

**TESTIMONY OF DEAN KAMEN
FOUNDER AND PRESIDENT, DEKA RESEARCH & DEVELOPMENT**

**BEFORE THE HOUSE COMMITTEE ON ENERGY AND
COMMERCE SUBCOMMITTEE ON ENERGY AND POWER**

**HEARING ON “21ST CENTURY ELECTRICITY CHALLENGE: ENSURING A
SECURE, RELIABLE, AND MODERN ELECTRICITY SYSTEM**

MARCH 4, 2015

Chairman Upton, Chairman Whitfield, and Ranking Member Rush, Vice Chairman Scalise, I greatly appreciate the Subcommittee’s invitation to testify this morning on how innovative technologies and business models can enable a modern, reliable, and secure electricity system. I am an inventor, entrepreneur, and President of Manchester, NH-based DEKA Research & Development. For more than 30 years, DEKA has been developing breakthrough technologies that have dramatically improved lives for millions of people around the world.

Today, I am here to present my perspective on how innovative technology and approaches could provide some solutions to the issues and challenges confronting this Committee and our country.

There is no doubt that the U.S. electric grid is an amazing achievement. In 2003, the National Academy of Engineering, of which I am a proud member, described the vast network of power plants and aluminum wires commonly known the U.S. electric power grid as the greatest engineering achievement of the 20th century. In 1882 Thomas Edison oversaw the deployment of the world’s first electric distribution system in New York City, which provided direct current for 59 customers in the Wall Street Area at a price of about \$5 per kilowatt hour. Today, the US electric power grid annually delivers close to 4,000 terawatt hours to more than 300 million Americans.

As great an engineering marvel as our electric grid has been, it is quickly becoming an icon of the 20th century that has not significantly evolved to embrace technological innovation as many other aspects of our economy have. I think we can all agree that America’s electric grid is in desperate need of modernization.

Consider the following facts about the U.S. electric system (from the U.S. Department of Energy and the Edison Electricity Institute):

- Electric generation capacity costs are approximately \$1 per watt. Current U.S. generation capacity is more than 1 trillion watts.

- Transmission lines cost an average of \$1 million per mile.
- Distribution lines cost an average of \$140,000 per mile.
- More than 50% of generating capacity in the U.S. is more than 30 years old.
- More than 70% of the 280,000 miles of transmission lines are more than 25 years old.
- More than 50% of the 2.2 million miles of distribution lines are more than 30 years old
- Annual capital costs for generation, transmission, and distribution is more than \$90 billion.
- In a traditional coal plant, only about 30-35% of the energy in the coal ends up as electricity.

Fortunately, I do not believe that we need to spend the billions, if not trillions, required to upgrade the electric grid to ensure the electricity quality and reliability we expect. As an observer of history, I believe that a distributed energy future is inevitable. [I will share a few slides that explain that perspective.] In recent years there has been a great deal of innovation with distributed generation and renewable, smart grid technologies, as well as energy storage systems. While these technologies offer a promising future for the U.S. electric system, our collective immediate challenge is to develop the appropriate business models and regulatory structures to effectively manage the integration of modern technologies while ensuring the continued operation and viability of our nation's electric grid. As we evolve toward a more diverse electric future enabled by new technologies, the challenge confronting this Committee and our country is to manage this transition in a way that does not endanger the availability of electricity.

Germany's energy transition offers some valuable lessons for the U.S. Through dramatic action and substantial subsidies, renewables now account for more than a quarter of German energy production. However, Germany is not yet a success story. It has some of the highest electricity prices in the world, but despite those high prices, the German electricity grid is neither technically nor economically healthy. It is facing significant challenges integrating intermittent solar power with the rest of its electricity infrastructure, and power quality and reliability are threatened. To meet the old challenges of an aging infrastructure as well as the new challenges of intermittent distributed renewables, the Economist projects that European utilities will spend more than EUR 1 trillion by 2020 – in an economic environment where revenues have moved from utilities to solar providers and utilities have lost half of their value since 2008. The German example illustrates what many have called the “Distributed Energy Resource (DER) death spiral”.

