

ENERGY EFFICIENCY ON AN URBAN SCALE

Year One Report: **FROM THE GROUND UP**

YR1

YR2

YR3



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Executive Summary

HOW LARGE INSTITUTIONS AND THE PRIVATE SECTOR CAN PARTNER TO CREATE ENERGY EFFICIENCY

The United States faces an extraordinary opportunity to develop a “new” supply of energy. The nation’s commercial and residential buildings currently consume 40% of the nation’s primary energy supply, but much of that energy is lost due to inefficiency. With the right programs and incentives in place, the U.S. could set off a national energy efficiency boom that would save an enormous amount of money and put formerly wasted energy to use.

To help jump-start an energy efficiency boom, the Department of Energy in 2010 selected Energize Phoenix as one of 41 initiatives across the country to develop and test new strategies for improving energy efficiency in the built environment. Successful projects will serve as models for other communities. Energize Phoenix aims to eliminate up to 50,000 metric tons of carbon emissions a year, create up to 2,000 green jobs, and transform energy use along a 10-mile stretch of the Metro Light Rail system designated as the Energize Phoenix Corridor.

Creating energy efficiency on an urban scale, however, requires multiple partners including at least a few major ones. Recognizing this, Energize Phoenix is led by an unusual collaboration of major institutions — City of Phoenix, Arizona State University, and Arizona Public Service, the state’s leading electricity provider.



Year 1 achievements include creating seven new energy efficiency programs that address apartment buildings, single-family homes, low-income home owners, small businesses, large businesses, commercial financing, and renters of single family homes. Four of these programs were rolled out by June 2011 with three others scheduled to launch in late summer 2011.

The most successful programs thus far have more than 40 commercial projects in process or completed for a total contractor-estimated, first year savings of more than 3.6 million kilowatt-hours.

More significantly for Year 1, Energize Phoenix painstakingly developed the critical infrastructure of partnerships, program design, incentive levels, financing structure, data collection, and marketing necessary to enable the success and sustainability of Energize Phoenix over the next two years and beyond. Therefore, the most valuable lessons learned in Year 1 address how to work effectively across vastly different organizational structures and needs to achieve the best possible results for all.

Among the universal lessons for Year 1 of Energize Phoenix:

- **Give yourself time:** Collaboration among large institutions involves resolving liability issues, finding responsive experts and decision makers, and dealing with revisions and capacity issues. Little can be accomplished until these issues — and others — are addressed.
- **Be ready to learn new cultures:** Each involved organization has a mission and goal. These must be understood and satisfied to achieve overall project success.
- **Engage experienced contractors:** Working with veteran energy upgrade professionals contributes to better program design, saves enormous time and resources, and speeds local job retention and creation.
- **Focus intensely on your target audience(s):** Big businesses, neighborhood stores, home owners of all income levels, and renters each have different needs, desires, and financial constraints. Understanding exactly what motivates each niche group to participate in energy efficiency upgrades is critical to targeted marketing.

Subsequent reports for Year 2 and Year 3 will provide results from Energize Phoenix efforts and important lessons learned in the process. The reports will document energy efficiency gains, explain program refinements, and analyze best methodologies for creating energy efficiency on an urban scale.



Stimulate Energy Efficiency



Introduction

The United States faces a period of increasingly volatile energy markets and a sluggish national economy — two fundamental challenges that are closely entwined. To address these issues, sweeping new policies and programs have been enacted at the Federal level to stimulate energy efficiency in the built environment as a serious matter of national security and economic growth.

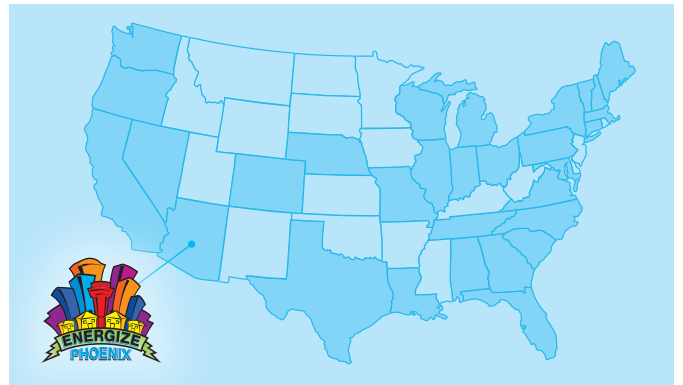
One of these new programs is the U.S. Department of Energy's Better Buildings Neighborhood Program. Rather than prescribe solutions, the program calls on local and state governments and partner organizations to work together to find innovative solutions that confront the rising energy challenge.



Since April 2010, this type of collaboration has been underway in Phoenix, Arizona. Energize Phoenix, an unprecedented partnership among the City of Phoenix, Arizona State University, and the state's major electricity provider, Arizona Public Service, is at work to improve energy efficiency in buildings of all sorts, save homeowners and business owners money, and create "green" jobs in the urban core of Phoenix.

Energize Phoenix is one of 41 state and local government initiatives across the country selected to develop and test new strategies for reducing energy consumption in their communities as a project of the Better Buildings Neighborhood Program. Successful projects will serve as case studies and models for other communities in the U.S. and elsewhere in the world.

This first report for Energize Phoenix contains lessons learned during the first year of a three-year effort funded by the U.S. Department of Energy. For purposes of this report, the "first year" is defined to include activities and decisions completed by June 1, 2011. It provides valuable insight into the complexities of pioneering a significant change in the way an entire community uses energy.



ENERGIZE PHOENIX IS A PARTNERSHIP OF





Reduce Energy Waste



Plugging the Leaks: Energy Consumption in the Built Environment

The United States consumes about 20% of the world's total primary energy supply, and 40% of that energy goes to buildings [1], primarily in the form of electricity. In 2011, commercial and residential buildings will account for about 73.5% of the total electricity sold in the U.S. and also 39% of the nation's carbon dioxide emissions. [2][3].

What these numbers add up to is a tremendous opportunity to create “new” energy by reducing waste in our building stock. Future opportunities for efficiency are even larger. According to Edward Mazria, founder and CEO of Architecture 2030, about 75% of the 275 billion square feet of existing U.S. building stock will either be renovated or new by 2035 [4]. With the right programs and incentives in place, the next 20 years could see an energy efficiency boom like no other.

Will society seize the day? Many government, private sector, and NGO visionaries have been working to transform the built environment for decades. [See online *Appendix A: Energy Efficiency and the Built Environment.*] Yet, despite readily available technologies and proven techniques, America's building owners, homeowners, architects, and contractors have been slow to adopt efficiency measures.

To remedy this reluctance, the U.S. Department of Energy (DOE) was charged with finding innovative solutions for speeding the nation's transformation to an energy efficient and renewable energy economy [5]. DOE's response for the built environment began with the Better Buildings Neighborhood Program, designed to catalyze, explore, document, and solve the challenges faced in rolling out community-scale energy efficient retrofits of the built environment.

BETTER BUILDINGS NEIGHBORHOOD PROGRAM AND THE BETTER BUILDINGS INITIATIVE

Under the brand “Better Buildings,” DOE initiated a community upgrade program in 2010 by dispersing \$508 million in grant funding to 41 state and local governments. The goal was to devise and test self-sustaining business models for retrofitting and improving buildings across the country [6]. DOE awarded Energize Phoenix a \$25 million grant through this competitive program.

As part of this funding, projects were required to provide home and building owners easier access to energy efficiency experts and complete building upgrades, thereby increasing the energy efficiency workforce [7]. DOE estimates the combined projects will retrofit 170,000 buildings with high quality energy efficiency retrofits, create or retain 30,000

jobs, reduce energy consumption in upgraded buildings between 15% and 30%, and save Americans up to \$65 million annually [8].

