The Premier Global Event in Applied Power Electronics™

APEC 2016

LONG BEACH California

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LONG BEACH CONVENTION & ENTERTAINMENT CENTER

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

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SMART GRID SOLUTIONS COMPANY

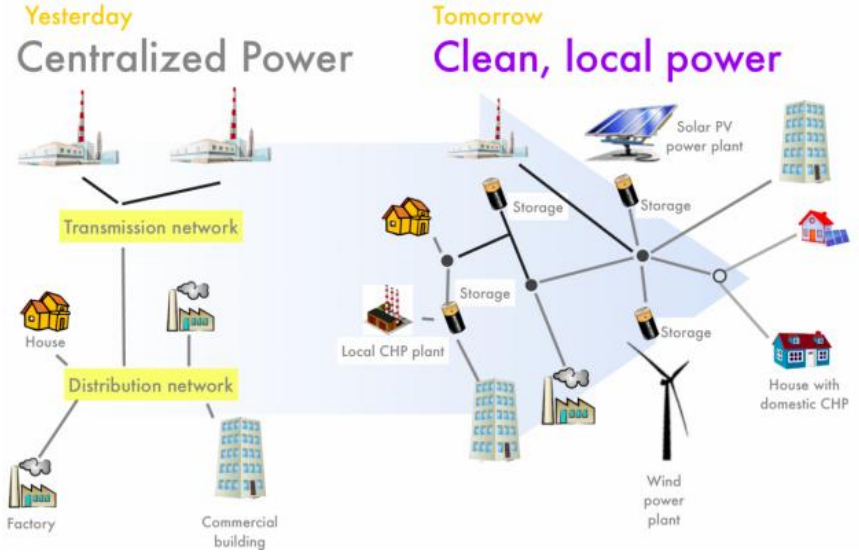
OUTLINE

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

- **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

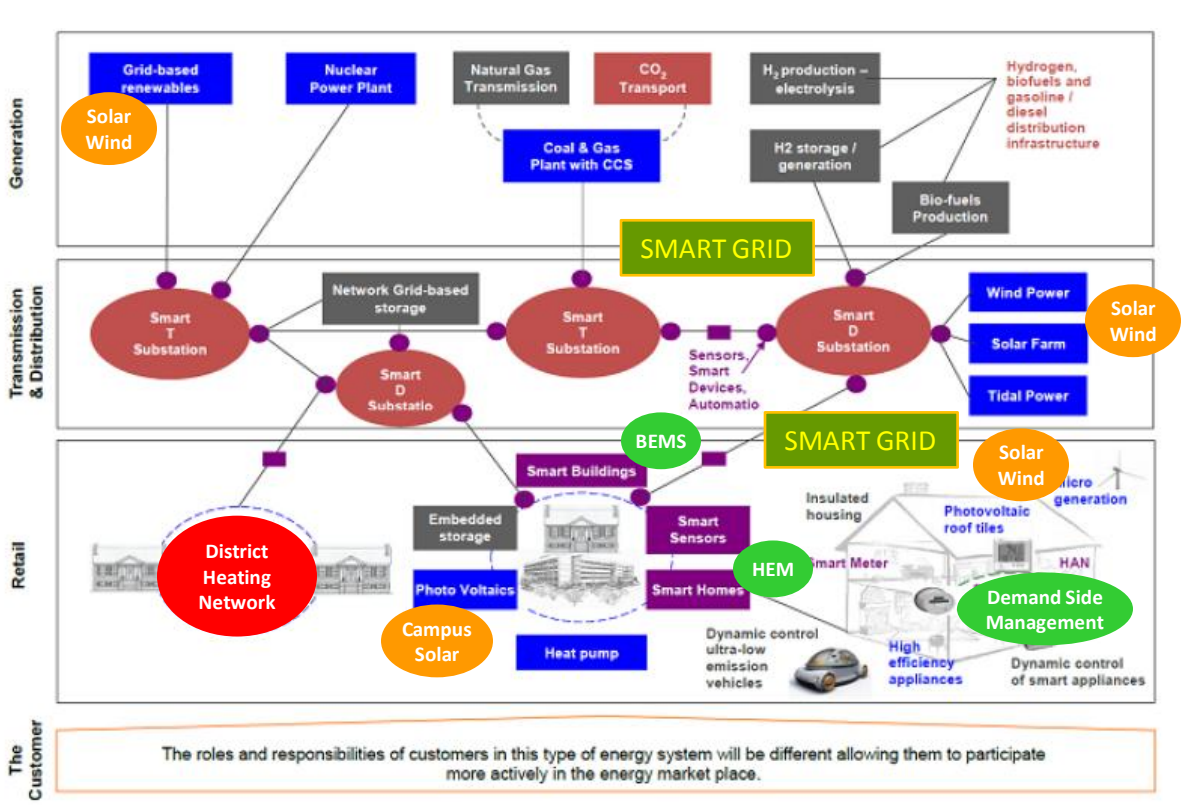
Evolving Smart Micro-Grids for Communities

