

The logo for the Metropolitan Planning Council features the text "Metropolitan Planning Council" in a bold, black, sans-serif font. A thick orange arc is positioned above the word "Planning", starting from the left side of the word and ending on the right side, arching over the letters.

# Metropolitan **Planning** Council

## **Tough Stuff**

Resilient Infrastructure in a Changing World

Wednesday, May 15, 2013

Noon to 1:30 p.m.

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Moderator

**PETER SKOSEY**  
**METROPOLITAN PLANNING COUNCIL**

# SYBIL DERRIBLE UNIVERSITY OF ILLINOIS – CHICAGO



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Resilience Planning:  
Concepts and Application to Urban Issues  
Civil and Materials Engineering  
University of Illinois at Chicago

# Does Every City Need A Chief Resilience Officer?

EMILY BADGER 7:00 AM ET 3 COMMENTS



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Tweet 44

+1 3

Share 7

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For cities, developing a plan for "sustainability" no longer sounds like enough. The word carries with it an environmental connotation (we need to live alongside nature in a "sustainable" way). And the absence of sustainability implies environmental disaster (resource shortages, rising sea levels, super storms). But many of the major problems facing cities in the 21st century don't quite fall under this category (poverty, economic crises, pandemics). And "sustainability" only speaks to half of any environmental story – you may power your entire city with solar cells, but what happens the morning after a hurricane passes through?

The new goal is now something more like "**resiliency**." This updated rallying cry takes as a given that some pretty bad things will inevitably happen: Cities will flood, and diseases will spread, and whole transportation networks will shut down. But now the mark of a competent

## BEYOND SUSTAINABILITY

<http://www.theatlanticcities.com/politics/2013/05/does-every-city-need-chief-resilience-officer/5576/>

# Urban Resilience: Keywords

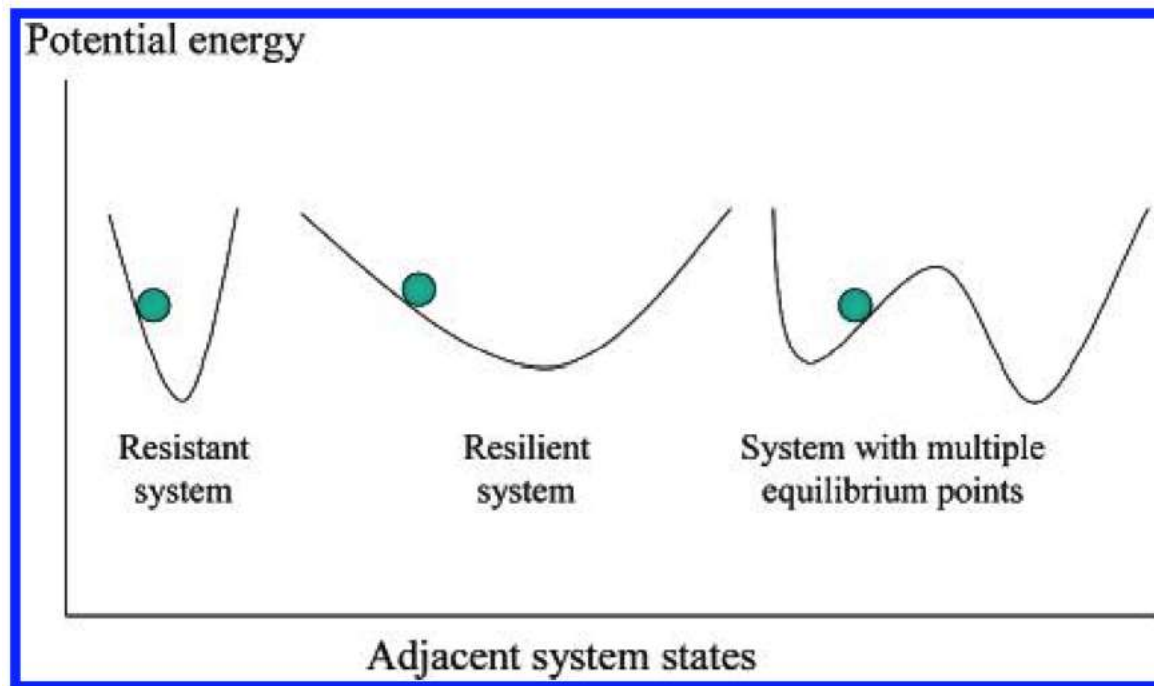
- Smart infrastructure (focus on infrastructure)
- Robustness
- Perturbation
- Sustainability
- Scalability
- (Distributed) Networks
- Centralization vs. Decentralization
- Planning vs. Self-organizing principles
  
- Complex Systems
- Cascade (Information)
- Percolation theory

# Urban Resilience: Definition

- Resilience of what to what?
- *The resilience of a specific ecological organization is measured by the amount of change that a system can experience before it is forced to reorganize.*  
(Peterson 2002)
- *The ability to resist disorder.*  
(Gunderson and Pritchard 2002)
- *The capacity to recover from non-structural changes.*  
(Gallopín 2006)
- *Time to recover...* from social, economic, and environmental stresses etc.

# Urban Resilience: Definition

- Ability to recover from perturbations



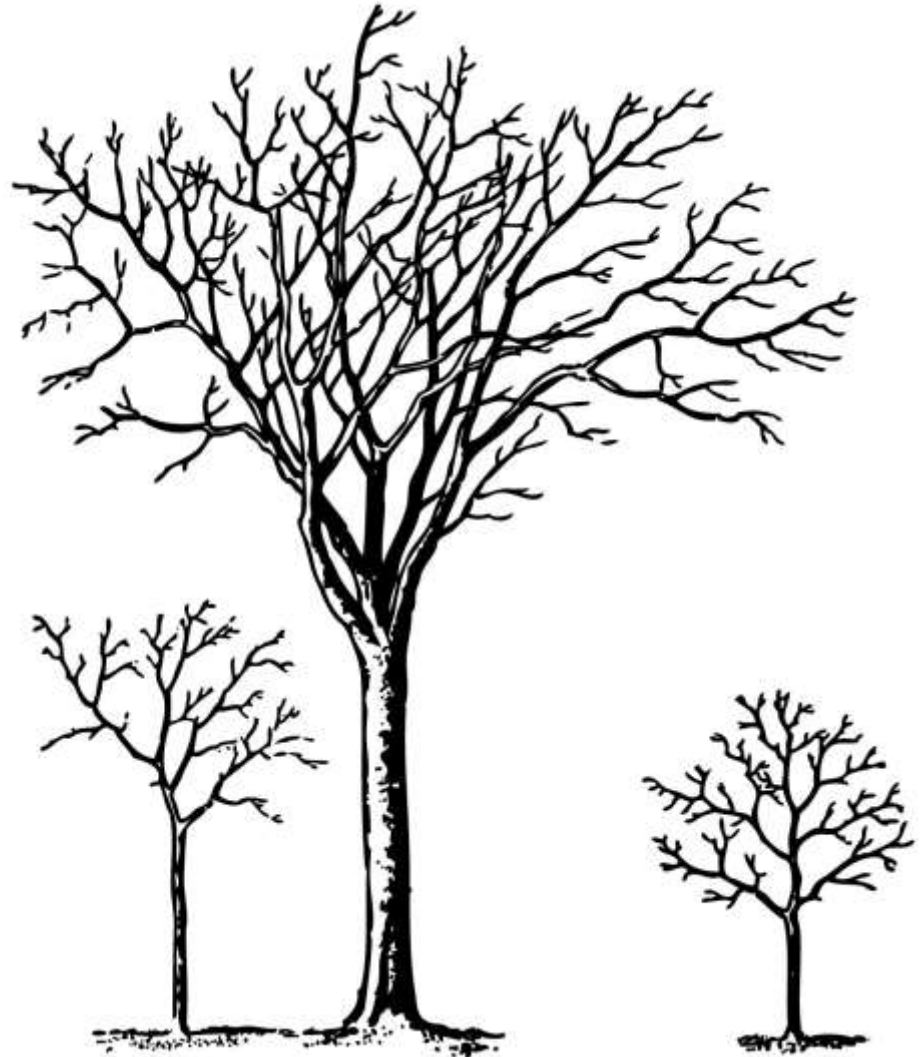
(Fiksel 2003)



