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"Moving from Split Incentives to Joint Stakes in Energy Technology and Climate Research Initiatives"

House Science Committee

Hearing on New Directions for Climate Research and Technology Initiatives

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Mr. Chairman and Members of the Committee, many thanks for the invitation to join you today to discuss "New Directions for Climate Research and Technology Initiatives." I am Scott Bernstein, President of the Center for Neighborhood Technology, and co- founder of the Community Energy Cooperative, based in Chicago, Illinois. CNT is a twenty three year old organization whose mission is to promote livable communities that work for everyone. Our practice and competencies are in developing insights into the hidden assets of existing communities and their institutional and technological underpinnings, then applying these insights into incentives for achieving greater resource efficiencies, promoting community durability and sustainability, and initiating new marketplace arrangements to help households and businesses capture these benefits. It's been our privilege to be a co-founder of national organizations that are promoting a sound energy future, such as the Surface Transportation Policy Project and Smart Growth America, and to participate in the federal policy formulation process on energy and climate strategy as a member of the President's Council on Sustainable Development, and the White House Policy Dialogue on Reducing Greenhouse Gas Emissions from Personal Motor Vehicles (aka "Car Talk.").

It is in the context of our experience with successful community-based energy programs - that we are pleased to testify to the Committee. We were asked today to address two broad questions. [SLIDE]

- Is Federal research and technology policy aligned to achieve national environmental and climate goals?
- Is there more that the Federal government could do to align those policies that would ensure our energy future, meet environmental goals and increase the opportunity for future economic growth?

From our perspective, we believe that the answer to the first question is no; changes to federal research and technology policy could be made that would more quickly achieve national environmental and climate goals.

And we believe that the answer to the second question is yes; if we could realign those policies it would create additional opportunities to ensure our energy future, meet environmental goals and increase economic growth.

To address these questions, we'd like first to review our experience in implementing large scale, rapid growth programs at the community level. The remainder of our testimony will describe the nature of the misalignment and provide some modest suggestions for change.

In that regard, we'd like to focus on four topics today. They include:

- How a decades-long focus on the new buildings, technologies and communities at the expense of existing buildings, communities and technologies has led to a misalignment of Federal policy

- How a focus on existing buildings and communities - in conjunction with rapid application of information technology - would help correct this misalignment and is necessary to incent rapid adoption of energy efficiency technologies and behavior;
- How the application of information technology is necessary to build a transparent system that would align the incentives for rapid change; and
- Potential federal roles to create the incentives necessary to capture the benefits of this increased energy efficiency.

BACKGROUND AND EXPERIENCE:

CNT has extensive experience in implementing energy programs in urban communities. In the late 1970's we built the first community-based solar greenhouses in the country. By the mid-1980's, we were running a large energy efficiency program that retrofitted over 12,000 units of multi-family housing in Chicago, significantly reducing energy consumption and cost for building owners and tenants, with paybacks in the five to seven year range. Along with similar programs to address energy efficiency in community facilities and pollution prevention in small manufacturing, we were responsible for the successful retrofitting of over 1,000 facilities in Chicago. Two of our partners in these enterprises, Neighborhood Housing Services of Chicago and the Community Investment Corporation, incorporated energy efficiency into their performance specification for thousands of additional homes and apartment buildings as a result of this experience. And as the natural gas markets began to deregulate, CNT organized the Gas Buyers' Club, to supply market-priced natural gas to small commercial and multi-family buildings. Our work earned special recognition awards from Secretary of Energy Donald Hodel, Renew America, the American Society of Heating, Refrigeration and Air Conditioning Engineers, Illinois Governor James Thompson, and the Grand Prize in a national Cost-Cutters Competition for Affordable Housing by Enterprise Foundation founder James Rouse. Throughout the subsequent years we have maintained a balanced approach to energy policy, helping four mayors of Chicago negotiate model franchise agreements; passing comprehensive municipal energy codes; developing market based approaches to accelerating adoption of energy efficiency technologies and practices; and our staff has also helped run Illinois Critical Trends Assessment Project for the Illinois Department of Natural Resources and the Illinois Scientific Surveys. Recently, we established a data base service with a carbon emissions calculator, covering 70,000 consumer products; this led to our being awarded support by the Transportation Research Board of the National Academy of Sciences to deploy its use nationally.

In 1998, CNT began to work with Commonwealth Edison, the local Chicago utility, to develop and test programs that could benefit both the utility and the communities it served, in the context of the utility restructuring that was beginning in Illinois at that time. As a result of that work, we established the Community Energy Cooperative in January 2000 to develop and implement innovative strategies that address the need for Illinois energy consumers to get smarter about their energy use. The Cooperative established its goals as working to help improve electrical reliability, to reduce the costs of energy services and to enable community participation in new energy markets. Commonwealth Edison provided the initial startup funding for the Cooperative, with additional support from the City of Chicago and the State of Illinois Department of Commerce and Community. In 2001 the Cooperative was established as its own organization, and is operated under a management contract with CNT. Additional support was received from the Association of Illinois Energy Cooperatives and the Illinois Clean Energy Foundation.

