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Resilient Urban Infrastructure

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The city of the future needs smart and sustainable infrastructure solutions

Goal: Competitiveness (economy, quality of life, environment)

The city of the future needs



- Efficient transportation of people and goods



- Efficient use of resources
- Low emissions



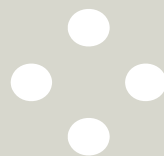
- Social support system
- Urban security



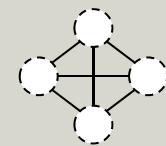
- Reliable and efficient supply of energy
- Clean technology

Fundamental change



From isolated solutions ...



... to interconnected and smart infrastructure solutions



The Infrastructure & Cities Sector has an increased focus on city needs

Structure		Key facts 2012	Thought Leadership
Solutions Systems Products Services	Rail Systems	<ul style="list-style-type: none"> • Revenue € 17.6 B • Profit € 1.1 B • Employees 89,000 • City Account Managers all over the world • 5 cities in the top 20 of our customers • Comprehensive portfolio 	 <ul style="list-style-type: none"> • Knowledge center "The Crystal" • 3 City Centers of Competence on 3 continents • Urban Research • Partnerships, e.g. with
	Mobility and Logistics		
	Low and Medium Voltage		
	Smart Grid		
	Building Technologies		
			

Thailand, Bangkok 2011



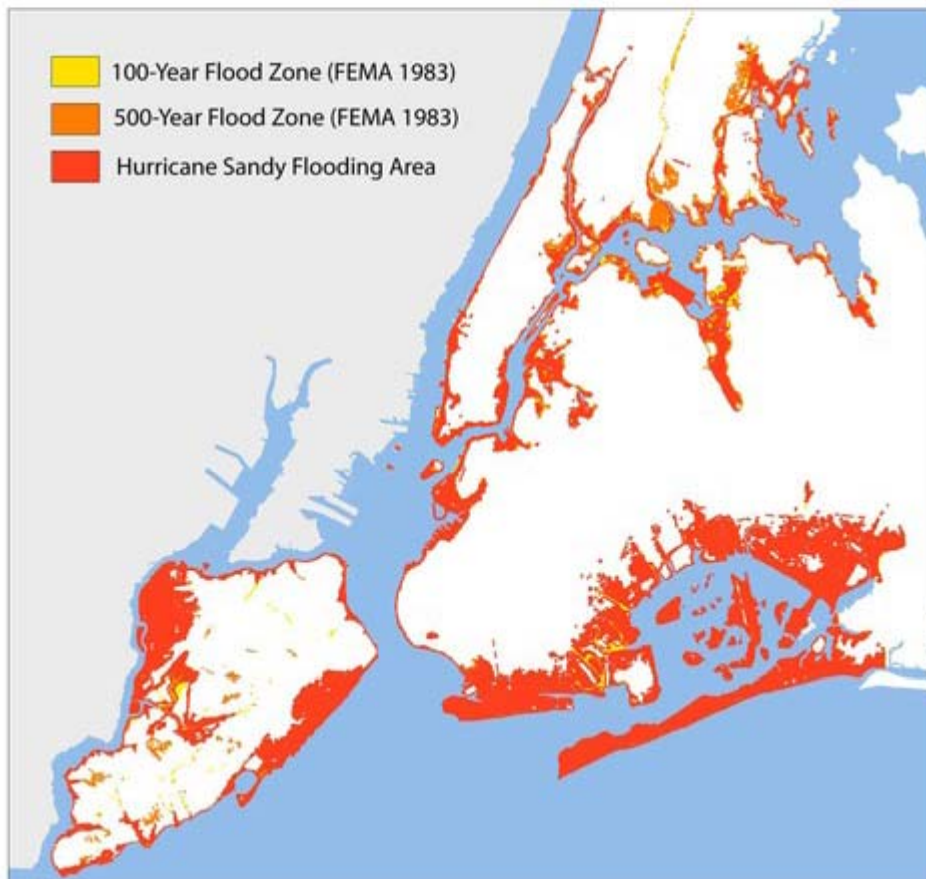
- 6 months flooding in Thailand affected more than 13 million people.
- 14,000 factories under water
- Manufacturing stoppages led to rise in prices of essential components; i.e. Hard Disk prices rose 40%
- Enterprises expressed doubts about investing in Thailand

