

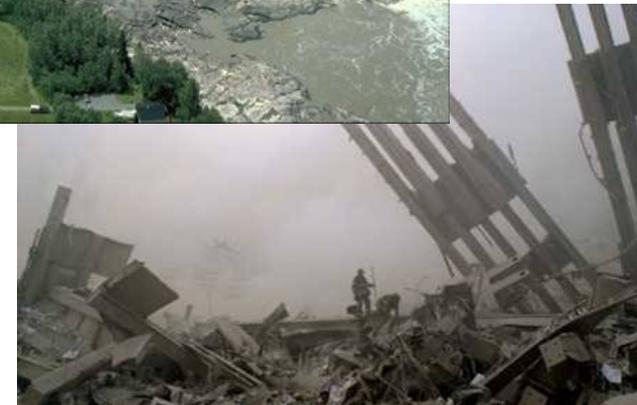
# National R&D Initiatives Relevant to Critical Infrastructure

*Mary Ellen Hynes, PhD, PE*

*Director Critical Infrastructure Protection  
R&D and USACE Liaison Officer*

*Science and Technology Directorate  
Department of Homeland Security*

14 July 2006



**Homeland  
Security**

# Underlying Premise

- All Hazards Risk Perspective Must Prevail for Wise Investment Decision Making

# Outline

- Direction from the President
- Federal Agency Activities for Critical Infrastructure Protection (CIP)
- Activities in DHS and S&T
- Closing Thoughts

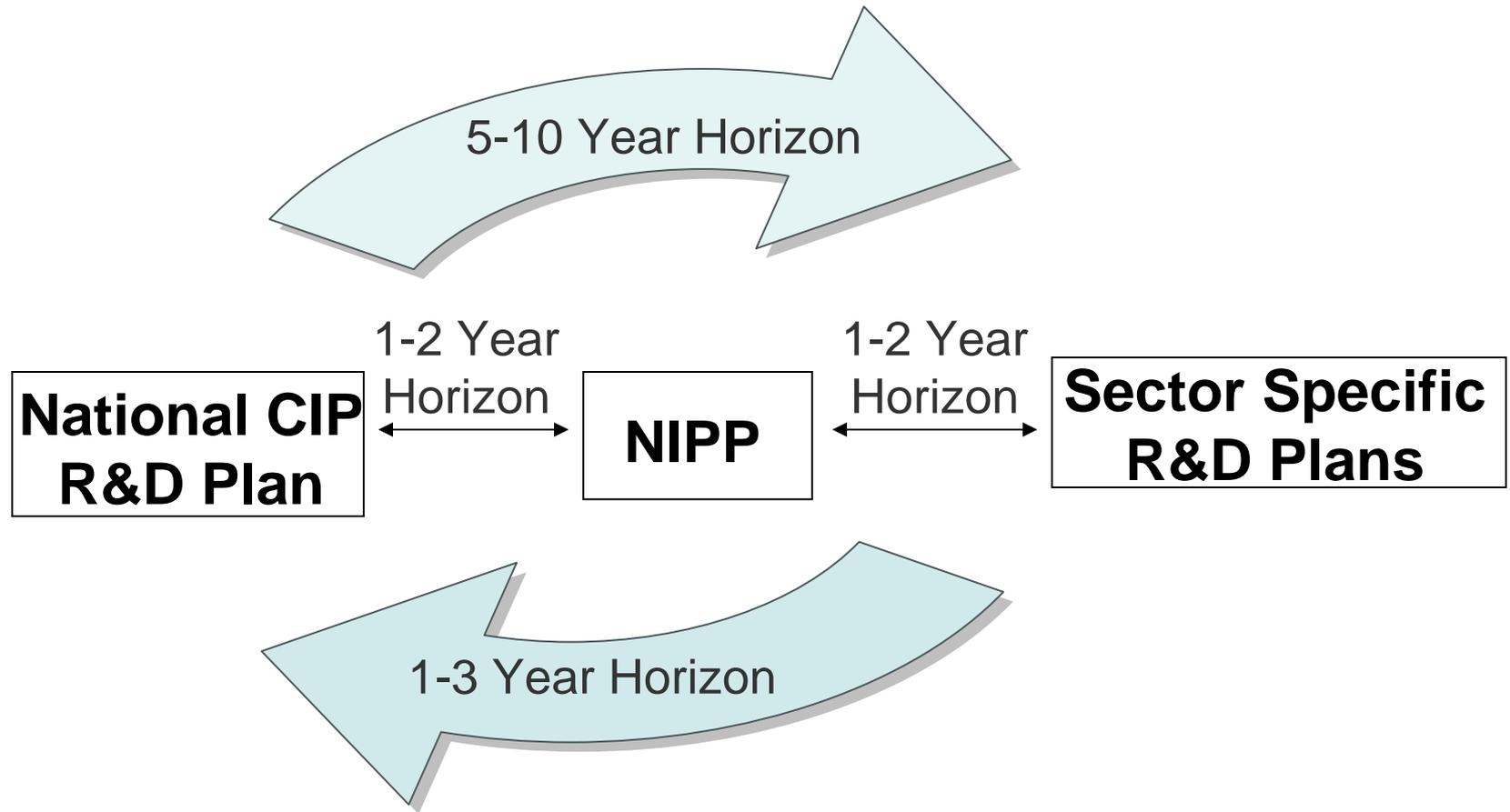
# Office of Science and Technology Policy

## Executive Office of the President

### Letter to OMB – FY 2008 Priorities

- American Competitiveness Initiative
- Homeland Security
- Energy Security
- Advanced Networking and High-end Computing
- National Nanotechnology Initiative
- Understanding Complex Biological Systems
- Environment

# Critical Infrastructure Plan Coordination



# National Strategic Goals for CIP R&D

- A common operating picture for critical infrastructure
- Next generation Internet
- Self-healing, resilient infrastructure

# Example Federal Agency Projects for CIP

## DHS

- *Insider Threat Prevention*
- *Secure Wireless Communications and Domain Name Protocol Security*
- *Large Scale Modeling of Infrastructure Interdependencies and Cascading Effects*
- *Real-time Digital Image Cataloging and Retrieval*
- *Standards for Risk Analysis*

## DOT

- *Massachusetts Bay Silver Line Tunnel Integrated Security System*
- *Adaptive Quarantine Project – Cyber Security*
- *Cooperative Hazardous Materials Transportation Research Program*

## EPA

- *Water Sentinel*

## NSF

- *Team for Research in Ubiquitous Secure Technology (TRUST)*
- *Trustworthy Cyber infrastructure for the Power Grid*
- *High Fidelity Numerical Modeling and Simulation of Fire Suppression*
- *Analysis and Modeling of Diffuse Ultrasonic Signals for Structural Health Monitoring*
- *Combining Ultralow Energy Electron Attachment and Miniature Mass Spectrometry: A New Concept for a Hand Held Detector for Explosives and Nerve Agents*
- *Anthrax Detector for Mail Sorting Systems*