The Cooperative developed a model in which it could capture the value of geographically targeted peak demand reductions on the utility system infrastructure. The tools used in this model included setting up programs that addressed community-based energy efficiency, distributed resources, load management and customer aggregation. We selected communities based on two criteria: communities that were experiencing serious reliability problems, and demonstrated community capacity to organize around complex issues. From the Cooperative's launch in June 2000 in the Pilsen community of Chicago (the oldest standing community in the city), the Cooperative has expanded its targeted programs to three other communities: Elgin (both the oldest and fastest growing suburb), Park Forest (with no growth) and the Northwest Side of Chicago (rapid growth near O'Hare Airport). During this time, the Cooperative has built a membership base of 7,000 households and over 150 businesses and municipalities. [SLIDE DESCRIBING COOP]

In each community the Cooperative used a variety of community-based organizing methods that were tailored to that community and provided immediate incentives including energy efficiency kits to every new member. The major programs that the Cooperative offered during its first two years focused on providing immediate value to members through the subsidy of changes in energy usage. By aggregation of members who could share in the value of reduction of demand the Cooperative was able to offer members a variety of incentive programs. These offers included: [SLIDE]

- Replacing 5,500 old inefficient window air conditioners with new Energy Star air conditioners. These have saved members an estimated $250,000 in energy costs, and permanently reduced peak electricity demand by approximately 3.7 megawatts.
- Replacing nearly 400 central air conditioning units with higher efficiency units, reducing energy demand by about 50% or 0.5 megawatts.
- Replacing 150 inefficient refrigerators with high efficiency units in Pilsen, and planning a wider-scale rebate program for Energy Star refrigerators in Elgin and Park Forest.
- Enrolling 4,000 Chicago households in a financial hedging program to provide protection against unexpected increases in the price of natural gas.
- Launching a lighting retrofit program for municipalities and small businesses, typically saving participants 30% on their lighting costs with investments that pay for themselves in about three years. Seventy Cooperative members reduced lighting electrical demand by about 2 megawatts and cumulatively will save approximately $400,000 per year.
- Organized nearly 30 megawatts of feeder-based curtailable commercial, industrial and municipal load with technology that including real-time monitoring of energy consumption by members and the Cooperative.
- Installed a sixty-kilowatt micro-turbine in an industrial facility in Pilsen to be used in conjunction with real time prices for peak reduction.
- Assisted in installing 100 kilowatts of solar rooftop systems for community organizations and municipal buildings for peak demand reduction.
- Provide real-time community based load shapes and information - supplied from Com Ed substations for the Pilsen neighborhood in Chicago at http://www.energycooperative.net/energy
- Provided ancillary programs to meet stated community needs, including an after school computer skills tutoring program; a startup car sharing program; and initiated plans for delivering broadband communications through wireless technology.

[SLIDE SHOWING PILSEN COMMUNITY REAL TIME DEMAND METER]

These programs have given members of the Cooperative a convenient and affordable means to upgrade their outdated and inefficient equipment and reduce their energy demand and consumption. It has also supplied them with personalized information and feedback about their energy consumption. In addition, they reduced the utility's need to supply expensive peak power, and reduced the stress on the electric distribution system in the targeted communities. The Cooperative demonstrated that it could get large numbers of people and businesses to act to reduce demand, but that in doing so it needed to invest substantial upfront amounts to create the information and financial incentives required to achieve the results discussed above. [SLIDE SHOWING DEMAND REDUCTION RESULTS]

It is because of this experience, and our previous experience in actually getting rapid participation in community energy initiatives, that we are able to help analyze the federal alignment of research and technology policy with national environmental and climate goals. Our analysis follows.

I. Federal Policy is Too Focused on New Buildings, New Technologies and New Communities.

A review of current authority under DOE's enabling legislation and more recently, provisions of the Energy Policy Act of 1992, reveals a strategy that is not well aligned with community or marketplace reality.

Strategies exist to provide a variety of energy rating systems for residential energy efficiency, standards for new appliance manufacture, standards for the manufacture of mobile homes, processes for the establishment of model codes, and requirements for the Secretaries of the federal departments of Housing and of Agriculture to establish mandatory codes for new construction of publicly assisted housing and mortgages insured under the National Housing Act, and for new construction of single family homes subject to mortgages insured, guaranteed or made by these agencies. Utilities were encouraged to make investments in conservation and energy efficiency. Initiatives aimed at appliances were started, and these were dependent on stock turnover of home equipment with typical useful lives of 10 to 20 years.

