



# Government Customer Symposium



November 16<sup>th</sup>, 2017

# Mission



To foster enhanced communication and strengthen long-term relationships with high valued customers through a trusted energy partnership.

# Agenda



- 11:15 a.m.** Registration, conversation and lunch
- 12:00 p.m.** Welcome and introduction . . . . . Gregory Knight
- 12:10 p.m.** Keynote address . . . . . Dr. Peter Williams
- 12:50 p.m.** Energy efficiency case study . . . . . Jeremy Townsend
- 1:10 p.m.** CEO update . . . . . Scott Prochazka
- 1:45 p.m.** Break
- 2:05 p.m.** Smart Utility, Smart Communities –  
Advancing the Smart Grid of the Future . . . . . Kenny Mercado
- 2:30 p.m.** Smart Utility, Smart Communities –  
Modernizing the Natural Gas Distribution System . . . . . Scott Doyle
- 2:55 p.m.** Summary and closing remarks . . . . . Gregory Knight

# Material Presented on a Courtesy Basis



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# CenterPoint Energy Overview Video



# Energy Utilities, Smart Cities & Resilience

Dr. Peter Williams, Distinguished Engineer, IBM

Discussion on how and why energy utilities are engaging with the smart city movement

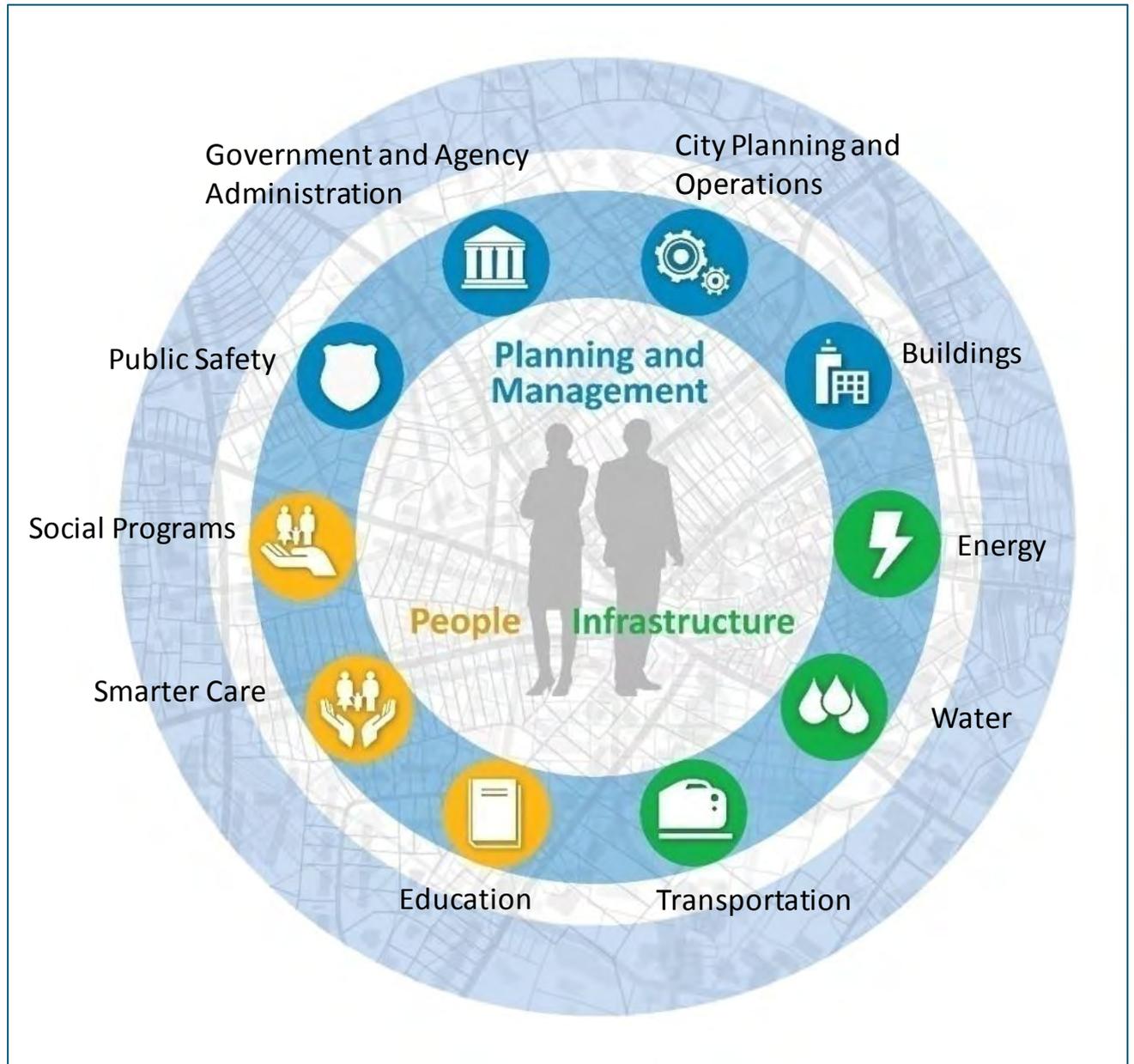
CenterPoint Energy Symposium, Thursday November 16<sup>th</sup>, 2017



# What is a smart city?

It's where the Internet of Things and Artificial Intelligence meet infrastructure, buildings, and operations.

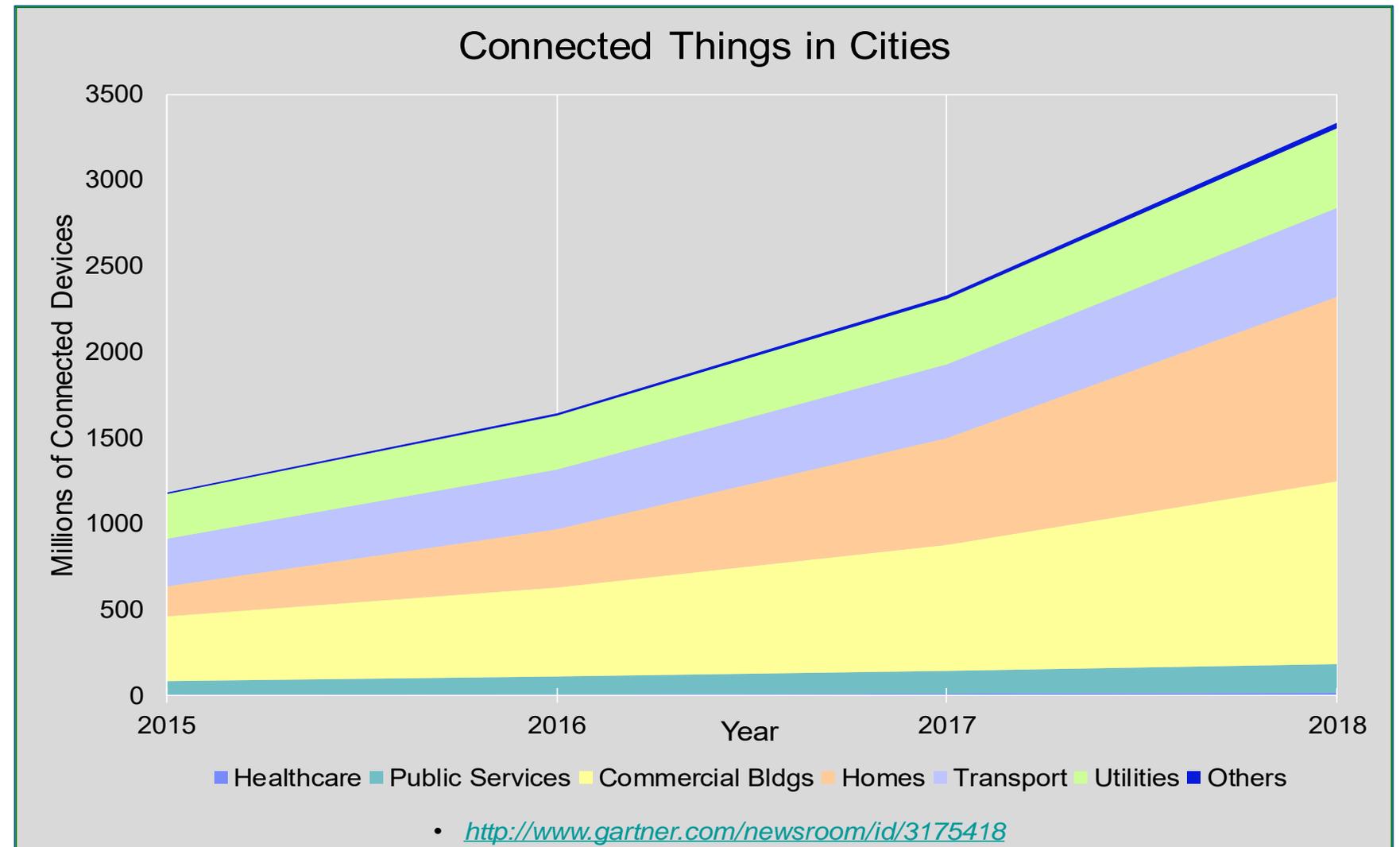
- There is no single definition of a smart city – or indeed, of a city!
- There are however two common threads:
  - The Internet of Things (IOT) – sensors, meters, personal devices. Smart cities are thought to be the fastest growing area of the IOT.
  - Artificial Intelligence (AI) and analytics, to use the data from the IOT!
- *Usually, a smart city focuses on improving some combination of operational efficiency, service, environmental impact, economic vitality, equity, or “livability”.*
- **Resilience** is increasingly added to this list.



# Smart cities are the fastest growing segment of the IOT

Estimates by Gartner, a noted IT analyst firm

- The fastest growth in the IOT will be in cities.
- Gartner projects 3.3 billion devices in cities by 2018, mainly in:
  - Commercial buildings (~32%);
  - Homes (which they include as part of smarter cities ~32%);
  - Utility and transportation infrastructures (each ~14%).



Note – Gartner's estimates *exclude* cellphones and autonomous vehicles.

# Artificial intelligence (AI) and smart cities

AI is increasingly required to process data from the IOT and elsewhere

- AI will use data from the IOT and other sources to optimize multiple systems, detect emergent patterns and provide new capabilities.
- AI may come from combining existing data and models – but increasingly from new technologies such as deep learning and cognitive computing which:
  - Integrates structured and unstructured data, including images;
  - Reasons – ideally, citing evidence;
  - Learns and improves over time;
  - Often, can interact in natural language.



