# Climate + Energy Element

August 28th, 2014

LVPC
Lehigh Valley Planning Commission
Planning for the Future of Lehigh + Northampton Counties

LVPC
2014 Climate + Energy Element

## Lehigh Valley Planning Commission

Kent H. Herman, Esq., *Chair*
Liesel Dreisbach, *Vice Chair*
Stephen Repasch, *Treasurer*
Norman E. Blatt, Jr., Esq.
Christen T. Borso
John Brown
Gordon Campbell
John N. Diacogiannis, CPCU
Karen Dolan
Robert Donchez
Percy H. Dougherty, PhD
Karen Duerholz
Charles W. Elliott, Esq.
Charles L. Fraust
George F. Gemmel
Matthew Glennon
Steven L. Glickman, RA, NCARB
Armand V. Greco
Virginia Haas (alt.)
Michael C. Hefele, AICP (alt.)
Darlene Heller (alt.)
Benjamin F. Howells, Jr.
Edward D. Hozza, Jr.
George Kinney (alt.)
Robert A. Lammi
Kevin Lott
Kenneth M. McClain
Christina V. Morgan
Thomas Muller
Thomas J. Nolan
Sara Pandl, AICP, RLA
Salvatore J. Panto, Jr.
Edward Pawlowski
Pamela Pearson, MBA
Kathy Rader
Michael Reph
Lisa Scheller
Peter G. Schweyer
Lori Sywensky (alt.)
Seth Vaughn
Donna Wright

## Lehigh Valley Planning Commission Staff

Becky A. Bradley, AICP, Executive Director
Anne L. Esser, MBA, Director of Administration
Eric C. McAfee, AICP, LEED AP, Director of Community Planning
Geoffrey A. Reese, P.E., Director of Environmental Planning
Tracy L. Oscavich, Associate Director of Development
William H. Deegan, Architectural/Urban Designer
David P. Berryman, Chief Community Planner
David E. Manhardt, AICP, Chief Geographic Information Systems Planner
Ngozi Obi, Senior Community Planner
Lynette E. Romig, Senior Geographic Information Systems Analyst
Travis I. Bartholomew, P.E., Senior Environmental Engineer
Teresa Mackey, Senior Environmental Planner
Susan L. Rockwell, Senior Environmental Planner
Michael S. Donchez, Senior Transportation Planner
Chris J. Mukkadan, Transportation Engineer
Gabriel F. Hurtado, Community Planner
Alice J. Lipe, Graphics & Publications Coordinator
Kathleen M. Sauerzopf, Executive Secretary

# Comprehensive Visioning and Coordinating Investment in the Region

LVPC
2014 Climate + Energy Element

# SUSTAINABLE COMMUNITIES CONSORTIUM PARTNERS

LVPC
Lehigh Valley Planning Commission

The work that provided the basis for this publication was supported by funding through Lehigh Valley Economic Development Corporation under an award with the U.S. Department of Housing and Urban Development. The substance and findings of the work are dedicated to the public. The author and publisher are solely responsible for the accuracy of the statements and interpretations contained in this publication. Such interpretations do not necessarily reflect the views of the Government.

## Process

LVPC
2014 Climate + Energy Element

Public Outreach

Draft Climate Element

Draft Energy Element

Public Comment Period

Climate + Energy Elements

Lehigh Valley Comprehensive Plan
with Climate + Energy Elements

# ELEMENT

# Integration of Climate + Energy Elements into the Lehigh Valley Comprehensive Plan

LVPC
2014 Climate + Energy Element


A comprehensive plan element is a summary of a subject with associated goals, policies and implementation tools. These overarching regional priorities are balanced within the existing framework of the plan.

**SOURCE -** Max Gunawan (Lumio)

# CLIMATE

# BACKGROUND + INTRODUCTION ON CLIMATE

The Earth's climate system is powered by the energy from the sun. The planet's surface temperature depends on the balance between incoming and outgoing energy. Sustained changes to the amount of incoming or outgoing energy can lead to climate change. This change in energy balance has occurred throughout the life of the planet due to natural forces. Prior to humans populating the Earth, volcanic eruptions, changes in the Earth's orbit, and changes in solar activity were the cause of climate change with the planet experiencing periods of warming and cooling. Many scientists today believe that global climate change is occurring based on a number of observations made over a period of time - average temperatures are increasing, the oceans are warming, sea levels are rising, and weather events are becoming more extreme. According to research by the scientific community, natural causes alone cannot explain the recently observed climate changes. They believe human activity contributes to climate change and is largely responsible for the changes we are seeing today.

Scientists point to the Industrial Revolution during the 1700s and 1800s as the period when human activity began having an impact on the rate of climate change. The discovery of fossil fuels and their use for heat, transportation and manufacturing has resulted in the release of substantial amounts of heat-trapping gases or "greenhouse gases" into the Earth's atmosphere. Greenhouse gases occur naturally in the Earth's atmosphere and act as a blanket around the planet, warming it to a temperature that can support life. This is known as the "greenhouse effect". The greenhouse effect is caused when sunlight passes through the Earth's atmosphere where the energy can either be reflected or absorbed by the planet's surface. The energy that is absorbed causes the surface to warm. Some of this absorbed energy is released back into the atmosphere as infrared radiation. In the atmosphere, most of this radiation is absorbed or trapped by the greenhouse gases and is then radiated back to the Earth's surface. Without this natural warming process, the planet would be uninhabitable. However, according to scientists, the increase in greenhouse gases in the atmosphere, caused largely by human activity, is resulting in global climate warming. Scientists also believe that continued warming is inevitable because greenhouse gases can remain in the atmosphere for long periods of time, trapping the heat for decades or centuries.

The primary greenhouse gases emitted into the atmosphere from human activity include carbon dioxide, methane, nitrous oxide and fluorinated gases. According to the U.S. Environmental Protection Agency (EPA), carbon dioxide ($CO_2$) accounted for about 84% of all greenhouse gas emissions from human activity in the U.S. in 2011.

Carbon dioxide ($CO_2$), while a minor component of the atmosphere, is the most important of the greenhouse gases that is influenced by humans. It is considered the primary greenhouse gas contributing to recent climate change by the EPA. It occurs naturally in the atmosphere and is constantly exchanged among the atmosphere, the oceans and the Earth's surface. The emission and removal of $CO_2$ by living organisms tends to balance as part of natural processes. Human activities are changing this balance by adding more $CO_2$ into the atmosphere. According to the National Oceanic and Atmospheric Administration (NOAA), current $CO_2$ concentrations have never been higher compared with the last 650,000 years as shown in Figure 1. Burning fossil fuels (coal, natural gas and oil) is the primary human activity that results in the release of $CO_2$. The three main sources of emissions in the U.S. are electricity generation, transportation and industrial processes. Other activities such as deforestation also result in increased $CO_2$ concentrations since trees remove $CO_2$ from the atmosphere through natural processes and act as a carbon sink.

Methane occurs naturally in the atmosphere as a product of biological processes, such as the decay of organic matter in wetlands. However, according to the EPA, it is the second most prevalent greenhouse gas

# Climate Change Indicator

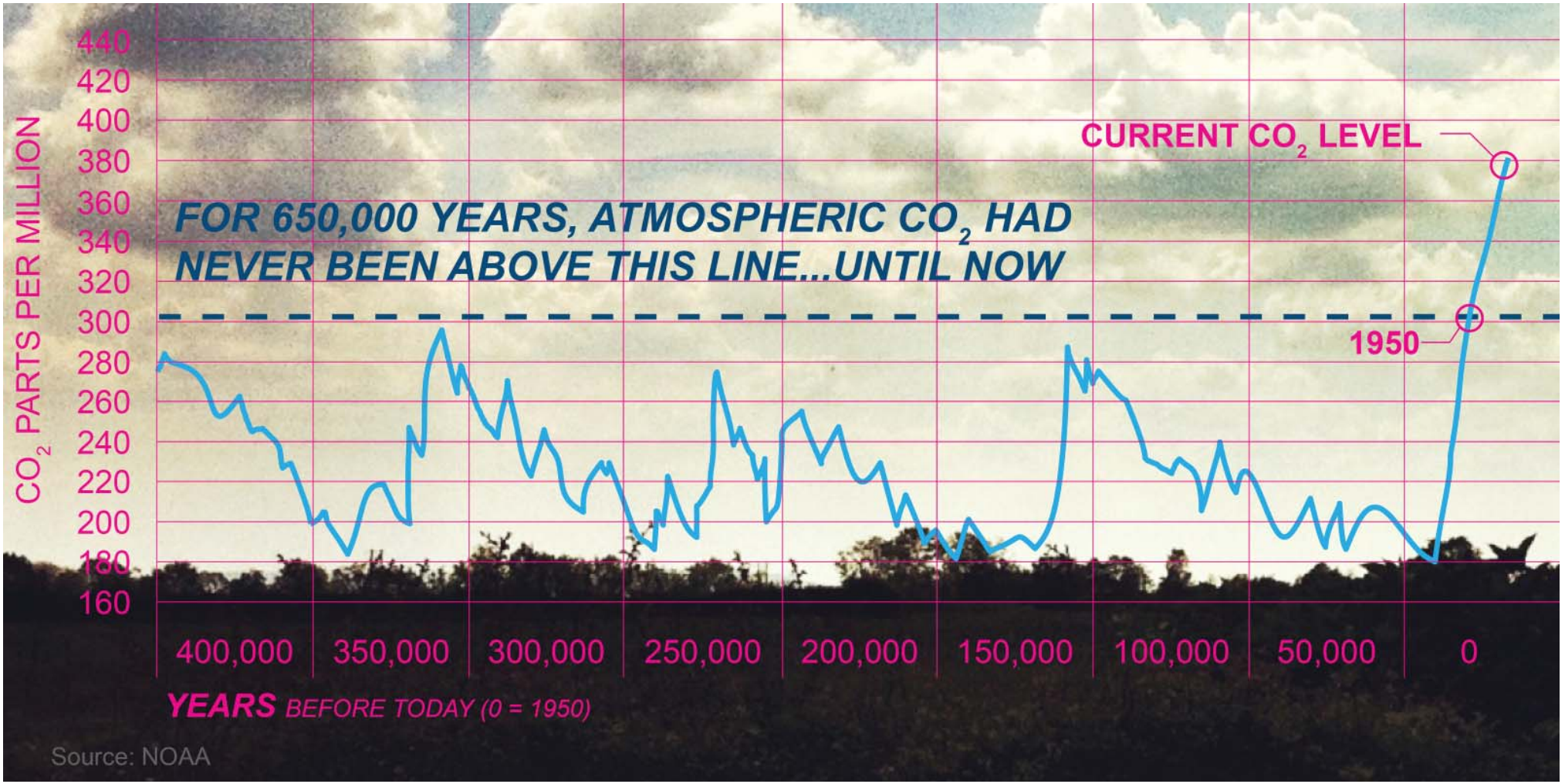


**Figure 1** – For 650,000 years, atmospheric $CO_2$ had never been above 300 PPM until about 1950. Atmospheric $CO_2$ levels continue to rise today.

**SOURCE** - National Oceanic and Atmospheric Administration

emitted by human activity in the U.S. The three main sources of methane emissions from human activity are industry, agriculture and landfills. Other sources of methane include coal mining, manure management and wastewater treatment.

Nitrous oxide is present in the atmosphere due to natural biological processes. The primary source of nitrous oxide due to human activity is agriculture/soil management practices. It is emitted through the use of synthetic fertilizers added to the soil. Other sources of nitrous oxide emissions include transportation through the combustion of fuel by motor vehicles and industry/chemical production.

