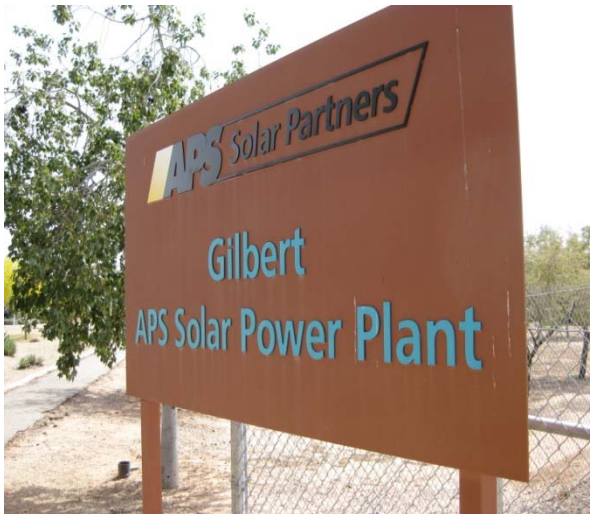
CHAPTER 11

ENERGY

Major Power Transmission Corridor

Vision Statement

Gilbert is committed to being in the forefront in energy efficiency, reducing energy demand and furthering the use of alternative and renewable energy sources.



Gilbert APS Solar Power Plant

Gilbert APS Solar Power Plant

Background

Gilbert municipal employees, businesses, schools and residents are increasingly aware of the need to promote the wise use of energy in their operations and daily lives. This awareness results from the escalating cost of energy for municipal facilities, businesses, offices, homes and vehicles; as well as environmental concerns related to air pollution, contamination, the urban heat island effect and the dwindling supply of natural resources, including traditional energy sources. Town officials, business owners and residents recognize the need and are willing to take efforts to reduce the demand for energy, become more efficient consumers of energy and consider the use of alternative energy sources. The effort to be in the forefront in these areas requires everyone to participate in a concerted, integrated approach to energy efficiency in order to reduce demand and increase the use of alternative and renewable energy sources within Gilbert.

The Energy element is presented in the following sections:

- Existing Conditions
- Integrated Energy Approach
  - Energy Conservation and Efficiency
  - Utilizing Alternative and Renewable Energy Sources
- Goals and Policies
- Implementation Strategies

Santan Generating Plant

11.1 Existing Conditions

The function, operation and infrastructure of public and private institutions, businesses and homes in Gilbert and the nation as a whole are dependent upon sufficient supplies of reasonably priced energy. A typical home in the Phoenix Metro area has an average daily use of 43 kilowatt-hours (kWh) of electricity. Because Gilbert is only 60% built-out, energy use within the community will increase by at least another 40% over present levels if current consumption rates continue. Gilbert has a relatively modern housing stock with the average age of all homes being approximately 11 years with the median or 50th percentile of homes having been constructed during 1999. Homes built in the 1970's and 1980's had less stringent requirements for energy efficiency than today's homes and similarly, future homes are expected to have higher standards for energy efficiency than homes have today.

Energy Generation in Gilbert

Salt River Project's (SRP) Santan Generating Station is located in Gilbert and has six natural gas combined cycle units providing an electrical generation capacity of 1,225 Megawatts (MW), enough power for approximately 270,000 homes.

Santan is used to supplement base-load plants. Santan is a relatively quick start source of electricity, capable of producing power within 20 to 60 minutes. The plant has been in operation since 1974.

Power Transmission Facilities in Gilbert

The primary power transmission corridor in Gilbert is known as the Western Canal power line corridor that contains a double set of high-power lines with 500 kilovolt (kV) capacity, running east- west located ½ mile south of Guadalupe Rd. with an overall length of 8.3 miles.

A second set of 230 kV power lines runs eastward along Queen Creek Rd. from Chandler, to the Roosevelt Water Conservation District (RWCD) canal near Higley Rd., then northward along the canal to the Union Pacific RR, then northwestward to the SRP Santan Generating Station and northward within a power line corridor situated west of Greenfield Rd. to Mesa, a total length of 13.3 miles.