In 2011, the even more ambitious Better Buildings Initiative was launched with a goal to achieve a 20% energy reduction for commercial buildings by 2020 and save business owners up to \$40 billion per year [9]. The initiative's strategy is to stimulate private sector investments for upgrading offices, stores, universities, hospitals, schools, and other municipal buildings for energy efficiency [10]. The initiative specifically calls for [11]:

- **New tax incentives for building efficiency:** Current deductions for commercial buildings are upgraded to a more generous tax credit that generates a projected 10-fold increase in commercial retrofit uptake.
- **More financing opportunities for commercial retrofits:** The Small Business Administration encourages lenders to take advantage of new, larger retrofit loans for small businesses; a new pilot program guarantees loans for energy efficiency upgrades at hospitals, schools, and commercial buildings.
- **“Race to Green” for state and municipal governments:** New competitive grants are awarded to states and local governments that streamline regulations, encourage upgrades, and attract private sector investment.
- **The Better Buildings Challenge:** CEOs and university presidents are challenged to make their facilities more efficient; this makes them eligible for public recognition, technical assistance, and best-practices sharing through a network of peers.
- **Training the next generation of commercial building technology workers:** A Building Construction Technology Extension Partnership will be launched to provide skilled workforce training in areas such as energy auditing and building operation.

Implementation of the individual components of the Better Buildings Initiative will require action at the executive, agency, and Congressional levels. Thus, it is still unclear which components of the Initiative will take shape and when. A study conducted by the Political Economy Research Institute at the University of Massachusetts Amherst, however, concluded that a fully implemented Better Buildings Initiative could create as many as 114,000 jobs [12].



Transform the Energy Market

Energy, Jobs, Savings: The Energize Phoenix Portfolio

Energize Phoenix aims to transform the energy use intensity of buildings and change energy-user behaviors along a 10-mile stretch of the recently constructed light rail system that serves the urban core of Phoenix. Inspired by Green Phoenix, an ambitious sustainability plan for Arizona’s largest city, and conceived through a unique collaboration of the City of Phoenix, Arizona Public Service Company (APS), and the Global Institute of Sustainability at Arizona State University (ASU), the project is funded by a \$25 million dollar grant from the U.S. Department of Energy’s Better Buildings Neighborhood Program using American Recovery and Reinvestment Act (ARRA) resources. Through a partnership with a local bank, National Bank of Arizona, the project will leverage initial DOE and ARRA investments to create a revolving loan fund that will provide capital and offer low, fixed-interest rate loans for participating commercial building owners.

The goals of Energize Phoenix are to eliminate up to 50,000 metric tons of carbon emissions a year, create up to 2,000 green jobs in the Phoenix area, and generate a culture of energy efficiency in the key geography surrounding the city’s new mass transit backbone, now referred to as the Energize Phoenix Corridor. These goals will be accomplished by enabling energy saving upgrades of up to 30% for as many as 1,700 residential units, and 18% for as much as 30 million square feet of commercial and industrial space. The project will also educate participants about energy consumption and will measure results from Energize Phoenix programs.

The lessons learned over the course of this project will be documented in this and future reports to provide a working model for urban energy efficiency and transfer practical knowledge to cities and regions that share in some of the major characteristics of the Energize Phoenix project. These characteristics include:

- **Mixed-use:** The Energize Phoenix Corridor extends across diverse communities and land uses, contains multiple residential and commercial building types, and includes residents and business owners in a wide range of demographic and psychographic groups.

- **Electricity-dominated:** Energy use in the Corridor is primarily electricity-fueled and cooling-driven, a characteristic of many warm-climate regions worldwide with growing populations.
- **Market-based:** Energize Phoenix incentive and financing strategies are non-regulatory and market-based, which means they can be replicated in other regions independent of local regulations.
- **Established workforce:** Energize Phoenix has the benefit of an established contractor workforce available in the weatherization and retrofit industry thanks to a long-standing Weatherization Assistance Program in the region and existing utility energy efficiency programs.

The Energize Phoenix model uses a multifaceted approach to encourage and enable energy efficiency upgrades. Incentives include rebates, financing, and education. Rebates are limited to the physical implementation of upgrades for energy efficiency, but APS additionally subsidizes some energy studies, such as energy assessments of homes and retro-commissioning for commercial buildings. Financing mechanisms vary depending on the participant’s needs and resources.

Numerous efficiency upgrades are possible under Energize Phoenix, but for quality control, participants must use an Energize Phoenix approved contractor to perform the work. Approved conservation measures include:

Repairing and enhancing insulation

Air sealing

Duct sealing

Attic insulation

Shade screens

Heating and cooling system upgrades

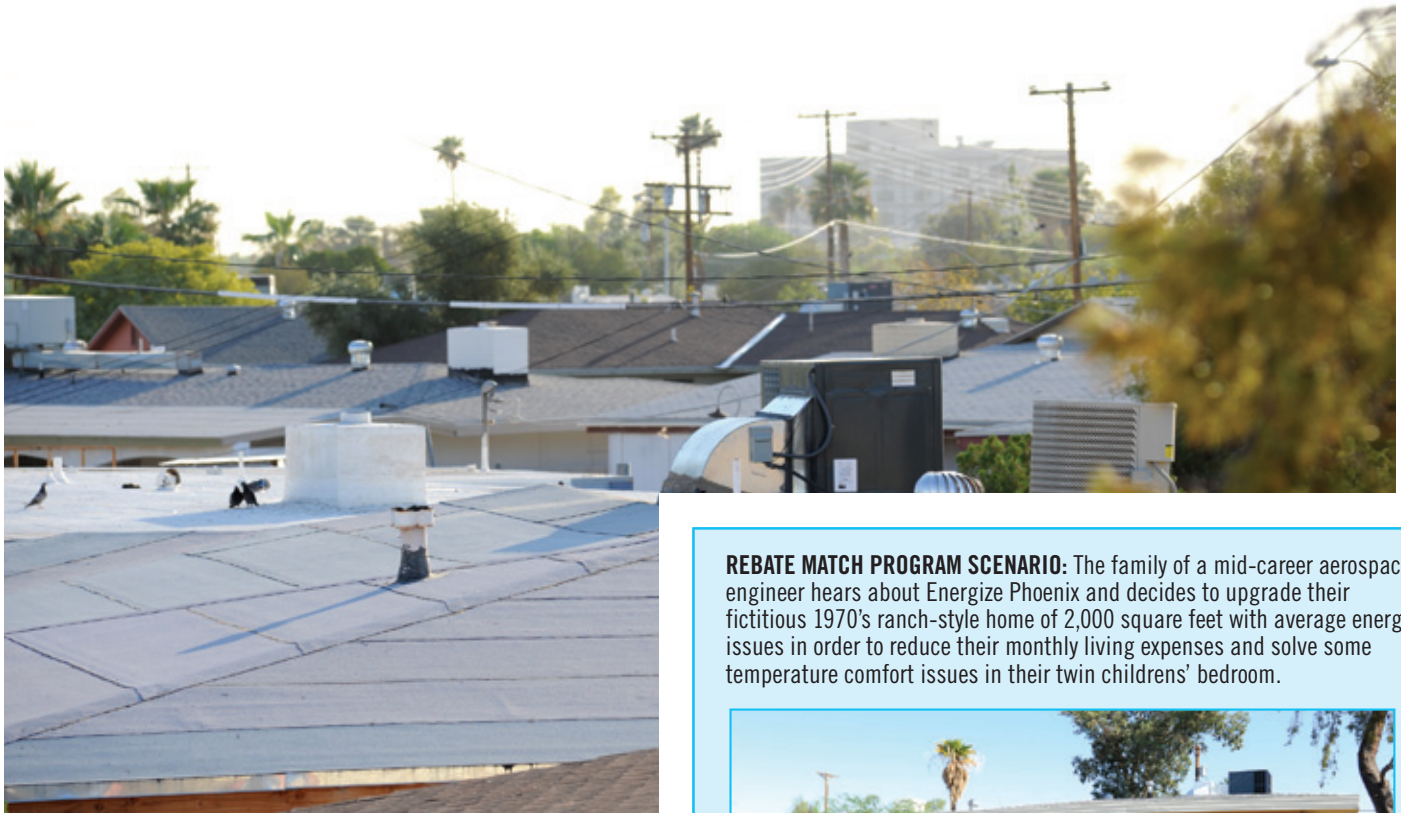
Lighting improvements

Solar water heater installation

Motor and pump upgrades

Food refrigeration upgrades (commercial)