# Example Federal Agency Projects for CIP

## DOC - NIST

- *Increased Structural Integrity and Fire Safety of Physical Systems*
- *Industrial Control System Security*
- *Information System Security Standards and Guidelines*
- *Complex System Failure Analysis*
- *Improved Electric Power Grid*
- *Personal Identity Verification*

## DoD - DTRA

- *Blast Mitigation Research*
- *Command and Control Advanced Concept Technology Demonstration*
- *Infrastructure Vulnerability Analysis and Mission Assurance for USMC*
- *Wireless WMD Vessel Boarding and Inspection System for USCG*

## DoD

- *Electronic Combat (EC) Technology*
- *Physical Security Equipment*
- *Man Portable Air Defense Systems (MANPADS)*

## TSWG

- *American Gas Association Standard for Supervisory Control and Data Acquisition (SCADA)*
- *SCADA Cryptographic Module*
- *SCADA Protocol Vulnerability*
- *Sensor Web for Infrastructure Protection (SWIP)*
- *Large Vehicle Bomb Detection*
- *Backscatter X-Ray Portal Testing*

# Example Federal Agency Projects for CIP

## HHS

- *Bioterrorism Preparedness in Rural and Urban Communities*
- *Bottom-Up Modeling of Evacuation Methodologies*
- *Measurement & Bioterrorism Preparedness: An Impact Study*

## CIA

- *Text Extraction for Threat Detection*
- *Identifying Non-obvious Relationships through Perpetual Analysis*
- *Automatically Detect and Respond to Key Events, Changes and Exceptions Across Disparate Systems and Sources.*

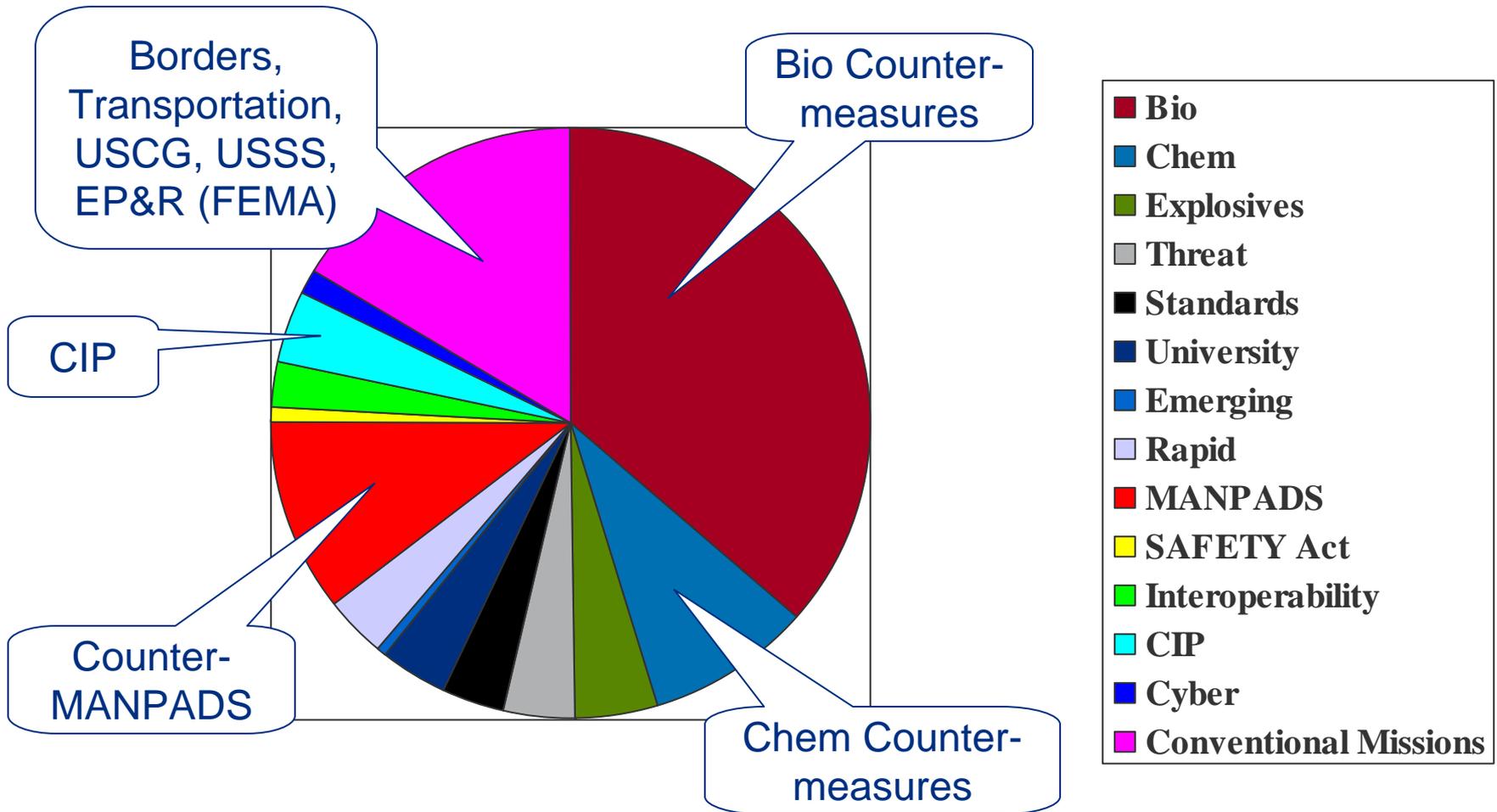
## DOI-BoR

- *Scale Model Testing of Embankment Dams Subjected to High-Explosive Charges*
- *Numerical Analyses on Effects of High-Explosives Placed Underwater and Upstream of Spillway Gates*

## NASA

- *Aircraft and System Vulnerability Mitigation Project (A&SVM)*
  - *Protected Asset Flight Systems*
  - *Safe Aircraft Flight Recovery*
  - *Electromagnetic Energy Surveillance and Detection*
  - *Damage Adaptive Control Systems*
  - *Fire Resistant, Damage Tolerant Composites*
  - *Fuel Tank Explosion Protection*

# S&T Approx. Budget Distribution



# DHS and S&T Activities Relevant to CI

## Preparedness Directorate

- *NIPP just released*
- *Critical Infrastructure Grant Programs*
- *Coordinating Council System*