When DOE legislation was first crafted, the federal government, through HUD, was a major source of financing for affordable housing projects. Since that time, the federal role has increasingly transitioned, and is characterized today by "people" based support, not project support, i.e., the federally assisted housing standards are for a type of housing that is experiencing a diminishing federal role-policy has been to reduce direct federal support of housing development and instead to support the ability of households to pay for housing. As a result, tax expenditures, for mortgage interest and property tax deductions, for low-income housing tax credits, and for rental housing development, outweigh direct federal housing assistance by over four to one. There are no energy performance measures required to earn the use of federal tax expenditures in residential property purchase or improvement.

Eighty-five percent of the buildings that will be standing in 2020 are standing today:

People live in buildings that are already built. Furthermore, the turnover in the building stock in the United States is very slow. The 1999 American Housing Survey reveals that there were 102.8 million occupied homes in the United States, of which approximately two-thirds were owner-occupied and one-third were renter-occupied. In any given year during the last few decades, growth in new homes rarely exceeds 2 percent. Studies by the Department of Housing and Urban Development, the National Association of Home Builders, appliance manufacturers and the National Institute for Standards and Technology suggest that all major building elements last between ten and twenty years. Standards set by the Bureau of Economic Analysis of the Department of Commerce and the Bureau of Labor Statistics are that permanent 1 to 4 unit homes have life expectancies of 80 years; larger multifamily buildings of 65 years; major renovations of 40 years, and mobile homes of twenty years. [SLIDE-TURNOVER HAPPENS SLOWLY]

Thus, in any given year, the potential housing available in which to address energy efficiency and associated emissions improvements is 50 to 100 times higher from the stock of existing homes than from the new structures.

If we had fifty years or more to capture the emission reductions from increased energy efficiency, a strategy that focused solely on the new structures would work. However, if our timeframe is less than fifty years, we need complementary strategies that focus on existing structures and existing communities.

Unfortunately, Federal policy over the past several decades has ignored this reality and has focused on the upgrading the energy efficiency of the new building stock and of new appliances, thereby missing the opportunity to capture the much larger benefits from the existing housing stock.

A good example of the kind of problem at hand is represented by multi-family rental properties in cold climates. These buildings' heating systems tend to be central equipment, gas fired, steam or hot water in nature. They are built to last for extremely long times, and there is no apparent incentive to replace them with newer equipment. In research performed for the Gas Research Institute (now the Gas Technology Institute) we found that in such systems, packages of distribution system and thermostatic controls could be introduced to these buildings at a price under $200 per dwelling unit with savings of 20 percent of an energy bill and simple paybacks on the investment of under three years. Adding this package to improved water heating, lighting, and building thermal efficiency brought the price up to $1,200 per dwelling, a 30 percent bill savings, and still a seven year payback, net of interest rate costs (which is the equivalent of a net return of 15 percent per annum on the investment). This kind of "upgrade" package was offered and accepted in a local program we operated, with hundreds of takers-over offers to completely replace central heating systems at a much higher price and much lower return

How relatively fast or slow is fifty years?

A recent study at UCLA probed the question of the potential value of requiring certain actions of homeowners to be "due on sale." Studying first homes in southern California, and then extending their findings nationally, they found that 56 percent of all properties were sold at least once within seven years, 75 percent of all property were sold within the previous 13 years, and 90 percent were sold within the previous 27 years. The author, economist Don Shoup, used this rate of ownership turnover to suggest the creation of a requirement of planting trees at time of sale, and developed simulation tools to demonstrate the community, economic, environmental and visual benefits of the strategy. This model demonstrates that relating to stock turnover alone, would at best, give you 90 percent of a policy goal such as those described in EPACT 92, within 27 years.

We sometimes forget, when looking at the relatively discouraging results associated with overall residential energy consumption trends, some things do change rapidly. Fifty years ago, franchising of small businesses was relatively unknown; today it accounts for the majority of small business startups. Home computers were exotic until the early 1980's, but today occupy close to half of all homes, and over half the homes with computers also have Internet service. Cell phone use is growing by leaps and bounds, and new wireless technologies may be able to close the gap of providing broadband service to "the last mile" better than standard telecommunications providers can.

Current Federal policy assumes little behavior change.

Current Federal energy policy assumes little behavior change on the part of consumers. The underlying assumptions of current policy is that by bringing new energy efficiency technologies on to the market, customers will adopt them at the point that they replace their existing units. This is the rationale for energy efficiency standards for appliances as well as building codes for individual structures.

Strictly on a numeric basis, this so-called replacement strategy, as we mentioned earlier, may well be successful if the timeframe for deployment was three or four generations. However, in so far as much of the strategy is voluntary, its success depends on people:

- Actually choosing to use the new energy efficiency technologies and
- Then not increasing their consumption once they have made those choices.