Fluorinated gases do not occur naturally in the atmosphere. The only source of these gases is from human activity. They are the most potent of the greenhouse gases and remain longer in the atmosphere compared to the other gases. Even small concentrations can greatly impact global temperatures. They are referred to as High Global Warming Potential gases because they can trap much greater amounts of heat than other gases. Fluorinated gases include hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride (SF6). HFCs are used as refrigerants, solvents and fire retardants. They were developed as substitutes for ozone depleting chemicals that have been restricted since 1987. Other sources of emissions include the production of aluminum and manufacture of semiconductors. PFCs are a byproduct of these industrial processes. SF6 is used in electrical transmission equipment, including circuit breakers.

## CLIMATE CHANGE IMPACTS IN PENNSYLVANIA

In 2008, the Commonwealth passed Act 70, the Pennsylvania Climate Change Act, which required the Pennsylvania Department of Environmental Protection (DEP) to develop an assessment report on the impacts of projected global climate change for Pennsylvania. The report, *Pennsylvania Climate Impact Assessment*, sponsored by DEP, was released in 2009. The report identifies potential climate change impacts on water resources, forests, aquatic ecosystems and fisheries, agriculture, energy, and human health, among others, through the end of this century as shown in Figure 2. A brief description of the projected impacts excerpted from the report is provided below. A discussion on energy is provided in the LVPC Energy Element of the Comprehensive Plan.

**Water Resources** – Heavy precipitation events are projected to increase throughout the state. Temperature is expected to increase resulting in a significant decrease in snow cover extent and duration as shown in Figure 3. More precipitation will fall as rain rather than snow. Increasing temperature is likely to lead to increasing evapotranspiration. Overall, Pennsylvania is likely to see a small increase in runoff on the order of 5 to 10 percent. However, this increase will basically all be during the winter months while summer flows might actually be reduced. Stream temperature, an important water quality characteristic for aquatic ecosystems, is likely to increase. potentially causing problems for species that require cold water for at least part of their life cycle.

**Aquatic Ecosystems and Fisheries** – The most significant effects predicted for stream and wetland communities are increased water temperature and increased variability of the water environment. The latter may be reflected in changing seasonal patterns of water levels, reduced stream flows during dry periods, larger floods and longer droughts. Such changes in temperature, water quantity and water quality will most certainly affect stream and wetland biological communities, and the largest negative impact may be in lost biodiversity as shown in Figure 4. Pennsylvania may see a decline in some of the most valued coldwater communities and a simultaneous increase in the abundance of less desirable biological assemblages, especially invasive species. Of special concern is the impact of higher temperatures and altered flow regimes


**Figure 2** – In Pennsylvania, climate change is expected to have an impact on both the environment and society.

**SOURCE** - Pennsylvania Department of Environmental Protection

## Water Resources


**Figure 3** – Pennsylvania can expect to see warmer temperatures throughout the year, meaning less snow in the winter. Heavier rainfall events are expected with worse droughts occuring between rainfall events.

**SOURCE** - Pennsylvania Department of Environmental Protection

# Aquatic Ecosystems

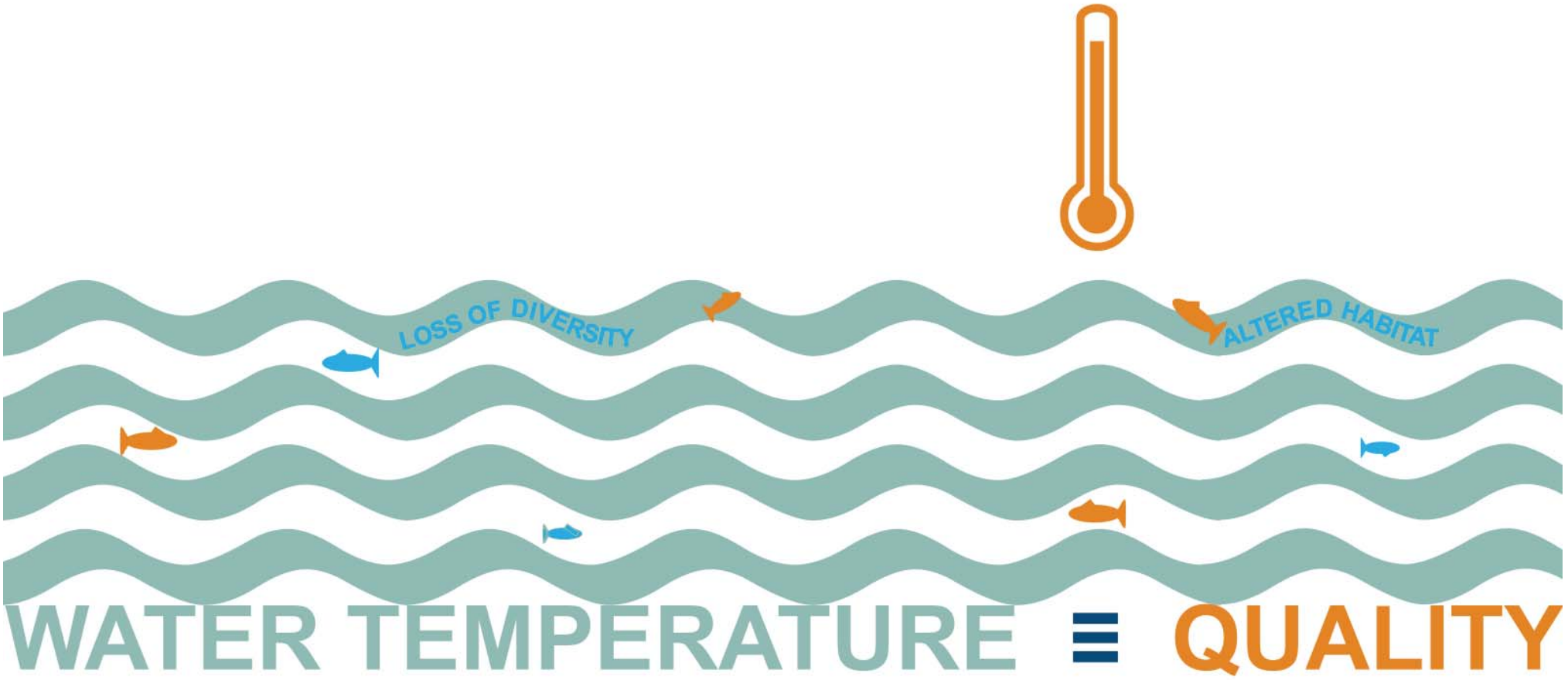


**Figure 4** – Stream temperatures will increase, resulting in unsuitable habitat for cold water species and lost biodiversity.

**SOURCE** - Pennsylvania Department of Environmental Protection

on Eastern Brook Trout, not only because of its status as a recreationally and culturally important species, but because it is an indicator of high water quality and may be an early victim of deleterious impacts of climate change.

**Forests** – The state will become increasingly unsuitable for many of the tree species that are now present, especially those generally associated with northern hardwood ecosystems. Northern species, such as paper birch, quaking aspen, bigtooth aspen and yellow birch, are projected to be greatly reduced, if not eliminated. The state is projected to become increasingly hospitable for more southern species, such as oaks and hickories, although the state's two most common oaks, northern red oak and chestnut oak, are projected to decline as shown in Figure 5.

**Agriculture** – Yields of cool temperature adapted fruits and vegetables, such as potatoes and apples, are likely to decline as a result of climate change, while yields of fruits and vegetables better suited to a warmer climate, such as sweet corn, are likely to rise as shown in Figure 6. Among Pennsylvania farmers, dairy producers may experience the greatest challenges from climate change given their reliance on own-crop production, animal heat stress due to housing in the ambient environment, and impacts to forage quality that will affect productivity.

**Human Health** – While most Pennsylvania residents will adapt to rising temperatures with installation and greater use of air conditioning, residents with limited resources will be unable to afford to install or operate air conditioning. Increased summer temperatures will result in increased formation of ground level ozone that has been shown to be related to higher incidence of respiratory disease and death as shown in Figure 7. Increased summer temperatures may also result in higher concentrations of particulates. Higher particulate concentrations have been shown to be related to higher incidence of respiratory and heart disease. Similarly, higher summer temperatures and higher $CO_2$ concentrations may result in higher concentrations of airborne allergens, such as mold spores and pollen. Increased precipitation will likely increase runoff that carries infectious pathogens so that the risk of water-borne disease will increase. With increased temperatures, water-based recreation is expected to increase, so that exposure to water-based disease would increase.

**Planning and Climate Change** – An additional source of information used in the development of the climate element was the American Planning Association (APA) *Policy Guide on Planning and Climate Change* (2011). The APA guide identifies a number of policy areas that should be considered when developing a policy framework for climate change as shown in Figure 8. For each policy area, there are a number of recommendations (120 total). These recommendations were compared to the existing goals, policies and implementation strategies within the current county comprehensive plan to determine recommended policy areas as shown in Figure 9.

Climate change can have far reaching effects, both positive and negative, on plant and animal ecosystems, biodiversity, and various aspects of society, including human health, where people can live, the types of crops that can be grown, and the economy. While uncertainties remain surrounding the magnitude of the impacts over time, scientists believe that humans can lessen their severity by implementing mitigation and adaptation measures now. Mitigation measures are those that result in a reduction of greenhouse gas emissions. Adaptation refers to planning for the changes that are expected to occur to reduce vulnerability as shown in Figure 10.

# Forests

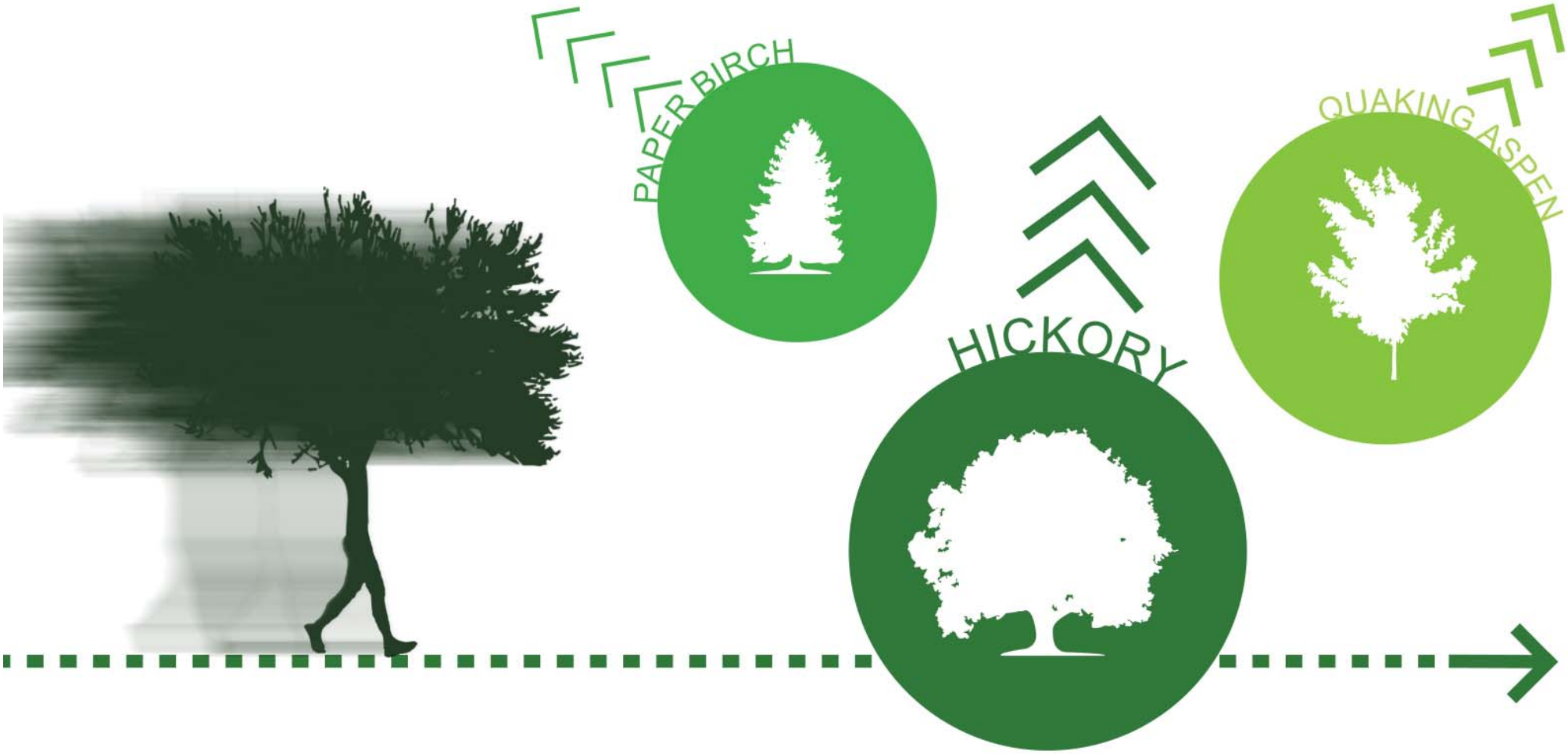


**Figure 5** – Warmer temperatures will result in the decline or loss of northern tree species. Northern species will be replaced by warmer climate tree species.

