STATEMENT OF MARK SPURR, LEGISLATIVE DIRECTOR, INTERNATIONAL DISTRICT ENERGY ASSOCIATION

Senate Energy and Natural Resources Committee
June 25, 2013

Chairman Franken, Ranking Member Risch, and Members of the Committee, thank you for inviting me to testify today on behalf of the International District Energy Association regarding opportunities to reduce energy waste and strengthen the resilience of U.S. energy supply infrastructure.

I want to congratulate Senators Shaheen and Portman on S.761 -- the Energy Savings and Industrial Competitiveness Act of 2013. It is an outstanding bipartisan bill that will help increase energy efficiency in two important sectors: buildings and industry.

I invite the Committee to consider the broader picture of U.S. energy use, **and how S.761 can be amended to make significant additional strides in reducing energy waste**. We can do this by looking at energy efficiency holistically, considering not only the buildings and industrial sectors but also the potential synergies between those sectors as well as with a broad of energy sources right in our own backyards. Of particular note is a huge energy consuming sector that is not considered in S.761: power generation.

Lawrence Livermore National Laboratory produces a flow diagram showing the total picture of U.S. energy use, based on data from the U.S. Department of Energy. I've included the 2011 version as Figure 1 on the next page. It shows how each source of fuel flows through five energy-using sectors: power generation, residential buildings, commercial buildings, industry and transportation.

What is striking is that of the total 97.3 quadrillion Btu (quads) of energy consumed, only 43 percent was converted to useful energy, and 57 percent was wasted (or, in the more neutral term, "rejected"). Of the wasted energy, power generation and transportation loom large. Boiling down the data, Figure 2 shows that 36 percent of our total national energy use is waste energy – largely in the form of heat – from power generation, industry and buildings.

Over one third of our total national energy is thrown away as heat, most of it from power plants.

I know that Sen. Manchin has called attention to this issue in prior Committee discussion of S.761. Speaking of the power generation sector, which is only 32 percent efficient, Sen. Manchin commented "We have a lot of waste there." He's quite right.

U.S. power plants are now 32% efficient. CHP can boost efficiency to over 80%.

Combined heat and power (CHP) refers to a set of technologies for generating power while recovering the normally-waste heat, boosting efficiency to over 80 percent. The recovered heat can be used for industrial process heat, space heating and/or domestic hot water, or can be converted to cooling for industrial processes or air conditioning.

CHP currently represents 82 GigaWatts (GW) or about 8 percent of U.S. power generation capacity, compared to 30 percent or more in European countries such as Denmark, Finland and the Netherlands.

