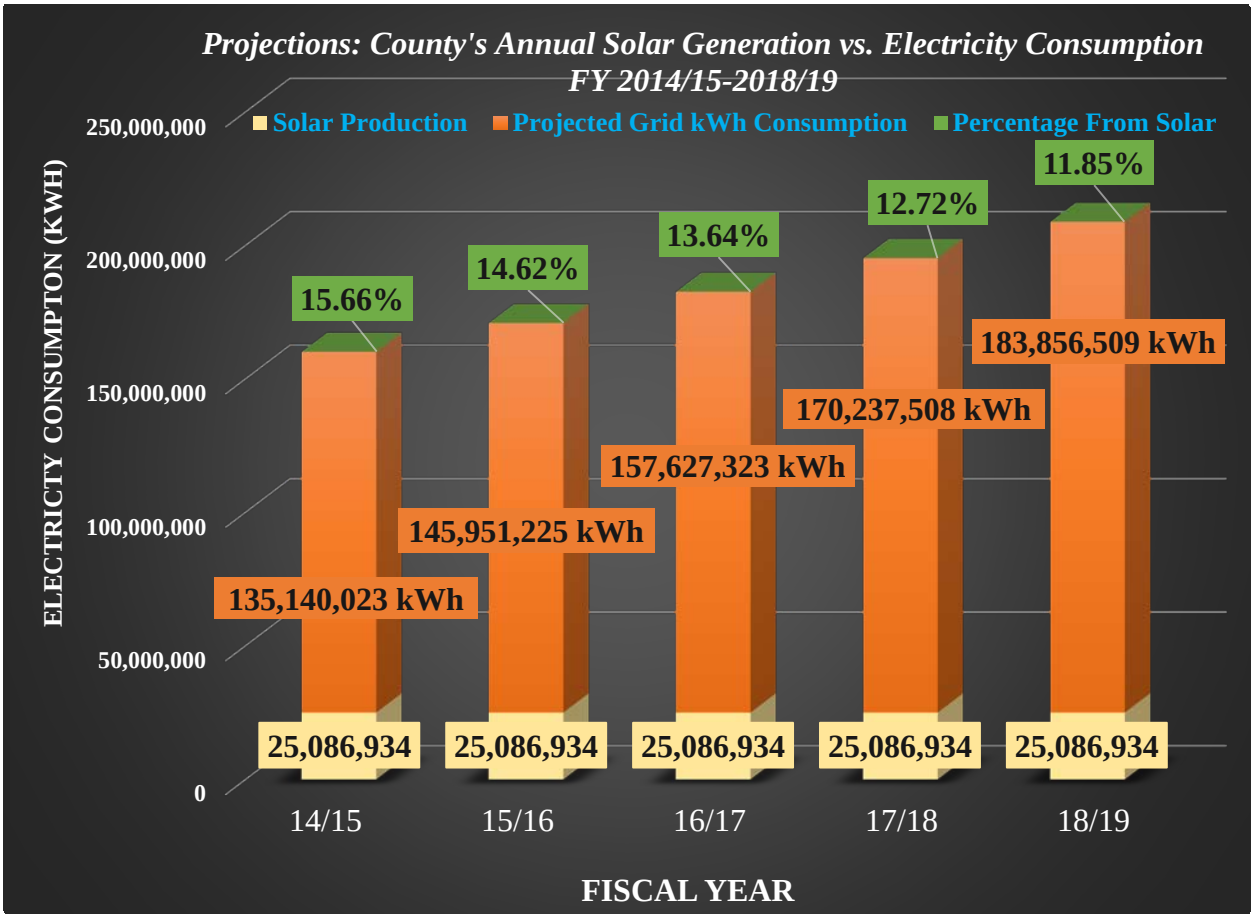

Figure 2. Projected annual renewable energy (RE) generation with Ajo Corridor Solar Project, versus projected consumption (FY 2014/15-2018/19). With an assumed consumption increases of 8.48% per year and in the absence of additional renewable energy or efficiency projects, the County's overall ratio of renewable electricity consumption will decrease from 15.66% to 11.85% by the end of FY 2018/19.

