SENATE COMMITTEE ON SOCIAL CONCERNS
MINUTES OF MEETING
October 31, 2011
Morrill Hall Room 238A

[In these minutes: smart grid energy infrastructure]

[These minutes reflect discussion and debate at a meeting of a committee of the University of Minnesota Senate; none of the comments, conclusions or actions reported in these minutes represent the views of, nor are they binding on, the Senate, the Administration or the Board of Regents.]

PRESENT: Dave Golden (chair), Timothy Sheldon, Teresa Schicker, Michael O'Day, Susan Cable Morrison, Ahmed Heikal, Anthony Quill, John Broadhurst, Stephen Gross, Amelious Whyte, Shannon Evans, Carol Foth, Dan Kelliher,

REGRETS: David Fuhs, Sandra Krebsbach, Maria Hanratty, Rebecca von Dissen, Kim Robien, Lizzy Shay, Michael Sommers. Elizabeth Ault,

ABSENT: Rebecca Shankle, Leah Iverson

GUESTS: Professor S. Massoud Amin, director, Technological Leadership Institute

OTHERS: Jon Steadland, president's office

Dave Golden called the meeting to order, and asked committee members to introduce themselves. He then introduced Dr. S. Massoud Amin, director, Technological Leadership Institute. Dr. Amin provided the committee with a PowerPoint presentation on enabling a stronger and smarter energy infrastructure through the "smart grid." He began his presentation with a brief overview of his background and academic work. He is a professor of Electrical and Computer Engineering, and is the Director of the Technological Leadership Institute at the University of Minnesota in Twin Cities. He also serves as the director of graduate studies for the security technologies. His research focuses on two areas: 1) Global transition dynamics to enhance resilience, agility, security and efficiency of complex dynamic systems. These systems include national critical infrastructures for interdependent energy, computer networks, communications, transportation and economic systems; 2) Technology scanning, mapping, and valuation to identify new science and technology-based opportunities.

Prior to joining the University of Minnesota in March 2003, Dr. Amin held positions including Area Manager of Infrastructure Security, Grid Operations/Planning, and Energy Markets at the Electric Power Research Institute (EPRI) in Palo Alto, California. In the aftermath of 9/11, he directed all security-related research and development at EPRI, including the Infrastructure Security Initiative and the Enterprise Information Security (EIS).

Dr. Amin next discussed background information on world energy need and supply. He stated increasing populations would place increasing demands and stress on lifeline infrastructures such as electricity. Most of the anticipated population growth is in less developed parts of the world where much of the population has no or poor access to electricity. The world's electricity supply will need to triple by 2050 to keep up with the demand, necessitating nearly 10,000 gigawatts of new generating capacity. The United States uses one-fourth of the world's energy supply.

Energy security in the United States is at the intersection of national security, economic security, and environmental security. Energy security will require a mix of energy sources. Sources of US energy supply from 1850 to the present have moved from wood and coal to increasing amounts of oil, gas, and nuclear sources. Currently, renewable sources of energy such as solar energy are a tiny fraction of the energy source mix. One reason is the lack of infrastructure to store and transfer this energy.

Dr. Amin stated the end-to end energy infrastructure from the fossil fuel to its active utilization is extremely inefficient. Seventy-eight percent of the energy is lost through inefficient generation and heat wastage, transmission and distribution, and inefficient end use. Overloading the electrical transmission grid due to increased demands for electronics and continued electrification have also caused drops in the electrical grid's efficiency. Dr. Amin further highlighted the strains placed on the electrical transmission system in the last ten years by the large and rapid growth in summer peak demand (16% growth), electricity use (10%growth), space cooling (115% growth), and TV/PC use (180% growth). He also emphasized the impending strains caused by cloud computing and the "digitization of society." He noted the electric load is expected to double every five years as a result of digitization and stated that 2,500-megawatt hours of electricity are used each week by tweeting alone.

Dr. Amin stated strengthening and protecting the energy supply requires both an upgrade of the existing electrical transmission system and creation of efficient local microgrids. He showed the committee several maps of the United State's electrical transmission system and assessments of needed upgrades. He stated the existing grid needs to be increased by 42,000 miles and the cost of this is $82 billion over the next ten years. He noted this is relatively inexpensive, but the greater challenge is incentivizing over 400 different electrical utilities to take part in the upgrade. He also showed the committee several examples of microgrids using distributed solar production such as the "solar cities" in Sapporo, Japan and Freiburg, Germany. He noted that government incentives are necessary to promote large-scale usage of renewable energy sources because these sources are not as efficient as natural gas or nuclear.

He stated high voltage transmission outages cost the United States between $80 and $188 billion per year, and on average last 92 minutes per year in the Midwest, excluding extreme weather disasters. In comparison, Japan averages only 4 minutes of power outages each year. Power outages have steadily increased as the grid has become less reliable. Between 1991 and 1995 there were only 41 outages affecting more than 50,000 customers, and between 2005 and 2009 there were 349 outages.

