



# Energy Efficiency & Renewable Energy Research at Advanced Research Inst.

Presentation to Electrical Engineering Department  
The Cairo University

30 November, 2014

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# ARI Research Projects

[www.ceage.vt.edu/ceage\\_projects](http://www.ceage.vt.edu/ceage_projects)



Sponsored Projects at ARI	
1	<b>Partnerships for Innovation (PFI): Role of the Smart Grid in Alleviating Electrical Power System Stress Conditions Through Demand response</b> Sponsor: US National Science Foundation
2	<b>A Test-Bed for Analyzing the Security and Resiliency of the DG-integrated Electric Power Distribution Network</b> Sponsor: US National Science Foundation
3	<b>Optimizing Electric Power Distribution Network Operation with Demand Response, Solar PV and Energy Storage to Mitigate the Impact of Growing Electric Vehicle Penetration</b> Sponsor: US National Science Foundation
4	<b>US-Egypt Cooperative Research: Managing Grid Integration of Large-Scale Wind Power Parks using Energy Storage Technology and Demand Response</b> Sponsor: US National Science Foundation
5	<b>Qatar Power System Transition to a Smart Grid</b> Sponsor: Qatar National Research Foundation



# ARI Research Projects

[www.ceage.vt.edu/ceage\\_projects](http://www.ceage.vt.edu/ceage_projects)



Organization	
6	<b>Bi-Level Demand-Sensitive LED Street Lighting Systems</b> Sponsor: US Army Corps of Engineers
7	<b>Feasibility and Guidelines for the Development of Microgrids in Campus Type Facility</b> Sponsor: US Army Corps of Engineers
8	<b>Smart Grid Information Clearinghouse</b> <a href="http://www.sgclearinghouse.org">www.sgclearinghouse.org</a> Sponsor: US Department of Energy
9	<b>US-China Workshop: Identification of Challenges and Opportunities for Large-Scale Deployment of the Smart Grid (February 2013)</b> Sponsor: US National Science Foundation
10	<b>Building Energy Management Open Source Software (BEMOSS)</b> Sponsor: US Department of Energy





## Building Energy Efficiency

Buildings consume over 40% of the total energy in the US

90% of commercial buildings are small (<5,000 sq ft) or medium-sized (<50,000 sq ft) and have no energy saving measures available

13 million commercial buildings in the USA

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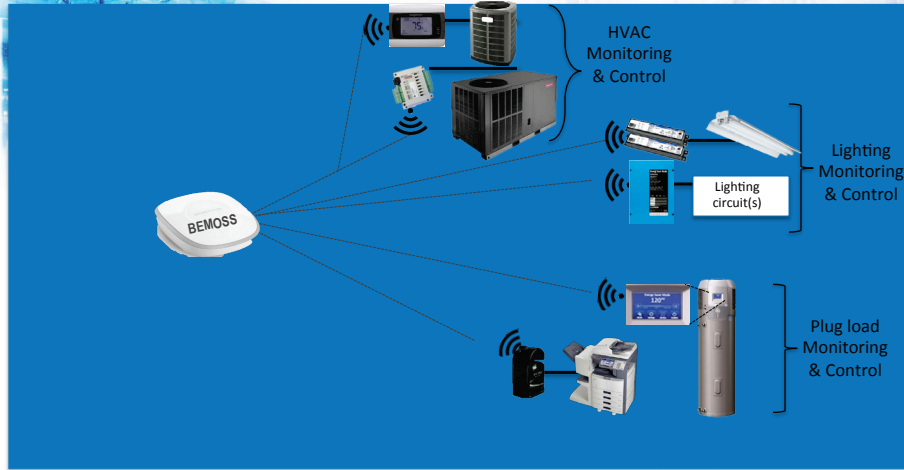
## Opportunities and Benefits of Energy Efficiency

These buildings typically do not use building automation systems to make them energy efficient

Policies encouraging building energy efficiency can reduce energy consumption and encourage product development and job opportunities in the service sector

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# Building Energy Management Open-Source Software



U.S. DEPARTMENT OF **ENERGY** | Energy Efficiency & Renewable Energy




Academic building in Alexandria



Park facility in Arlington



Retail building in Blacksburg




## *Bi-Level Demand-Sensitive LED Street Lighting Systems*

*PIs: Dr. Saifur Rahman and Dr. Manisa Pipattanasomporn*

Objective: To design, develop and demonstrate an energy efficient **bi-level demand-sensitive** LED street lighting system

and returned to full intensity when traffic is detected.