**SOURCE** - Pennsylvania Department of Environmental Protection

# Agriculture


**Figure 6** – Growth of crops requiring cool temperatures will decline while crops requiring warm temperatures will increase.

**SOURCE** - Pennsylvania Department of Environmental Protection

# Human Health

**Figure 7** – Increased temperatures will increase the formation of ground level ozone and small particulates resulting in higher incidences of respiratory problems.

**SOURCE** - Pennsylvania Department of Environmental Protection

## American Planning Association Climate Policy Ideas




**Figure 8** – American Planning Association recommended climate change policy areas.

## Distilled Information

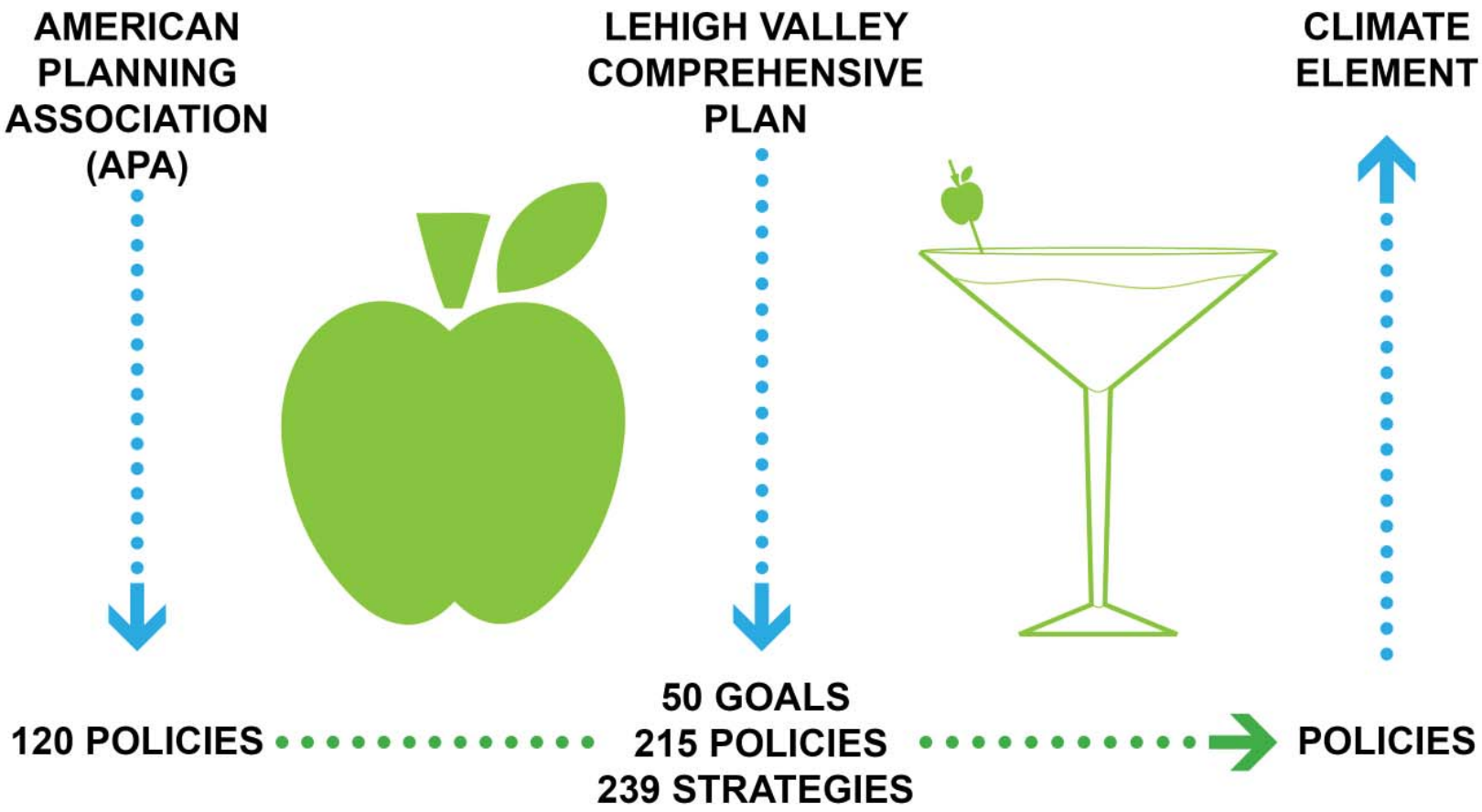


**Figure 9** – APA recommended policy areas distilled through existing county comprehensive plan goals, policies, and strategies to create the climate element.

## Summary


**Figure 10**

## CLIMATE GOAL 1: To protect, conserve and enhance natural ecosystems to provide long-term resilience to climate change.

**Policies**

- Protect, conserve and enhance the region's most important natural resource areas, consistent with up-to-date mapping and analysis, to ensure appropriate long-term conservation priorities.
- Protect, conserve and enhance woodland resources, especially near rivers, streams and wetlands, to sequester carbon, maintain hydrology, minimize nutrient enrichment and mitigate heat impacts.
- Mitigate or adapt to climate change impacts to water resources including surface and ground waters used for potable water supply, recreation, power generation, agriculture, commercial and industrial uses and other uses.
- Encourage riparian buffers that contain a variety of native trees and plants. Discourage the development of riparian buffers with monocultures of exotic vegetation.

**Implementation**

- LVPC will maintain up-to-date mapping of important natural resource areas and recommended conservation priorities as part of updates to the Comprehensive Plan.
- LVPC will prepare recommendations for management of woodlands to mitigate/adapt to climate change especially dealing with timber harvesting practices to minimize poor harvesting techniques like high grading (taking the largest and most valuable trees only) and diameter limit cutting (removing trees over a certain diameter regardless of condition, species, etc.). Preventing forest loss and maintaining a high degree of biodiversity would be key priorities.
- Pennsylvania DEP and the Delaware River Basin Commission (DRBC), among others, should provide technical guidance regarding likely impacts of climate change on water resources in the Delaware River basin.
- LVPC will prepare a mitigation/adaptation strategy for water resources as part of the Plan for the Reliable Supply for Water included in an update of the Regional Comprehensive Plan. Such a strategy will consider possible impacts to water resources related to groundwater and soil moisture droughts, warming and other water quality impacts on surface waters and impacts on stormwater runoff.

## CLIMATE GOAL 2: To protect public infrastructure from potentially harmful impacts associated with climate change.

### Policies

- For existing infrastructure, mitigate possible increased flood risk for water supply, sewage disposal, stormwater management and transportation infrastructure through design safety factors applied to normal replacement and rehabilitation programs.
- For new infrastructure, mitigate possible increased flood risk for water supply, sewage disposal, stormwater management and transportation infrastructure by incorporating location and safety factors in planning and design.
- Transportation infrastructure, both new and replacement/ rehabilitation, should be designed to withstand impacts of higher temperatures and other climate impacts beyond flood risk.
- For electricity, gas, communication and other utility infrastructure, mitigate possible increased risk of severe storms or other climate impacts on service.

### Implementation

- PennDOT, Lehigh and Northampton counties and local municipalities should consider possible increased flood risk in their maintenance and capital improvement programs for existing roadways and bridges and the planning and design of new roadways and bridges.
- Community water suppliers and public sewage facilities operators should consider possible increased flood risk in their maintenance and capital improvement programs for existing facilities and the planning and design of new facilities.
- Owners of stormwater management facilities should factor possible increased flood risk into the planning and design of new or remediated facilities.
- LVPC will consider possible increased flood risk on stormwater management planning and design practices as part of updated plans and ordinances under the Stormwater Management Act, Act 167 of 1978.
- DEP should incorporate climate change considerations into the Stormwater Best Management Practices manual.
- PennDOT, Lehigh and Northampton counties, and local municipalities should design and construct new or replacement/ rehabilitation transportation infrastructure to withstand impacts of higher temperatures and other climate impacts beyond flood risk.
- Electricity, gas, communication and other utility service providers should continue to evolve design and maintenance practices to mitigate impacts of severe storms or other climate impacts on service.

## CLIMATE GOAL 3: To protect residents, property and critical facilities from natural hazards as evolving over time due to climate change.

### Policies

- Mitigate or avoid increased risks to residents, property and critical facilities due to climate change regarding floods, lightning, heat, wildfires and other natural hazards and changes to air and water quality affecting public health.

### Implementation

- Lehigh and Northampton counties should routinely update the two-county Hazard Mitigation Plan, identify any increased risks and vulnerability due to climate change and prepare a recommended mitigation strategy for the counties and municipalities.
- Municipalities should participate in the two-county Hazard Mitigation Plan, identify a project or projects to better prepare the municipality to mitigate natural hazard risks and ensure that climate change considerations are considered in the planning and design of projects.
- FEMA, PEMA and the county emergency management agencies should educate municipalities and the public regarding both the potential increased risk of natural hazards associated with climate change and possible mitigation strategies and projects.

**CLIMATE GOAL 4: To create a land use pattern that helps to mitigate climate change impacts through a compact urban development area, mixed land uses, higher densities in urban areas and through preserving land for agricultural and environmental purposes.**

## Policies

- Provide a compact urban development area with higher densities served by community water supply, public sewage disposal, public transit and high capacity transportation infrastructure.
- Provide a land use pattern that mixes land uses so the jobs, services, schools, shopping and other destinations are near residents' homes and neighborhoods.
- Provide higher density, mixed-use development centers near transit stops and stations.
- Provide jobs and appropriately priced housing located close to one another so people at all income levels can live near their places of work.
- Provide for preservation of agricultural land use and environmental protection in non-urban areas.
- Provide zoning and development standards that promote a more compact urban form through mixed-use developments, transit-oriented design and greater development density.
- Ensure that schools and public facilities are accessible by walking, biking or transit.
- Ensure that agricultural lands are operated to optimize organic matter and enhance productivity.
- Provide for local use of locally grown foods and agricultural products.

## Implementation

- LVPC will maintain and update a General Land Use Plan for the Lehigh Valley as part of the Regional Comprehensive Plan that identifies areas recommended for urban development, agriculture and environmental protection.
- LVPC will consider further specific land use policy to mitigate climate change impacts in updates to the Regional Comprehensive Plan.
- LVPC will create or update guides and model regulations on various techniques such as mixed-use development and street connectivity to implement the goals and policies in the Regional Comprehensive Plan. LVPC will promote guides and regulations to municipalities and the public through website, social media, newsletter and other means.
- Municipalities should create comprehensive plans and zoning ordinances that are consistent with the LVPC Regional Comprehensive Plan and General Land Use Plan.
- Municipalities should implement zoning and development standards that promote a more compact urban form through mixed-use developments, transit-oriented design and greater development density in areas recommended for urban development.
- LVPC will provide recommendations to municipalities to implement the above goal and policies in review of comprehensive plans and zoning ordinances.
- Local grocers should have a priority for locally grown food and other agricultural products.
- Farmers markets should be maintained or established to provide ample opportunities for local use of locally grown foods and agricultural products.
- Farmers should implement conservation tillage and Best Management Practices (BMPs) for $CO_2$ and other greenhouse gas sequestration and management.
- Farm support agencies should continue to engage farmers on the impacts of climate change on agricultural production.