A new 230 kV power line was approved by the Arizona Corporation Commission to extend from the Moody substation near Power Road and the RWCD Canal along the canal to the Union Pacific RR then easterly toward Queen Creek, a length of 1.1 miles, exiting Gilbert.

Numerous other power lines including 69 kV and 12 kV lines are located along arterial streets and other suitable areas. A total of about 15 electrical substation exist or are proposed in Gilbert which act to reduce the voltage of major power lines, generally with 69 kV or greater capacities, to 10 kV for connection to the local power distribution system to homes and businesses. (See Public Facilities Map, Chapter 5).

Water Reclamation Plant

11.2 Integrated Energy Approach

The development and implementation of an integrated energy approach requires a broad-based effort that includes the conservation of energy and an increase in the use of alternative energy sources in our community. Through a public and private partnership, the Town of Gilbert commissioned a two mega-watt solar power project at its Neely Wastewater Reclamation Facility in November, 2011. With over 8,000 photovoltaic tracking solar panels this solar power system will off-set over 86 million pounds of carbon dioxide over the life of the system and will generate over 4 million kilowatt hours (kwh) of electricity annually – equivalent to producing enough electricity to power more than 438 average American homes for one year. The solar system, installed over groundwater recharge basins at Gilbert's Neely recharge facility, is expected to provide approximately $2 million in energy cost savings at Gilbert's Neely Wastewater Reclamation Plant over the next 20 years.

Gilbert will continue to promote the wise use of energy through an energy policy that:

- Evaluates areas of energy use to promote energy efficiency, reduce demand and further the use of alternative renewable energy,
- Includes all Gilbert residents, businesses, institutions and other interests,
- Develop policies that encourage and provide incentives for efficient energy use
- Seeks involvement of academic institutions, utility companies, businesses, government agencies and the public to promote new technologies, applications, approaches and opportunities for energy conservation and the use of alternative energy sources,
- Promotes public education in the wise use of energy,
- Pursues and utilizes more effective energy systems and methods as these become available.

Community Water Lifeline

11.3 Integrated Energy Approach Area 1: Energy Conservation and Efficiency

Gilbert will endeavor to promote energy efficiency by supporting conservation, green building, effective land use patterns (such as infill and redevelopment, mixed-use development, efficient transportation/circulation systems), utility systems, cool pavements, alternative energy sources and emerging and new energy technologies. Implementation of an integrated energy approach requires close interaction with local utility providers, Salt River Project (SRP), Arizona Public Service (APS), Southwest Gas (SWG), businesses, community leaders, residents, developers and contractors and educators. Research and technology centers such as Arizona State University (ASU) and Chandler Gilbert Community College (CGCC) provide a valuable resource of knowledge in their staff and students. Efforts should be made to access and utilize this knowledge base and encourage the active participation and partnership with the centers in the development and implementation of a comprehensive energy plan.

Education

Education for the efficient use and conservation of energy is vital for Gilbert to act to reduce its energy demand. In order to succeed, it is important that information and education be provided to the public to promote wise energy use, to consider and establish efficiency practices and to adopt new techniques and technologies to reduce energy demand. While many groups will be involved in this effort, the participation of schools and universities will be vital. The cooperation and partnership among schools, research and technology centers, businesses and Gilbert residents is very important to promote the education, training and the use of new technologies and innovations in efficient energy use.

Actions to Reduce Energy Demand

The US Department of Energy's Energy Savers Handbook states that in a typical 2,000 sq. ft. home, 40% of the annual energy bill can be attributed to heating and cooling costs, with an additional 15% used for water heating costs. In addition, the US Green Building Council (USGBC) indicates that overall, buildings account for 40% of the nation's total energy consumption.