Integrating into Smart Cities

Towards Perfect Power

Ref:
Institute for Local Self-Reliance
ILSR.ORG

SMART ENERGY: ROADMAP



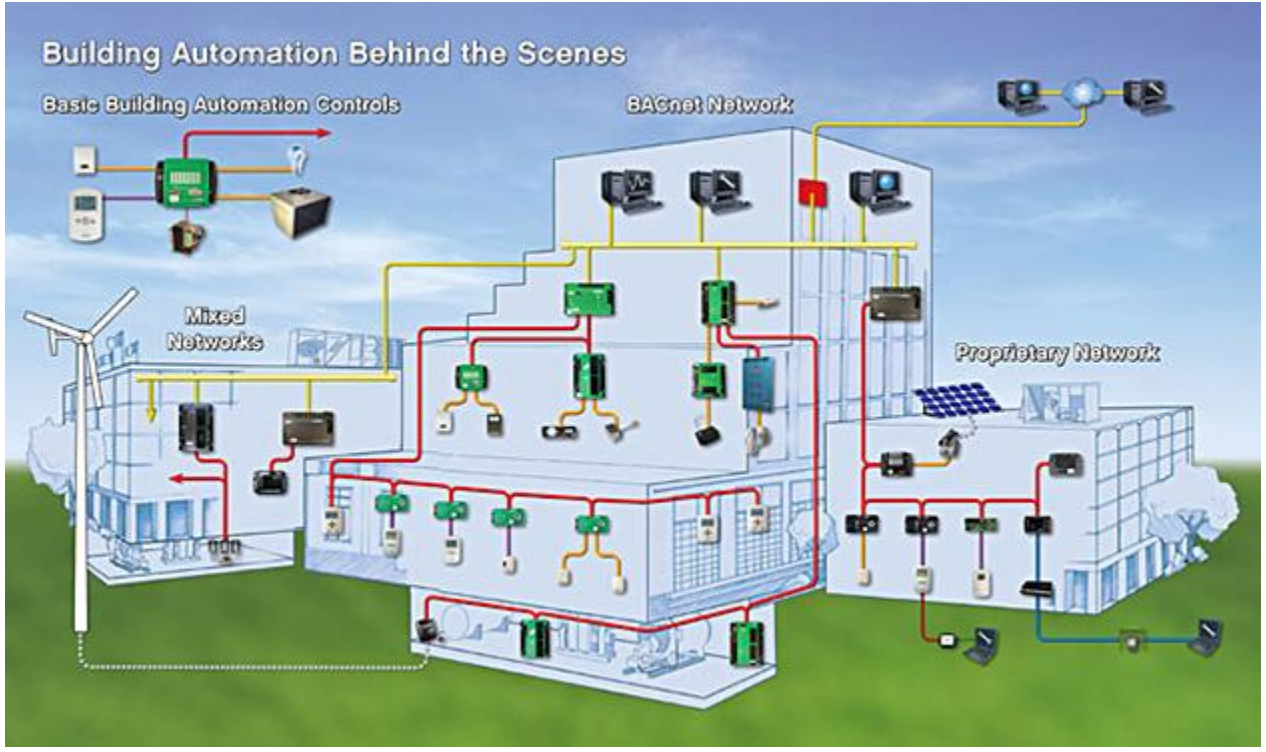
- **Smart Grid**
- Renewables (Solar, Wind, ...)
- Energy Management (BEMS/HEM/DSM)
- District Heating
- Storage & Demand Shifting
- Electricity/Heat Generation
- Sensing, Control & Integration
- Other Infrastructure