The streetlight will be dimmed at night

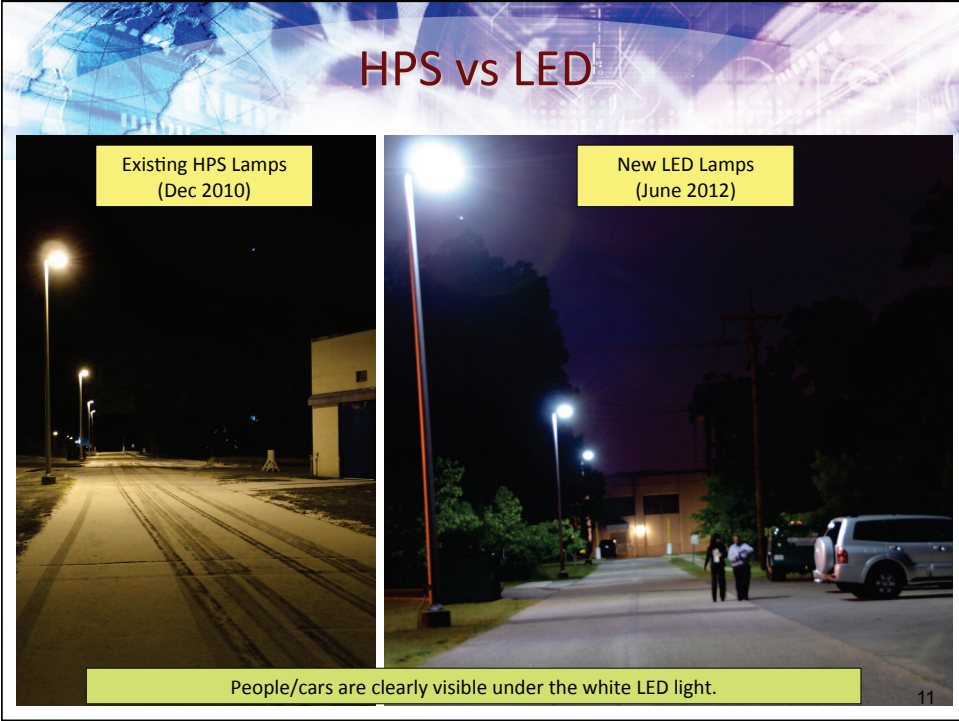
Sponsored by US Army Corps of Engineers  
Department of Defense

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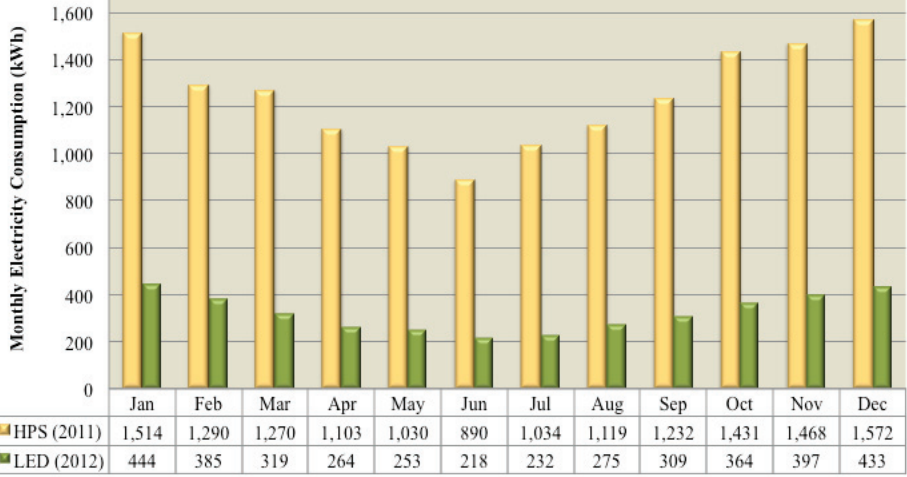
## LED Lighting Project @ Carderock