**Estimated damages:
US\$45 B**

Photo source: Bazuki Mohammed – Reuters

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USA, New York City 2012

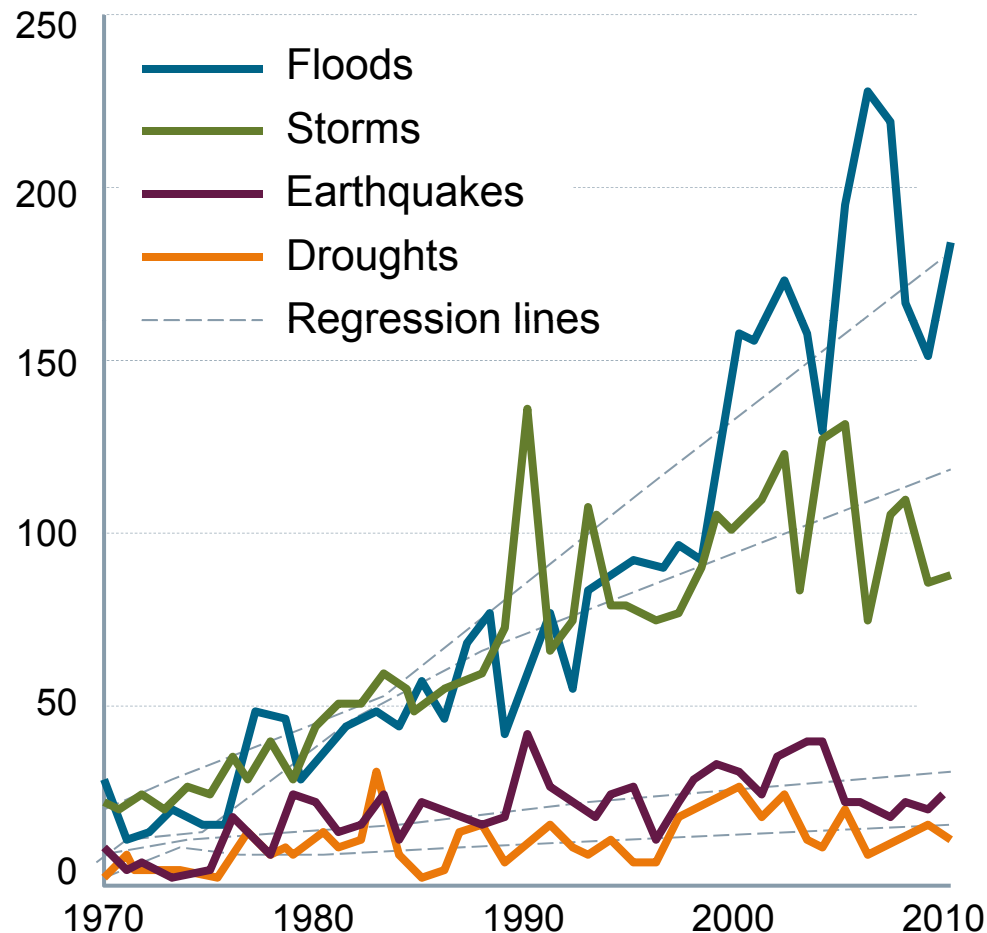


*Federal Emergency Management Administration: 2/3 of storm surge damage exceeded 500 year FEMA demarcation in New York City

- Hurricane Sandy was second costliest in US history
- More than 8 million people without power
- NYSE down for two days – prior 2 day stretch was in 1888
- 2/3 of storm surge damage exceeded 500 year FEMA* demarcation

**Estimated damages:
US\$50 B**

Weather patterns are becoming more extreme, mostly due to climate change.