# Planning for Resilience

State-of-the-practice ?

- Efficiency
- Economies of Scale
- Optimization

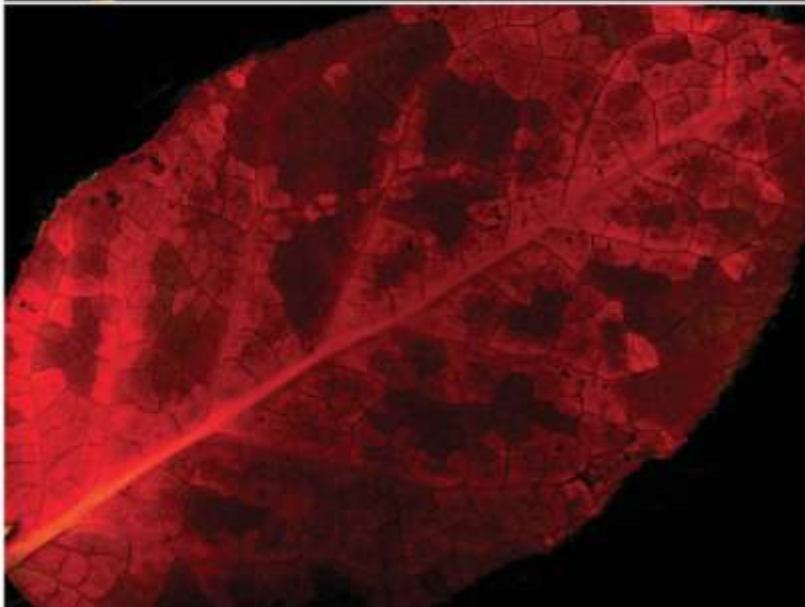
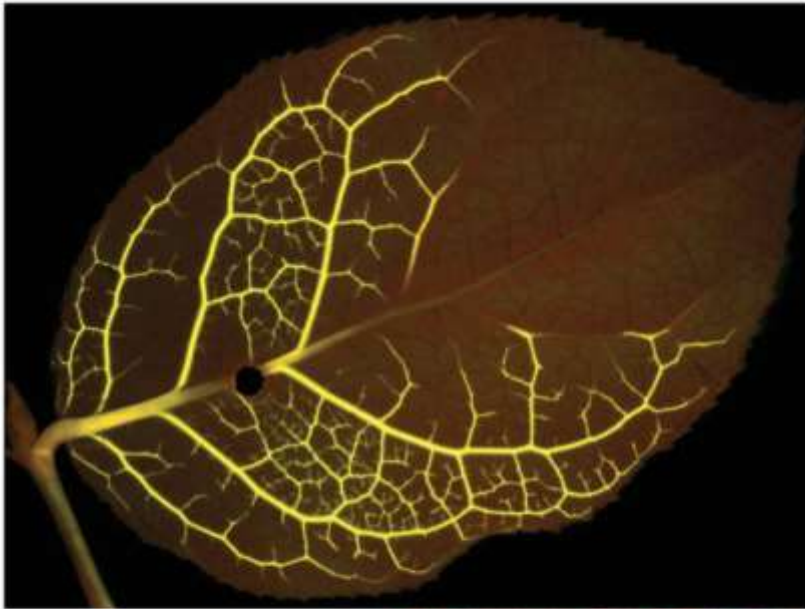




# Planning for Resilience

**BUT**

# Planning for Resilience



Katifori et al. 2010



# Planning for Resilience

**BUT**



# Planning for Resilience

*“We can't solve problems by using the same kind of thinking we used when we created them”.*