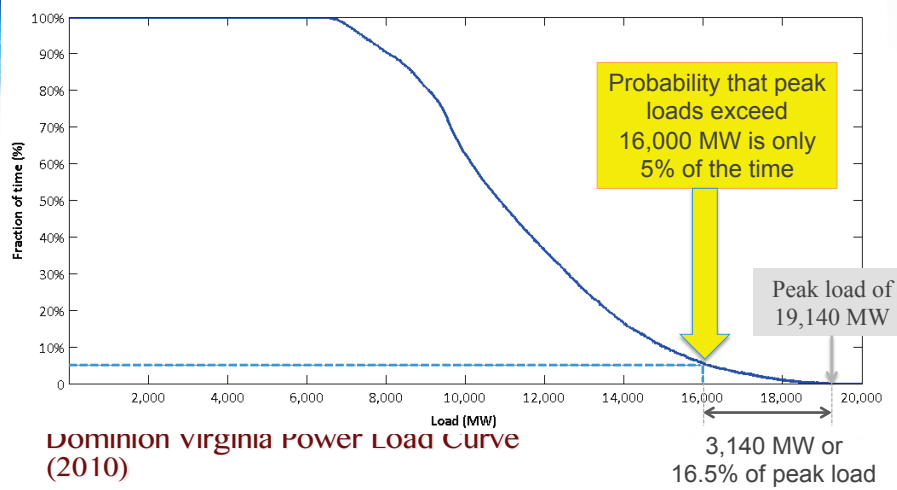


# HPS vs LED Monthly Electricity Consumption

Average electricity **savings of 75%** was experienced after the installation.



# Electric Utility Efficiency Improvement



## *Role of the Smart Grid in Alleviating Electrical Power System Stress Conditions Through Demand Response*

Objective: To design and develop a smart grid sensing and control hardware and software platform that enables efficient and flexible demand response programs with customer choice.

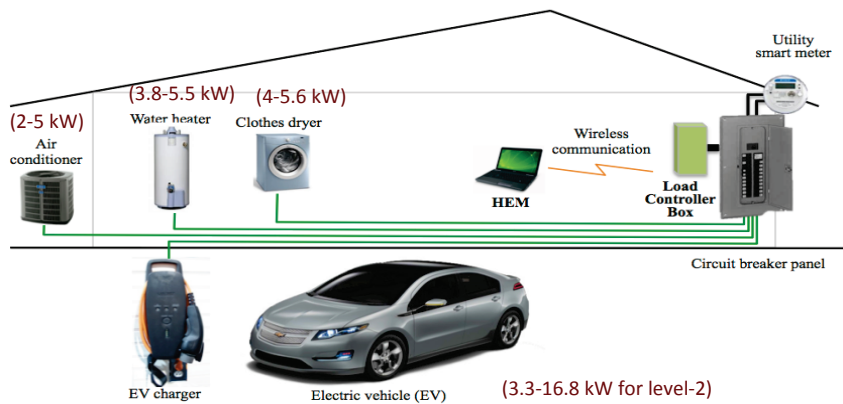


Sponsored by US National Science Foundation  
[www.ceage.vt.edu/ceage\\_projects](http://www.ceage.vt.edu/ceage_projects)



# Home Energy Management (HEM)

- Hardware and software that allows scheduling the operation of household power-intensive appliances in real-time to improve overall efficiency of an electric power network

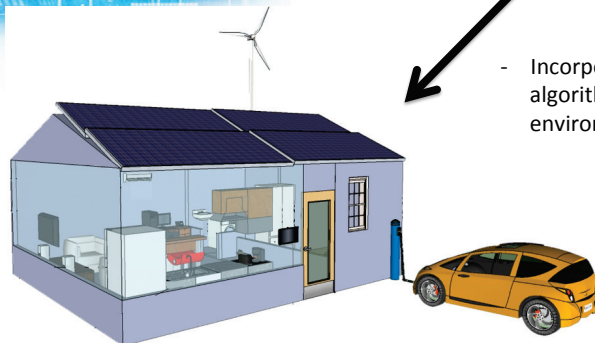


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# Collaboration with Yildiz Technical University, Istanbul, Turkey

