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RURAL ENERGY USE AND THE CHALLENGES FOR ENERGY CONSERVATION AND EFFICIENCY

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Dependence on fossil fuels and concerns about greenhouse gas emissions are spurring interest in the use of policy and technology solutions to curb and rationalize energy consumption and reduce U.S. dependency on foreign fossil fuels. Two solutions are proposed to mitigate the problems associated with a fossil fuel economy: large-scale use of alternative and renewable energy sources, and significant improvements in energy conservation and efficiency. Improvements in energy use (including reduced environmental impact) and conservation are an absolute necessity to assure a sustainable energy future. However, policies and technologies must appropriately influence their target stakeholders.

This Policy Brief focuses on energy conservation and efficiency, with particular focus on personal transportation and residential energy consumption in rural areas. Residential and transportation energy consumption results from a combination of infrastructure and behavior factors, which make rural and urban areas quite different, calling for further investigation on technological measures and policies to promote energy efficiency and conservation. The most prominent implications found are:

1. Rural households are about 30 percent bigger, but use only 10 percent more energy. Therefore, rural households are generally more energy efficient per square foot than urban households. This means that improved energy efficiencies may be more difficult to achieve than in urban households.

2. Rural households have fewer energy options. Natural gas is less commonly used for space heating in rural areas, likely because the natural gas infrastructure is not as well developed in rural areas.

3. Rural energy use is related to the rural lifestyle. Most often and in many ways, this lifestyle is a choice.

4. There are different vehicles used in rural settings than in urban settings and they are used in different ways. In rural communities, there is a greater use of larger vehicles, such as pick-up trucks. While there are many advances being made by car manufacturers in alternative transportation, these are largely in smaller passenger vehicles. Where options exist for larger vehicles, such as pick-up trucks and medium duty trucks, the lack of a rural infrastructure, may make adoption more difficult (i.e. adoption of natural gas vehicles, which currently are prospected to be a cheaper alternative to gasoline, in rural areas might be more difficult).

5. Nine out of ten households in the United States are in urban settings, making it harder to justify federal and national investments and policies directly oriented to reduce rural energy consumption.

The differences in energy consumption in rural areas is caused by a diversity of factors, ranging from household characteristics, socio-economic dynamics, and environmental conditions. The typical image of a rural house is of an old, large farmhouse. Rural households are indeed larger than urban residences. On average, rural homes are 30 percent larger than urban homes, and they are typically detached houses, which means that they are more exposed to weather conditions and do not benefit from radiant heat from adjacent buildings. On the other hand, unlike the stereotype, rural houses are typically newer, compared to their urban counterparts. This leads to a difference of about $400 in the average energy-related annual expenditure of American households.

Second, families living in rural areas drive about 7,000 more miles annually than their urban counterparts, which results in an excess of about 330 gallons of gasoline consumed every year. Thus, increasing energy efficiency and conservation in both rural and urban settings requires policy incentives that respond to the different conditions in these areas.

The U.S. Energy Information Administration publishes yearly projections based on known technology and technological and demographic trends. According to such projections, overall U.S.

energy consumption will grow at an average annual rate of 0.3 percent from 2010 through 2035. EIA does not expect the U.S. to return to the levels of energy demand growth experienced in the 20 years prior to the 2008- 2009 recession because of more moderate projected economic growth and population growth, coupled with increasing levels of energy efficiency. Projected energy demand for transportation grows at an annual rate of 0.1 percent from 2010 through 2035 according to EIA, and electricity demand grows by 0.7 percent per year, primarily as a result of rising energy consumption in the building sector.

For some end-uses, current federal and state energy requirements and incentives play a continuing role in requiring more efficient technologies. Energy consumption per capita is expected to decline by an average of 0.6 percent per year from 2010 to 2035 (see Figure 1). As shown in Figure 1, the amount of energy consumed per capita has been fairly steady since about 1980, with a slight decline in recent years. Even though we are living in larger homes, driving more miles, and using more electrical devices, we are actually consuming less energy because of improvements in efficiency and energy conservation techniques (especially true for passenger vehicles). Additionally, energy intensity of the U.S. economy, measured as energy consumption per real dollar of GDP, has steadily declined and is projected to decrease by an average of 2.1 percent per year from 2010 to 2035. This indicates better energy efficiency in all segments of American life, and a transition from an energy-intensive manufacturing industry to less energy-consuming industrial and commercial processes.

Focusing on the residential sector, 19 percent of the U.S. population lives in rural areas (Census 2010 Population Statistics), where the majority of the energy is consumed. Urban areas include all urbanized areas (over 50,000 population) and Urban Clusters (2,500 to 49,999 population) as defined by the Bureau of the Census in the 2000 Decennial Census. Significant differences are noticed between rural and urban settings, ranging from spending patterns, education, living habits, and energy consumption.

The U.S. Energy Information Administration administers periodically the Residential Energy Consumption Survey (RECS) to a nationally representative sample of housing units. These data are analyzed and results show that residential per household energy consumption in rural areas is about 10 percent higher compared to urban areas, with electricity 50 percent higher (15,258 kWh/year compared to 10,290 kWh/year), while number of household members remain basically unchanged (an average of 2.69 people per household for rural areas, compared to 2.66 in urban areas).

This is due to several reasons, most evidently a higher square footage. Several externalities play a significant role in this disparity. “There are a lot of things that go into it”, says Stephanie Battles, director of the U.S. Energy Information Administration’s Energy Consumption Division. Several policy incentives are available, which help promote greater energy efficiency, including the market penetration of high efficiency appliances (energy star rated appliances) and fluorescent/led lighting. However, greater efficiency is not always accompanied by lower energy use overall. For instance, square footage plays a crucial role, and homes built since 1990 are on average 27 percent larger than homes built in earlier decades. In addition, while appliances are more efficient on average now than 10 years ago, households often have a greater number of electrical devices.