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

Ref:
Smart Grid Vision & Roadmap
Gov.uk

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

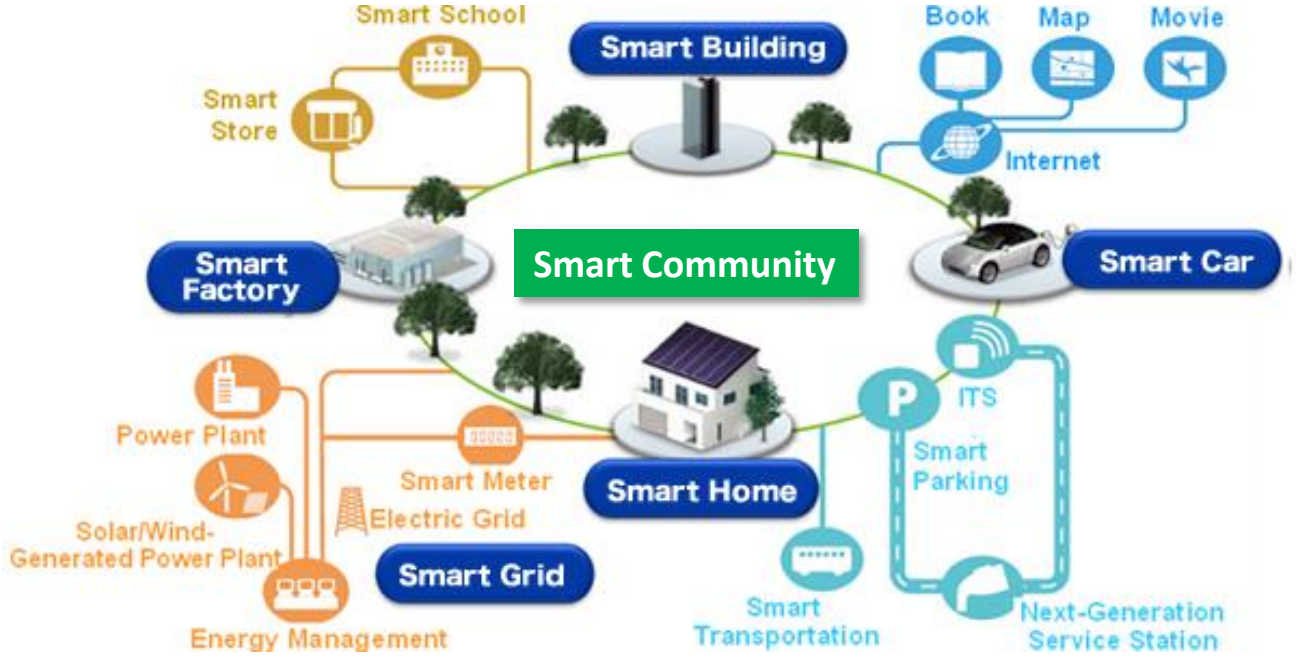
DER: Solar & Wind

Ref: electrical-knowhow.com

CEMS: ENERGY MANAGEMENT FOR COMMUNITY/NEIGHBORHOOD

SMART COMMUNITY

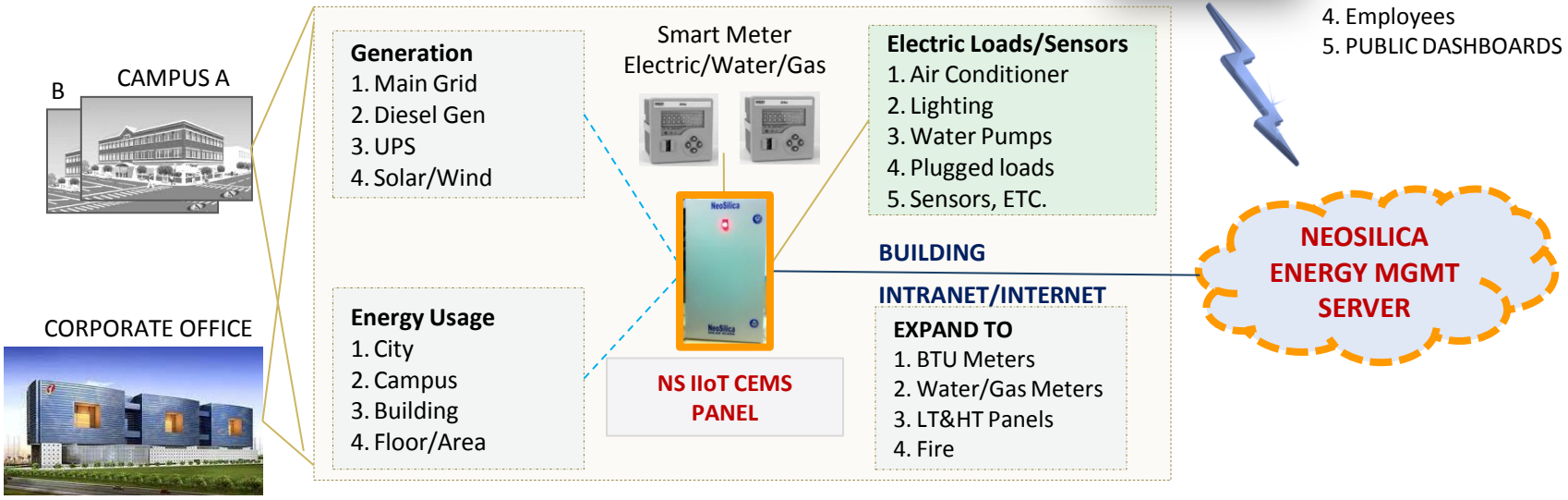
Smart City is A Network of Smart Communities. 75% of World Population will be in Cities by 2030.