## CLIMATE GOAL 5: To provide building and site design practices that help to mitigate climate change impacts.

### Policies

- Support the development and application of green building standards, especially for public facilities, that provide for energy efficiency, water conservation, minimized impervious cover, stormwater capture and re-use, and use of native plant landscaping.
- Support the design of communities, neighborhoods and individual developments to minimize heat absorption.
- Support the use of green technologies where feasible (e.g. green roofs to minimize heat island effects and solar arrays as an alternative energy source).

### Implementation

- LVPC will prepare model regulations regarding green building, development and redevelopment practices, including native plant landscaping. LVPC will promote regulations to municipalities and the public through website, social media, newsletter and other means.
- Municipalities should incorporate green building and development requirements in subdivision and zoning regulations.

## CLIMATE GOAL 6: To reduce Lehigh Valley greenhouse gas emissions from residences, government operations and businesses.

### Policies

- Lehigh Valley residences, government operations and businesses should responsibly reduce greenhouse gas emissions based on practical methods identified in a comprehensive inventory and reduction strategy, including periodic monitoring progress.

### Implementation

- LVPC will prepare and maintain an inventory of practical strategies for individuals to reduce greenhouse gas emissions, such as purchasing Energy Star products, insulating the home, renewable energy options and providing regular vehicle maintenance and make the information available to the public.
- LVPC will prepare a greenhouse gas emissions inventory and emissions reduction strategy in consultation with county and local government officials, business officials and the general public.
- LVPC will conduct an education and outreach program regarding climate change impacts and greenhouse gas emission reductions based on the strategy created.
- LVPC will support workable federal and state policies, laws or regulations to mitigate impacts of climate change.

# ENERGY

## FUNDAMENTALS OF ENERGY

From the first cement and steel kilns to heating the modern home (heating oil, electricity, and natural gas heat up to 96% of all homes in the Lehigh Valley), to the nearly 5 billion vehicle miles traveled by Lehigh Valley automobiles in 2012, affordable and reliable energy sources have always been counted upon to sustain our needs, population growth and economy. It is important to consider where we get our energy from and how we use it in a region that is expected to grow significantly over the next 30 years.

No doubt energy is a complicated topic. It's useful, powerful, valuable and impacts decision making, from the kitchen table to the farthest reaches of the globe. It is equal parts resource and product. It's constantly evolving, affected by a changing and broad range of technological advancements, as well as regulatory, market and environmental factors. It's controversial, with questions about how we obtain it, use it, and how much of it we have left, particularly in terms of its cheapest and most productive sources. The price of energy depends on those factors and often affects how we consume it. Our most productive energy sources severely pollute the environment and our cleanest energies have yet to meet our energy needs.

The future residents of the Lehigh Valley will probably consume less energy than we do today, partly out of an expectation that the cost of energy will continue to rise—which will impact our decisions on how we use energy—but also through continued technological innovation. It has been a constant in energy efficiency. We have evolved from the open pit fire to modern heat pumps to heat spaces, wet mud to spray foam to insulate spaces, gas lamps to LEDs to light the way. The Model T, as seen in Figure 11, considered America's "first" car, got 25 miles to the gallon, but it had a maximum speed of 40 mph, had no safety features or pollution controls and was half the weight and size of today's 2,500 lb. engine/motor hybrid of 2014, which can get 100 miles per gallon and a maximum speed of over 100 mph. Although alternatively fueled and "hybrid" vehicles only make up 3.2% of all vehicles on the road today, by 2025 many analysts anticipate that 36% of all vehicles globally will be alternatively fueled, using energy sources such as electrical batteries, natural gas or hydrogen fuel cells.

A fundamental physical law relative to energy is the First Law of Thermodynamics, which states that energy cannot be created or destroyed. We can't "make" energy. The amount of energy on Earth is constant. It is only possible to extract energy from objects that already contain a finite amount of it. We can't manufacture coal or oil. We can use the heat from naturally occurring radioactive materials to generate steam, but those materials already exist in limited supply. The only significant external input of energy into the Earth's otherwise closed system is the energy from the sun.

It also takes energy to get energy. In fact, it takes increasing amounts of energy to get all the new energy sources out of the ground, ready to use and delivered to where it needs to be. The supply and cost of energy is directly related to the ratio of energy returned on energy invested. Further, energy reserves are not as important as how fast we can get to them. Ultimately, a region could have billions of cubic feet of natural gas underground, but all that matters is how quickly and inexpensively we can get the natural gas out of the ground and to a power plant.

Pennsylvania is confronting three critical considerations in regards to extracting and using energy: the retirement of coal-fired electricity generation plants; the state's aging nuclear power plants; and durability of the power grid that carries the electricity. According to the 2014 Pennsylvania State Energy Plan, the state has 211 major electric generation facilities. Nearly 40% of all electricity comes from the burning of coal, and over 75% of coal mined in Pennsylvania is used to

# Fundamentals of Energy Consumption

LVPC
2014 Climate + Energy Element

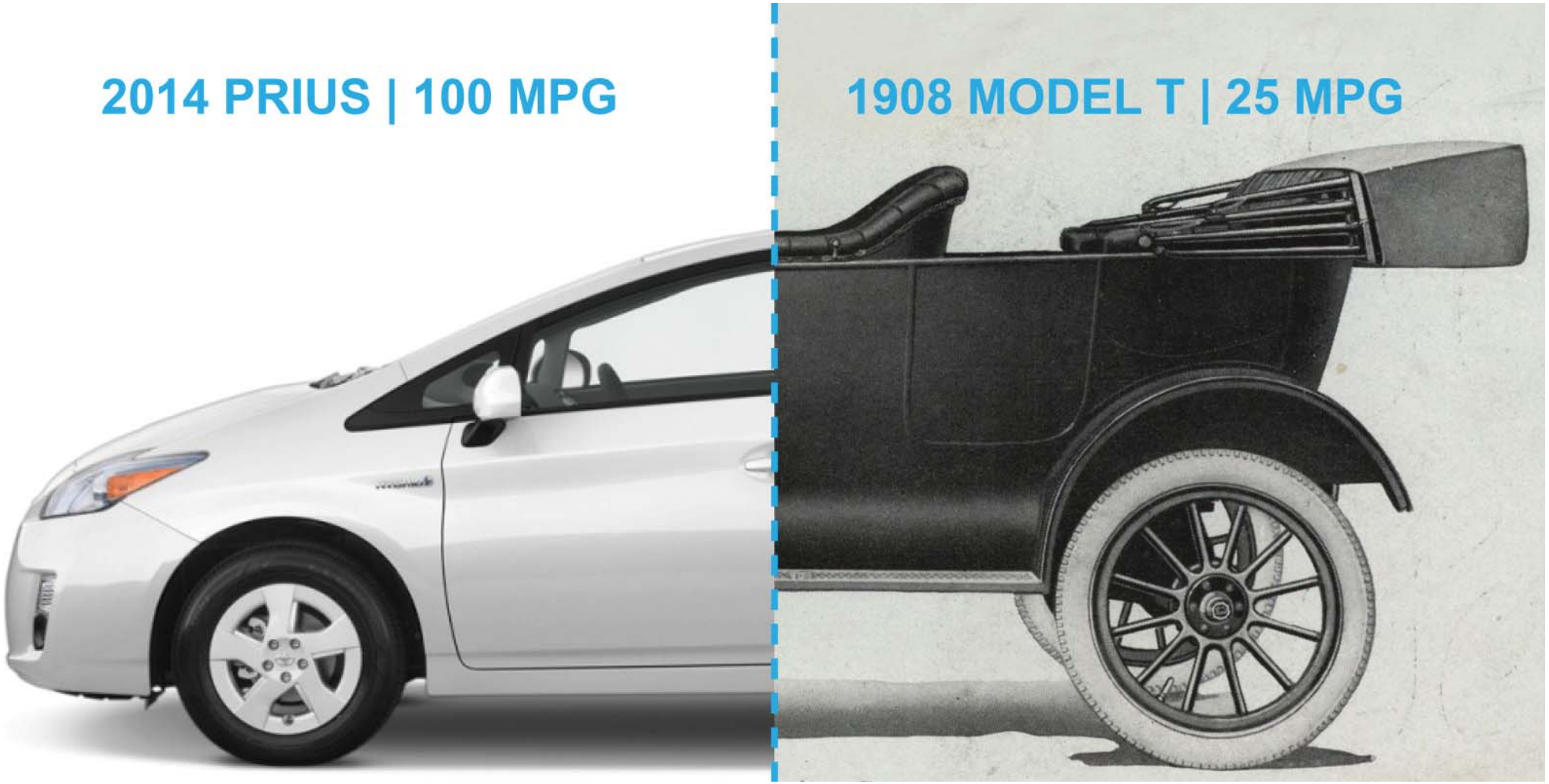


**Figure 11** - Despite lacking safety features, emission controls and weighing half of most modern cars, Henry Ford's Model T still only managed 40 mph maximum at only a quarter of the fuel efficiency of the modern Toyota Prius. Nonetheless, hybrids such as the Prius only comprise about 3% of the vehicles on the road today.

**SOURCE** - United States Department of Energy Alternative Fuels Data Center, "Alternative Vehicles in Use", January 2014

generate electricity. For decades, Pennsylvania's many power plants would generate all the power needed by its residents, businesses and industries. While it remains a net exporter of energy to the nation, since 2007 Pennsylvania has imported electricity during times of peak demand, due to the combination of extreme weather events, the pipeline restrictions of natural gas and closure of electricity generation plants in the state and in the region seen in Figure 12. During heat waves or prolonged periods of very cold winter days where energy consumption is high, electricity will be imported into the state to help meet daily and peak demand and increase reserve.

Under normal conditions, the state remains a critical exporter of energy; however, occasional shortages have been a reality for much of the last decade. By 2015, continued plant retirements will reduce electrical generation capacity by 4,820 MW. It is important to note that in Pennsylvania, coal-fired power plants provide the additional "peak load" capacity needed on the coldest and hottest days. But an increasing number of those plants are falling under Environmental Protection Agency scrutiny, due to unacceptable emissions levels—like the one in the northeast corner of the Lehigh Valley that shut down its two coal-fired units in early June, visible in the Figure 12 photo. Proposals to switch the operation to ultra-low sulfur diesel are still pending, eliciting considerable skepticism from environmentalists. As those coal-fired plants continue to close, other energy sources such as natural gas will need to fill that gap or additional imports of electricity will be required to support times of peak energy usage. Unlike coal which can be stored on site in a "just in case" scenario, natural gas is considered "just in time" and piped directly to the plant via pipeline. Natural gas, while plentiful in Pennsylvania, is limited by a shortage of natural gas pipeline capacity. Bottlenecks can occur, as they did during the winter of 2013/2014, leading to rapidly increasing prices. In turn, electricity prices also rose dramatically. Thus, the successful pursuit of an alternative to coal simply elicited a host of affordability concerns for Pennsylvania households.