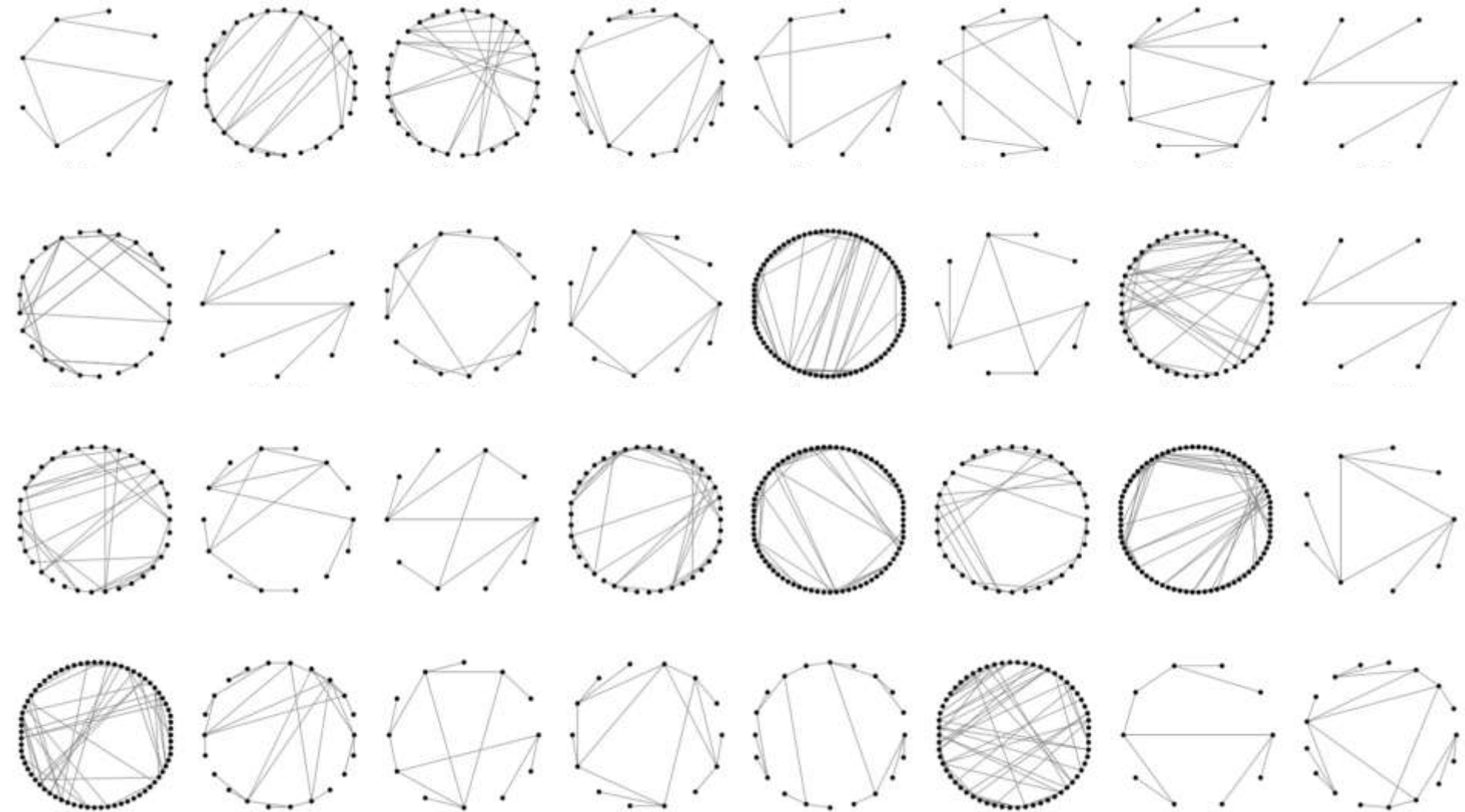
Einstein



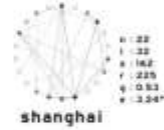
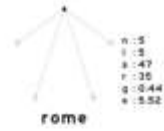
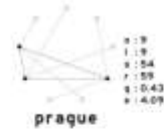
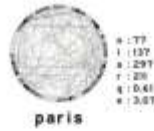
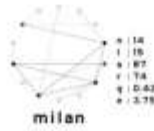
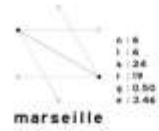
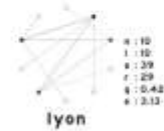
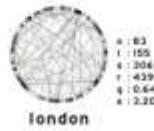
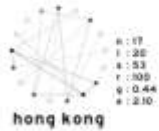
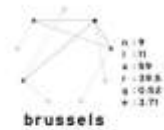
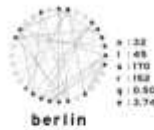
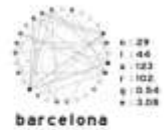
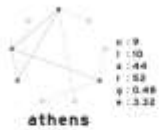
# Planning for Resilience

- Solutions?
- Better understanding of cities
- Better integration of urban systems
- (Re)definition of planning for urban resilience
- Scenario analysis

# Metro Networks



# world metro networks



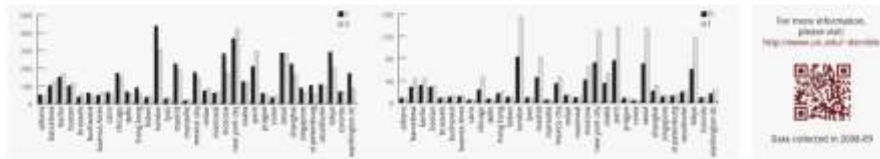
**Legend**

Circle colors and sizes are proportional to the number of lines and stations of a connection every other regular station on a network.

- high degree node
- color: degree, size: nodes
- low degree node
- number of nodes
- number of links
- number of stations
- path length (km)
- total or potential number of links for global network
- degree distribution power law
- scaling factor
- $\gamma = 2.5$