Custom measures



Following are descriptions of the seven Energize Phoenix programs

RESIDENTIAL PROGRAMS

Rebate Match program leverages an existing APS program, AZ Home Performance with ENERGY STAR®, with rebates for up to 100% of the incremental cost of each energy conservation measure (ECM) implemented. With the exception of HVAC replacement, this amounts to the total cost in most cases. Residents of owner-occupied, single-family homes enter the program by contacting an Energize Phoenix approved contractor to conduct a subsidized home energy assessment set at \$99 — APS pays the contractor an additional \$200. The energy assessment gives the homeowner a list of potential measures, their costs, the expected APS and Energize Phoenix incentives, and the expected financial payback period. The homeowner selects which, if any, measures to undertake, and the contractor performs the work, retesting the home after completion. The homeowner then pays the contractor, and both APS and Energize Phoenix issue rebate checks. Projects involving historic properties must receive prior approval from the city’s Historic Preservation Office. Energize Phoenix is in the process of expanding Rebate Match to include condominiums and townhomes, but with some different specifics. Rollout is expected for August 2011.

REBATE MATCH PROGRAM SCENARIO: The family of a mid-career aerospace engineer hears about Energize Phoenix and decides to upgrade their fictitious 1970’s ranch-style home of 2,000 square feet with average energy issues in order to reduce their monthly living expenses and solve some temperature comfort issues in their twin childrens’ bedroom.



Audit

Audit Total Cost	\$ 299
APS subsidy to contractor	\$ (200)
Participant Out of Pocket	\$ 99
Energize Phoenix Rebate	\$ (0)
Final Cost to Participant*	\$ 99

Measures Implemented

HVAC Replacement	\$ 5,000
APS HVAC Rebate (14 SEER, 10.8 EER)	\$ (425)
EP HVAC Rebate Match	\$ (425)
Duct Testing & Sealing	\$ 725
APS Duct Testing & Sealing Rebate	\$ (250)
EP Duct Rebate Match	\$ (250)
Air Sealing	\$ 400
APS Air Sealing Rebate	\$ (250)
EP Air Sealing Rebate Match**	\$ (150)
Insulation Repair and Upgrade (R-30)	\$ 1,450
APS Insulation Rebate	\$ (250)
EP Insulation Rebate Match	\$ (250)
Participant Out of Pocket	\$ 7,575
Total Rebates	\$ (2,250)
Final Cost to Participant***	\$ 5,325

Estimated 25% energy savings from ECM’s employed.

* Energize Phoenix will offer \$99 audit rebates for a limited time in Fall 2011

** Rebate capped to total incremental cost of measure

*** Does not include any federal tax credits

Source: Global Institute of Sustainability at Arizona State University

The **60/40 program** also leverages APS rebates through a partial grant for qualifying single-family, detached, low-to-moderate income homeowners residing in the Energize Phoenix Corridor. Homeowners earning less than 400% of federal poverty level— less than approximately \$89,000 annual gross income per family of four — are eligible. (Homeowners earning less than 200% of poverty level are already covered by the existing Weatherization Assistance Program, which pays 100% of upgrade costs.) The 60/40 program covers 60% of upgrade costs and the homeowner pays 40% (a portion of which is offset by APS rebates). Energize Phoenix is also developing subsidized financing options for the homeowner’s portion.

The City of Phoenix directly manages the 60/40 program. The City sends an auditor to assess the scope of work, solicits bids from three or more approved contractors, and works with homeowners to identify priorities and allocate funding. The homeowner chooses the contractor, but must pay the difference if it is not the low bidder. Participants are also eligible for APS rebates. The 60/40 program is expected to be available in August 2011.

60/40 PROGRAM SCENARIO: A fictitious family of three earning \$64K per year works with Neighborhood Services staff to assess and upgrade their 1,200 square foot 1930’s midtown historic home. After receiving approval of the planned work by the Historic Preservation office, the selected contractor proceeds.



Total Project Cost	\$ 12,000
Energize Phoenix Grant (60%)	\$ (7,200)
Participant Payment/Loan (40%)	\$ 4,800
APS AC Rebate	\$ (525)
APS Duct Test & Repair Rebate	\$ (250)
APS Insulation Rebate	\$ (250)
APS Sun Shade Screen Rebate	\$ (250)
Total APS Rebates	\$ (1,275)
Final Cost to Participant	\$ 3,525

Source: Global Institute of Sustainability at Arizona State University

The **Rental program** provides grants for energy efficiency upgrades to owners of multi-family apartment complexes serving mostly low-to-moderate income residents in the Energize Phoenix Corridor. Building owners with a minimum equity of 90% loan-to-value and who agree to reserve at least 67% of units for tenants with income at or below 400% of poverty level may receive a conditional grant for energy efficiency upgrades covering up to \$3,000 per unit or the cost to achieve 15% estimated energy savings — which could exceed \$3,000 per unit in some cases. Participants must meet accessibility, crime-free, historic preservation, and housing quality standards before being funded. The City works with the owner to determine the scope of work and then contracts with one of three or more bidders. Contingent on continued ownership of the property, 10% of the conditional grant is forgiven each year.

RENTAL PROGRAM SCENARIO: The landlord of a fictitious 1970’s apartment complex with 25 units and average energy issues learns about Energize Phoenix from a tenant and contacts Neighborhood Services to undertake a comprehensive energy upgrade.



<u>Audit</u>	
Audit Total Cost	\$ 3,000
Energize Phoenix Program*	\$ (3,000)
<u>Measures Implemented</u>	
HVAC Replacement	\$ 87,500
Duct Sealing	\$ 2,500
Air Sealing	\$ 1,250
Insulation Repair and Upgrade (R-30)	\$ 6,250
Energize Phoenix Conditional Grant	\$ (75,000)
Total Project Cost	\$ 100,500
Total Conditional Grant**	\$ (75,000)
Participant Out of Pocket***	\$ 22,500

Estimated 25% energy savings from ECM’s employed.

* Energize Phoenix pays the cost of the audit

** = \$3000 x 25. Paid as a conditional grant whose principal is forgiven at 10% per year

*** Does not include any federal tax credits

Source: Global Institute of Sustainability at Arizona State University

BUSINESS/COMMERCIAL PROGRAMS

The **Small Business program** includes prescriptive measures that address common lighting and food refrigeration upgrades. It is based on the APS Solutions for Business “Express Solutions” program. Businesses, governments, and nonprofits with an average monthly per-meter demand of 400kW or less (approximately \$14,000 per month or less in utility expenses) may be eligible, as well as all schools. In the program, approved commercial contractors perform free energy assessments and develop proposals showing estimated project cost, total energy savings, and both APS and Energize Phoenix rebates. As with the residential Rebate Match program, Energize Phoenix matches APS rebates up to 100% of the incremental or project cost of the individual energy conservation measures. Once the customer approves the proposal and APS and Energize Phoenix approve the incentive estimates, the contractor installs the approved measures. The customer then pays the contractor for the work, less the APS incentive. APS verifies the work and pays its incentive directly to the contractor. Energize Phoenix then issues a rebate to the customer.

SMALL BUSINESS PROGRAM SCENARIO: A contractor performs a lighting retrofit on a fictitious pharmacy, replacing 40 dual-lamp 60/75W hybrid 8' fluorescent fixtures with 40 new dual-lamp 32W T-8 lamp fixtures with electronic ballasts.