Unfortunately, as patterns of energy consumption in the residential sector over the past twenty years have shown, the success of these strategies has been variable at best.

While there are many incidental reasons why this result has occurred, we believe that one of the most fundamental reasons is the disconnect between consumers' consumption and investment behavior and the results of that behavior on the things that people care about: reducing their costs, improving their communities, and reducing emissions from power plants. In short, people see no reason - in their every day decision-making - to change their behavior. The information links - at a scale that would be meaningful to individual consumers - between behavior and outcome have not been established. As a result, little direct learning has occurred.

II. Why a Focus on Existing Buildings and Communities Could Correct This Misalignment

Demographic and Migration Trends Are Determining Energy Demand

Household size has dropped almost continuously since it was first measured in the 1790 census; more recently, it has dropped from 3.3 persons per household in 1965 to 2.5 persons today. [SLIDE- HOUSING SIZE GROWS AS HOUSEHOLD SIZE DROPS] We know from analysis of data provided by the Residential Energy Consumption Survey that as household size increases, total consumption goes up but consumption per capita drops. More than any other factor, the rapid aging of the American population is driving formation of smaller households.

At the same time, the housing production market is offering products out of synch with demographic reality. While household size dropped by one-quarter, average new home size increased by one-third. In the current debate of are we sprawling or are we moving back in, the answer is a clear "yes" to both. From 1982 to 1997, the Natural Resources Inventory of the Department of Agriculture shows that the amount of land used for development increased by 35 percent, while the number of households increased by 21 percent-sprawl outran household increase by 62 percent [SLIDE-LAND USE INCREASED 62 PERCENT FASTER THAN HOUSEHOLDS], for every one percent increase in households, there was a corresponding 1.6 percent increase in developed land, resulting in an increase from 1990 to 2000 from 80 to 90 percent of the U.S. population living in metropolitan areas. There is a return to central cities that reversed decades long population loss in places like Chicago and Atlanta, but not in Buffalo or Cleveland, most metropolitan growth is suburban and the majority of American households now reside in the suburbs. In the most populated metropolitan areas of the country, the rate of household formation is exceeding the rate of new building permits by 10 to 20 percent. [SLIDE-HOUSEHOLDS NOW GROWING FASTER THAN HOUSING]

The Residential Energy Conservation Survey of the Energy Information Administration shows that from 1978 to 1987, there was a fairly steady drop in household energy consumption, from 138 million BTU's in 1978 to 101 million in 1987, and that it has stayed roughly at that level through the year for which the latest data is available, 1997. [SLIDE-TRENDS IN RESIDENTIAL ENERGY CONSUMPTION]

This is explained partly by the demographic and migration trends above, and partly by changes in the way we use time and use technology.

A good example of changes in building technology is air conditioning. Originally developed to help food, tobacco and printing industries increase productivity by controlling humidity, applications quickly spread to entertainment, offices and eventually residential uses. Without air conditioning, much of the southern United States would not have developed so quickly after World War II. Central air conditioning grew from10.8 percent of the housing stock in 1970 to 55.6 percent in 1999; room air conditioners appeared in 25.9 percent of the housing in 1970 and 25.9 percent in 1999; all told, homes that had at least one form of air conditioning increased from 36.7 percent of housing in 1970 to 81.3 percent in 1999.

A similar story can be told about electric heat penetration, although with less spectacular rates. Homes that were heated electrically in 1970 were just 7.7 percent of the stock, 16.9 percent in 1979, 25.9 percent in 1989 and 31.6 percent in 1999.

The Apple personal computers were first manufactured in 1976. By 1997, 43 million households or 35 percent had at least one PC, and by 1998 or 42 percent had at least one, over half of whom had Internet service. Similar rates of growth obtain for other electrically intensive appliances such as home entertainment and time-savers such as microwave ovens.

Several surveys on how Americans use their time have been conducted during the past two decades. The results support the view that up to 90 percent of time is spent indoors. As a result of the findings that increased indoor time and increased decentralization lead to decreased physical activity, the Surgeon General of the United States declared a national health emergency in 1995. The Centers for Disease Control and Prevention treat this crisis as partly the cumulative risk associated with pollutants that get concentrated in indoor air, and partly as actually reduced time spent in physical activity.