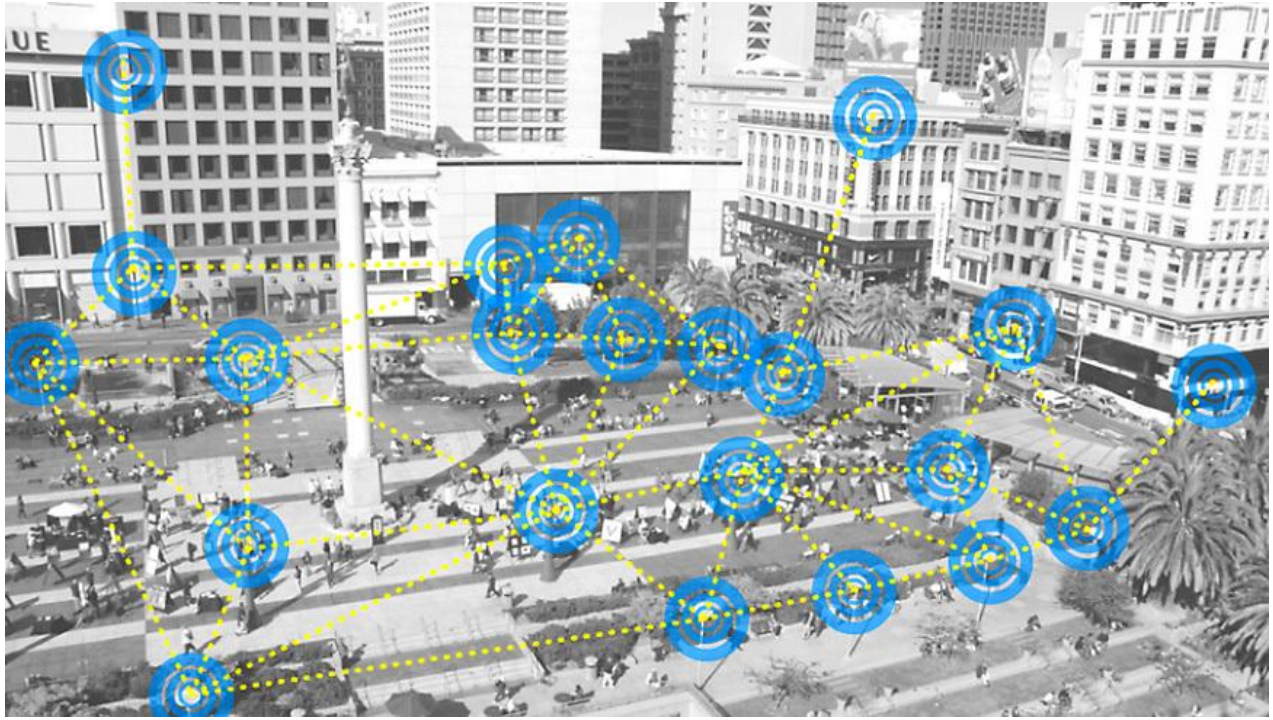
Ref: Renesas.com

ENERGY MANAGEMENT ARCHITECTURE

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



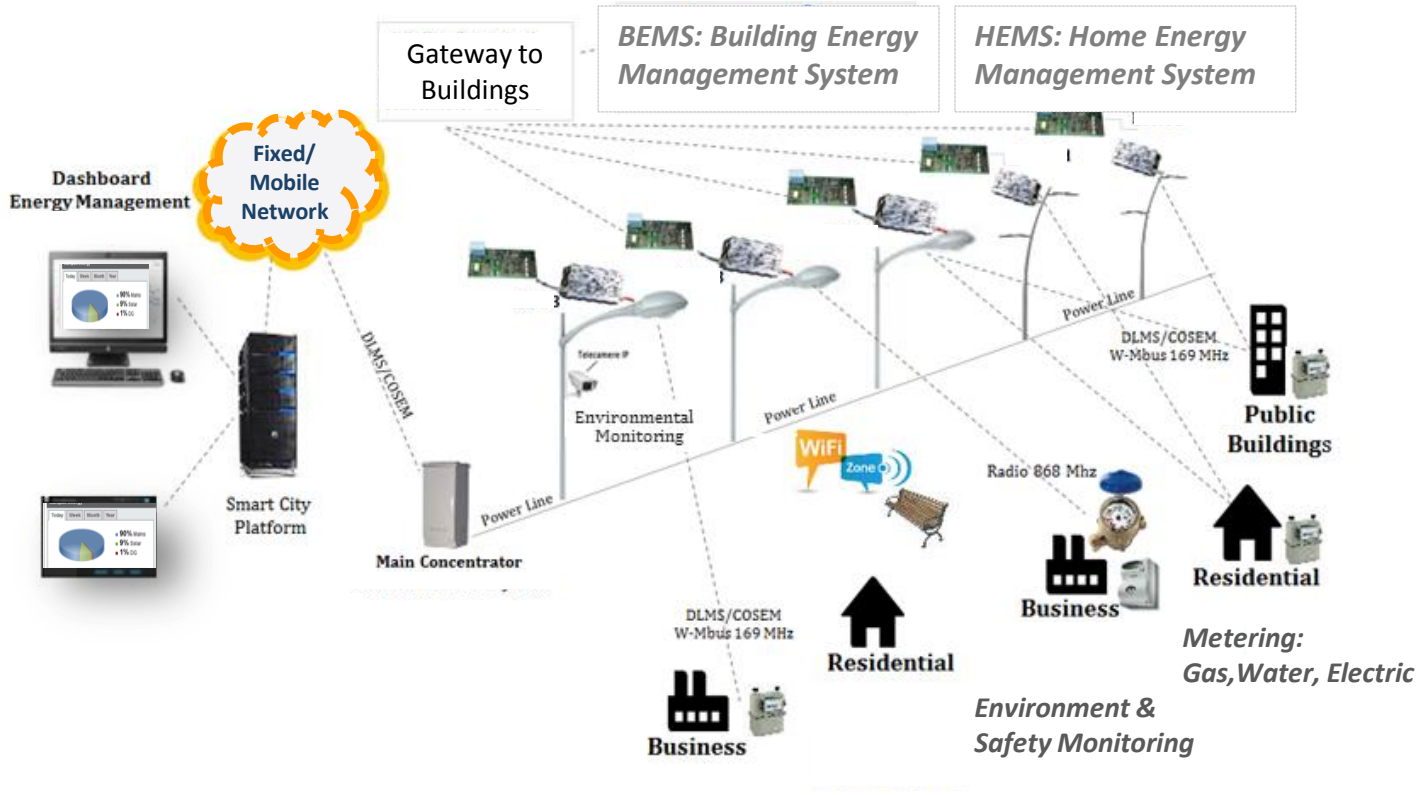
SMART STREET LIGHTING



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

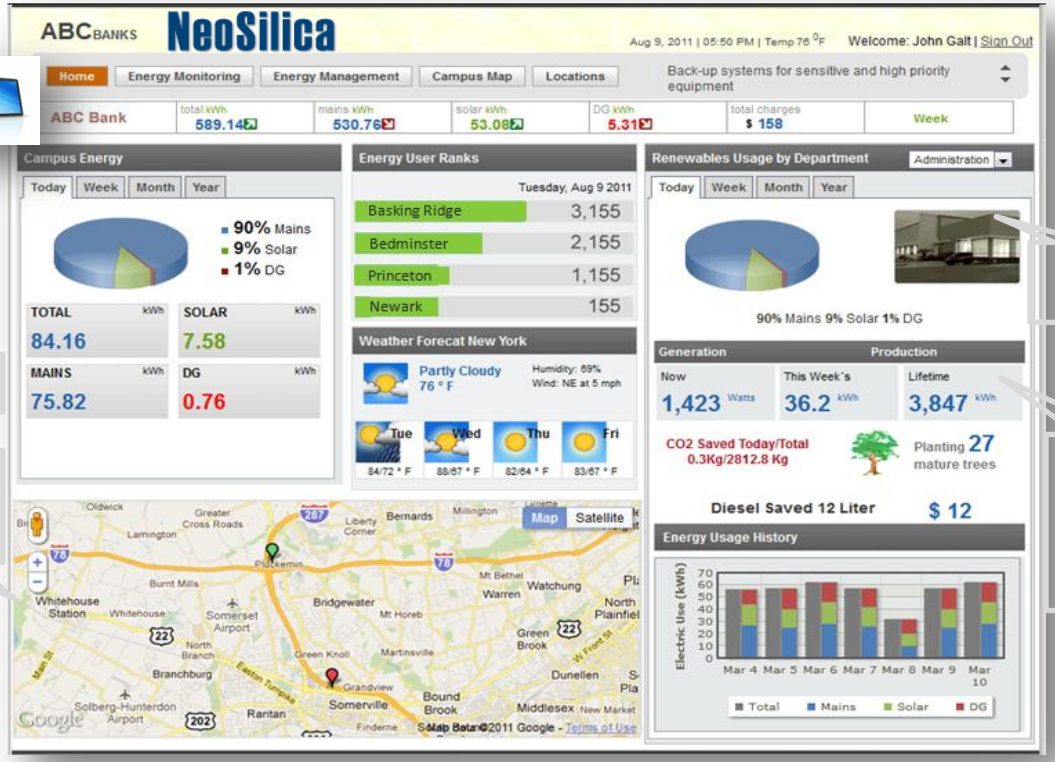
Ref:
theagilelandscape.com

SMART COMMUNITY INTEGRATED APPLICATIONS



COMMUNITY – ENERGY DASHBOARD WEB

