Energy Conservation & Community Planning

by Karen Popek Hart, AICP

Energy hogs. Wasteful consumers. Fossil fuel junkies. None of us likes to be called names, but as a nation, we deserve them. The aggregate statistics are dramatic:

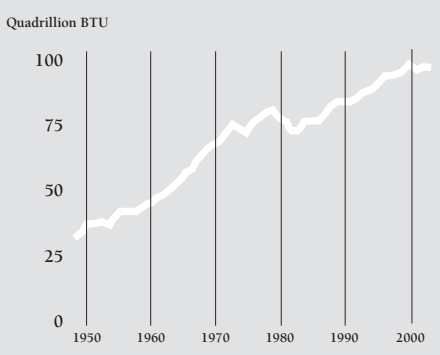
• U.S. energy consumption is more than 339 million BTU per capita (with Canadian consumption at 418 million).[1] Contrast this to average worldwide consumption of slightly more than 50 million BTU per capita. Even compared to other developed countries, the U.S. and Canada are very heavy energy consumers.

• In the 20 year period from 1983 to 2003, U.S. domestic petroleum production decreased nearly 30 percent, while U.S. petroleum consumption increased by 180 percent.[2]

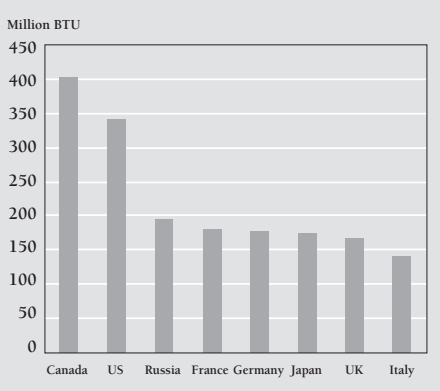
• Total energy use in the U.S. continues to steadily grow, though the per capita growth rate has leveled off.

• While the U.S. represents only five percent of the world's population, it consumes 35 percent of its energy and generates about 24 percent of global energy-related carbon dioxide emissions.[3]

• Approximately 86 percent of the energy Americans use comes from non-renewable fossil fuels: 40 percent from oil, 23 percent from coal, and 23 percent from natural gas.[4]



U.S. Energy Consumption, 1949-2003 (in quadrillion BTU). Source: U.S. Energy Information Administration.



Per Capita Energy Consumption, 2001 (in million BTU). Source: U.S. EIA.

Land Use Matters

What, exactly, consumes all this energy? The short answer is: our businesses, our cars, and our homes. The industrial sector uses 39 percent of total energy, followed by the transportation sector at 27 percent, the residential sector at 19 percent, and the commercial sector at 15 percent.[5]

Our businesses: Because the industrial and commercial sectors together use over half of all energy, their impact on our communities (in terms of jobs and taxes), and on our environment (in terms of resources consumed and pollutants generated), is huge. The good news is that businesses tend to be oriented to the bottom line, so incentives to save on energy costs are also powerful.

Our cars: Transportation is second only to industry in energy use. It is also the largest consumer of petroleum, with 97 percent of the U.S. transportation sector dependent on petroleum fuel. Per capita, we use more energy for transportation than citizens of any other industrialized country, with transportation accounting for a growing proportion of our total energy use.

In Washington State, for example, energy consumption per capita for transportation rose 43 percent between 1970 and 1993, while *total* energy consumption per capita for all uses remained relatively level.[6] The average passenger car consumes about 514 gallons/year (while the average SUV consumes 778 gallons/year).[7]

Since the purpose of transportation is to transfer people and material between other land uses, it is not possible to talk about land use and energy without considering transportation.

Our homes: Consider that, on an annual basis, the average detached single-family residence of 2.7 persons per household uses about 107 million BTU.[8] Consider also that the average size of a

1 U.S. Energy Information Administration (EIA), *International Energy Annual 2002, Table E.1c World Per Capita Total Primary Energy Consumption.* The British Thermal Unit (BTU) is a standard measure of heat energy, representing the amount needed to raise the temperature of one pound of water by one degree Fahrenheit.

2 In 1983, U.S. domestic petroleum production stood at 20.6 quadrillion BTU, falling to 14.5 quadrillion BTU in 2003. In contrast, U.S. petroleum consumption rose from 30.1 quadrillion BTU in 1983 to 84.3 quadrillion BTU in 2003. EIA, "Energy Consumption by Source, 1949-2003," Table 1.3; EIA, *Annual Energy Outlook* 2005 (early release), "Energy Production by Fuel, 1970-2025."

3 EIA, *Emissions of Greenhouse Gases in the United States 2003* (released Dec. 2004). According to the report, U.S. emissions constitute 49 percent of emissions from all industrialized countries.

