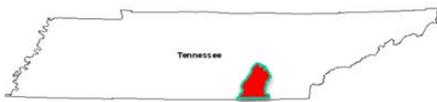




**Electric Power Board**  
**Chattanooga**



**DOE Next Generation Components R&D Program Planning Workshop**



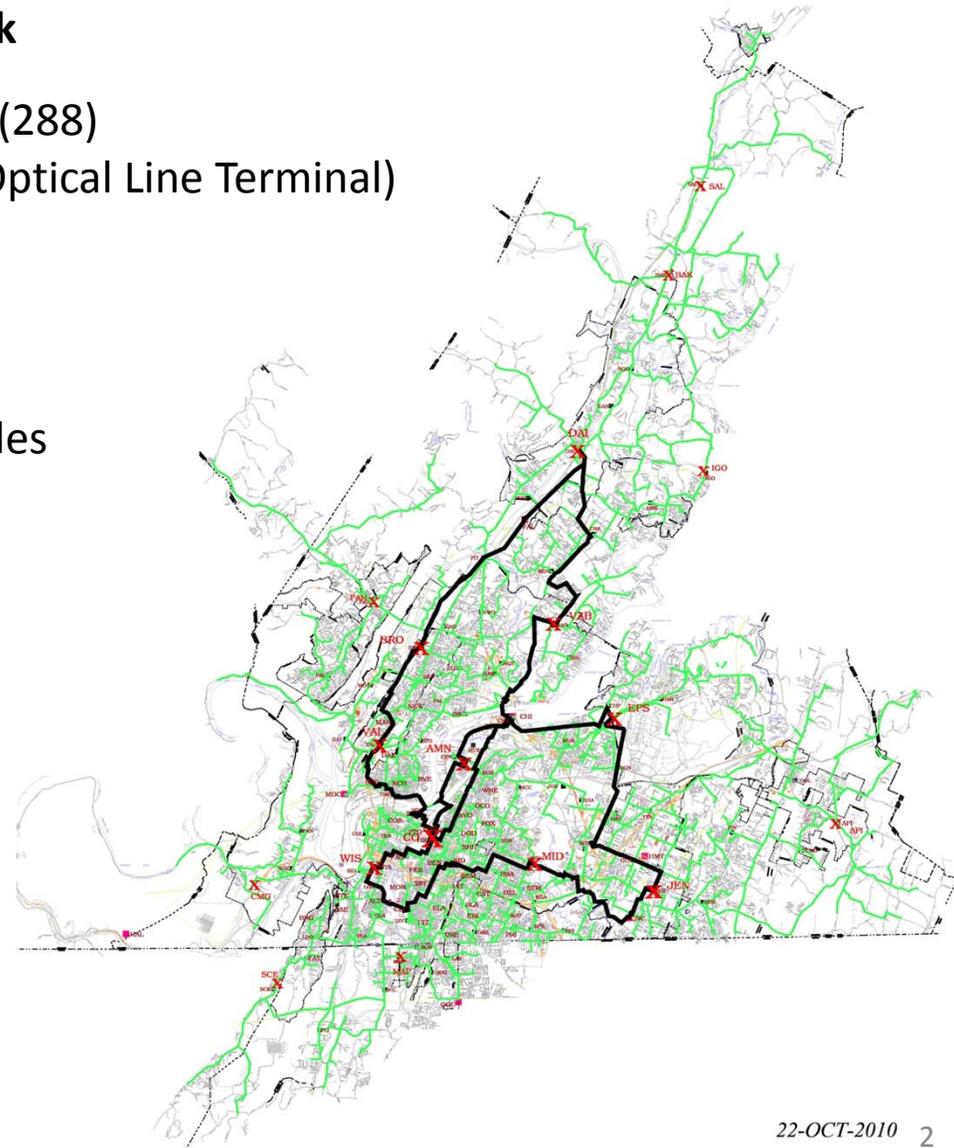
08/2016  
Lilian Bruce  
Strategic Research, EPB

