

Notes on Priming the Pima County Productivity Pump: The Economic Imperative of Energy Efficiency

John A. "Skip" Laitner
September 9, 2015

Slide 0 Introduction

Priming the Pima County Productivity Pump: The Economic Imperative of Energy Efficiency

John A. "Skip" Laitner
Pima County Energy and Water Summit
Tucson, Arizona
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Good morning, with a heartfelt thanks for the invitation to participate in today's discussion. Indeed, I want to extend my compliments to Pima County for what I hope will be seen as a historic gathering -- one that will become an important step toward moving the County onto a more robust and sustainable path of economic activity.

Two weeks ago I received an unexpected call from my colleague Jeremy Rifkin. Some of you may know him as the author of the 2011 best-selling book, the *Third Industrial Revolution*. A quick way to think about the Third Industrial Revolution? It is the investment in new materials and new designs, which are digitally-interconnected in ways that greatly accelerate the more productive use of energy and other resources—to a big economic advantage.

As some of you may also know, I work with Jeremy, serving as his chief economist on what we call Third Industrial Revolution Master Plans. We've done such plans for a number of places including Rome, the Province of Utrecht in Netherlands, and our most recent and perhaps most successful, Nord-Pas de Calais. This is a region of some 4 million people in northeastern France.

What is interesting about Nord-Pas de Calais is that it is a major industrial region in France, and a former coal mining area that no longer mines coal. Indeed, in a small town of Loos-en-Gohelle just outside of the regional capital of Lille, where the miners once descended into the mine, now sits a world class art museum. Quite a stunning reinvention of their economy. I could tell you so much more about their intent to cut energy use in half and power all remaining energy needs with renewables, but alas, there is no real time today. Back to the phone call, however. . . .

The reason for the unexpected call to me was that a high level group of Chinese government officials asked Jeremy for thoughts on how the ideas which underpin the Third Industrial Revolution might stabilize and reinvigorate their national economy; and more critically, how those ideas might transition into a more robust and sustainable level of economic activity. As a result, we spent a long weekend putting together a memorandum on our thoughts and insights for what I call an investment-led productivity strategy for China. Jeremy's big concern – I think appropriately – was

that that they were otherwise going to simply build what he calls a 'new old.' Yes, they have plans for new infrastructure upgrades, but those investments would largely be wasted on the old, the Second Industrial Revolution technologies.

He completed the memorandum a week ago this past Monday; and on this Friday he leaves for Beijing to help shape a revitalized economic narrative that we hope can transition China's existing liabilities into a formidable asset that can transform their economy, and genuinely usher in a Third Industrial Revolution. Some of the same thoughts that shape our discussions with China, now provide a backdrop to the short time we are spending here together today.

So given that backstory, how to think about my short presentation that follows? Two things for the moment. First, I will broadly document what I call the economic imperative of energy efficiency. Yes, including renewable energy technologies. Second, rather than a talk, I'd like to think of it as the beginning of a badly needed conversation with all of Tucson, all of Pima County and all of the United States. Because we have still so much to learn about this thing we call energy. And as we will find out, both our climate and our economy depend on the smarter, more productive use of energy.

As I am thinking about how we might revitalize the economy here in Pima County, I recall a comment by Steve Jobs, "How do people know what they want when they haven't seen it yet?" In the words of award-winning economist, and former President of the American Economic Association, Kenneth Boulding (you might know him best as the one who coined the phrase 'spaceship earth'), our task is to help shape a positive image of the future, which is "critical to choice-oriented behavior," and which can help engage the larger community of Pima County in the tasks ahead.

Before we dive more deeply, however, I want to get a sense of the audience and your general awareness of energy and technology perspectives. I want you to raise your hand as I pose a few questions. Depending on your response, I may shape the balance of the discussion accordingly.

First, you are all likely aware of the name Henry Ford. Raise your hand if you know that he is the brilliant innovator behind assembly line production.

Second, raise your hand if you also know that Louis Pasteur first gained fame by developing the pasteurization process for milk.

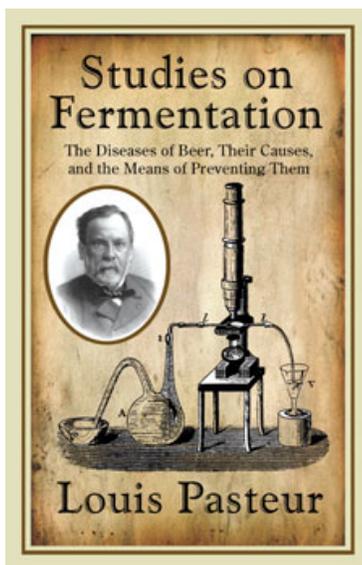
Next, raise your hand if you are aware or that you believe, that in terms of available energy, a kilogram of dynamite contains more energy than a kilogram of food, say hamburgers or chocolate chip cookies?

Finally, and not that you necessarily like the prospect of more coal in our future, but raise your hand if you are generally aware that at current prices there are at least 200 years of coal resources – if not more – that are available for development and future use?