# The IOT and AI working together in cities

## Green Horizon – Beijing, Delhi, Johannesburg and elsewhere

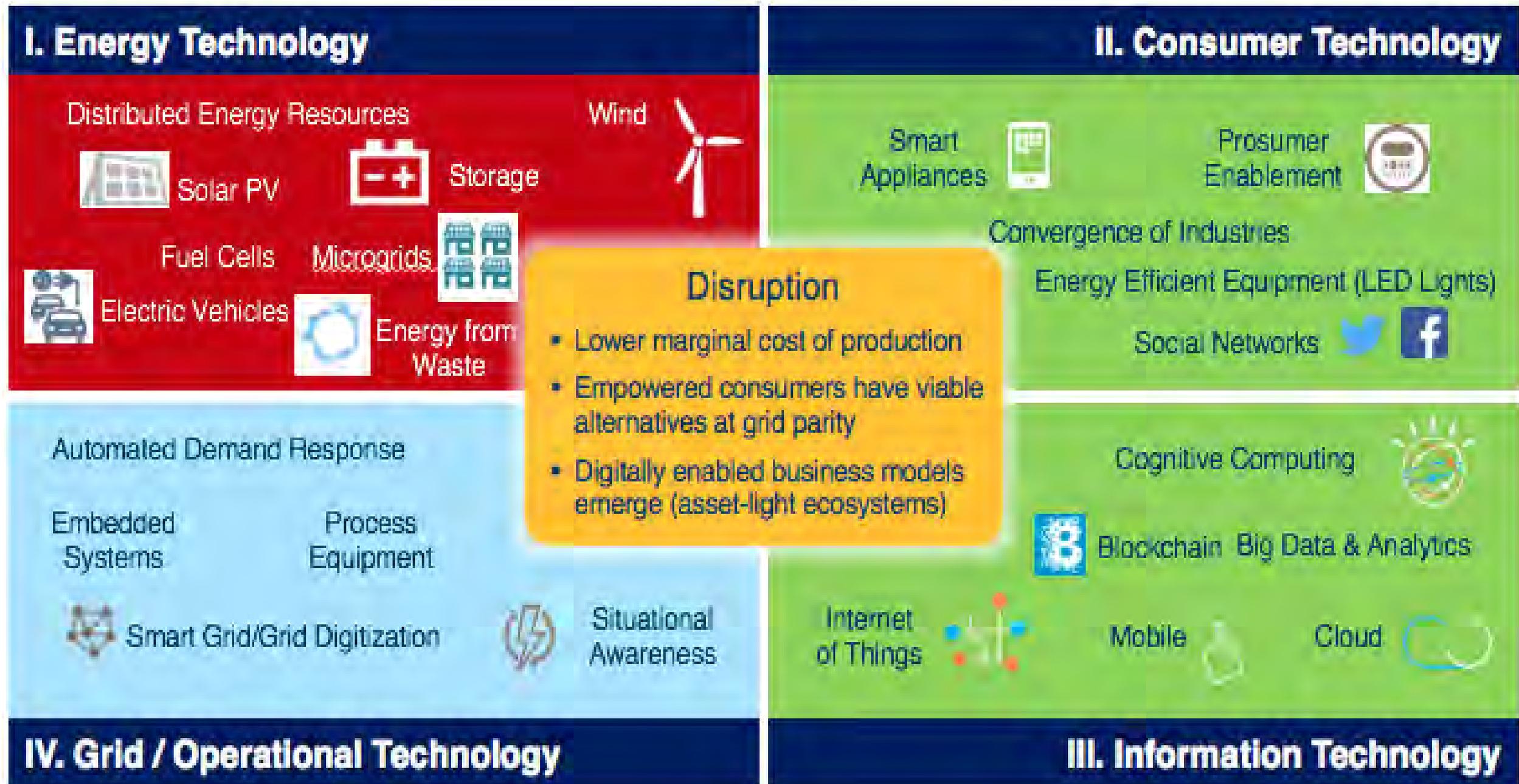
- Combines data on topology with '000s of sensors to integrate wind patterns, temperature and humidity with industrial activity and traffic to predict:
  - Micro-weather - up to 72 hours in advance and on a 0.5-1km<sup>2</sup> grid;
  - Particulate levels;
  - Wind and solar power output.
- Like all cognitive systems, GH *learns* – its predictions improve with experience.
- Primarily focused on localized health warnings and required responses.
  - Will also enable urban design solutions to be tested.
- Same core tooling supports outage prediction.





# Utilities can surely relate...

They are undergoing their own IOT and AI-driven revolution (coupled with renewables and storage technologies).



# Where do cities start?

That depends on the city's goals for being "smart". As examples:

## Sustainability?

- Smart buildings, homes
- Smart street lighting
- DER – solar, wind, microgrids
- EV enablement
- Environment sensing

## Social equity and empowerment?

- Microgrids and community solar
- Home energy retrofits
- Improved internet access
- Improved transit and transportation/mobility

## Livability?

- Services via mobile apps
- Energy and water system reliability – AMI, smart grid
- Air pollution warnings
- Crime cameras
- Traffic management
- Smart street lights

## Resilience?

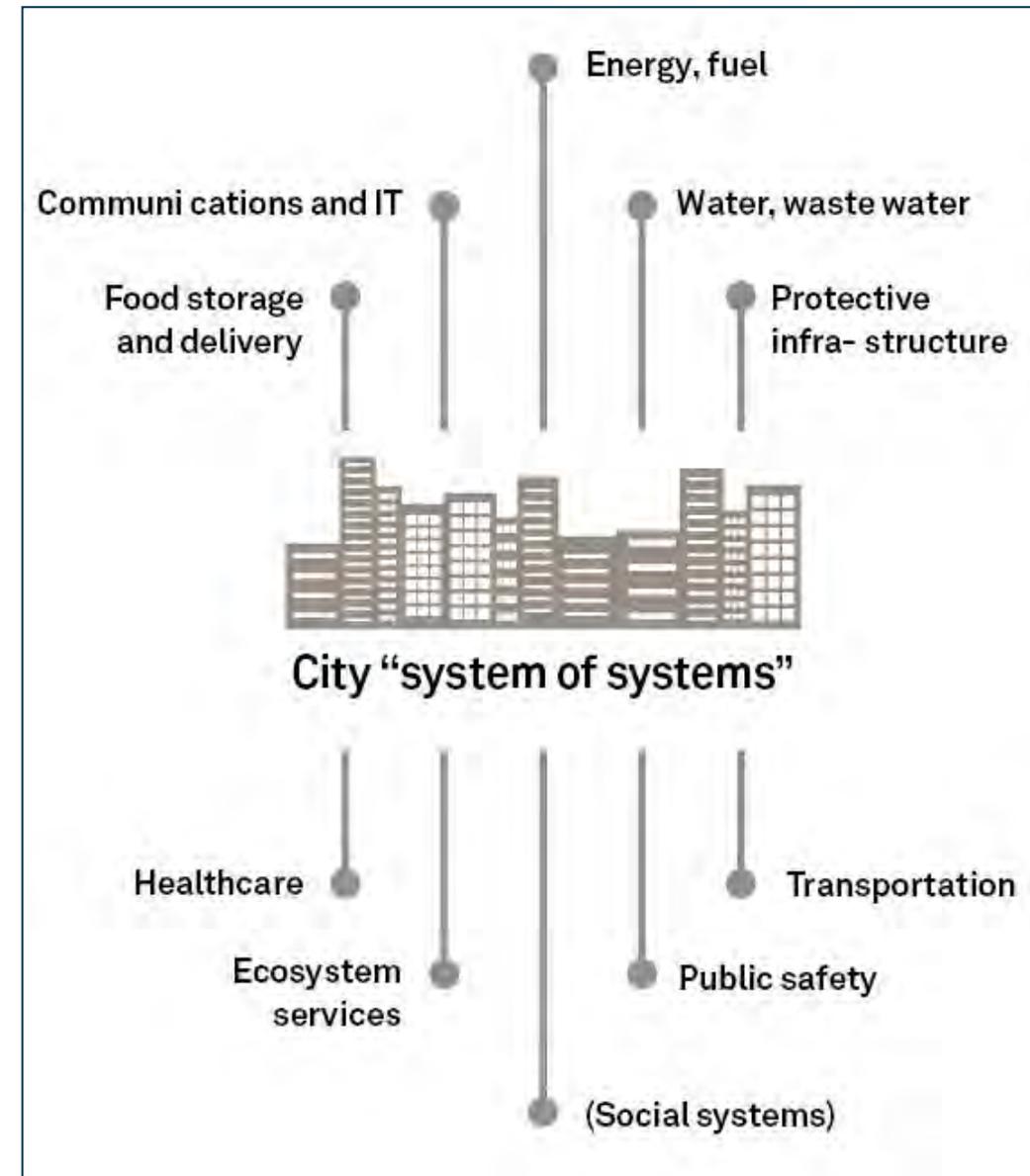
- AMI, DER for redundancy
- Emergency management and coordination systems
- Air, water sensors
- Smart street lights
- High resolution weather alerts, outage prediction



# Disaster resilience is a team sport

It has to address the “system of systems” in a city – of which the energy system is key component.

- Multiple connections and interactions:
  - Causal
  - Resources, data
- But because each system may have different owners (sometimes in the private sector) and stakeholders, **disaster resilience is a “team sport” – a multi-organizational endeavor.**
- If you ignore the connections, you may miss key impacts or key interdependencies, resulting in “failure chains”.