These factors, along with increasing weather instability, excessive rates of heat deaths, increased rates of asthma and other respiratory disease have led to increased use of air conditioning and humidity control equipment at home. All these factors, along with increased aging, have led to increased home medical care, including home based inhalation therapy for the medically indigent. In sum, the combination of time savings, comfort and medical necessity are driving electrical use. Excessive sprawl and unnecessarily large homes are driving both building and transportation energy use. These factors are driving the level of emissions per household of both criteria pollutants and of greenhouse gases. [SLIDE-HOMES AND EQUIPMENT GET MORE EFFICIENT, BUT SIZE AND USES GROW, WIPING OUT EFFICIENCY GAINS]

What These Patterns Mean for Greenhouse Gas Production and Climate Change

The increase in sprawl has led to an increased in automobile dependence and the extent of driving. For every one percent increase in measured land use, there was a measured increase nationally in annual vehicle miles traveled of 1.72 percent. However, the rate of automobile use varies within metropolitan areas mostly according to location and convenience. We've estimated the relationship between land use patterns and convenience to amenities versus rates of car ownership and extent of driving. Our regression model predicts the latter two variables accurately 92 percent of the time. Using this model, the Transportation Research Board of the National Academy of Sciences recognized the quality of the work with research support to develop an emissions calculator based on these factors. [SLIDE- COMMUNITY QUALITY DETERMINES TRAVEL DEMAND]

As an example of the relevance of this research, the following two maps of the Chicago MSA demonstrate an important principle, If the question is asked, where does most of the greenhouse gas emissions in the region generated by transportation come from, the map on the left gives the standard answer, with "hot spots" in the most densely populated areas. This map aggregates emissions by area unit. However, if emissions are measured based on actual household use of transportation, a very different picture emerges. The map on the right is based on the regression model, and shows that the rate of emissions generation per household is much higher in the newest and least densely settled areas of the region. [SLIDE-MAP OF TWO VIEWS OF CO2 AND CHICAGO]

For household energy use in the home, unfortunately no such mapping is possible at this time. Energy use information is owned by utilities. Customer information is delivered on a monthly basis, not cumulative. The information on a bill can be based on as little as seven actual and five estimated monthly readings. Except in a few service territories where combined gas and electric service is offered, the uncertainty is doubled by the presence of multiple service providers. We'd like to be able to distinguish between cumulative energy use and time of day and time of year demand variations; only for large and usually non-residential customers is demand information available. EIA does not report disaggregated information by geographic area at any scale smaller than a state. The Residential Energy Consumption Survey is a national sample of households judged to be not statistically significant at any geography below the national, and in any event has no access to demand, as opposed to energy use information. Our best guess is that while home energy use will certainly be more related to household income than is energy used by households for transportation, the combination of home size and changing demographics will still show an overall pattern of energy efficiency as a function of location and density.

The lack of more generally available household energy utilization information is most unfortunate. Utilities experience peak demand, both during the summer and increasingly in the winter as well. Peak demand causes the need for extra fuel supply and for extra generation capacity. The ratio of peak demand to base-load for electrical generation can easily be two to one; given Chicago's economic and physical climates, peak electrical demand only occurs for approximately 500 hours per year. Without changes in the existing system, utilities will likely continue to experience a total of just 2.5 percent of the year that requires high cos,t supplemental peak load generation.

III. THE APPLICATION OF INFORMATION TECHNOLOGY IS NECESSARY TO BUILD A TRANSPARENT SYSTEM THAN CAN ALIGN THE INCENTIVES FOR RAPID CHANGE

The current energy information system for consumers is an old, one-way system that does not provide people or communities with the information they need to know to make smart decisions:

Information is necessary for people to make smart decisions. Without good and timely information, people have no rational basis for changing their behavior. In other parts of the economy, Federal policy has acknowledged this need. For example, the ever-increasing complexity of our financial lives has produced an entirely new and rapidly growing credit-counseling industry, supported by Federal policy. The Internet has made information available to the digitally connected individual at a scale that was unimaginable only ten years ago. How disconnected is the energy world between supply and demand, between producer and consumer?

Let me try and describe this phenomenon by analogy.

Imagine a world where everyone needs to own a car, and, as a result, it is in the public interest to have speed limit regulation. In this world, lawmakers establish speed limits, transportation departments dutifully post speed limit signs and even take out full page ads in newspapers to tell drivers about the speed limits. But because there are no real-time speed measurement devices (known as speedometers), drivers have no way of knowing how fast they are going. Without the accurate real-time information about their individual speed, they have no way of making a knowledgeable and thoughtful decision as to whether they are complying with the law.

[SLIDE- A LESS THAN OPTIMAL ENFORCEMENT METHOD]

Imagine another world where health authorities told people that they should reduce their caloric intake in order to be healthier. But with no measurement device to tell people about the calorie content of food, people simply didn't have the information to make the choices that would have made them healthier.

This actually was the case back in the 1890's until Ellen Swallow Richards formulated a scientific basis for a dietetics based on the caloric content of food.