# Chattanooga's Fiber Network

*Fiber-To-The-Home*

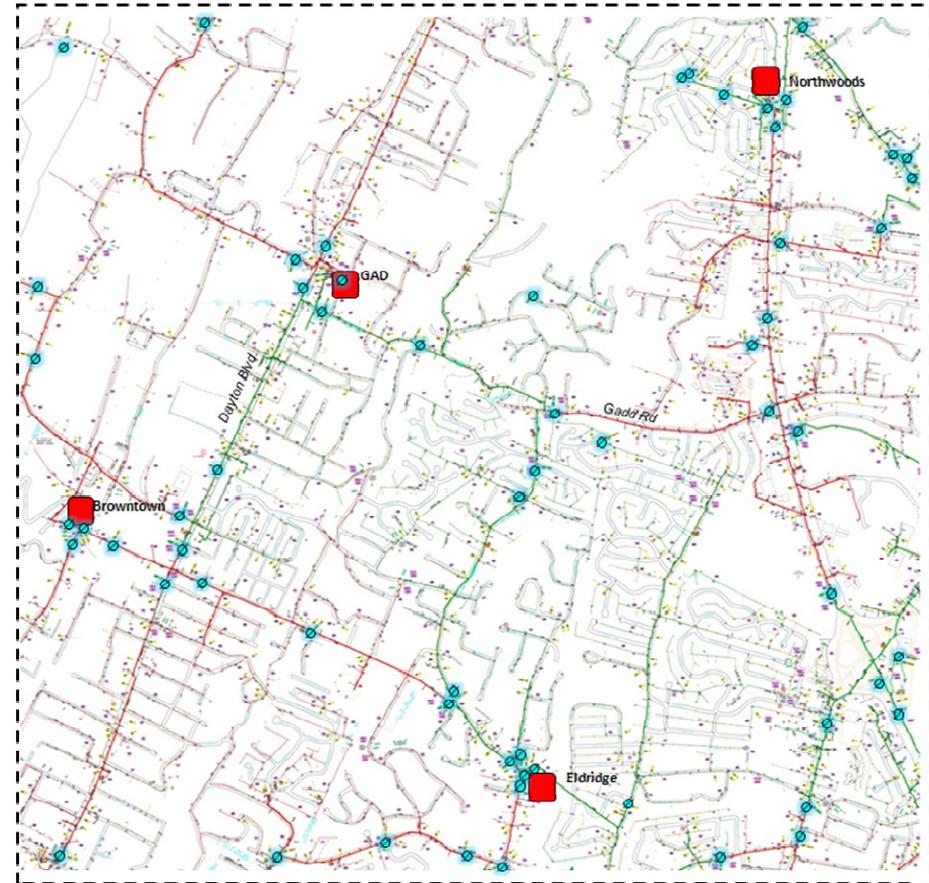
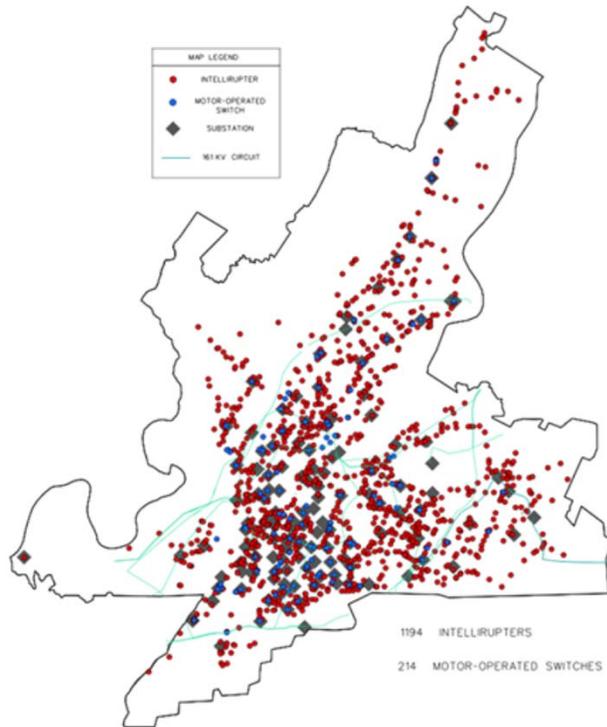
## A GPON-Gigabit Passive Optic Network