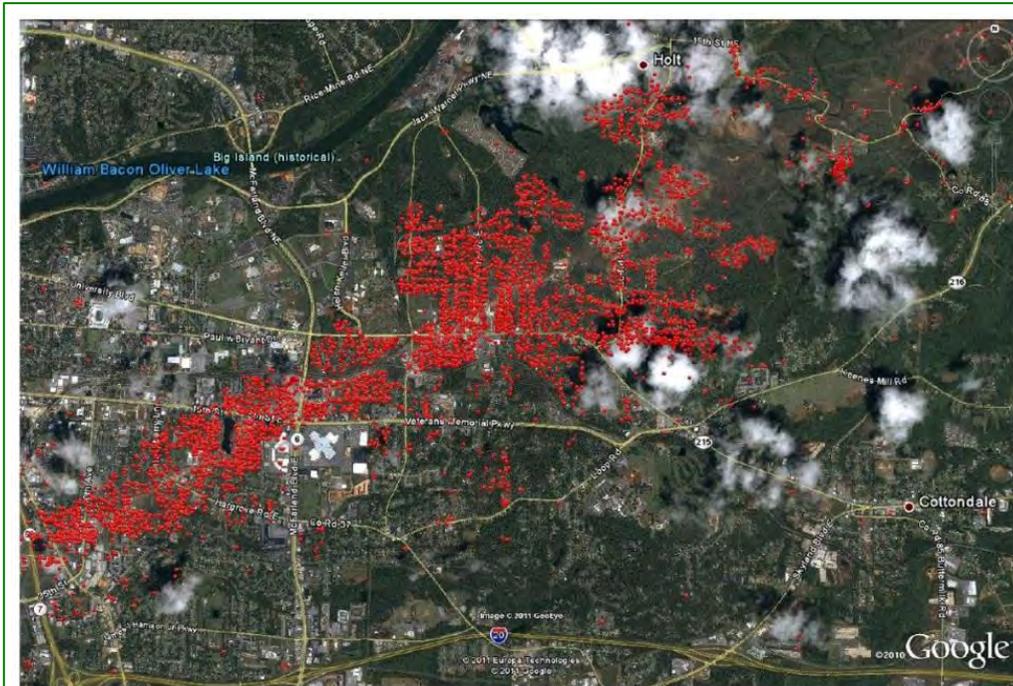


## In short, for utilities and cities, it's “hang together or hang separately”

To be more resilient, utilities and cities need each other.

### ▪ Utility may need, for example:

- Planning support.
- Data on regional hazards and disaster scenarios.
- Data on city emergency response capabilities.
- Data on other contingent systems (communications, transportation, law & order...).
- Collaboration from other system owners/operators
- Help for staff after an event (so they can keep working).



[https://e2e.ti.com/cfs-file/\\_key/communityserver-blogs-components-weblogfiles/00-00-00-07-62/8321.Smart-meter-2.JPG](https://e2e.ti.com/cfs-file/_key/communityserver-blogs-components-weblogfiles/00-00-00-07-62/8321.Smart-meter-2.JPG)

- Loss of service recorded by smart meters after a tornado in Alabama, USA. As well as helping the utility, this data can also help emergency responders.

### ▪ City may need, for example:

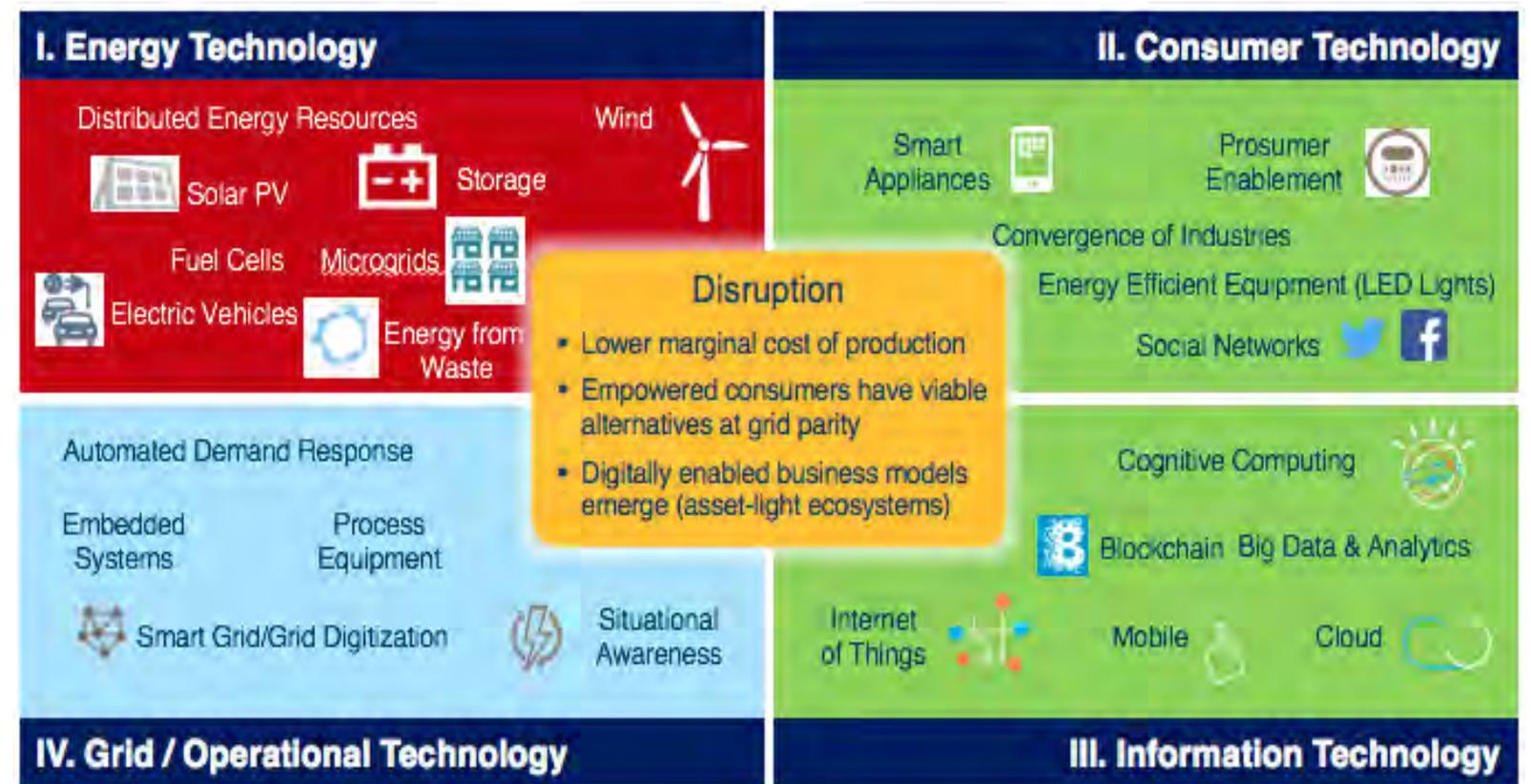
- Outage predictions.
- Data on service resilience, event impacts and service restoration.
- Data on contingent critical assets (substations etc).
- Incident response expertise.
- A communication channel to the utility's workforce.
- Use of facilities (if not required by the utility).



# Smart grids inherently help to build resilience

## How modern energy technologies enable reliability and resilience

- AMI and grid instrumentation:
  - Enable detailed situational awareness and fault diagnosis on a micro-scale;
  - Enable remote disconnects of flooded areas or properties;
  - May enable some self-healing.
- DER (wind, solar etc) and microgrids:
  - Provide alternative energy sources to central generation;
  - Reduce the number of single points of failure.
- DR can reduce central generation loads.
- Consumer enablement technology can improve 2-way communications.



- AMI = Advanced Meter Infrastructures
- DER = Distributed Energy Resources
- DR = Demand Response

# Further examples of utility-city collaboration for resilience

The “team sport” in action...

- Sharing high resolution weather forecasts – wind, hail, rainfall, wildfires;
- Sharing outage predictions for given areas, as well as restoration times;
- Event management capabilities – people, systems, facilities;
- Highways and utilities – critical access roads, culverts, likely flood spots, smart street lights:
  - Smart street lights guiding evacuations;
- Mailshots to customers (billing inserts);
- Access to AMI or street lighting networks for weather instruments, flood sensors etc.



## Pre-storm electric service tips

- If someone in your home depends on electricity for life-sustaining equipment, you need to make other arrangements
- Unplug sensitive electrical appliances, such as your computer
- If you expect flood waters to approach your home, turn off electricity at the circuit breaker



**2009**  
**EMERGENCY**  
PREPAREDNESS WORKSHOP

## A word on smart street lights...

An LED-powered lamp, with its own pole, power supply and network connectivity – a physical and virtual platform...

### Financial benefits

- Energy savings (LEDs, dynamic lighting – lighting can be 50% of a city's energy budget)
- Maintenance savings (reliability, self-reporting failures).

### Lighting benefits

- Variable light intensity and “temperature”
- Self adjusting for:
  - traffic (vehicle, pedestrian...)
  - **weather**
  - events (accidents, gunshots, crime reports, flooding)
  - **evacuation routes.**

### “Platform” benefits

- Traffic cameras/signals
- Crime cameras
- Event detection
- **Air quality sensors**
- Variable road signs
- EV charging
- Smart parking
- Smart waste bins
- **Insurance validation**
- Panic buttons
- Other uses for network: AMI, wi-fi hotspots etc.



**Thank you!**

CLEAResult<sup>®</sup>



# Energy Efficiency Case Study: Impact for Local Governments

**Jeremy Townsend** CEM, CEA, CDSM  
VICE PRESIDENT





# Jeremy Townsend CEM, CEA, CDSM

## VICE PRESIDENT

Vice President of CLEARResult's Southeast region with over 13 years experience in energy engineering, commercial and residential construction, project management, and utility program management.



# INTRODUCTION

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Team roles



## Program administrator

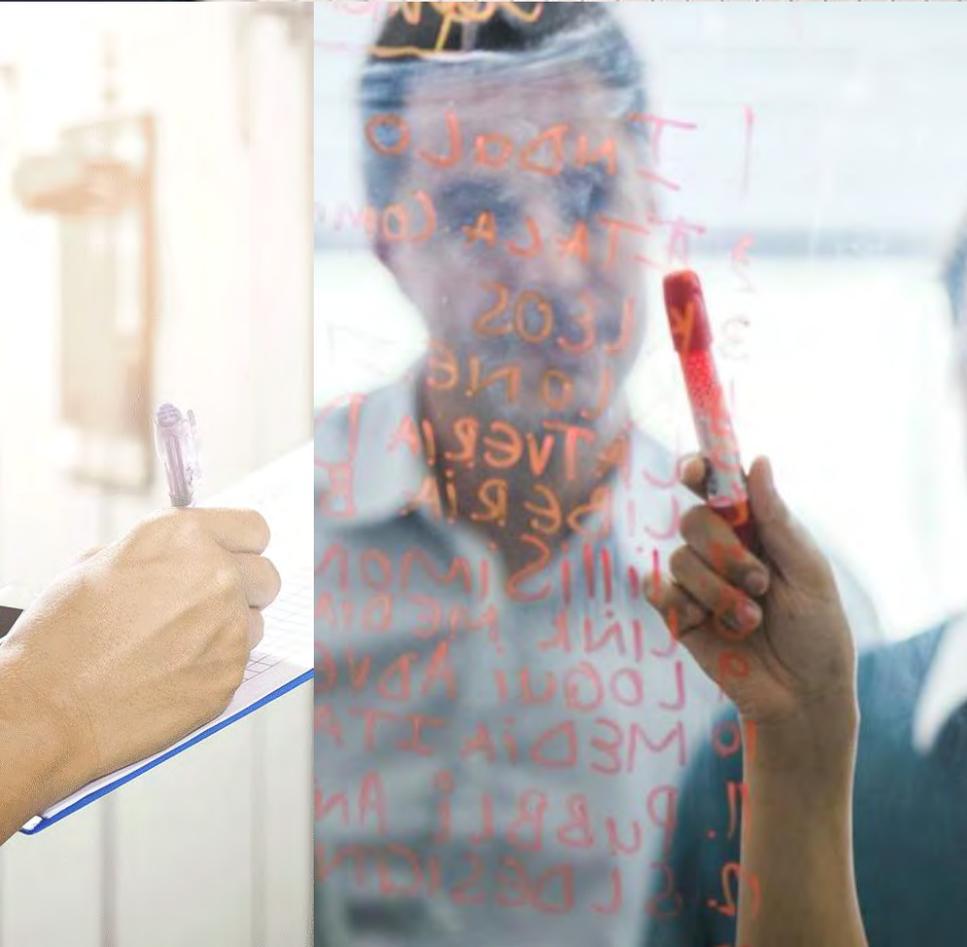
- Fund & market programs
- Conduct post inspections
- Administer incentive payments