Nuclear energy, while indisputably cleaner than coal, brings with it a variety of its own potential hazards. Pennsylvania can claim the nation's first nuclear power plant outside Shippingport in 1957. Today, the state's five nuclear power plants generate 35% of the state's electricity, ranking second in the nation in electricity generation by nuclear power. Unfortunately, these power plants are aging, expensive to repair, difficult to build and the issues regarding the long-term processing and security of spent nuclear fuel remain challenging. Nationally, nuclear energy ranks in the middle, age-wise, when compared to both renewable and fossil fuel sources. Nearly 51% of all generating capacity in the United States was built before 1980. Most coal-fired capacity is 40 years or older, with gas-fired capacity at less than 20 years old, and most wind generation capacity is less than 10 years old. Over 95% of the nation's hydropower facilities were built more than 90 years ago. Nearly half of all nuclear reactors are over 30 years old.

The power grid—the means of transporting energy from one place to another—is as important as energy production itself. A complex system of interconnected power plants, substations and transmission lines that generates, transmits and distributes energy, the grid is generally strong enough to meet everyday needs. Older lines and transformers are more susceptible to failure as they are above ground and exposed to the elements, and they carry electricity less efficiently as they age. Periods of extreme heat or cold drive extraordinary levels of consumption and put enormous physical demands on the aging power grid. Renewable energy can also put pressure on the grid by unpredictably sending vast amounts of "extra" energy into a system not designed with capacity to accommodate it. This networks endures maintenance issues related to its age. Nationally, 70% of transmission lines and transformers are at least 25 years old, and 60% of circuit breakers are at least 30 years old. Regionally, some of the grid infrastructure dates to the 1920s.

# Aging Infrastructure / Hazard Vulnerability





**Figure 12** - The NRG Plant in Portland (left), in northeast Northampton County, shut down its coal-fired boilers on June 1, 2014 after settling a lawsuit with New Jersey and Connecticut that alleged non-compliance with the Federal Clean Air Act. The aftermath of Superstorm Sandy in October 2012 (right) left a good portion of the region without power for days.

**SOURCE** - Sheehan, Jennifer. "Bulk of Portland Generating Station to Close by June 1", The Morning Call, April 8, 2014, http://articles.mcall.com/2014-04-08/business/mc-portland-power-plant-20140408_1_portland-generating-station-david-gaier-nrg-energy

Several recent storms, from Tropical Storm Irene and the Halloween Nor'easter of 2011 to Superstorm Sandy in October 2012, led to extended power outages regionally. The outages prompted calls for improvements in storm outage response and pointed out the need to better protect the grid from storm damage. For several years, local utility companies have been implementing long-term modernization programs. Modernizing the electric power grid requires significant investment in new infrastructure. The cost estimates for modernizing the national grid range from $340 billion to $850 billion by 2030. Regardless of the exact costs, determining how those costs will be shared by the private and public sectors and recovered from customers remains a challenge.

## THE TWO-PART CHALLENGE

The amount of energy available to us is strictly constrained while the demand grows, resulting in price increases even as extraction becomes more cost efficient, seen in Figure 13. The challenge of planning for energy as a commodity involves 1) figuring out how to most efficiently use finite resources to fuel and support an infinite number of functions and uses in a region with both growing population and economy, and 2) determining how to reliably, adequately and safely access and use energy from different sources.

### Efficient Use of Resources

The Lehigh Valley is home to the global headquarters of PPL Electric Utilities and Air Products. The region has numerous nonrenewable and renewable electric generation facilities powered by oil, coal, gas, solar and biomass fuel sources seen in Figure 14. In addition to the first commercial nuclear plant in the country, Pennsylvania was home to the first commercial oil well drilled in the country in 1859 and is one of the few states that mine anthracite coal, which has a higher heat value than other kinds of coal. For many years in the 1800s, Pennsylvania led the nation in timber production. Today, according to the U.S. Department of Energy, Pennsylvania is a crucial provider of energy to the nation. Pennsylvania is part of the Eastern Interconnection of the national grid and included in the PJM Interconnection, which operates a regional power grid and wholesale electric market over 14 states. The North American electricity grid, as it extends to both Canada and Mexico, is the world's largest and most complex system of power generation, transmission, and distribution.

The evolution of the types and uses of energy can change quickly. Note the changes in consumption by sector as seen in Figure 15. While the amount of energy used for industrial consumption decreased over 40 years, electricity generation consumption doubled between 1970 and 1990. Electricity generation in Pennsylvania has shifted away from dependency on coal over the years, going from 77.9% coal in 1970 to 49.4% in 2010, as nuclear power and natural gas emerged as viable energy sources. In the Lehigh Valley, six rubrics can help us understand how we use energy:

**More people, more energy demand.** Today, the average Pennsylvania resident uses 837 killowatt hours of electricity and 75 gallons of gasoline per month. Regionally, consumers of energy will increase by 226,722 people from 2010 to 2040. This is an increase of 35% over three decades. This projected increase in population represents faster growth than experienced over the previous three decades (1980-2010), which was 30%. Lehigh County's population is projected to increase by 120,478 people from 2010 to 2040, averaging 11.5% per decade. In comparison, the population grew at a rate of 9.4% per decade over the previous 30 years. Northampton County's population will increase by 106,244 people from 2010 to 2040, 11.9% per decade. In comparison, the population grew at a rate of 10.7% per decade over the previous 30 years.

**How we heat our homes.** In 1990, heating oil was the primary fuel. By 2010, however, natural gas and electricity were the primary fuel sources,

# Energy as a Commodity

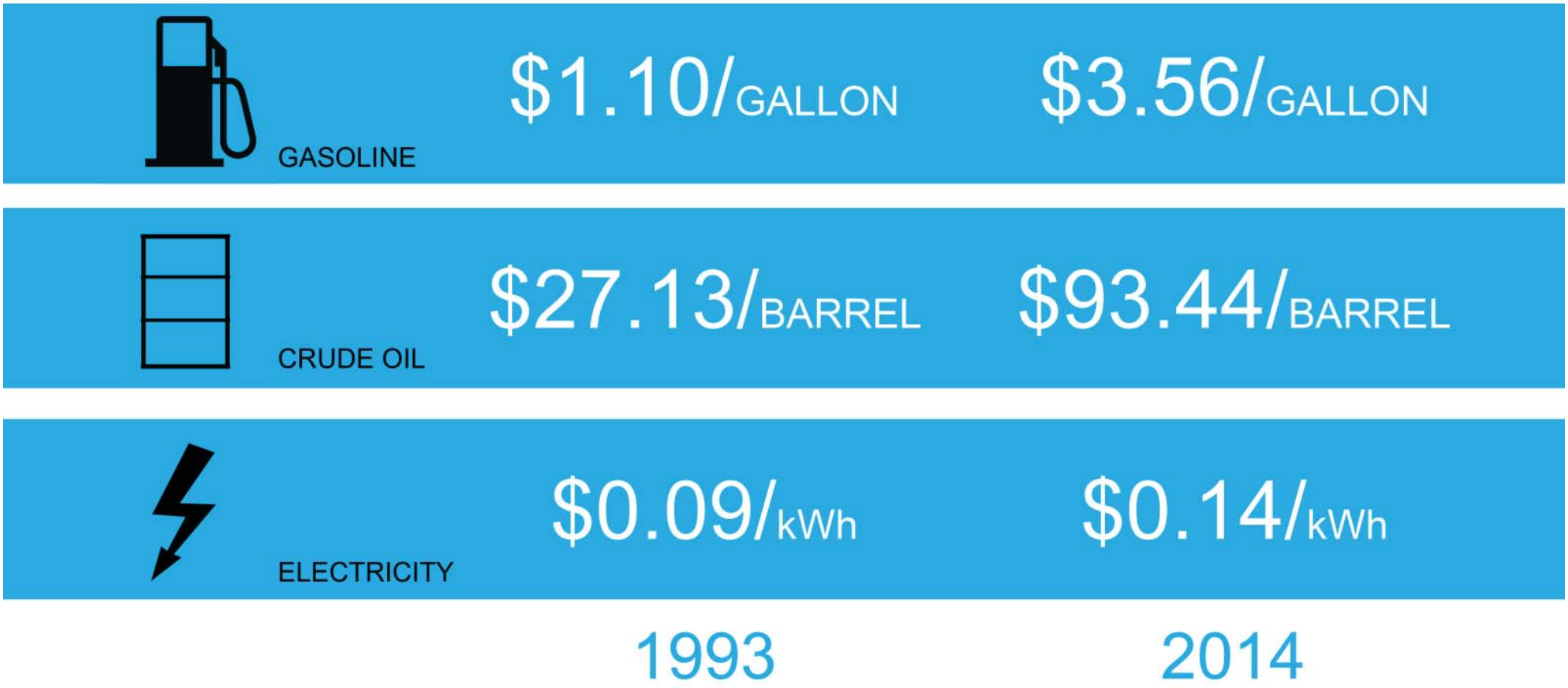


**Figure 13** - A primary goal through increasing energy efficiency is to find new ways to lower per unit costs. But increasing global demand for finite resources has pushed prices upward for some of the most common energy sources.

**SOURCE** - Inflation Data.com, Historical Crude Oil Prices http://www.inflationdata.com/inflation/Inflation_Rate/Historical_Oil_Prices_Table.asp, 03/06/2014) and Lehigh Valley Energy Profile, February 2014

# PA Energy Production Profile



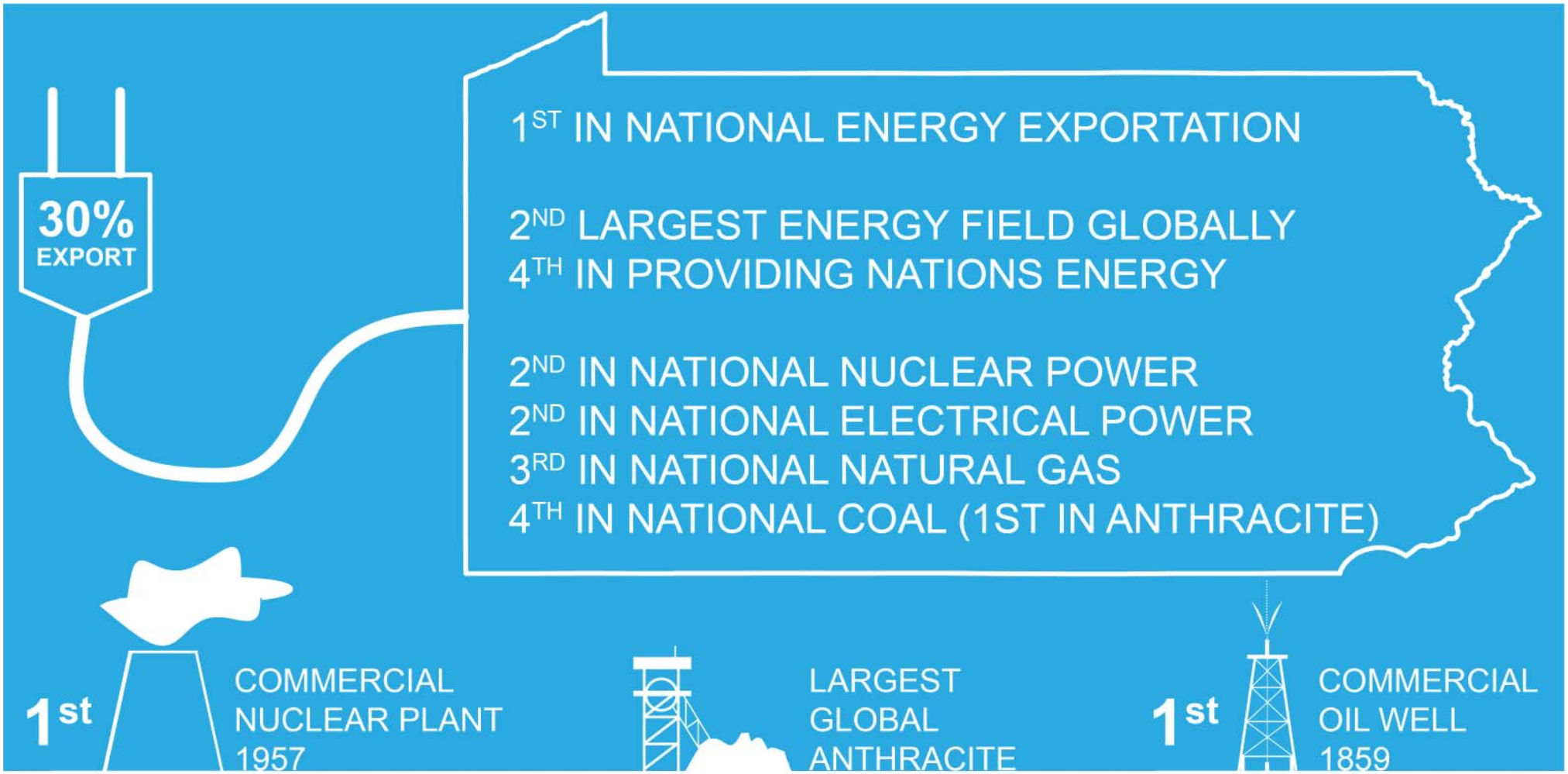


**Figure 14** - Pennysylvania has long been an energy pioneer and to this day remains a leader in providing energy across a variety of sources. While it generally boasts a strong net export rate, since 2007 the state has, during peak usage period, been forced to import energy from other jurisdictions to handle the demand.