Thank you. And I would now ask how you would feel to learn that every time that someone raised their hand they were wrong?

It was not Henry Ford, but Michael Owens who developed the first assembly line machine for beer; in effect an automated bottling machine. Ford's real genius was for recognizing the need to bring the cost of a new car down to \$500, and the assembly line was of the ways to get it done.

Louis Pasteur actually was noted first for his work with beer, and then milk. In 1876 wrote a paper called, *Studies on Fermentation: The Diseases of Beer, Their Causes and the Means of Preventing Them*.



Third, lest you think I have a fondness for beer—and indeed I do—yes, we have plenty of coal, but not at current prices. Prices are going to have to rise big-time if we are going to even think about tapping into large amounts of the available coal resource.

And finally, many foods have more energy than dynamite, but dynamite releases that energy much more quickly.

In a very similar, but perhaps a more critical way, we need to rethink the role of resources and energy within the economic process. To help with that rethinking, let's begin by the use of what we might call three thought experiments. . .

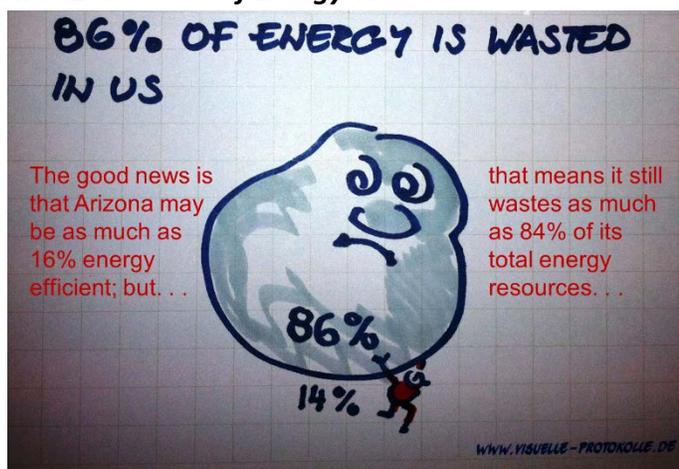
*** First, Arizona's state budget is on the order of \$13 billion per year. We fret over the appropriate size of that budget, and whether we are efficiently allocating those revenues to bring the best economy forward. Yet, the state as a whole also spends, not \$13 billion, but \$23 billion for energy. That's \$23 billion for cooling our homes and schools, maintaining our Internet activities, commuting to work, or powering our industrial operations. I suggest that we would do more for the state's economic well-being if we focused more on the productive use of energy—cutting energy costs by, say, 40 percent—rather than cutting state taxes.

*** Second, based on statewide per capita estimates, I am guessing that households and businesses in Pima County spend on the order of \$3.5 billion each year for energy. Energy for all uses. If we reduce those costs by that same 40 percent that I just discussed—and with an investment-led strategy, one that emphasizes the deep penetration of energy efficiency and renewable energy technologies, we certainly can save a net 40 percent—the economic benefit would be at least 10 times the annual impact of the Gem Show. Likely much greater.

*** Finally, let's assume that neither County Administrator Chuck Huckelberry nor Tucson Mayor Jonathan Rothschild retire until the year 2050; and let's also assume that neither the City nor the County is allowed to increase tax rates over the next 35 years. Given the economic trends (as we shall see in a moment), they may be forced to cover revenue shortfalls roughly equivalent to 3-10 times their current annual budgets. And depending on the volatility of prices, market disruptions, and possible social disruptions from a growing number of people without jobs, it could be significantly more.

The reason? My research, and that of my colleague Bob Ayres, indicates that the inefficient use of resources throughout the U.S. economy—whether the huge waste associated with materials, water, and especially energy—imposes a very large array of costs that weakens the economic process.

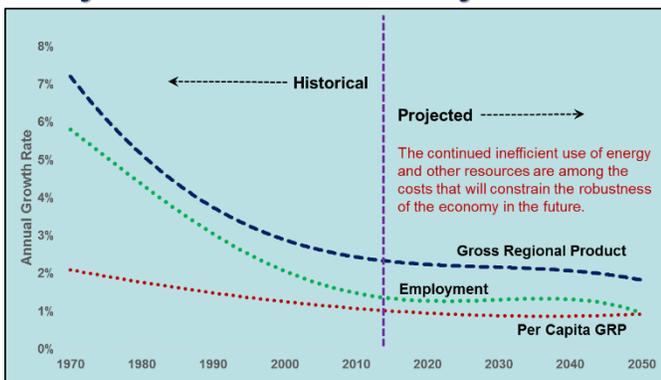
Slide 1 the Scale of Energy Wasted



I spoke two years ago in Zurich, Switzerland. Two quick sketch artists heard that talk and drew this intriguing cartoon which nicely captures the current economic difficulty. Based on my research, the U.S. wastes 14 percent of all energy consumed within the economic process. As you can imagine, a 14 percent (in)efficient conversion implies an 86 percent level of wasted energy. That magnitude of waste creates an array of direct and indirect costs that can only weaken the economy. As you can also imagine, it is hard to be nimble and productive when you're heavily burdened by such a big level of waste that burdens economic activity. The good news (subject to check) is that Arizona appears to convert energy at a marginally better rate, perhaps 16 percent of all energy consumed. Yet, that means the state still wastes about 84 percent of the energy it now uses each year. Still a very sizeable burden that weakens the robustness of the economy.