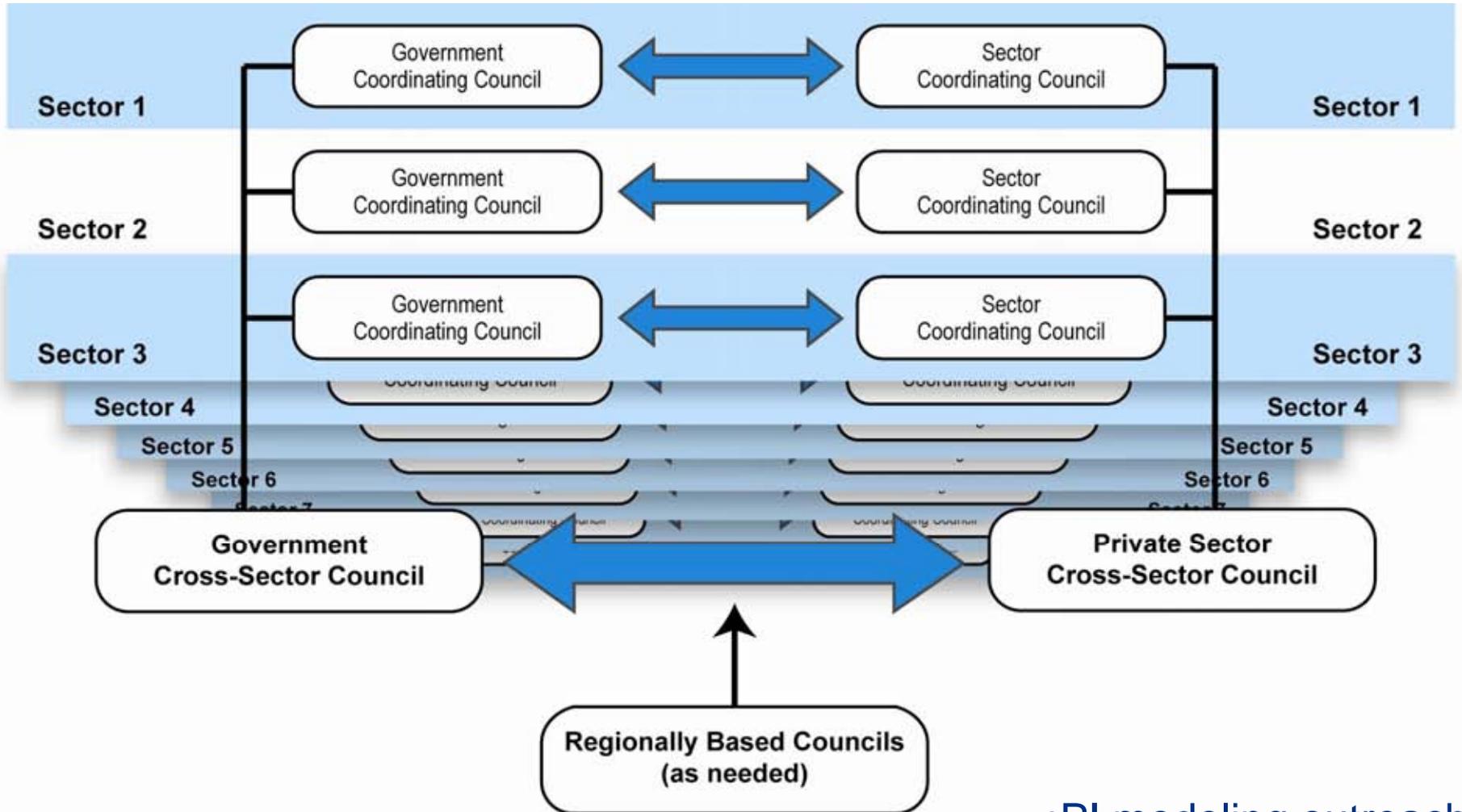
## EOP

- *Pandemic Influenza Task Force*

## S&T Critical Infrastructure Protection Initiatives

- *Pandemic Influenza Modeling*
  - *Need to understand labor shortfalls and their impact on CI services*
- *National CIP R&D Plan to Support the NIPP*
- *Insider Threat Prevention Technologies*
- *Modeling, Simulation and Analysis for Decision Support*

# Sector Partnership Structure



- PI modeling outreach  
*Labor shortfalls*
- SSP preparation

# DHS and S&T Activities Relevant to CI

## Preparedness Directorate

- *NIPP just released*
- *Critical Infrastructure Grant Programs*
- *Coordinating Council System*

## EOP

- *Pandemic Influenza Task Force*

## S&T Critical Infrastructure Protection Initiatives

- *Pandemic Influenza Modeling*
  - *Need to understand labor shortfalls and their impact on CI services*
- *National CIP R&D Plan to Support the NIPP*
- *Insider Threat Prevention Technologies*
- *Modeling, Simulation and Analysis for Decision Support*