That, then, is the state of the energy information system for residential and small commercial (approximately two-thirds of the electricity and natural gas load). Home energy use is metered in ways that have not changed for a very long time-the typical meter in the home and small business is a state-of-the-art 1960's model. Energy use is measured in cumulative units, usually kilowatt-hours for electricity and "therms" for natural gas. The meter that measures use is an electromechanical device, with no information storage or telecommunications capability. The device can be retrofitted for radio frequency or power-line carrier capability, but only at a very high price. This kind of communications is used to avoid the high cost of actually having to read a meter, but does not provide stored information, provides no information on instantaneous peak demand, is not accessible, and is only really useful for expediting a billing function.

We take for granted the idea that someone out there is measuring what we need to know. Weather provides an interesting example. Until a short decade ago, weather reports originated from stations based at airports. More recent reports on the evening news show an even distribution. But this was not due to an increase in NOAA certified weather stations, rather, an entrepreneurial company started selling slightly less accurate monitors for a modest $5,000 to schools and cultural institutions, and brokered a relationship between these institutions and local media outlets. The firm, Automated Weather Source, now boasts the largest network of weather stations in the world, which they use to provide real time baselines and augmented forecasts for large scale energy planning.

This brings us to an observation and a proposition.

It is widely acknowledged in the utility industry and in energy policy analysis circles that reducing peak demand is highly desirable. If it were possible to reduce peak demand, the price volatility that the nation has seen in both the gas markets and in the electricity markets would be dramatically reduced and old, polluting power plants would likely be retired. Even if peak demand could not be completely reduced, it is technically possible today to supply that demand from small, distributed energy supply systems, including micro-turbines, fuel cells or solar rooftop photovoltaic systems.

The benefits of peak reduction reach beyond rationalizing the generation side of the business, but also to rationalizing the distribution or "wires" side. By reducing peak demand, the reliability of electric service would improve and distribution utilities would spend significantly less on seldom used but very expensive substations, feeders and transformers, designed to meet demand that only occurs a few hundred hours out of the year. In addition, consumer costs would fall as consumption and demand were reduced and rationalized. Finally, a less "peaky" system would be more reliable and the more distributed system that would evolve would be less susceptible to massive failures caused by sabotage or terrorism. [SLIDE-THE BENEFITS OF LOCALIZED PEAK DEMAND REDUCTION]

Unfortunately, most experts also acknowledge that - given the current information and feedback system in the electric utility business - none of this is likely to occur. Unless individual consumers get timely access to information they need to understand how much energy they consume, when they consume it and what the actual market prices are, they will have little incentive to change their behavior.

Why are the information systems so antiquated?

The answer, unfortunately, is simple. None of the current actors have any incentive to upgrade it. Small commercial and residential customers have no incentive - in fact, are legally precluded in most jurisdictions from owning their own meter. State regulatory agencies, the public entity that largely oversees the metering and distribution function - are largely reactive institutions; loathe to impose costs on utilities on a proactive basis. And the utilities themselves have little incentive, as the current technology serves what they see as their main function - billing - as well as it has for the last seventy years. Even within utility companies, there are split incentives, with the wishes of the billing department generally trumping other requirements.

This is the nature of the dilemma we face from misaligned incentives and policies. We want increased energy efficiency and consumer behavior change, we want climate stabilization, we want rational energy markets where consumers respond to price, we want energy distribution systems that aren't over-built and far more expensive than they have to be. But we are at a standstill. Until we upgrade the information system so that people receive the information they need to make good decisions, all of those benefits are beyond our collective reach.

What can we do to correct this situation and move toward a modern information system?

Let's start by positing a scenario. In this scenario, joint announcements are made simultaneously across the nation by utility executives, civic, local government and community leaders. They announce the creation of a network of networks. Each local network is an association of place-based cooperatives, that is, membership organizations of energy users. The places they are organized around are the substations and feeders that serve them electricity. Each local community starts with a baseline analysis of its energy use characteristics, in total energy, in peak demand, for the community as a whole and disaggregated by customer and by type of end use. Budgets and goals are established for each place around end-use energy and end-use peak demand reduction. Reliability goals are jointly established between the utility, the community and the customer; in turn these goals are aggregated up territory-wide, and an association of communities is created to support the information infrastructure necessary to market the individual actions and investments to community residents and businesses. [SLIDE- SHIFTS NECESSARY, FROM A CUSTOMER CLASS ORIENTATION TO A NETWORK OF PLACES, FROM STRICT BUYER/SELLER TO PROVIDER/COMMUNITY/USER FRAMING]

In effect, each community becomes a "micro-grid." Each micro-grid section of the utility service territory has its own requirements for maintenance, reinvestment, upgrading, and its own cost of service considerations. Under the plan, partnerships can be set up in each of several hundred micro-grid territories to manage the process of-[SLIDE]

- Establishing baseline energy use and energy demand profiles;
- Identifying opportunities for demand management and for site-specific generation;
- Developing methods of organizing electricity users into "energy maintenance organizations" to offer the benefits of least cost energy, joint procurement of energy efficient appliances, and low emissions power;
- Providing calculators to help estimate energy savings and potential emissions reductions;
- Establishing market aggregation mechanisms to enable crediting for greenhouse gas reduction; and
- Promoting environmental and energy education in the local schools and other community settings.