Slide 2 Pima County Projections

Key Trends in Pima County 1970-2050



Source: John A. "Skip" Laitner, Economic and Human Dimensions Research Associates using Woods and Pooled data for Pima County, Arizona, August 22, 2015.

Annual Growth Metrics	1970-2014	2014-2050
GRP	3.71%	2.20%
Jobs	2.9%	1.4% +320K but could be 420K (or more)
Per Capita	1.29%	0.97%

Slide 3 The Iceberg



Source: Laitner et al. The Long-Term Energy Efficiency Potential: What the Evidence Suggests (2012)

In a 2012 study I led with my colleagues from the American Council for an Energy-Efficient Economy (ACEEE), we have roughly 250 billion barrel of efficiency equivalent that we could develop here in the United States, enough to reduce our energy needs by one-half by 2050 and still have an even stronger economy. Because our vision is more shaped by waste than ingenuity, we see a much more limited opportunity.

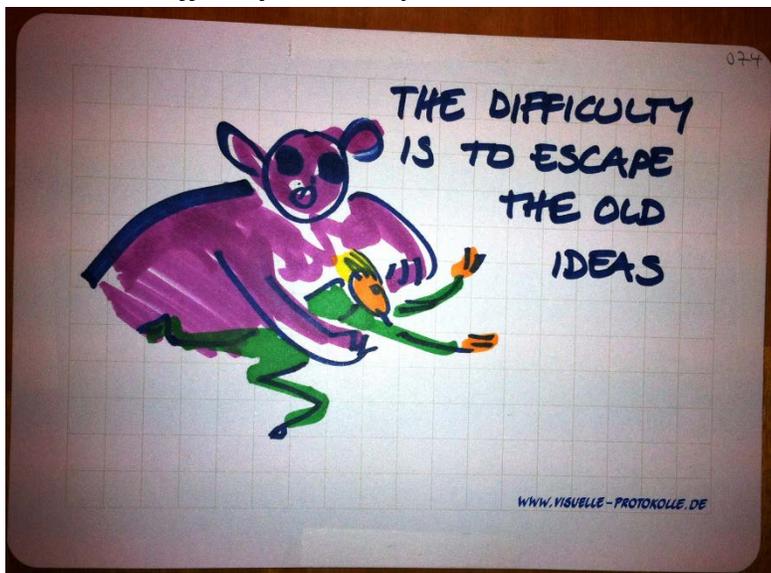
Slide 4 Rex Tries to Remain Focused



High above the hushed crowd, Rex tried to remain focused. Still, he couldn't shake one nagging thought: He was an old dog and this was a new trick.

- *Strap on your best sense of humor. You're going to need it
- *Ask better questions, demand better answers; and think beyond County operations alone

Slide 5 The Difficulty is to Escape the Old Ideas



The difficulty lies not with the new ideas, but in escaping the old. . .

Energy and Water Summit September 9, 2015

Staff Presentation

EnergyCAP 101

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Abstract:

EnergyCAP is a utility bill management program that has been fully implemented by Pima County's Energy Division to provide a resource for the Energy Manager and departments to electronically access utility bills in order to explore cost-saving strategies through improved energy and water efficiencies. Additionally, EnergyCAP provides an analytical tool for assessing the County's annual progress towards meeting renewable energy, carbon reduction, and water conservation targets as mandated through the 2014 Board-adopted Sustainable Action Plan for County Operations. "You cannot manage what you do not measure," EnergyCAP provides this tool and the foundation to initiate the next steps in developing a Master Energy and Water Plan for County operations.

Introduction

In 2009, when I became Energy Manager, utility bills in Pima County, much like many Municipalities were treated as any other invoice. The utility bills were sent from the utility companies to Accounts Payable. Accounts Payable processed the invoice and arranged for payment. The paper invoices, once processed were sent to a warehouse where they were stored in case an original copy was needed.

Accounts Payable worked hard to get the bills paid in a timely manner to avoid shut offs and late fees, time and effort were spent every month to work with departments that had started or stopped utility services to correct accounting inaccuracies related to stopping or starting accounts (which departments pay for).

However, under this system, departments struggled to get copies of utility bills that were charged to their utility budget in order to determine which utility accounts were associated with which facility. Sorting out the invoices required a substantial amount of staff time and effort, on multiple occasions employees had to physically visit a property to search for a utility meter so that a department could figure out who was paying for it.

As the new Energy manager, I did not have access to utility bills, either. Data that I needed to benchmark our facilities and develop energy conservation measures was lacking or non-existent. Fortunately, in 2010, Pima County applied for and received Energy Efficiency and Conservation Block Grant funds from the State of Arizona. Facilities Management managed this grant and working with multiple County departments and the SAPCO Steering Committee, developed a list of Count-wide energy conservation measures across multiple projects. One project was the procurement of a utility bill tracking and management software program.