Estimated kW Demand Reduction	3.6
Estimated Annual kWh Savings	15,725
Estimated Annual \$ Savings	\$ 1,380
Total Project Cost	\$ 2,645
APS Rebates (Paid to Contractor)	\$ (1,890)
Participant Out of Pocket	\$ 755
EP Matching Rebate*	\$ (755)
Final Cost to Participant	\$ -
Estimated Payback (Years)	0

* Rebate amount is capped at total incremental cost of ECM
 Source: Global Institute of Sustainability at Arizona State University

The **Business program** provides rebates for a wide range of prescriptive and custom energy conservation measures for nonresidential customers with monthly electricity demand of any amount. It is based on the APS Solutions for Business “Classic” program. Approved Business program contractors develop upgrade proposals for customers for free or as an outcome of a consulting project or ongoing energy services company contract. The proposal includes approved estimates for APS and Energize Phoenix rebates. Once the customer signs the contract, the contractor performs the work. The rest of the process is identical to the Small Business program.

BUSINESS PROGRAM SCENARIO: The landlord of a fictitious 1980's 4-story office building replaces two aging water-cooled chillers with new, 160 Ton, .40 kWh/Ton - IPLV ones. The contractor also installs a building controls system that is expected to additionally save 85,000 kWh annually.



Estimated Annual Chiller kWh Savings	289,900
Estimated Annual Chiller \$ Savings	\$ 24,033
Estimated Annual Controls kWh Savings	84,100
Estimated Annual Controls \$ Savings	\$ 6,972
Chiller Replacement Cost	\$ 418,000
APS Chiller Prescriptive Rebate	\$ (19,840)
EP Chiller Rebate Match	\$ (19,840)
Controls System Cost	\$ 61,000
APS Controls Custom Rebate	\$ (9,251)
EP Controls Rebate Match	\$ (9,251)
Total Project Cost	\$ 479,000
Total Rebates	\$ (58,182)
Net Cost to Participant	\$ 420,818

Source: Global Institute of Sustainability at Arizona State University

The **Commercial Financing program** provides a revolving loan fund for nonresidential customers wanting to finance energy efficiency projects. The minimum project size is \$50,000, after APS and Energize Phoenix incentives. Participants can obtain low, fixed-interest rate loans for 12 months to 120 months. Collateral is generally required, depending upon loan size, term, and underwriting requirements.

Energize Phoenix is partnering with National Bank of Arizona to set up the fund. Each “participation loan” will be funded by a combination of private bank capital (70% of loan) and Energize Phoenix capital (30% of loan) and further supported by a cumulative loan loss reserve that supports the lenders in case of a default. The cumulative loan loss reserve is funded by Energize Phoenix at a rate equal to 15% of each loan issued, with a cap of \$2.25 million on the pool.

COMMERCIAL FINANCING PROGRAM SCENARIO: A corner shopping center owner is convinced by an Energize Phoenix contractor of the merits of an energy upgrade for the property. The total project costs \$150K, but is reduced to \$100K through APS and Energize Phoenix rebates. She does not have the capital to pay for the project up front and approaches Energize Phoenix about its financing program with confidence that the monthly energy savings will cover the loan payments in a well-structured loan.



The Loan: On a \$100,000 loan, Energize Phoenix will have a 30% (or \$30,000) “participation” in the loan, and the bank will have 70% (or \$70,000) “participation.” The City will also set aside 15% (or \$15,000) into a Cumulative Loan Loss Reserve (CLLR) account:

If the bank continues to make \$100,000 loans on other commercial projects, after four loans the CLLR account will total \$60,000.

Loan amount	Bank participation	City participation	LLR contribution	Cumulative LLR (CLLR)
\$100,000	\$70,000	\$30,000	\$15,000	\$15,000
\$100,000	\$70,000	\$30,000	\$15,000	\$30,000
\$100,000	\$70,000	\$30,000	\$15,000	\$45,000
\$100,000	\$70,000	\$30,000	\$15,000	\$60,000

If a loss were to occur on one of the \$100,000 loans, with only a balance of \$60,000 in the CLLR account, the bank would receive \$42,000 from the CLLR account (\$60,000 x 70%) the City would receive \$18,000 from the CLLR account (\$60,000 x 30%) and the CLLR account balance would be \$0.

	Participation	CLLR Payment	Net Loss
Bank	\$ (70,000)	\$ 42,000	\$ (28,000)
City	\$ (30,000)	\$ 18,000	\$ (12,000)
CLLR Remaining Balance		\$ 0	

In this example, the bank would take an \$28,000 loss and the City would take a \$12,000 loss on a loan default of \$100,000.

Source: Global Institute of Sustainability at Arizona State University

The **Energy Dashboard program** teams ASU with Phoenix’s Neighborhood Services Department to measure the effectiveness of education and feedback strategies in reducing energy waste for Energize Phoenix’s final constituency — renters of single-family homes. The program will shed light on this understudied population of energy users through two different interventions:

- An energy dashboard device, installed at no cost, that provides renters with real-time feedback about the home’s energy usage
- An energy use awareness assessment and education program that provides renters with information about major appliances and equipment in the home, time of use rates, and other energy factors, such as window shades, thermostat, and fans.



Participants in the program may receive either or both of the interventions, or no interventions at all. Utility bills of all participants will be analyzed before and after the interventions to determine the effects on energy use.

ENERGY DASHBOARD STUDY DESIGN

CATEGORIES	DASHBOARD	NO DASHBOARD	SUBTOTAL PARTICIPANTS
Education	50	50	100
No Education	50	50	100
Subtotal Participants	100	100	200 Total Participants



Build the Infrastructure

Building Momentum: Year One Accomplishments and Outcomes



Energize Phoenix’s startup year necessarily focused on developing the base infrastructure among partner institutions. This very complex process was lengthy and often challenging, involving change, compromise, and innovation among three established institutions. However, getting it right from the beginning was key to the future success of the project. For implementation, Energize Phoenix has been fortunate to be able to call on an established base of private-sector contractors experienced in energy efficiency work and programs, unlike some Better Buildings projects. This averted the potentially significant time and cost of developing an energy efficiency workforce from scratch. Major actions and accomplishments in the first year include:

ACCOMPLISHMENT	INSTITUTIONS
Created intergovernmental agreements and inter-institutional memoranda of agreement	CITY, APS, ASU
Identified institutional departments involved	CITY, APS, ASU
Developed inter-institutional process flow charts	CITY, APS, ASU
Developed participant and contractor agreements	CITY
Learned and adapted to DOE Reporting Requirements	CITY, ASU, APS
Developed waste stream/NEPA reporting, Davis-Bacon, and Buy American processes	CITY
Developed and delegated historical preservation plan	CITY
Created brand strategy, brand, marketing strategy, tactics, and marketing materials	ASU (DRA*), CITY, APS
Developed robust program evaluation criteria and methods	ASU, CITY, APS
Identified source and structure of evaluation data	ASU, APS, CITY
Designed and implemented Energy Dashboard program	ASU, CITY
Designed and administered behavioral data survey	ASU, CITY, APS
Developed commercial building project evaluation templates and case studies	ASU

* DRA Strategic Communications is the marketing and communications subcontractor for Energize Phoenix.

Source: [Global Institute of Sustainability at Arizona State University](#)

To review the details of each of these and more actions and accomplishments, see online *Appendix B: Year One Actions and Accomplishments*.