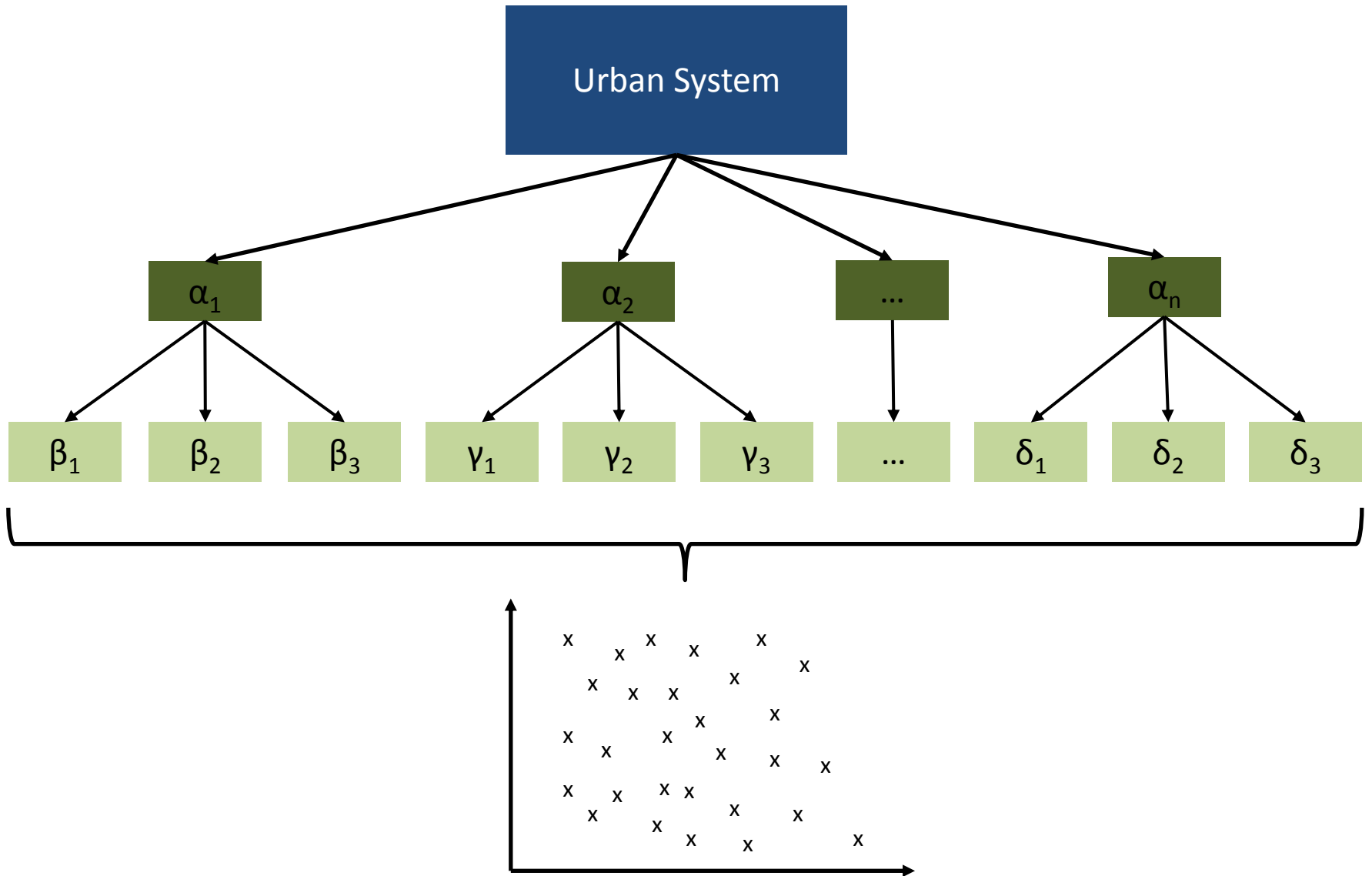
**lyon metro**

synthetic diagram     empirical visualization





# Scenario Analysis



# Future Cities



# Thank You

Sybil Derrible  
[derrible@uic.edu](mailto:derrible@uic.edu)



# J. TYLER ANTHONY COMED



An Exelon Company

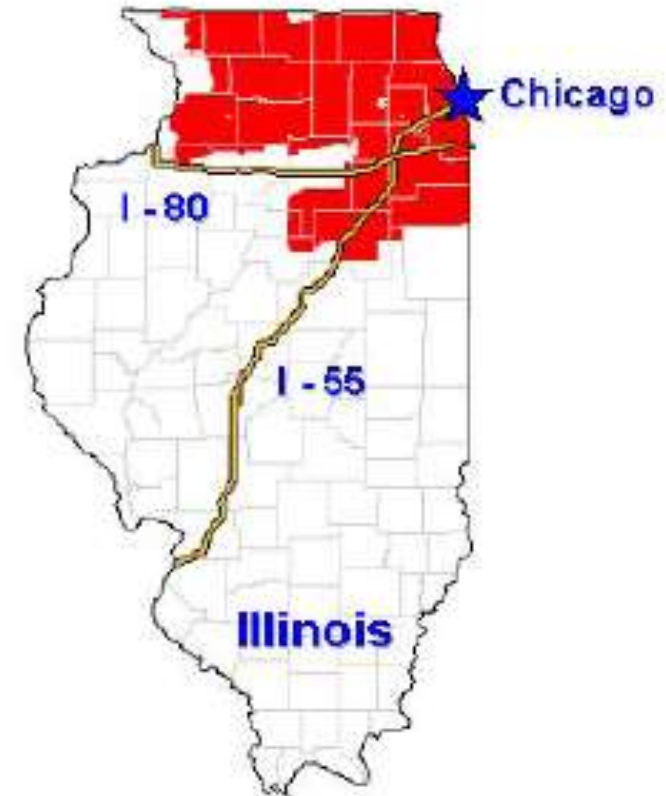
# **A 21<sup>st</sup> Century Grid for A 21<sup>st</sup> Century Economy**

**Metropolitan Planning Council  
Roundtable  
May 15<sup>th</sup>**

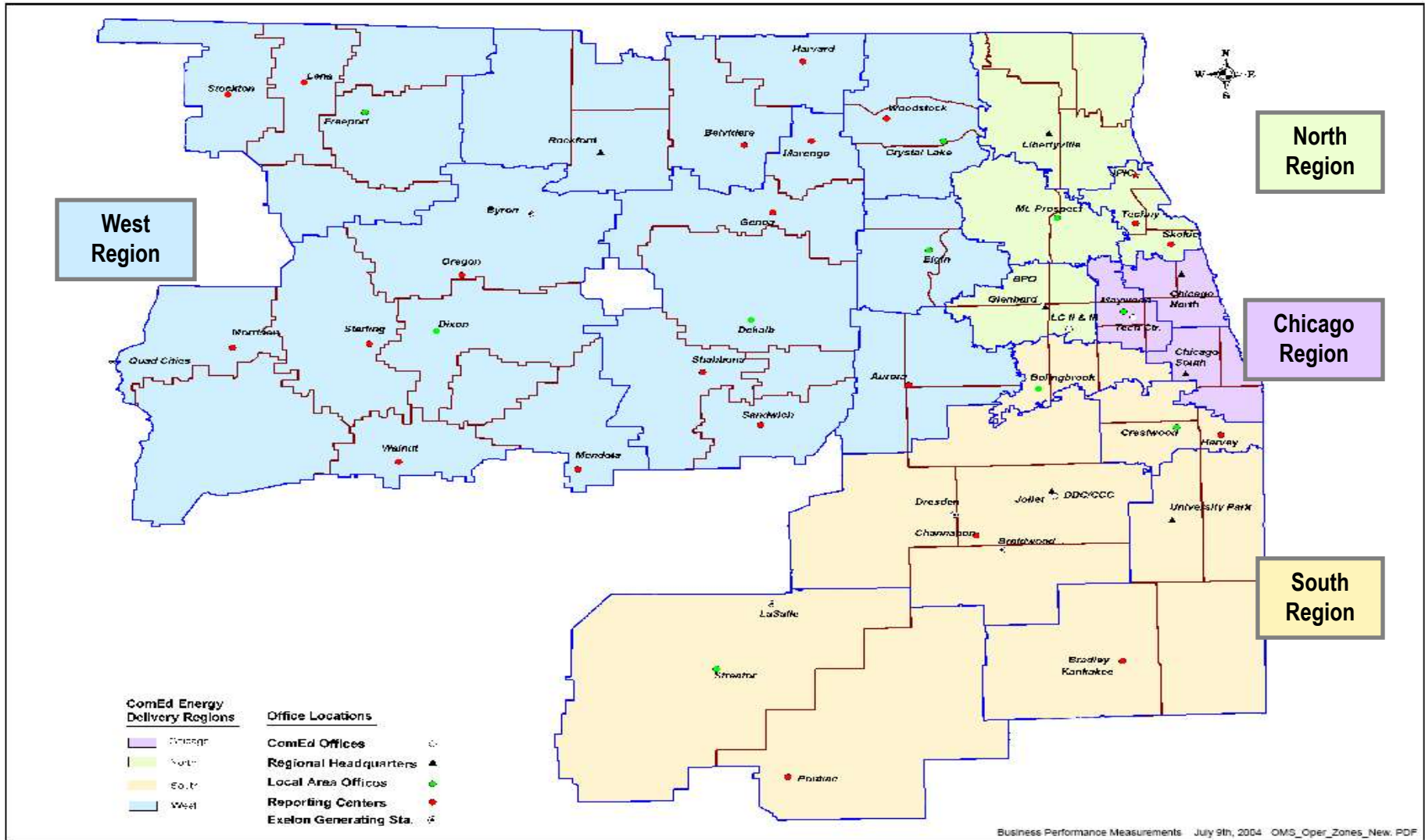
**J. Tyler Anthony  
ComEd SVP, Distribution Operations**