It is currently estimated that 80% of the heat loss in buildings occurs through windows, doors and ceilings. Moreover, heat gain can be an even larger issue in warm states like Arizona. Utility companies indicate that existing homes and businesses can be upgraded and made 20 to 25% more energy efficient by taking steps to increase insulation value and sealing the building envelope to reduce air infiltration, provide shading for windows from direct exposure to the sun, adding dual pane windows and replacing inefficient heating, ventilation and air conditioning (HVAC) systems. Other energy savings can be obtained by use of energy efficient CFI (compact florescent) and LED (light emitting diode) light bulbs and energy efficient appliances.

A variety of programs offered by federal, state, utility and other companies offer incentives, rebates, tax credits and price reductions for upgrading insulation, windows, HVAC systems, appliances and other measures to promote energy conservation and reduce demand for energy. For example, increasing attic insulation and adding shade screens on south and west facing windows can provide up to 12% annual saving on energy bills. With the application of rebates and incentives available for insulation upgrades and sealing the building envelope to reduce air infiltration, the payback period for insulation improvements that lower energy bills may be achieved in 2 or 4 years and worth the cost of upgrading. Similarly, upgrading the HVAC system from SEER 10 (Seasonal Energy Efficiency Ratio), commonly installed in the mid 1990, to today's efficient SEER 14 to 16 systems (presently available to SEER 19

and 21) and following the "Manuel J" mechanical system ratings are cost efficient over time and reduce energy usage. It is generally believed that upgrades to more efficient HVAC systems are worth incurring, especially where Federal, State and utility rebates and credits are provided, since with reduced energy consumption the repayment for such investments is generally obtained in 3 to 6 years.

Energy Efficient Techniques for Existing Buildings

One of the best ways to evaluate the energy efficiency of a home, office or other building is to obtain an "energy audit" by a certified audit company or through utility companies. From this analysis, a recommended approach is developed and includes items such as increasing the insulation value, sealing doors and windows, upgrading windows, adding sunscreens and window shading and upgrading HVAC systems.

Energy Wise/Green Building Techniques

In addition to increased insulation and sealing the building envelope, providing shade screens and use of high efficiency HVAC systems, additional ways to make a home or business more energy efficient and "green" in order of anticipated payback period are as follows:

- Using energy efficient CFI and LED lighting and providing natural day light opportunities,
- Considering "time-of-use" electric plans offered by electric utility companies to encourage power uses during "non-peak" periods,
- Safely weatherizing and sealing air leakage,
- Seal ductwork to eliminate air leakage,
- Providing shading with window sunscreens and architectural elements and detailing such as recesses, overhangs, patios and awnings to reduce solar heat gain along south and west building exposures in the summer,
- Upgrading to programmable thermostats,
- Conduct a blower door test (Energy Assessment) to determine air infiltration and sources,
- Utilizing ceiling insulation with values of R30-38 or above,
- Using of 2 by 6 inch wood frame construction and exterior insulation to reduce heat loss/gain in walls and using thermal mass and thermal breaks in walls and foundations where appropriate,

- Limiting the amount of glazing in homes, make the sizing and placement of each window count for view and lighting and not just creating a window for the sake of adding glass,
- Utilizing ceiling insulation with values of R30-38 or above,
- Pre-designing "duct runs" and bundled wire packets to allow for blanketed, sealed ductwork and uninterrupted insulation placement,
- Providing window sunscreens and other shading as architectural elements and detailing such as recesses, overhangs, patios and awnings to reduce solar heat gain along south and west building exposures in the Summer,
- Providing glazing, solar-angled shading elements and deciduous landscaping that allows for solar access, natural lighting and heat gain for homes in the Winter,
- Using landscaping such as trees, shrubs, trellises and "green screens" to shade homes and the use of "smart" landscape irrigation systems,
- Using radiant barriers in attics that can be applied as covers over insulation or as roof underlays,
- Replacing inefficient doors and windows and using Low-e and dual and triple pane windows on south and west exposures to reduce heat gain and loss.
- Replace HVAC with more energy efficient systems.