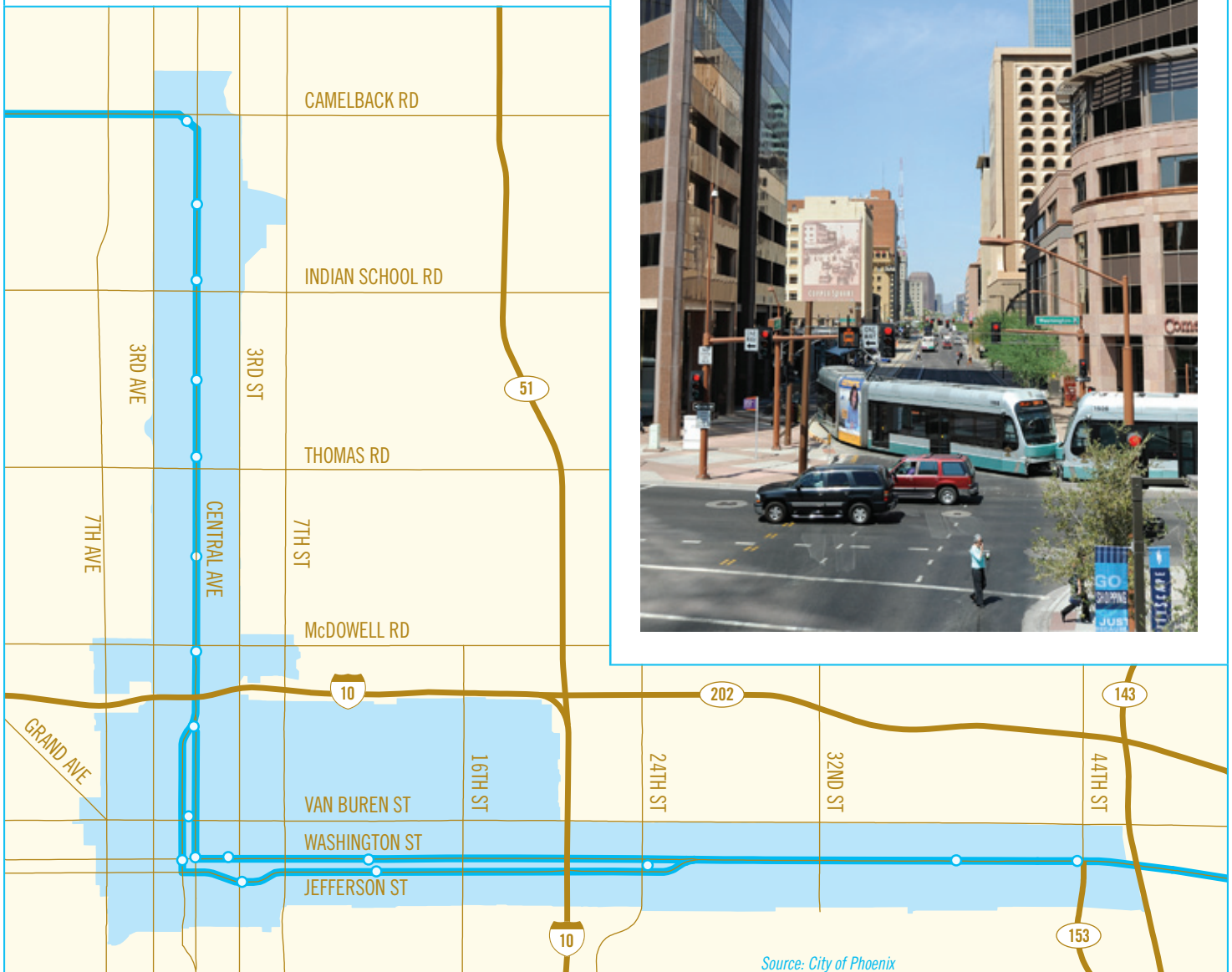
FIRST YEAR OUTCOMES

Several key programs launched or prepared to launch during Year 1. Meanwhile, ASU researchers gathered data to characterize the Energize Phoenix Corridor as part of the effort to understand energy use in the Corridor and monitor results.



Land Use and Population

The Energize Phoenix Corridor follows a 10-mile stretch of the Metro Light Rail line in Phoenix and is centered on the Phoenix central business district. The light rail system initiated operations in December 2008 and now binds the Corridor into a single region. The Corridor encompasses 15 of the total 27 light rail stations as it expands from the central business district northward along Central Avenue and eastward along Washington and Jefferson Streets.



GIS mapping and background analysis of the Corridor shows that it is a highly diverse, mixed-use area that is home to 37,000 residents occupying some 15,000 housing units. More than 35% of households in the area fall below the poverty level. The Corridor also includes over 2,400 commercial and institutional establishments totaling more than 125 million square feet with 83,000 employees.



The Maricopa County Assessor's Office shows a total of 8,236 total parcels in the Corridor. Among these, 2,925 are classified as residential, 4,222 as commercial, and the remainder vacant or unassessed. Note that the commercial group includes 502 commercially operated multi-family residential parcels that are classified as rental.

For a full analysis of the residential and commercial electricity customers in the Corridor, see online *Appendix C: Characteristics of the Energize Phoenix Corridor*.

PARCEL CLASSIFICATION	OWN	RENT	OWN	RENT	TOTAL
Commercial	9.95%	90.05%	420	3,802	4,222
Multiple Family Residential	5.98%	94.02%	30	472	502
Municipal Ownership	0.40%	99.60%	2	495	497
Residential	53.16%	46.84%	1,555	1,370	2,925
Single Family Residential	55.23%	44.77%	1,367	1,108	2,475
Condominiums	41.05%	58.95%	172	247	419
Townhouses	59.26%	40.74%	16	11	27
Mobile Homes	0.00%	100.00%		4	4
Vacant	5.43%	94.57%	41	714	755
Unassessed	0.00%	100.00%		302	302
Agriculture	0.00%	100.00%		32	32
GRAND TOTAL	24.48%	75.52%	2,016	6,220	8,236

Source: Maricopa County Assessor

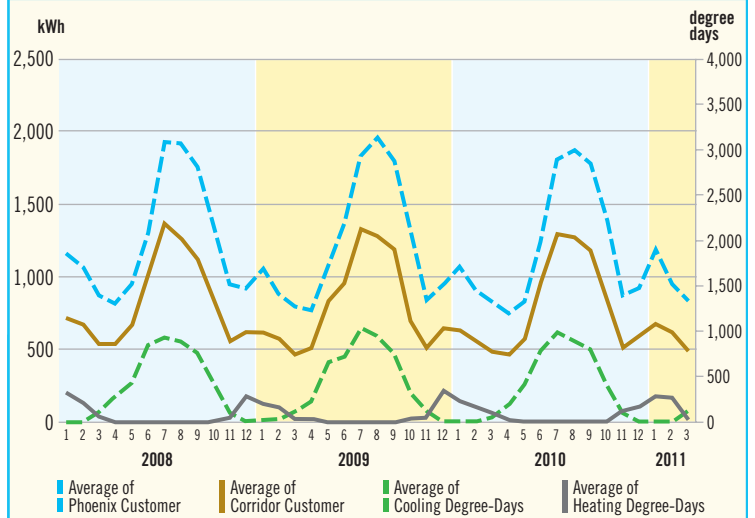




Comparative Energy Use and Costs

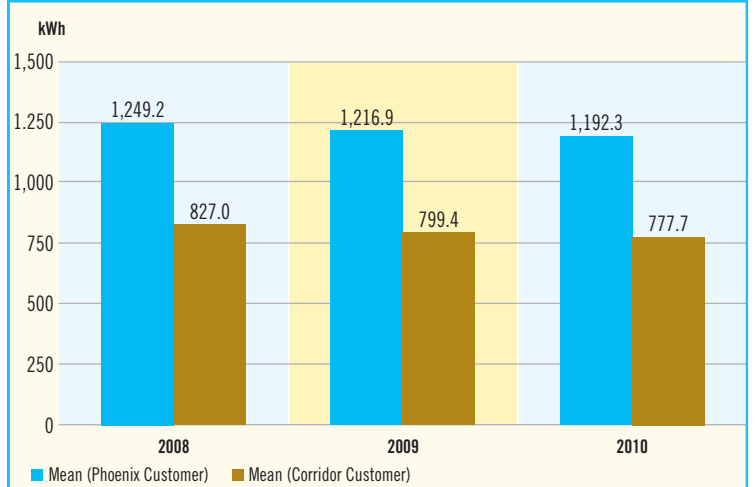
Residential energy use follows a strong seasonal pattern corresponding to the number of cooling degree-days and heating degree-days. Comparisons of the Corridor with overall Phoenix customers reveals significantly lower historical energy consumption in the Corridor.