- ✓ ComEd System Overview
- ✓ Regulation
- ✓ Infrastructure
- ✓ Grid Modernization
- ✓ Emergency Preparedness

- ✓ **Service territory is Northern IL including Chicago**
- ✓ **11,411 square miles**
- ✓ **Covers 70% of the population**
- ✓ **3.8 million customers in more than 400 communities**
- ✓ **5547 miles of transmission lines**
- ✓ **5433 distribution circuits**
- ✓ **44,400 miles of overhead distribution lines**
- ✓ **55,600 miles of underground distribution cable**
- ✓ **5,884 employees**
- ✓ **System Peak of 23,753 MW  
July 20<sup>th</sup>, 2011**



# ComEd Operating Regions (4)



Business Performance Measurements July 9th, 2004 OMS\_Oper\_Zones\_New.PDF



An Exelon Company



# Transmission and Distribution Relationship

Generation  
765kV to 345kV

Transmission  
138kV to 765kV

12 kV  
Distribution

TSO OCC

TSS

TDC

Switchyard

34 kV  
Distribution

DIST CENTER

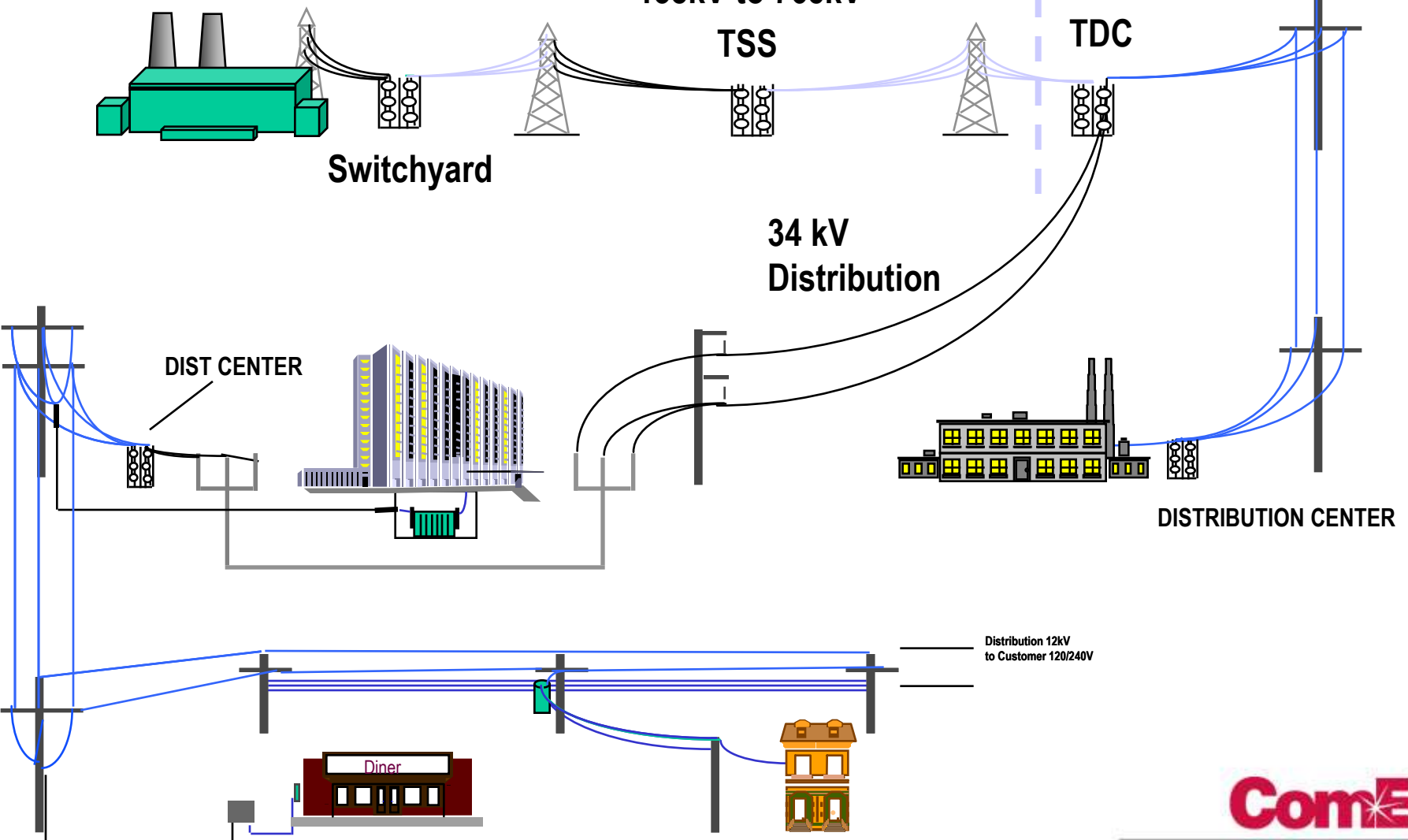
DISTRIBUTION CENTER

Distribution 12kV  
to Customer 120/240V

Diner



An Exelon Company





- ✓ **The Energy Infrastructure Modernization Act (EIMA)**
- ✓ **Consumer-centered regulatory model**
- ✓ **Catalyst for \$2.6 billion in infrastructure and modern grid investment**
- ✓ **Delivers much needed economic development and thousands of jobs**
- ✓ **Reforms a century-old regulatory process**
- ✓ **Protects customers and enhances regulatory oversight**

## Distribution Infrastructure Improvements



### *Vision Statement*

*Enhance customer value with cost-effective technological advancements that empower customers in ways that lead to more efficient utilization of electricity, reductions in future demand growth, improvements in the environment and a more reliable and secure system.*

### **“Smart Grid” Electric System Upgrades**



## \$1.3B Investment Allocated to Infrastructure Improvements

	5-Year Goal	2012
Underground Residential Cable	Refurbish or replace <b>OVER 4,100 miles</b>	Refurbished or replace <b>OVER 450 miles</b>
Mainline Underground Cable	Assess, refurbish or rebuild <b>OVER 32,000 manholes</b>  Test & replace <b>OVER 2,000 miles</b> of mainline cable	Assessed 8,000 and refurbish or rebuild <b>OVER 4,400 manholes</b>  Test & replaced <b>OVER 250 miles</b> of mainline cable
Wood Poles	Inspect <b>OVER 650,000 poles</b>  Replace or reinforce <b>OVER 15,000 poles</b>	Inspected <b>OVER 133,000 poles</b>  Replace or reinforce <b>OVER 2,500 poles</b>
Storm Hardening	<b>\$200M in improvements</b>	<b>~\$20M in improvements</b>