## CLEAResult<sup>®</sup>

- Conduct outreach
- Provide technical assistance
- Benchmarking

## Program implementer

- Energy master planning (as needed)
- Verify energy savings



# PROGRAM OVERVIEW

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CitySmart



Why does CenterPoint Energy offer EE programs?



# SCORE/CitySmart is focused on institutional customers, including:

- City, County, and Municipal Governments
- Select Federal and State Government Agencies
- K-12
- Higher Education
- Non-Profit Organizers
- Faith-Based Organizers



# Non-cash incentives –

Benchmarking    Energy master planning    Technical assistance

# Cash incentives – for qualifying measures

Demand savings (kW)	Energy savings (kWh/yr)	Incentives paid (\$)
<b>3,400</b>	<b>14,500,000</b>	<b>\$1,500,000</b>

# Barriers

# Opportunities

Limited budget

Cash

Where to begin

Estimating savings +  
returns

Impact decision makers

Change-adverse  
culture

Navigating  
technology

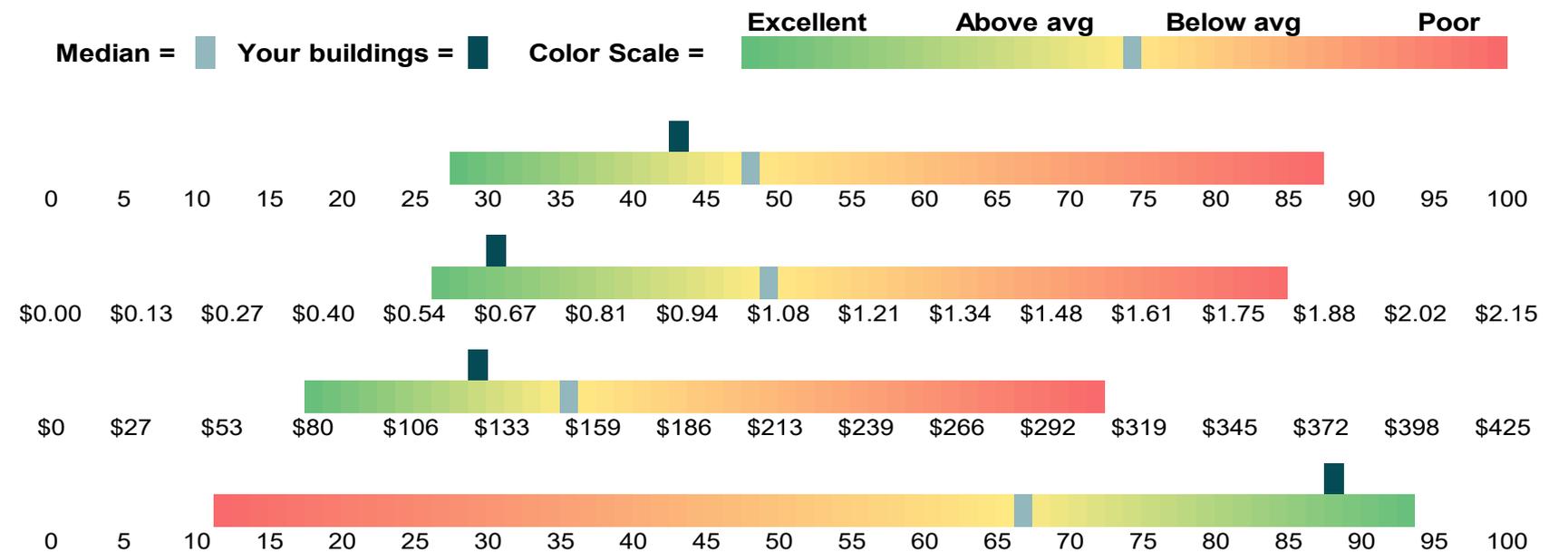
Technical support

# Energy performance benchmarking analysis

Organization-wide summary / Sample organization

## Organization-wide summary / Sample Organization

CLEARResult benchmarks	Median*	Your buildings
Energy use index (kBtu/sq.ft)	47.8	<b>43.2</b>
Energy cost index (\$/sq.ft)	\$1.06	<b>\$0.66</b>
Energy cost per occupant	\$153	<b>\$122</b>
EPA portfolio manager score	67	<b>89</b>



\* Median for a similar profile of similar building types in your climate region.

# Energy performance benchmarking analysis

## Organization-wide summary / Sample organization

0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100

\* Median for a similar profile of similar building types in your climate region.

Building characteristics		Monthly utility data						Annual energy use/cost summary	
		Month	kWh	kW	Cost	Therms	Cost		
Climate region	Climate	Jan-16	193,693	907	\$10,643	20,050	\$9,671	Usage- Electricity (kWh)	2,499,464
Type of building	All Bldgs	Feb-16	173,076	734	\$9,771	16,150	\$7,920	Usage- Gas (therms)	85,070
Type of heating system	N/A	Mar-16	177,233	777	\$10,036	11,940	\$6,328	Usage- Electricity (MMBtu)	8,528
Year built	N/A	Apr-16	171,187	725	\$19,228	3,360	\$2,895	Usage- Gas (MMBtu)	8,507
Floor area (sq. ft.)	393,894	May-16	158,728	690	\$17,651	500	\$1,397	Usage- Total energy (MMBtu)	17,035
Number of occupants	2,112	Jun-16	189,718	800	\$21,280	360	\$1,325	Usage- Electricity % of total	50%
Number of PCs	630	Jul-16	356,878	1,514	\$39,716	660	\$1,443	Cost- Electricity (\$)	\$205,047
On-site cooking?	N/A	Aug-16	299,651	1,313	\$33,379	910	\$1,550	Cost- Gas (\$)	\$53,564
Monthly energy use (MMBtu) profile		Sep-16	187,026	785	\$10,591	1,700	\$1,891	Cost- Total energy (\$)	\$258,610
		Oct-16	190,028	820	\$10,738	7,520	\$4,416	Cost- Electricity % of total	79%
		Nov-16	187,679	789	\$10,341	7,230	\$5,343	Electricity cost per kWh	\$0.08
		Dec-16	214,567	905	\$11,675	14,690	\$9,383	Gas cost per therm	\$0.63

# HARRIS COUNTY

## Project description

Various lighting and HVAC measures installed at **eighteen** different facilities since **2013**.

## Savings impacts

- 200 kW
- 2,700,000 million kWh
- \$200,000 cash incentive
- \$4,300,000 (projected 15-year savings)

## Additional impact

Cash incentives for scheduled chiller replacements has created a steady stream of incentive dollars to be applied toward future projects.



# GALVESTON COUNTY

## Project description

Retrofit over **4,000 light fixtures to LED** in the county courthouse, jail, and parking garage.

## Savings impacts

- 160 kW
- 2,700,000 million kWh
- \$95,000 cash incentive
- \$4,300,000 (projected 15-year savings)

## Additional impact

The county wanted to see a reduction in the labor required to maintain the lighting and improved light output in some areas.



# CITY OF PASADENA

## Project description

Completed lighting and HVAC upgrades at **six** different facilities since 2011.

## Savings impacts

- 54 kW
- 225,000 kWh
- \$350,000 (projected 15-year savings)

## Additional impact

Began participation by completing a benchmark and energy master planning workshop. Then completed projects at several facilities including fire stations, aquatics center, library, and others.



# CITY OF LA MARQUE

## Project description

Replaced aging equipment at waste water treatment plant with high-efficiency units equipped with VFDs.

## Savings impacts

- 145 kW
- 5000,000 kWh
- \$31,000 cash incentive
- \$780,000 (projected 15-year savings)

## Additional impact

Replacement of old equipment was an opportune time to upgrade to high-efficiency equipment.