- Two fully redundant 10 gig rings (288)
  - 10 gig East and West /OLT(Optical Line Terminal)
  - 1.6 Tbps of capacity
- Central Office-GPON Electronics
- 11 Super Nodes & 6 Remote Nodes
  - 82 OLTs today
- 91 miles of Transport fiber
- 802 miles of Feeder fiber
- 3,365 miles of Distribution fiber
- 4,300+ miles of Drop fiber



# EPB Smart Grid

*Intelligent, Interactive, Self Healing*



- ~1,200 Installed Intellirupters, 12 kV
- 214 Motor Operated Switches, 46kV
- All communication over EPB Fiber
- Utilizes peer to peer communication for distributed automation
- AMI at all 174,000 premise
- Voltage Line Regulators

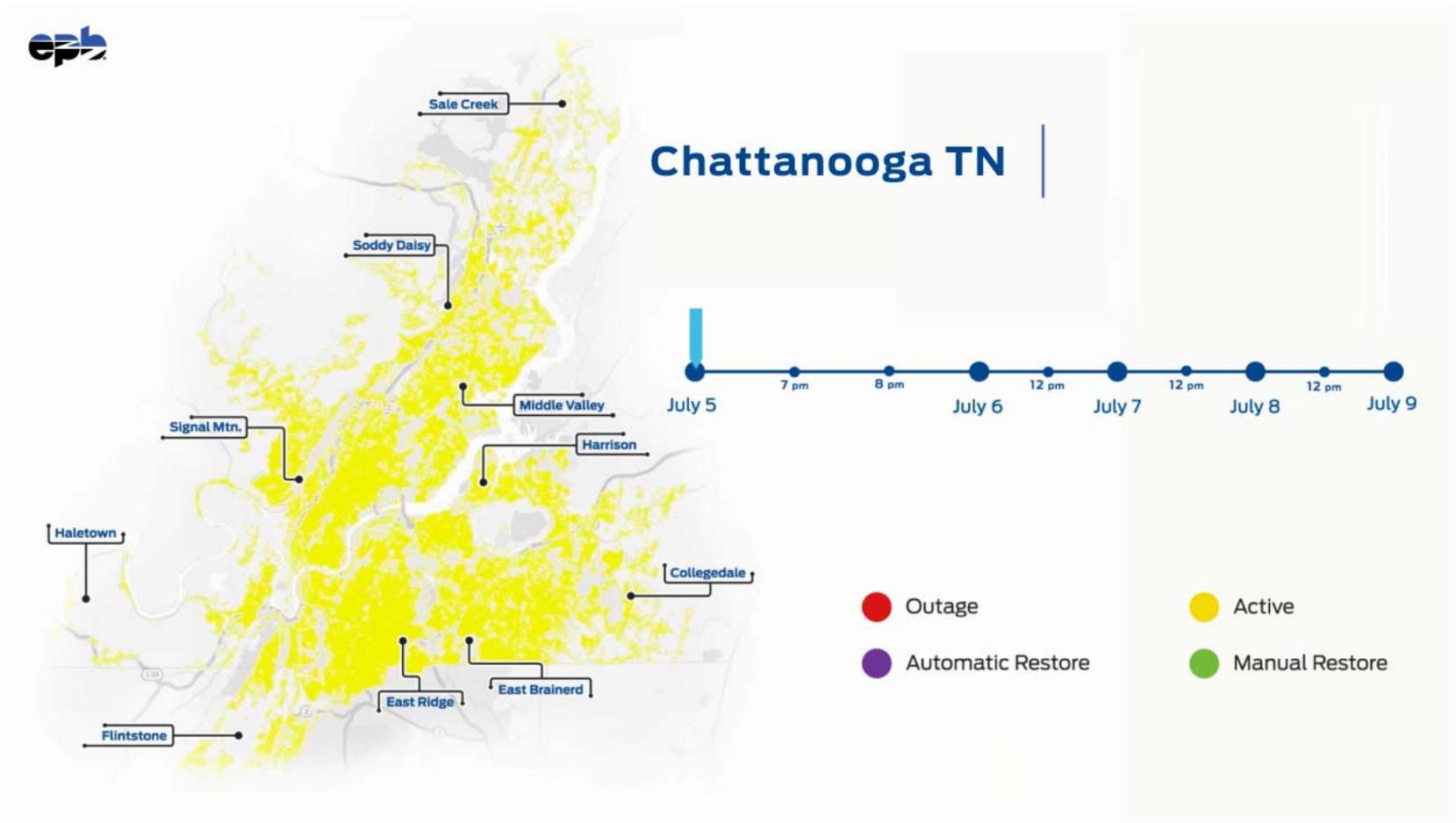
# EPB Smart Grid

*Fiber & Culture Enabled*



# EPB Outage Replays – July 2012

Fiber Enabled

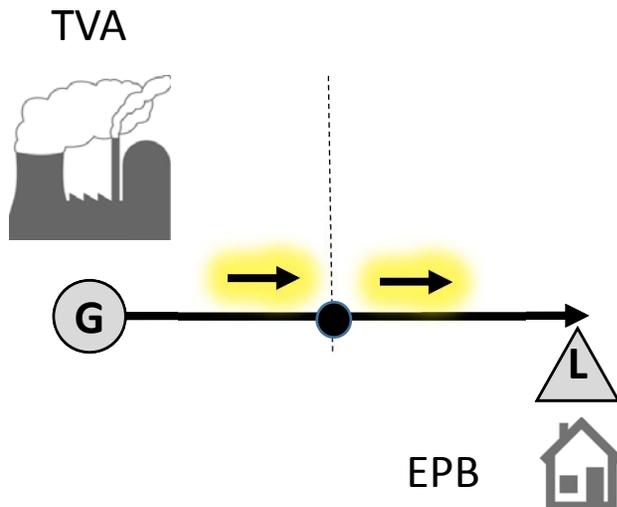


# Challenges

Structural