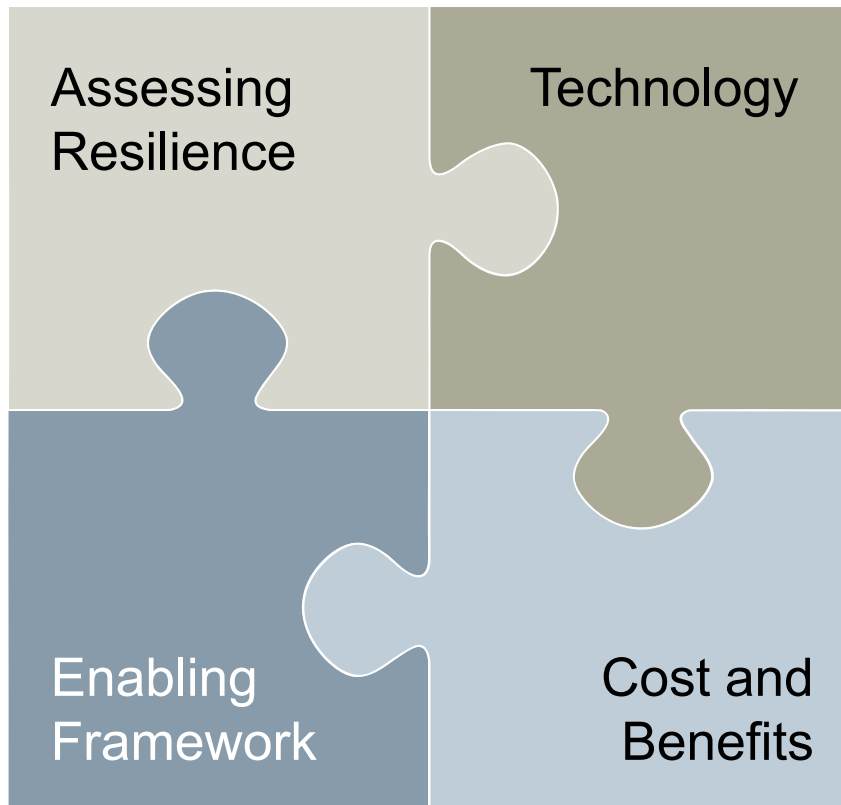
- Climate change leads to higher temperatures, rising sea levels and more rainfall
- Increasing number of extreme weather events
- Increasing urbanization and settlement patterns lead to higher damages

**Estimated damages 2012:
US\$160 B worldwide
(67% in USA)**

Figure 1: Number of recorded disasters
Source: EMDAT-CRED, Brussels

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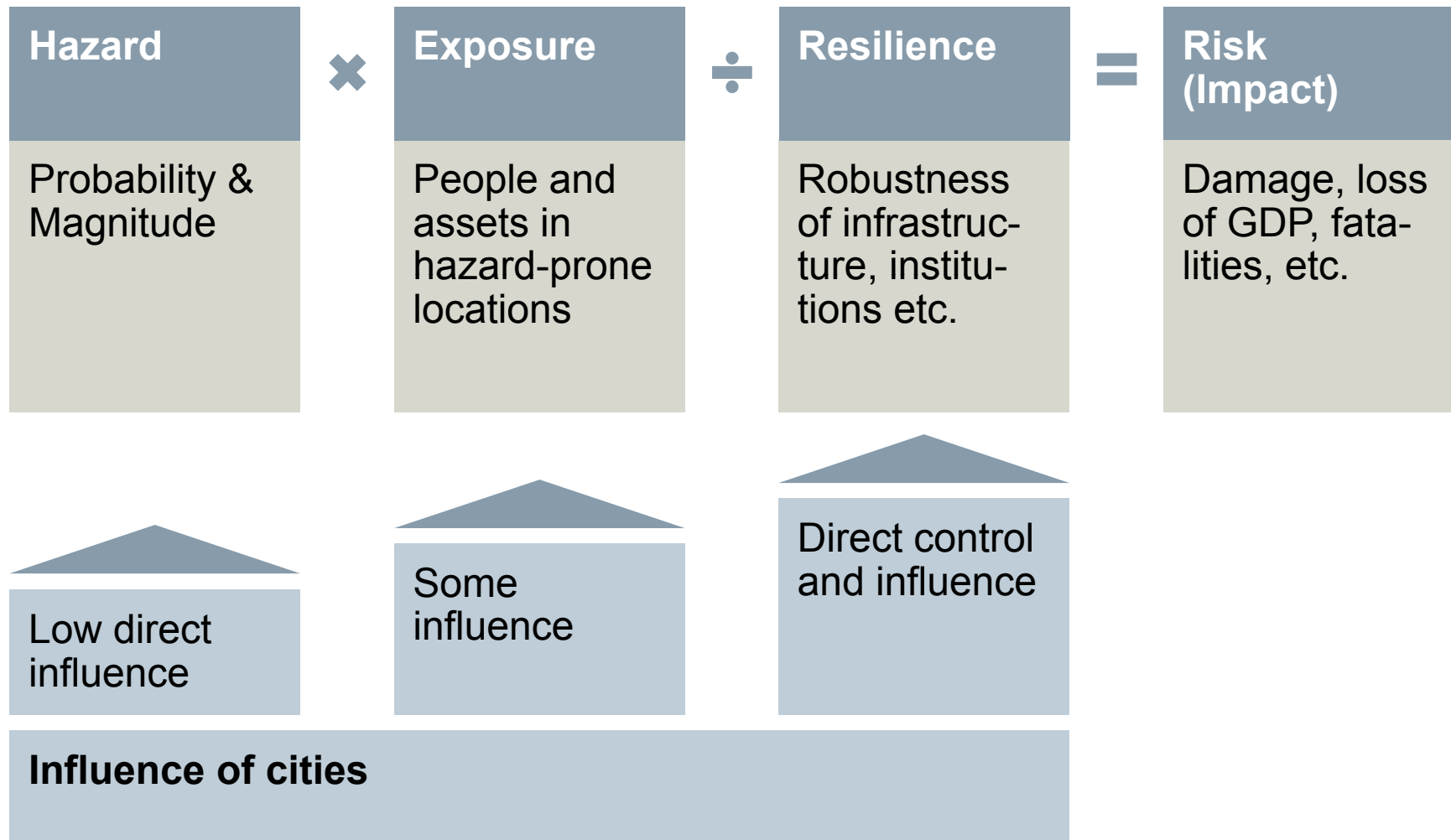
A report to help operationalize resilience