**SOURCE** - Pennsylvania State Energy Plan, January 2014

# PA Energy Consumption

2014 Climate + Energy Element

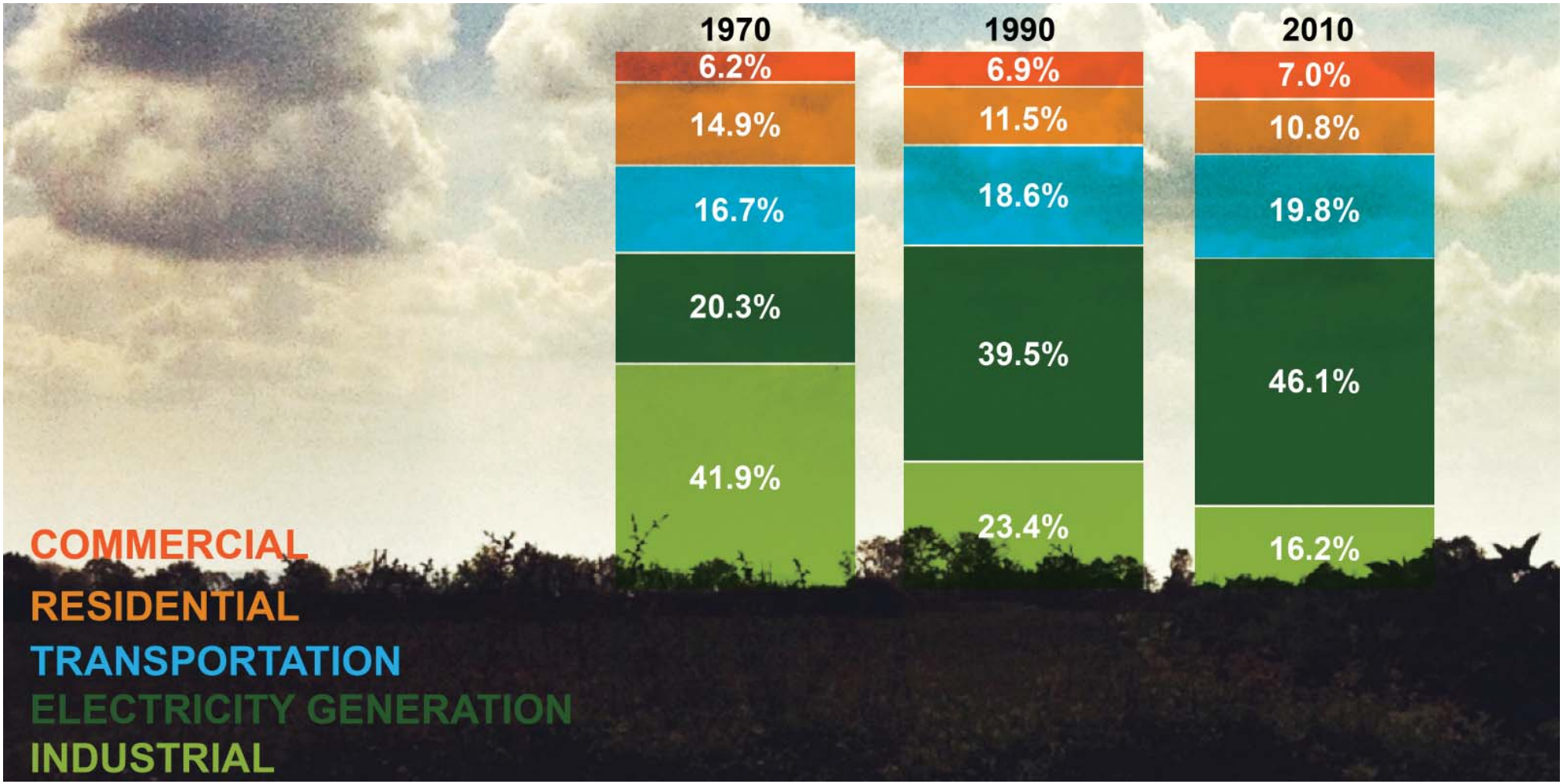


**Figure 15** - As manufacturing has declined and more households embrace electric for heating or cooling their homes, the percentage of energy in Pennsylvania used for electricity generation has more than doubled in the last 40 years.

**SOURCES** - Energy Information Administration; Pennsylvania Governors Energy Council, “An Energy Plan for Pennsylvania”, May 1980; Pennsylvania State Energy Plan, January 2014

seen in Figure 16. The move away from heating oil is due in part to new construction using other fuel sources, and also a large number of households have replaced their oil burners with heat pumps or furnaces using another fuel.

**The age of our housing stock.** Nearly 44% of the owner-occupied housing stock in the Lehigh Valley is over 50 years old. In the cities, the stock is especially old, ranging from 72.7% over 50 years old in Bethlehem to 84.4% in Easton. While old housing stock is not necessarily energy inefficient, as it may have been upgraded over time, these metrics show that the majority of local housing stock was built before the advent of modern building and energy codes in the 1980s and 1990s.

**Our driving.** Our automobile use, and thereby our energy consumption for transportation, has increased. In 1990, there were 3.4 billion annual vehicle miles traveled in the Lehigh Valley. In 2000, there were nearly 4.7 billion and in 2012, nearly 5 billion.

**Our land use pattern.** Inexpensive energy prompted intense population growth and a low density, land intensive development pattern locally. The region added 72,706 housing units between 1980 and 2010, or an average of 2,423 per year. Between 1980 and 2010, 87% of the population growth in the Lehigh Valley was outside the cities of Allentown, Bethlehem and Easton. In 1964, 74% of the 466,357 acres in the Lehigh Valley was vacant, as seen in Figure 17. By 2010, vacant land had decreased to 48%. Land being converted to housing, commercial and industrial development has risen. In the 1970s, approximately three square miles of land were developed per year. By the mid-2000's, this had risen to 3.5 square miles per year.

**The cost of energy.** Previous Regional Comprehensive Plans had energy "elements". The last one appeared in the 1993 plan. The cost of energy resources has risen substantially since then.

**Diversification**

Energy efficiency is the use of any technology that requires less energy to carry out the same task. It can be measured by the difference between how much energy is used to provide the same level of performance, comfort or convenience by the same type of product, building or vehicle. An example of energy efficiency is a compact fluorescent light bulb, a hybrid automobile or construction of a building that has energy efficient windows, plumbing, heating and ventilation equipment.

Energy conservation is any activity or behavior where the outcome is the consumption of less energy. An example of energy conservation could be something simple as turning lights off when not in the room. When thinking about the built environment, orienting homes and buildings in a particular way can reduce the need to artificially heat and cool homes. Buildings can be designed and oriented to receive maximum winter sun for heat and using vegetation and topography to buffer against winter temperatures and wind.

Locally, energy conservation and efficiency have been topics of interest for both the public and private sector and residents alike. Many nonprofits, government entities and homeowners have taken advantage of rebate and incentive programs, have performed energy audits and have invested in energy efficient technologies. Around the Lehigh Valley, many buildings are now built to LEED (Leadership in Energy and Environmental Design) standards, and there are solar panel farms, landfill gas plants and electric cars on the roads. There are nonprofit agencies and active community groups passionate about the topic, particularly as communities and industries seek alternatives to energy sources that are less efficient or generate more negative externalities, usually in the form of polluting emissions.

# Lehigh Valley Heating by Fuel Type



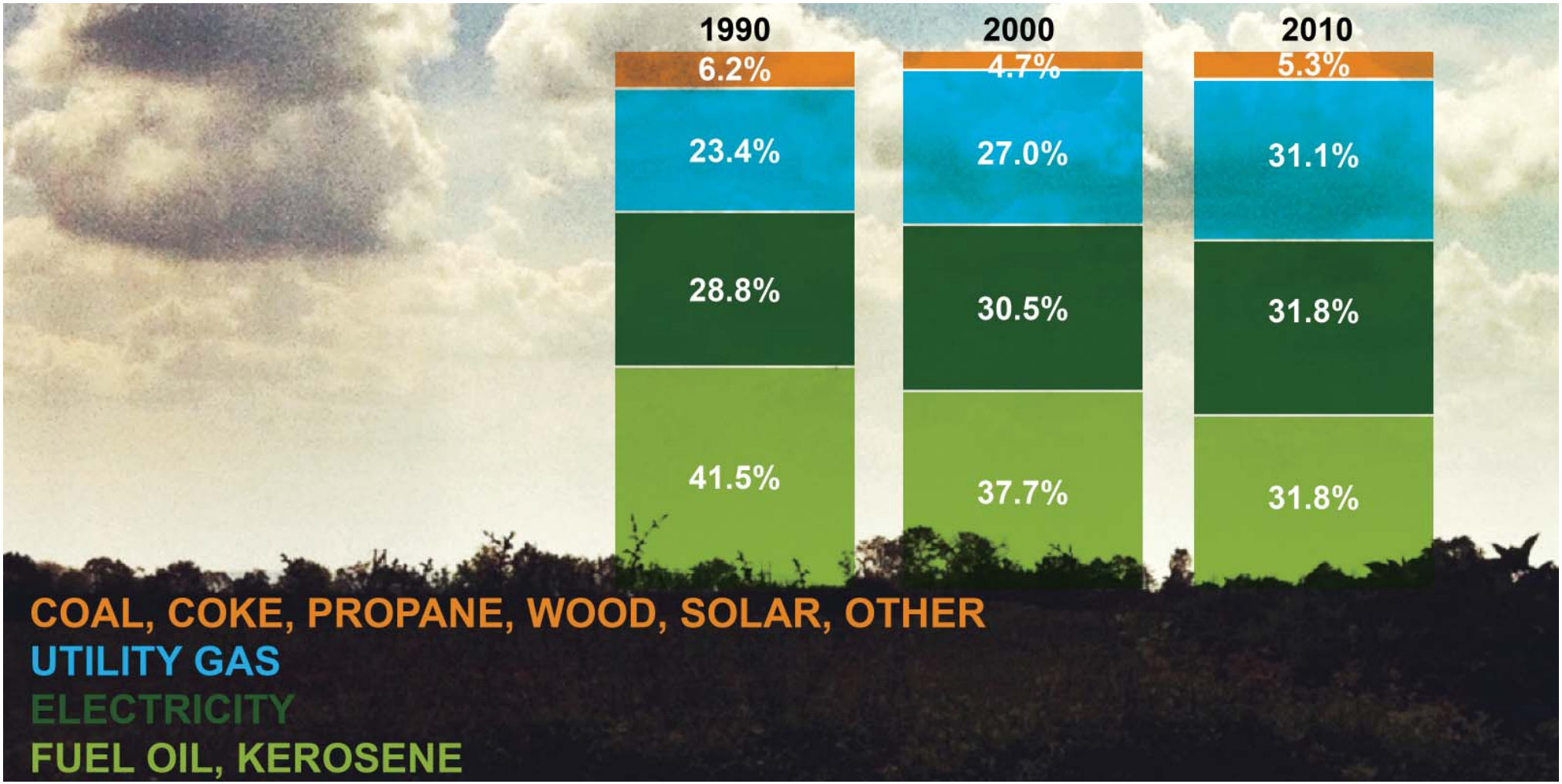


**Figure 16** - Heating oil was still the primary fuel in the Lehigh Valley as recently as 1990, but many households have replaced their oil burners with heat pumps.