Additionally, even if urban traffic might lead to extremely high fuel consumption, on a per capita basis more energy is consumed in rural areas to move people around. This is mainly due to the longer distances driven and a lack of public transit alternatives in rural areas. According to EIA data, families living in rural areas drive about 7,000 more miles annually than their urban counterparts, which results in an average annual excess of about 330 gallons of gasoline (assuming an average MPG of 21 miles per gallon). Urban areas win again the match thanks to public transportation and shorter distances, allowing people to commute by bike or simply walk (also carpooling is favored, since people live close to each other).

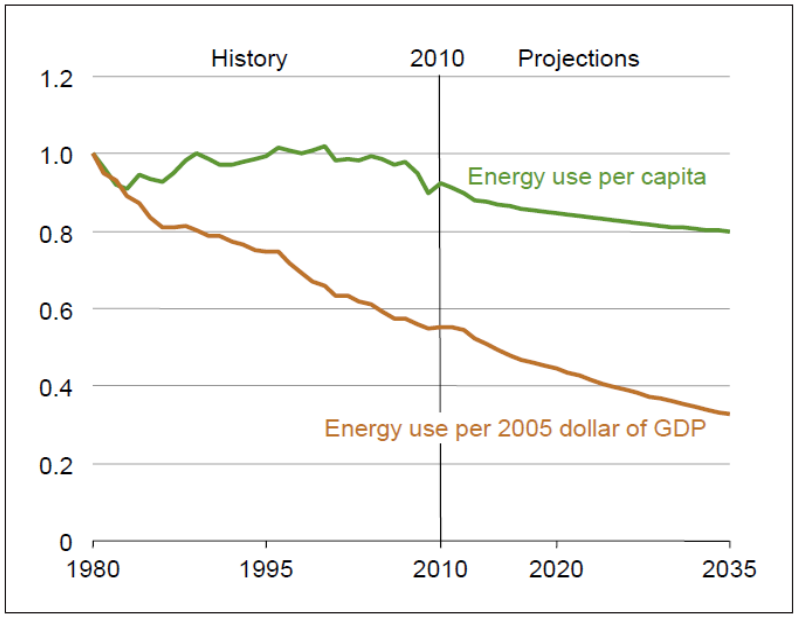

Figure 1. Energy use per capita and per dollar of GDP, 1980-2035. From EIA, Annual Energy Outlook 2012.

Vast amounts of energy could be saved if cars were driven fewer miles, if public transportation was more widely used, and if homes were smaller and more efficient.

There are numerous policy and technology solutions that could help address these issues,

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including mandating better gas mileage for cars, providing incentives to increase the market penetration of advanced highly efficient vehicles (hybrids, electric, and others), improving the insulation in homes, increasing the energy efficiency of appliances, and the adoption of higher efficiency lighting. Smart grid technologies could also be used to better manage the distribution and use of energy. None of these solutions alone can address the disparity between rural and urban energy use though. Therefore, a well-balanced mix of policies needs to be in place.

Energy is a key component of people's life, which has major socio-economic bearings. Promotion of energy conservation and efficiency measures in residential and transportation sectors heavily impact life habits of the residents. When dealing with energy conservation, two main approaches are possible: increase people density (i.e. smaller households and public transportation/ carpooling); or increase efficiency of energy use (i.e. high-efficiency appliances and lights, and improved vehicles).

Currently, the energy policies promoted in the United States are trying to increase people density in the personal transportation sector while there are attempts at improving energy efficiency in both the transportation and residential sector. Nevertheless, significant differences are present when comparing urban and rural energy consumption, both for transportation and residential consumption.

First, different attitude towards energy use and different needs are noted, especially for the transportation sector, where scarcely populated areas present peculiar characteristics and public transportation is impractical. Rural families drive more miles, and generally use larger vehicles. On average rural households, which are newer, consume more energy. Nevertheless, they are generally more energy efficient per square foot than urban households, meaning that improved rural household energy efficiencies may be more difficult to achieve than in urban households. Yet, energy comes in different forms, and rural households tend to consume substantially more electricity.

Second, the majority of energy is consumed in urban areas, even if per capita consumption in rural areas is higher. Yet, solutions involving increases in people density—which significantly affects people's lifestyle—does not apply for rural areas. Mass public transportation is unfeasible. Rural residents often choose to live in rural settings, where they can acquire larger properties, and they accept the trade-off of longer commutes to work. There are physical and geographic realities that make rural lifestyles more energy intensive. In addition, rural households have fewer energy options. Natural gas is less common for space heating, likely because the natural gas infrastructure is not as well developed in rural areas. The same happens for transportation, with a lot of focus given to highly efficient passenger vehicles, natural gas vehicles, and electric cars. These, due to different final purposes, lack of infrastructure, or limited driving range do not cope well with rural transportation needs.

Nonetheless, smart policies and innovative technologies can be used to reduce the overall energy consumption. Often a lot of attention is given to electricity and gasoline consumption, while a complete picture of the residential and transportation energy consumption should be analyzed to optimize and rationalize the overall national energy use. In order to equally promote energy efficiency and conservation in rural and urban settings further investigation on technological measures and policies is needed.

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is organized by the Regional Rural Development Centers to provide information about the increasingly contentious and complex agricultural and rural development U.S. policy issues.

The Center is funded by the USDA National Institute of Food and Agriculture (NIFA) under a competitive grant (Number 2012-70002-19385), and engages land-grant universities as well as national organizations, agencies, and experts to develop and deliver timely policy-relevant information around signature areas identified by our Advisory Boards.

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