Learning the lessons from Germany, avoiding the DER “death spiral” and managing our modern electric transition in a way that preserves our grid while maintaining viable

business models for our electric utilities is no small task. New utility models and regulatory structures will be required. These models must promote competition while encouraging smart investments to modernize the grid will be required.

DEKA has been working on a technology that we believe could be part of a more robust and efficient solution: a Stirling-cycle energy appliance that can cleanly, quietly, and reliably convert a wide variety of fuels into electricity and useful heat. Our Stirling-cycle appliance is highly complementary to recent advances in photovoltaics and energy storage, with the advantage that it can generate electricity indefinitely, even when the sky is dark and the grid is down. DEKA has been conducting field trials of this device in partnership with NRG, and I am enthusiastic about its potential to help the US have a smooth transition to its distributed energy future.

I appreciate the opportunity to testify this morning. I applaud your efforts to examine how new technologies and business models can be employed to tackle our 21st Century Electricity challenges. I look forward to working with you on this important endeavor.

Biography of Dean Kamen

Dean Kamen is an inventor, an entrepreneur, and a tireless advocate for science and technology. His roles as inventor and advocate are intertwined—his own passion for technology and its practical uses has driven his personal determination to spread the word about technology's virtues and by so doing to change the culture of the United States.

As an inventor, he holds more than 440 U.S. and foreign patents, many of them for innovative medical devices that have expanded the frontiers of health care worldwide. While still a college undergraduate, he invented the first wearable infusion pump, which rapidly gained acceptance from such diverse medical specialties as oncology, neonatology, and endocrinology. In 1976, he founded his first medical device company, AutoSyringe, Inc., to manufacture and market the pumps. At age 30, he sold that company to Baxter Healthcare Corporation. By then, he had added a number of other infusion devices, including the first wearable insulin pump for diabetics.

Following the sale of AutoSyringe, Inc., he founded DEKA Research & Development Corporation to develop internally generated inventions as well as to provide research and development for major corporate clients. Kamen led DEKA's development of the HomeChoice™ peritoneal dialysis system for Baxter International Inc. The HomeChoice™ system allows patients to be dialyzed in the privacy and comfort of their home and quickly became the worldwide market leader. Kamen also led the development of technology to improve slide preparation for the CYTYC (now Hologic

Inc.) ThinPrep® Pap Test. Kamen-led DEKA teams have also developed critical components of the UVAR™ XTS™ System, an extracorporeal photophoreisis device marketed by Therakos, a unit of Johnson & Johnson, for treatment of T-Cell lymphoma. An advanced prosthetic arm in development for DARPA should advance the quality of life for returning injured soldiers. Other notable developments include the Hydroflex™ surgical irrigation pump for C.R. Bard, the Crown™ stent, an improvement to the original Palmaz-Schatz stent, for Johnson & Johnson, the iBOT™ mobility device, and the Segway® Human Transporter.

Kamen has received many awards for his efforts. Notably, Kamen was awarded the National Medal of Technology in 2000. Presented by President Clinton, this award was in recognition for inventions that have advanced medical care worldwide, and for innovative and imaginative leadership in awakening America to the excitement of science and technology. Kamen was also awarded the Lemelson-MIT Prize in 2002, and was inducted into the National Inventors Hall of Fame in May 2005. He is a Fellow of the American Institute for Medical & Biological Engineering, and has been a member of the National Academy of Engineering since 1997.

In 2010, Dean hosted the Planet Green television series Dean of Invention.

In addition to DEKA, one of Dean's proudest accomplishments is founding FIRST® (For Inspiration and Recognition of Science and Technology), an organization dedicated to motivating the next generation to understand, use and enjoy science and technology. Founded in 1989, this year FIRST will serve more than 1 million young people, ages 6 to 18, in more than 80 countries around the globe. High-school-aged participants are eligible to apply for more than \$30 million in scholarships from leading colleges, universities, and corporations. Studies have shown that FIRST alumni are highly motivated to pursue careers in science and engineering, thus fulfilling Dean's goal of inspiring the next generation of technological leaders.