## \$1.3B Investment to Digitize the System with New Smart Grid Technology

### Digital Technology:

- ✓ Install **distribution automation** devices to detect issues on the grid and automatically re-route power to minimize customer outages
- ✓ Upgrade 10 electrical **substations** that will improve automated monitoring of grid performance, increase reliability and reduce power delivery expenses
- ✓ Over **four million smart meter** installations—one in every home and business that will ...
  - Enhance outage identification and restoration
  - Improve meter reading and billing efficiencies
  - Reduce electricity theft
  - Enhance disconnection and reconnection of electric service
  - Provide customers more information, services, savings, choice and control



# Wallace Smart Substation



- ✓ **Reliability**
  - **System SAIFI** 20% improvement in 10 years
  - **System CAIDI** 15% improvement in 10 years
  - **Southern and Northern Region SAIFI** 20% improvement in 10 years
  - **Service Reliability Target (Customer Target Program)** 75% improvement in 10 years
  
- ✓ **Customer Benefits**
  - **Estimated Bills** 90% reduction in 10 years
  
- ✓ **AMI Benefits (average of):**
  - **Consumption on Inactive Meters** 90% reduction in 10 years
  - **Unaccounted For Energy** 50% reduction in 10 years
  - **Uncollectible Expense** \$30M reduction over 10 years
  
- ✓ **Opportunities for Minority-Owned and Female-Owned Business Enterprises**
  - **Opportunities for MWBE** 15% increase to capital MWBE expenditures over 10 years
  
- ✓ **Penalties**
  - **Reliability Metrics (each goal):** 5 bps years 1-3, 6 bps years 4-6, 7 bps years 7-10
  - **Estimated Bill Metric:** 5 bps every year
  - **AMI Benefits Metric (averaged):** 5 bps every year

# Emergency Preparedness

ComEd launched a Storm Task Force in the fall of 2011 that focused on the following critical areas:

- ✓ Customer Communications
- ✓ Municipal Interface
- ✓ Storm Process Improvements
- ✓ System Hardening

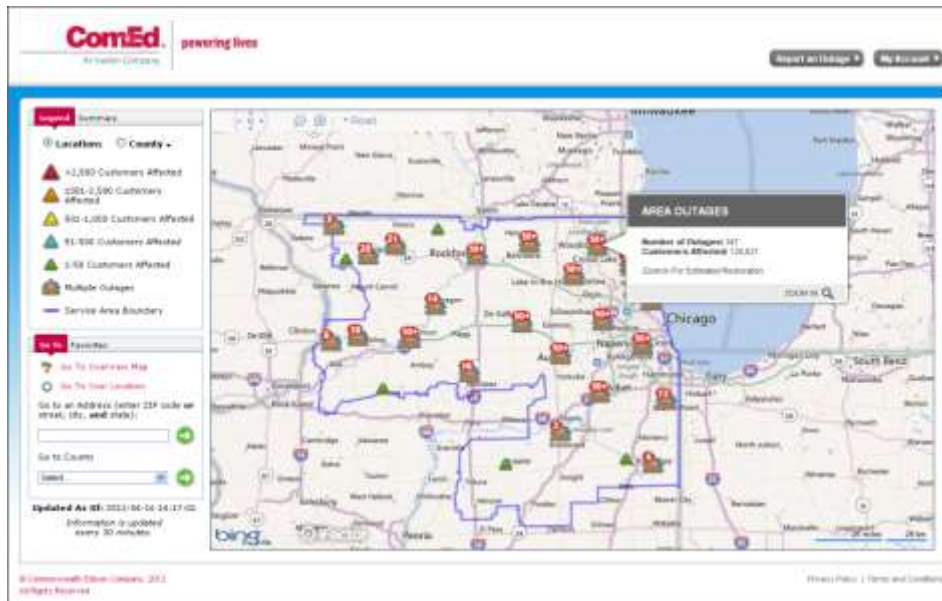




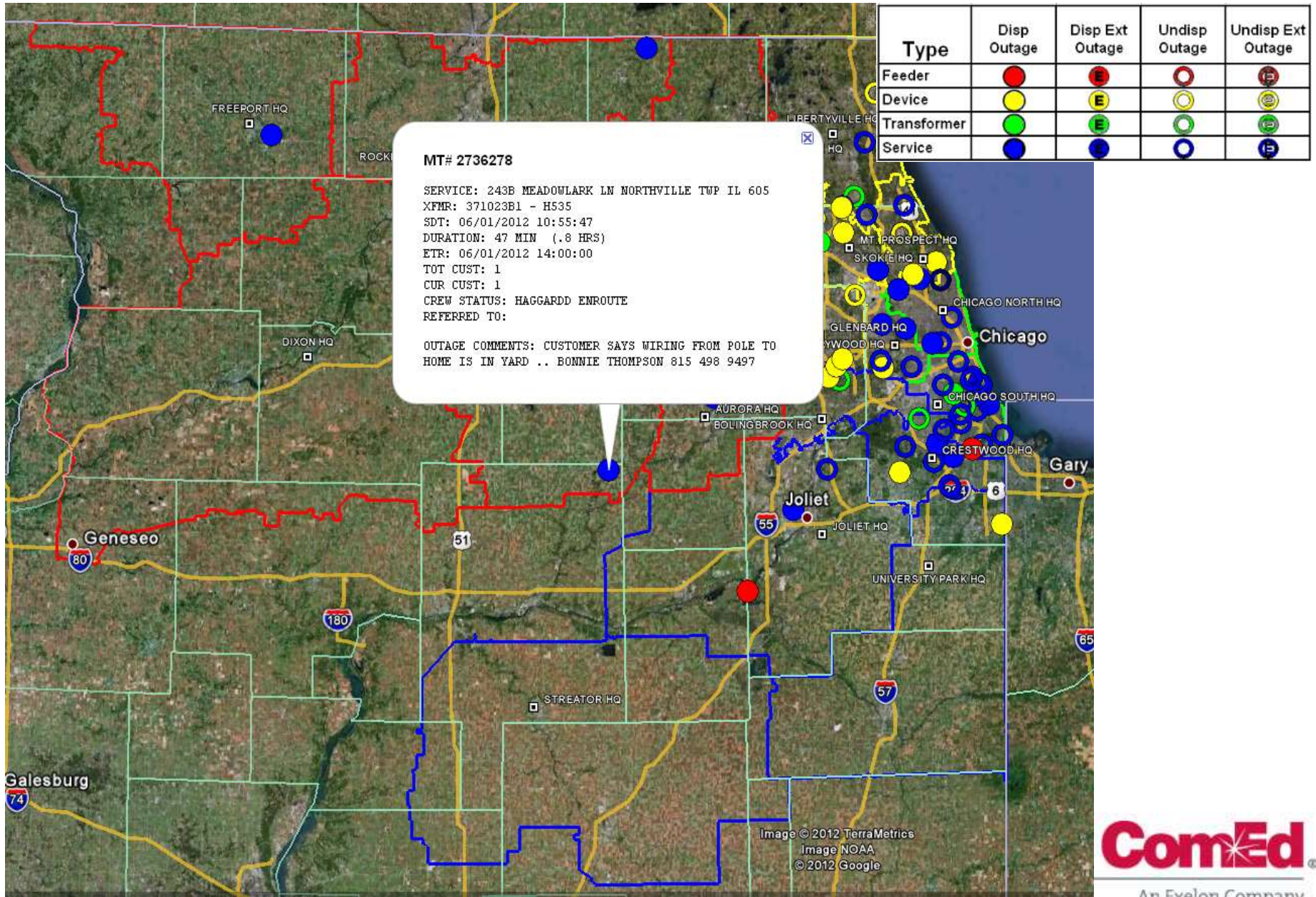
## Improved outage communication capability led to improved customer experience