11.4 Integrated Energy Approach Area 2: Utilizing Alternative and Renewable Energy Sources

The most effective way for residents and businesses to impact energy usage (and decrease its associated costs) is to reduce energy consumption as outlined in Area 1 (Energy Conservation and Efficiency) above. However, as technology develops, it is anticipated that a shift to alternative and renewable energy sources will play an increasingly important role. And while none of the technologies and sources outlined below has been perfected (and some may never be cost-effective in Gilbert due to its climate and geography), each is worth noting here as a potential opportunity for the future. Ultimately, the usage of these alternative and renewable energy sources will depend on their availability, cost and public support.

Alternative Renewable Energy Sources

Solar power: the use of the sun's rays for active and passive heating of air or water, or other liquid and production of electricity with photovoltaic (PV) cells. The two mega-watt Neely Wastewater Plant solar power installation is an example of solar PV.

Wind power: the use of wind to rotate a propeller and generate electricity by a turbine generator.

Hydro power: the use of moving water to drive a turbine generator to generate electricity, such as hydro electric dam.

Biomass, Biofuel and Biogas: Biomass comes from sources of vegetation; Biofuel comes from vegetation derived oils including reprocessed cooking oils or pellets; and Biogas is a combustible gas caused by the decay of vegetation and organic materials. Through combustion, these fuel sources create steam to power turbine generators to create electricity. Alternatively, they can be refined and can act as an oil or gas to

operate motors in vehicles and other internal combustion engines. Ethanol and bio-diesel fuels are examples of suitable fuels for vehicles.

Biothermal, Geothermal: The use of the natural heat or the different temperatures that are found in the earth's subsurface including volcanic features such as natural occurring steam, hot springs, etc. They may also include use of near-surface ground temperatures contrasts, where subsurface temperatures are more moderate than air temperatures. They can be used to modify above ground building temperatures by circulating air or liquid from subsurface areas to buildings, causing a cooling effect in the summer and a warming effect in the winter.

Alternative Energy Systems

Solar Energy is at present the most prevalent source of alternative energy in the Phoenix Metro area. Solar energy is collected and used in both passive and active systems.

Passive solar heating allows the sun's rays to enter through windows or to heat air or water which is then circulated through a building to provide heated air or water.

Active solar collectors generate electricity through photovoltaic (PV) cells and can also create hot water through solar hot water systems. Many large-scale solar energy generation fields currently require the use of large quantities of water (for steam powered turbines) and this is a concern for their long-term application in Arizona. As technology develops, it is hoped that water usage may be minimized so that solar may play a much larger role in energy generation.

As for smaller active solar applications, solar PV cell panels use semiconductor materials such as silicon wafers that contain both a positive and negative charged layer of material. Sunlight hits the panel and causes electrons to travel across the 2 layers creating an electric current that can be collected for electrical usage.

The Phoenix Metro area receives an average of 214 clear days, 80 partly cloudy days and only 71 cloudy days, thus receiving 3,732 hours of sunshine annually (which works out to 85.2% of the area's possible sunshine) (source NOAA). The sunny climate makes Greater Phoenix prime for solar cell (PV) panel use as well as solar hot water heaters as alternative sources of energy. However, it is widely recognized by energy efficiency professionals that the best and the most cost effective place to start for a home or business is with increased insulation of the ceiling, walls, windows and floor and to increase the efficiency of HVAC systems. When that is completed, consideration of an alternative energy system such as solar cell (PV) panels and solar water heaters or other systems should be considered.

Stand alone or separate PV systems are not linked to the power grid and generate electric power for direct, real-time power usage or to store surplus power in batteries.

Grid tie PV systems are the most common systems used in the Phoenix Metro area and use real time generated power after on-site PV cell power is converted from direct (DC) current to alternating (AC) current, with any excess power fed back to the electric distribution grid system and sold back to the electric company at wholesale prices, thus reducing the electric bill.