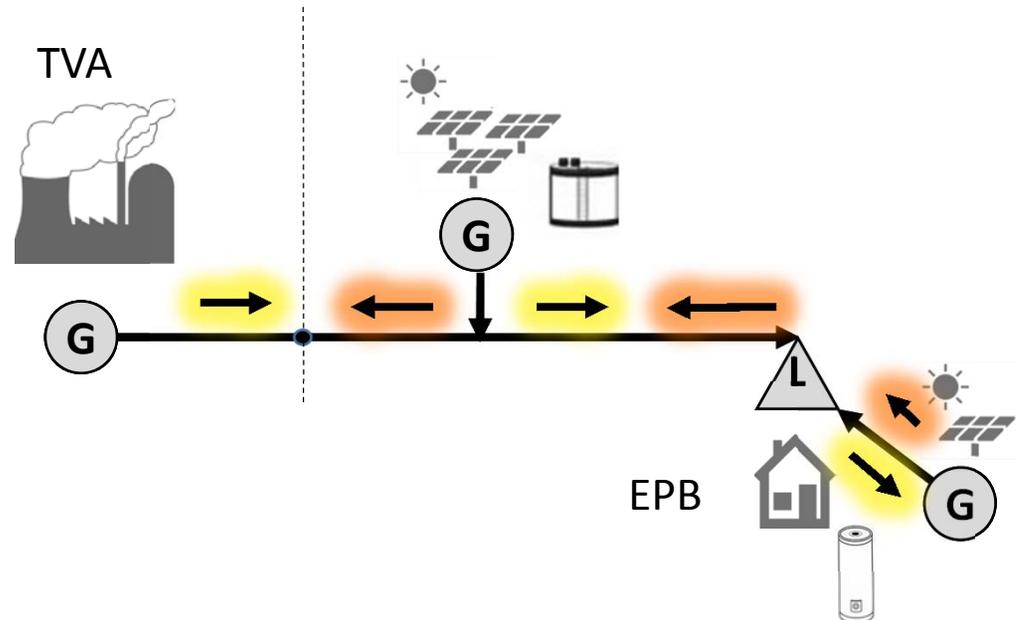
## Yesterday

- Passive participant
- One Way Flows
- Power demands up ~ 6%



## Today

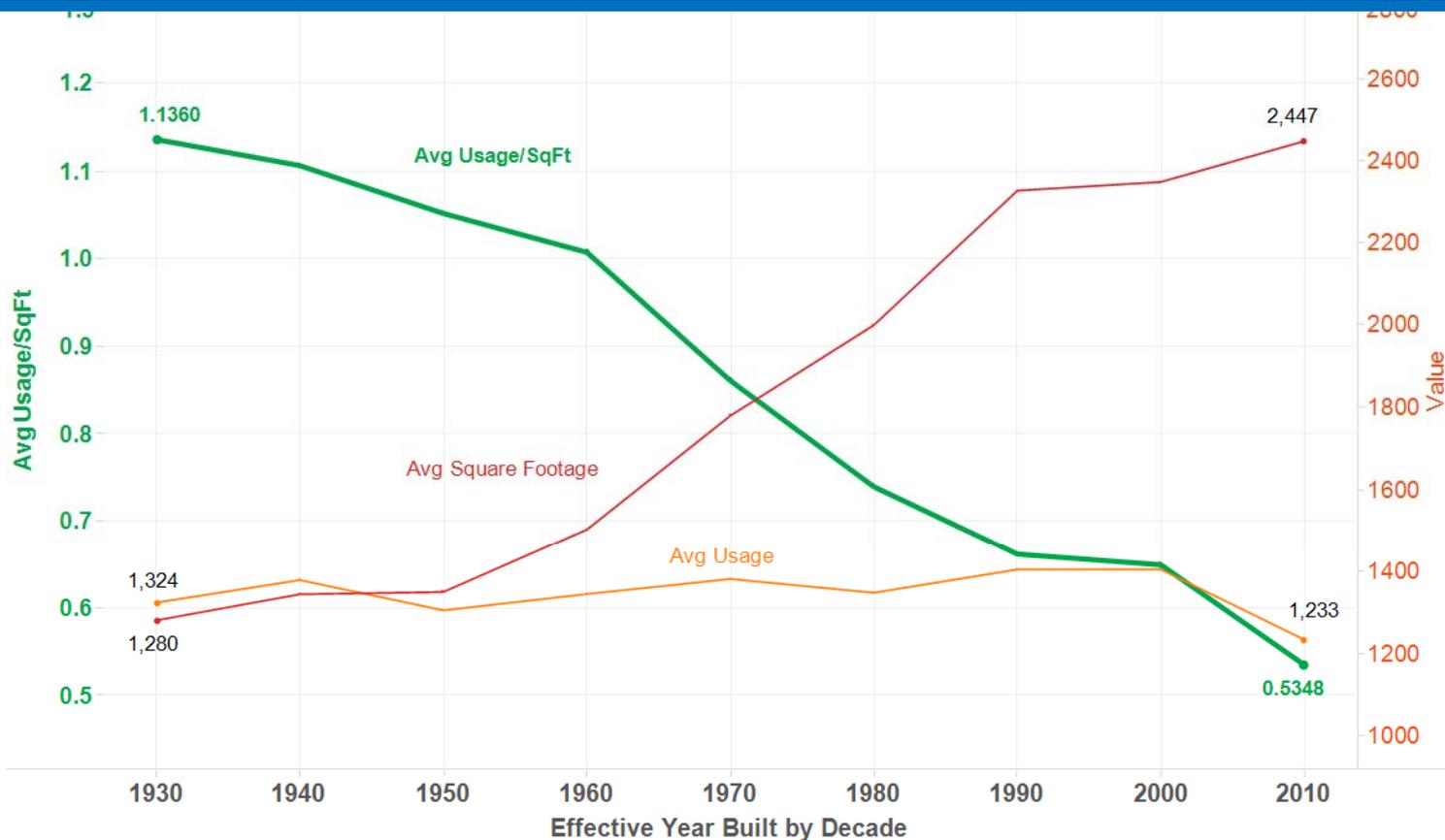
- Consumption trending down
- Acceleration of Clean Energy Resources
  - Dual Directional Flow



- Enthusiasm for Energy Reduction
- Lack of enthusiasm on centralized power model
- New Entrants into the Power business
- Demand for Delivery Resilience