# Program contacts

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# CEO Update

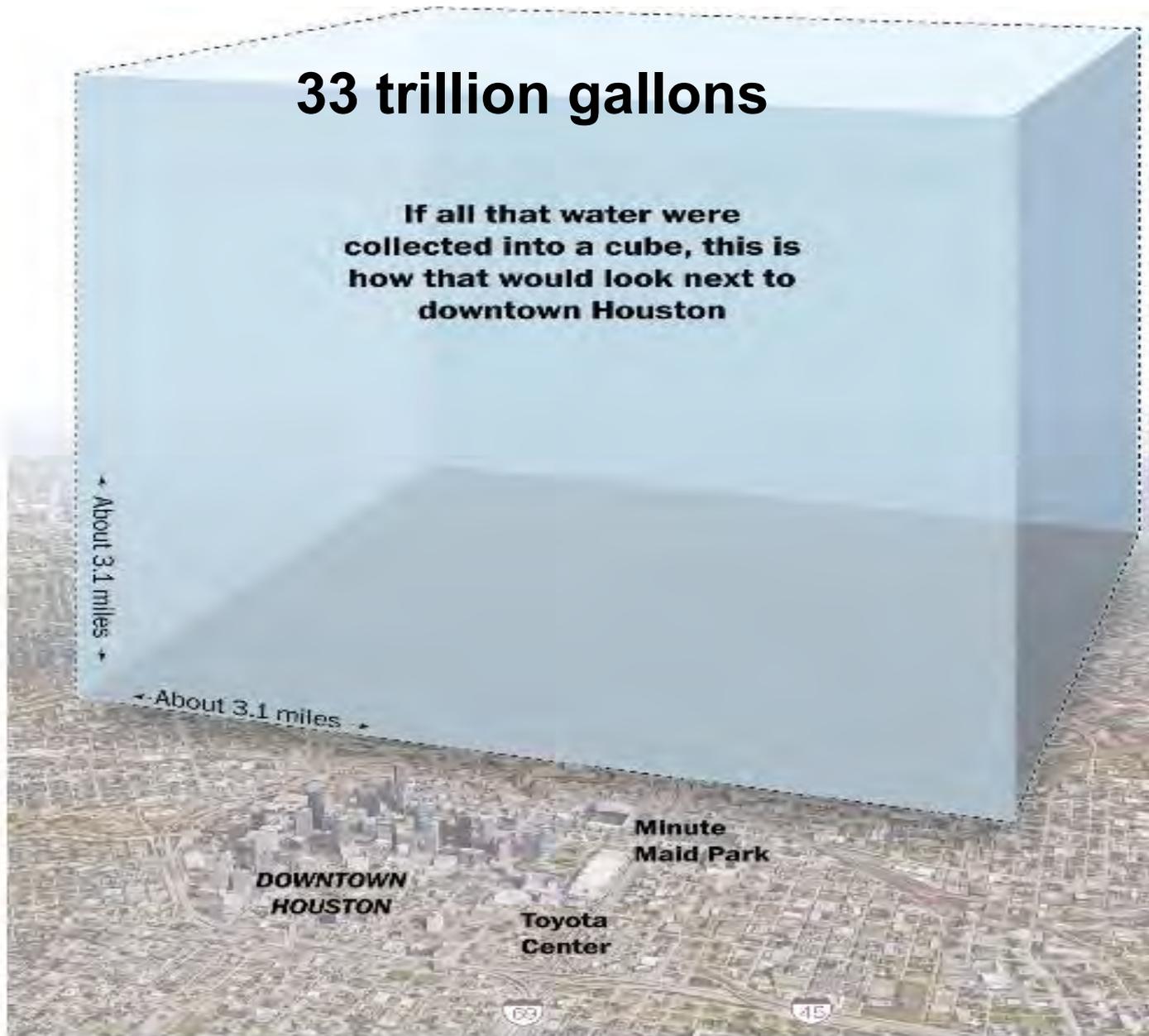
Scott Prochazka  
President & CEO

# Hurricane Harvey – A Record-breaking Storm



**33 trillion gallons**

If all that water were collected into a cube, this is how that would look next to downtown Houston



Sources: Ryan Maue, Capital Weather Gang, Google Earth

THE WASHINGTON POST

## August 26 – September 4:

- **52 inches** rainfall in southeast Texas
- Harvey made landfall **multiple times**
  - **Category 4** near Port Aransas, Texas
  - **Tropical storm** in Cameron, Louisiana
- More than **42,000** lightning strikes
- Record number of tornado warnings in southeast Texas



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# Topics



- Key influences on electric and natural gas utilities
- Our participation in and perspective on distributed energy resources
- Greater Houston's population and employment forecast
- CenterPoint Energy's investments for growth, reliability, and safety
- Our value proposition: from utility to energy partner

# Key Utility Influences



## Customer-driven



**Electric &  
Natural Gas Vehicles**



**Backup  
Generation**

## Big Data



**Distributed  
Generation**



**Power-Sensitive  
Equipment**



**Fuel Cells**



**Drones**

## Technology-driven



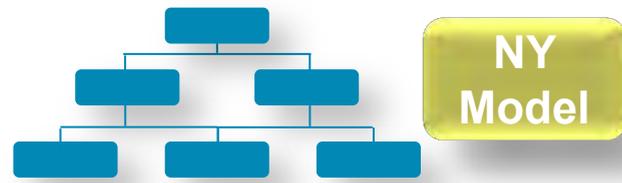
**Picarro Leak  
Detection**

## Battery Storage



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# Market Environments for Emerging Energy Technologies



## Central Planning

Regulators establish comprehensive regulatory framework and compact that defines utility roles, responsibilities, and financial incentives and penalties



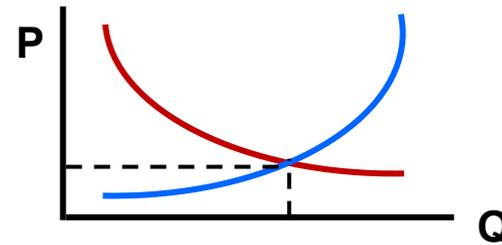
## Infrastructure Incentives

Programs and mechanisms to promote development of certain kinds of energy infrastructure are established



## Technology-Rich

Legal or regulatory requirements are established that put a “finger on the scale” for certain technologies



## Market-Based

Market and competitive forces are relied upon to allocate resources, select technologies, and compensate market participants

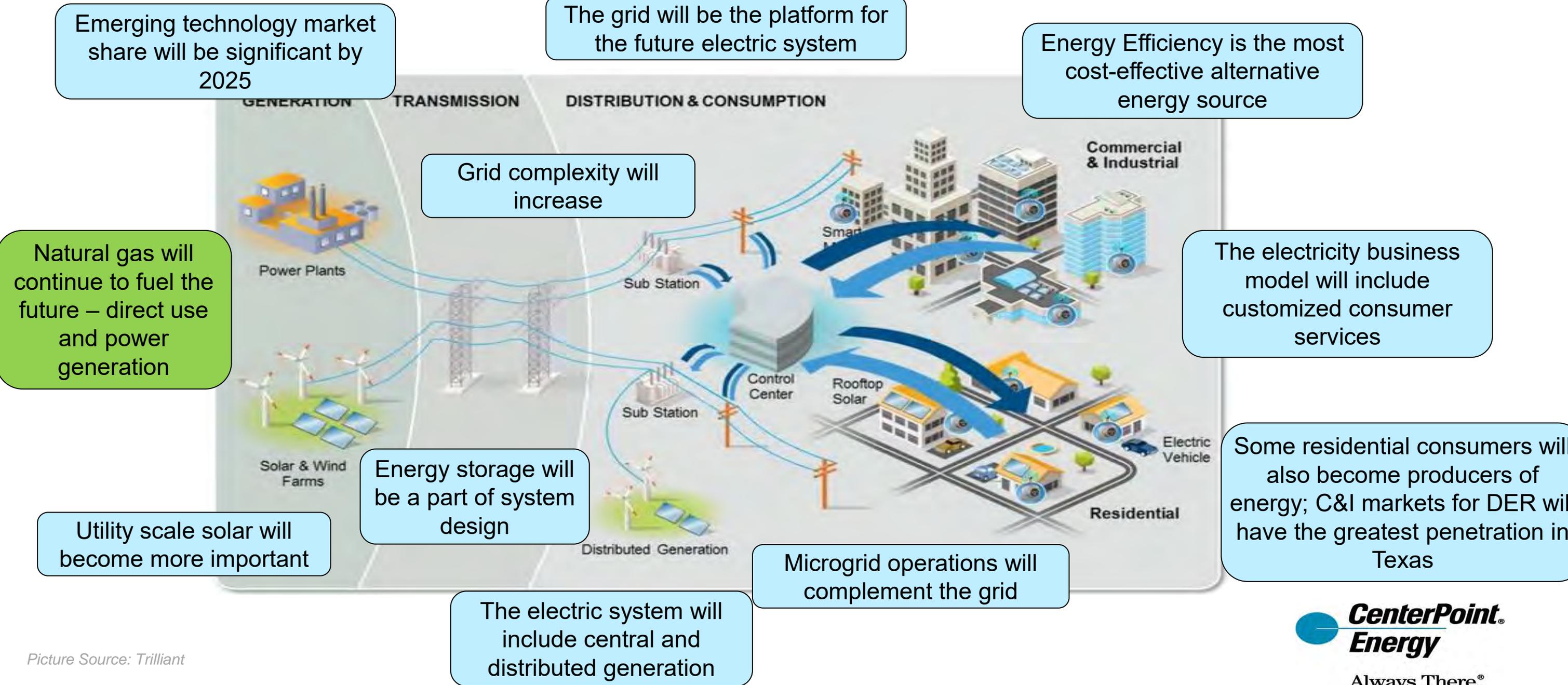


## Incentive Subsidies

Special tariff or other subsidies (including tax credits) are established to encourage certain types of resources or utility behaviors