# There Are Many Models

Whistler, British Columbia

**Interdependencies CIP-DSS**

**Quick, Broad  
Risk Analysis**

**Detailed  
Sector  
Analysis  
(NISAC)**

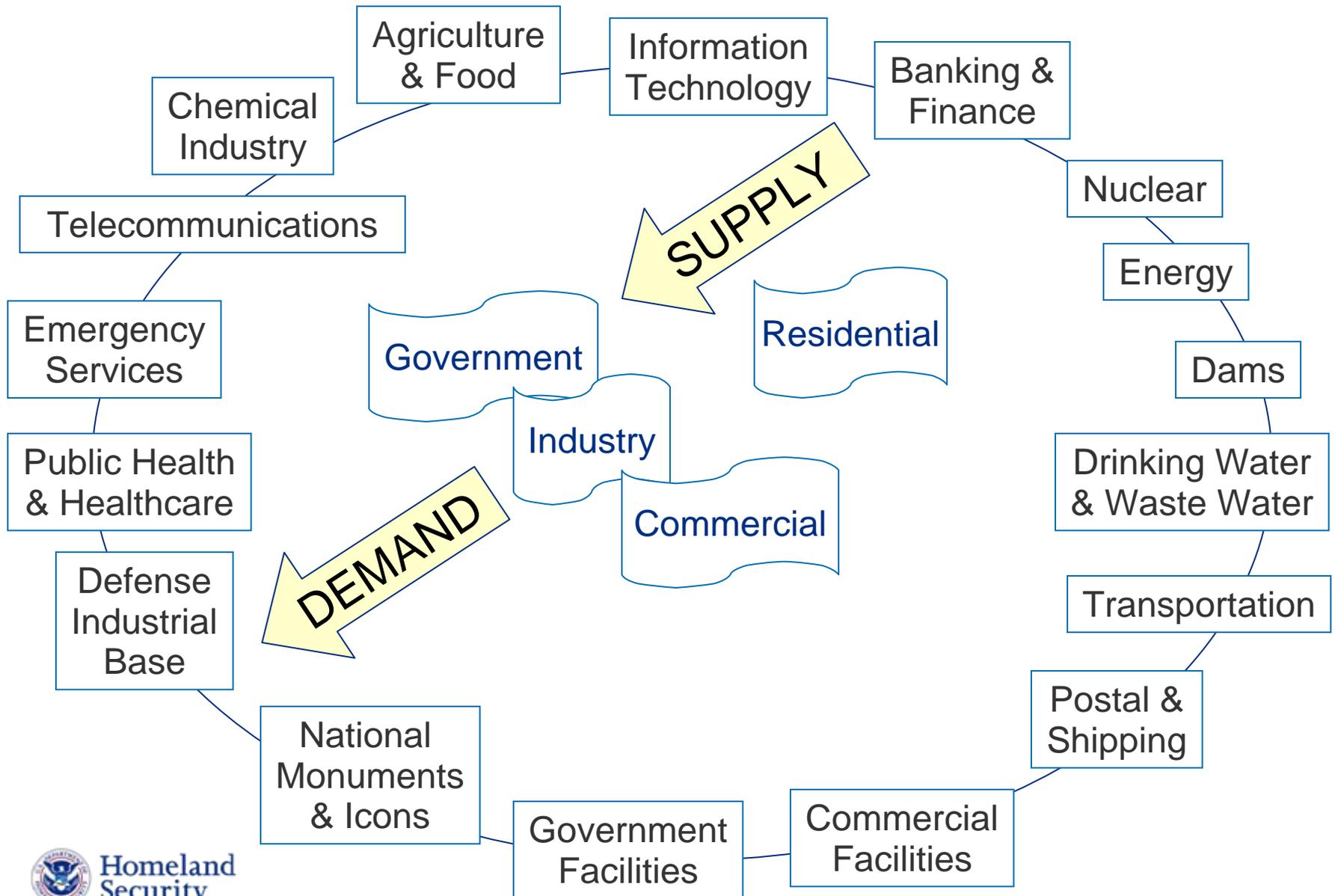
**Scoring  
Techniques**

**Detailed  
Sector  
Analysis**

**Detailed  
Component  
Analyses**

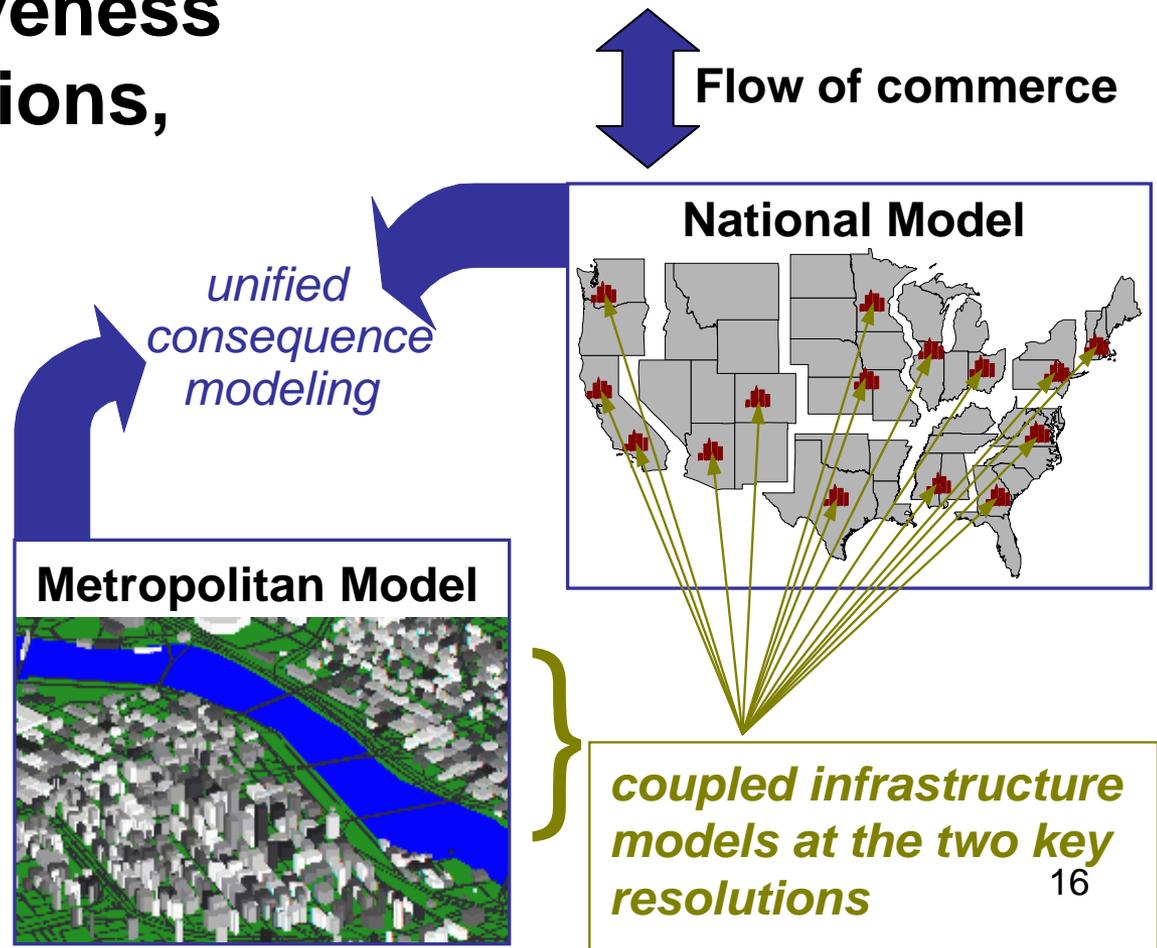


# 17 Interdependent Critical Infrastructure Sectors



# Interdependencies Model

- Simulate disruptions
- Estimate consequences
- Evaluate effectiveness of mitigation actions, policy options
- Two Scales
  - National
  - Metropolitan



# Pandemic Influenza Task Force - Economics

- CIP-DSS team now engaged with NISAC (National Infrastructure Simulation and Analysis Center) to evaluate economic consequences of PI for different policy options (e.g. school closures, other types of social distancing)
- Reaching out through the Coordinating Council framework to obtain information to fine tune the models and better represent the impacts of labor shortfalls on individual infrastructure sectors including geographic effects
- Please help if you are called upon – thank you!