# Average Usage / Sq. Ft Trends

Structural



	1930	1940	1950	1960	1970	1980	1990	2000	2010
Avg Usage/SqFt	1.1360	1.1062	1.0515	1.0071	0.8605	0.7394	0.6616	0.6493	0.5348
Avg(Usage)/Avg(SqFt)	1.0337	1.0257	0.9668	0.8946	0.7758	0.6737	0.6035	0.5981	0.5040
Avg Usage	1,324	1,378	1,305	1,344	1,381	1,347	1,404	1,404	1,233
Avg Sq Ft	1,280	1,344	1,349	1,503	1,780	2,000	2,327	2,348	2,447
Premise Count	243	929	2,602	5,515	21,424	30,699	10,380	11,988	1,202
# Monthly Bills	5,842	22,349	62,733	132,855	516,427	740,377	250,297	289,736	28,943
Monthly Bills/Premise	24.04	24.06	24.11	24.09	24.11	24.12	24.11	24.17	24.08

# Acceleration of Clean Energy

- *COP21*

- *RE100-Renewable Energy Collective*



- *State Legislation*

# Consumption Discouraged-Pledges Made



## NETZERO

Times Free Press Local Business Sports Life Opinion Politics Obits National Right2Know Search

### Net zero home planned in North Chattanooga as example of energy sustainable housing

January 7th, 2015 | by Mitra Malek | in Business Around the Region | Read Time: 3 mins.

- High clerestory windows allow sky views and filtered light to balance down into interior spaces
- Low roof slope allows for high so or gain on TV when solar rad often is maximum
- Operable transom coverings on high interior wall of backroom allow cross ventilation
- Operable casement sill windows at stairwell allow who e-tower cross ventilation
- Floor cutouts and small star rooms promote stack-effect ventilation and free of movement
- 8.5 kW photovoltaic array directly mounted to metal existing standing system
- High-angle summer sun is blocked by roof overhang and porch, preventing undesirable summer solar heat gain on windows & interior floors
- Low-angle winter sun is allowed to penetrate deep into the living space
- Screened porch extends living space through most of the year
- Operable window units and full height doors capture summer breezes

The NextGen house is expected to be Chattanooga's first net-zero-energy home.

# Mass entrance of Power Providers



- *Google unleashes DeepMind on energy-hungry data center, cutting cooling bill by 40%*