1. Upward trend in 2013 Q1 JD Power on being kept informed of outage information
2. Doubled the amount of subscribers of text alerts in 2012

- ✓ Two-way texting
- ✓ Smartphone application
- ✓ Enterprise storm dashboard
- ✓ Interactive outage maps on ComEd.com
- ✓ Facebook



# Technology Improvements - Smart Boards



# Municipal Interface

- Improved with creation of the Joint Operations Centers (JOCs) – 17 municipal/county locations
  - Opens for a significant event (20% of accounts out of service for 3 hours)
  - Improves identification of Critical Infrastructure within a service territory
  - Addresses the prioritization of critical municipal issues during storms
    - Medical centers, nursing homes, water pumping stations, etc
  - Municipal Reps have direct contact with ComEd Reps in same facility
  - JOC software application assists with managing and prioritizing restoration
  - State-wide exercise (Operation Joint Venture) scheduled for June 13 to open 6 JOCs simultaneously, challenging scenarios, and multi-agency coordination (IEMA, IDOT, Illinois National Guard, FEMA, City of Chicago, CITGO refinery, NICOR, AT&T, etc)

**JOC Dashboard - QA**

ComEd Overview | JOC Dashboard | JOC Locations - 6 Open | Help | My Access Profile | Chantel, Robert J.

Region	Area	% Affected	Outage Age Breakdown	Actions	Open JOC Locations
North	Glenbard	0%		1st 2nd	
North	Libertyville	0%		1st	
North	Maywood	0%		Activate JOC	
North	Ill. Prospect	0%		1st	
North	Stote	0%		Activate JOC	
South	Bolingbrook	0%		1st	
South	Crestwood	0%		Activate JOC	
South	Joliet	0%		Activate JOC	
South	Streator	0%		Activate JOC	
South	University Park	0%		Activate JOC	

As of: 01/22/2013 13:00

**Legend**

- Normal** (Green) 0 - 11% Total Constituents Affected
- Advisory** (Yellow) >= 12% Total Constituents Affected
- Watch** (Orange) >= 20% Total Constituents Affected for >= 1 hour
- Warning** (Red) >= 20% Constituents Affected for >= 3 hours

for Shared Use Only

NATIONAL EXERCISE PROGRAM

**Exercise Plan (ExPlan)**

OPERATION JOINT VENTURE

SPONSORED BY ComEd EMERGENCY PREPAREDNESS

## Joint Operations Center (JOC) / Joint Information Center (JIC)

- ✓ JOC documentation finalized and process institutionalized
- ✓ JOC drill was planned, coordinated and performed with Skokie - positive feedback
- ✓ Identified over 3,700 Life/Health/Safety accounts in 400 Municipalities

## Dispatching

- ✓ Service dispatching was shifted to the Transmission and Substation (T&S) organization
- ✓ Utilized additional new OCC dispatchers and workstations to support foreign crews
- ✓ Quarterback Supervisor process was utilized to drive crew productivity
- ✓ Established a crew to dispatcher ratio of 6-9:1

## Damage Assessment

- ✓ Wire Watching control was shifted to Customer Operations
- ✓ Patrolling resource pool was expanded and equipped with mobile dispatch terminals
- ✓ New Damage form was utilized by Patrollers

## Contractor Acquisition and Management

- ✓ Logistics Consultant support was successfully piloted during the July 24th storm
- ✓ Tiered staffing protocol utilized to properly staff Foreign Crew Coordinators (FCC's)
- ✓ Increased coordination with BGE and PECO for mutual aid support

## Supply / Staging Centers

- ✓ Utilized SSG and Contractors of Choice for material delivery
- ✓ Incorporated refueling operations at vehicle staging centers
- ✓ Utilized the MOC for Incident Command and on boarding



**ComEd**

An Exelon Company

## 2012

- ✓ 54,000 customers benefitted in over 120 communities
- ✓ Completed 534 storm hardening jobs
- ✓ Converted 5,200 feet overhead wire to underground cable
- ✓ Installed nearly 22 miles of tree resistant Spacer Cable
- ✓ Installed 223 Fuse Trip Saver devices
- ✓ Completed Enhanced Vegetation Management trimming on 263 circuits and removed over 13,000 trees

## 2013 Plan

- ✓ Install approximately 36,000 feet of Spacer Cable
- ✓ Convert approximately 25,000 feet of overhead wire to underground cable
- ✓ Install approximately 20 Automatic Fuse Devices
- ✓ Perform enhanced Vegetation management trimming on 163 circuit sections

# Questions / Comments

Can one argue what's third?

1. Air
2. Water
3. Electricity

# STEPHEN KONYA

## ILL. DEPT. OF PUBLIC HEALTH



# BRACE-Illinois

Building Resilience Against Climate Effects





# What is Public Health?

## Public health keeps kids healthy and communities strong

### Public health and prevention programs in your community:



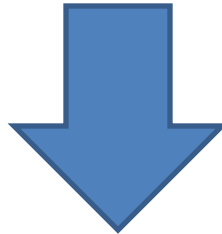
**We all benefit**

Source: APHA



# Weather, Climate, and Health

- Exposure to extreme environmental conditions
  - Heat, floods, ozone
- Provides environments for spread of diseases
  - Mosquitoes, ticks
- Provides environments that effect chronic illnesses
  - Asthma, allergies