EnergyCAP is the utility bill tracking and management computer program purchased by Pima County in 2011. The EnergyCAP program, administered by the Energy Division in Facilities Management, has resulted in a vendor-hosted website that Pima County users can log onto and review the utility bills associated with their department's utility budget. All of the data fields on any bill can be managed via a data base program. Cost and consumption as well as trends and reports can be generated from the empirical data collected from the actual utility bill.

Building the foundational database for EnergyCAP required more than six months of work by the Energy Division working with Information Technology Department and Finance. While time-consuming, this tremendous cross-departmental effort has yielded significant rewards including the first ever

complete catalog of Pima County properties and facilities with associated utility meters and accounts along with financial data for invoice payments.

EnergyCAP began generating savings for Pima County, right away. The database with utility costs and consumption per meter allowed for the benchmarking of the County's largest energy consumers. With EnergyCAP, it is possible to take "snapshots" of energy use in order to prioritize energy conservation measures and make decisions based on estimated return on investments. Moreover, with EnergyCap, the County could track the results of the conservations measures related to cost and consumption.

Once the database was built and operational, the Energy Division at Facilities Management began familiarizing and training County departments on how to use the program. For the first time, department personnel could log on to a website and see the utility bills that were being charged to their budget. Departments working through the Energy Division could audit their utility bill accounting information and correct deficiencies through Finance. Several utility accounts were closed due to inactivity or erroneous information.

EnergyCAP has also become the principal tool for collecting and reporting data on energy and water consumption to assess how well the County as a whole is progressing towards achieving annual SAPCO targets, as well as for producing regional reports such as the greenhouse gas inventory. Moreover, EnergyCAP has been fundamental in tracking the County's efforts at installing and producing renewable energy through solar photovoltaics.

With the empirical data produced in EnergyCAP, Pima County contractors can conduct feasibility studies of which sites are prime candidates for renewable energy projects. Then, the County can track before and after energy consumption data using EnergyCAP to validate the return on investment of these installations.

The Energy Division has only just begun to use all of the features provided in this database software. In fact, Facilities Management is in the process of procuring a new master agreement with EnergyCAP to continue the second phase of implementation. Additional software features and services provides the option of growing our EnergyCAP resources especially now that all of Pima County's hundreds of utility bills have been electronically uploaded to the database and the data cleaned and vetted.

Conclusion

With EnergyCAP and broadening cross-departmental cooperation, Pima County is in a position to track and manage any commodity-based invoice from fuel to cell phones. Additionally, EnergyCAP could be used to communicate with the County's enterprise system to receive, track and pay bills, electronically.

Utility bill management programs, electronic management of diversified data collecting and management systems, energy conservation measures, energy audits, benchmarking are all needs that the County has identified as needing attention, to improve the energy efficiency and hence the County's bottom line. The next step needed in the efficiency improvement process is a County-wide energy audit. You cannot manage what you do not measure. A performance contract to initiate an energy audit is next step in developing a Master Energy and Water Plan for County operations.

Marc Lynn is available to assist with training staff in how to access and use EnergyCap to reduce utility overhead costs. To schedule a training session, please contact Linda Sabori at (520) 724-3601 or Linda.Sabori@pima.gov.

Energy and Water Summit September 9, 2015

Staff Presentation

Energy and Water in Water Reclamation

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Pima County Regional Water Reclamation Department

Since 2012, the Pima County Regional Wastewater Reclamation Department (RWRD) has embraced a systematic approach to integrate energy management into daily operation and long-term planning in its water reclamation facilities (WRF), of which there are two metropolitan (Tres Rios, and Agua Nueva) and [six sub-regional facilities](#). In April 2013, the Department's first *Monthly Power Use and Cost Report* was published - a major milestone of our energy management efforts. In 2013, RWRD received a grant from the Water Infrastructure Finance Authority for an energy audit of all sub-regional wastewater reclamation facilities. With the energy efficiency improvements brought through the Regional Optimization Master Plan (ROMP), the total energy used by the two metropolitan regional facilities actually *decreased* by approximately 25 percent between FY2010-11 and 2014-15, while producing a much higher quality of reclaimed water.

Introduction:

According to [USEPA](#), water and wastewater treatment is responsible for approximately three to four percent of the nation's energy consumption, equating to (a) about \$4 billion; (b) approximately 56 billion kilowatt hours (kWh); and, the emission of over 45 million tons of greenhouse gases (GHG) into the environment. Energy costs represent 25 to 30 percent of the costs to operate and maintain water and wastewater facilities.

Like other municipal wastewater utilities, RWRD faces many challenges including more stringent regulations, growing population, and increasing energy costs. The Department's goal is to be energy intelligent while continuing to improve system-sustainability.