PC
Mobile
Tablet



Total View

Locations
To Drill
Down

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

WHAT IS SMART GRID? FOR UTILITIES

MAKING

grid infrastructure, renewables, storage, homes and buildings

Connected, Efficient & Sustainable

USING

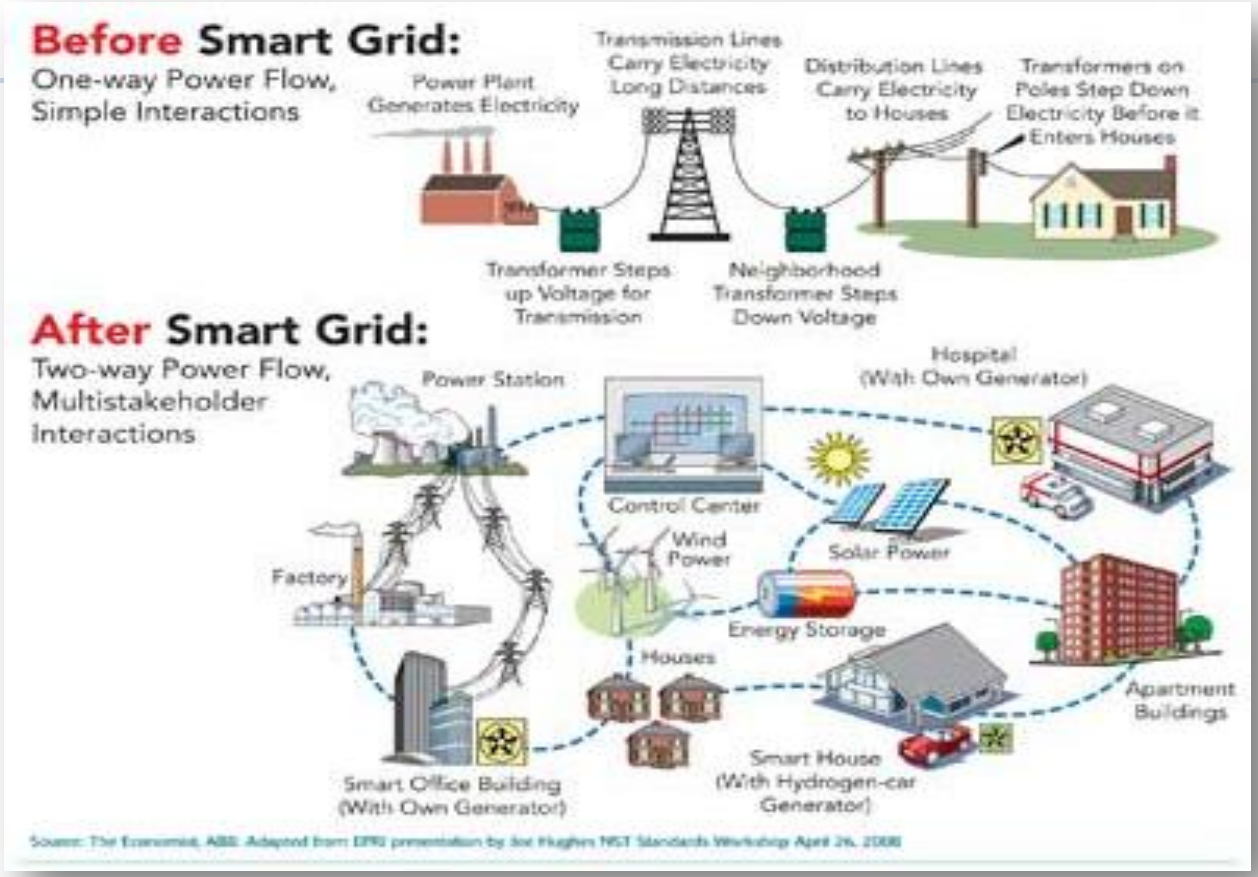
Electronics, Networking, Enterprise IT, Analytics along with Advanced Electrical