## VT's HEM Algorithm

- Incorporated & tested HEM algorithm in YTU smart home environment



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# Solar Photovoltaics

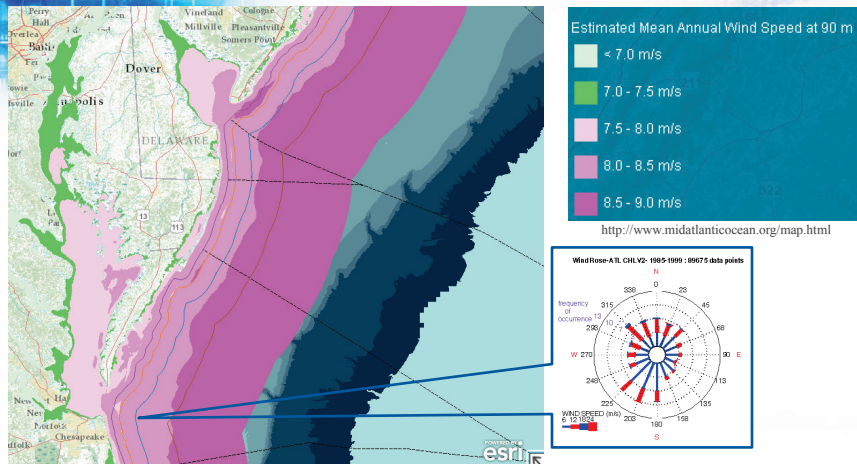


Roof-top Solar at Virginia Tech Arlington Research Center

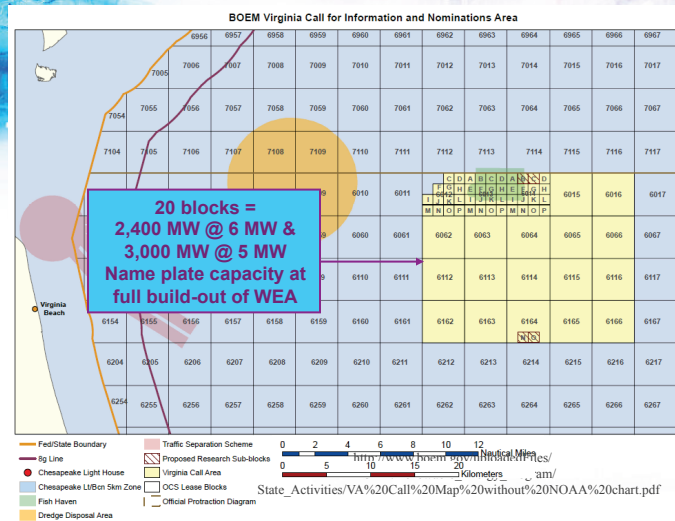


# Mid-Atlantic Off-shore Wind Resource

# Mid-Atlantic Wind Resource



# Virginia Wind Area of Potential



# Portal for Smart Grid Information Collection and Archival

## Smart Grid Information Clearinghouse

Pls: Dr. Saifur Rahman and Dr. Manisa Pipattanasomporn

Objective: To design, populate, manage and maintain a public SGIC web portal that reaches out to a broad user community both for information gathering and knowledge delivery.

[www.SGIClearinghouse.org](http://www.SGIClearinghouse.org)



Sponsored by US Department of Energy

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The screenshot shows the SGIC website interface. At the top, there is a navigation bar with the SGIC logo, the text "Smart Grid Information Clearinghouse", and the URL "www.sgicclearinghouse.org". Below the navigation bar is a search bar with a "Search" button. The main content area features a large banner image of a city at night with the text "Power for the Digital Economy". Below the banner are several content blocks: "FOR CONSUMERS" with a shopping cart icon, "SMART GRID 101" with a block letter 'A', "PROJECT MAP" with a map icon, "TECHNOLOGIES" with a power line icon, and "SMART GRID STORIES" with a list of news items. At the bottom, there is an "EVENT CALENDAR" with a calendar icon, a "Content Submission Platform" with a list of submission categories, and the "SMARTGRID.GOV" logo.