Sustained drought and increasing concerns about water scarcity means reclaimed water is an increasingly important renewable water source. The improved water quality through ROMP increases options for reclaimed water use, not just for Pima County but also for the several entities with effluent entitlements to reclaimed water, which include (a) Southern Arizona Water Rights Settlement Act (SAWRSA) allocation of 28,200 acre-feet (AF) managed by the Bureau of Reclamation; (b) 30,528 AF accorded to City of Tucson and other water providers; and, (c) 3,292 AF retained by Pima County (http://webcms.pima.gov/UserFiles/Servers/Server_6/File/Government/Wastewater%20Reclamation/Treatment/Effluent_gen_2014.pdf).

Proposed Water-Energy Solutions:

Benchmarking and Energy Audit

The first fundamental step for energy management is benchmarking. Pima County RWRD owns and operates eight water reclamation facilities (WRF), 28 pump stations and over 3,400 miles of major sewer lines. In April 2013, the Department's first *Monthly Power Use and Cost Report* was published to provide a bench mark for future studies. RWRD's major facilities consumed over 9,000,000 kWh energy in fiscal

year 2014-15, which included conventional electricity, natural gas, biogas, and solar. The Department's baseline energy use is a fundamental data source needed to measure the effectiveness of energy efficiency improvements.

Utilizing funds received from the Water Infrastructure Finance Authority (WIFA), RWRD plans to conduct energy audits for all six of its sub-regional WRFs.

In addition to reducing greenhouse gas (GHG) emissions, another energy management objective is to lower costs. Utility companies have various tariffs to meet the needs of their customers. Therefore, to ensure that utility companies apply the lowest and best rates, it is important to understand their fee structure and to closely monitor the utility rates they apply.

Better Wastewater Treatment with Less Energy Consumption

To meet regulatory requirements, RWRD recently completed a major capital improvement program called the Regional Optimization Master Plan (ROMP). The two major WRFs serving the metropolitan area were upgraded from facilities that apply 'secondary treatment' to biological nutrient removal facilities with tertiary treatment capabilities. The water quality of the treated effluent improved significantly and the power consumption of these new wastewater treatment systems is projected to decrease dramatically.

During construction, each of the plant-wide power systems was upgraded with energy-efficient, power conservation systems resulting in long-term power reliability at the least possible cost. With these improvements, the total energy used by the two metropolitan WRFs actually *decreased* by approximately 25 percent between FY2010-11 and 2014-15, while producing a much higher quality of reclaimed water for the entire community.

Maximize the Use of Renewable Energy

In addition to improving energy efficiency, RWRD is also increasing its use of renewable energy. In 2010 and 2011, two, one-megawatt, solar power projects were completed: one at Tres Rios WRF and the other at Agua Nueva WRF. Electricity generated at these solar facilities augments power for the wastewater treatment processes at the regional facilities. In fiscal year 2013-14, the two solar farms generated over 4,000,000 kWh of electricity, which could power 400 homes. Next, RWRD is planning to use solar power at three of its sub-regional facilities.

Maximize the Use of Reclaimed Water

The improved water quality from the ROMP upgrades to the metropolitan WRFs is providing a number of benefits, including increased opportunities for direct use, increased infiltration and improved aquatic habitat in the Santa Cruz River. Direct delivery of reclaimed water is being planned to Mike Jacob Sports Park (6901 North Casa Grande Highway) and direct delivery options will be considered for El Corazón (at the confluence of the Santa Cruz, Rillito, and Cañada del Oro rivers). Monitoring in the Santa Cruz River in the last year showed improvements in aquatic wildlife. Increased infiltration means less reclaimed water leaves Pima County and more is recharged in the Tucson Basin. In 2014, approximately 10,200 acre-feet were measured leaving the gauging station at Trico-Marana Road compared to 28,300 acre-feet in 2013. As a result of improved water quality and increased infiltration, long-term storage of County effluent also increased from 181 acre-feet in 2013 to 449 acre-feet in 2014.

Energy and Water Summit September 9, 2015

Staff Presentation

Performance Contracting

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Abstract:

Performance Contracting is a type of service agreement to provide energy and water auditing across facilities to benchmark and recommend efficiency upgrades to clients. Many governments are using Performance Contracting to improve their bottom line. With no upfront costs and associated opportunities to actually generate revenue, Performance Contracting is mechanism, if managed well, has been demonstrated to yield rapid and long-term economic and environmental benefits.

Introduction:

I would like to start this discussion, with the end result in mind. Pima County is at a decision-making crossroads in the sense that much of our equipment and infrastructure is dated. Facilities Management as well as other County departments will need to budget for the replacement of aging equipment. In many cases, the decision will come down to; do we replace “like for like”? Do we continue to do what we have for the last thirty years? Or, do we plan for the next thirty years and take stock of what we have and what is available to us to incorporate operational efficiencies to improve our bottom line?

Navigating this transition at the County-scale can be achieved more efficiently and effectively through a Master Water and Energy Planning Initiative. Much like our Sustainable Action Plan for County Operations (SAPCO), a Master Plan for Energy and Water would provide a framework to assess and organize how departments could work together to mitigate utility costs. The Plan would work hand in hand with SAPCO; reducing water and energy consumption and the County’s carbon footprint as well.