AVERAGE RESIDENTIAL CUSTOMER kWh BY MONTH



Source: Global Institute of Sustainability at Arizona State University, from APS billing data

ANNUAL ENERGY USE COMPARISON IN kWh PHOENIX VS. CORRIDOR RESIDENTIAL CUSTOMERS

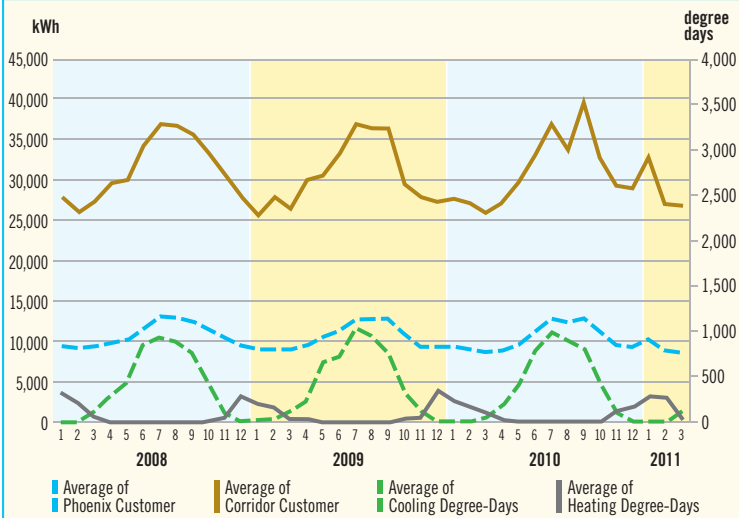


Source: Global Institute of Sustainability at Arizona State University, from APS billing data

The cyclical seasonal pattern is less apparent for commercial customers, likely because energy used for cooling and heating represents a smaller fraction of total energy usage for commercial space compared to residential buildings. Energy use by commercial customers in the Corridor, however, is significantly higher than in the rest of the City of Phoenix.

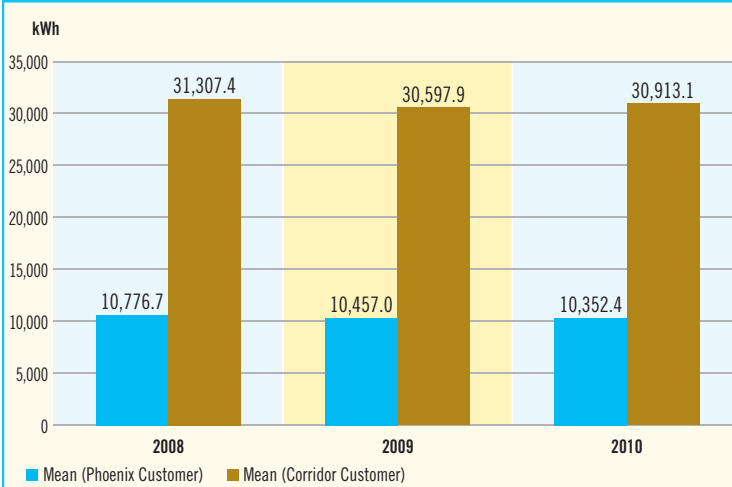
For more details, see online *Appendix D: Base Year Energy Use*.

AVERAGE COMMERCIAL CUSTOMER kWh BY MONTH

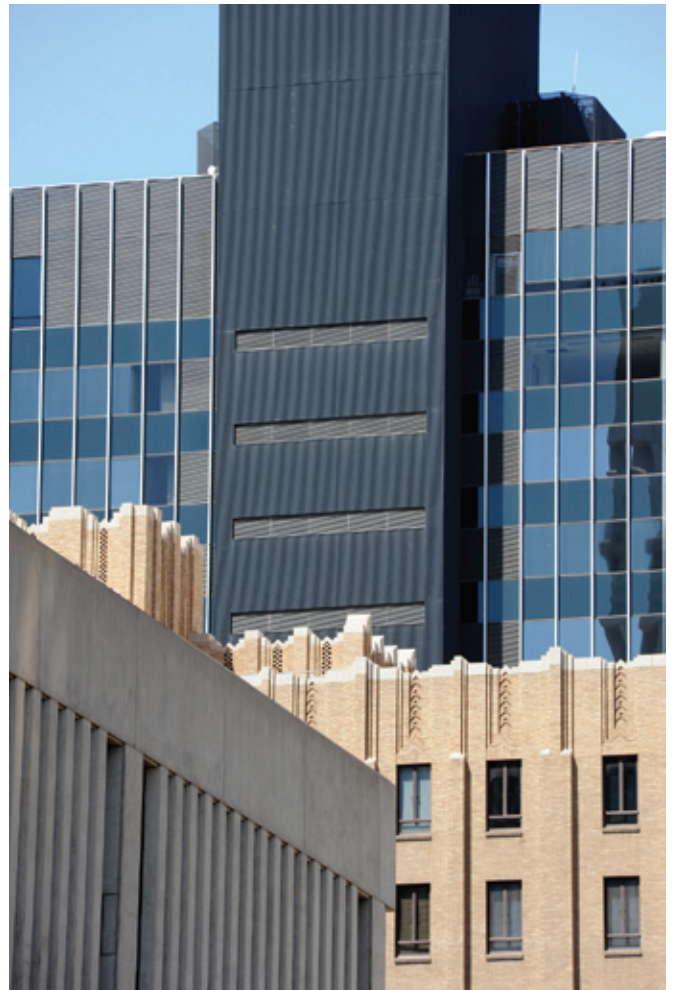


Source: Global Institute of Sustainability at Arizona State University, from APS billing data

ANNUAL ENERGY USE COMPARISON IN kWh PHOENIX VS. CORRIDOR COMMERCIAL CUSTOMERS



Source: Global Institute of Sustainability at Arizona State University, from APS billing data



PROGRAM LAUNCHES AND PROJECTS

Individual components of Energize Phoenix have been launched as developed, providing a continually expanding scope of engagement. Launch dates are as follows:

- Rental program – November 2010
- Small Business program – February 2011
- Business program – February 2011
- Rebate Match – March 2011
- 60/40 program – expected August 2011
- Commercial Financing program – expected August 2011
- Energy Dashboard program – participant recruitment scheduled for July 2011

The Commercial program attracted the most uptake as of June 2011 with 71 applications. All but one were lighting retrofits.

For more information, see online *Appendix E: Current Commercial Projects*.

In the other programs as of June 2011, Rental received applications for 10 projects that would upgrade about 325 units in multi-family housing complexes. Rebate Match received one project request for rebate. The 60/40 program generated several inquiries though it was not yet ready for launch.



COMMERCIAL PROJECTS IN PROCESS OR COMPLETED BY JUNE 1, 2011

	Number of Projects	Sq. Ft.	Est. Cost	Final Cost	EP Rebate Obligation*	Est. 1st Year kWh Savings
Completed**	10	109,721	\$66,049	\$69,800	\$20,209	444,153
Small Business Program	9	104,084	\$60,764	\$64,515	\$18,174	414,485
Business Program	1	5,637	\$5,285	\$5,285	\$2,035	29,668
In Progress***	31	1,274,916	\$3,331,703		\$280,904	3,228,871
Small Business Program	23	651,343	\$225,393		\$79,439	1,285,340
Business Program	8	623,573	\$3,106,310		\$201,465	1,943,531
Pipeline****	30	4,389,796	\$1,302,245			1,988,101
Small Business Program	7	175,087	\$114,796			833,973
Business Program	23	4,214,709	\$1,187,449			1,154,128
Grand Total	71	5,774,433	\$4,699,996	\$72,214	\$301,113	5,661,125

* Utility has not provided rebate amounts.

** Projects are counted as completed when rebate payment notification letter is mailed.

*** "In Progress" refers to projects for which work has begun and/or are approved to begin with rebate funds reserved.

**** "Pipeline" refers to projects for which applications have been received but not fully processed.

Source: Global Institute of Sustainability at Arizona State University

Among all projects, 17 commercial projects had been physically completed by June 2011. (Only 10 were officially designated “complete” according to project reporting criteria that a final rebate check be authorized for issue.) The projects include multiple building types — small and large office buildings, retail and convenience stores, small hotels, and others. Nearly all were single end-use retrofit projects focused on lighting retrofits. The lone exception was a multiple end-use retrofit project that includes a major HVAC component. The savings of this project are expected to far exceed the energy savings from all the other completed projects combined.