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

CREATING

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

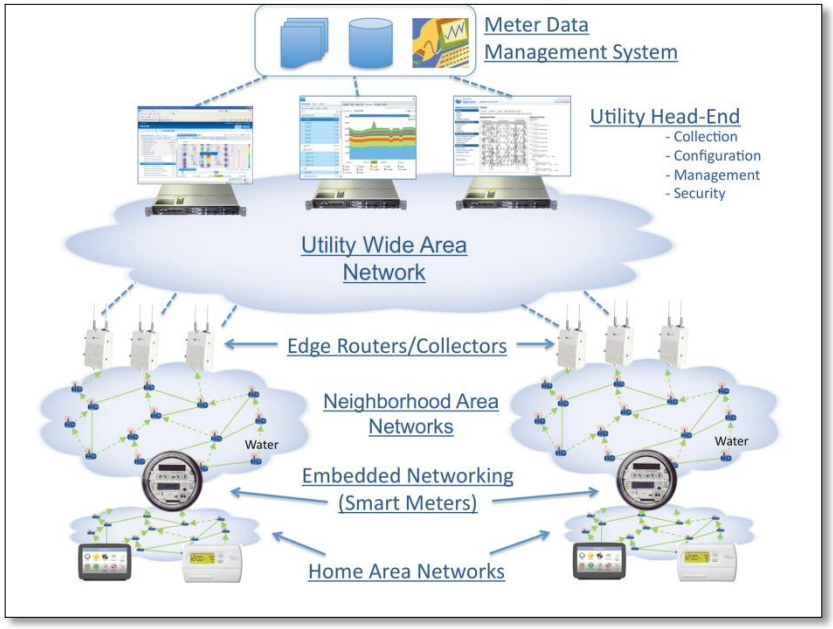
Evolving Iteratively!



Ref: belden.com

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

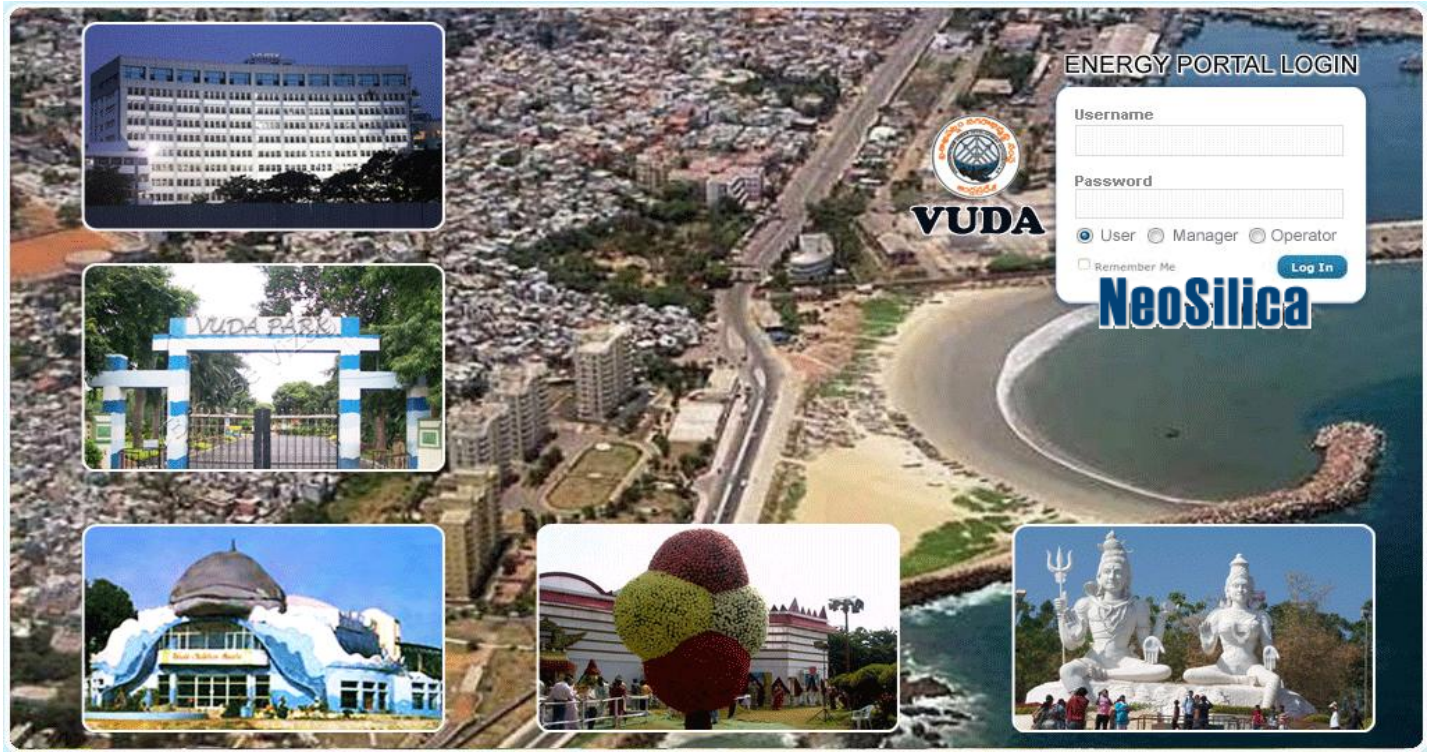


NeoSilica offers (for Electric, Water, Gas)

