



CC Share Alike
http://en.wikipedia.org/wiki/File:Home_office_small_office.JPG

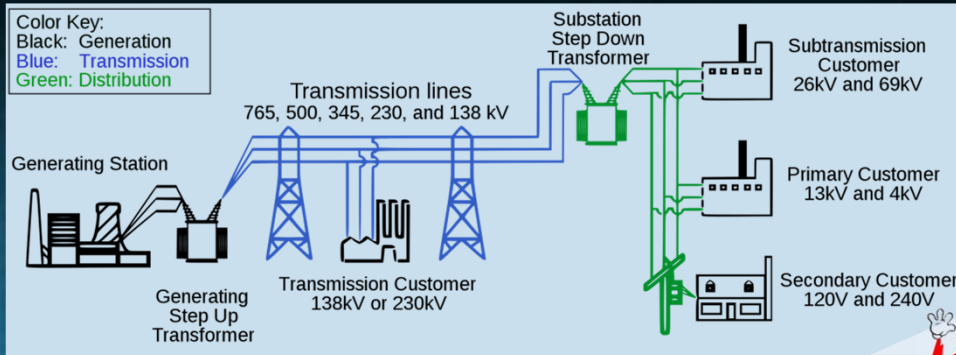
DC in the Home & Home Office

8 April 2011

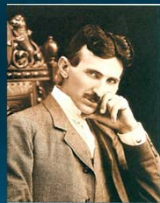
Guy AlLee
Research Scientist
Manager, NM Energy Systems Research Center
Intel Labs



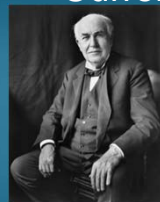
Electrification: #1 Greatest Engineering Achievements of the 20th Century¹



1990 Wind competitive with Utility generation



1888 War of Currents



1905 Electric Utility as "Natural Monopoly"

1930s Hoover Dam, TVA, REA, Public Utility Holding Company Act of 1935, BPA

1970s EPRI, Energy Crisis, PURPA, Three Mile Island



2000s California Energy Crisis, Northeast Blackout, Energy Policy Act of 2005

Power electronic systems expected to control 80% of all electricity used by 2010.

—Center for Power Electronic Systems (CPES)

If you were designing the grid today, it would be DC



¹ <http://www.greatachievements.org/>

Personal Computing Empowered the Consumer

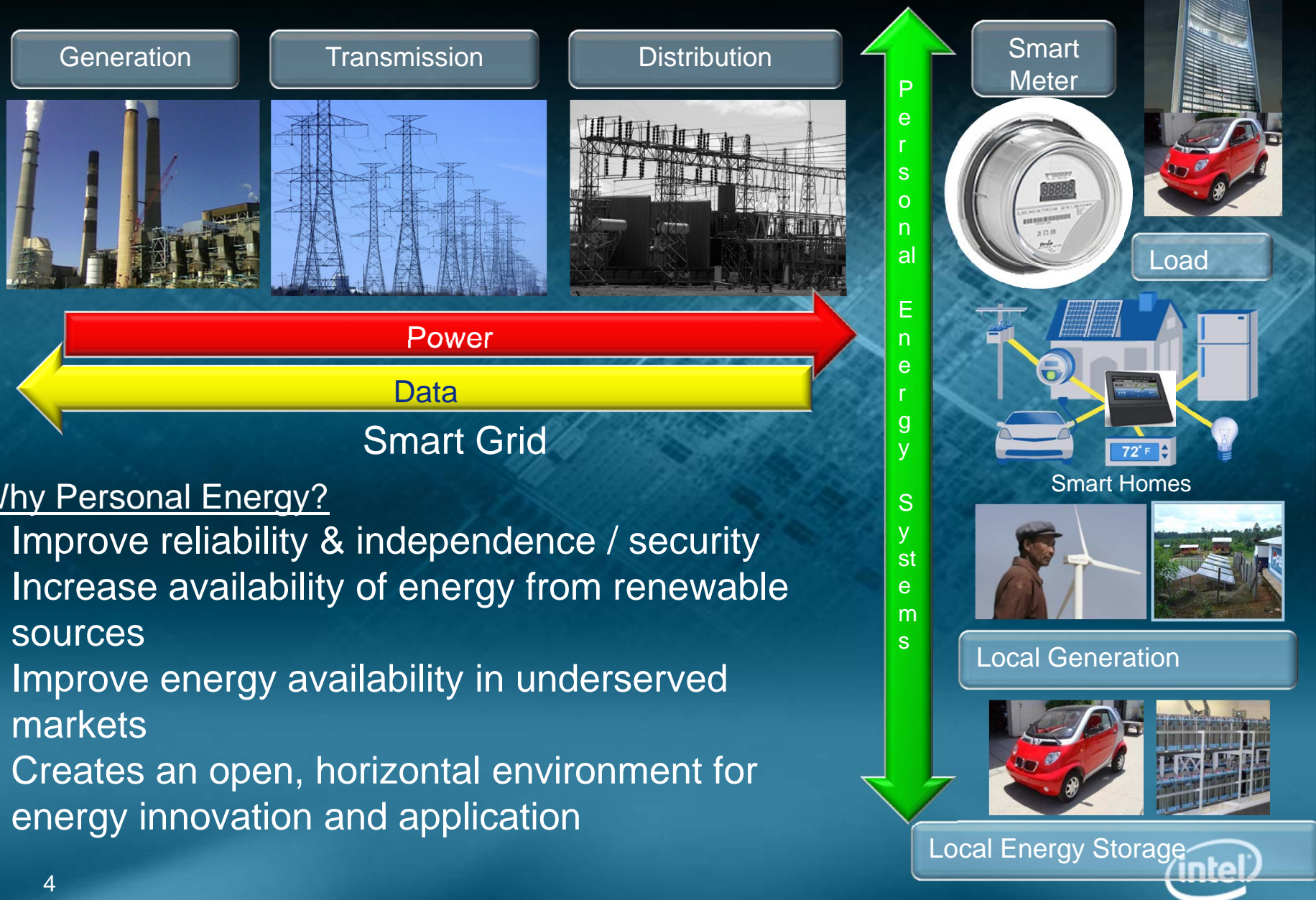


30 Years Ago,
Computing Was Far
Less Personal
Far Away From Users
Not Easily Accessible
Professionals Did It



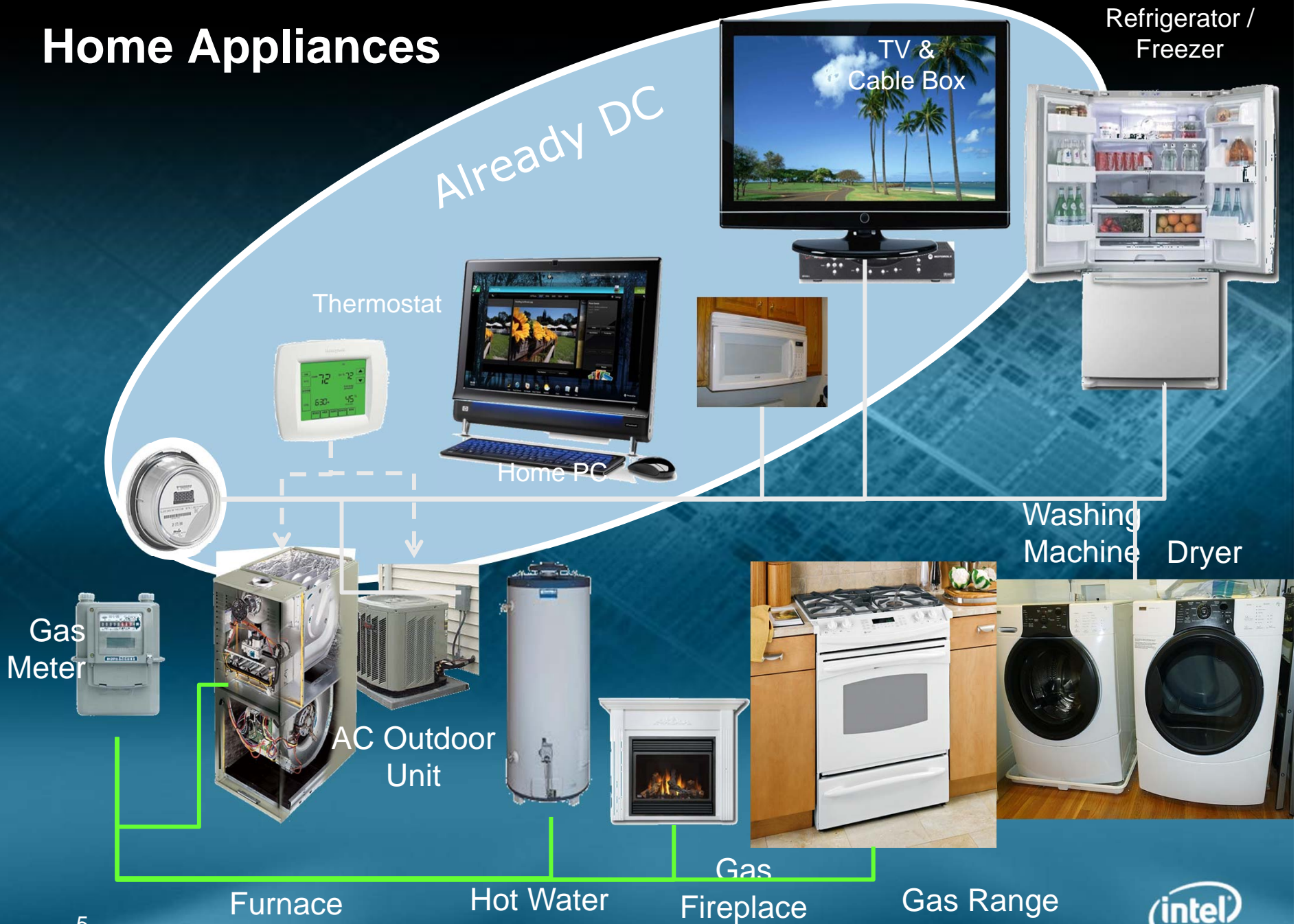
Today, Computing Is
Always At Our
Fingertips
Everywhere We Go
Part of Our Lives
Everyone Does It

From Grid to Personal Energy Systems



Home Appliances

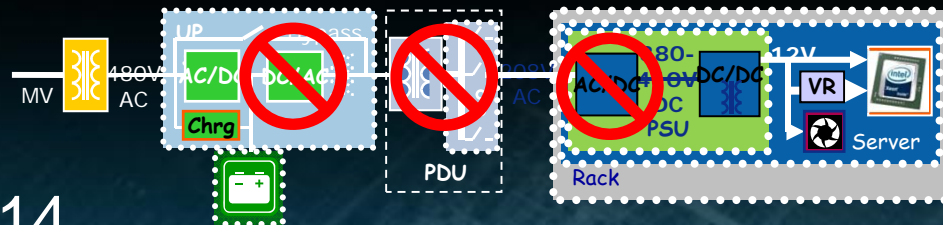
Already DC



380VDC – The New Standard

- ETSI 300132-3 (draft)
EMerge Alliance → NEC 2014
 - 28% more efficient than 208VAC¹
 - 7% more efficient than 415VAC²
 - 15% less up-front capital cost in volume²
 - 33% less floor space²
 - 36% lower lifetime cost³
 - 200%-1000% more reliable²
 - No Harmonics, Safer (+/- 190VDC)
 - UCSD, Duke Energy, Intel IT (2011)
- Likely to be picked up by other industries
 - PV, Wind, Office Lighting, EV Charging, VFD Motors

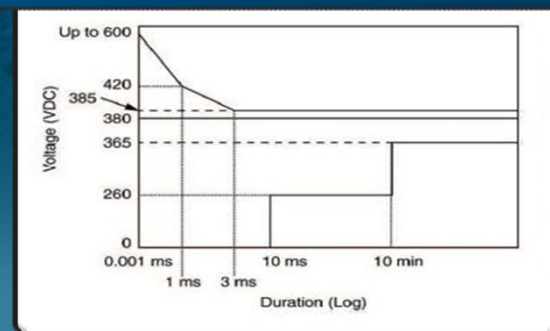
380VDC: Highest voltage, volume parts, fewest conversions



8/27: UCSD 380VDC Datacenter



Standardized Voltage Envelope



380VDC is the highest efficiency, cost effective solution

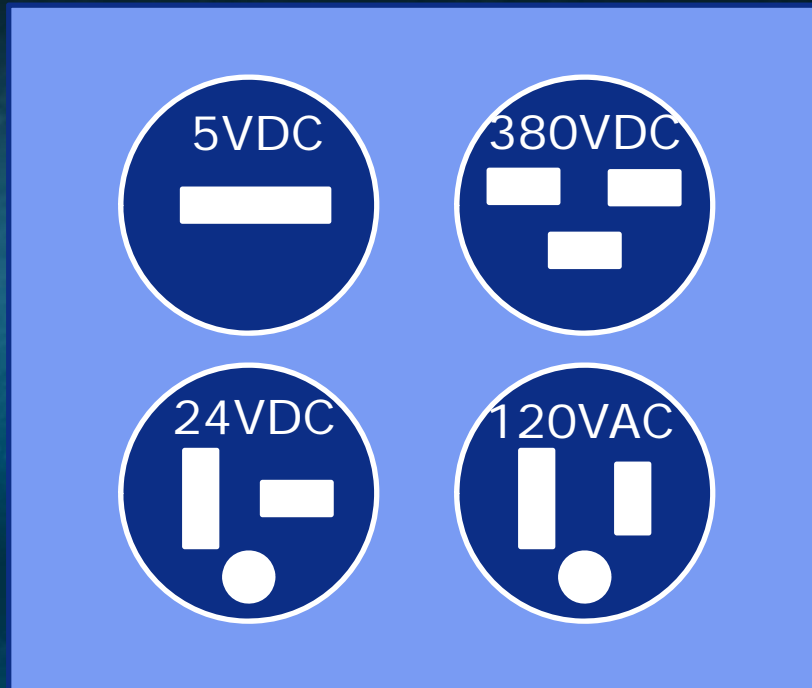
¹ Intel, Intel Paper, 2007

² Intel, HP/EYP, Emerson, Whitepaper, 2009

³ Validus/GE Study, 2010



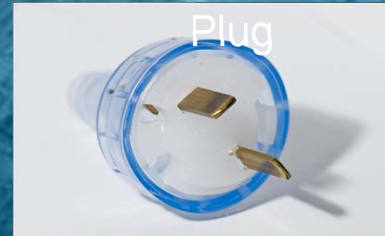
Duplex Box, DC & AC Socket for Residential/Commercial Plug Loads



Standard
380VDC
Plug & Socket



Standard ELV DC
Plug



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[http://commons.wiki
media.org/wiki/File:T
_configuration_01_Pe
ngo.jpg](http://commons.wiki
media.org/wiki/File:T
_configuration_01_Pe
ngo.jpg)

Standard IEC-309
380VDC Plug & Socket



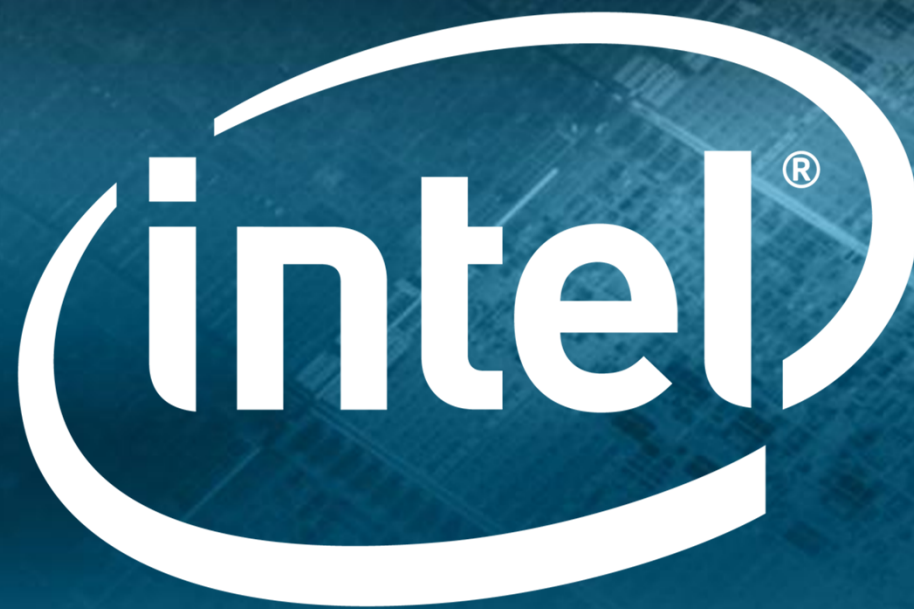
- 5VDC @ 1A “USB” form factor – intelligent socket (fed from 24VDC)
- 24VDC Class 2, 240VA touch-safe, point to point wired from source¹
- 380VDC APP plug & socket (up to 5A) & IEC-309 (up to 32A)
- 120VAC outlet, daisy chained with other outlets on 15A circuit

¹ Compare With Australian ELV Standards (AS 5009). Reference: Standard alone
Power Systems Components, Edition 1 (Dec 2002) Resource Book. Renewable
Energy Centre. <http://www.renewableenergycentre.org.au>



Additional sources of information on Energy & 380VDC

- Plug and Play Electricity
http://blogs.intel.com/research/2010/04/plug_and_play_energy_efficienc.php
- DC, An idea whose time has come and gone?
http://blogs.intel.com/research/2010/05/dc_-_an_idea_whose_time_has_co.php
- EMerge Alliance <http://emergealliance.org>
- Environmental view of 380VDC from Yale School of Forestry & Environmental Studies:
<http://environment.research.yale.edu/documents/downloads/0-9/05-DC-Microgrids.pdf>
- Enernet: Internet Lessons for Solving Energy, Bob Metcalfe
<http://www.slideshare.net/gigaom/bob-metcalfe-internet-history-applied-to-solving-energy>
- Electricity 2.0: Unlocking the Power of the Open Energy Network
<http://ndn.org/electricity20>
- SMART 2020: Enabling the low carbon economy in the information age, The Climate Group on behalf of the Global e-Sustainability Initiative (GeSI), ©2008 www.smart2020.org
- World Energy Outlook 2009, International Energy Agency
<http://www.worldenergyoutlook.org/>



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Rev. 5/7/10