In Gilbert, solar panels and solar water heaters (roof-mounted or installed elsewhere on the property) are increasingly popular and available to residents and businesses. This is a result of higher energy costs and Federal, State, utility company and other company rebates, tax credits, discounts and incentives available to reduce the costs to make systems more affordable. While some residents are concerned with the aesthetics of solar devices on neighboring properties, state legislation currently limits the ability of municipalities and homeowners associations (HOA's) to create restrictions on solar panels related to the placement of these systems when the result will decrease operating efficiency or increase the cost incurred by the homeowner. It has been suggested that Gilbert develop voluntary guidelines for solar equipment placement to mitigate issues associated with the perceived negative aesthetics and safety.

Wind power is not considered to be a substantial opportunity for alternative energy generation in Greater Phoenix since the area's average annual wind speed is about 6.2 MPH (NOAA) while wind turbine electrical generators generally require average wind speeds of 15 MPH. However, wind power can be generated in other areas of Arizona and transmitted to the Phoenix Metro area. The Dry Lake Wind Project in Northern Arizona generates enough power for more than 9,100 homes, which is delivered to customers in Phoenix.

Hydro power is also not considered to provide any substantial opportunity within Gilbert as the level topography here has a total elevation change ranging from 1421 feet above sea level at the highest point at the southeast corner to 1210 feet at the lowest point at the northwest corner, a total change in altitude of about 211 feet over the 72.6 square miles area of the Town. Also, no running water, other than that found in irrigation canals, exists to provide for the use of hydro power or opportunity foreseen.

Biomass, Biofuel and Biogas, have a significant potential for use in Gilbert. Biomass material can be used as a fuel source for combustion to creating steam to operate a turbine generator to produce electricity. Biofuel and biogas can be used as a fuel, similar to gasoline, to operate vehicles and internal combustion motors. This alternative fuel source includes ethanol and bio-diesel fuels that have the opportunity to supplement or replace gasoline in vehicles and bio-diesel can replace and substitute diesel fueled vehicles.

Biothermal and Geothermal energy sources also offer significant potential for use in Gilbert. This is not related to volcanic heating sources that can be tapped such as steam, or hot springs, but through use of naturally occurring moderate temperatures at subsurface depths of 20, 30 or more feet underground ground that average a consistent temperature of 72°. These moderate temperatures, when accessed through systems using the movement of air or liquids such as water, antifreeze or Freon, etc., through a pipe grid system, can create warming to the building in winter (52.3° average January Phoenix temperature) and cooling to buildings in summer (92.3° average July Phoenix temperature, source NOAA).

Electrical Transmission Center

SRP Santan Generating Plant

11.5 Goals and Policies

Goal 1.0

Incorporate energy efficiency and alternative and renewable energy sources into all aspects of Gilbert planning.

Policy 1.1 Establish an integrated energy approach encompassing the usage of efficient energy techniques/technologies and alternative/renewable energy sources for Gilbert municipal operations.

Policy 1.2 Encourage 'walkable' communities, vertical development where appropriate, mass transit and efficient land use patterns to minimize fuel consumption and energy usage.

Policy 1.3 Encourage and support reliable cost-efficient electrical distribution and generation systems.

Policy 1.4 Continue the involvement and commitment of public committees (such as the Environmental Programs Task Force) and other interested groups to plan and promote energy efficiency, alternative energy usage and green and sustainable programs for Gilbert.

Policy 1.5 Encourage efficient energy use in Gilbert municipal operations.

Policy 1.6 Encourage energy efficiency and use of alternative energy sources in all new construction and development in Gilbert.

Goal 2.0

Promote education and facilitate discussion about energy conservation and the usage of alternative and renewable energy sources throughout Gilbert.

Policy 2.1 Provide educational opportunities to businesses, contractors and residents regarding energy efficiency, how to reduce energy demand and how to increase the use of alternative, renewable energy sources.

Policy 2.2 Promote and coordinate partnerships for energy efficiency education and training opportunities between schools, colleges, the construction and business community, public utilities and residents.