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

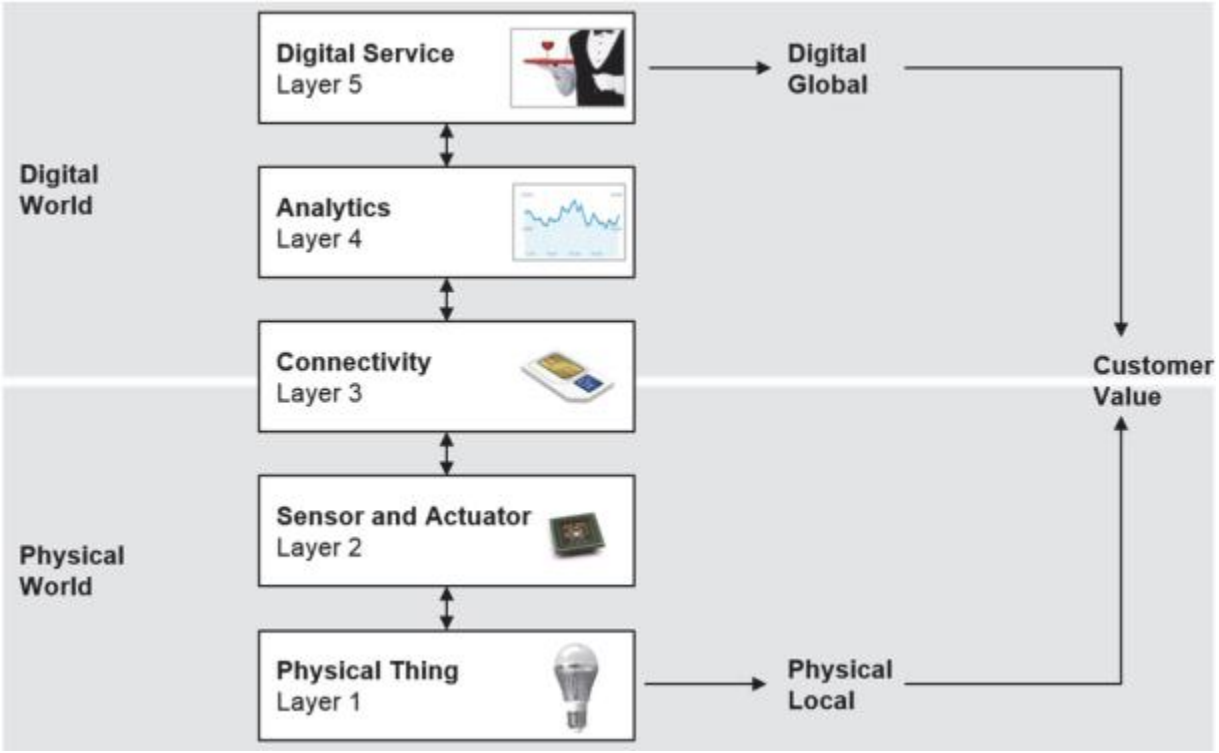
Highly Effective in Micro Grid environments, Urban/Rural, Grid-connected/disconnected Combining Smart Grid, Solar and Building solutions.