**SOURCE** - Lehigh Valley Energy Profile, February 2014

# Land Use in the Lehigh Valley



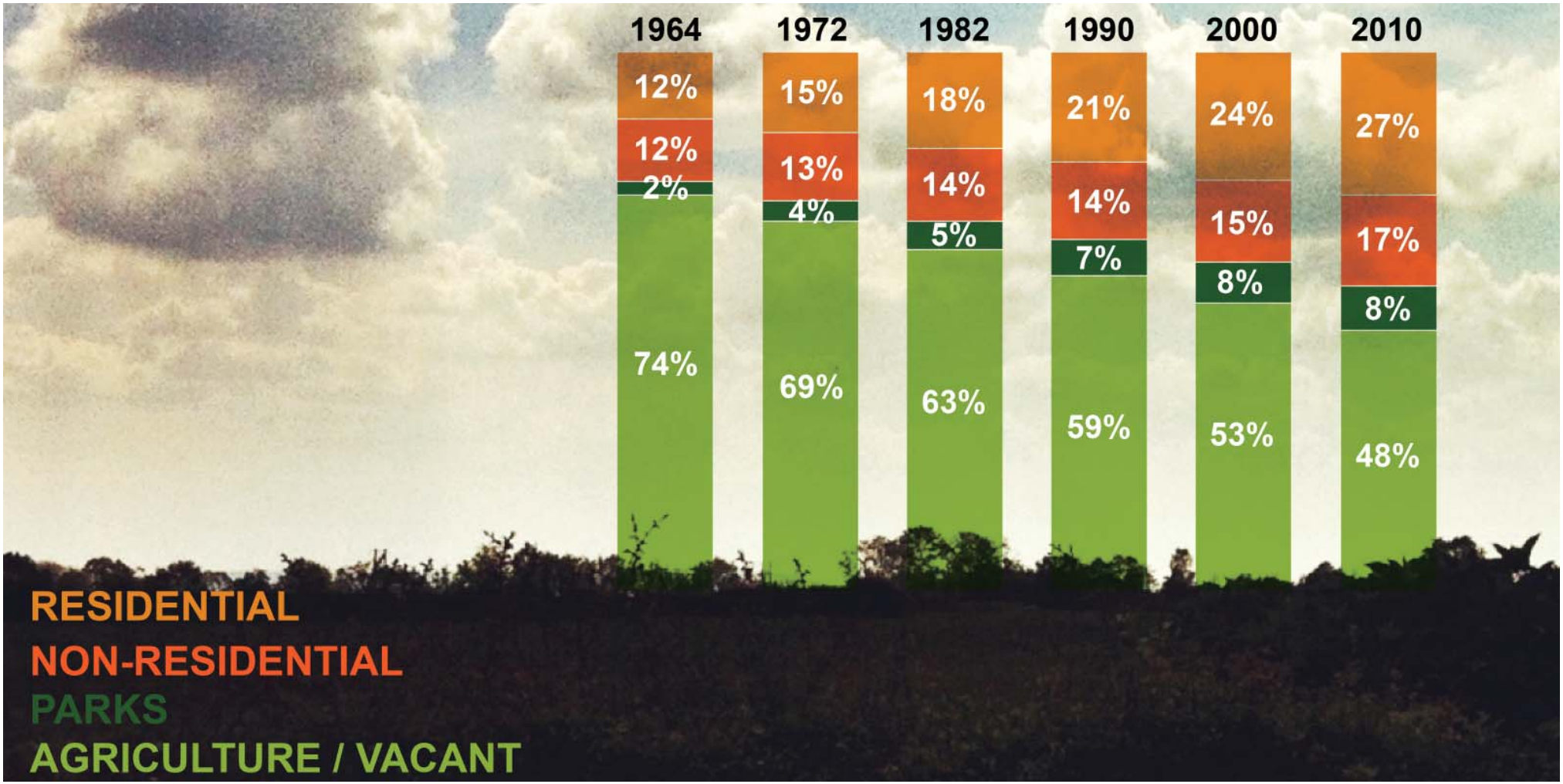


**Figure 17** - Low density development patterns, spawned in part by cheap energy and car fuel, have resulted in the amount of vacant or agricultural land in the Lehigh Valley diminishing from nearly three-quarters in 1964 to less than half by 2010.

**SOURCE** - Lehigh Valley Planning Commission

Energy sources can be classified into two types: nonrenewable and renewable. Nonrenewable resources, such as fossil fuels and nuclear material, are removed from the earth and used. Renewable resources, such as wind, water, solar, and geothermal, come from sources that regenerate as fast as they are consumed and are continuously available. Further complicating matters, all of these energy sources are not created equal. A heat calculator summarizes the cost of some common energy sources, how much energy is generated (BTU) and what you would pay for it. The differences in pricing and heating output between renewable and nonrenewable energies are obvious. For starters, while we purchase some fuels by the energy content of the fuel, we purchase others by volume or weight—and we use different units for different fuels. Heating oil, propane, and kerosene are sold by the gallon, natural gas by the hundred cubic feet (ccf) or therm (100,000 BTU's), firewood by the cord, wood pellets and coal by the ton, and electricity by the kilowatt-hour (kWh).

The amount of usable heat we get from a fuel also depends both on the efficiency of a given heating device and on how efficiently that heat is distributed to the conditioned space. The efficiency of combustion appliances varies widely, from a low of about 40% for older woodstoves to over 95% for a modern condensing gas furnace. Electric-resistance baseboard heaters are 100% efficient, while heat pumps, which use electricity to move heat from one place to another instead of converting the electricity directly into heat, range in efficiency from 200% to over 300%.

Pennsylvania has large reserves of nonrenewable fossil fuels, with substantial reserves of coal and natural gas. However, the consideration of the cost to the environment has led for the push for renewable, clean energy. In 2004, Pennsylvania's General Assembly enacted the Alternative Energy Portfolio Standards Act (AEPS), which requires that 18% of all energy generation comes from alternative and renewable sources by 2021. Of that, 8% must be derived from renewable energy sources with 10% derived from alternative energy sources. The legislation also created a $650 million Alternative Energy Investment Fund. The state has been aggressive in the commitment to renewables. By 2012, Pennsylvania had 6,600 solar PV systems and ranked 9th nationwide for total solar capacity. Over 600 wind turbines have been erected, generating 1,300 MW of energy. Further, the state has 17 hydroelectric plants and has capacity to manufacture 82 million gallons of biodiesel fuel annually.

Pennsylvania also completed a statewide Energy Plan in January 2014. The Plan can generally be considered an "all of the above and below" energy policy, utilizing the entire portfolio of energy resources available in the state, nonrenewable and renewable, with emphasis on reducing greenhouse gas emissions and making energy more affordable for consumers and businesses.

## COMPREHENSIVE PLAN ENERGY ELEMENT

### The Development of the Energy Element

The Lehigh Valley Planning Commission (LVPC) staffed an "Energy Center" at the Commission through the 1980s, through the State of Pennsylvania Governor's Energy Council, which included outreach on those topics along with energy conservation through energy efficient residential site design practices. Regional Comprehensive Plans had energy "elements" that included goals, policies and strategies to conserve energy on topics ranging from clustering and mixed-use development, to increased public transit ridership and weatherization. The last energy element appeared in the 1993 plan.

The LVPC is a partner in the Envision Lehigh Valley consortium that was awarded a Sustainable Communities Planning Grant in 2011. Part of

the LVPC's work under the grant was to create a new Energy Element that would once again be part of a future regional comprehensive plan as indicated in Figure 18. The Element isn't a comprehensive regional energy plan. Instead, it is a smaller scale supplement of goals, policies and strategies that will be incorporated into a future regional comprehensive plan.

The LVPC Environment Committee was tasked with developing the Element. The Committee, a cross-section of interested Lehigh Valley residents, met for approximately nine months on the Element. There were nine (9) meetings on the following dates: October 29, November 19, December 17, 2013 and January 28, February 25, March 25, April 22, May 27 and June 24, 2014. The Committee reviewed the 1993 Regional Comprehensive Plan Element on energy and prepared and completed the Lehigh Valley Energy Profile in February 2014, a 108-page compilation of historic national, state and regional energy pricing and consumption data, so that it could be used as background research and technical assistance in preparation of the Element. The Committee also participated in presentations on renewable energy from Dr. Dork Sahagian of Lehigh University and LEED/Green Building by Janet Milkman from the Delaware Valley Green Builders Council. The LVPC performed outreach in the community, meeting with regional groups, such as the Energy and Environment Committee of the Greater Lehigh Valley Chamber of Commerce, and local businesses, such as Air Products. On June 19, 2014, LVPC staff presented the draft goals to approximately 50 interested Lehigh Valley residents as part of a Climate/Energy forum at the Nurture Nature Center in Easton.

The Committee recognizes that many factors affecting the future of energy in the Lehigh Valley will extend beyond the control of local plans and initiatives. Some of those factors may favor the goals of the Element and some may not. The most critical factors are as follows:

1. Energy prices set by domestic and global markets for oil, natural gas, coal, and biomass fuels and installation costs for nuclear, solar and wind systems.

2. Decisions by utility companies servicing the Lehigh Valley regarding regulated pricing, energy sources and fuel mix. These decisions are often driven by market conditions and state and federal directives.

3. Federal energy policy affecting environmental regulations on fossil and nuclear sources, efficiency and renewable standards and subsidies for fuel sources.