# Our beliefs about the electric utility of the future



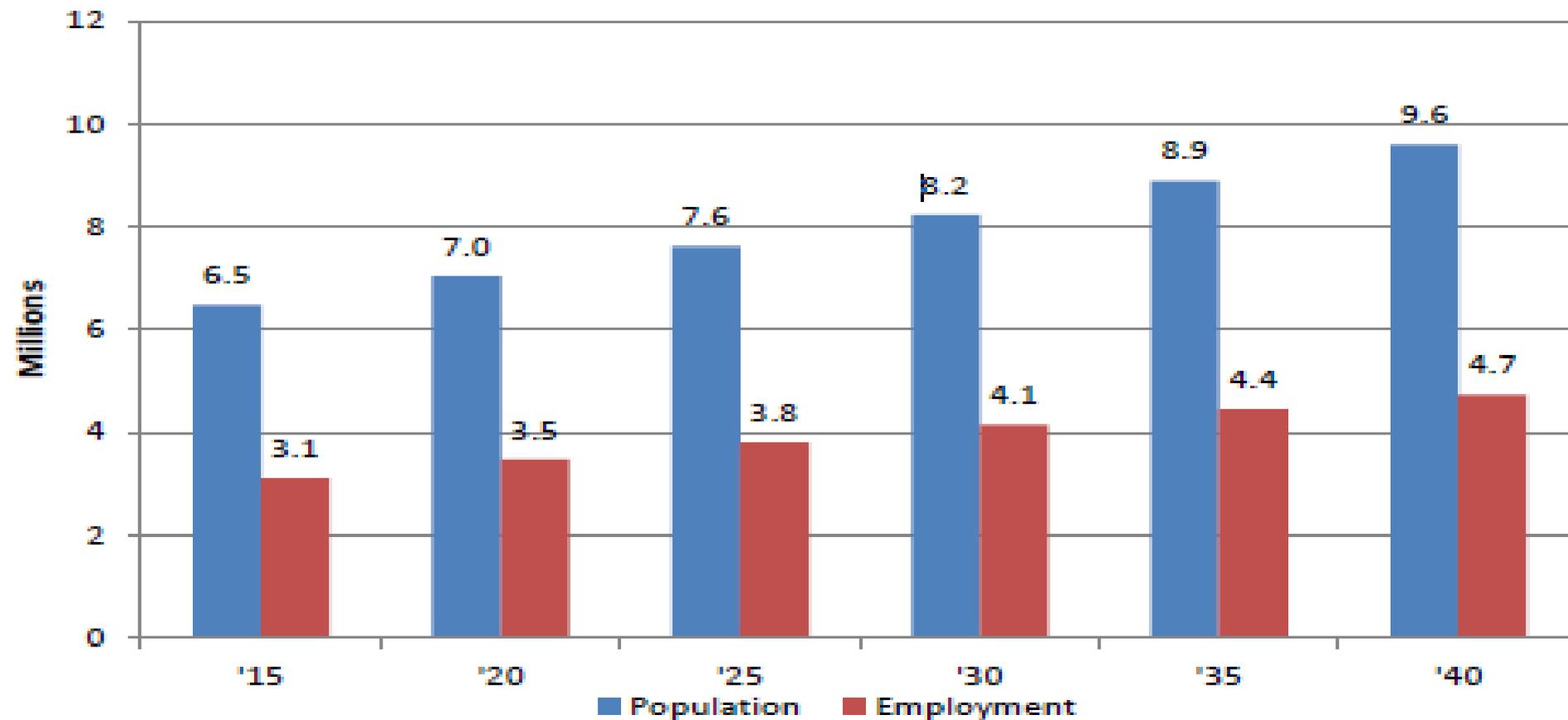
Picture Source: Trilliant

# Population and employment forecast



The Perryman Group forecasts Houston's population and employment to grow faster than the state and the nation over the next 25 years.

**Population and Employment  
Houston-The Woodlands-Sugar Land MSA**



Source: The Perryman Group, Summer 2016

# CNP is Building the Grid of the Future



### Smart Meters



### Intelligent Grid



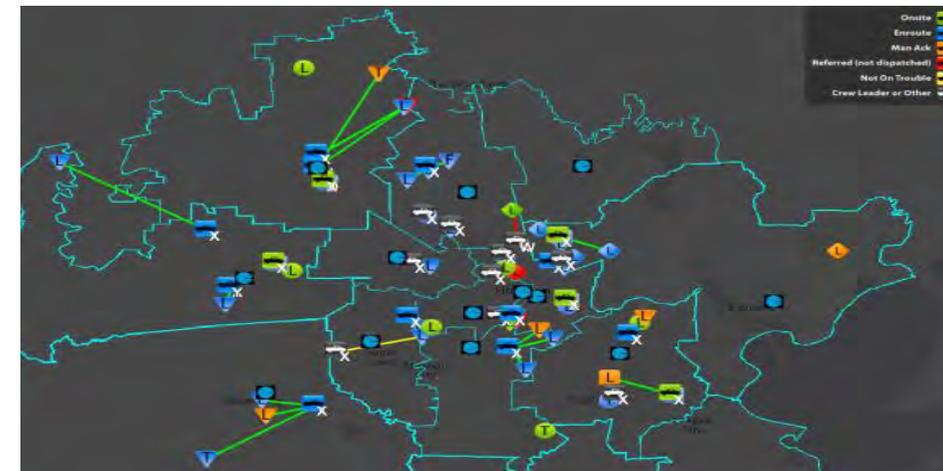
### Real-time usage data



### Power Alert Service



### Big Data Analytics



# CNP is Improving Customer Satisfaction While Reducing Carbon Emissions



New, improved gas leak detection systems



Drive-by Advanced Meters



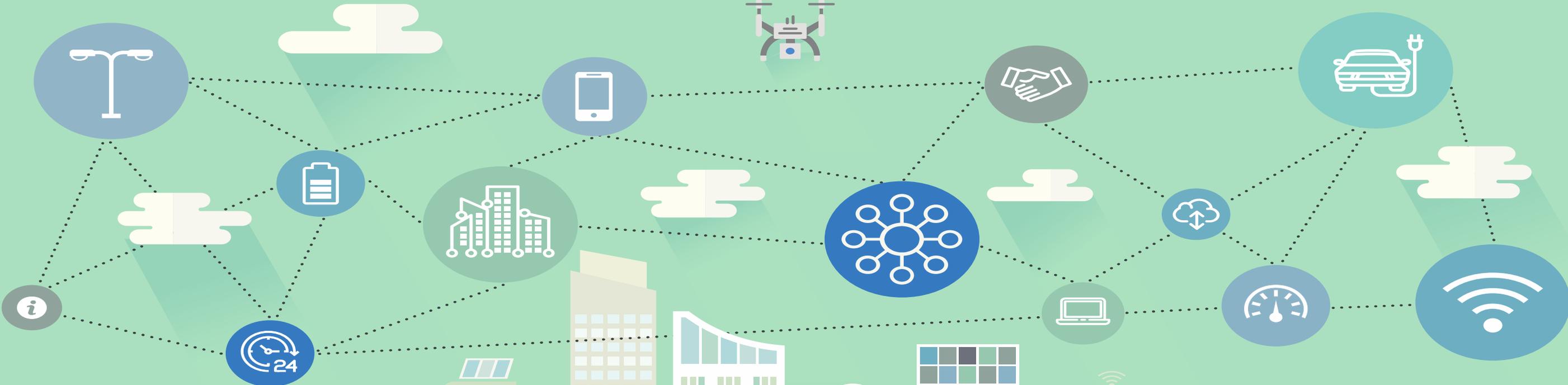
Pipeline replacement programs



Predictive Analytics Engine



# Smart Cities



# Our value proposition

*Where we started – traditional utility model*



## Yesterday

- **Businesses**

- Transformation from integrated electric utility to wires and poles
- Competitive natural gas supply
- Regulated natural gas sales and delivery

- **Focus**

- Safe and reliable infrastructure
- Success measured by energy delivered; frequency and length of outages

- **Responsive customer engagement**

- Success measured by % of calls answered in x time
- Responsive to regulatory issues

- **Customer Expectations**

- Measured against a traditional utility experience
- Customer engagement predominately event-driven



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# Our value proposition

*Where we are headed – drivers for evolution*



Rising customer expectations across industries

Regulated and competitive services

Trusted energy partner

## **Today**

- **Deliver energy**
  - Electricity and natural gas delivery
  - Competitive natural gas supply
  - Continued focus on safety and reliability
- **Deliver service**
  - Customized products
  - Self-service capabilities
  - Proactive communications (Power Alert Service)
  - Enhanced energy management and reliability solutions
  - Competitive solutions/partnerships
- **Deliver value**
  - Engagement with customer is proactive, enterprise-wide and seamless
  - Focus on financial and operational improvements for customer
  - Allows customers to focus on core competencies/skills



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# Hurricane Harvey – Houston Strong CenterPoint Energy Strong





# Break

20 minutes



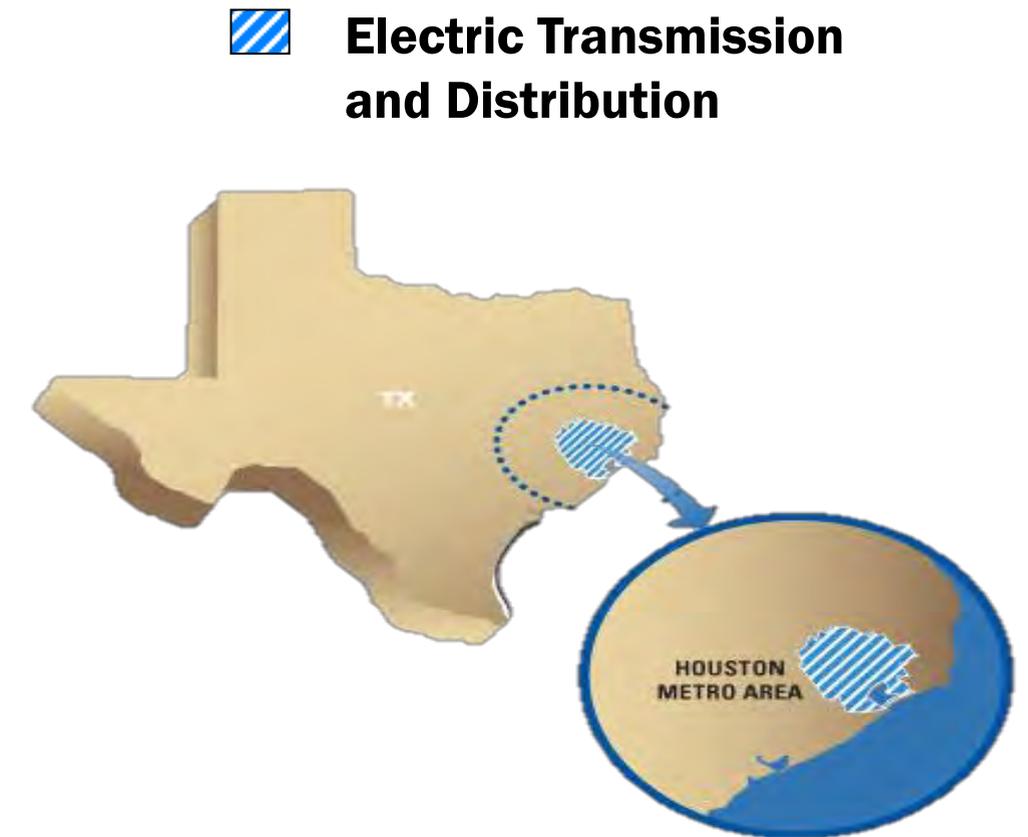
# Smart Utility, Smart Community- Advancing the Smart Grid of the Future

Kenny Mercado  
Senior Vice President, Electric Operations

# Electric Transmission & Distribution



- Customers consist of about 64 retail electric providers that sell electricity to over 2.4 million metered customers in a 5,000 square-mile area that includes the vast majority of the Houston/Galveston metropolitan area
- Owns and maintains:
  - 52,639 miles of overhead and underground distribution lines
  - 3,718 miles of overhead and underground transmission lines
- Delivered 86.8 million megawatt-hours
- Experienced 2% customer growth, nearly 55,000 new meters
- Invested a record \$858 million in capital projects
- Expect to invest \$4.1 billion over next 5 years



Source: Form 10-K

# Harvey by the Numbers

## *Electric Operations Response*



- **1.27 million** total restorations
- **17** substations out of service or inaccessible due to high water
- **7** transmission lines locked out
- **2,200** employees plus **1,500** contractors & mutual assistance from **7** states
- **755 million** total minutes out over 10 days
- **83** buildings in Downtown Houston lost electrical service due to high water



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# Impact of Grid Modernization

## *Benefits of Advanced Metering System (AMS) and Intelligent Grid*



- AMS meters increased efficiency during the storm
  - Executed **45,000 orders** remotely at **97% performance**
  - Billed **700,000 accounts** with actual readings at **98.9% performance**
- Intelligent Grid helped avoid outages
  - Operated **250 devices** impacting **140,000 customers**
  - Avoided **41 million outage minutes**
- Use of real-time analytics to assess, monitor and resolve cases
  - Aided in developing better situational awareness
- Use of drones, mobile substations, Power Alert Service (PAS), and flood wall to protect service to Texas Medical Center.