CITY ENERGY PORTAL – ACROSS GOVT BUILDINGS



TECHNOLOGY

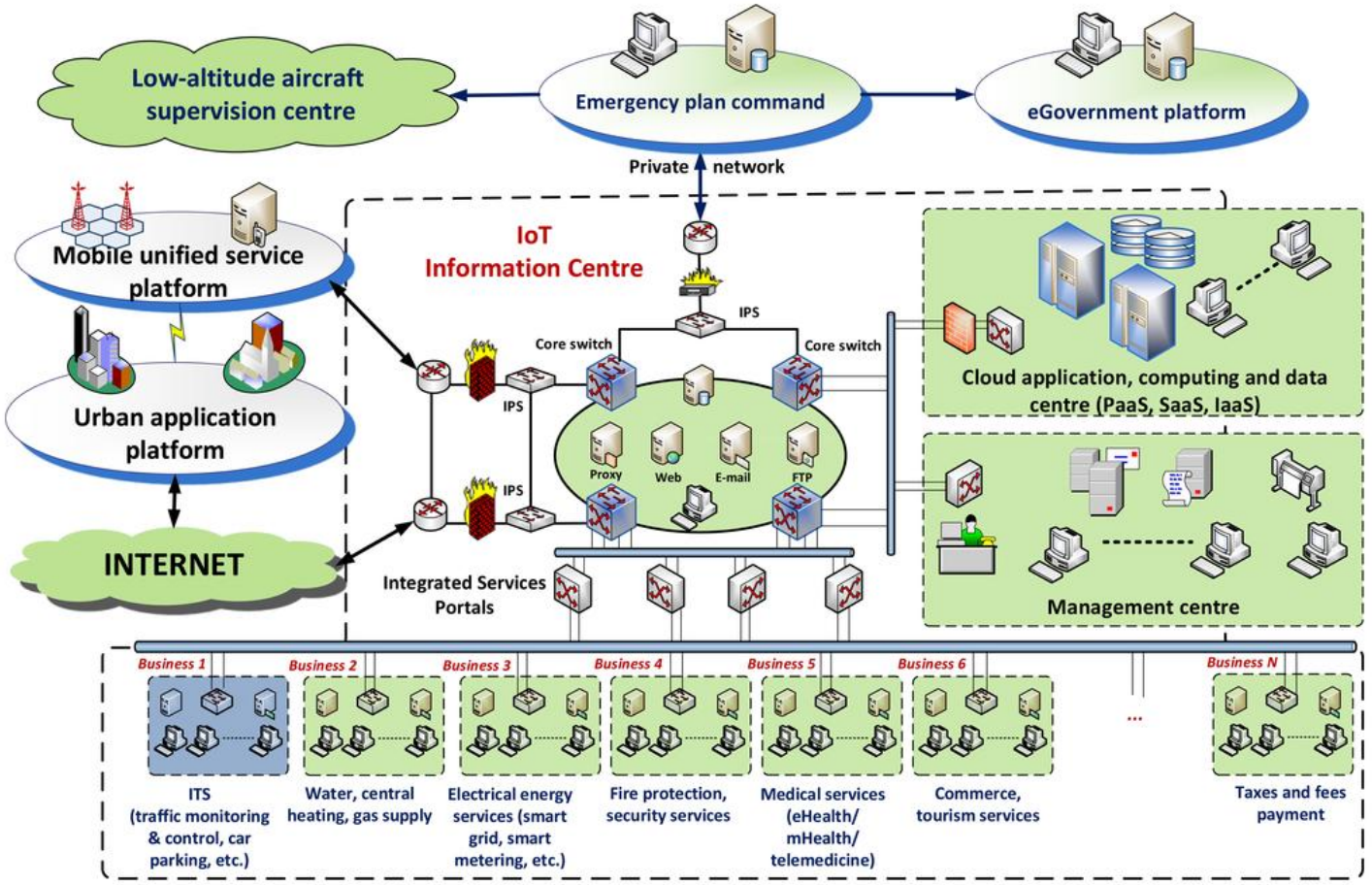
VALUE CREATION LAYERS IN IoT SOLUTIONS



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.

IoT Whitepaper
Bosch
2015



SMART CITY ARCHITECTURE & INTEGRATED APPLICATIONS

USING

IIoT + CLOUD + ANALYTICS PLATFORM

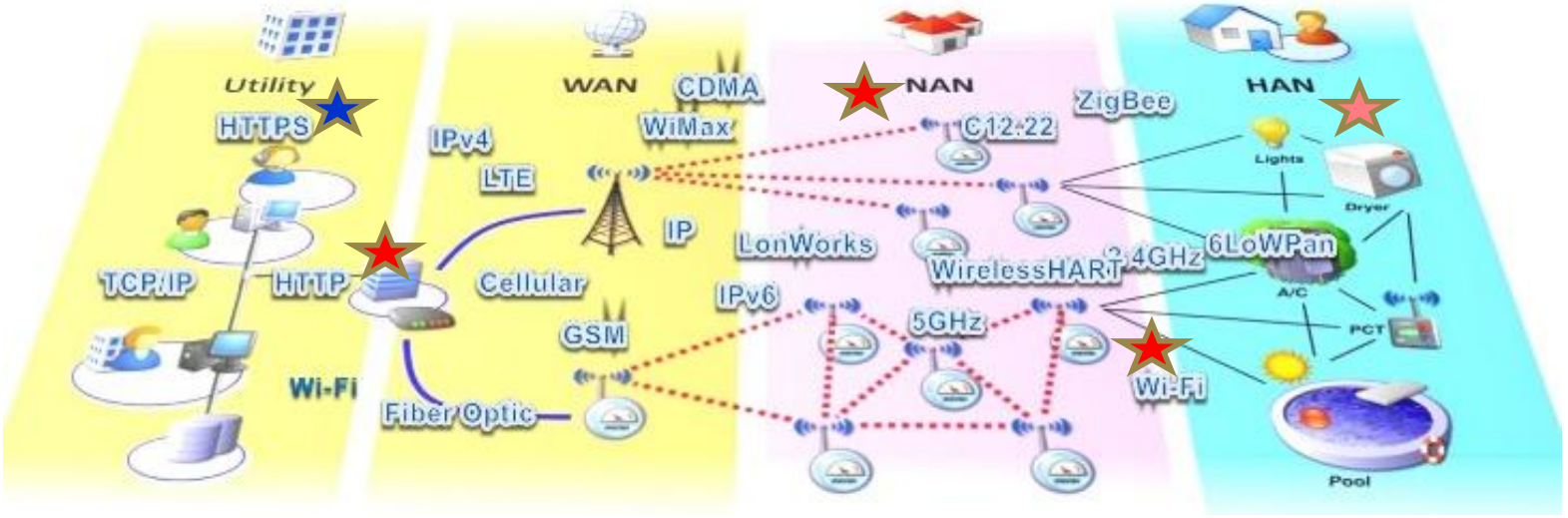
Sensors & Smart City, Nov 14, 2015 mdpi.com

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



Smart Grid Security East 2011

For Power Device Manufacturers

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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