

# **IET Conference on Power in Unity: A Whole System Approach**

**IET Seminar Digests 15377**

**London, United Kingdom  
16-17 October 2013**

**ISBN: 978-1-62993-834-9**

**Printed from e-media with permission by:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571



**Some format issues inherent in the e-media version may also appear in this print version.**

Copyright© (2013) by the Institution of Engineering and Technology  
All rights reserved.

Printed by Curran Associates, Inc. (2014)

For permission requests, please contact the Institution of Engineering and Technology  
at the address below.

Institution of Engineering and Technology  
P. O. Box 96  
Stevenage, Hertfordshire  
U.K. SG1 2SD

Phone: 01-441-438-767-328-328  
Fax: 01-441-438-767-328-375

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

**Additional copies of this publication are available from:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: 845-758-0400  
Fax: 845-758-2634  
Email: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

## TABLE OF CONTENTS

<b>Whole System Approach .....</b>	1
<i>Simon Harrison</i>	
<b>Making the Most of Renewable Energy.....</b>	11
<i>Phil Lawton</i>	
<b>Assessing Future Uncertainties on Today's Distribution Networks .....</b>	22
<i>Dave Roberts, John Scott</i>	
<b>Smart Solutions for Connecting DG: The Flexible Plug and Play Methods .....</b>	38
<i>Sotiris Georgopoulos</i>	
<b>Changes Ahead for Power System Management and Control.....</b>	45
<i>Eric Brown</i>	
<b>Data: Just Big, or Clever Too? Transforming Consumers from Passive Recipients Into Active Participants .....</b>	54
<i>Chris Hillier</i>	
<b>Resilience of Smart Grid Networks.....</b>	67
<i>Nigel Bessant</i>	
<b>Community Energy – Solution or Problem? .....</b>	80
<i>Duncan Botting</i>	
<b>Smart Grid in Europe .....</b>	91
<i>Graham Ault</i>	
<b>Smart Grid Control Technologies: Achieving Functional Interoperability on a Wider Scale .....</b>	108
<i>Ibrahim Abdulhadi</i>	
<b>Integration of Wind Power Using V2G As a Flexible Storage .....</b>	120
<i>A.S. Hassan, C.E. Marmaras, E.S. Xydas, L.M. Cipcigan, N. Jenkins</i>	
<b>Optimization of Microgrid with Demand Side Management Using Genetic Algorithm.....</b>	134
<i>V. Jayadev, K. Shanti Swarup</i>	
<b>Market-based Local Balancing in Distribution Networks.....</b>	166
<i>Michał Wierzbowski, Blazej Olek</i>	
<b>A Case Study of Delivering an Active Network Management Control System on a UK DNO Network.....</b>	179
<i>Anth Gaskill</i>	
<b>The Future of Energy Storage in the UK - Power in Unity: A Whole System Approach .....</b>	185
<i>Eric Lounsbury</i>	
<b>Energy Storage: Challenges in Policy Faced by Utilities: A Coherent Framework for Storage? .....</b>	196
<i>Asheya Patten</i>	
<b>Utility-Scale Energy Storage: Liquid Air a Pioneering Solution to the Problem of Energy Storage.....</b>	208
<i>Gareth Brett, Matt Barnett</i>	
<b>Smarter Network Storage for Future Electricity Networks .....</b>	226
<i>Nick Heyward</i>	
<b>Overview of EPSRC Research Project Integrated Market-fit and Affordable Grid-scale Energy Storage: Project No: EP/K002228/1 .....</b>	231
<i>Jonathan Clarke</i>	
<b>Integrated Market-Fit Affordable Grid-Scale Energy Storage &amp; Compressed Air Energy Storage .....</b>	238
<i>Xing Luo</i>	
<b>Developing Future Power Networks: Energy Storage for Distribution Networks .....</b>	254
<i>Ben Godfrey</i>	
<b>Power in Unity: A Whole System Approach .....</b>	262
<i>Steven Zakaib</i>	
<b>Risky Business? A Look at Investment in Electricity Storage .....</b>	276
<i>Anthony Price</i>	
<b>The Value of Storage .....</b>	283
<i>Mark Wagner</i>	
<b>Deployment of Community Scale Energy Storage on LV Networks .....</b>	289
<i>Esther Dudek, Alistair Steele</i>	
<b>An Energy Storage System for the Scottish Isle of Gigha .....</b>	302
<i>S.D. Wilson, J. Samuel, G. Simmonds</i>	
<b>Distributed Energy Storage Using Second-Life Electric Vehicle Batteries.....</b>	315
<i>S. Skarvelis-Kazakos, S. Daniel, S. Buckley</i>	