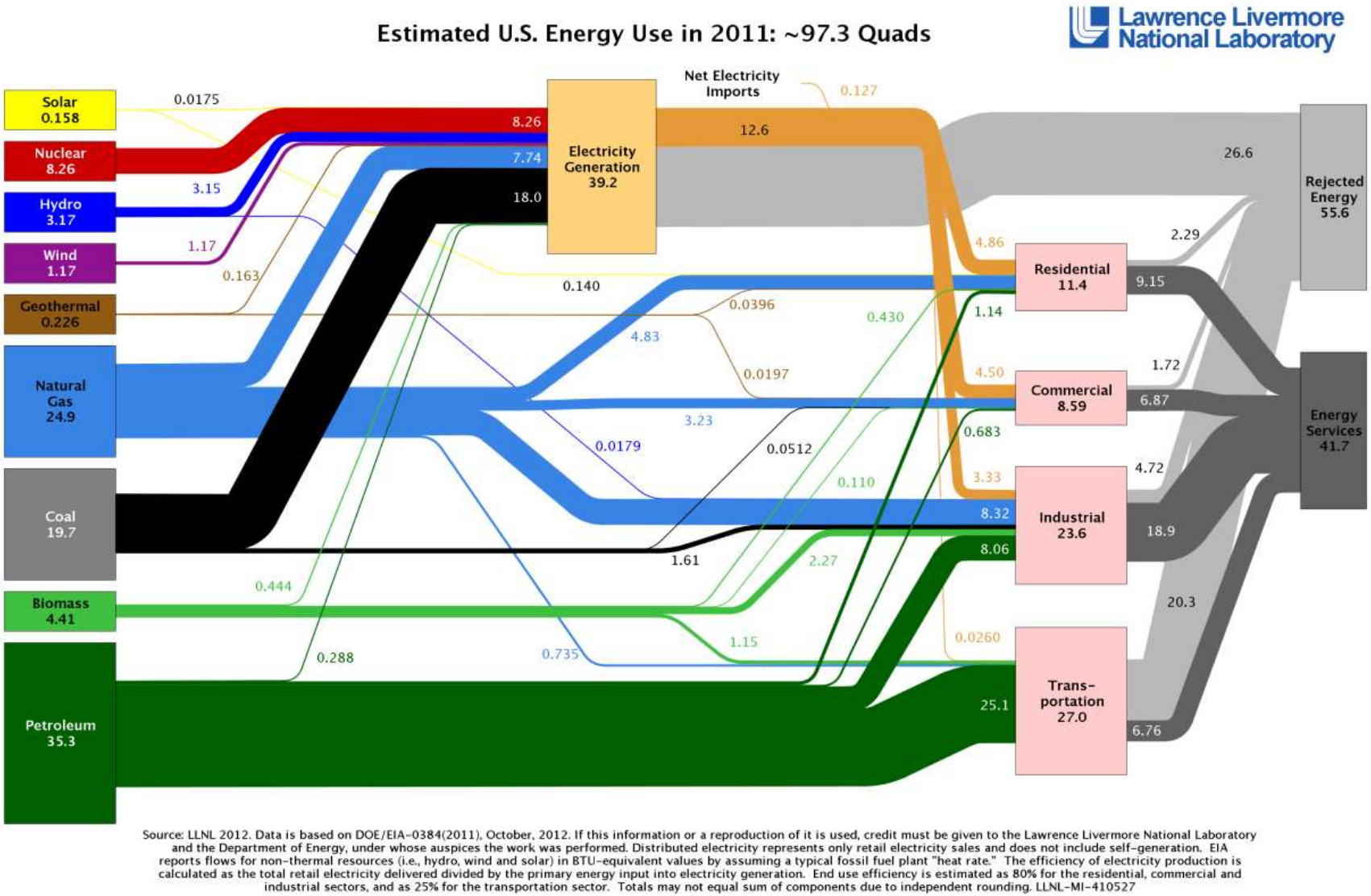

Figure 1. U.S. Energy Use 2011 (Source: Lawrence Livermore National Laboratory and the U.S. Department of Energy. Data is based on DOE/EIA-0384 (2011), October 2012.)

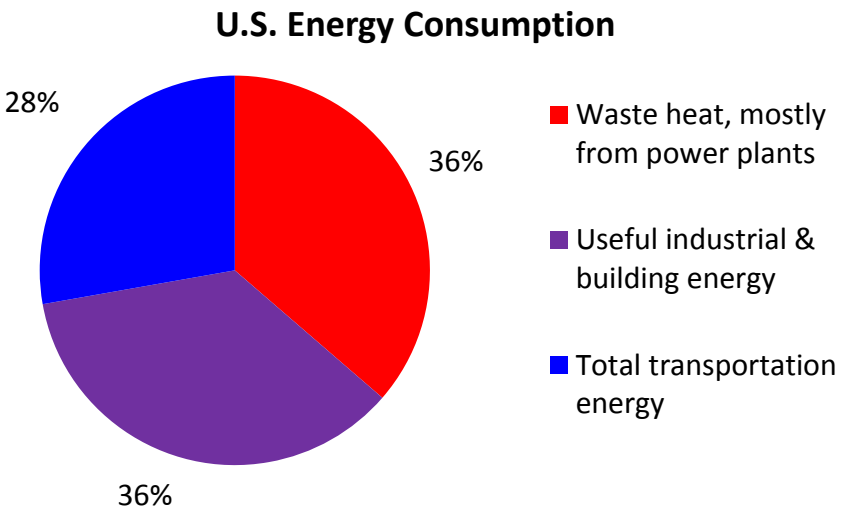

Figure 2. Magnitude of Wasted Heat in the U.S. Energy Use, 2011

There is significant potential for growth in U.S. CHP.