Climate change might increase severity and alter disease patterns



# Climate Change and Health

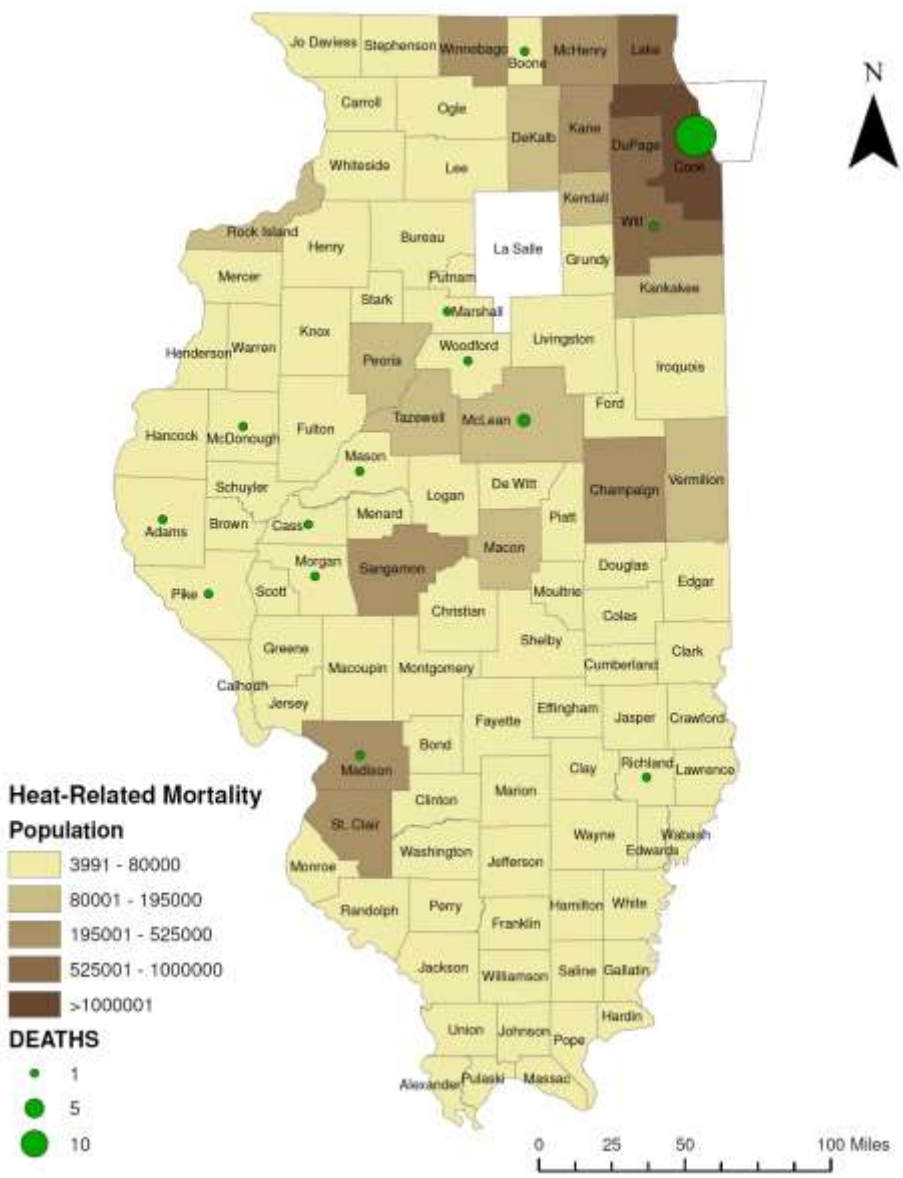


Photo: CDC

- Heat-related illnesses
- Vectorborne illnesses
- Extreme weather events
- Asthma
  - Ozone
  - Allergens
- Waterborne illness
- Injuries
- Carbon monoxide
- Mental health
- Inability of medical systems to function



# Heat-Related Deaths in Illinois, May-September 2011



# Adaptation

“Adjustments in a system’s behavior and characteristics that enhance its ability to cope with external stress”

(Smit 2006)



I-10, August 30, 2005  
Associated Press



<http://www.twinspanbridge.com>



# BRACE

## Building Resilience Against Climate Effects

**Purpose:** To improve the resilience of public health systems to stress brought on by increases in the burden of climate-sensitive diseases and injury

**How:** Develop a climate and health adaptation plan; a set of deliberate and specific efforts to anticipate and prepare for the adverse health effects of climate change

**BRACE IL Goal:** To develop a climate and health adaptation plan that minimizes the adverse impacts of climate change on the health of the public in Illinois



# BRACE Framework

1. Forecast climate impacts
2. Assess vulnerabilities
3. Project disease burden
4. Assess public health interventions
5. Develop and implement a climate and health adaptation plan
6. Assess impacts, improve quality of that plan



# Public Health and a framework for prevention of heat-related illness

- Medicine vs. Public health
  - Medical care: taking care of individuals with illness
  - Public health: preventing illness and injury in populations
- Primary Prevention: reduce exposure to extreme heat
  1. Urban design
  2. Power grids
  3. Tree canopy
  4. Green roofs





# Public Health and a framework for prevention of heat-related illness

- Secondary Prevention: Heat index is elevated, let's reduce impacts on health
  1. Heat alert system
  2. "Check up on a neighbor" system
  3. Cooling centers
- Tertiary Prevention: Heat-related illness has occurred, let's prevent deaths and high morbidity
  1. Emergency responders trained, ready
  2. Hospital preparedness



# Current Standings with Project

- Forecast Climate Impact:  
10 year Average (2003-2012)

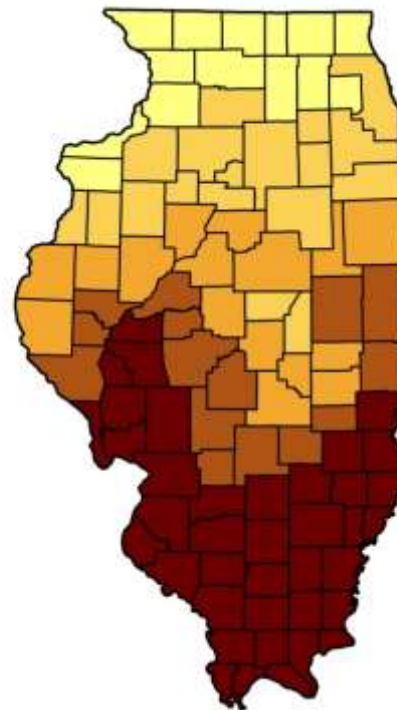
Average Monthly  
Precipitation



Average Monthly  
Air Temperature



Average Monthly  
Soil Temperature



# Current Standings with Project

- Vulnerability Assessment:
  - Collecting demographic data
    - Age, race, income
  - Health facilities data
    - Hospitals, community health centers, long-term care facilities
- Training and Education:
  - Educational needs assessment disseminated to Local Health Department Administrators



# Call to Action

*“the biggest global health threat of the 21<sup>st</sup> century”* — The Lancet, Britain’s premier health journal

*“Climate Change will affect, in profoundly adverse ways, some of the most fundamental determinants of health: food, air, and water”*

– Margaret Chan, director general of the World health Organization (WHO)



# Additional Resources

- TED Talk – Vicki Arroyo: “Let's prepare for our new climate”



# Contact Info

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Please wait for the microphone, state your name and affiliation

# QUESTIONS & ANSWERS



Metropolitan **Planning** Council

## **Tough Stuff**

Resilient Infrastructure in a Changing World

Please fill out the survey and place it in the basket as you leave. Thank you!



@metroplanners #resiliency