Summary of the International Technology Innovation Summit of EPRI hosted by ESB in Dublin, Ireland (3, 4 and 5th June 2014)

Every year the Electric Power Research Institute (EPRI) of the US is hosting an innovation summit on important themes of the industry. This year the innovation summit was dedicated to the developments in the electric grid and more specifically the technical implications of the rise of distributed generation and the transformation of the distribution grid from passive to active. It was very fortunate for the partners of the SmartPV project that an invitation came through to Dr Venizelos Efthymiou, chairman of FOSS at the University of Cyprus to participate in the proceedings of the workshop on behalf of the SmartPV consortium (see the attached final list of attendees at the innovation summit and the collective picture of all participants).

The International Technology Innovation Summit provides an opportunity for Chief Technology Officers or equivalent to exchange information on the opportunities for technology to shape the future of the electricity system (see the attached agenda of the innovation summit). The information that is shared will help participants to develop roadmaps for their own technology development and adoption and to inform critical stakeholders on the enabling policies that will be needed to go hand in hand with technology adoption.

The theme of EPRI's 3rd International Technology Summit was "The Integrated Grid: Realizing the Full Value of Central and Distributed Energy Resources." The electric power system has evolved by leveraging central power plants interconnected via grids of transmission lines and feeding distribution networks that supply power to customers. This design is now beginning to change, rapidly in some locations, with the rise of distributed energy resources (DER) such as small natural gas-fueled generators, combined heat and power plants, electricity storage, and solar photovoltaics (PV) connected to the distribution system.

To realize fully the value of distributed resources and to supply all consumers with a quality and reliable supply, there is a growing need to integrate DER in the planning and operation of the electricity grid and to expand the scope of the existing grid to include DER operation – what EPRI is calling "The Integrated Grid" (see the attached leaflet of the summit "The Integrated Grid infographic").

The electric power system has evolved through large, central power plants interconnected via grids of transmission lines and distribution networks that feed power to customers. The system is beginning to change—rapidly in some areas— with the rise of distributed energy resources (DER) such as small natural gas–fueled generators, combined heat and power plants, electricity storage, and solar photovoltaics (PV) on rooftops and in larger arrays connected to the distribution system. In many settings DER already have an impact on the operation of the electric power grid. Through a

combination of technological improvements, policy incentives, and consumer choices in technology and service, the role of DER is likely to become more important in the future.

The successful integration of DER depends on the existing electric power grid. That grid, especially its distribution systems, was not designed to accommodate a high penetration of DER while sustaining high levels of electric quality and reliability. The technical characteristics of certain types of DER, such as variability and intermittency, are quite different from central power stations. To realize fully the value of distributed resources and to serve all consumers at established standards of quality and reliability, the need has arisen to integrate DER in the planning and operation of the electricity grid and to expand its scope to include DER operation.

As can be appreciated the innovation summit has given the opportunity to the project consortium, of relating the content of the planned work with the aspirations of the international world and adapt the deliverables of the project in such a way so as to be in line with the international aspirations and needs of the electrical industry. The Integrated Grid among other things, depends a lot on effective forecasting tools, time of use tariffs and demand side management to achieve sufficient integration and optimal system solutions for all participants and stakeholders.

Dr Venizelos Efthymiou
Chairman of FOSS
Research Centre of "Sustainable Energy"
University of Cyprus

ATTENDEE LIST

International Technology Innovation Summit

June 3-5, 2014

Dublin, Ireland

First Name	*Last Name*	*Company*	*Title*
Richard	Acton	EPRI International, Inc.	Country Manager
Rolf	Apel	Siemens AG	Principal Key Expert, Technology and Innovation
Jose	Arrojo	ENEL S.p.A.	Vice President of Innovation
Gareth	Baber	Toshiba International Corp.	GM, Infrastructure Division
Paul	Beaton	National Academy of the Sciences	
Andreas	Berthold-van der Molen	Microsoft	Industry Director, Power and Utility
Laura	Brien	CER, Ireland	Director of Markets
John	Byrne	ESB	Smart Networks Manager
Manuel	Calvo	Gas Natural SDG, S.A.	Technology Director
Sheryl	Carter	DBA Board of Directors	Co-Director, Energy Program
Bill	Cassidy	ALSTOM Grid	Country Sales Director
Desmond	Chan	Bechtel Power Corporation	Manager of Technology
Jorgen	Christensen	Association of Danish Electric Utility	Chief Technology Officer
David	Clarke	Energy Technologies Institute	Chief Executive
James	Connaughton	C3 Energy	Executive Vice President
Tony	Court	Cisco Ltd	Senior Director EMAR
Martin	Curley	Intel Labs, Europe	VP & GM
Suzanne	Daugherty	PJM Interconnection	SR VP, CFO and Treasurer
Agustin	Delgado	Iberdrola, S.A.	Innovation,Environment,Quality Dire
Jose	Delgado	EPRI International, Inc.	Country Manager
Rich	Dewey	New York ISO	Sr. VP & CIO
Eddie	Downey	IFA	President
Kevin	East	EPRI International, Inc.	Director, International Strategic Accounts
Venizelos	Efthymiou	University of Cyprus	Faculty of Engineering
Bernhard	Ernst	SMA Solar Technology AG	Director, Grid Integration
Adnan Mohammed	Fakhro	Electricity and Water Authority (EWA), Bahrain	Deputy Chief Distribution & Customer Services
Fallon	Teresa	ESB	Manager, Smart Network
Lorenzo	Francia	UNESA - A. E. Industria Electrica	Tech. & Engineering Mgr., Nuclear
Seamus	Garvey	University of Nottingham	Professor
Clark	Gellings	Electric Power Research Institute (EPRI)	EPRI Fellow
Roberto	Gonzalez Sainz-Maza	Iberdrola Distribucion	European Smart Grid Projects Mgr.
Bob	Hanna	Department of Communications Energy & Natural Resources (Ireland)	Chief Technical Advisor
Tony	Hearne	ESB	Manager, Renewable Planning
Chris	Hobson	Southern Company Services, Inc.	SVP, Research & Environ. Affairs
Brid	Horan	ESB	Deputy CEO
Mark	Horsley	Northern Gas Networks	Chief Executive Officer
Olivier	Huet	ERDF	Deputy Director, Strategy
Neil	Hughes	National Grid Electricity Transmission plc	Head of Technology
Michael	Hynes	ESB	Smart Networks Engineer
Sebastian	Johansen	Fortum Oyj	Senior Technology Expert
Robert	Jones	Morgan Stanley	Senior Advisor
Yong-Hak	Kim	Korea Electric Power Corp.	Senior Researcher
Klaus	Kleinekorte	Amprion GmbH	Dr.
Eamonn	Lannoye	EPRI International, Inc.	Engineer/Scientist II
Lea Ann	Lawson	Electric Power Research Institute (EPRI)	Executive Assistant
Robert	Long	SCANA Corp.	General Manager Resource Planning
Barry	MacColl	ESKOM	General Manager – Research, Testing and Development
Bernadine	Maloney	ESB	Mgr., Clean Coal Project
Rob	Manning	Tennessee Valley Authority (TVA)	External Relations & Shared Serv
Arshad	Mansoor	Electric Power Research Institute (EPRI)	SVP, Research & Development
Maria	Martin	EPRI International, Inc.	Country Manager, Latin America
Kenneth	Matthews	IWEA	Gen Sec/CEO
Mark	McCullough	American Electric Power Service Corp.	Exec Vice President, Generation

ATTENDEE LIST

International Technology Innovation Summit

June 3-5, 2014

Dublin, Ireland

First Name	*Last Name*	*Company*	*Title*
Mark	McGranaghan	Electric Power Research Institute (EPRI)	VP, PDU
John	McSweeney	ESB Energy International	Head of Innovation
Mehdi	Moussavi	AREVA	VP, External Partnerships
Koen	Noyens	Eurelectric	Advisor
Pat	O'Doherty	ESB	CEO
Dervla	O'Flaherty	ESB	Marketing & Communications Manager
Ronan	O'Hogartaigh	ESB	Operations Manager, Asset Manager
Denis	O'Leary	ESB	Head of Smart Energy Technologies
Terry	Oliver	Bonneville Power Administration (BPA)	Chief Technology Innovation Officer
Mark	O'Malley	UCD	Professor of Electrical Engineering
Chris	Open	E.ON Technologies (Ratcliffe) Limited	R&D Programme Leader
Jerry	O'Sullivan	ESB Networks	Executive Director, Networks
Shane	O'Sullivan	ESB Networks	Executive Director
Jan	Panek	European Commission	Head of Unit, DG Energy, Unit B3
Soon-Kyu	Park	Korea Electric Power Corp.	Head, KEPCO Research Institute
Sauro	Pasini	ENEL Ingegneria e Ricerca S.p.A.	VP, Res Tech Area, Eng & Innovation
Kevin	Payne	Southern California Edison Co.	Sr Vice President, Customer Service
John	Power	Engineers Ireland	CE
Gil	Quiniones	New York Power Authority	President & CEO
Anda	Ray	Electric Power Research Institute (EPRI)	Vice President - Environment & Chief Sustainability Officer
Michael	Reid	Duke Energy Corp.	Director of Technology Development
Ian	Rose	Passivsystems Limited	Professional Services Director
Ronald	Schoff	Electric Power Research Institute (EPRI)	Program Manager, Sr
Pat	Smith	IFA	CEO
Richard	Smith	Ameren Services Co.	Director - Research & Development
Konstantin	Staschus	ENTSO-E, European Network of Transmission System Operators for Electricity	Secretary-General
Jose	Tagle	Iberdrola, S.A.	Head of Technology Innovation Dept.
Thomas	Theisen	RWE	General Manager, New Technologies
Celine	Trainor	ESB	
Peter	van der Sluijs	Alliander	Head of Strategy
Chandu	Visweswariah	IBM	IBM Fellow
Vaclav	Vyskocil	EPRI International, Inc.	Account Executive
Anthony	Walsh	ESB	Specifications Manager
Michael	Walsh	EirGrid	Director Future Grids
Ian	Welch	Ian Welch Power Consulting Ltd.	Director
Dave	Willis	ESB	Engineer
Owen	Wilson	Electricity Assoc Ireland	Mgr., Group HSE


Energy for generations
EPRI ELECTRIC POWER RESEARCH INSTITUTE
International Technology Innovation Summit
June 3-5, 2014
Energy for generations

FINAL AGENDA

Electric Power Research Institute
International Technology Innovation Summit

Hosted by Electricity Supply Board (ESB)

June 3-4, 2014
The Westin Dublin at College Green
Westmoreland Street, Dublin, Ireland

June 5, 2014
Science Gallery, Trinity College Dublin

Purpose

The International Technology Innovation Summit provides an opportunity for Chief Technology Officers or equivalent to exchange information on the opportunities for technology to shape the future of the electricity system. The information that is shared will help participants to develop roadmaps for their own technology development and adoption and to inform critical stakeholders on the enabling policies that will be needed to go hand in hand with technology adoption.

The theme of EPRI's 3rd International Technology Summit is "The Integrated Grid: Realizing the Full Value of Central and Distributed Energy Resources." The electric power system has evolved by leveraging central power plants interconnected via grids of transmission lines and feeding distribution networks that supply power to customers. This design is now beginning to change, rapidly in some locations, with the rise of distributed energy resources (DER) such as small natural gas-fueled generators, combined heat and power plants, electricity storage, and solar photovoltaics (PV) connected to the distribution system.

To realize fully the value of distributed resources and to supply all consumers with a quality and reliable supply, there is a growing need to integrate DER in the planning and operation of the electricity grid and to expand the scope of the existing grid to include DER operation – what EPRI is calling "The Integrated Grid."

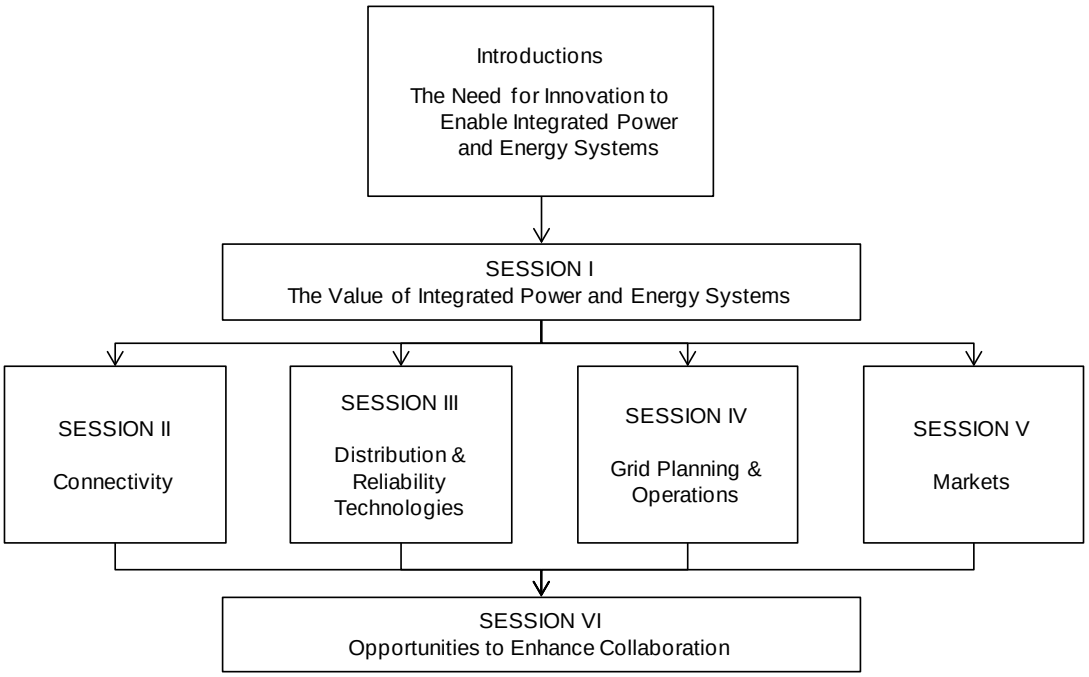
Summit Agenda

The purpose of this Summit is to share experiences among international participants and to chart a course to transform to an integrated grid through:

- Innovation to enable integrated power and energy systems
- Deployment of advanced grid and customer technologies
- Strategies for integrating DER with grid planning and operation

- Refining interconnection rules and telecom technologies
- Creating innovative and effective markets and rate designs

The speakers and the participants will share their experience in transforming to an integrated grid, and the experience will be the takeaway for the participants to form their own strategy for transforming to an integrated grid.



Day 1: Tuesday, June 3, 2014

The first day of the Summit will define the integrated grid concept and highlight the need for an integrated power and energy system to address the world's desires to provide safe, clean, reliable and affordable energy to all citizens. Collaborative sessions will chart the vital steps to deliver an integrated grid based on International experience in the areas of grid planning, grid operations and adapting to new technologies. Sessions on the first day will highlight experiences in Ireland, Germany and other countries with detailed insights into the technological challenges and solutions delivered. A definition of integrated power systems will be offered along with discussions on enabling the integrated grid through collaboration in:

- innovation in developing an integrated grid
- interconnection rules and communications technologies and standards
- deployment of advanced distribution and reliability technologies

Day 2: Wednesday, June 4, 2014

The second day of the Summit will continue to focus on innovation in system development and new market-based strategies. Innovative and effective strategies to integrate distributed resources will be presented, including real experiences of the challenges and successes to date. Sessions will cover:

- Changing role and expectations of customers
- Strategies for integrating distributed energy resources with grid planning and operation
- Innovative market and rate designs for sustainable grid services

Day 2 will conclude by offering a call to action: enabling enhanced worldwide collaboration toward the effective development of the integrated grid.

Day 3: Thursday, June 5, 2014

The final day of the Summit will feature a dialogue with senior European and U.S. executives of some of the largest multinationals that have their European headquarters based in Ireland, on their perspective on the energy industry into the future in terms of convergence in the power and ICT industries. This event will take place in Ireland's innovative Science Gallery at Trinity College Dublin, where participants will have a unique opportunity to engage with industry thought leaders whose development strategies will have a significant impact on the role of the power system going forward.

AGENDA – Pre-Meeting Day
Venue – The Westin Dublin

Time	Topic	Speaker
Monday, June 2, 2014 – Reception and Dinner		
17:30	**Assemble in the Westin Lobby**	
18:30 – 22:00	**Welcome to Dublin** Dinner and a traditional Irish evening	National Art Gallery

AGENDA – Day 1
Venue – The Westin Dublin

Time	Topic	Speaker
Tuesday, June 3, 2014		
7:30 – 8:30	***Breakfast on your own***	Exchange Restaurant
9:00 – 9:20	**Convene in Banking Hall** **Introductions** **Program Overview** • Summary of 2013 summit • Industry issues which led to integrated power and energy concept • Overview agenda	Clark Gellings, Fellow, EPRI Denis O Leary, Head of Smart Energy Technologies, ESB
9:20 – 9:50	**ESB – Innovating for Growth**	Pat O'Doherty, CEO, ESB
	Session I – Why an Integrated System? This session is intended to highlight the needs for an integrated power and energy system to address the world's desires to provide safe, clean, reliable and affordable energy to all citizens.	
9:50 – 10:30	**The Value of an Integrated Grid** • What is the value of the Grid? • How can distributed and central generation resources coexist? • What will be needed to evolve an integrated grid?	Arshad Mansoor, SVP R&D, EPRI
10:30 – 10:50	***Break***	
10:50 – 11:20	**Keynote Address**	Jan Panek, Head of Unit, DG Energy, Unit B3, European Commission
11:20 – 11:50	**Germany's Energy Goals and Realities** • Germany's energy goals provide challenges for TSO's and DSO's alike	Klaus Kleinekorte, Managing Director, Amprion GmbH
11:50 – 12:30	**Open Discussion**	Clark Gellings
12:30 – 13:30	***Lunch***	

Time	Topic	Speaker
13:30 – 15:30	**Session II – Opportunities Which Changes in Connectivity can Bring** This session is intended to stimulate discussion regarding connectivity, both to understand the impact of increasing connectivity across the electricity enterprise and with consumers, and to leverage the capabilities which new technologies may afford the industry. **Participants will be asked to identify the priority innovations which will yield opportunities for the industry and highlight some of the key challenges that connectivity will bring.** • Absent innovation the retail electricity business will struggle to remain relevant • Connectivity will indeed challenge the relationship between utilities and customers • Connectivity can also provide substantial opportunities for utilities in the development of the Smart home of the future	Moderator: John Mc Sweeney, Head of Innovation, ESB Presenters: Robert Jones, Sr. Advisor, Morgan Stanley, EPRI Advisory Council Ian Rose, Professional Services Director, Passivsystems Martin Curley, VP & GM, Intel Labs Europe Jim Connaughton, EVP, C3 Energy,
15:30 – 15:50	***Break***	
15:50 – 18:00	**Session III – Deployment of Advanced Distribution & Reliability Technologies** This session is intended to highlight the innovation that will be needed in order to assure the power delivery system (transmission and distribution) of the future is able to facilitate the integrated power and energy system including the need for interconnection rules and communications technologies and standards. • Technology development and deployment needed to enable a truly integrated power system • Advanced distribution and transmission technologies • Smart Grids, Smart Substations and changes in the interface between DSOs and TSOs	Moderator: Thomas Theisen, General Manager, New Technologies RWE Presenters: Konstantin Staschus, Secretary-General, ENTSO-E Michael Walsh, Director of Future Grids, EirGrid Seamus Garvey, Professor, University of Nottingham
18:00	***Adjourn***	Clark Gellings
18:00	**Assemble in the Westin Lobby** Coach departs to Dublin Castle	
19:00 – 23:00	**Reception and Dinner**	Dublin Castle

Time	Topic	Speaker
	A tour of historic Dublin Castle will be followed by dinner in the grand St. Patrick's Hall. Guest of honour : Pat Rabbitte TD, Minister for Energy Communications & Natural Resources Industry Recognitions: Outstanding Contribution to EPRI	Research Advisory Committee Recognition: Chris Hobson, Southern Company Presented by Arshad Mansoor, SVP, EPRI

AGENDA – Day 2
Venue – The Westin Dublin

Time	Topic	Speaker
Wednesday, June 4, 2014		
7:30 – 8:30	***Breakfast on your own***	***Exchange Restaurant***
8:30 – 10:30	**Session IV – Strategies for Integrating Distributed Energy Resources & Their Role in Tomorrow's Energy Landscape with Grid Planning & Operation** This session is intended to identify the likely pathways which innovations in distributed energy resources may take and how they could become part of an overall integrated energy and power system. • The impact of the increasing consumer adoption of distributed energy resources • Central station resources remain an essential asset to meet consumer needs • What strategies can be employed to utilize both central and distributed resources in the most effective manner?	Moderator: Terry Oliver, CTO, Bonneville Power Administration & EPRI Board Member Presenters: Terry Oliver, CTO, Bonneville Power Administration & EPRI Board Member Jorgen Christensen, CTO, Danish Energy Association Dr. Bernhard Ernst, SMA Kevin Payne, Sr. VP Customer Service, Southern California Edison Co. Peter van der Sluijs, Head of Strategy, Alliander Mark O'Malley, Professor of Electrical Engineering, UCD
10:30 – 10:50	***Break***	
10:50 – 12:50	**Session IV – continues**	
12:50 – 13:50	***Lunch***	

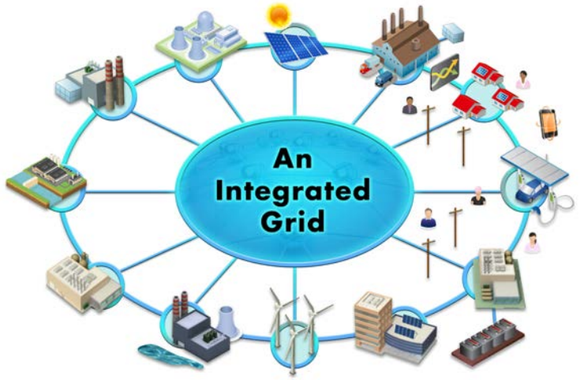
Time	Topic	Speaker
13:50 – 15:50	**Session V – Innovations in Wholesale Markets & Rate Design** This session is intended to highlight the opportunities to use markets and rate design to incentivize integrated power and energy systems. • Integrated power and energy systems will not evolve effectively without consistent and fair rules • Wholesale markets must provide proper incentives for energy, capacity and ancillary services • Which wholesale market designs coupled with innovative retail rate design can accomplish society's objectives to provide safe, clean, reliable and affordable energy for citizens?	Moderator: Sheryl Carter, Co-Director, Energy Prog., Natural Resources Defense Council & EPRI Board Member Presenters: Sheryl Carter, Co-Director, Energy Prog., Natural Resources Defense Council & EPRI Board Member Suzanne Daugherty, CFO, PJM Laura Brien, Director Markets, Commission for Energy Regulation (CER) Eamonn Lannoye, Engineer/Scientist II, EPRI
15:50 – 16:10	***Break***	
16:10 – 17.45	**Session VI – Enhancing Collaboration: A Call to Action!** This session is intended to describe opportunities to broadly collaborate among the global industry so as to leverage resources, both financial and technical to enable the integrated grid. Each panelist will provide a brief summary of insights from the proceeding (10 minutes each w/o slides). • Global collaboration is the only effective way to enable accelerated development, demonstration and eventual collaboration of innovative technologies • Can attendees highlight the actions necessary to enable greater success in global electric energy R&D?	Moderator: David Clarke, Chief Executive, Energy Technologies Institute Presenters: David Clarke, Chief Executive, Energy Technologies Institute Robin Manning, Exec. VP External Relations and Shared Services, TVA Panelists: Sauro Pasini, VP, Res Tech Area, Eng & Innovation, ENEL Denis O'Leary, Head of Smart Energy Technologies, ESB Mark McGranaghan, VP Power Delivery and Utilization, EPRI Barry MacColl, General Manager – Research, Testing and Development, ESKOM
17.45	***Adjourn***	

Time	Topic	Speaker
18:30	**Assemble in the Westin Lobby** Coach departs to the Guinness Storehouse	
19:00 – 23:00	**Reception and Dinner**	Guinness Storehouse

AGENDA – Day 3
Venue – Science Gallery, Trinity College Dublin

Time	Topic	Speaker
Thursday, June 5,		
7:30 – 8:30	***Breakfast (on your own)***	***Exchange Restaurant***
8:30	**Assemble in the Westin Lobby** Walk to Science Gallery, Trinity College Dublin	
9:00 – 9:45	**Developing Ireland's Smart Grid**	Presenter: Jerry O'Sullivan, Managing Director, ESB Networks.
9:45 – 12:30	**Forum on Advanced Information and Communications (ICT)Technology in Energy** Leading IT companies will deliver keynote presentations on their strategic business objectives and opinions of the future direction of the international energy industry. This highly interactive session will focus on the following areas: • Future Smart Cities – can technology replace future utility technology infrastructure investment? • How can ICT enable future business models within the energy sector? • What are the challenges to the convergence of utility Information Technology (IT) with Operational Technology (OT)? • Does IT/OT convergence make the operation of both infrastructures more efficient?	Moderator: Mark McGranaghan, VP Power Delivery and Utilization, EPRI Presenters: Chandu Visweswariah, Fellow in Smarter Energy, IBM Tony Court, Senior Director, EMAR, CISCO Ltd Rolf Apel, Principal Key Expert, Siemens AG Andreas Berthold-van der Molen, Industry Director, Power and Utility, Microsoft
13:00 – 15:00	***Lunch***	
15:00	**Adjourn**	

The Integrated Grid: Realizing the Full Value of Central and Distributed Energy Resources



Executive Summary

The electric power system is beginning to change—rapidly in some areas—with the rise of distributed energy resources (DER) 1 such as small natural gas-fueled generators, combined heat and power plants, electricity storage, and solar photovoltaics (PV) on rooftops and in larger arrays connected to the distribution system. In many settings DER already have an impact on the operation of the electric power grid. Through a combination of technological improvements, policy incentives, and consumer choices in technology and service, the role of DER is likely to grow in the future.

Key Points

1. Consumers and investors of all sizes are installing DER with technical and economic attributes that differ radically from the central energy resources that have traditionally dominated the power system. So far, rapidly expanding deployments of DER are connected to the grid but not integrated into grid operations, which is unlikely to be a sustainable pattern.
2. The successful integration of DER depends on the existing electric power grid. That grid, especially its distribution systems, was not designed to accommodate a high penetration of DER while sustaining high levels of electric quality and reliability. The technical characteristics of certain types of DER, such as variability and intermittency, are quite different from central power stations.
3. Grid connectivity provides five primary benefits to DER. 2
4. EPRI estimates the cost of providing grid services for customers with DER systems is about $51/month on average in the typical current configuration of the grid in the United States; 3 in residential PV systems, for example, providing that same service completely independent of the grid would be four to eight times more expensive.
5. DER provides benefits to an integrated grid. 4
6. To realize fully the value of distributed resources and to serve all consumers at established standards of quality and reliability, the need has arisen to integrate DER in the planning and operation of the electricity grid and to expand its scope to include DER operation—what EPRI is calling *the Integrated Grid*.

Action Plan

1. Interconnection Rules and Communications Technologies and Standards
2. Assessment and Deployment of Advanced Distribution and Reliability Technologies
3. Strategies for Integrating DER with Grid Planning and Operation
4. Enabling Policy and Regulation

Next Steps for EPRI and Industry

EPRI has started work on a three-phase initiative to provide stakeholders with information and tools that will be integral to the four areas of collaboration outlined above:

Phase I – A concept paper and associated briefings and technical papers to align stakeholders on the main issues while outlining real examples to support open fact-based discussion.

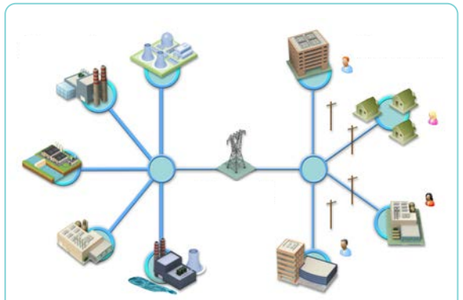
Phase II – Development of a framework for assessing the costs and benefits of the combinations of technology that lead to a more integrated grid.

Phase III – Conduct global demonstrations and modeling using the analytics and procedures developed in Phase II to provide comprehensive data and information that stakeholders will need for the system-wide implementation of integrated grid technologies in the most cost-effective manner.

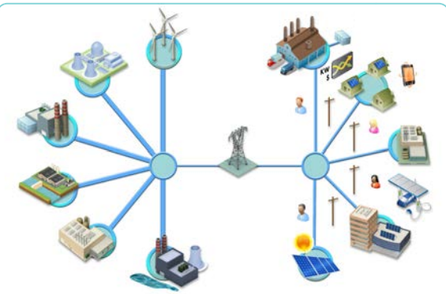
Related Publications

The Integrated Grid: Realizing the Full Value of Central and Distributed Energy Resources (3002002733)
The Integrated Grid Phase II: Development of a Benefit-Cost Framework (3002004028)

1 Today's Power System — Interconnected but not Integrated

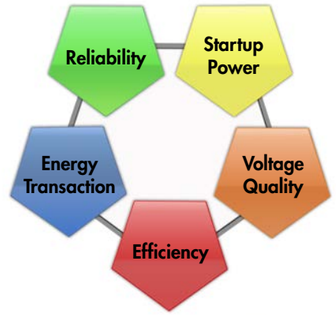


Core Mission – Today
1. Safe
2. Reliable
3. Affordable
4. Environmentally Responsible

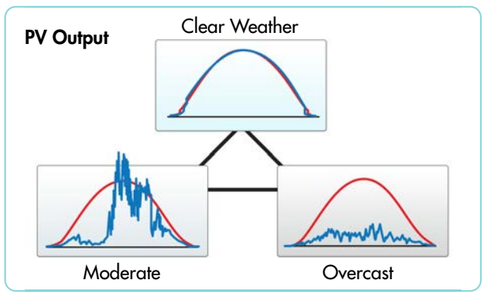


Core Mission – Future
1. Safe
2. Reliable
3. Affordable
4. Environmentally Responsible
5. *Flexible*
6. *Resilient*
7. *Connected*

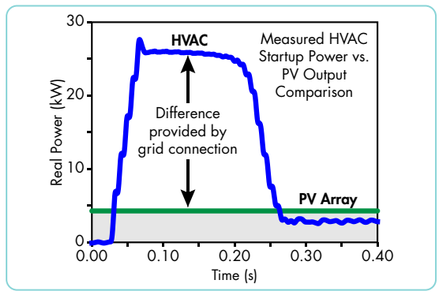
2 Value of Integrated Grid to DER



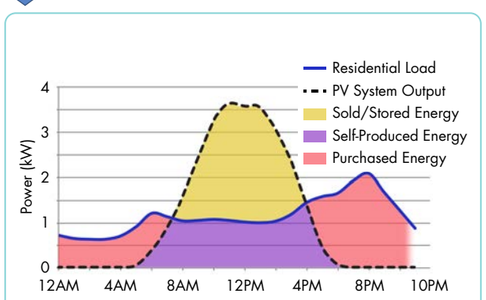
Reliability



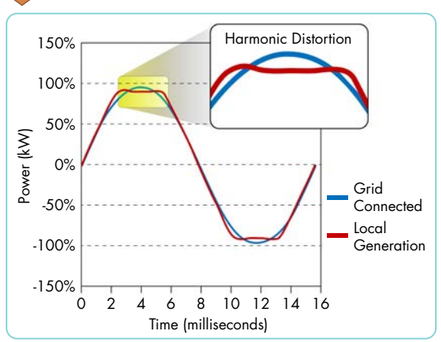
Startup Power



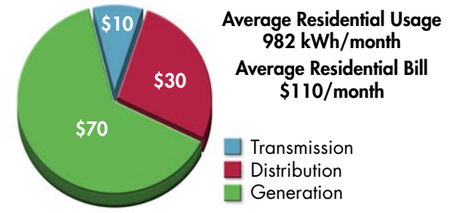
Energy Transaction



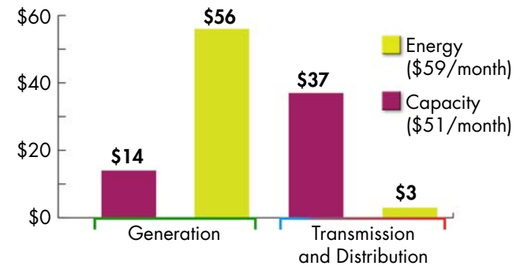
Voltage Quality



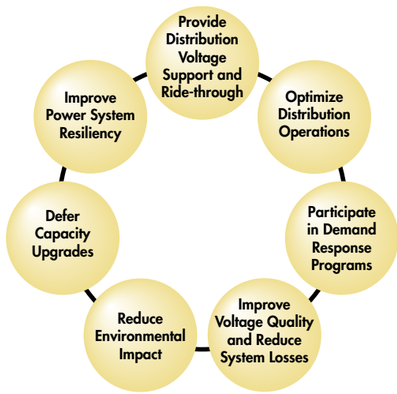
3 U.S. Average Cost to Consumers



3 Energy and Capacity Costs



4 Value of DER to the Integrated Grid



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