# We are modernizing and advancing the reliability and resiliency of the grid



- Deploying intelligent grid with advanced management system
- Crews are mobile managed and electronically dispatched
- Trees trimmed on proactive cycles
- Regular scheduled wood pole, underground cable, and guy wire replacement programs
- Through PAS, customers are electronically alerted when power is out and when power is back on



# We are expanding and advancing the reliability and resiliency of the grid



## ➤ Brazos Valley Connection Project

- PUCT approved April 2016

❑ Estimated Cost: \$310 MM

- 60-mile, 345 kV Zenith to Gibbons Creek Line
- 53% Complete Overall, 100% ROW Complete, 100% Structures Installed

❑ Energization targeted for February 2018

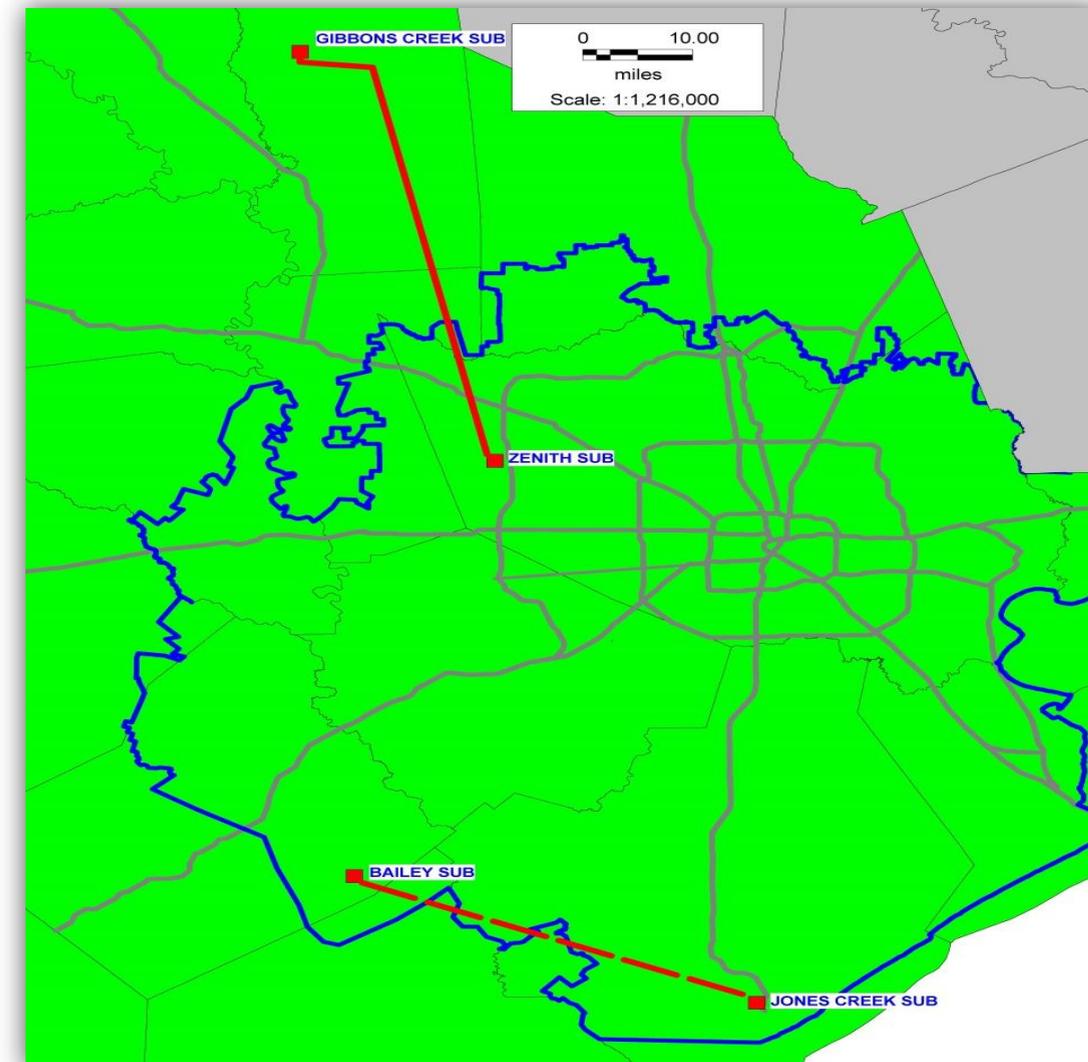
## ➤ Freeport Area Master Plan Project (2019-2021/2022)

- Serves newly committed and future load
- Improves 345kV grid operating flexibility

❑ Estimated Cost: \$250 MM

- Bridge the Gap Voltage Support Upgrades in 2019
- 48-mile, 345 kV Bailey-Jones Creek Line in 2020-2022

❑ Pending ERCOT BOD approval in Dec 2017



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# How can we work smarter together?



Smarter  
Grids



Smarter  
Transportation



Smarter  
Lighting



Data  
Analytics &  
Advanced  
Monitoring



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# Smart LED Streetlight Projects

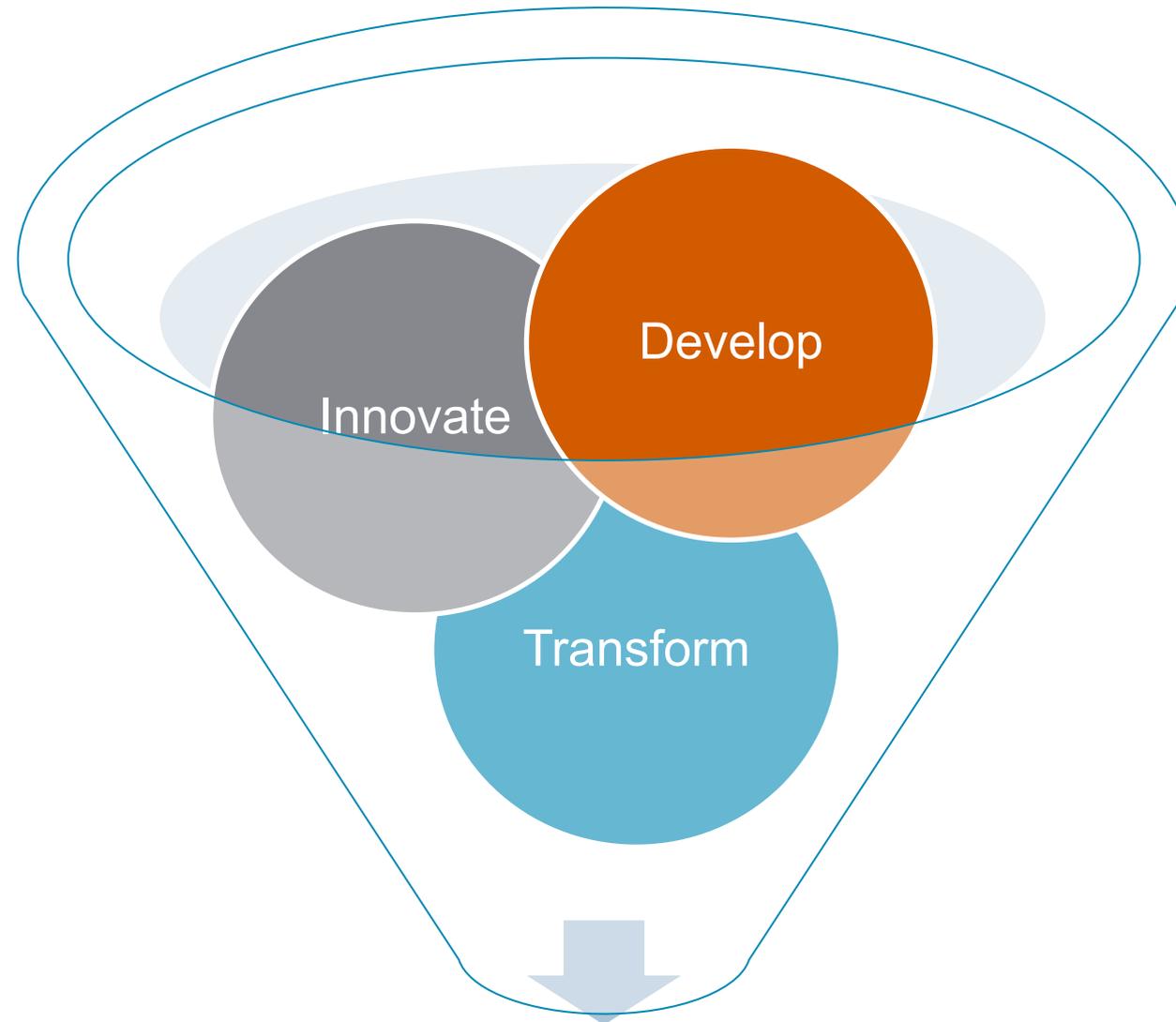


- CenterPoint Energy plans to partner with all cities to replace street lighting with LEDs
- Significant energy savings potential
- Can lead to advanced monitoring capabilities to measure noise levels, air quality, traffic, security, and water levels



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# Let's do this together



## Reliability Solutions





**Thank You**



# Preference Center Update

Roderick Batteaux

Program Manager, Customer Service

# Enhanced Preference Center Features



## View and manage gas and electric accounts online with a single sign on

- Features of this online account management include:
  - Managing preferences for proactive communications including:
    - Service order status updates and Power Alert Service
  - Get a summary view of your gas and electric accounts
  - Ability to designate multiple authorized account users
  - Power Alert Service preferences will be enhanced to allow multiple alert notifications per channel (email, text and/or phone call)