<b>Utilization of Energy Storage Systems Charged from Grid in Buildings and Comparison with Solar Systems</b>	328
<i>Vedat Kiray, Lutfu Sagbasua, Taner Topal</i>	
<b>Smart Metering: Working Towards Mass Roll-Out</b>	345
<i>Jacqui Russell</i>	
<b>Data Service Provider: Developing and Operating Systems Linking Smart Meters and Utilities</b>	349
<i>Richard Hampshire</i>	
<b>Smart Energy Code</b>	356
<i>David Thorne</i>	
<b>Digital Transformation in the Energy Industry</b>	361
<i>Mike Short</i>	
<b>Smart Metering Installation Code of Practice (SMICoP)</b>	369
<i>Rosie McGlynn</i>	
<b>Smart Metering / Smart Grids Standards Development</b>	372
<i>John Cowburn</i>	
<b>Smart Meter Security in an Uncertain World</b>	385
<i>Martyn Thomas</i>	
<b>Network Operators – Supporting the Smart Meter Rollout Programme</b>	389
<i>Brian Stratton</i>	
<b>Using Industry Data to Facilitate the Smart Meter Rollout</b>	396
<i>Stuart Lacey</i>	
<b>Meeting the Challenges of the Smart Meter Revolution</b>	406
<i>Stefan Leedham</i>	
<b>The Load Management Functions That Must Be Delivered by the Smart Metering System</b>	415
<i>S.D. Wilson, D.C. Brogden, B. Hopkins</i>	
<b>Whole System Approach to Future Power Operations Comprising a Majority of Distributed Generation</b>	430
<i>John Sanderson</i>	
<b>Power Quality Issues in Future Power Systems</b>	439
<i>Dave Openshaw</i>	
<b>What is the Real Effect of Poor Power Quality?</b>	448
<i>Steve Stott</i>	
<b>The Future Whole Energy System Stability, Reliability and Security: WITH or WITHOUT Fear of Blackouts?</b>	457
<i>Catalina Spataru</i>	
<b>Power Quality Monitoring Case Study</b>	473
<i>Simon Hodgson</i>	
<b>Distributed Generation Effects on Voltage Congestion</b>	483
<i>Franco Pizzutto</i>	
<b>Economic Impact of Power Quality Disturbances on Customers and Utilities</b>	491
<i>Jovica V. Milanovic</i>	
<b>Harmonics in Power Systems</b>	510
<i>Zia Emin</i>	
<b>IET Demand Response</b>	526
<i>Nick Butlin</i>	
<b>Estimation of the Limiting Penetration of Low Carbon Connections through an Assessment of LV Harmonics</b>	541
<i>G.E. Williamson, Z. Emin, I. Povey</i>	
<b>Novel Scheme for Load Shedding and Identification of Critical Tie-Lines in WAMS Emergency Control</b>	552
<i>S. Parvathi, K. Shanti Swarup</i>	
<b>Demand Side Management For Industrial Consumers</b>	579
<i>Rebecca Threlfall, David McNaught, Bryan O'Neill</i>	
<b>Ancillary Services Provided by Renewable Energy Sources</b>	595
<i>B. Olek, M. Wierzbowski</i>	
<b>Author Index</b>	