# Distilled Information

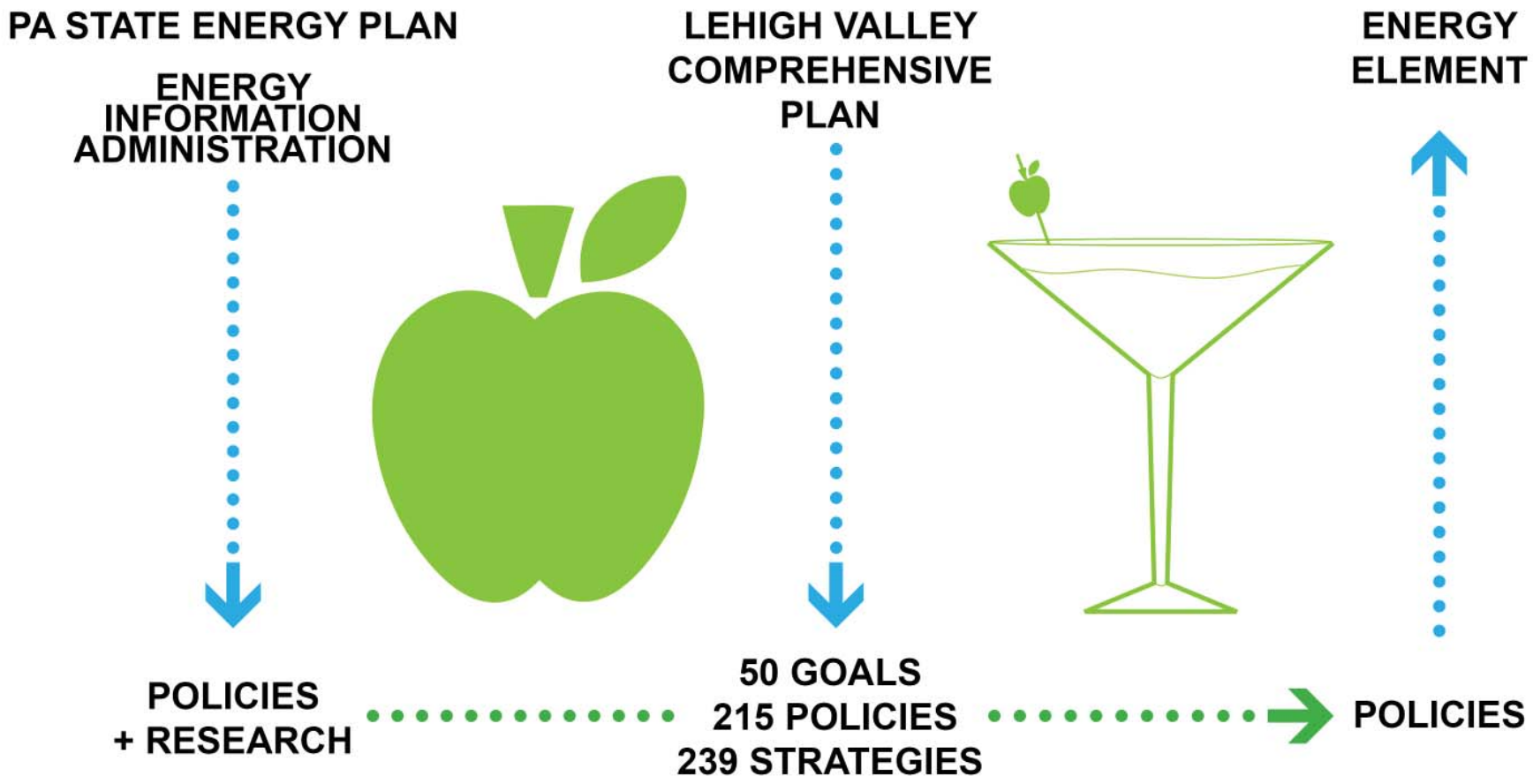


**Figure 18** - Like the Climate Element, the Energy Element pulls together a variety of sources, policies, and decades of research, distilling them into a final document that is succinct, readable and actionable.

## BACKGROUND + INTRODUCTION ON ENERGY

The Committee believes the Energy Element provides for a balance between a sustainable environment and a viable regional economy by promoting energy efficiency, conservation, production, and consumption of a reliable and efficient mix of energy sources that represent the fewest social, environmental, and economic costs and the greatest long-term benefits to the residents of the Lehigh Valley. Via the Element, the Committee envisions a future where access to reliable, diversified energy supplies and their use do not degrade the environmental quality of the Lehigh Valley. It recognizes the importance of renewable energy resources for the economy, the value in conservation efforts, and the significance of land use and transportation planning on energy consumption. Public transportation and a well-connected bicycle and pedestrian network are services that would benefit our municipalities. It recognizes that both the public and private sector can employ new energy efficient techniques and technologies, as well as encourage residents to take an interest in energy consumption and conservation.

It should be noted that the Committee has not presented all the possibilities for energy conservation and alternative energy sources, but has included activities and technologies considered most feasible and current as of the writing of the Element. There was no unanimity among the members of the Committee on the recommendations; two or three recommendations were the subject of spirited debate. The Element is not meant as a mandate to local government, but as a suggestion for the most feasible initiatives. The Committee recognizes that some items may take a long time to implement and other items may be workable in one municipality, but not in another. At this time, the Energy Element represents the strongest effort and brings a variety of considerations on the topics of energy efficiency and diversification of sources to the table in a way that should inspire a greater breadth of the Lehigh Valley's ever growing and changing population.

## ENERGY GOAL 1: To Promote energy efficiency and natural resource conservation within existing and new buildings and land development.

### Policies

- Encourage energy efficiency of all residential subdivisions and multifamily, commercial, and industrial projects through building codes, zoning and site planning design that incorporate Leadership in Energy and Environmental Design (LEED) or other accepted standards.
- Maximize the conservation of all forms of energy guided by proven economic and planning principles that manage land use and growth of urban development.
- Promote green infrastructure that relies on native plants and natural processes for stormwater management, irrigation, groundwater recharge and flood prevention.
- Improve operational efficiency and reduce energy waste through targeted retrofitting of older buildings.

### Implementation

- Developers should consider the physical characteristics of the site, including the climate, building shape, size, orientation and arrangement, and the native landscaping during the design process to reduce demands for artificial heating, cooling, and lighting.
- Municipalities should update subdivision and land development ordinances to promote street connectivity, efficient use of infrastructure, and low impact development, using the Pennsylvania Housing and Research Center (PHRC) Subdivision and Land Development Guidelines as a model.
- The LVPC will provide models of land development approaches that reduce infrastructure costs and energy use such as conservation subdivisions, low impact design, mixed-use development, traditional neighborhood development, transit-oriented development, street connectivity, and access management when consistent with the policies of this Plan.
- Provide examples and best practices to developers and other investors of targeted retrofitting of older buildings to improve efficiency and reduce energy waste.

## ENERGY GOAL 2: To encourage alternatives to automobile use, both motorized and non-motorized.

### Policies

- Promote a diverse array of energy efficient transportation options that maximize access of the Valley's population to key goods, services and centers of commerce, while helping to make the region an attainment area for ozone and particulate standards.
- Continue to promote walkable and bike-friendly neighborhoods through the design and construction of interconnected streets, sidewalks, bike sharing, mass transit and mixed-use developments.
- Encourage the use of alternative fuel vehicles (AFVs) and support development of the necessary infrastructure in areas recommended along regional transportation corridors in order to make AFVs viable transportation options.
- Encourage the upgrading of government, commercial and industrial fleet vehicles through the use of clean technologies, to reduce emissions and improve efficiency for trucks, locomotives and other fueled equipment.

### Implementation

- Collaborate with the counties and regional economic development partners to develop incentives for businesses to sponsor programs for public transportation, carpooling, ride sharing and alternative means of transportation over longer distances.
- Provide municipalities with the necessary planning to expand the path/trail network in ways that improve pedestrian, bicycle and disabled access to important activity centers, such as schools, libraries, parks, housing, LANta bus stops, workplaces and shopping areas.
- When reviewing land development plans that anticipate high concentrations of diesel vehicles, LVPC will recommend and support the use of auto-idlers and other efficient technology to reduce emissions and the waste of fuel, while helping to educate and address vehicle idling concerns through appropriate site planning strategies and informational signage.
- Regional economic development agencies, planning partners and municipalities should work cooperatively to reduce both outbound and inbound commuting through planning strategies that encourage job retention, local-first hiring practices, the growth of local employment nodes and the provision of adequate housing supply for that local employment.
- Provide technical assistance in the planning of electric charging and alternative fueling infrastructure along regional transportation corridors.

## ENERGY GOAL 3: To support the diversification of energy sources.

### Policies

- Encourage efficient systems such as solar arrays or biofuel pastures that help diversify the region's energy consumption while lowering both cost and carbon emissions.
- Support the retrofitting of existing coal-fired electricity generating plants and facilities that use clean coal technology, if other reasonable alternatives are not available.
- Support efficient, renewable low emissions energy sources and production techniques that reduce impacts to the environment.
- Advocate for the region to prioritize attracting investment that develops and implements the goals of this Element, such as renewable energy development, alternative fuel technology and energy efficient improvements, processes and development.

### Implementation

- In carrying out its planning review responsibilities, the LVPC will comment on the siting and appropriateness of both renewable and nonrenewable energy systems, plants and facilities using the policies of this Plan. Plants and facilities that generate and distribute energy across a region are classified as land uses of regional significance and should be located in areas recommended for urban development by this Plan.
- LVPC will support maximizing transmission capacity of existing corridors and increasing the capacity of existing transmission lines through higher intensity zoning abutting these corridors. New corridors and lines should only be proposed if it has been sufficiently demonstrated no feasible alternatives exist.
- Partner with utility providers and hazard mitigation experts to offer requisite technical assistance that will modernize and improve the security and reliability of the Lehigh Valley energy infrastructure to meet baseload and peak energy demand, with the exception of areas identified as having very high or high conservation priority as identified in this Plan.
- Protect natural feature or farmland preservation areas identified by this Plan from large scale solar panel arrays and wind turbine systems.
- LVPC will support workable federal and state policies, laws and regulations to mitigate impacts of climate change.

## ENERGY GOAL 4: To advocate increased energy conservation and efficiency awareness.

### Policies

- Municipalities should incorporate energy conservation, energy efficiency and renewable energy development into their comprehensive plans and ordinances where appropriate.
- Promote energy efficiency and conservation thought leadership in the Lehigh Valley, while building local awareness of global efforts, news, and programs that do the same. Outreach to property owners should emphasize that the upgrading, weatherizing and servicing of existing building systems to improve operational efficiency is just as critical as the installation of new, innovative renewable features.

### Implementation

- The LVPC will provide easier access to energy information through updating and publishing the Lehigh Valley Energy Profile to inform the public and private sectors about energy prices and consumption.
- Raise public awareness of energy conservation issues, trends, news and resources through the consistent use of social media, public service announcements and viable websites (such as LVPC) as an outlet for discussion and thought leadership in the Lehigh Valley.
- The LVPC will partner with local professional organizations and trade groups to host and promote periodic workshops on topics of low impact development techniques, retrofitting, solar cooperatives, weatherization, energy audits on existing building systems, green building practices and other energy conservation strategies.
- Actively publicize best practices, both in the home and business, of the appropriate use of renewables, weatherization, recycling/reuse, daylight harvesting (the use of daylight to offset electric lighting), natural heating/cooling and other conservation efforts to reduce energy consumption and create healthier environments.

LVPC
2014 Climate + Energy Element

# **Thank you** to everyone who contributed to this project:

Aurel Arndt
Phila Back
Robert Barkanic
William Barnes
Jim Birdsall
Dr. Martin Boksenbaum
John M. Brown
Joe Calhoun
Kevin T. Campbell
Ralph E. Carp
Yari Colon-Lopez
Bryan Cope
Bob Cox
Peter Crownfield
Ron Dendas
Michelle M. Diaz
Cecilia Eberhard
John Eberhard
Robert Episcopo
Frank Facchiano
Kathy Fox
Tom Ganssle
Michael Gibson
Rachel Goshgarian
Joanne Guth
Adam Haydt
John Hayes
Lynne Holden
Virginia Hoyt
Gene Hunter
Allan Johnson
Mike Kaiser
Karen Kapral
Nicole Karsch
Edward Kiczek
Bob Kriebel
Richard Lane
Freddy Lutz
Joyce Marin
John Marks
Betty Mauro
Joseph Mauro
Daniel McCarthy
Jeff McGeehin
Janet Milkman
Tess Mondello
Don Moore
Maggie Murphy
April Niver
Marie North
Julie O'Brien
Owen O'Neil
Craig Onori
John Orsini
Tracy Oscavich
Robert Pitcavage
Lenore Pitsilos
James Policelli
Dan Poresky
Bruce Rabenold
Kirk Raup
Matt Restaino
Luis Rodriguez
Joris Rosse
Lynn Rothman
Dr. Dork Sahagian
Tracy Samuelson
Kim Schaffer
Dieter Scheel
Charlie Schmehl
Steven Schmitt
Steven Schrayer
Claudia Steckel
Peggy Terleski
Julie Thomases
Natalie Vu
Liz Weaver
Jeffrey Wendle
Jon Wilcox
Keith Williams
Andrea Wittchen
Al Wurth

**And all the other individuals and organizations that helped develop these two reports**

# Notes:

# Notes: