

The Premier Global  
Event in Applied  
Power Electronics™

**APEC**  
**2016**



LONG BEACH CONVENTION & ENTERTAINMENT CENTER

**IIoT IN MULTI-UTILITY SMART GRID FOR COMMUNITY & SMART CITY**

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**NEOSILICA**  
SMART GRID SOLUTIONS COMPANY

**NEOSILICA**



# OUTLINE

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## 1. Introduction

- A. Premise, Paradigm Shift: Two-Way Electric Grid, Vision: Perfect Power

## 2. Smart Energy Applications

- A. BEMS: Grid Responsive Smart Buildings
- B. CEMS: Smart Grid for Communities
- C. Smart Grid for Utilities
- D. Integration for Smart City

## 3. Technology

- A. IoT based Applications for Smart City
- B. Smart Grid: Networks & Security
- C. IoT and Value Creation

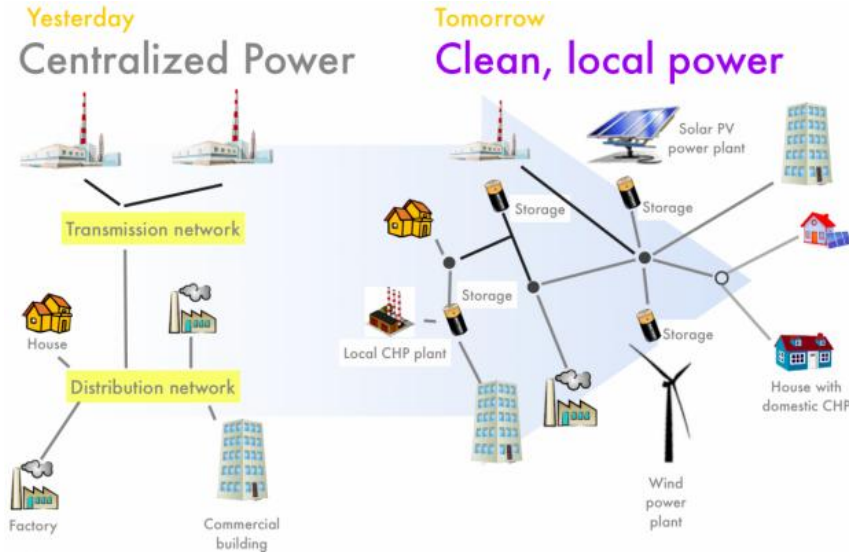
## 4. For Device Manufacturers

# ABSTRACT

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- ❖ **Premise:** When electrical lines ‘walked’ into cities, entire landscape has changed. Called “*Second Electrification*” now – the ‘data lines’ are going to walk in (wired/wireless) – that will change our lives forever!
- ❖ **Paradigm Shift:** Grid & power systems are transitioning from ‘*One-Way*’ power flow and simple interactions to – ‘*Two-Way*’ power flow with ‘*Intelligent Systems*’ with multiple stakeholder interactions.
- ❖ **Vision:** ‘*Perfect Power*’ – Transition from few large Centralized Generators TO many Distributed Local Generators (DER) for 100% Reliability.
- ❖ **Applications:** ‘*Grid Responsive*’ – Homes, Buildings, Communities and Smart Grid.
- ❖ ‘*Smart City*’ – Integrated Multi-Utility Systems for Citizen, Electricity, Water, ...
- ❖ **Technology:** ‘*IIoT + Cloud + Analytics*’ Platform for a Greener Planet. Systems and Network Security. *IT, ICT and IoT* – to *monitor, control, trade and conserve* – ‘Energy, Water & Gas’.
- ❖ **Guidance for Power Device Manufacturers**

# CENTRALIZED VS. CLEAN & DISTRIBUTED

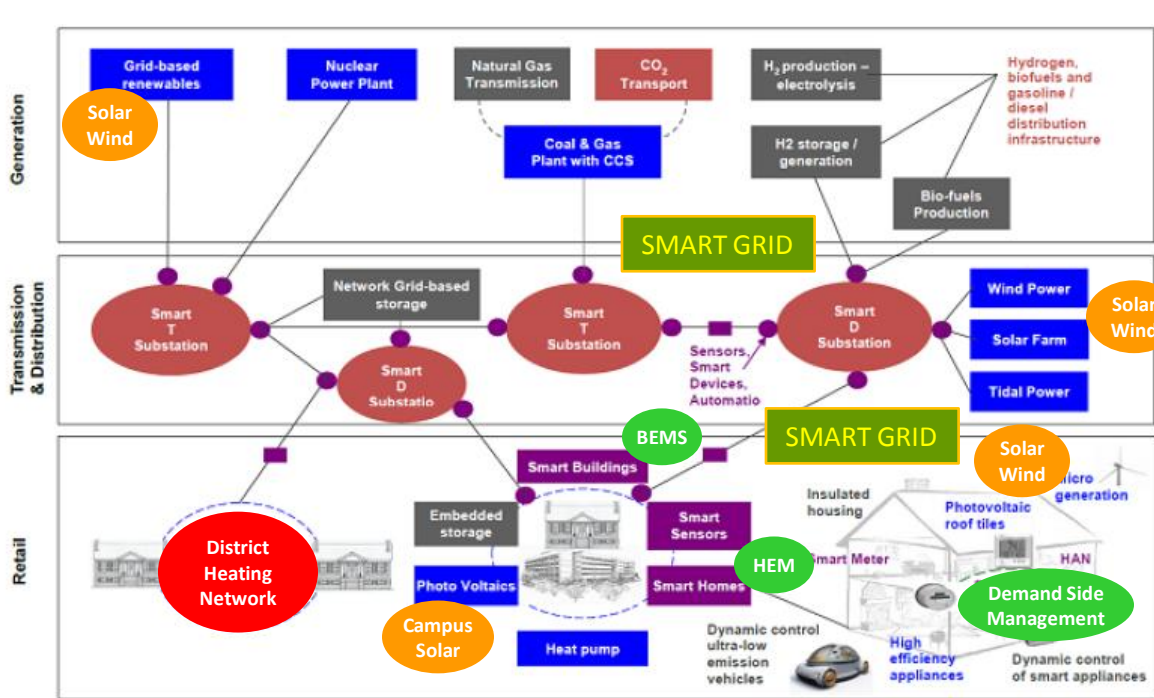


Smart Grid integrating to TAP INTO –

- A. Local Generation (Solar/Wind)
- B. Demand Response
- C. Unused power in Batteries, EV & UPS
- D. Use Smart Inverters that charge
- E. Energy Management – at Peak Load

**Evolving Smart Micro-Grids for Communities  
Integrating into Smart Cities  
Towards Perfect Power**

# SMART ENERGY: ROADMAP



- Smart Grid
- Renewables (Solar, Wind, ...)
- Energy Management (BEMS/HEM/DSM)
- District Heating
- Storage & Demand Shifting
- Electricity/Heat Generation
- Sensing, Control & Integration
- Other Infrastructure

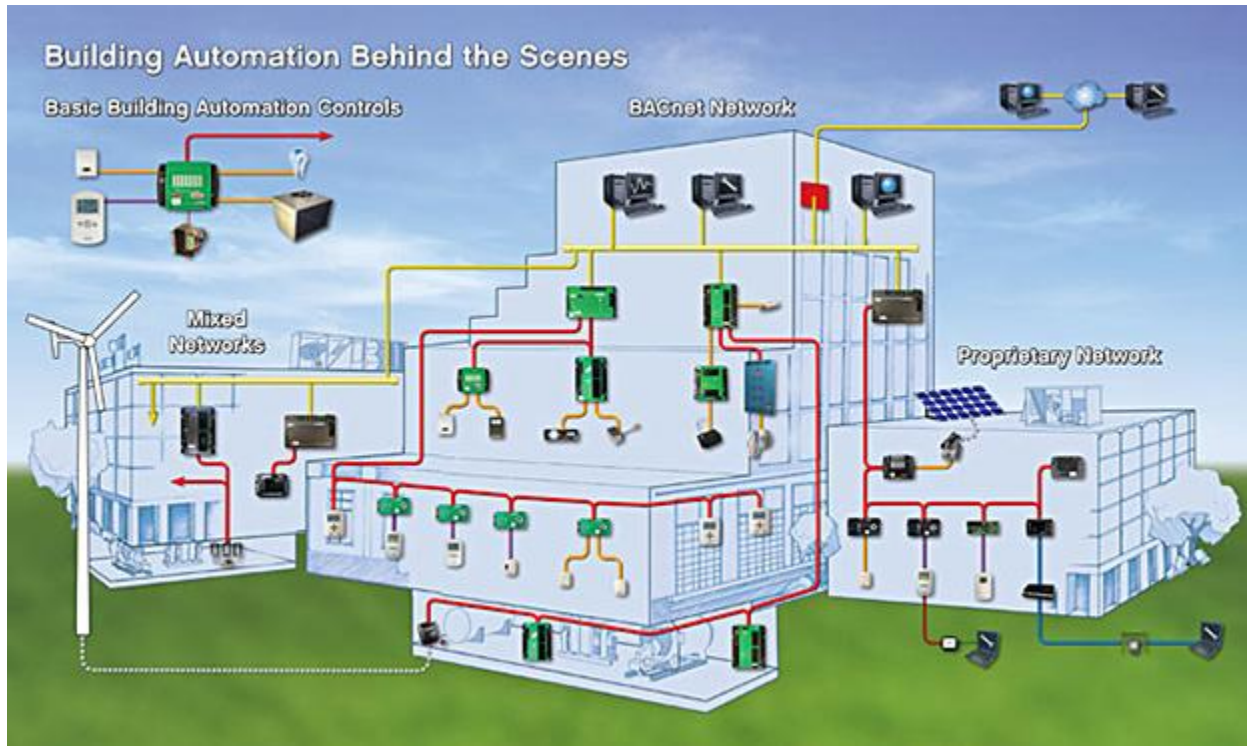
BEMS: Building Energy Management System  
 HEM: Home Energy Management  
 DSM: Demand Side Management

The Customer  
 The roles and responsibilities of customers in this type of energy system will be different allowing them to participate more actively in the energy market place.

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# **BEMS: ENERGY MANAGEMENT FOR GRID-RESPONSIVE BUILDINGS**

# BEMS: GRID-RESPONSIVE SMART BUILDINGS



Active Systems to Monitor and Manage For Automation, Conservation

For Owners, Tenants In Connection with Smart Grid & Smart City

DER: Solar & Wind

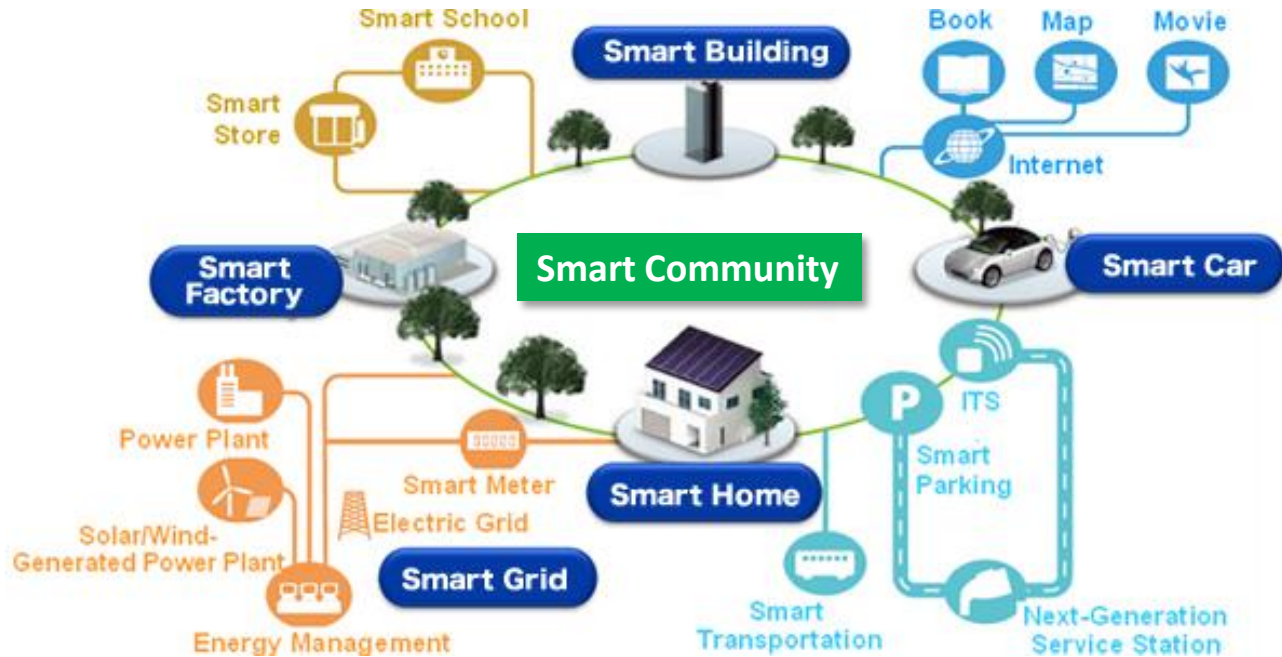
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**CEMS: ENERGY MANAGEMENT  
FOR  
COMMUNITY/NEIGHBORHOOD**



# SMART COMMUNITY

Smart City is A Network of Smart Communities. 75% of World Population will be in Cities by 2030.



# ENERGY MANAGEMENT ARCHITECTURE

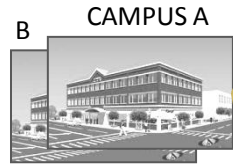
FOR OFFICE PARKS, LARGE RESIDENTIAL HOTELS, UNIVERSITY, ...

PC | Mobile | Tablet



Secure Anywhere Access For Different Users

1. Management
2. Facility Managers
3. Location Managers
4. Employees
5. PUBLIC DASHBOARDS



- Generation**
1. Main Grid
  2. Diesel Gen
  3. UPS
  4. Solar/Wind

Smart Meter  
Electric/Water/Gas



- Electric Loads/Sensors**
1. Air Conditioner
  2. Lighting
  3. Water Pumps
  4. Plugged loads
  5. Sensors, ETC.



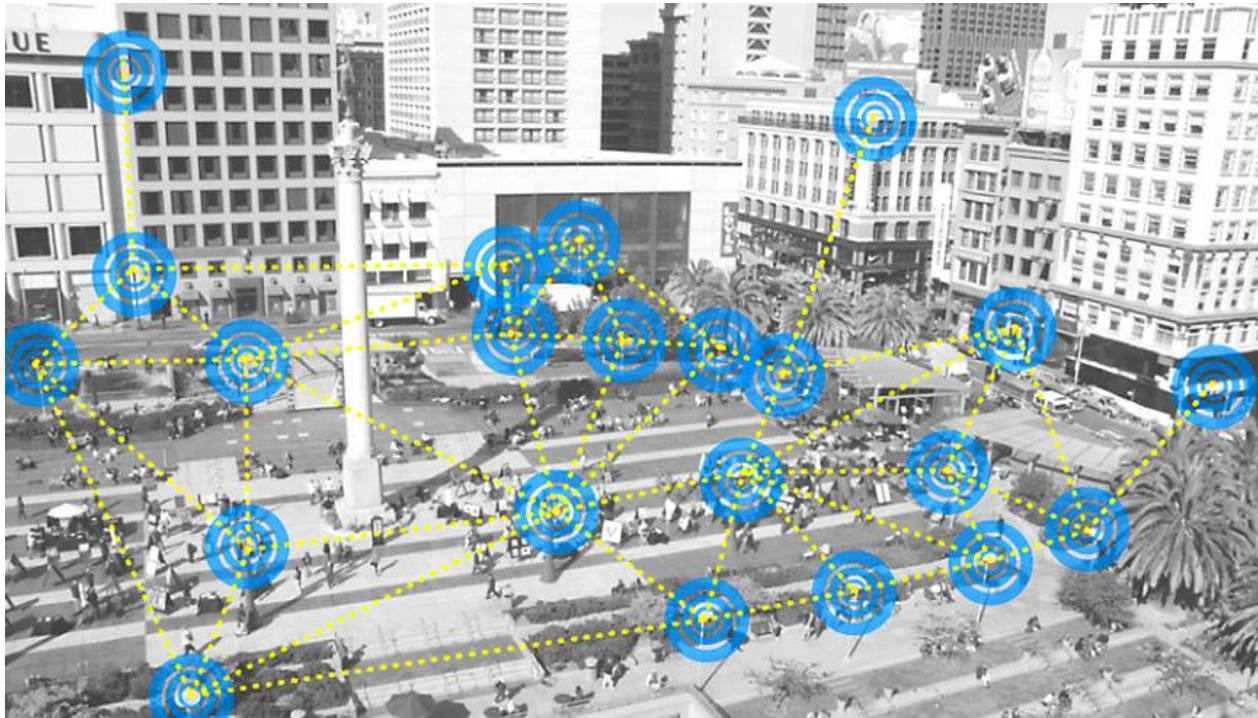
**NS IIoT CEMS  
PANEL**

- Energy Usage**
1. City
  2. Campus
  3. Building
  4. Floor/Area

- BUILDING  
INTRANET/INTERNET**
- EXPAND TO**
1. BTU Meters
  2. Water/Gas Meters
  3. LT&HT Panels
  4. Fire

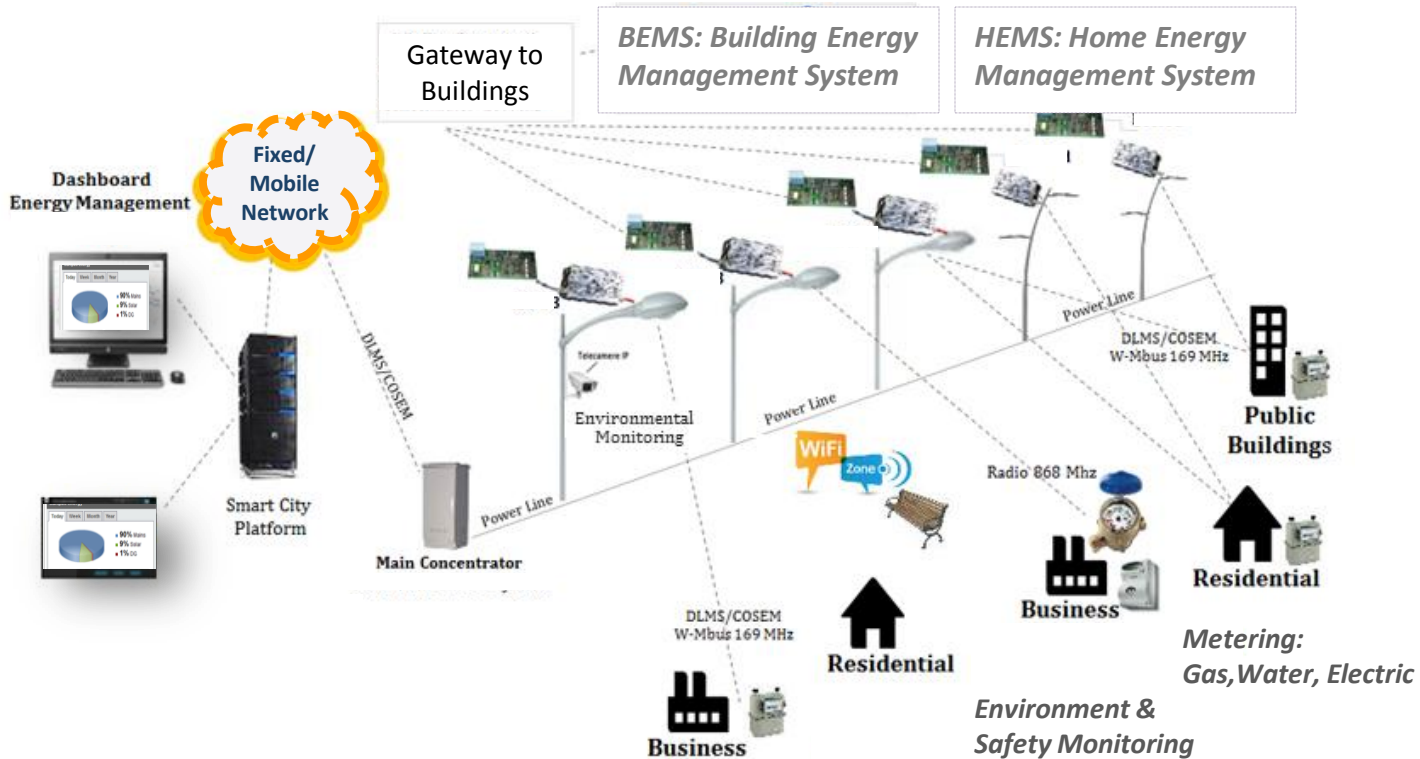


# SMART STREET LIGHTING



Mesh RF network  
Connecting multiple  
Street lights into a  
Single system for a  
Community/City

# SMART COMMUNITY INTEGRATED APPLICATIONS





# COMMUNITY – ENERGY DASHBOARD WEB



PC  
Mobile  
Tablet

Total View

Locations  
To Drill  
Down

**ABC BANKS NeoSilica**  
 Aug 9, 2011 | 05:50 PM | Temp 76 °F | Welcome: John Galt | Sign Out

Home | Energy Monitoring | Energy Management | Campus Map | Locations

Back-up systems for sensitive and high priority equipment

ABC Bank	total kWh 589.14	mains kWh 530.76	solar kWh 53.08	DG kWh 5.31	total charges \$ 158	Week
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**Campus Energy**  
 Today | Week | Month | Year

90% Mains  
9% Solar  
1% DG

TOTAL kWh	SOLAR kWh
84.16	7.58
MAINS kWh	DG kWh
75.82	0.76

**Energy User Ranks**  
 Tuesday, Aug 9 2011

Basking Ridge	3,155
Bedminster	2,155
Princeton	1,155
Newark	155

**Weather Forecast New York**  
 Partly Cloudy 76 ° F  
 Humidity: 69%  
 Wind: NE at 5 mph

Tue 84/72 ° F | Wed 88-67 ° F | Thu 82-64 ° F | Fri 83-67 ° F

**Renewables Usage by Department**  
 Administration

90% Mains 9% Solar 1% DG

Generation	Production
Now 1,423 Watts	This Week's 36.2 kWh
	Lifetime 3,847 kWh

CO2 Saved Today/Total  
0.3Kg/2812.8 Kg

Planting 27 mature trees

Diesel Saved 12 Liter \$ 12

**Energy Usage History**

Electric Use (kWh)

Date	Total	Mains	Solar	DG
Mar 4	~50	~45	~5	~0
Mar 5	~50	~45	~5	~0
Mar 6	~50	~45	~5	~0
Mar 7	~50	~45	~5	~0
Mar 8	~50	~45	~5	~0
Mar 9	~50	~45	~5	~0
Mar 10	~50	~45	~5	~0

Map showing locations: Oldwick, Greater Cross Roads, Liberty Corner, Bernards, Mt Bethel, Warren, Watching, North Plainfield, Mt Horeb, Green Knoll, Martinsville, Green Brook, Dunellen, Somerville, Bound Brook, Middlesex, New Market, Rantam, Somerville, Bound Brook, Middlesex, New Market, Solberg-Hunterdon Airport, Flanders, etc.

Branch  
Level

GHG  
Reduction  
Share with  
Customers/  
Employees

**SINGLE SOLUTION FOR A Large Organization with Many Locations & Buildings**

*Manage "Energy" as Key Performance Indicator (KPI) across all Buildings*

**TARGETED** Region/State/City/ Building/Area/Floor or Device

# MULTI-UTILITY SMART GRID FOR CITIES

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# WHAT IS SMART GRID? FOR UTILITIES

## MAKING

*grid infrastructure, renewables, storage, homes and buildings*

**Connected, Efficient & Sustainable**

## USING

*Electronics, Networking, Enterprise IT, Analytics along with Advanced Electrical*

*IIoT, M2M, Cloud, Mobile, Big Data, ...*

## CREATING

**System of Systems – over – Network of Networks**

**Evolving Iteratively!**

**Before Smart Grid:**

One-way Power Flow,  
Simple Interactions



**After Smart Grid:**

Two-way Power Flow,  
Multistakeholder Interactions



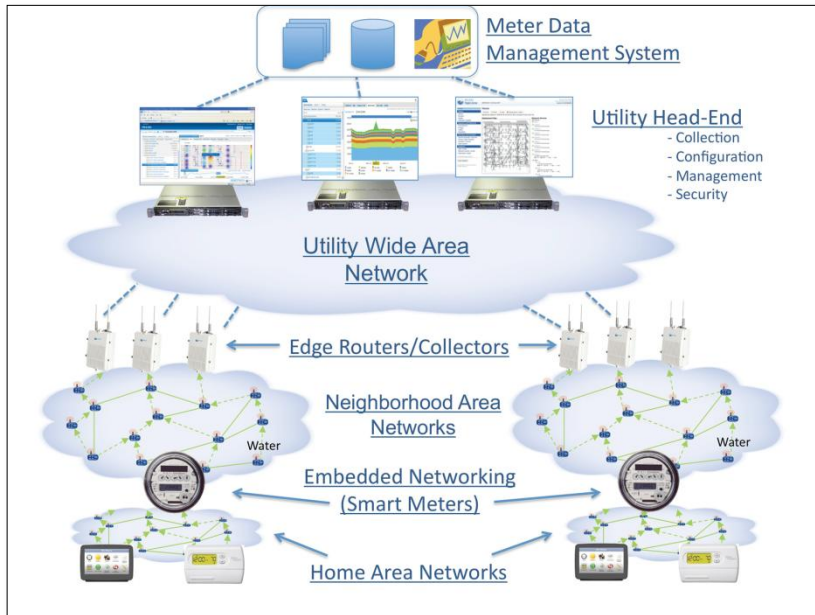
Source: The Economist, ABB. Adapted from EPRI presentation by Joe Hughes NIST Standards Workshop April 26, 2008



# SMART GRID

## NEOSILICA MDMS, DR, PORTALS, RI, ...

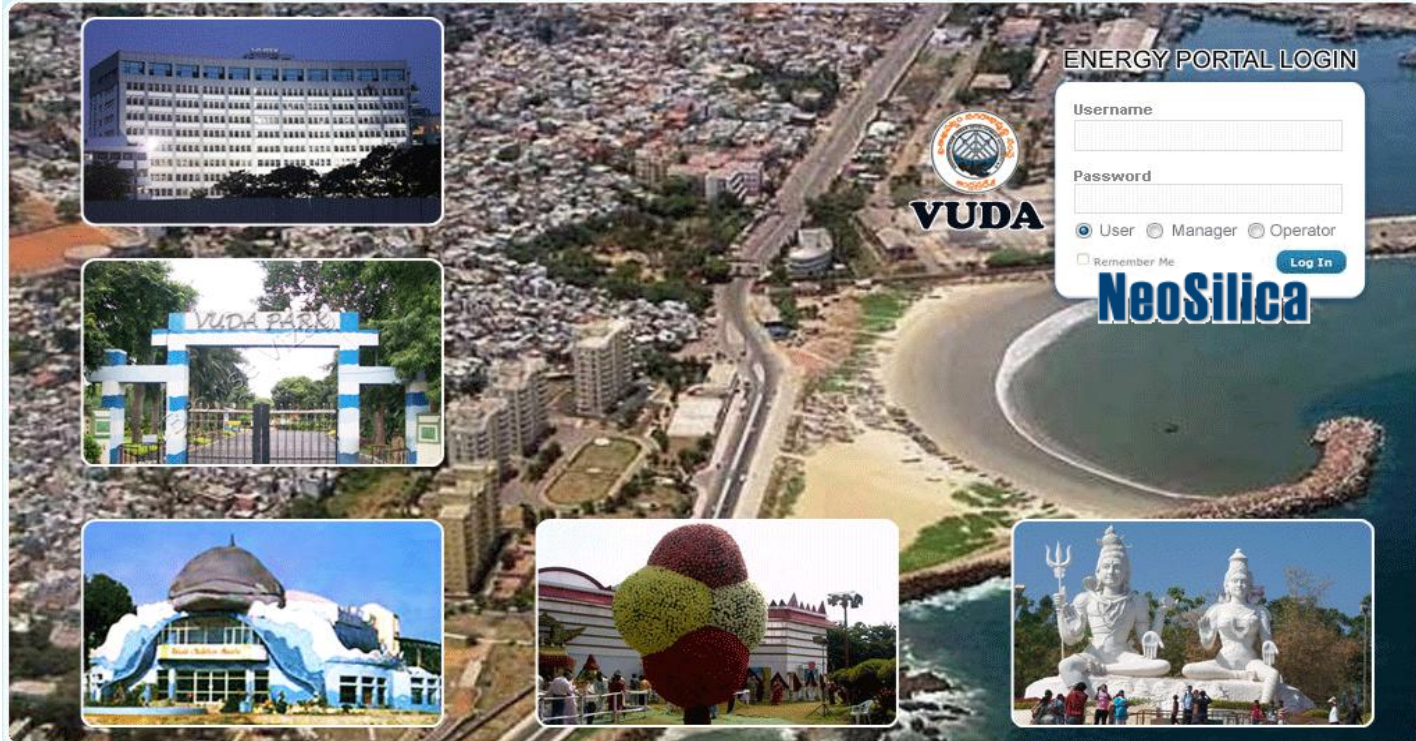
1. In Tata Power for 20,000 L&T Meters since 2014
2. In Pondicherry for 1,500 Meters, from 10 different Smart Meter Manufacturers



- NeoSilica offers (for Electric, Water, Gas)**
1. Meter Data Management System (MDMS)
  2. Meter Data Acquisition System (MDAS)
  3. Peak Load Management (PLM)
  4. Demand Response (DR)
  5. Utility Analytics & Energy Accounting
  6. Renewable Integration (RI)
  7. Utility Portal (integrated)
  8. Customer Portal

Highly Effective in Micro Grid environments,  
 Urban/Rural, Grid-connected/disconnected  
 Combining Smart Grid, Solar and Building solutions.

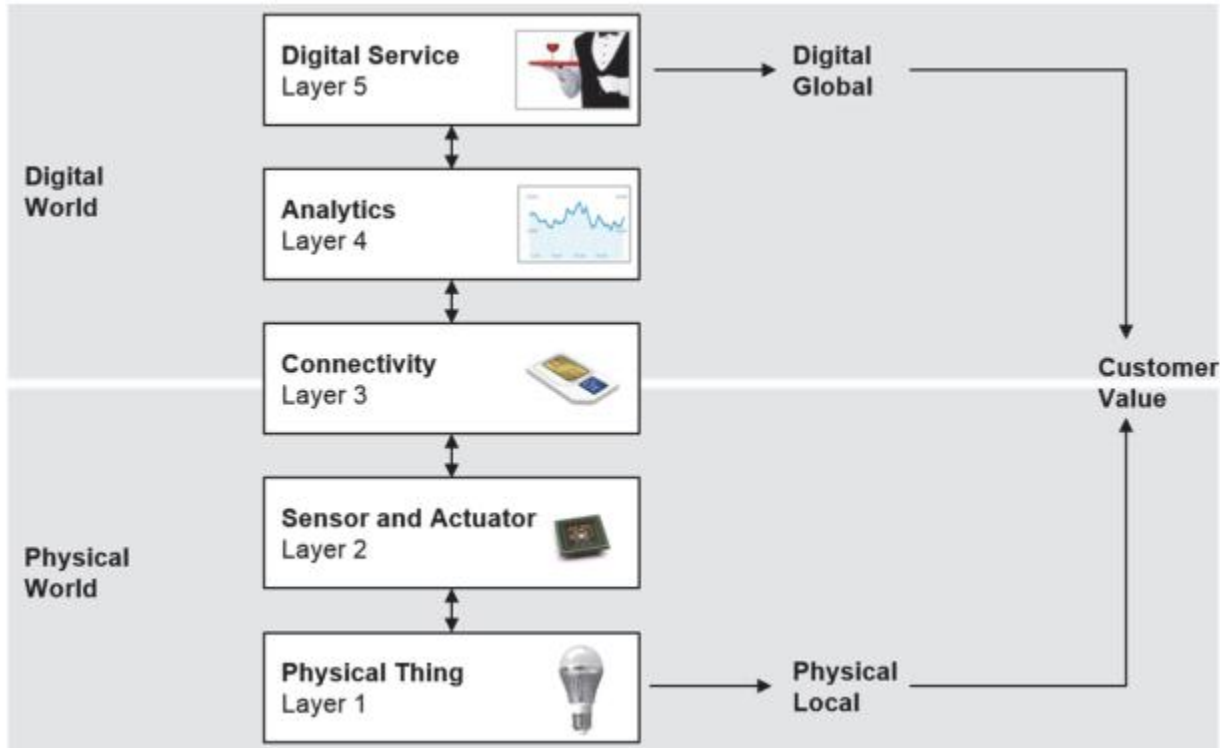
# CITY ENERGY PORTAL – ACROSS GOVT BUILDINGS



# TECHNOLOGY

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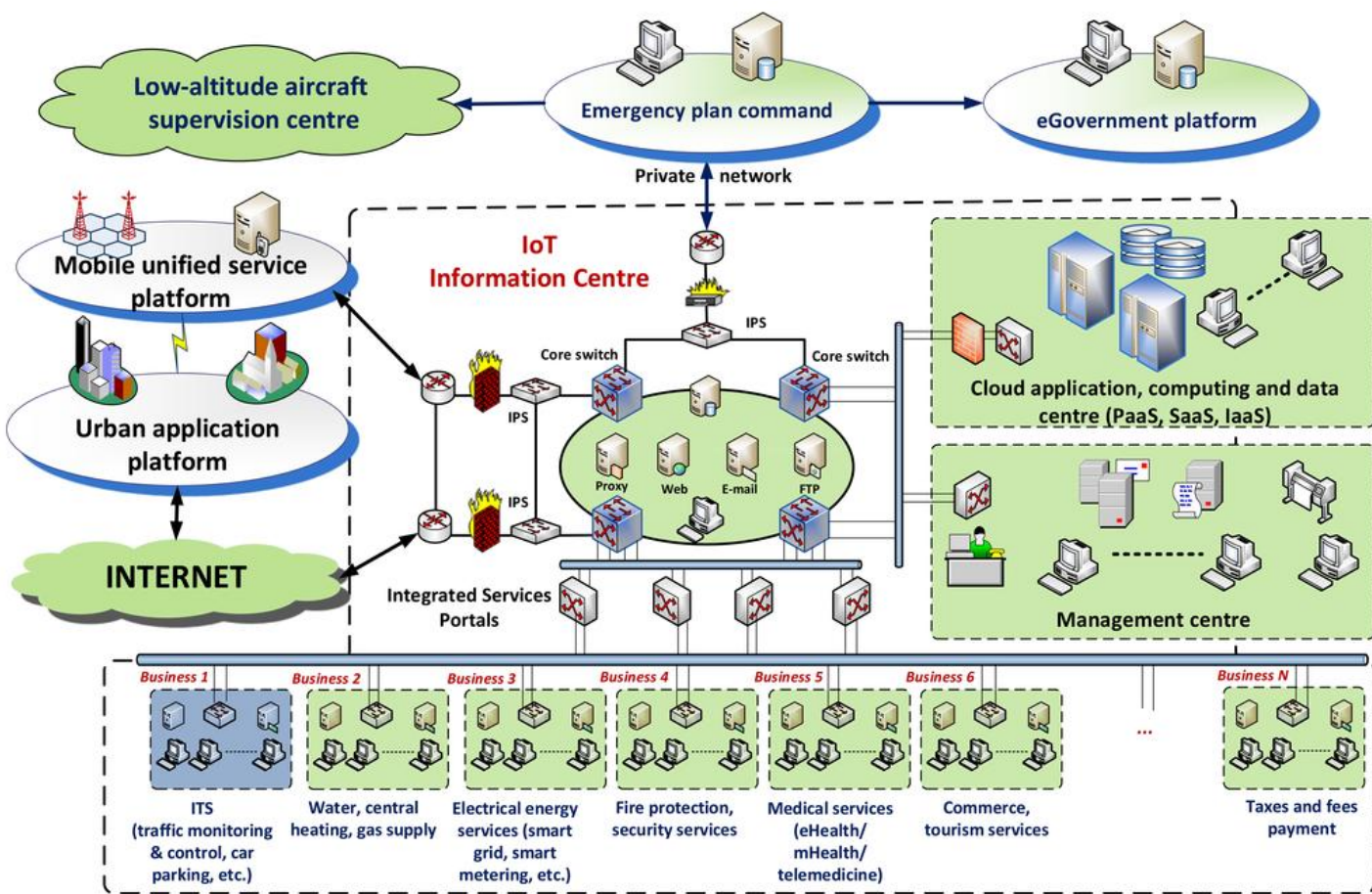
# VALUE CREATION LAYERS IN IoT SOLUTIONS



IoT-based Solutions enable High Value and Advanced Digital Services that Redefine and Add New Business Models.

For example, a printer can be sold based on “Outcome”, that is “# of Pages Printed”, so that the manufacturer can own maintenance and spare parts (cartridge) revenues.





**SMART CITY  
ARCHITECTURE &  
INTEGRATED  
APPLICATIONS  
USING  
IIoT + CLOUD +  
ANALYTICS PLATFORM**

*Sensors & Smart City,  
Nov 14, 2015  
mdpi.com*

# SMART GRID: NETWORKS & SECURITY

**System of Systems – running on Network of Networks**

★ Application & DB Security

★ Perimeter & NW Security

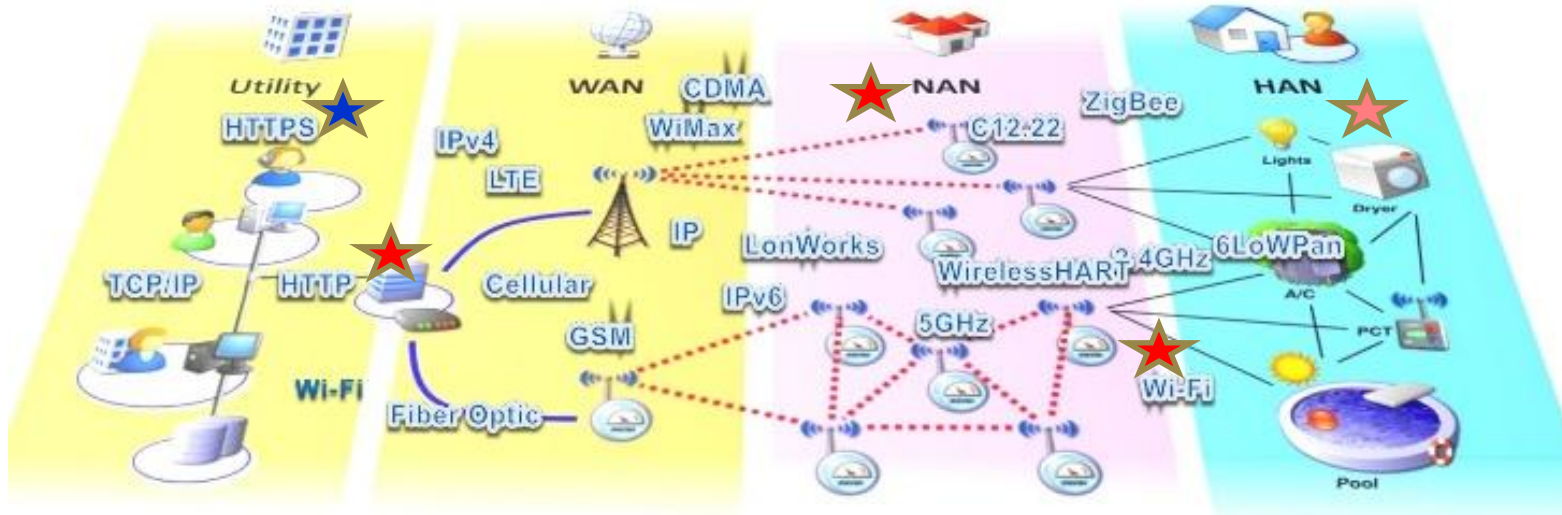
★ End Device Security

IT DATA CENTER

WAN & SECURITY

NEIGHBOURHOOD

HOME/BUILDING



# For Power Device Manufacturers

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1. ***No device will be an island.*** They will all be connected, into single or multiple systems, for different stakeholders.
2. **Design for Maintenance, Monitoring & Management.** Every new hardware should be designed for easy diagnostics and management, individually or through a subsystem.
3. **Build Smart Subsystems around your devices.** Allow easy monitoring of all internals of your device.
4. **Consider IP Networks and IPv6.** Using IIoT, more field gateways are transforming networks to IP based, away from legacy.
5. **Derive New Revenues and Business Models.** Leverage IoT platform to deliver new business revenues.

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**THANK YOU**

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SMART GRID SOLUTIONS COMPANY

Satyam Bheemarasetti  
Ravi Prasad Patruni

**NEOSILICA**

An abstract digital cityscape visualization with blue and red lines forming a grid and architectural structures, suggesting a smart city or smart grid environment.