A recent study estimated a technical potential of 125 GW in additional CHP capacity in systems below 100 MegaWatts (MW) in size. Of the technical potential for new CHP capacity, 56 GW is in the industrial sector and 69 GW is in the commercial sector. Of the total *technical* potential, it is estimated that 6 GW has strong *economic* potential (payback less than 5 years), 35 GW has moderate economic potential (payback 5-10 years) and 82 MW has low economic potential (payback exceeds 10 years).[1]

The Department of Energy has estimated that increasing CHP from its current 9% share of U.S. electric power to 20% by 2030 would:

- Avoid 60% of the projected increase in U.S. carbon dioxide emissions (equivalent to taking half of all U.S. passenger vehicles off the road);
- Create more than 1 million new, high-skilled jobs here in the U.S.; and
- Generate $234 billion in new investments.[2]

DOE analysis indicates substantial economic and environmental benefits from increased CHP.

Economies of scale make it more cost-effective to install CHP in sizes above 5 MW, which is why district energy systems are critical to more widespread implementation of CHP.

District energy systems help increase CHP because they pool the thermal users to accommodate larger, more cost-effective CHP units.

District energy systems supply hot water or steam and chilled water to buildings for space heating, domestic hot water, air conditioning and industrial process energy. These systems pool the thermal users to accommodate larger, more cost-effective CHP units. Widespread use of district energy is the reason that countries like Denmark and Finland have high levels of CHP.

[1] The Opportunity for CHP in the United States, ICF International, May 2013.

[2] U.S. Department of Energy, "Combined Heat and Power: Effective Energy Solutions for a Sustainable Future" (Dec. 1, 2008), p. 3-4.

District energy systems represent a substantial "heat sink" for further implementation of CHP. Many U.S. cities, colleges, universities, industrial facilities, hospitals and military bases use district energy. These systems exist in all 50 U.S. states. Landmark buildings like the White House, U.S. Capitol and Supreme Court, Empire State Building, Mayo Clinic and Harvard Medical School use district energy. District energy systems serve over 8 billion square feet of building space, equal to 12 percent of total commercial floor space.[3] About 13 percent of U.S. district energy systems incorporate CHP.[4]

Beyond CHP, there are plenty of other sources of local energy – "home-grown" energy sources that exist today in our backyards. For example:

- Most of the buildings in downtown St. Paul, Minnesota are heated and cooled using energy that literally comes from residents' backyards: tree trimmings and other waste wood. This community waste material is converted to supply heating, cooling and electricity.
- In Detroit, Michigan, the downtown district energy system fueled with municipal solid waste.
- Both the University of Iowa and the University of Minnesota have used oat hulls, a food processing waste, as fuel.
- Lake Cayuga is in Cornell University's backyard. Cornell constructed a piping system which uses the naturally occurring cold lake water for air conditioning, cutting power consumption by 87%.
- Montpelier, Vermont broke ground in April on a district heating system to be fueled with local wood.
- The Oregon Institute of Technology uses a resource under its backyard -- geothermal hot water that provides a clean, renewable source of campus heat.
- A BMW manufacturing plant in Spartanburg, SC uses local landfill gas as a CHP fuel. Combustion turbines produce 11 MW of electricity as well as process steam.
- Cox Interior is a Kentucky company that makes interior and exterior finishing products. They use wood waste from their manufacturing process to fuel a 5 MW CHP system, providing process power and heat.

Beyond CHP, there many untapped sources of energy in our own "backyards" such as:

- Urban waste wood
- Industrial exhaust gases
- Municipal solid waste
- Landfill gas
- Food processing waste
- Geothermal heat

Hurricanes Sandy (2012), Irene (2011), Gustav (2008), Ike (2008), Katrina (2005) and Wilma (2005) brought power grids down, causing huge economic losses in output, income and employment. The Northeastern blackout in 2003 was not caused by severe weather but by transmission system failures, but also resulted in substantial economic losses as data centers, factories, hospitals, offices and other employers shut down.

There are significant economic losses from energy supply disruption just from interruption of business operations.

The economic losses from energy supply disruption from interruption of business operations are enormous. For instance, economic research firm Moody's Analytics attributed nearly $20 billion in losses from suspended business activity just due to Superstorm Sandy.[5] Rutgers recently published a report that estimates economic losses, not including damages to physical structures, of approximately $11.7 billion

[3] Commercial Buildings Energy Consumption Survey, 2003, U.S. Energy Information Administration, with updated based on data collected by the International District Energy Association.

[4] Energy and Environmental Analysis Inc. and IDEA, District Energy Services: Commercial Data Analysis for EIA's National Energy Modeling System, August 2007; unpublished surveys by IDEA, 2003-2009.