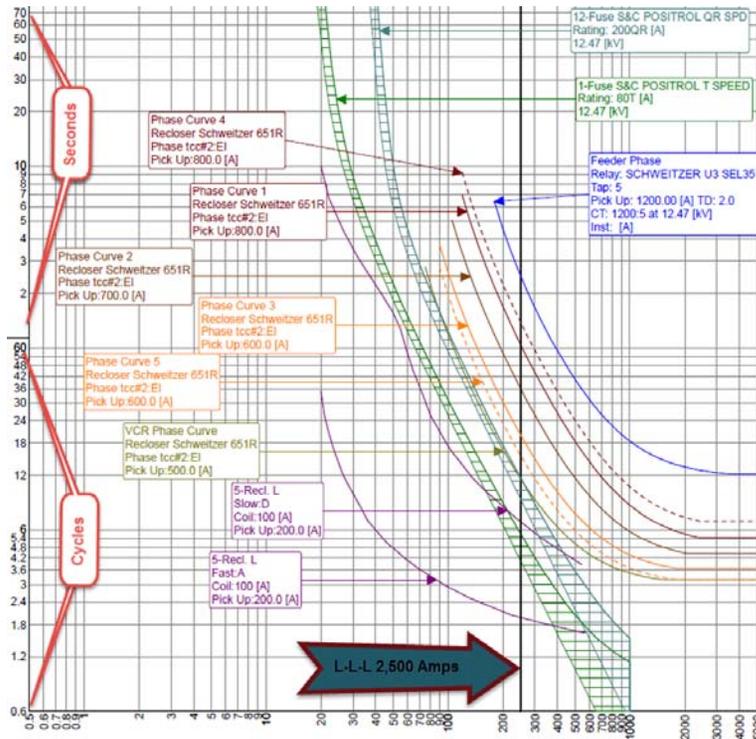
# Traditional Grid - Obsolete

Posted May 19, 2016 - 6:43pm | Updated May 19, 2016 - 7:00pm

## MGM Resorts to leave Nevada Power, pay \$86.9M exit fee



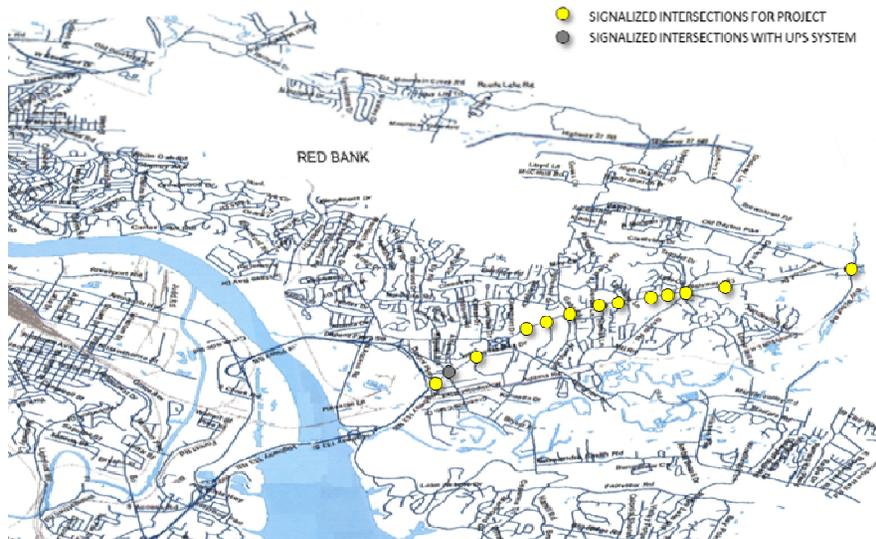
# Opportunities - Utility



Dynamic Protection Systems

- Technologies that Enable Alternative Energy and New Energy Efficient Loads
- Equipment that allows for power where and when you want it
- Communication Rich Electronics
  - Fiber
  - 5G

