



ISGAN and Annex 5: SIRFN AND A SPRING INT'L WORKSHOP AT BNL...

**BNL Smart Grid Workshop
9 October 2015 • Brookhaven, NY**

Russell Conklin

*Vice Chair, ISGAN Executive Committee
Policy Analyst, U.S. Department of Energy*

Objectives Today



- Inform about CEM, ISGAN and SIRFN
- Share vision for Spring 2016 workshop here at BNL
- Solicit ideas and take feedback on that vision

First – Some Context



Mérida, Mexico



CLEAN ENERGY MINISTERIAL

Accelerating the Transition to Clean Energy Technologies



CLEAN ENERGY
MINISTERIAL

Accelerating the Transition to Clean Energy Technologies

www.cleanenergyministerial.org



CEM INITIATIVES

	AUSTRALIA	BRAZIL	CANADA	CHINA	DENMARK	EUROPEAN COMMISSION	FINLAND	FRANCE	GERMANY	INDIA	INDONESIA	ITALY	JAPAN	KOREA	MEXICO	NORWAY	RUSSIA	SAUDI ARABIA	SOUTH AFRICA	SPAIN	SWEDEN	UNITED ARAB EMIRATES	UNITED KINGDOM	UNITED STATES
APPLIANCES (SEAD)	●	●	●		●			●	■	●		●	●	●		●		●	●	●	●	●	●	■
BLDS & INDUSTRY (EMWG)	●		●		●	●			●	●			●	●		●		●	●	●				■
SECTORAL (SWG)												■												
BIOENERGY		■									●	●												
HYDROPOWER		■									●				●	●								
SOLAR AND WIND					■		●	■	●	●										■				●
21 ST CENTURY POWER (21CPP)				●		●			■					●					●	●				■
ELECTRIC VEHICLES (EVI)			●	■	●		●	●	●			●	●	●		●			●	●	●		●	■
SMART CITIES (GSCN)				●		●	●														●	■		
SMART GRIDS (ISGAN)	●		●	●	●	●	●	●	●	●	●	■	●	■	●	●	●		●	●	■			■
SOLUTIONS CENTER (CESC)	■			●			●		●	●	●	●	●		●				●			●		■
GLOBAL LEAP												●	●						●				●	■
WOMEN IN ENERGY (C3E)													●		●	●			●			●	●	■

■ Lead ● Participant

Non-CEM countries, non-governmental organizations, and private businesses also participate in some initiatives.

CEM COMPARATIVE ADVANTAGE

Building a solid foundation

Real-world action

Private sector leadership

Sustained, year-round initiatives

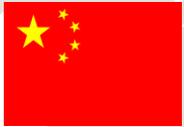
Exclusive focus on clean energy efforts

High-level energy policymakers connected with technical experts

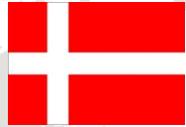


CEM Steering Committee

Established to provide year-round leadership and strategic guidance and to prioritize efforts in areas of greatest potential impact



China



Denmark



European Commission



France



India



Mexico



United Arab Emirates



United States

NEXT STEPS:

- Draft CEM framework document
- Identify options for CEM secretariat
- Explore deepening private sector engagement
- Develop objectives and metrics to track progress
- Expand communications and outreach efforts

GLOBAL LIGHTING CHALLENGE

A global race to reach cumulative sales of **10 billion** high-efficiency, high-quality and affordable advanced lighting products

Australia, China, France, Germany, India, Indonesia, Korea, Mexico, Russia, South Africa, Sweden, the United States, and the Directorate-General for Energy of the European Commission



CLEAN ENERGY SOLUTIONS CENTER

Scaling up the Solutions Center to respond to more requests for **real-time, no-cost assistance to policymakers** throughout the world and establishing **a new clean energy finance portal**

Australia and the United States announced additional funding; Canada, France, India, Italy, and Indonesia announced in-kind support with additional experts and tools.



POWER SYSTEM CHALLENGE

14 key countries and the EC endorsing eight principles to guide country efforts toward the clean, reliable, resilient and affordable power systems of the future

Denmark, Finland, France, Germany, India, Indonesia, Japan, Korea, Mexico, Norway, South Africa, Sweden, the United Arab Emirates, the United States, and the Directorate-General for Energy of the European Commission



POWER SYSTEM CHALLENGE

THE 8 PRINCIPALS

1. Power system transformation is a strategic imperative.
2. Cleaner power systems will improve public health and combat climate change.
3. Markets, prices, and tariffs should be aligned to support power system transformation.
4. **Smart grids are a key enabler for power system transformation**
5. Renewable energy is a strategic power system resource.
6. Innovation in finance and procurement is essential to accelerating transformation.
7. Power systems should be optimized to interface with other energy systems.
8. Skill and capacity development is critical to 21st century power systems.

The text of the challenge can be found here:

<http://cleanenergyministerial.org/portals/2/pdfs/CEM6-CEMPowerSystemChallenge-JointStatement.pdf>



Electric
Vehicles
Initiative



CEM7



https://www.youtube.com/watch?v=TUYdK4cNsBY&feature=youtu.be&utm_source=6-4-US&utm_medium=website&utm_campaign=web-sliders

CEM7 and CEM8

World's two largest economies and carbon emitters demonstrate commitment to the CEM and to clean energy



President Barack Obama announced in a video message that the **United States** will host **CEM7 in 2016**

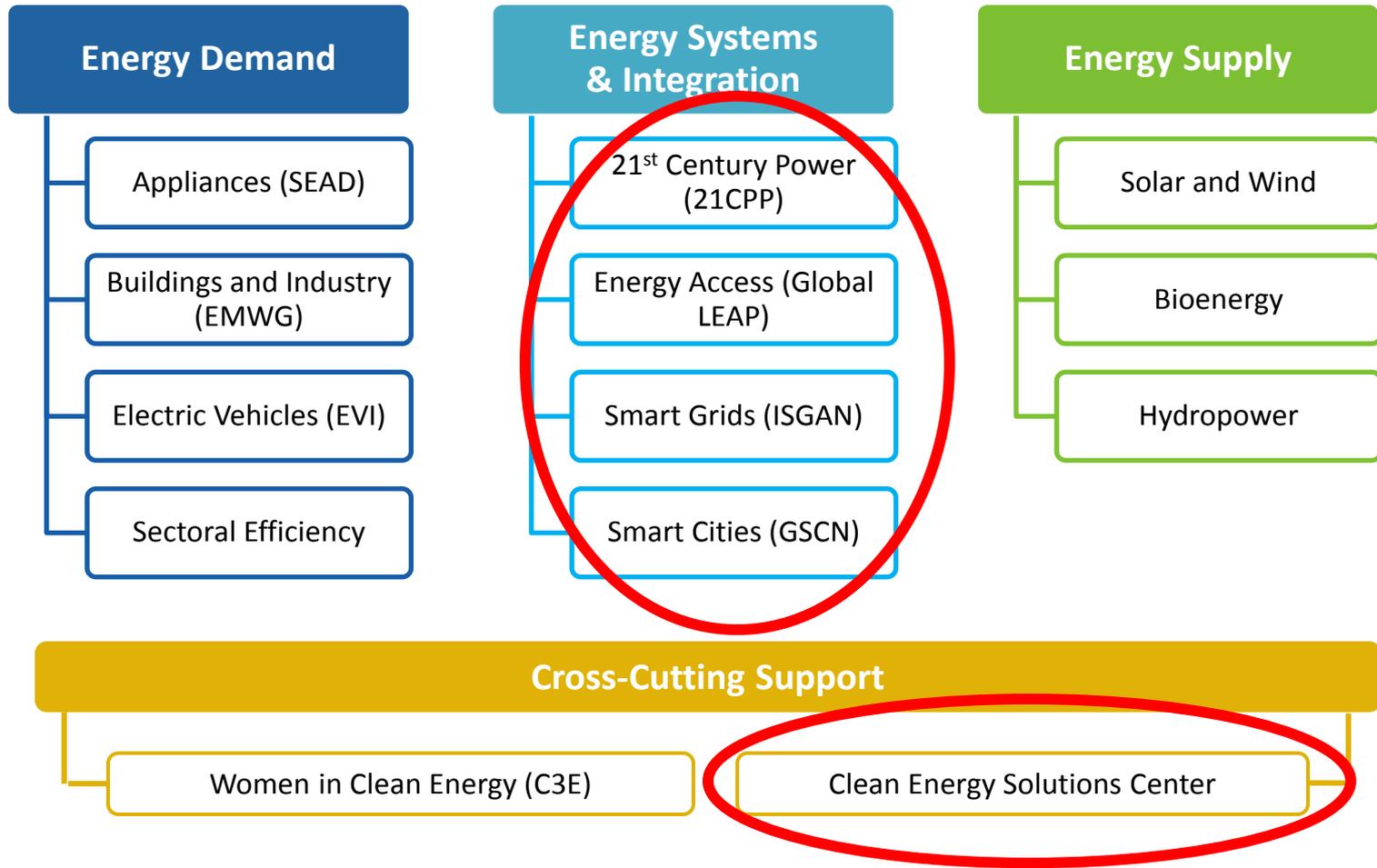
China's Minister Wan Gang announced that **China** intends to host **CEM8 in 2017**

CEM7 in California

- Fully use “CEM 2.0” platform to accelerate the global clean energy transformation
- Drive implementation of clean energy policies post-Paris COP and raise ambition further
- Leverage high-level political will (ministers from the world’s largest economies) for ambitious, real-world policies and action
- Highest-level private sector leadership; showcase innovation
- Drive ambitious outcomes, commitments, and actions from all

INITIATIVES

Year-round technical and policy collaboration delivering tangible results



Now – Back to ISGAN



WHY MULTILATERAL COOPERATION ON SMART GRIDS

Diverse Systems, Common Drivers:

- Electricity grids differ greatly from country to country, market to market, in technical characteristics, market structures, and governance.
- Yet, countries are asking the **same questions** about grid modernization and drawing from **similar pools of technologies, policies & standards**.
- **Multilateral cooperation** increases the likelihood of brokering **meaningful connections** across the specific areas of synergy.

Top 6
Motivating Drivers
for Smart Grids
from ISGAN analysis of
22 national-level survey
results



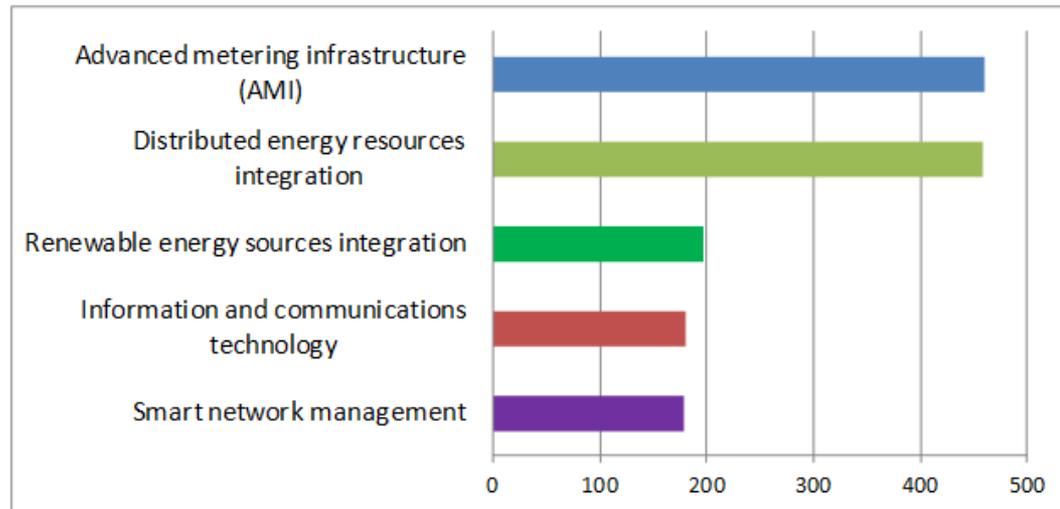
WHY MULTILATERAL COOPERATION ON SMART GRIDS



Diverse Systems, Common Drivers:

- Electricity grids differ greatly from country to country, market to market, in technical characteristics, market structures, and governance.
- Yet, countries are asking the **same questions** about grid modernization and drawing from **similar pools of technologies, policies & standards**.
- **Multilateral cooperation** increases the likelihood of brokering **meaningful connections** across the specific areas of synergy.

**Top 5
Technologies
across All Drivers
from ISGAN analysis of
22 national-level survey
results**



International Smart Grid Action Network =

Strategic platform to support high-level attention and action for the accelerated development and deployment of smarter, cleaner electricity grids around the world.

ISGAN activities are meant to...

- call attention to the importance of electricity grids for clean energy
- build a better global understanding of smart grids
- improve peer-to-peer exchange
- address gaps in knowledge and tools
- recognize excellence
- support replication of proven ideas

ISGAN Strengths



- **Broad Expert Network:**

ISGAN leverages expertise from governments, national laboratories and research institutions, transmission and distribution system operators, power generators, and others from **25 countries across five continents**.

- **Partnerships with Thought Leaders:**

ISGAN engages leading governmental and private sector initiatives (*e.g., ELECTRA, Global Smart Grid Federation*), the IEA Energy Technology Network, and other Clean Energy Ministerial initiatives (*e.g., 21st Century Power Partnership, Electric Vehicles Initiative*)

- **Diverse Portfolio:**

ISGAN implements a wide range of knowledge exchange and technical activities to capture international experience and advance systems perspectives on power grids and grid integration.

Participants



Contracting Parties: 25

Invited: Malaysia

Expression of Interest:
Indonesia



BROADER NETWORK



ISGAN WORK PROGRAM



Foundational Projects (Global Understanding & Tools)

Technical Projects

Other Projects

Annex 1:
Smart Grid
Inventory

COMPLETE

Annex 2:
Smart Grid
Case
Studies

Annex 5:
Smart Grid
International
Research
Facility
Network
(SIRFN)

Annex 7:
Smart Grid
Transitions
—
Institutional
Change

Annex 3:
Benefit-Cost
Analyses
and Toolkits

Annex 4:
Synthesis of
Insights for
Decision
Makers**

Annex 6:
Power T&D
Systems

ISGAN
Award of
Excellence

Virtual Training
Academy
(approved)

** Knowledge sharing
by design

ISGAN PRIORITIES



CAPTURE EXPERIENCES, BUILD GLOBAL UNDERSTANDING & TOOLS, FOSTER PEER EXCHANGE

Annex 1:

- Biennial assessment of smart grid project webinars

MOVED

Annex 2:

- Periodic case books:
 - DSM
 - AMI (*updated*)
 - Consumer engagement (*in development*)
- Best practice workshops

Annex 5:

- Comparative evaluation of smart inverter test protocols
- Smart distribution simulation platform
- Advanced test. mthds
- Technical workshops

Annex 7:

- Online network of professionals in social sciences for grids
- Data analysis of key “gatekeepers” & themes
- Social license for grids

Annex 3:

- Comparison of cost-benefit methodologies
- Tool to assess grid technology maturity
- Tools to assess value of specific smart grid technologies

Annex 4:

- Discussion papers on (*for example*)
 - RE integration
 - Smart grids in islands
 - Consumer engagement
- Outreach & comms strategies

Annex 6:

- Discussion papers & briefs (*for example*)
 - EU & US policy
 - Smart & strong transmission
- Best practice case book (*forthcoming*)
- Technical workshops

**ISGAN
Award of
Excellence**

**Virtual Training
Academy
(in development)**

AWARD OF EXCELLENCE



- **International competition to showcase global excellence, leadership and innovation in smart grid projects.**
- Theme for 2014: “Consumer Engagement & Empowerment”
- Winning project, runner up and finalists were announced in May 2014 in Korea at the Fifth Clean Energy Ministerial



***Congratulations to Entergy New Orleans’
“SmartView” AMI Pilot! 2014 Winner!***

- Winner selected by independent international jury of smart grid experts

The ISGAN Award of Excellence competition is supported by



AWARD OF EXCELLENCE



2015 Awards Theme:
**Excellence in Smart Grids
for Renewable Energy
Integration**



- Winner and honorable mentions announced on May 27 at Sixth Clean Energy Ministerial in Mérida, Mexico
- Jury led again by GSGF Executive Director Ronnie Belmans (also includes Becky Harrison, CEO, GridWise Alliance)

The ISGAN Award of Excellence competition is supported by



2015 Results



Winner

GRID4EU - Large-Scale Demonstration Of European Smart Distribution Networks

by Électricité Réseau Distribution France (ERDF), France (representing 6 European countries)



Honorable Mention

DS3 - Delivering A Secure, Sustainable Electricity System

by EirGrid, Ireland

Honorable Mention

Smart Grid Station of Korea Electric Power Corporation

by KEPCO, Korea



GSGF Best Smartgrid Project Award

Smart Grid Station of Korea Electric Power Corporation

by KEPCO, Korea

Award Ceremony at CEM6



Swedish Minister of Energy Ibrahim Baylan delivered the honors...



- Smart Grid Station of Korea Electric Power Corporation - by KEPCO, Korea



- GRID4EU - Large-Scale Demonstration Of European Smart Distribution Networks - by ERDF, France (representing 6 European countries)



- DS3 - Delivering A Secure, Sustainable Electricity System - by EirGrid, Ireland

As for SIRFN...



WHAT IS SIRFN?



(BESIDES BEING A BETTER ACRONYM THAN ISGAN)

The Smart Grid International Research Facility Network (SIRFN) is a **coordinated network of smart grid research and test-bed facilities and relevant projects in the field** in countries participating in ISGAN.

SIRFN's collaborative testing/evaluation capabilities are meant to be leveraged by the international community to enable improved design, implementation, and testing of smart grids.



Operating Agent: **DERlab**

Current SIRFN Participants



Central Power Research Institute



Korean Agency for Technology & Standards



Maybe →



SIRFN Objectives



- **Share Capabilities:**
Exchange knowledge on engaged facilities, including their infrastructure, equipment, programmes, etc.
- **Share Knowledge:**
Active information sharing among facilities to include:
 - Non-proprietary results of current research
 - Best practices, novel & emerging methods, etc.
- **Coordinate Joint Evaluation/Testing:**
Extend and expand smart grids testing and evaluation by identifying international testing gaps, implementing joint efforts

SIRFN's Value Proposition



- **Access to world-class facilities**

- Worldwide network of laboratories and test beds across **14 member countries**
- At least one leading research organization in each participating country; some like France and the U.S. with multiple institutions
- Engagement with **DERLab** members not directly in SIRFN



- **Technical Excellence**

- Participating facilities (and experts) are **world leaders**
- Growing number of **publications, partnerships and presentations**
- **Flexible portfolio** based on participants' capabilities, interests, and priorities

- **SIRFN/DERLab meetings, events, and facility information ensure **relevance to global smart grid community****

Areas of Collaboration



Smart Grid International Research Facility Network

Test Protocols for Advanced Inverter Functions

- *Goal:* Develop / demonstrate a consensus-based interoperability certification standard for IEC 61850-90-7 advanced distributed energy resources (currently, PV and ESS)
- “Round robin” evaluation of test protocols among facilities
- Meant to inform/accelerate adoption of the protocols by international standards organizations / grid code bodies
- *Example:* SIRFN results are informing updates to UL 1741 certification standard

Advanced Laboratory Testing Methods

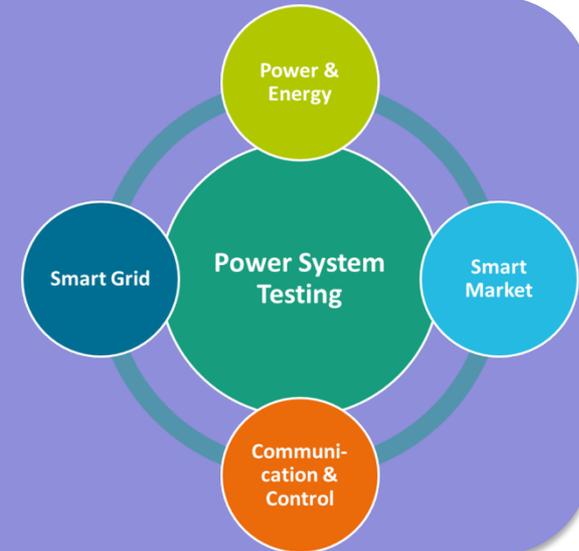
- Utilize novel ideas and novel methods (PHIL, CHIL, MD/Co-Sim)
- Creation of a work basis for future contributions to
 - Rapid prototyping and manufacturing
 - Standardized testing procedures (writing, testing)
 - Novel research areas in the electrical domain

Areas of Collaboration

Smart Grid International Research Facility Network

Power Systems Testing

- Numerous interdependencies in power system control
- Testing components only may miss such interactions/interdependencies
- Seeks to define requirements for true systems testing, applying state-of-the-art adv. lab testing methods



Smart Grid Modeling

- Developing model server for use by SIRFN facilities
- One-to-one replica utility systems – using real-world data and network topologies wherever possible – allowing holistic looks at system effects
- Evaluation of alternative designs against policy goals

Deliverables



- **Inverter test protocols – PV, ESS**
 - Initial PV protocols came out under Sandia logo
 - ESS protocols coming soon under ISGAN – SIRFN logo
- **Related research papers and presentations**
 - Released under IEEE, conferences like EU PVSEC, IRED, etc.
- **Trainings**
 - For example, BNL is training India’s Central Power Research Institute on use and programming Academic DEW (via webinar and teleconferences)
- **Workshops and technical meetings**
 - Typically, 1-2 per year
 - Workshop: Brookhaven Nat. Lab (NY, USA), April 14-15, 2016
 - Technical Meeting: IRED 2016 (Niagara Falls, Can.), Oct. 24, 2016
 - (+ Maybe one before then, if it can be scheduled...)
- **Proposed discussion paper: Key lessons learned and implications**
 - Capture experiences to date (both substantive and “meta”)

Examples of Work



- **Presentations**

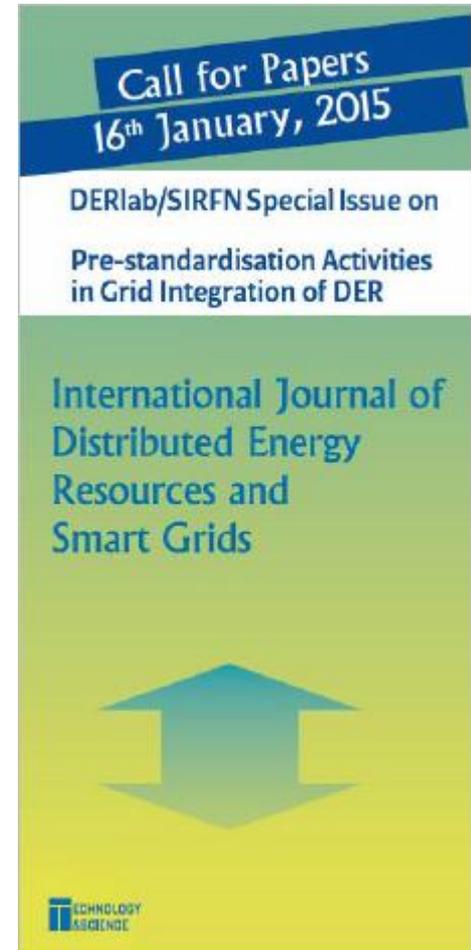
- D. Rosewater, “International development of energy storage interoperability test protocols for renewable energy integration, EU PVSEC 2015 **Plenary**, Hamburg, Germany, 17 Sept 2015
- J. Johnson, “Evolving grid codes around the world”, SunSpec Alliance Annual Meeting, San Francisco, CA, 31 Mar, 2015.

- **Papers**

- J. Neely, J. Johnson, R. Bryne, R. T. Elliott, Structured optimization for parameter selection of frequency-watt grid support functions for wide-area damping, International Journal of Distributed Energy Resources and Smart Grids, DERlab/SIRFN Special Issue on Pre-standardisation Activities in Grid Integration of DER, 2015.
- D. Rosewater, J. Johnson, C. Messner, R. Bründlinger, K. Johannes, M. Verga, R. Lazzari, J. Hashimoto, K. Otani, International development... [See above], EU PVSEC, Hamburg, Germany, 14-18 Sept, 2015.

- **DERlab/SIRFN Special Issue on Pre-standardisation Activities in Grid Integration of DER (*forthcoming*)**

- **Articles will be made available for free to ISGAN (and SIRFN) participants**



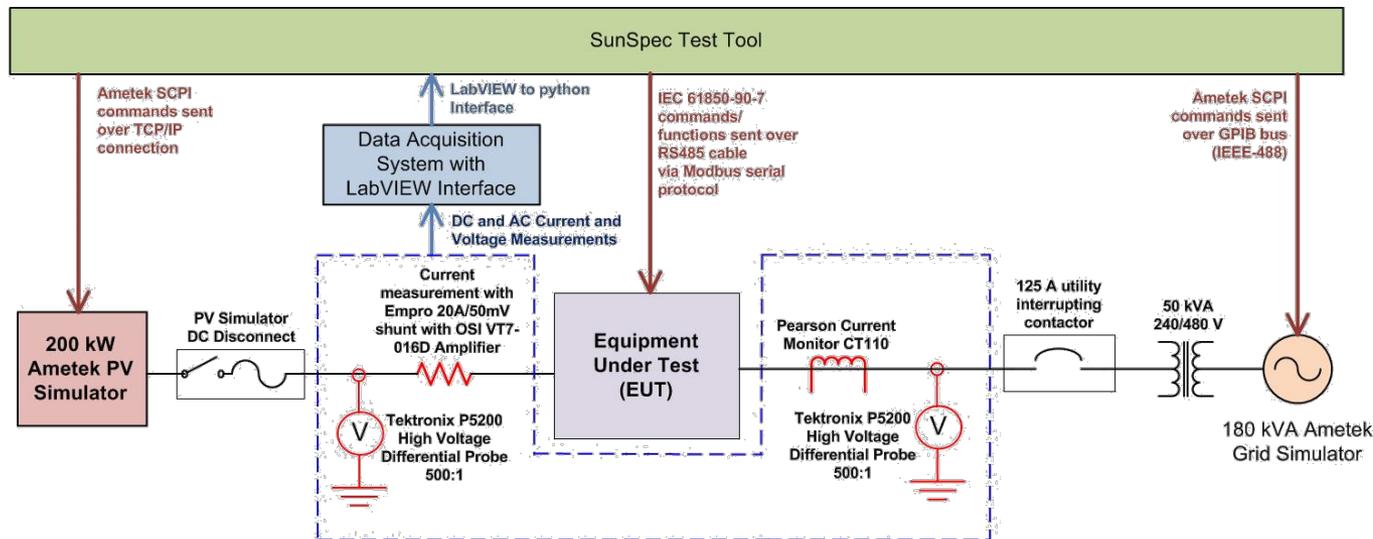
Presentation to EU PVSEC 2015



- In plenary, shared work to date on ESS interoperability testing protocols among Sandia, AIT (Austria), RSE (Italy) and FREA (Japan)

SIRFN Program Impact

- The research project has made impact!
 - For instance, the refined PV inverter test protocols for the project have acted as **the basis** for the new testing requirements in **UL 1741 Supplement A**.
 - As part of the project, Sandia has worked with the **SunSpec Alliance** to create an automated **System Validation Platform (SVP)**.
 - This software allows test scripts to be passed between laboratories.
 - KERI and Sandia have copies of the software program.
 - Underwriters Laboratories is investigating the SVP for certification testing



J. Johnson, B. Fox, "Automating the Sandia Advanced Interoperability Test Protocols," 40th IEEE PVSC, Denver, CO, 8-13 June, 2014.

Looking to Spring '16...



Next April – BNL Workshop



- **Vision: An international workshop on smart grids, microgrids, and modeling/simulation**
- **Objectives:**
 - Improve understanding on shared priorities and available tools
 - Exchange knowledge and lessons learned
 - Facilitate sustained international engagement in areas of mutual interest or need
 - Where applicable, enhance countries' progress on CEM Power System Challenge
 - Value for both domestic and international participants!

Next April – BNL Workshop



- **Proposed Targets:**

- Mix of U.S. and non-U.S. speakers
- Mix of developed and key emerging economies (*e.g., India, South Africa, Nigeria, etc.*)
- Discussion cutting across policy and technical issues/needs
- Comparison of approaches across regions (U.S., Europe, Asia, etc.) and tools (*e.g., EDD, Homer, DER-CAM, etc.*)
- Beyond the workshop, opportunities for meetings, enhanced learning / training, site visits, etc. for international participants

Your thoughts?



- Q & A / Discussion

THANK YOU!

For more information, please visit:

- Clean Energy Ministerial: www.cleanenergyministerial.org
- IEA Energy Technology Network: www.iea.org/techno/index.asp
- ISGAN: www.iea-igsaw.org
- ISGAN Partners:
 - 21st Century Power Partnership (CEM): www.21stcenturypower.org
 - Global Smart Grid Federation: www.globalsmartgridfederation.org
 - Electric Vehicles Initiative (CEM): www.worlddevcities.org
 - Clean Energy Solutions Center (CEM): www.cleanenergysolutions.org



Contact info: russell.conklin@hq.doe.gov, +1 202 586 8339

ISGAN Secretariat: igsaw@smartgrid.or.kr

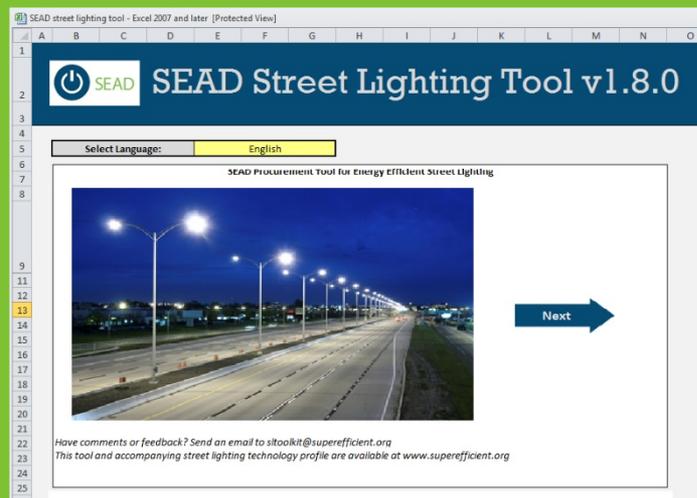
SIRFN Operating Agent: sirfn@der-lab.net

APPENDIX

CEM INITIATIVES

Energy Demand

The Super-efficient Equipment and Appliance Deployment (SEAD) initiative is supporting the transition to energy efficient street lighting by providing a free calculator and training that helps purchasers make more informed choices that could contribute to energy savings of up to 50 percent.



CEM INITIATIVES

Energy Demand

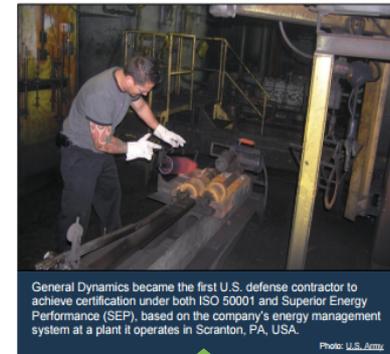
The Energy Management Working Group targets the massive energy savings possible through public-private partnerships in industrial and commercial settings; ISO 50001 pilot programs at companies in Canada, the U.S., Mexico show energy performance improvements of 10 percent or more.

Global Energy Management System Implementation: Case Study

USA, Superior Energy Performance

GENERAL DYNAMICS Ordnance and Tactical Systems

Defense contractor improves energy performance nearly 12%, achieving a six-month payback and earning Gold-level certification by Superior Energy Performance



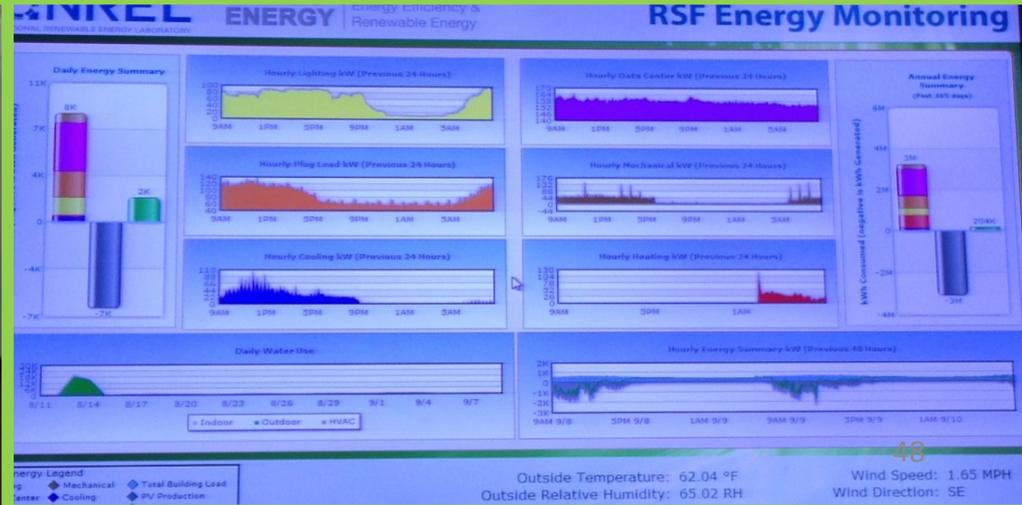
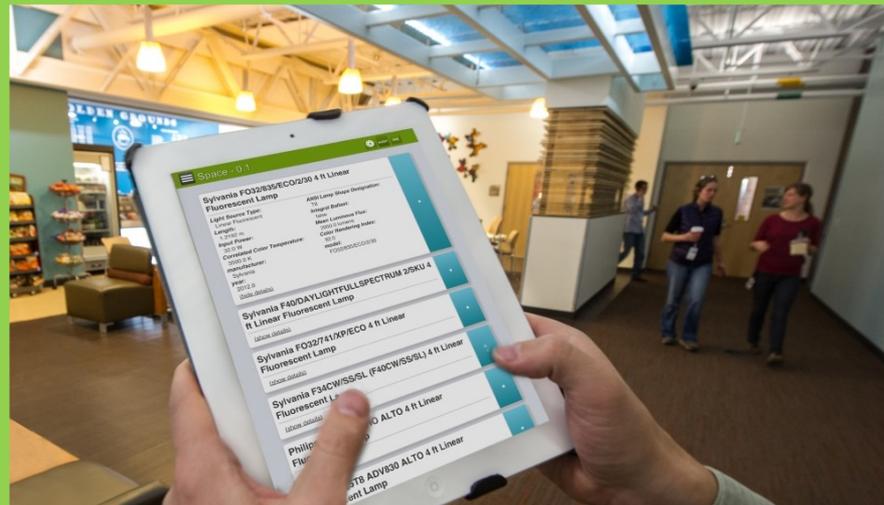
General Dynamics became the first U.S. defense contractor to achieve certification under both ISO 50001 and Superior Energy Performance (SEP), based on the company's energy management system at a plant it operates in Scranton, PA, USA.
Photo: U.S. Army

Case Study Snapshot
 Industry: Defense Contracting
 Energy Management System (EnMS) guidance/standard: ISO 50001
 Key driver for EnMS: Environmental stewardship, government requirements, and cost reduction
 Improvement focus: Seven processes using significant amounts of energy
 Location: Scranton, Pennsylvania, USA
 Product(s): Large-caliber artillery and mortar projectiles
 Cost to implement: \$255,000
 Annual energy cost savings: \$956,000
 SEP Marginal Payback period: About six months
 Energy sources: Electricity and natural gas
 Energy reduction goal: 25% reduction in energy intensity by 2020

Business Benefits Achieved

General Dynamics Ordnance and Tactical Systems (GD-OTS) worked with the U.S. Department of Energy's Advanced Manufacturing Office to successfully implement an energy management system (EnMS) at its facility. The system includes energy audits, energy monitoring, and energy conservation measures. The system has resulted in a 12% improvement in energy performance, a six-month payback period, and Gold-level certification by Superior Energy Performance (SEP). The system also helps the plant to estimate energy savings and to identify areas for improvement. The plant's energy resources are now proactively managed via a rigorous business system to sustain those energy savings and continue strengthening plant energy performance in the future.

About Superior Energy Performance (SEP)
 Defense contractor improves energy performance nearly 12%, achieving a six-month payback.



CEM INITIATIVES

Energy Systems & Integration

The Global Lighting and Energy Access Partnership (Global LEAP) partnered to create a quality assurance framework that helped enable the sale of 5.7 million off-grid solar lighting systems in Africa, delivering health and social benefits to more than 28 million people and mitigating more than 3 million tonnes of CO₂.

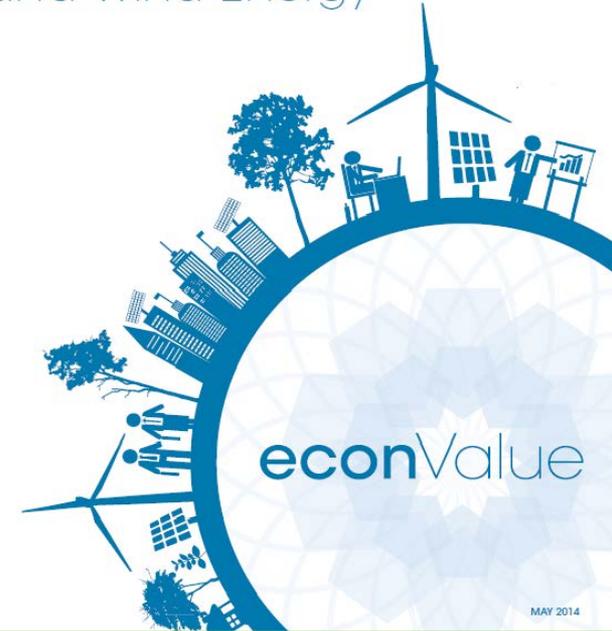


CEM INITIATIVES

Energy Supply

An econ-Value report, produced by the Multilateral Solar and Wind Working Group in partnership with IRENA, is helping policy makers analyze the economic opportunities from solar and wind development and identify the policies to best support those opportunities.

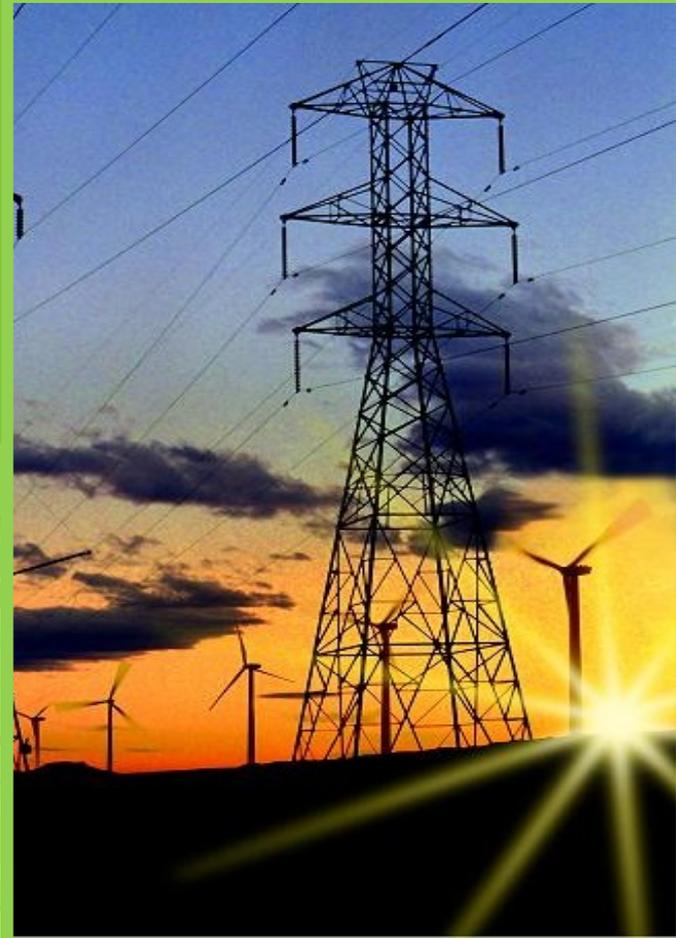
The Socio-economic
Benefits of Solar
and Wind Energy



CEM INITIATIVES

Energy Systems & Integration

Technical assistance provided through the 21st Century Power Partnership is building capacity in countries including India, Mexico, and South Africa to manage the integration of variable renewable energy and the deployment of large-scale energy efficiency and smart grid solutions.



CEM INITIATIVES

Energy Demand

Analysis done by the Electric Vehicle Initiative showed India could save 4.8 billion barrels of oil and 270 million tons of CO₂ emissions by 2030 if its deployment targets are met and is now being used to to inform India's National Mission on Electric Mobility.



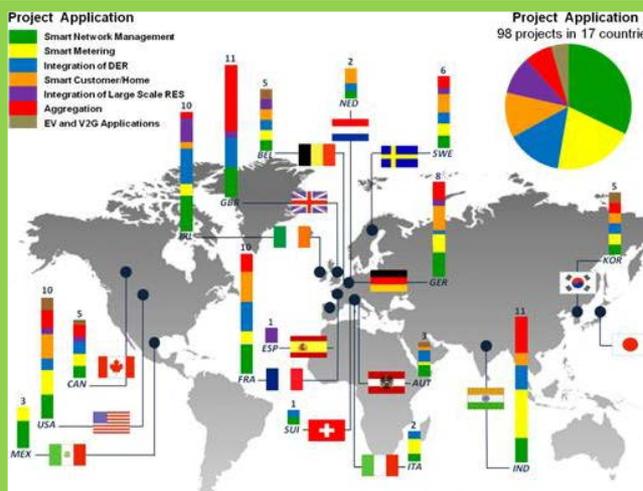
Assessing and Accelerating Electric Vehicle Deployment in India



CEM INITIATIVES

Energy Systems & Integration

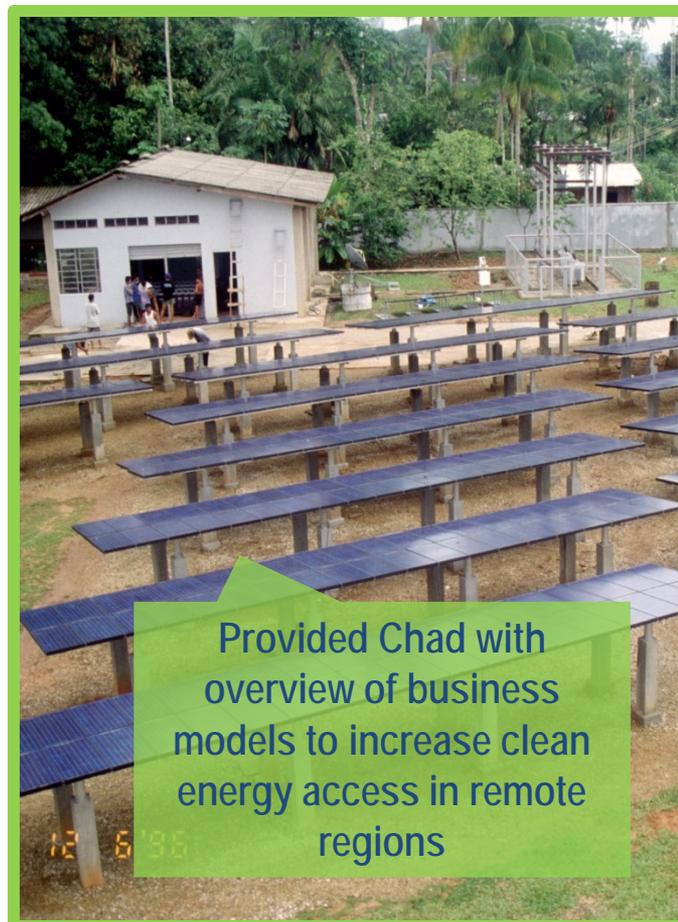
The International Smart Grid Action Network (ISGAN) is a global platform for addressing gaps in data, knowledge and tools related to smart grids. For example, world-class labs in ISGAN are advancing interoperability test protocols for critical solar and energy storage inverter functions.



CEM INITIATIVES

Cross-Cutting Support

The Clean Energy Solutions Center has provided high-quality clean energy policy assistance to more than 80 countries through its rapid response no-cost Ask An Expert service.



Provided Chad with overview of business models to increase clean energy access in remote regions

Helped Caribbean Community set aggressive 47% renewable energy target for 2027



Worked with South Africa on regulation designed to promote energy efficiency in commercial buildings