# Thank You



# Smart Utility, Smart Community- Modernizing the Natural Gas Distribution System

Scott Doyle

Senior Vice President - Natural Gas Distribution

# Agenda



- Natural Gas Distribution
- Harvey by the Numbers
- System Reliability
- Shared Purpose
- Vision of Meter Infrastructure
- Fueling our Economy

# Natural Gas Distribution



- **Gas Operations**

- Serves approximately 3.4 million customers in six states
- Owns and operates approx. 122,522 miles of main and service lines
- Growth of more than 35,000 customers in 2016
- Invested \$505.7 million of capital in natural gas infrastructure in 2016
- Capital spending will remain high as we modernize our infrastructure for safety and reliability

- **Houston Metro Gas Operations**

- Houston Market serves ~1.35 million customers
- Owns and operates over 39,433 miles of main and service lines
- Growth of nearly 2,600 commercial customers in 2016
  - 2,811 commercial & industrial
  - Invested \$119.78 million of capital investments in natural gas infrastructure in 2016



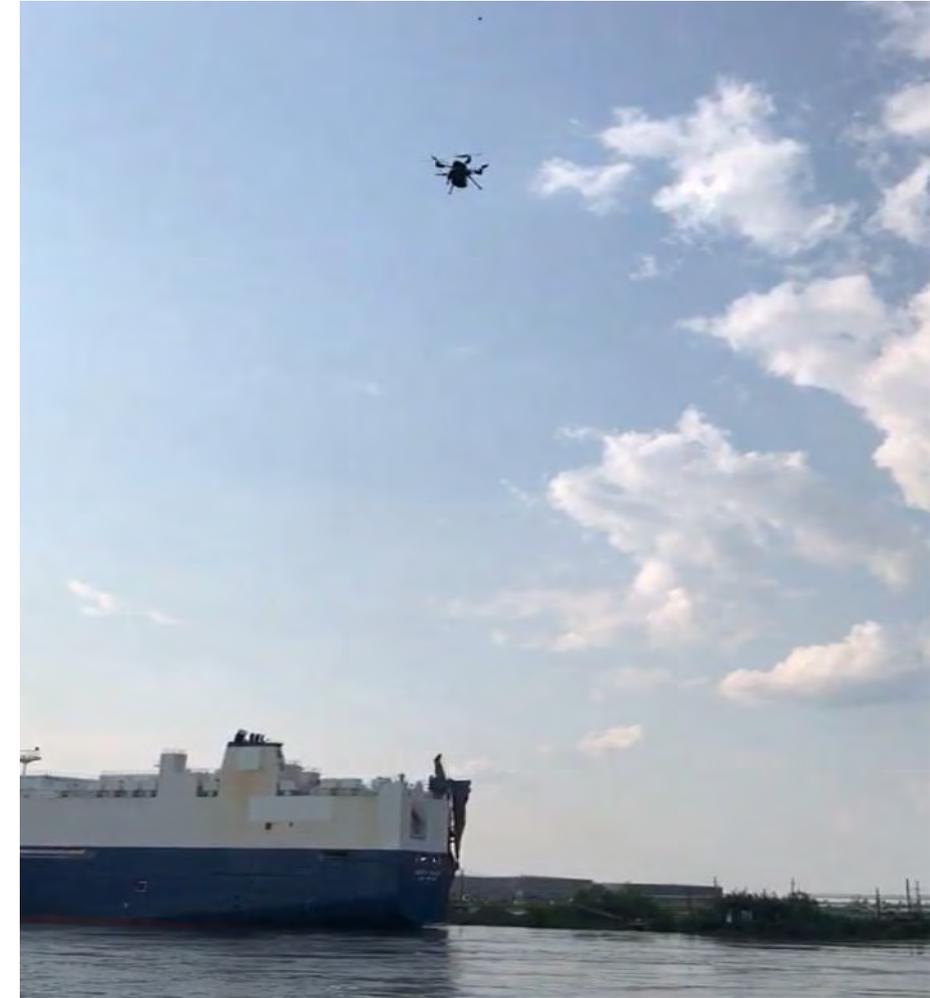
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# Harvey by the Numbers

## *Gas Operations Response*



- Advanced Leak Survey Technology
  - Surveyed **554** miles in South Texas within five days (wind impacted areas)
- CNP coordinated with city of Beaumont to address breach in **18-inch** gas pipeline under the Neches River
  - A remote methane leak detector (RMLD) mounted on a drone to check methane levels in Neches River
  - Divers, air boats, drones and high-profile vehicles used during response



# System Reliability

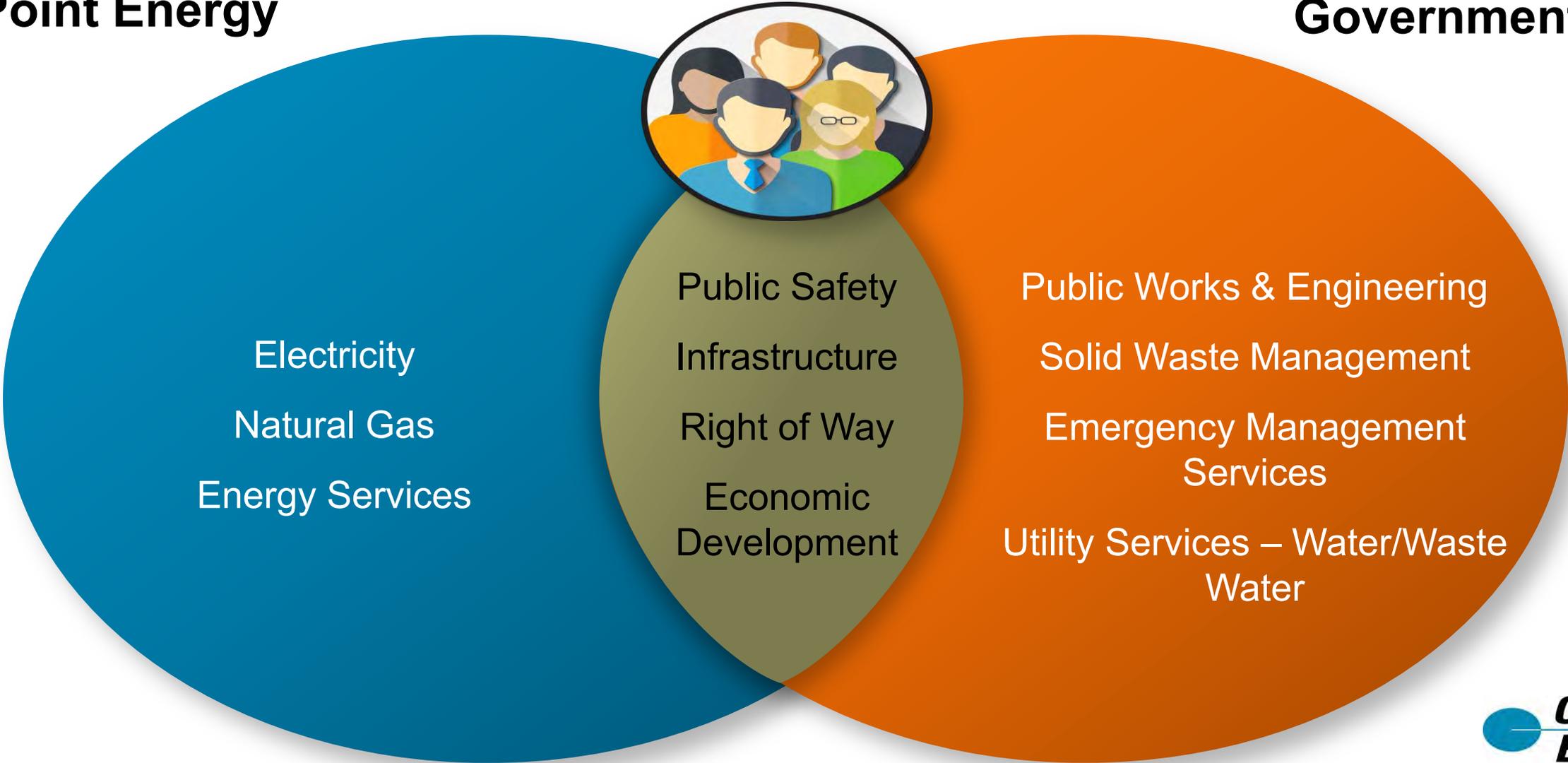


# Shared Purpose



## CenterPoint Energy

## Government



# Meter Infrastructure



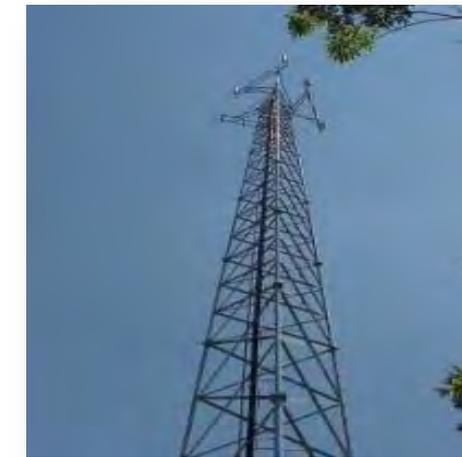
- Current State

- Mobile drive-by meter reading
- Virtually eliminates inaccuracies
- Reduces access issues
- Reduces costs



- Future State

- Fixed network
- Operational measures
- Real time monitoring
- Flow alarms



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# Fueling the Houston Metro Economy



Natural gas can fuel growing economy at affordable prices well into the future



Proprietary and Confidential



**Industry Share of Houston MSA Employment**

- 21.0% Trade, Transportation, and Utilities
- 15.2% Professional and Business Services
- 12.9% Educational and Health Services
- 13.2% Government
- 10.6% Leisure and Hospitality
- 7.7% Manufacturing
- 7.0% Construction
- 3.4% Other Services
- 3.2% Finance and Insurance
- 2.9% Mining and Logging (Upstream Energy)
- 1.8% Real Estate and Rental and Leasing
- 1.0% Information

Source: Texas Workforce Commission

If Houston were an independent nation, the region would have the 23<sup>rd</sup> largest economy in the world, behind Taiwan and ahead of Nigeria.

**3.3** percent expected real GDP annual growth from '15 - '40

**GDP expected to more than double between '15 and '40**

**4<sup>TH</sup>** largest U.S. metro economy

**20** Fortune 500 Companies call Houston home



Always There.®



# Thank You



# Summary and Closing Remarks

Gregg Knight

Senior Vice President and Chief Customer Officer



**Thank you for attending!**