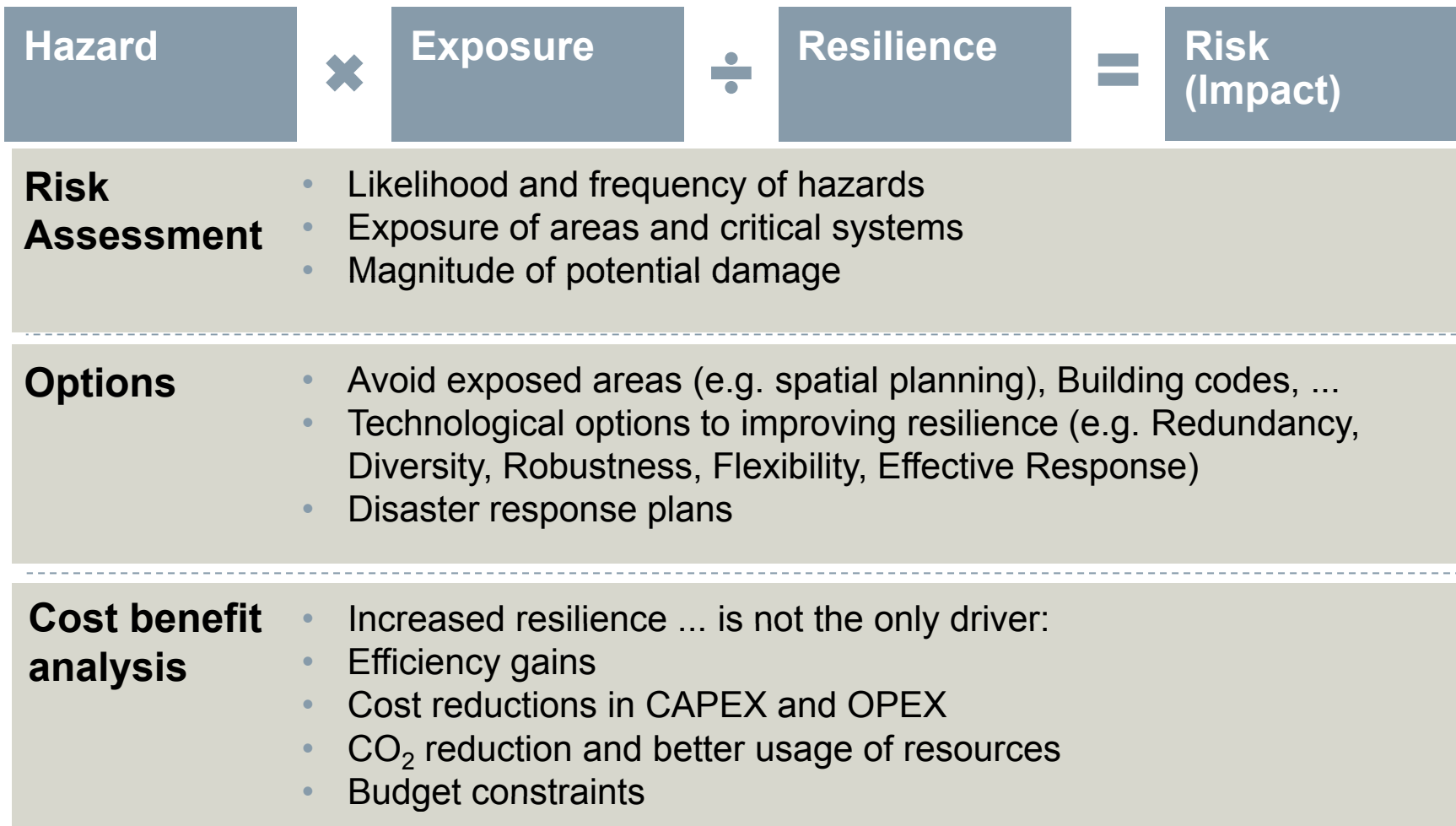
Research approach

- Collaboration between **Arup, RPA and Siemens**
- Focus on **energy, transportation, water** technologies and trends
- How to **minimize disruption**, and quickly **restore** basic functionalities
- How to **get there** and where to start
- Role of **policies & regulations**
- **Cost** and financial **benefits**
- **NYC case study**