# PEST Evaluation

- Political
- Economic
- Social
- Technical

“The soft stuff is much harder than the hard stuff”

*David Nelson, OSTP*

- *How do you measure preparedness?*
- *How do you measure resiliency?*

# West Point Capstone Project Perspective of Soft Factors & How They Influenced Resiliency of a City

## Soft Factors

### Social

- Crime Rate
- Gov. Subsidized Housing
- Education Level
- Investments in Charities
- Savings Levels in Region

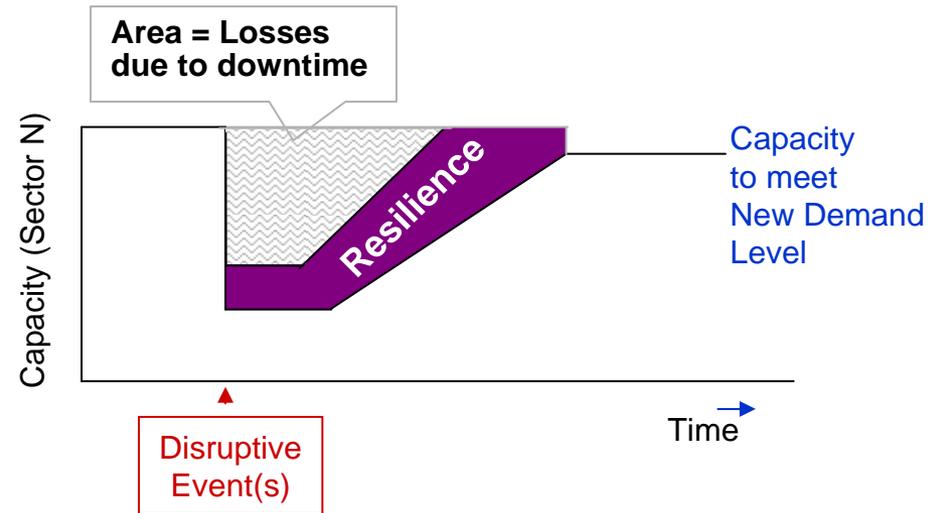
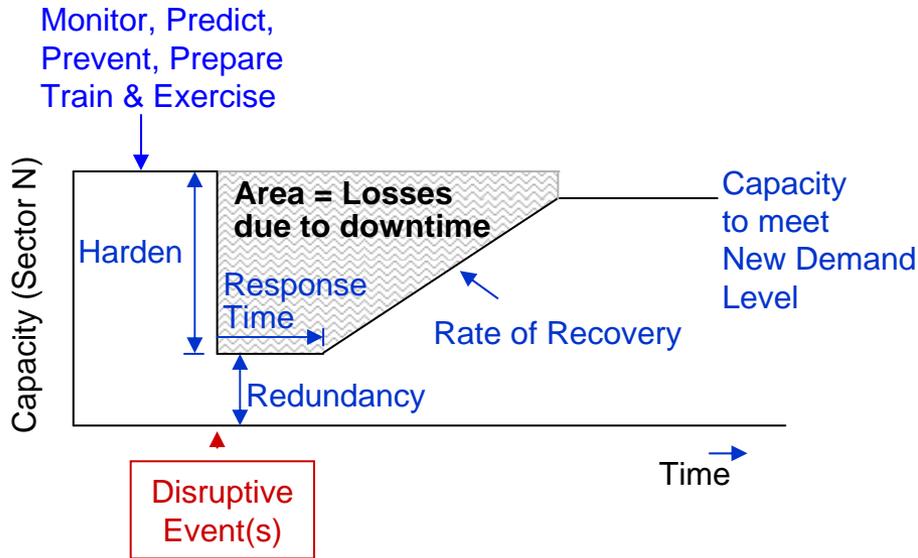
### Political

- Dominant Political Party
- Media Coverage
- Committees for Emergency Response
- Presence of Political Leaders

### Economic

- GDP of Metro Area
- Insurance Coverage
- Emergency Funds
- Scientific Innovations
- Businesses

# Protection Continuum



## Criteria for Success - Solutions are:

- Practical
- Effective
- Affordable
- Sustainable
- Attractive in the marketplace

# Closing thoughts\*

- NCIP R&D Strategic Goals, NIPP, SSPs
- CIPAC Coordinating Council System
- PEST: Soft Factors – very important!
- Regional Initiatives – “Every American has a role to play in homeland security” President Bush on Sept 11, 2001
- Congratulations to TISP for Regional Disaster Resilience Guide
- Pandemic Influenza Planning – please help the modeling teams!

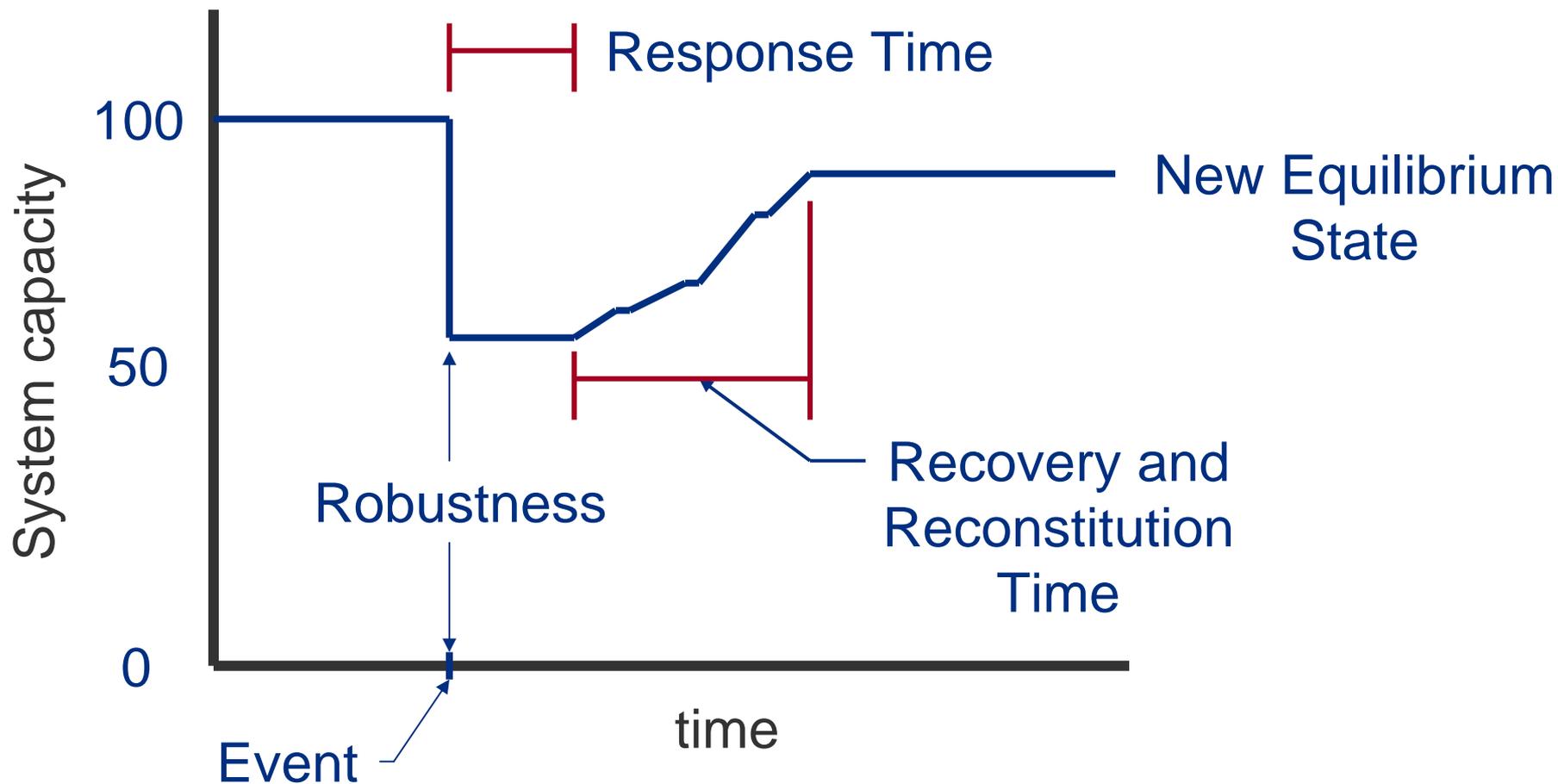
## Thank you!