A number of resources are available to the County to support this effort. One of the most important first steps we should undertake is to access support services provided by the Arizona Governor’s Energy Office to guide us through the process of procuring a Performance Contract. *Performance Contracting* is a type of service agreement, wherein an Energy Service Company (ESCO) is contracted to audit energy use within an organization. The purpose and results of the audit are used to “benchmark” facilities, which is a critical step in developing a Master Water and Energy Plan. Based on the audit findings, Performance Contractors provide recommended Energy Conservation Measures (ECMs). Implementing the ECMs in turn leads to operational efficiencies that reduce bottom line costs.

Performance contracting is mechanism being used by many local governments to provide energy and water improvements without upfront costs. The contract is paid for from the utility savings that the ESCO guaranties will result from the recommended conservation measures based on the energy and water audit. Clients have ultimate decision-making authority over whether to pursue any portion or all of the recommended measures and separate contract is created for each measure agreed to.

Conclusion:

Upgrading costly equipment and infrastructure is on the horizon for Pima County over next few years. In combination, with current utility costs and future projected utility rate increases of an average three to six percent per year, the County is in an excellent position to consider alternative energy and water programs, especially given predicted water shortages and energy stresses associated with climate variability. In either or both events, a future vision could realize the County’s utility budget as a revenue stream instead of the historical “cost of doing business.” A first step in the process is procuring a Performance Contractor through the Master Energy and Water Planning Initiative.

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Staff Presentation

Solar Electric and Energy Storage Solutions

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Abstract

Advanced solar electric solutions and energy storage systems have achieved manufacturing-scale production and reliability and are now economically feasible, and in many circumstances significantly favorable, alternatives to traditional grid-supplied electricity. Assessing how these tools and technologies might benefit the County by stabilizing and reducing operational costs and improving the reliability and security of non-discretionary energy and water supplies should be a component of a Master Energy and Water Planning Initiative.

Introduction

Pima County's budget has been significantly and negatively affected by chronic and repetitive increases in the cost of utility-supplied electricity. Arizona energy utility revenues increased an average of 7.5% per year 2000-2009¹ and TEP's 2012 base rate increased the County's cost by 16% and created several additional surcharges that can increase without notice monthly. TEP has indicated that they will file yet another request to increase rates and restrict customer generation later this year. This compounded cost of electricity requires the County to consider risks and plan for its financial resources, including reallocation of financial resources original planned for other services and/or needs. Additional issues associated with use of electricity provided by our region's utilities include:

- Pending rate cases by Tucson Electric Power Company (TEP) and Trico Electric Cooperative, Inc. (Trico) to prohibit or constrain customer generation of lower cost electricity;
- The utilities' current rate structure calculates and provides profit as a percentage of costs, promoting constant cost increases;
- The amount of groundwater required to generate electricity from fossil fuels and the increasing demand for and risk of water scarcity leading to increased costs for both electricity and water;
Burning coal or gas to produce steam to run turbines to generate electricity results in a water loss by evaporation of up to ¾ gallon/kilowatt-hour (kWh) produced². TEP sells about 10 billion kWh/year resulting in a loss by evaporation of up to 7.5 Billion gallons (23,017 acre-feet) of ground water per/year. Pima County purchases 129M kWh/year of fossil-fueled power from utilities, using 97 million gallons/year (298 AF).
- Current water resources are insufficient to satisfy future urban, food/agriculture, and energy generation demands requiring the development of alternative resources. According to David Modeer, former General Manager of the Central Arizona Project (CAP), the cost of that water will be 10-50 times more expensive than current water resources;
- Slowing of the response to meet carbon-reduction targets, and the continued establishment of new fossil-fueled generating assets, that further endanger human health, infrastructure, and the economy;
- Increasing grid vulnerability and the consequent reduction in the reliability of electricity for County operations due to more frequent and extreme wildfires, heat and cold events.

Proposed Solution(s)

Advanced solar electric solutions and energy storage options offer new opportunities for Pima County to reduce risks and improve energy (and indirectly, water) efficiencies, thereby generating significant financial savings. The potential actions and concepts provided below should be researched, analyzed and possibly piloted through a Master Energy and Water Planning Initiative.

1) Solicit bids to establish wholesale Renewable Energy Contracts; consider aggregation of demand with City of Tucson, University of Arizona and Raytheon to reduce costs.

Utility-scale solar facilities have been established at 4c/kWh. Assuming a maximum cost of 2.7/kWh for TEP delivery, this action could establish a cost of 7c/kWh for Pima County. This collaborative regional would require pursuing a tariff with the Arizona Corporation Commission (ACC) similar to the Arizona Public Service's AG-1 tariff (ACC docket 11-0224).

2) Solicit bids for additional solar electric generation and Energy Storage Services for the Pima County Regional Wastewater Reclamation Department (RWRD) Metropolitan Water Reclamation Facilities (WRF).