Table 3. Projected Annual Percentage of County Electricity Provided by RE (Solar)

Year	Projected Grid kWh Consumption	Solar Production	Projected Total Consumption (Grid+Solar)	Percentage From Solar
14/15	135,140,023	25,086,934	160,226,956	15.66%
15/16	146,599,897	25,086,934	171,686,830	14.61%
16/17	159,031,568	25,086,934	184,118,502	13.63%
17/18	172,517,445	25,086,934	197,604,379	12.70%
18/19	187,146,924	25,086,934	212,233,858	11.82%

Table 3. Projections for annual electricity consumption and renewable energy generation. The average annual rise in County consumption of 8.48% excludes FY 2013/14, and assuming no additional renewable energy or energy efficiency projects are implemented, the data in column five shows that under this scenario, the percentage of the County's renewable energy use will decrease from 15.66% to 11.82% by the end of FY 2018/19.

3. Explanation for the FY 2013/14 Increase in Energy Consumption

Given that there was no appreciable change in the County's square footage in 2013/14 (based on best available data), the 38% increase in electricity consumption observed in Figure 1 and Table 2 was most likely the result of significant capacity upgrades to the County's wastewater treatment system, the decommissioning of the biogas combined heating and power plant at the Ina Road WRF and increased purchase of electricity. Data from RWRD and EnergyCap show during the same year, electricity consumption by RWRD rose 108% (See Figure 3 and Table 4). Likewise, the increase in electricity consumption by RWRD (29,398,140 kWh) can account for most of the additional electricity consumed by the County in FY 2013/14 (35,291,717 kWh, see "Difference" columns in Tables 2 and 4. Figure 3 illustrates the strong correlation between the increase in overall County consumption and RWRD's increased consumption in FY 2013/14.