Nationally, it becomes advantageous to share practices, both to promote rapid learning and to reduce transaction costs. What results is-[SLIDE]

- A network of learning regions
- Place-based tools for rapid learning an enhanced marketplace participation

- Resulting in high-performance, continuous improvement of
- Better decisions and faster outcomes, measured across economic, ecological and equity dimensions, and
- A clear shift from split incentives to joint stakes and mutual benefits

Creating a Scorekeeping Method That Works

We want to provide insights into methods for achieving rapid improvement in energy efficiency and emissions reduction.

Sometimes, when involved in evaluations of rates of deployment of single technologies, it seems that change is doomed to death by slowness. But even though population and building stock levels change very slowly, many aspects of the U.S. economy and of household behavior do change quite quickly. Small business franchises account for the largest fraction of business formation, but were virtually unknown 40 years ago. Desktop microcomputers were a luxury in the seventies, a start-up in the 80's but ubiquitous by the 90's. Internet communications, cellular telephones and broadband are but the latest innovations to rapidly achieve market prominence.

This latter set of achievements offers intriguing possibilities for the topic at hand. One reason that deployment of efficiencies is slow is that the necessary information for making informed decisions is neither easily available nor affordable. Households, communities and businesses generally face three kinds of barriers to achieving the kind of rapid change envisioned for a climate stabilization scenario.

To address these three challenges, we propose engaging in activities that have the following objectives-

- Design and develop methods that use economic analysis and geographic information to break out of artificial categories and examine places at the right scale to find the value within them.
- Create systems that allow communities to capture the value of the assets.
- Aggregate neighborhood-based groups of consumers to achieve widespread benefits.

These recommendations even aggregate up to the national level. The kind of durability promoting, place-based orientation these numbers are based on, can help correct for an unfortunate bias in national income accounting. Charles Hulten of the National Bureau of Economic Research recently pointed out that innovation and efficiency are systemically undercounted in GDP account formation. Imagine two national economies (or two versions of the economy of a single nation), both of which have the same technology and start with 100 units of input, so that both produce 100 physical units of output. Suppose, now that some ingenious person in economy A discovers a way to double the amount of output that 100 units of input can produce. At the same time, an innovator in economy B discovers a way to double the utility of the 100 physical units of output that are produced. A measure of total factor productivity based entirely on physical units will double in A but remain flat in B even though the inhabitants of both countries are equally well off as a as a result o their respective innovations. So there's a paradox: efficiency and returns to investment, particularly by small users, can go up without showing in measures of national economic well being. The relevance of this observation to the task at hand is striking. Too often, setting an aggressive efficiency goal is claimed to be counter to national economic interest. Programs that can achieve deeper and more rapid efficiencies by focusing on localized opportunities will reveal themselves to be of local value, but that value will be undercounted in measures of national well being.

IV. Potential Federal Roles to Create the Incentives Necessary to Capture the Benefits of Increased Energy Efficiency and Address Climate Change Adequately

A system that would meet the challenge of the vision painted above would need to: [SLIDE]

1. Help shift the basis and point of view for energy policy from a customer class view (residential, commercial, industrial) to a place-based basis

2. Shift the target market from the annual change in building and building technology inventory (the "new" market) to the existing stock of buildings and building technology (the "existing" market)

3. Shift the information available to energy users from an arbitrary billing cycle (monthly) to continuous and "real time" data

4. Shift the information available to energy users from an instantaneous and unstored sample to a stored and continuously available database

5. Shift the publicly available data on energy use in communities from large administrative areas (states) to small areas that relate to how people see their own lives and how utilities actually manage energy delivery (communities, neighborhoods, substations and feeders)

6. Expose the incentives in current policy and practice for maintaining an obsolete and misleading information system (inherent profitability of current metering practice, the continued bundling of metering with distribution, the apparent low first cost of continued use of obsolescent meters, tax incentives and state rate base allowances for continued use of existing technology, the apparently longer life of electromechanical meters compared to the new electronic systems)

7. Expose the low rates of market deployment for efficiency technologies compared to computer and communications

8. Suggest the relative efficacy of hooking efficiency decisions to investment decisions that people are willing to make, e.g., to local telecommunications service

Recent reviews by NAS and others help us move in the right direction:

The recent National Academy of Sciences review panel of the Department of Energy's research and development activity found that on net, the department's activities were cost-effective. However, their recommendations are worth considering, in light of the finding that on average, DOE's investment accelerated deployment of such "hard" technologies as low-e windows and compact fluorescent lamps by five years.(Note: this statement itself is difficult to evaluate-what's worth more, a five year advance in market penetration for compact lamps or a five year head start for converting antiquated meters to real time place-based networks?)