**\*The comments and observations made in this presentation are those of the author, not necessarily representative of and certainly not binding for DHS policy.**

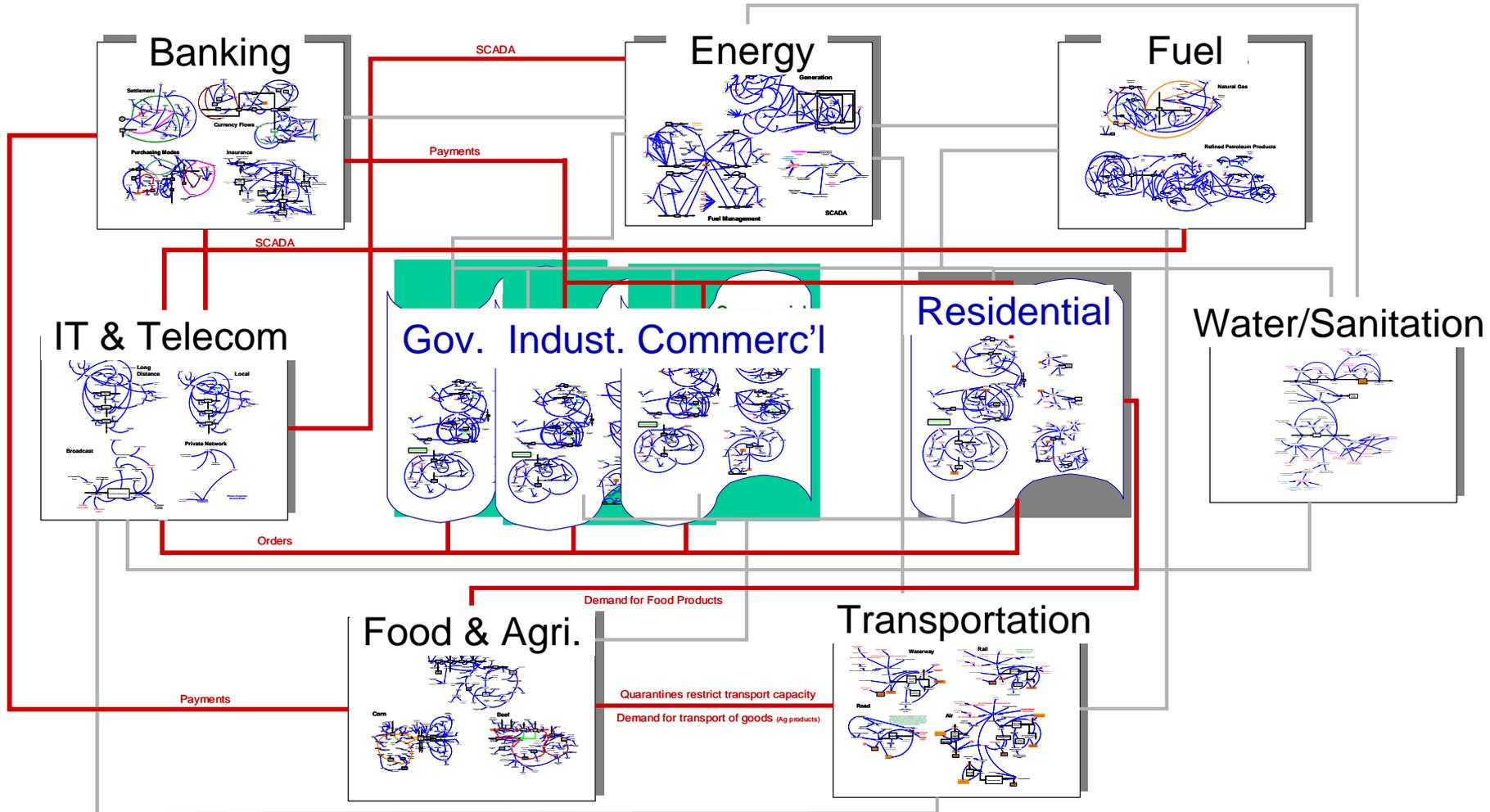


# Homeland Security

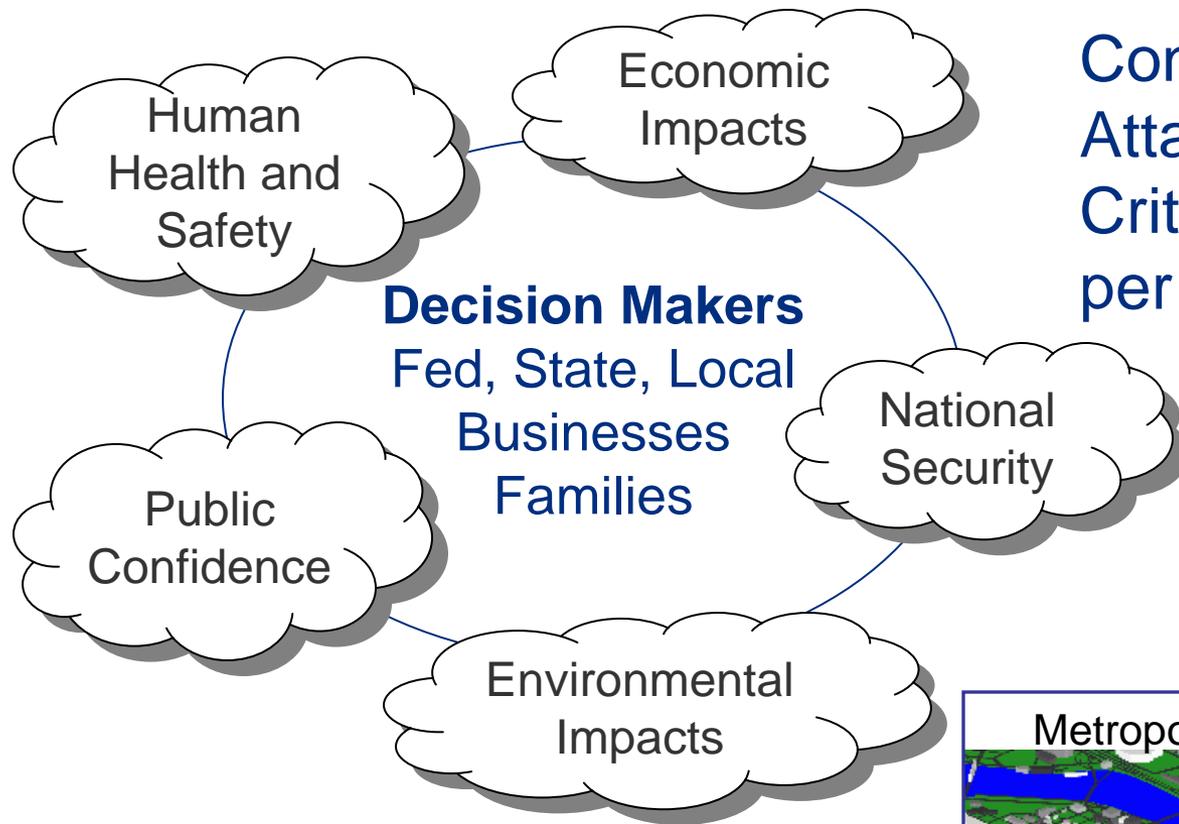
# Generic Infrastructure Resiliency Model