Policy 2.3 Encourage cooperation among schools, research and technology centers, businesses and Gilbert residents to promote new technologies and innovations in clean and renewable industries and creation of job opportunities, as outlined in the Chapter 9 Economic Element.

Policy 2.4 Facilitate the exchange of ideas related to the wise use of energy, including methods, technologies and integrated energy plans.

Policy 2.5 Develop and distribute an information sheet for homeowners interested in adding solar power to their homes, including suggestions regarding aesthetics, safety and the need to hire licensed contractors to do the work.

Goal 3.0

Establish policies that encourage and provide incentives for efficient energy use to support and encourage energy conservation and the usage of alternative and renewable sources of energy.

Policy 3.1 Continue to utilize and consider the adoption of the International Energy Conservation Code (IECC), as revised and recognized by the US Green Building Council (USGBC), and other building codes as a source of acceptable standards for energy efficiency in construction.

Policy 3.2 Encourage development and implementation of Pervious Pavement (Cool Pavement) guidelines as the use of such pavement is recognized to help mitigate the impact of the urban heat island (UHI) effect.

Policy 3.3 Consider the use of alternative materials, designs and methods of construction to promote energy conservation, where verification is provided by an engineer, architect, or other professional, that the alternative construction form, meets the intent of the Building Code.

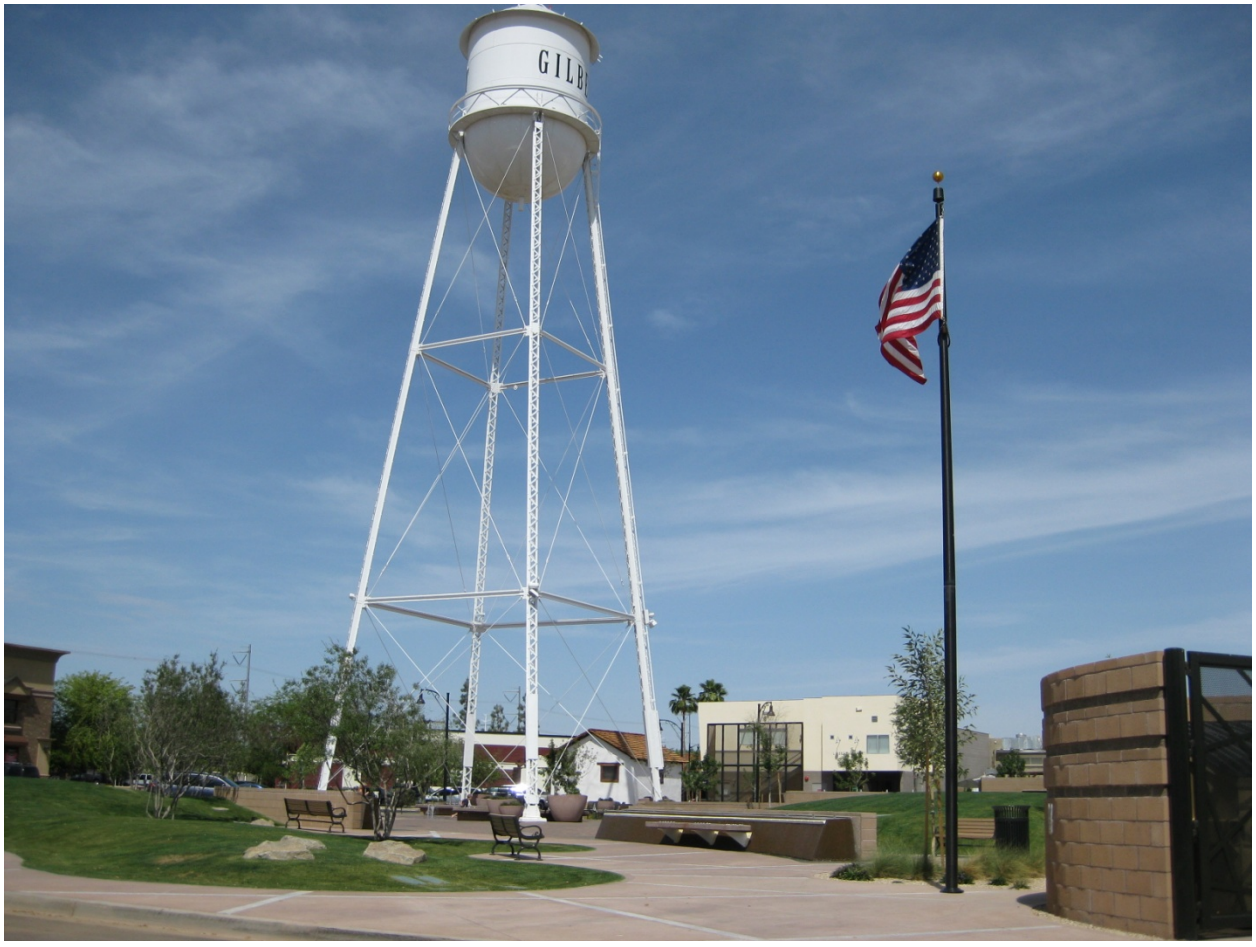
Policy 3.4 Establish guiding principles and encourage best practices for the placement and installation of solar (PV) panels and solar water heaters for residential and commercial uses.