SUMMARY OF COMPLETED COMMERCIAL RETROFIT PROJECTS

Date of Completion	Building Type	Type of Application	Contractor Estimated Annual Savings		Retrofit
			kWh	Percent	
4/19/11	Service	SB	12,940	26%	Lighting
4/19/11	Service	SB	15,201	30%***	Lighting
4/19/11**	Food Sales	SB	9,802		Lighting
4/28/11	Mercantile	SB	13,513		Lighting
4/29/11	Fabricated Metal Products	SB	2,109	7%	Lighting
4/29/11**	Chemicals	PA	41,226	5%	Lighting
5/02/11	Food Service	SB	29,668	12%	Lighting
5/11/11	Mercantile	SB	33,664	83%****	Lighting
5/12/11	Fabricated Metal Products	SB	35,447		Lighting
5/17/11	Food Sales	SB	5,975		Lighting
5/17/11**	Fabricated Metal Products	SB	9,941		Lighting
5/18/11**	Office	SB	10,149		Lighting
5/19/11	Mercantile	SB	12,380		Lighting
5/19/11	Lodging	SB	282,720	33%	Lighting
5/23/11**	Fabricated Metal Products	PA	30,689		Lighting
5/27/11**	Mercantile	SB	115,738		Lighting
*	Office	PA & CA	1,266,200	10%	Multiple
			1,927,362		

Note: Small Business (SB), Prescriptive Application (PA), Custom Application (CA)

* In Progress

** Projects physically complete but pending rebate approval

*** Missing November 2010 billing data

**** Historical change in building energy use levels (Reason TBD)

Source: Global Institute of Sustainability at Arizona State University, from Energize Phoenix applications

COMMERCIAL PROJECT ENERGY ANALYSIS

One objective of Energize Phoenix is to independently evaluate contractor-reported savings from individual building retrofits. To do this, the energy analysis team relies on utility bill data from APS to establish a baseline. Then, over time, the savings predicted by the contractor are compared with “actual savings” — an amount determined by a combination of post-upgrade energy bills and monitoring, plus some normalizing for weather and other variables as appropriate.

Because of the high number of projects, the team will analyze a subset of the completed retrofit projects and install monitoring equipment for a relatively short period of time. Any variance between predicted and actual savings will be calculated, the causes identified when possible, and results provided to APS and the contractor to help improve future estimates and savings.

For more information, see online *Appendix F: Energy Analysis (Non-Residential)*.





Learn What Works

Building on Experience: Lessons Learned from Year One

The first year of Energize Phoenix provided practical knowledge about what works when building the infrastructure to achieve energy efficiency goals. The lessons learned, below, are presented in three categories — program level, research specific, and energy efficiency specific.

PROGRAM LESSONS

Creating a project infrastructure among large institutions takes time —

- **Inter-institutional integration** requires time for personnel to adapt to differing cultures, standards of operation, and decision making. The outcome is expanded team member capacity and management skills to tackle complex sustainability problems.
- **Liability** concerns are common among most large institutions and individual risk management policies often conflict because of varying regulatory requirements. Resolving differences can create both lengthy negotiations and innovative solutions.
- **Narrow divisions of labor** in large institutions spread authority among many departments and individuals with specialized expertise, lengthening decision making timeframes. Interdependencies among three institutions expands this geometrically.
- **Revision fatigue** impacts inter-departmental enthusiasm when departments that are accustomed to reviewing the “final” version of a contract or document are then confronted with additional revisions from an institutional partner.
- **Personnel capacity** has been falling as budgets tighten, giving many employees little time to take on new projects, including the hiring and training of new project personnel.



Cultures differ among partners —

- **City of Phoenix’s** mission is to deliver a range of services equitably and efficiently to the citizens of Phoenix, and ultimate accountability rests with voters. Most big policy changes, therefore, must engage many perspectives — a process that requires additional time for public and regulatory review.
- **ASU Global Institute of Sustainability’s** mission is to find viable solutions to the grand challenges of sustainability, with a mix of accountability to students, administration, the Arizona Board of Regents, and grant funders. ASU’s requests for data from partner institutions can raise privacy and time issues while its analysis can improve project performance in real time.
- **Arizona Public Service’s** mission is to provide affordable and reliable electricity from diverse sources, and its accountability is to shareholders, the Arizona Corporation Commission, and customers. Regulatory mandates, customer privacy policies, and market competition act as disincentives to sharing of proprietary information while energy efficiency program expertise greatly enhances program design.

Many voices and diverse listeners create marketing challenges —

- Selling a good program means understanding many different audiences. Contractors, who already had a trust relationship with APS, expressed interest early on before details were finished, but homeowner groups were much less receptive to incomplete information.
- Developing marketing communications involves balancing the often competing issues of accuracy and speed, with partners viewing the tradeoff differently. Over time and with market feedback, a diverse working group can gravitate toward a shared norm.
- Non-traditional boundaries confound media buys. Energize Phoenix's compact geography and mass-transit anchor, however, make door-to-door outreach more feasible.

For more information about marketing, see online *Appendix G: Energize Phoenix Strategic Communications Plan*.



Novel geography offers advantages and challenges —

- The newness of the light rail line brings attention and a spirit of optimism to Energize Phoenix as a symbol of urban progress.
- The Energize Phoenix Corridor provides access to a priceless diversity of people, industries, and buildings in developing and testing a program of energy efficiency and job creation.
- Budget realities and other factors caused boundaries of the Corridor to cut some traditional neighborhoods in two, creating the perception of inequities. This generated occasional discontent among those outside of the program boundary.



Experienced contractors improve design and impact —

- Access to a trained weatherization workforce saved tremendous time and resources. Involving experienced contractors early also contributed to better program design.
- Energy efficiency upgrade programs stimulate local green jobs. Local companies with local workers dominate the Energize Phoenix contractor workforce.

For more information, see online *Appendix H: Results of Commercial Contractor Survey*.



Focus intensely on the target audience —

- Participation in the Rebate Match program has yet to meet expectations, likely partially because residents of the Corridor are significantly less affluent than average APS customers. The subsidized \$99 homeowner contribution to energy assessments still represents a barrier to entry. To stimulate greater interest, Energize Phoenix plans to rebate the entire cost of the energy assessment during a portion of Year 2 as a “limited time offer.”
- One commercial contractor successfully produced the overwhelming majority of first year projects by focusing its business model and marketing on a narrow niche of the market—small building owners.



Be prepared for reporting changes —

- DOE’s mandate to swiftly roll out the Better Buildings program led to ongoing modifications in the reporting process as the program evolved. Energize Phoenix personnel learned to expect and adapt to these changes.

Partnerships add value —

- Diverse partners contribute invaluable skills, experience, and infrastructure to a project, presenting opportunities for solutions that would otherwise be impossible. The synergies of the Energize Phoenix partnership will become clear in Year 2 as the programs are refined and Year 1 groundwork pays off.



RESEARCH LESSONS

Universities provide expertise to design experiments and analyze data. Interdisciplinary teams of university scientists, however, have their own complexities to navigate. What follows are lessons learned through the lens of researchers.

Crossing disciplines creates scientific challenges —

- Contrasting theories and methodologies mean design and data alternatives will be debated to achieve optimal outcomes.
- University research involving human subjects requires review by an Institutional Review Board to assure the physical and mental safety and well-being of the subjects. This can add significant time to program implementation schedules.



Broad projects offer valuable research experience for eager students —

- Energize Phoenix engages graduate and undergraduate students from many disciplines. Experiential opportunities include surveying, data processing and analysis, project management assistance, literature research assistance, presentation development, spin-off student research projects, and internships with partners, participants, and contractors. This training helps university students become valuable contributors to the community as residents and green collar workers.