These facilities purchase electricity from TEP at a cost of 8.2c/kWh via a Large Light and Power rate. About 50% of the cost is for a 'demand' charge that could be avoided or reduced via more investment in solar electric generation and energy storage equipment. Energy storage could also improve the reliability of supply. Recently, RWRD experienced several lengthy lapses in electric service to critical water treatment facilities.

3) Generate new revenue through sale of solar electric Renewable Energy Credits (RECs).

The County currently generates about 19 million REC's (kilowatt-hour, kWh)/year. Although we have identified no current buyers, the EPA Clean Power Plan is expected to increase that market significantly. Utilizing the results of the California Air Resource Board's May 2015 Quarterly auction³ our REC's would be valued at about \$228,000 per year. At a cost of 6c/kwh those revenues could fund additional Solar Service Agreements to generate 3.8M kh per year, about 2.6% of our current annual usage.

4) Solicit bids for Energy Storage Services for County facilities on tariffs with demand charges and for emergency operations.

As mentioned in #2 above, this solution would provide energy storage service for our office loads located in urban locations that have insufficient area for solar generation to reduce or avoid demand charges.

5) Establish a Special Contract with TEP to enable Pima County to establish large-scale, least expensive solar facilities on land owned by the County via typical Solar Service Agreements, and to have TEP 'credit' that energy to selected County urban meters where establishment of solar facilities is not feasible.

Pay TEP a virtual transport or distribution fee for use of the existing electricity-distribution infrastructure to move our solar energy to selected County meters. Assuming a TEP distribution fee of 2.7 c/kWh, the cost included in current residential rates, and establishment of solar facilities at cost not greater than the 5.8 c/kWh of our recent large scale contracts, the resulting cost would be about 8.5 c/kWh, about 30% less than our current cost/kWh. Only the distribution cost would be subject to increase.

6) For major downtown facilities where net-metering is not feasible (i.e., Administration, Public Works, Legal Services, Library Buildings), explore the feasibility of establishing energy-storage equipment/services and a contract with TEP to purchase cheap excess energy (~4c/kWh) at night for use by the facilities during the day at a cost less than TEP's rate.

Conclusion

Current and emerging renewable energy and storage technology is available, reliable and now affordable. This technology should be considered for inclusion as a primary component of a Master Energy and Water Planning Initiative to avoid and mitigate a variety of diverse threats and negative consequences to Pima County. Deployment of these actions may also be used to encourage Manufacturers to locate in Pima County providing recurring economic benefit.

¹ U.S. EIA Form EIA-861, Annual Electric Power Industry Report, Table 8, Arizona, 1999-2009 Commercial Retail Revenues

² TEP's fossil fueled generation process loses to evaporation up to ¾ gallon of water per kWh; R. Kane, former TEP Sundt Plant manager

³ California Air Resource Board May 2015 Quarterly auction http://www.arb.ca.gov/cc/capandtrade/auction/results_summary.pdf
\$12.10 to \$12.29 per ton; 19M REC's per year at 2 lbs. of carbon per REC = 19,000 tons x \$12/ton = \$228,000/yr.

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Staff Presentation

Financing Energy Efficiency Through Internal Revolving Energy Funds

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Abstract

Rising energy costs place a significant burden on Pima County's operating budget. Increasing energy efficiency is the cheapest, most reliable way to reducing this burden. However, budget constraints have made it difficult to implement the kinds of solutions needed to make its operations more efficient. Establishing a revolving energy fund will help to alleviate this problem by ensuring a steady stream of funding will become available to invest in improving energy-efficiency. A revolving energy fund is a special fund dedicated to financing energy-efficiency projects that is then replenished through the resulting cost savings. Internal Revolving Energy Funds have proven highly successful in enabling many local governments and institutions to realize significant cost-savings while reducing their environmental impact and continuing to provide quality services.

Introduction

Since adoption of the Sustainable Action Plan for County Operations (SAPCO), Pima County has saved more than \$1,000,000 per year in avoided energy costs, providing a financial cushion during a period of strained budgets. However, most of these projects were either no-cost or low-cost efforts financed through the American Recovery and Reinvestment Act (ARRA) grants which have since dried up, making further energy conservation efforts increasingly challenging. At the same time, the County's energy use intensity and the cost of energy continue to rise.

While these savings are substantial, these efforts are just the tip of the iceberg. With energy costs eclipsing \$16,000,000 in FY 2014-2015, Pima County has an immense opportunity to "free up" financial resources through energy conservation and efficiency. In the United States, buildings consume roughly half of all of all energy used and three quarters of all electricity. Of this, more than 30% is wasted and could be saved through energy-efficiency. Improving energy efficiency is regarded as the fastest and most cost-effective method to achieve global greenhouse gas emission targets, and promote cost savings, environmental protection, better public health, and economic sustainability (IEA, 2014).

Like many other local governments, Pima County faces challenges financing energy-efficiency projects. Energy and water improvements are often associated with large, one-time, upfront costs that have not been allocated for in a jurisdiction's budget. With financial constraints and money set aside for other infrastructure maintenance and upgrades, funding for energy efficiency is often unavailable.