**SGIC** Smart Grid Information Clearinghouse [www.sgicclearinghouse.org](http://www.sgicclearinghouse.org)

Home Smart Grid 101 Smart Grid Projects Deployment Experience In-Depth Information International My SGIC About SGIC

**Power for the Digital Economy**

**FOR CONSUMERS**  
What can the Smart Grid do for me?

**SMART GRID 101**  
New to the Smart Grid? Visit our 101 page!

**PROJECT MAP**  
Projects near you? See our map.

**TECHNOLOGIES**  
What are the Smart Grid Technologies?

**SMART GRID STORIES**  
Historically Black Colleges and Universities Receive Funds for Fossil Energy Research *DOE RSS - [ 08/15 ]*  
IBM Launches New Grid Innovation *SmartMeters.com - [ 08/14 ]*  
Read more...

**EVENT CALENDAR**

**Content Submission Platform**

Use case	Contact SGIC team
Product registration	Smart grid project (U.S.)
Document & multimedia	Smart grid project (international)
Consumer awareness program	

**SMARTGRID.GOV**

SGIC

Smart Grid  
Information Clearinghouse

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## Smart Grid Projects

The SGIC smart grid project page archives smart grid projects in the United States. Use the filter below to browse the smart grid projects by project category. Click here to visit our international smart grid projects page. [Additional information about the government-funded projects is also available on www.smartgrid.gov.](#)

Filter

Project Category

## Smart Grid Projects

**Search Results**

Project Map
Project List
Funding Opportunity Announcements



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## International Smart Grid Projects

The SGIC international project page archives information about smart grid projects in Africa, Americas, Asia, Europe and Oceania. Use the menu below to navigate through the international smart grid projects by continent. Click here for projects in the United States.

Filter

Project Category

## International Smart Grid Projects

**Search Results**

Project Map
Africa
Americas
Asia
Europe
Oceania



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Smart Grid 101

The basic information on smart grid is captured under the following topics in the Smart Grid Information Clearinghouse (SGIC) web portal.

[Learn More](#)
[Acronyms](#)
[Resource Library](#)
[NIST Model](#)
[Consumer Awareness](#)
[Educational Videos](#)

- Learn More  
 Click here to find out more about smart grid, browse consumer awareness programs offered by the US federal government and state/local governments and the private sector, and access the SGIC content submission platform.
- Acronyms  
 The SGIC acronyms and glossary page provides over 400 frequently used smart grid-related acronyms and definitions.
- Resource Library  
 The SGIC resource library brings together smart grid-related documents published by a group of trusted sources. The library also contains documents submitted by others that have been reviewed for relevance.
- NIST Model  
 Explore the NIST conceptual model that defines the 7 smart grid clouds: generation, transmission, distribution, customers, operations, markets and service providers.
- Consumer Awareness
- Educational Videos

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In-Depth Information

In order to offer a comprehensive understanding of the smart grid and how it benefits the end-user, the SGIC web portal classifies the relevant information in the following five categories.

[Standards](#)
[Technologies](#)
[Cyber Security](#)
[Legislation](#)
[Education and Training](#)
[Demand Response](#)

- Standards  
 The SGIC standards page provides information and links to smart grid-related standards from various Standards Development Organizations (SDOs).
- Technologies  
 The SGIC technology page provides examples of smart grid technologies grouped into five key technology areas: integrated communications, sensing and measurement, advanced components, advanced control methods and interfaces and decision support.
- Cyber Security  
 The SGIC Cyber Security page brings together background information and training courses that are related to cyber security in the smart grid environment.
- Legislation  
 The SGIC legislation and regulation page is intended to provide a expansive source of information on U.S. legislations and regulations both at the federal level and at the state level.
- Education and Training  
 The SGIC education page brings together smart grid related educational courses and training materials published by various sources.
- Demand Response

## Other On-Going Work at ARI – Electric Vehicles



*Thank You*

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