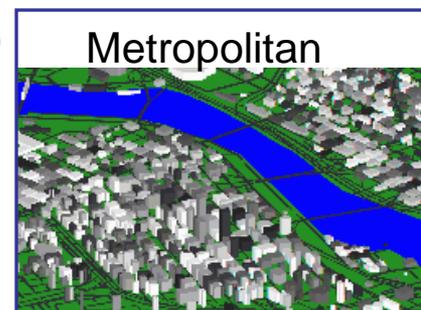
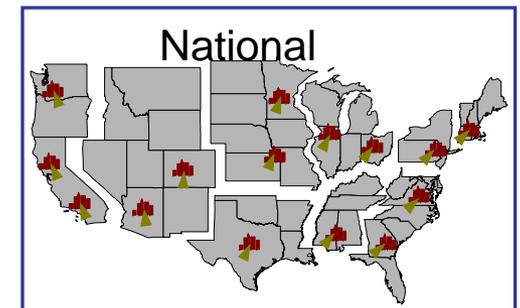
# Large Scale System Dynamics Model of Critical Infrastructures and Major Interdependencies



# Critical Infrastructure Protection Decision Support System (CIP-DSS) - Consequences



Consequence Metrics for Attacks/Hazards on Critical Infrastructure per HSPD-7



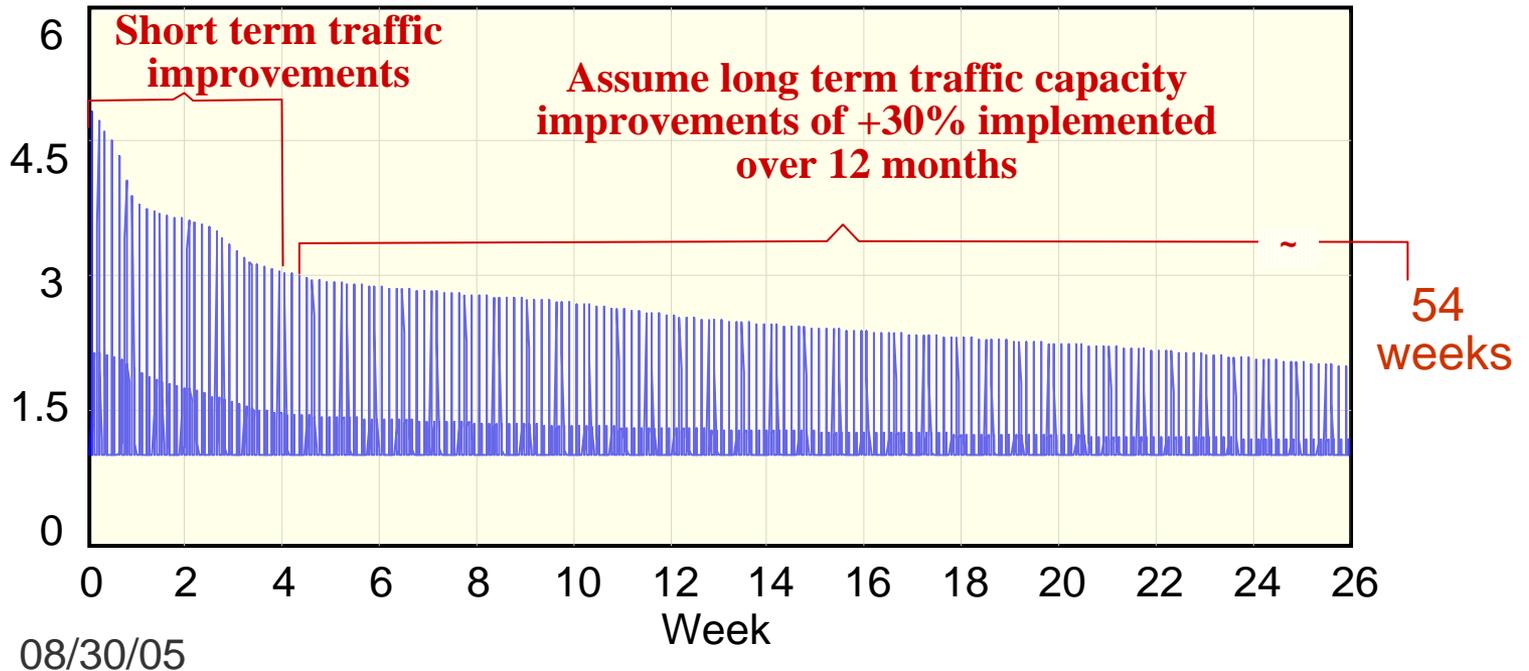
# Example output

- What will be the demands on critical infrastructure services and degradation in mission / quality of services if a major metropolitan area increases its population by 50% over a very short period of time (i.e., receive displaced persons from a major storm)?