4 EIA, "Energy Consumption by Source, 1949-2003," Table 1.3.

5 EIA, "Energy Consumption Estimates by Source and End-Use Sector 2001," Table S1.

6 According to data from the Washington Dept. of Community, Trade, & Economic Development, this reflected an increase (in the transportation sector) from 85 to 112 million BTU/per capita. Looked at another way, in 1970 energy use for transportation represented 38 percent of total energy use; in 1993, over 51 percent. As the Department noted, "Most of the increase occurred in transportation fuels, as communities began to sprawl and Washingtonians drove more and more miles per year."

7 EIA, *Household Vehicles Energy Consumption, 1994 Report* (released: Aug. 1997; this is the most recent data available from the EIA).

new house has steadily increased, going from 1,645 square feet in 1975 to 2,225 in 1999.[9]

The U.S. Energy Information Administration predicts that demand for home energy will increase by an average of 0.9 percent/year over the next twenty years, as more use is made of computers, appliances, and other energy consuming devices.[10]

Where and How We Build Matters

Between 1982 and 1997 the U.S. population grew by about 17 percent. During the same period, the amount of land consumed for urban development increased by 47 percent.[11] Americans continue to spread themselves more thinly across the landscape. The results of these individual locational decisions are quantifiable by increased infrastructure costs to serve spread-out development, and by the increased amount of energy needed for transportation, community services, and buildings.

Reasonable people can disagree about the degree to which sprawl has been facilitated by the automobile, but it is clear that automobile travel has increased substantially over the past decades, far outpacing population growth. In fact, from 1980 to 1997, vehicle miles traveled (VMT, in traffic engineer jargon) grew by 63 percent, nearly three times the rate of population growth. The U.S. EPA reports that more than 60 percent of the increase in VMT has been due to an increasingly dispersed, low-density pattern of land development and "the fact that jobs and housing have become increasingly segregated from one another"[12]

Geographer Susan Owens, in her book *Energy Planning and Urban Form*, similarly notes that "the single most important factor affecting the relationship of urban form and transport energy requirements is the physical separation of activities, determined by both density and the interspersion of land uses." In other words, how densely we build, and the degree to which land uses are intermixed (so energy costs can be reduced), determines what our communities look like *and* how much energy they use.

Energy costs are reduced when land uses are sited more compactly. Energy is also lost in transmission, so the longer the distance energy has to travel, the more expensive its true cost. In most parts of the country, however, utilities charge the "average unit price," meaning customers pay the same price per unit of power regardless of the true cost of their service, thereby subsidizing dispersed development.[13]

How we design and build new developments also has major energy impacts. There are many aspects of a development's design that can help reduce energy consumption, often by enabling less auto use. To cite just a few examples:

- providing sidewalks for bicyclists and pedestrians.
- increasing street interconnectivity (which reduces average driving distances).
- encouraging mixed use projects.
- building at densities that support public transit use (estimates vary from a minimum of 6 to 20 units per acre, depending on the community).

Generally speaking, higher densities also yield reduced per capita infrastructure needs – for roads, power and telecommunications lines, water, and sewer. This, in turn, results in lower energy requirements since less infrastructure needs to be manufactured,

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8 EIA, *Residential Energy Consumption Surveys 2001,* "Total Energy Consumption and Expenditures by Household Member," Table CE1-6.1u.

9 U.S. Census Bureau, *Characteristics of New Housing,* Table 16.

10 EIA, *Annual Energy Outlook 2005* (early release).

11 William Fulton et al, *Who Sprawls Most? How Growth Patterns Differ Across the U. S.* (The Brookings Institution, 2001).

12 U. S. EPA., *Our Built and Natural Environments: A Technical Review of the Interactions between Land Use, Transportation, and Environmental Quality* (2001). The report points to a 36 percent increase in the average length of work trips between 1983 and 1995.

13 The U.S. Congress' Office of Technology Assessment has reported that: "The pricing of public and private utilities ... understates the costs of providing services to suburban and exurban residents ... fringe suburban and exurban development is subsidized, largely because utility and other services are provided on an average cost basis." *The Technological Reshaping of Metropolitan America* (1995).

From the Editor

Energy Independence

Few would dispute that our nation's growing dependence on imported oil is not smart.

Three-time Pulitzer Prize winning journalist Thomas Friedman recently observed: "You give me an America that is energy-independent and I will give you sharply reduced oil revenues for the worst governments in the world. ... deprive these regimes of the huge oil windfalls on which they depend and you will force them to reform by having to tap their people instead of oil wells."[1]

A crash effort to achieve energy independence, Friedman notes, would also have a huge impact on global warming and would "galvanize ... every American kid, in every school" around the vision of an energy-independent America.

Perhaps it's time for us, as planning commissioners and concerned citizens, to step up to the plate – at the local level – and see what each of us can do to move our communities closer to energy independence.

On the next several pages, you'll see how cities and towns are taking steps to reduce energy consumption (and save dollars as well).

1 Thomas L. Friedman, "Fly Me to the Moon," *The New York Times,* Dec. 5, 2004.

WAYNE SENVILLE

The McNeil Generating Plant in Burlington, Vermont, consumes about 76 tons of wood per hour and generates 50 megawatts of electricity. On an annual basis, the wood used is the equivalent of 360,000 barrels of imported oil. Using wood as a fuel source also helps support the state's forestry industry.