Research goals in applied sustainability projects must be adaptable —

- ASU scientists from different disciplines met in advance to understand each other's goals and develop a research framework within the resource and knowledge limitations of a proposal-phase project. As details of the various Energize Phoenix programs developed, adjustments had to be made to identify the research that best aligns with and supports program designs.

Funded public-private projects open novel risks and challenges for partners —

- Investor-owned utilities that are open to cooperative, nonintrusive behavioral research might not agree to research involving external exposure to their business processes.
- Investor-owned utilities may hesitate to join federally-funded projects because of the potential for expensive financial audits that may extend long after the project.
- Regulated utilities generally need generous timelines to develop new programs and to get rebate resources and energy efficiency targets approved.

Complex projects require tracking enormous amounts of diverse data —

- Setting up a new database calls for creative planning for many issues and unknowns. These include the ultimate size of the database, number of users, types of access needed, security measures, and various unknowns such as future uses and database platforms.

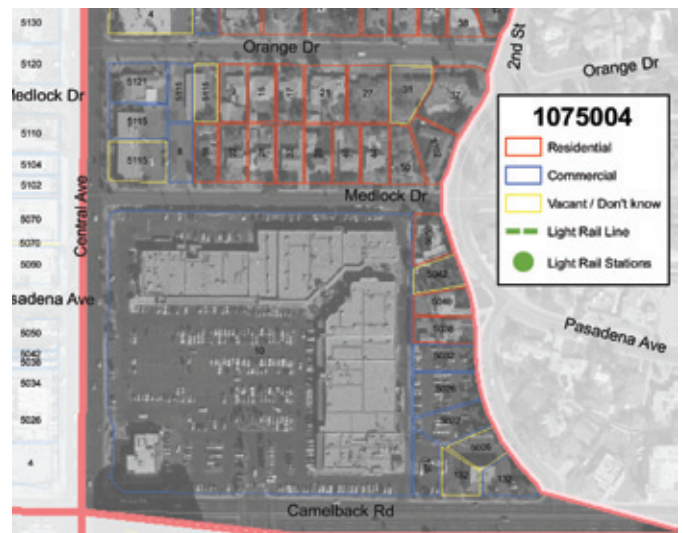


ENERGY EFFICIENCY LESSONS

Most of the research on energy efficiency achievements must wait until significant data come in during Years 2 and 3. Below are a few of the early lessons.

Even the most promising data sets don't tell the whole story —

- Utility billing data cannot be expected to supply information on some significant factors affecting energy usage changes, such as building occupancy rates, behavior modifications, and changes in building use (e.g., increases in manufacturing production or conversion from retail to restaurant). Clarifying these and other anomalies requires substantial additional investigation.
- Maricopa County Assessor data on properties may not be updated or verified for decades, which means they include a significant amount of error, including misrepresented properties and uses, out of date building sizes, and incorrect addresses. A project to update assessor data could likely pay for itself through resulting corrections to property tax assessments.



Build on the lessons learned from prior research —

- Previous studies should be used to guide new projects. A literature review of research on feedback device studies helped inform the Energy Dashboard program design and ensure its maximum contribution to the body of research knowledge. [See online *Appendix I: Research to Inform Design of Residential Energy Use Behavior Change Study*.] DOE branding consultant findings and a behavioral change research literature review helped shape marketing language choices.



Strengthen Our Economy

Next Steps: The Goals Ahead

Future reports will provide the results of program participation and research findings in Years 2 and 3, as well as improvements made to the programs from lessons learned.

Year Two Goals

- Begin monitoring and verification of select nonresidential buildings for more detailed case study analyses
- Implement the Energy Dashboard study
- Launch the 60/40 program and full residential marketing plan with an emphasis on Spanish-speaking and low-income residents
- Launch the Commercial Financing program to increase the volume of medium-to-large commercial projects
- Increase outreach to local community organizations to promote residential programs and ASU behavioral research
- Perform data analysis on participating projects and feed results back into program design to optimize all programs



Year Three Goals

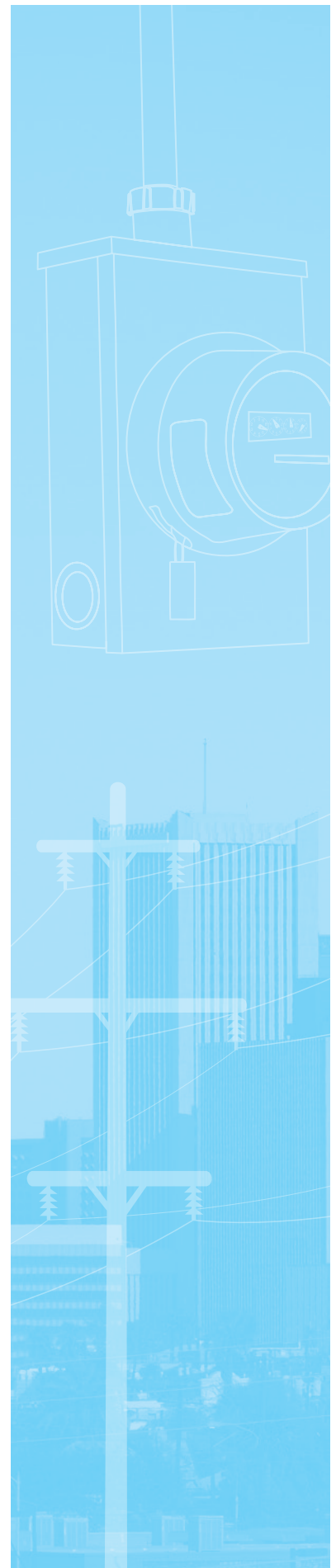
- Evaluate energy savings of Energize Phoenix through macro statistical analysis of all projects and individual case studies of select projects
- Determine demographic and attitudinal impacts on energy usage and participation rates of residents and businesses
- Identify building factors most likely to influence savings in energy efficiency upgrades
- Reach project goals for energy savings and number of retrofits
- Create a critical mass culture of energy efficiency within the Energize Phoenix Corridor

“Block by block, neighborhood by neighborhood, we will make our communities more energy efficient and help families save money. At the same time, we’ll create thousands of jobs and strengthen our economy.”^[13]”

—Dr. Steven Chu,
Secretary, U.S. Department of Energy,
April 21st, 2010

Endnotes

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**“We cannot keep going from shock to
trance on the issue of energy security,
rushing to propose action when
gas prices rise, then hitting the
snooze button when they fall again...
it is time to do what we can
to secure our energy future.^[14]”**

—President Obama,
March 30th, 2011

PRINCIPAL AUTHORS OF APPENDICES (All from ASU except where noted)

Appendix A: Energy Efficiency and the Built Environment: Mick Dalrymple

Appendix B: Year One Actions and Accomplishments: Mick Dalrymple, Drew Bryck

Appendix C: Characteristics of the Energize Phoenix Corridor: Mike Kuby, Alex Castelazo, George Oliver, Tim James, Matt Croucher

Appendix D: Base Year Energy Use: Alex Castelazo, Matt Croucher, Tim James

Appendix E: Current Commercial Projects: Alex Castelazo

Appendix F: Energy Analysis (Non-Residential): Shreya Agnihotri, Sadiq Jubran, T. Agami Reddy, Pat Phelan

Appendix G: Energize Phoenix Strategic Communications Plan: Denise D. Resnik, Michelle McGinty, Sarah Geiger (*DRA Strategic Communications*)

Appendix H: Results of Commercial Contractor Survey: Alena Martinez-Hart, Mick Dalrymple

Appendix I: Research to Inform Design of Residential Energy Use Behavior Change Study: Karla Grijalva, Supriya Goel, Aleksasha Webster, Harvey Bryan

Appendix J: Behavioral Survey Design, Administration and Preliminary Results: Samantha Neufeld, Anna Berlin, Drew Bryck, Susan Ledlow

All appendices and main report are available online at energize.asu.edu



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