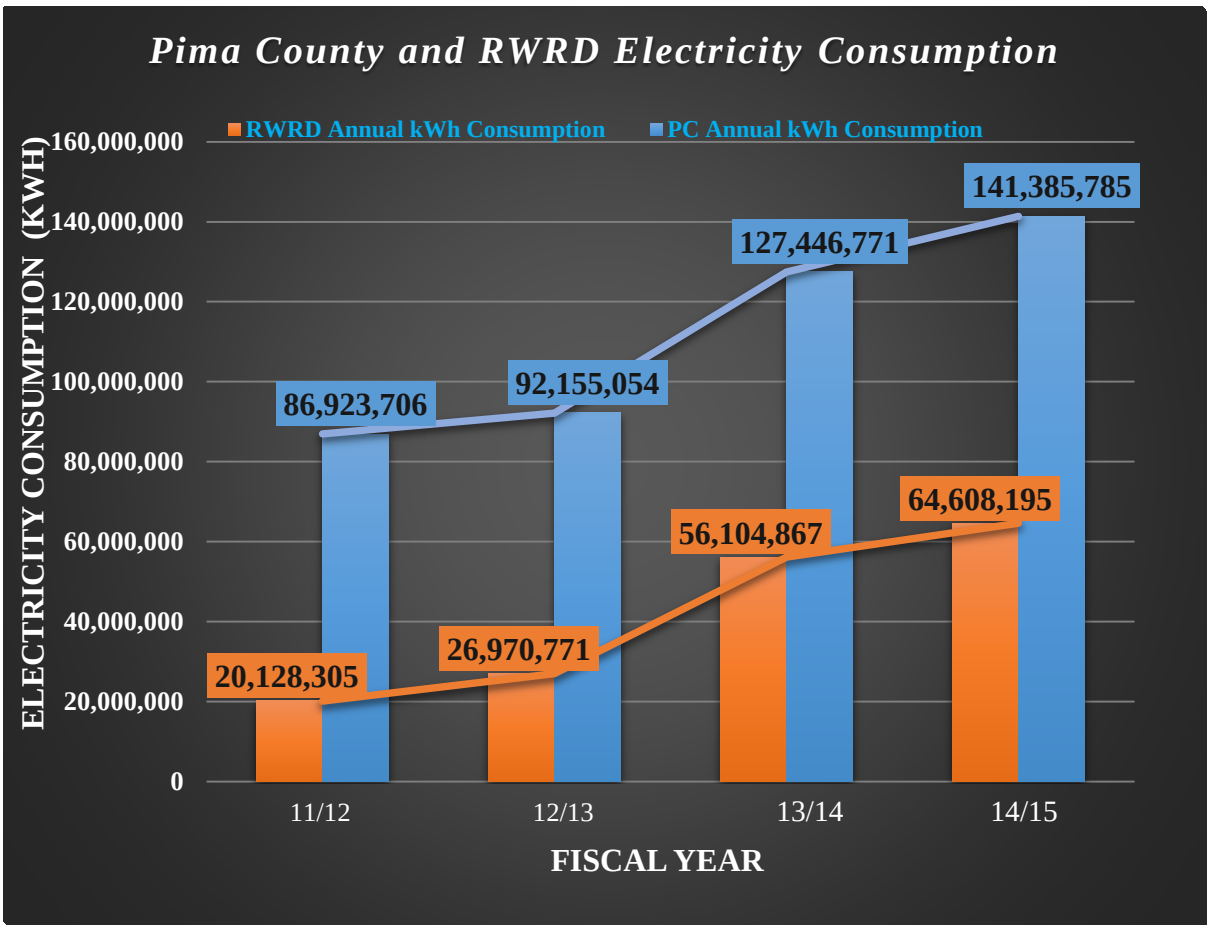

Figure 3. Comparison of Pima County and RWRD electricity consumption FY 2011/12-2014/15. Note the strong correlation between the increase in overall County consumption and in RWRD's consumption in FY 2013/14.

Table 4. RWRD Annual kWh Consumption					
Year	**Grid kWh Consumption**	**Solar Production**	**Total Consumption**	**Difference**	**% Change**
11/12	15,862,437	4,265,868	20,128,305	N.A.	N.A.
12/13	22,792,436	4,178,335	26,970,771	6,842,466	33.99%
13/14	52,021,388	4,083,479	56,104,867	29,134,096	108.02%
14/15	60,940,974	3,667,221	64,608,195	8,503,328	15.16%
				Average% Δ	**24.58%**

Table 4. EnergyCap data for annual grid kWh consumed from FY 2011/12-2014/15. Actual solar production data was pulled from the Sun Edison database. **Note:** The FY 2014/15 figures for consumption and production are projected totals based on the average monthly increase in consumption compared to FY 2013/14. The overall 24.58% annual change excludes FY 2013/14 as an outlier. **Note:** The kWh figure (29,134,096 kWh) for FY 2013/14 in the "Difference" column is nearly equal to the kWh figure (35,291,717 kWh) in the "Difference" column for FY 2013/14 in Table 2.

Summary:

The 2008/09 energy consumption baseline established for the original Sustainable Action Plan was calculated using cost data of energy purchased to estimate electricity consumption. Estimated electricity consumption was then divided by 2,000,000 kWh/MW (a rough conversion factor) to estimate the baseline annual demand (100,327,840 kWh/ 2,000,000 kWh/MW= 50.16 MW). This baseline is admittedly a rough estimate of purchased power, which did not include self-generated power consumed at the Roger Road and Ina Road WRF. Given that megawatts are a measure of power (maximum instantanious energy production i.e. installed capacity) rather than a measure of energy and the target is a function of energy use (%kWh/year), the calculation method was revised during the update process to improve accuracy in the 2014 Action Plan. Annual performance is now calculated unsing actual consumption data from EnergyCap using the following equation: **Annual kWh from Renewable Energy / Annual kWh consumed (kWh grid electricity + kWh R.E.) = % Renewable Energy**

The Ajo Corridor Solar Project will bring the County's installed generation capacity to 14.7 MW, enough to generate more than 25,000,000 kWh per year. In the context of FY 2014/15, this would be sufficient to generate almost 16% of the County's electricity needs. However, electricity consumption has shown an upward trend for the past several years. Unless additional renewable energy and energy efficiency projects are implemented, the percentage of electricity generated by renewable sources could fall from 16% to 11.82% by FY 2018/19.

The FY 2013/14 increase in the County's electricity consumption was likely the result of the significant upgrades to the County's wastewater treatment plants and system, increased purchase of electricity, and the decommissioning of the biogas combined heating and power plant at the Ina Road WRF. Through further analysis, the source of the additional 8.48% increase per year in consumption since FY 2011/12 does not appear related to an increase in office space or facility square footage in County properties; however, the factors responsible for the increases in consumption have not yet been identified.

Achieving the County's renewable and energy efficiency targets is still well within reach. Collaboration among FM, RWRD, OSC and other departments to identify and implement strategies such as energy audits and employee behavior change campaigns is being discussed along with other strategies such as development of a master energy plan to curb the upward trend in electricity consumption at Pima County. The Sustainable Action Plan remains a valuable tool for monitoring progress towards achieving the renewable energy target of 15% by 2025, which was approved by the Pima County Board of Supervisors in Resolution 2014-63.

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