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installed, and maintained.[14]

Neighborhood design standards, patterned after the increasingly popular LEED® Green Building Rating System, are being developed by the U.S. Green Building Council, in partnership with the Natural Resources Defense Council and the Congress for the New Urbanism. Known as "LEED-ND" (the ND standing for neighborhood design), the new standards will be used to certify "smart" developments – similar to the way in which LEED certification is currently available for individual buildings.

Energy savings will be a key component of LEED-ND. Criteria will focus, in part, on design features which reduce automobile dependence, and on locational factors, such as the proximity of proposed developments to existing infrastructure. Once LEED-ND is available (most likely in 2006), local governments may want to consider incorporating incentives or requirements into their ordinances to encourage developers to meet or exceed these standards.

In addition to improved neighborhood design standards, communities may want to adopt specific site design strategies to encourage new development to take better advantage of solar orientation, wind direction, topography, established vegetation, and other factors that can lower energy usage. In commercial buildings, for example, space heating, cooling, and ventilation typically accounts for about 42 percent of energy use – areas in which energy-efficient design can have a great impact.[15] Local codes and ordinances that take into account energy efficiency standards will become increasingly important to communities in the future.

Local governments across the country are taking steps to understand, and reduce, their energy consumption. The following examples show just some of the approaches being taken:

Ann Arbor, Michigan (population 114,000) hired an energy coordinator several years ago to work with various departments to reduce the city's energy costs. The city council also appointed an energy commission, made up of citizens and technical experts. Through their educational efforts, successful grant-writing, and pilot projects, the city has made great strides in reducing its energy consumption and related costs.

Projects have included: synchronizing traffic signals to reduce idling and improve air quality; replacing pedestrian walk signal lights with light-emitting diodes (LED) to reduce energy costs and lengthen light life; and automating utility controls at the water and waste water treatment plants to better monitor processes and reduce the need for chemicals.

Ann Arbor recently adopted a "Green Fleets" program designed to reduce the impacts of fuel use on public health and the environment. Key goals of the program include: (1) creating a Green Fleets

14 The relationship between density and the "costs of sprawl" is a complex and controversial field of research, well beyond the scope of this article. Suffice it to say that most researchers have found a relationship between higher density and reduced infrastructure costs. For the most comprehensive recent research, see *The Costs of Sprawl-2000*, prepared by the national Transportation Research Board in 2002 (TCRP Report 74).

15 For more on energy-efficient building design: U.S. Dept. of Energy's High Performance Buildings: <www.eere.energy.gov/buildings/highperformance/>; U.S. EPA's Energy Star: <www.energystar.gov>; and the U.S. Green Buildings Council's LEED web site: <www.usgbc.org>.

Outdoor Lighting

Communities can gain significant energy savings through more efficient outdoor lighting. Moreover, you don't need to be a big city to achieve this. For example, the small Idaho mountain towns of Ketchum (population 3,873) and Hailey (population 6,200) have adopted outdoor lighting ordinances. The ordinances have multiple objectives, including reducing skyglow to preserve views of the night sky, cutting down on glare, *and* reducing energy consumption.

According to Dr. Steve Pauley, who helped put together the Ketchum ordinance, one of its key features is the requirement that new municipal street lighting use "full cutoff" fixtures, preventing light from being emitted above "the 90 degree plane of a horizontal fixture." As Pauley notes, "by shining shielded light straight down onto the target that needs lighting, one can often reduce the wattage of a lamp by 30 to 40 percent."

Hailey followed in Ketchum's footsteps. As Hailey planning director Kathy Grotto put it, "We had the full support of our Planning & Zoning Commission and our City Council, and also the support of the majority of citizens and business owners." As to the future, Grotto notes that "Blaine County and other cities in the county are also considering outdoor lighting ordinances, so we hope to one day have valley-wide regulations so we can continue to walk outside of our homes at night and see the Milky Way!"

Perhaps the most comprehensive approach to energy savings through better street lighting can be found in Calgary's "EnviroSmart Streetlights" project. This Canadian city is retrofitting most of its 37,500 street lights on residential and collector streets with new, lower wattage, flat-lens fixtures.

Public safety is a key consideration. While less light will be emitted from each street light, the city believes the new fixtures will decrease glare, "increasing visibility by directing light onto the roadway and preventing it from shining into the eyes of motorists." Street lighting will continue to meet minimum Illuminating Engineering Society guidelines. Some street lights will not immediately be changed, including those in front of parks and playgrounds.

When the $6.6 million dollar project is completed later this year, Calgary expects to benefit from substantial electric savings, on the order of $2 million per year – enabling it to recoup the costs of installing the new fixtures within four years. Another important benefit will be lower carbon dioxide emissions (as much as 16,000 tons/year) from reduced demand on the city's gas and coal-burning generators.