But the committee went on to note, "the importance of standards pulling technological innovation in buildings and transportation cannot be exaggerated. Often, DOE energy efficiency research has been used to provide a proper basis for standards." They also noted, "programs seeking to support the development of technologies for rapid deployment are more likely to be successful when the technological goals of these programs are consistent with the economic incentives of users to adopt such technologies. They observed, "the large realized benefits accrued in areas where public funding would be expected to have considerable leverage. The buildings sector is fragmented, and the prevailing incentive structure is not conducive to technological innovation." They also called for broader industry collaboration, as well as collaboration with at least one other federal agency: "DOE should work to establish improved communication with EPA and the private sector, with the goal of accelerating deployment of environmentally clean technologies."

Perhaps the most profound observation was about the relationship between the development of energy technologies and the need to rapidly deploy what we know how to do:

"Where its research, development and demonstration programs seek to develop technologies for near-term deployment, DOE should consider combining support …with the development of appropriate market incentives for the adoption of these technologies based on an understanding of market conditions and consumer needs. These incentives span the gamut from product standards to tax incentives. Conversely, it is unrealistic to expect immediate deployment of technologies developed with public funds that are suited to a very different environment of energy related costs and prices. But such technologies may provide significant option and knowledge benefits, and they represent appropriate targets for DOE …programs."

The call for collaboration with industry could also include consideration of collaboration with the energy using public, and with the communities within which they reside. Success in deployment in the buildings and transportation sectors clearly depends on partnerships with end users, their communities, and with the organization to which they belong.

A good model for a principle exists in the Intermodal Surface Transportation Efficiency Act of 1991. In Section 134, it states: "Citizen participation shall be early and continuous." This planning section also calls for plans to precede budgets, and includes consideration of the transportation demand effects of land use, including energy impacts and must be conducted in conformity with section 108 of the Clean Air Act Amendments of 1990; this latter section calls for each Metropolitan Planning Organization's and State's Transportation Improvement Plan to be in conformity with state's State Implementation Plan for bringing metropolitan areas into attainment with National Ambient Air Quality Standards. DOE could adopt the principle of "early and continuous," and should develop processes to participate in state and metropolitan planning, with an eye to improving the quality and pace of technology deployment.

Much more is likely needed in the way of inter-agency collaboration beyond just EPA and DOE. The divisions at the Department of Transportation responsible for implementing ISTEA are an essential partner; there are opportunities to take advantage of the federal government's capacity to enhance credit and financing through HUD, DOT and with the Small Business Administration; regulatory agencies that oversee the financial services industry are in a position to look favorably on lending institution activities that advance national energy and environmental goals. There is a pilot program housed at HUD with the participation of the National Institute of Standards and Technology at the Department of Commerce known as the Program for Advanced Technology in Housing, or PATH. Operated jointly with the National Association of Home Builders, it is almost exclusively focused on new housing and receives an appropriation of just $9.5 million; but it is a start. The committee should consider strategies to motivate a broader and more meaningful collaboration with the necessary federal and private sector actors, including non governmental, to more fully address the need noted by the NAS committee to de-fragment the buildings industry.

Specific actions that the federal government can do to meet these specifications and considerations include-[SLIDE]

A. Use tax policy to stimulate meter technology turnover

B. Explore federal authority to help states consider unbundling metering and distribution service

C. Explore use of existing federal credit enhancement mechanisms to help create community scale energy services

D. Change federal research and development budgets on buildings and energy commensurate with the opportunities inherent in working with existing buildings and community scale benefits

E. Identify coordinated strategy that results in a place- based infrastructure for real time alignment and community decision support

To get started, we recommend that the Committee consider the following actions-[SLIDE]

1. Invite a white paper to extend these ideas. In particular, ideas for using existing federal authority (provision of information, direct financing or credit enhancement, regulatory authority, tax policy) to further these goals should be identified

2. Authorize funding for the creation of a task force to explore these ideas on a priority basis, to report back to the Committee by the end of the year, with recommendations for further action

3. Request the cooperation of and collaboration between the Departments of Housing and Urban Development, Energy, Commerce and EPA in furthering these goals

4. Consider adding requirements for these departments to address progress in addressing these shifts (toward existing buildings, community basis, rapid learning, incentive correction, market transformation for learning systems) to the annual performance reports of these agencies submitted pursuant to the Government Performance and Results Act

On behalf of the Center for Neighborhood Technology and its affiliated partners, and the thousands of members of the Community Energy Cooperative and all other organizations who believe that community and place matter in energy and climate policy, our sincere thanks for the opportunity to testify to the committee today. This concludes my testimony, and I'd be happy to answer any questions.

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