# Effect on Transportation: *How much longer will a trip by car take?*

*A multiplier of 3 means a trip that normally took 20 minutes will now take an hour*

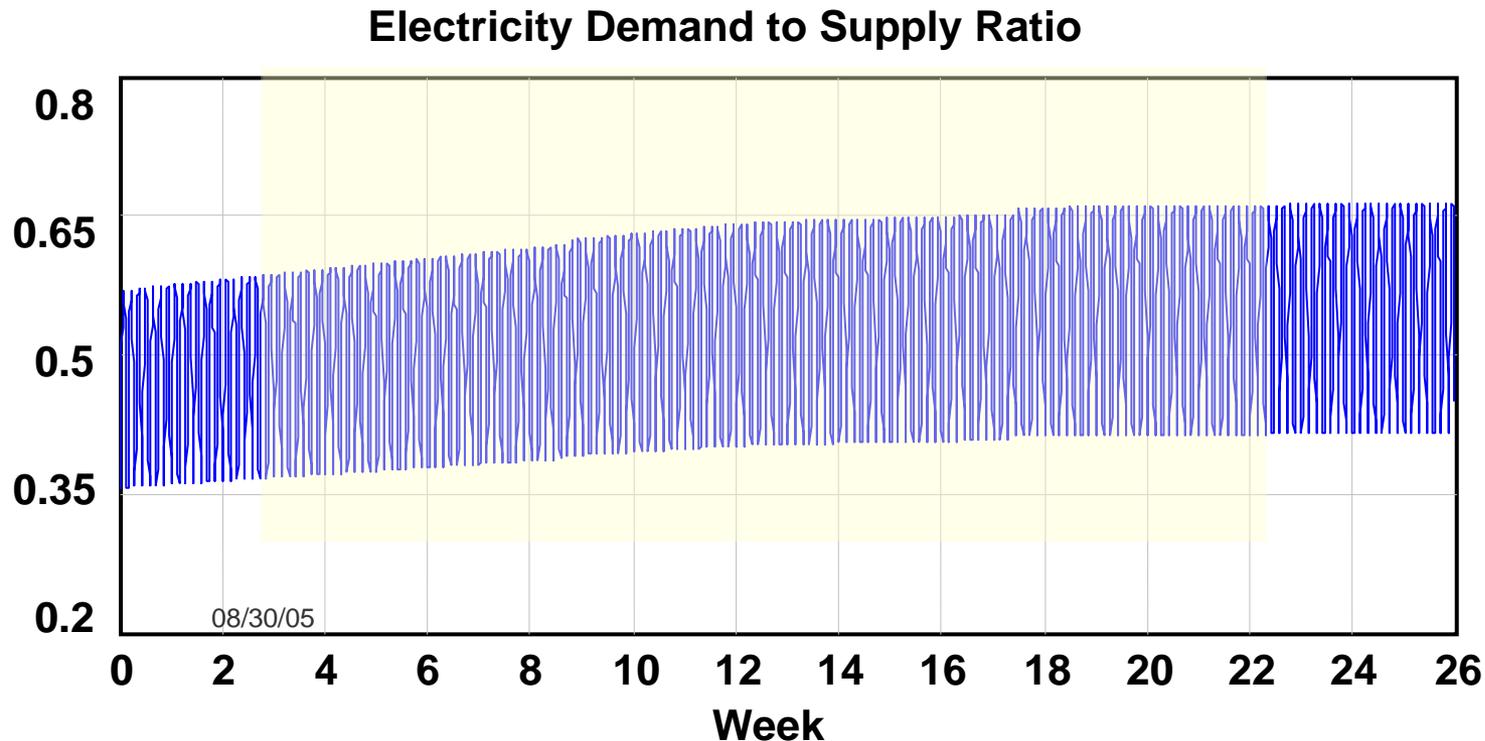
Average Trip Duration Multiplier



Traffic counts after the first week indicate car volume is up 35% to 45%

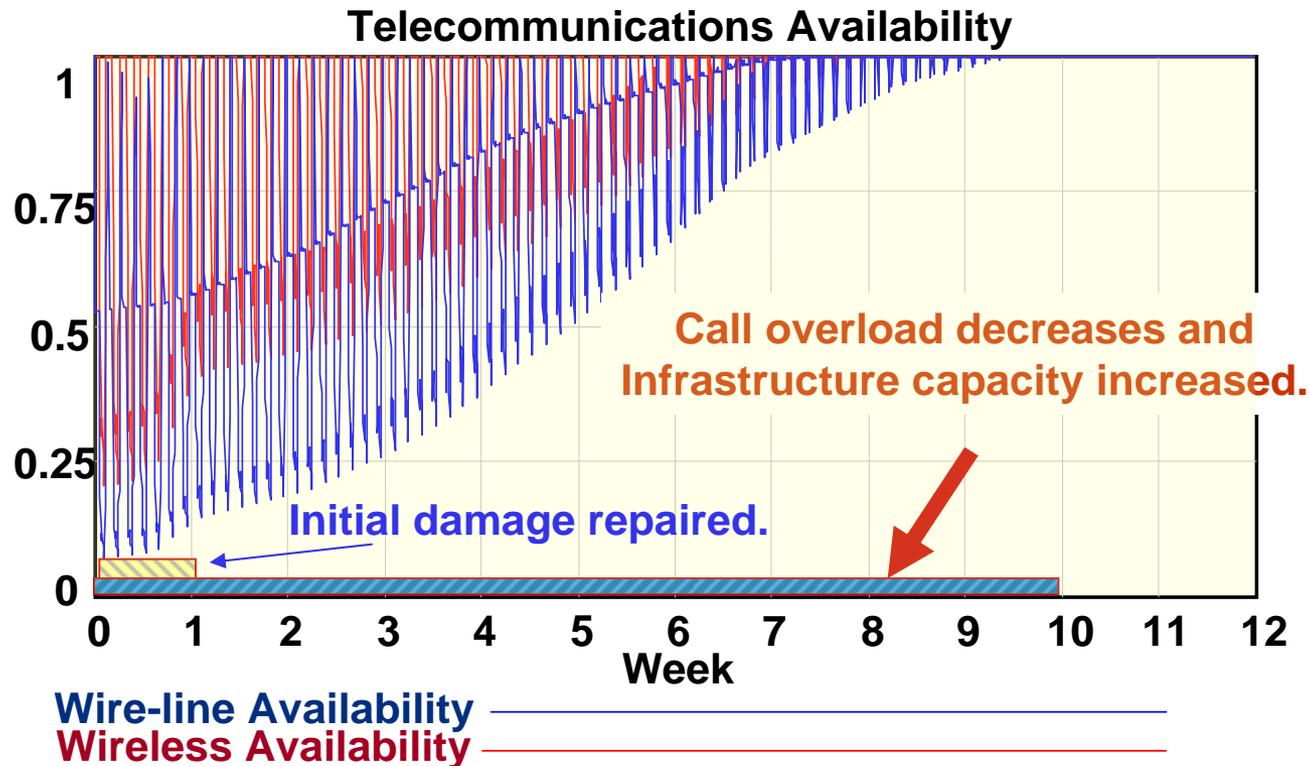
Model also estimates impact of such factors as gasoline supply and law enforcement availability

# Effects on Electricity Demand vs. Supply



*For this example city, more than adequate electrical supply is available. Although growth is expected, it is unlikely to require very significant infrastructure investments.*

# Metropolitan Telecommunications



Telecommunications capacity diminishes in first few days to a week while call demand increased dramatically, as much as three times normal volume

*Telecom suffers from an initial call overload with short term loss of wire-line and wireless capacity. Rapid repair and 25-40% increases in capacity over 10 weeks achieves full capacity for new population level.*

Telecommunications infrastructure will be required to increase capacity