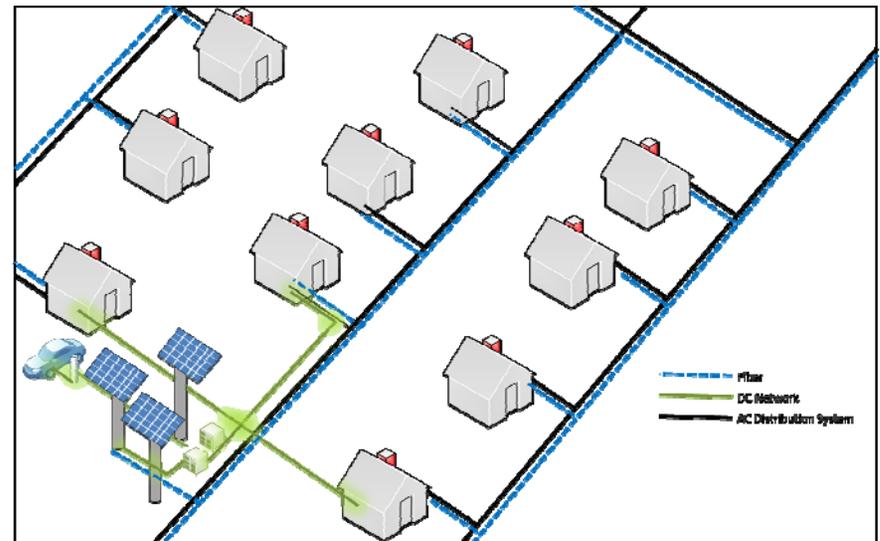
# Opportunities-Community / Customer



## Last Mile Alternative Resilience - Pure DC

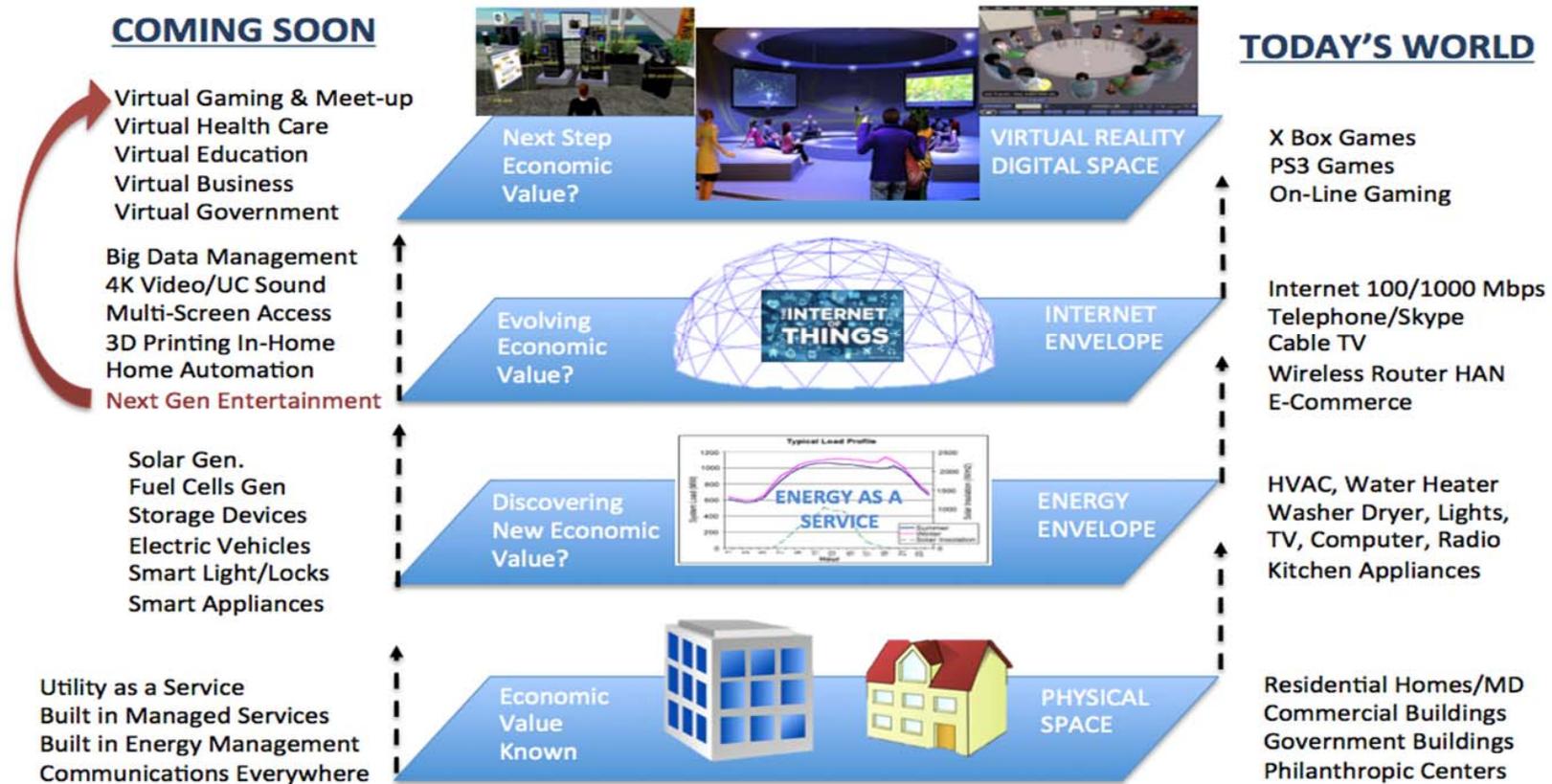
Extend DER capabilities to Support other Community networks

- Traffic
- Water
- Waste



# More Opportunities

## THE ENERGY INTERNET OF THINGS: A FOUR DIMENSIONAL MODEL FOR THE FUTURE



- **Self Aware/Considerate Appliance**
  - **Devices that maximize interrelationship between device and power consumption**

# Preparing for the Future

- *Last mile communication infrastructure, 5G Small Cells*
- *Strategic Partnerships*
  - *USIGNITE, ORNL, UTK CURENT, EPRI, TVA, City of Chattanooga, TEC*
- *DER Integrations*
  - *Storage & Solar*
- *New Electric Loads – Vehicles, Intelligent Lighting*
- *Microgrid Demonstration*
- *IoT-Sensor deployments*
  - *Utility Based; Stationary & Mobile*
  - *Grid Enabled customer appliances*
- *CYBER*