Policy 3.5 Develop, promote and implement a separate, quicker "green track" review process and associated guidelines for energy efficient development applications and projects.

Policy 3.6 Promote entrepreneurial efforts to develop and use new products, materials, services, technologies and processes to support energy efficiency and alternative and renewable energy sources.

Policy 3.7 Establish policies to encourage businesses and residents to purchase renewable energy.

Policy 3.8 Provide incentives for efficient energy usage by Gilbert businesses and residents.



Water Tower Park

11.6 Implementation Strategies

The intent of the Energy Element is to provide guiding principles for energy efficiency, reduce energy demand and to further the utilization of alternative and renewable energy sources.

Energy	Responsible Entity	Complete By
A. Establish guidelines regarding an Integrated Energy Approach to promote energy efficiency and reduced energy demand by the following means:		
1. Use of best practices for energy conservation in Gilbert municipal operations.	Development Services	Ongoing
2. Support increased insulation, sealed envelopes and upgraded HVAC systems in existing homes and businesses.	Development Services	Ongoing
3. Promote green building and effective land use patterns.	Permitting and Plan Review Planning	Ongoing
4. Provide education and information to residents on the wise use of energy.	Permitting and Plan Review Planning	Ongoing
5. Create informational brochures for distribution to contractors and homeowners for rooftop mounted solar panels and water heaters.	Environment and Safety Town Manager's Office Planning	Ongoing

B. Establish guidelines regarding an Integrated Energy Approach to promote use of alternative and renewable energy sources by the following means;	All Departments	Ongoing
1. Support, anticipate and promote technology advancements and shifts to allow and enable increased usage of alternative and renewable energy.	All Departments	Ongoing
2. Consider and evaluate options for the use of alternative of and renewable energy sources where these sources become available and are cost effective.	Development Services Public Works Environmental Safety Town Manager's Office	Ongoing
3. Provide education and information to residents of options for alternative and renewable energy sources.	Development Services Public Works Environment Safety Town Manager's Office	Ongoing
4. Promote a partnership with education centers, businesses, utility companies and residents regarding opportunities for and application of alternative and renewable energy sources.	Planning Business Development	Ongoing
5. Implement a public process to determine whether building permits should be required for rooftop or ground-mounted solar installations (PV panels or solar water heaters) when installed by an Arizona Licensed Contractor and the equipment is recognized and listed in standard equipment manuals.	Development Services Permitting and Plan Review	Ongoing
6. Develop, promote and implement a separate, quicker "green track" review process and associated guidelines for energy efficient development applications and projects.	Development Services Permitting and Plan Review	Ongoing