After providing this background on the energy transmission system, Dr. Amin introduced the "smart grid." He stated the smart grid represents a remaking of the electrical power system encompassing all aspects of generation, delivery, and consumption. The end vision of the smart grid is a "highly developed electrical platform that engages consumers, enhances efficiency, ensures reliability and enables integration of renewable energy and electric transportation. The core of the smart grid is the seamless exchange of information from transmission to the consumer. Communication systems enable this infrastructure. One example of the smart grid is its ability to use sensors to measure how and when consumers us the most power. This information allows consumers to be charged variable rates for energy use based upon supply and demand. The variable rate will incentivize consumers to shift their heavy use of electricity to times of the day when demand is low.

Dr. Amin next outlined the costs and benefits of the smart grid:
Benefits:

- Increases efficiency by five percent ($20.4 billion in savings annually)
- Reduces costs of outages by about $49 billion/year
- Reduces carbon dioxide emissions by 12 -18% by 2030
- Decreases infrastructure investment costs by $46-117 billion
- Economic growth:
    - Adds $1.8 trillion annual revenue to the U.S economy by 2020.

Costs:

- Strengthening the grid will cost $82 billion for ten years
- Smart grid requires investment of $17 to $24 billion per year over the next 20 years.

Investment in the smart grid would nearly pay for itself by reducing outage costs and improving energy efficiency.

Dr. Amin believes the best way to implement the smart grid is at the city or college campus level. At the University of Minnesota, Dr. Amin and his team are working on the following projects:

- Integrating Plug-in Hybrid Electric Vehicles into the grid
- Fast power grid simulation and risk assessment
- More secure and smarter grid security of cyber-physical infrastructure
- Integration of Wind and Smart Grid Overlay at University of Minnesota Morris.
- An assessment of UMore Park to determine whether application of smart grid technologies would provide options for better managing community energy needs.

His long-term goal is to transform the University of Minnesota's Twin Cities' campus into "Smart GridU" by:
1) Developing system models, algorithms and tools for successfully integrating the components (generation, storage and loads) within a microgrid on the University of Minnesota campus.

2) Conducting "wind-tunnel" data-driven simulation testing of smart grid designs, alternative architectures, and technology assessments, utilizing the University as a living laboratory.
3) Developing a roadmap to achieve a "net zero smart grid" at the large-scale community level – i.e., a self-contained, intelligent electricity infrastructure able to match renewable energy supply to the electricity demand.

Dr. Amin discussed his proposal for a smarter more secure real-time distribution management system and the wide variety of individuals and corporations involved in the proposal. He also discussed building a Minnesota Smart grid working group that would identify smart grid pilot projects, develop the generation, transmission, utility, customer model, develop a portfolio for Minnesota Smart Grid capabilities.
He also touched on:

- Existing resources such as Minnesota's wind power generation
- Technology and service providers in Minnesota
- Existing Smart Grid projects,
- Renewable energy research at the University
- Emerging technology for energy storage.

Considering, the Smart Grid from a policy perspective he suggested starting at the local level and then moving up the political ladder to the state, regional, and national levels. He then discussed in more detail the Smart Grid assessment at UMore Park and potential smart grid projects at the University of Minnesota Morris. He also noted that Minnesota's technological leadership role enabled economic growth and the University had pioneered biosciences, medical devices, energy & power, agri-technologies, IT sensing and controls, security technologies, nano/bio/ IT.

Michael O'Day asked if individual or small scale solar power generation could be sold back to utility companies. Dr. Amin indicated this could be done, and explained the difficulties of solar power storage. He gave an example of how a solar powered electric vehicle charging station on the smart grid could charge the car during off-peak hours and sell back any unused power to the utility.

Tim Sheldon asked how the committee could support Dr. Amin's work. Dr. Amin discussed beginning the Smart Grid process by placing sensors in buildings that are being renovated and then moving out to the rest of the campus.

Teresa Schicker asked if Dr. Amin had any current construction projects in mind and whether there was any discussion of applying smart grid technology to the Central Corridor Light Rail Transit Project. Dr. Amin stated he was not currently working on implementing smart grid technology in any of the buildings on the Twin Cities campus, but the CCLRT and Northrup Auditorium renovation would both have been good candidates. Mr. Golden suggested the committee could consider speaking with Facilities Management about the possibility of including smart grid technology requirements in the request for proposal process on construction projects. Dr. Amin noted that the best

projects for application of smart grid technologies are those over which the University has full control.

Mr. Golden also asked if there is anything controversial about smart grid technologies. Dr. Amin stated the smart grid is not controversial, but it should not be confused with the smart meter. There are some concerns over smart meter security and data privacy. He warned the committee about defective smart meters.

Dr. Amin stated he would be happy to work with the committee on any action they may decide to take. Mr. Golden thanked Dr. Amin for his presentation.

Due to time constraints, the Committee voted to table the remaining issues on the agenda until the November 28 meeting.

Hearing no further business, Mr. Golden adjourned the meeting.

Dawn Zugay
University Senate Office