One of the action items included in the 2014 SAPCO requires Pima County to investigate alternative funding sources for furthering its ability to achieve its sustainability goals. In accordance, staff has completed an extensive review of green financing mechanisms and developed this brief, which provides a case for adopting an internal revolving energy fund. The

fund would finance energy-efficiency projects and be replenished through the resulting reductions in energy expenditures.

What is an Internal Revolving Energy Fund?

A revolving energy fund is a special fund dedicated to financing energy efficiency projects. Seed money is used to complete an initial series of energy efficiency projects that result in a cost savings. All or portion of these savings are then reinvested in completing additional energy efficiency projects. By reinvesting savings accrued from previous energy-efficiency efforts, these funds become self-sustaining, insuring that a steady stream of funding exists for continued energy-efficiency improvements, as illustrated in the diagram below.

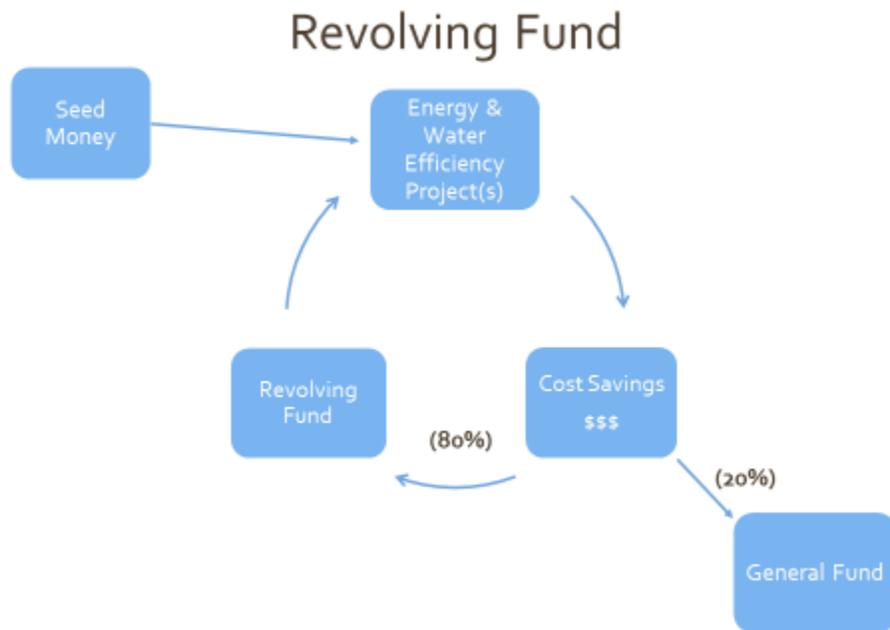


Figure 1 Revolving Fund Diagram

Why an Internal Revolving Energy Fund?

Establishing an internal revolving energy fund will help to insure that the County will succeed in meeting its sustainability targets while saving tax payer dollars. According to a report by the Sustainable Endowments Institute, with a median return on investment of 32%, revolving funds used to finance energy efficiency projects have been shown to outperform market returns. Revolving funds are highly flexible and can be used to minimize transaction costs associated with Energy Performance Contracts, significantly reducing the amount of time required to observe a financial savings. In addition, these funds help to relieve pressure on operating and capital expenses by alleviating the need to set aside funds for needed energy upgrades.

The Office of Sustainability and Conservation conducted a simulation to model fund performance for Pima County. Staff used cost and cost savings for energy conservation measures recommended in a previous energy audit conducted by Sebesta Blomberg & Associates, Inc. to complete the simulation. Staff assumed an initial allocation of \$500,000 was granted to serve as seed funding for the program and assumed that 80% of the savings would be returned to the fund while 20% would be returned to the General Fund each year. The

simulation was run for 10 years and resulted in over \$6 million in savings from avoided energy costs.

Where Else Has this Been Done?

In 1980, the nation's first internal revolving energy fund was established by the City of Phoenix, which spent \$50,000 to implement energy-efficiency measures. The city used a portion of the savings generated by the projects to establish a revolving energy fund. It committed to reinvest half of all of savings up to \$500,000 to implement additional energy efficiency projects. The fund has since been expanded and during the first 20 years of implementation, has saved the City more than \$63 million in energy costs (Kalapos, 2005). Following Phoenix's success, internal revolving energy funds have since been established by dozens of local governments and more than 52 universities in the US (Sustainable Endowments Institute, 2012).

Conclusion

Rising energy costs place a significant burden on Pima County's operating budget. Increasing energy efficiency is the cheapest, most reliable way to reducing this burden. However, budget constraints have made it difficult to implement the kinds of solutions needed to make its operations more efficient. Establishing an internal revolving energy fund will help to alleviate this problem by ensuring that a steady stream of fund becomes available to invest in improving energy-efficiency. Internal Revolving Energy Funds have proven highly successful in enabling many local governments and institutions to realize significant cost savings while reducing their environmental impact and continuing to provide quality services.

References

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