[5] http://money.cnn.com/2012/10/29/news/economy/hurricane-sandy-business/index.html

in state Gross Domestic Product (GDP).[6] The study found that overall GDP losses could have been reduced in New Jersey if there had been additional backup sources of power such as CHP, which would have lessened the economic losses associated with power outages.

In 2001 report,[7] the Electric Power Research Institute (EPRI) evaluated industrial and digital economy businesses to determine the economic costs of power outages and power quality disturbances, focusing on 3 sectors:

1. Digital Economy (DE) sector: comprised mainly of data storage and retrieval, data processing, or research and development operations such as the telecommunications, data storage, biotechnology, electronics manufacturing, and the financial industry.
2. Continuous Process Manufacturing (CPM) sector: comprised of manufacturing facilities that continuously feed raw materials through an industrial process such as the paper, chemical, petroleum, rubber and plastics, stone, clay, glass, and primary metals industries.
3. Fabrication and Essential Services (F&ES) sector: all other manufacturing industries, plus utilities and transportation facilities, water and wastewater treatment, and gas utilities and pipelines.

Although these three sectors only accounted for 17% of all U.S. businesses, they amounted to 40% of U.S. GDP. The study found that industrial and digital economy firms are losing about $45.7 billion per year due to power outages, with an additional $6.7 billion in costs resulted from power quality disturbances other than outages. The EPRI study concluded that the cost of power outages for all industry combined is an estimated at $120 to $190 billion per year.

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The total cost of business interruptions from the 2003 Northeastern blackout, which lasted 2 days, have been estimated as follows: 1) Anderson Economic Group[8] -- $4.5 to $8.2 billion; 2) U.S. Department of Energy[9] -- $6 billion; and 3) ICF Consulting[10] -- $7 to $10 billion.

CHP and other local energy sources are inherently more resilient to disruption from natural disasters or other events that interrupt energy supply from complex and interconnected grids.

CHP and other local energy sources are inherently more resilient to disruption from natural disasters or other events that interrupt energy supply from complex and interconnected grids. CHP systems can be designed to operate in “island” mode during a grid outage. CHP and district energy systems have demonstrated that they can keep the power on, keep factories and business running, and continue to keep people warm in the winter and cool in the summer even when the power grid is down.

A recent report for Oak Ridge National Laboratory[11] notes: “When Superstorm Sandy made landfall on the eastern coast of the United States –New Jersey, New York and Connecticut were the most heavily hit areas.

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[6] Rutgers Regional Report, The Economic and Fiscal Impacts of Hurricane Sandy in New Jersey, January 2013.
[7] Consortium for Electric Infrastructure to Support a Digital Society (CEIDS), An Initiative by EPRI and the Electricity Innovation Institute, *The Cost of Power Disturbances to Industrial & Digital Economy Companies*, June 2001,
[8] Anderson, Patrick L. and Ilhan K, Geckil, “Northeast Blackout Likely to Reduce US Earnings by $6.4 Billion,” AEG Working Paper 2003-2, August 19, 2003
[9] Transforming the Grid to Revolutionize Electric Power in North America, Bill Parks, U.S. Department of Energy, Edison Electric Institute’s Fall 2003 Transmission, Distribution and Metering Conference, October 13, 2003.
[10] The Economic Cost of the Blackout: An Issue Paper on the Northeastern Blackout, ICF Consulting, August 14, 2003.

Extended power outages affected the region for days. However, some commercial and industrial facilities in the area were able to power through Superstorm Sandy due to onsite CHP." Here are very brief summaries of some of case studies presented in that report:

- **Princeton University - Princeton, NJ.** During Superstorm Sandy, Princeton disconnected from the grid and used its district energy CHP system to power the campus. The CHP system was also able to provide uninterrupted steam and chilled water service. Many staff members stayed overnight at the University because of the storm. CHP was vital to maintaining important university facilities such as research labs, experiments and data that could have been compromised by a loss of power.

- **Louisiana State University - Baton Rouge, LA.** For four days during Hurricane Gustav in 2008, the CHP system provided electricity to critical sections of the campus. During Hurricane Katrina, LSU stayed on-line and never lost power, which allowed the school to continue to operate and allow administrative offices of the University of New Orleans and the LSU Medical School to relocate to the main LSU campus.

- **Nassau Energy Corporation – Garden City, NY.** During Superstorm Sandy, the CHP system was able to continue supplying power to the grid, and also maintained the supply of thermal energy to the Nassau University Medical Center, Nassau Community College, and all other end-use customers. Nassau Community College served as an emergency shelter during the hurricane and provided services to over 1,000 people displaced by the storm for about a month and a half. A representative from the Community College said that the College has never experienced any disruptions in service from the district energy CHP system.

CHP and district energy systems have demonstrated that they can keep the power on, keep factories and businesses running, and continue to keep people warm in the winter and cool in the summer even when the power grid is down.

- **South Oaks Hospital - Amityville, NY.** South Oaks isolated itself from the grid on the evening of October 28 and remained disconnected from the grid for 15 days. South Oaks was able to provide critical services relying solely on their CHP system. They admitted patients from other sites that had been displaced by the storm. They offered refrigeration for vital medicines to those who had lost power and had no means of keeping medicines refrigerated.

- **Greenwich Hospital - Greenwich, CT.** Due to its CHP system, Greenwich Hospital was able to continue normal operations throughout the storm. The hospital admitted additional patients during the outage period. In addition, 150 extra staff stayed overnight to ensure the hospital remained fully functioning.

- **Public Interest Data Center - New York, NY.** During the storm the power to the building and surrounding area was out for over two days; however, the data center was able to remain fully operational. Even though the areas surrounding the building were out of power, employees of PINS were able to come into the office and resume their normal functions. In addition to keeping the

[11] Combined Heat and Power: Enabling Resilient Energy Infrastructure for Critical Facilities, prepared for Oak Ridge National Laboratory, ICF International, March 2013.

power and cooling operational for the data center, the CHP system was also able to provide the building landlord with power to continue to run their computer and security systems.

- **New York University – New York, NY.** NYU's core campus maintained both power and heat during Superstorm Sandy because of its CHP system. The system provided uninterrupted electricity, heating, and cooling to the campus, and also enabled NYU and City officials to set up a command post on the campus as well as serve area residents forced to evacuate their homes.

I urge your support for legislation introduced by Sen. Franken. The Local Energy Supply and Resiliency Act (LESRA) will help industry, universities, hospitals and others implement CHP, capture waste heat and use renewable resources for heating, cooling, and power generation. It will also strengthen our ability to keep the lights on, keep buildings comfortable and enable uninterrupted business operations.

The Local Energy Supply and Resiliency Act (LESRA) will help industry, universities, hospitals and others reduce energy waste and strengthen our ability to keep the lights on and enable uninterrupted business operations.

Industrial competitiveness will be enhanced by LESRA because it will help steel mills, paper mills and other businesses develop new revenue streams. LESRA will also help communities, universities and others reduce energy costs, reduce emissions and enhance energy supply resiliency.

The bill establishes two programs:

- **Technical Assistance Program.** The bill establishes a grant program in the Department of Energy to provide technical assistance for identifying, evaluating, planning and designing waste heat recovery systems for the purposes of heating, cooling, and power generation. This program helps for-profit and nonprofit entities identify opportunities, assess feasibility, overcome barriers to project implementation, conduct financial assessments and perform the required engineering. Authorized appropriations: $150 million over the period 2014 to 2018.

- **Local Energy Infrastructure Loan Guarantee Program.** The bill authorizes the Department of Energy to provide loan guarantees to projects that: 1) recover waste heat or use local renewable energy for heating or cooling: 2) generate power locally with CHP or renewable energy; 3) distribute power in microgrids, or 4) distribute heating or cooling energy to buildings. Reducing interest costs is the key to implementing highly efficient and resilient energy infrastructure. Unlike past DOE loan guarantees for innovative technologies, this program would focus on proven technologies, with the goal of reducing interest costs for local energy infrastructure. Funds to carry out the program will come from user fees and unused funds that were previously appropriated.

Thank you for the opportunity to speak with you today.

About the International District Energy Association

IDEA is a non-profit trade association founded in 1909 to facilitate the exchange of information among district energy professionals. IDEA currently has 1733 members in 27 countries, and is governed by a 20-member, all-volunteer Board of Directors. IDEA's mission is to foster the success of its members as leaders in providing reliable, economical, efficient and environmentally sound district energy services. IDEA promotes energy efficiency and environmental quality through the advancement of district heating, district cooling and cogeneration (also known as combined heat and power or CHP).