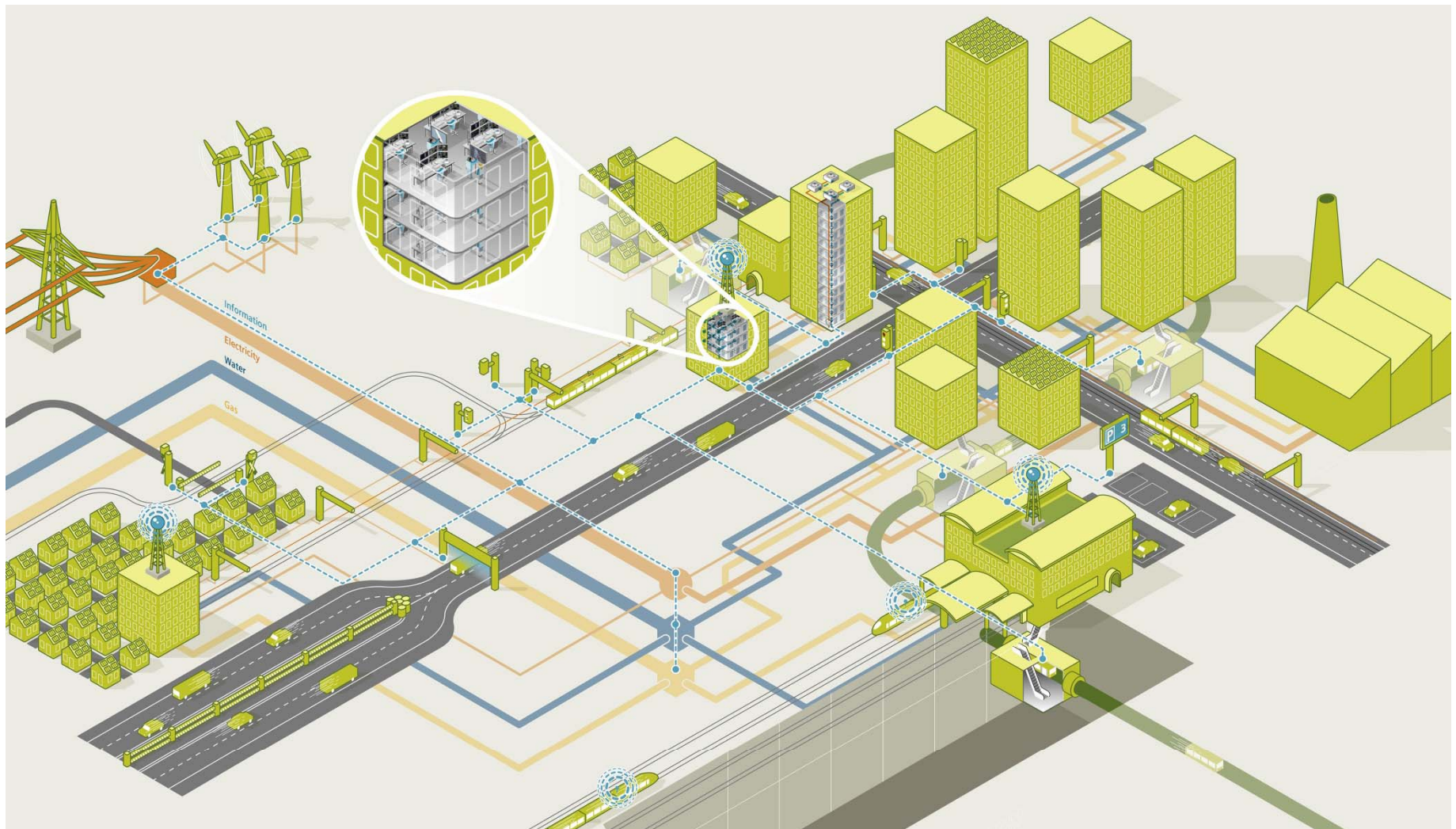
Increasing resilience reduces risk



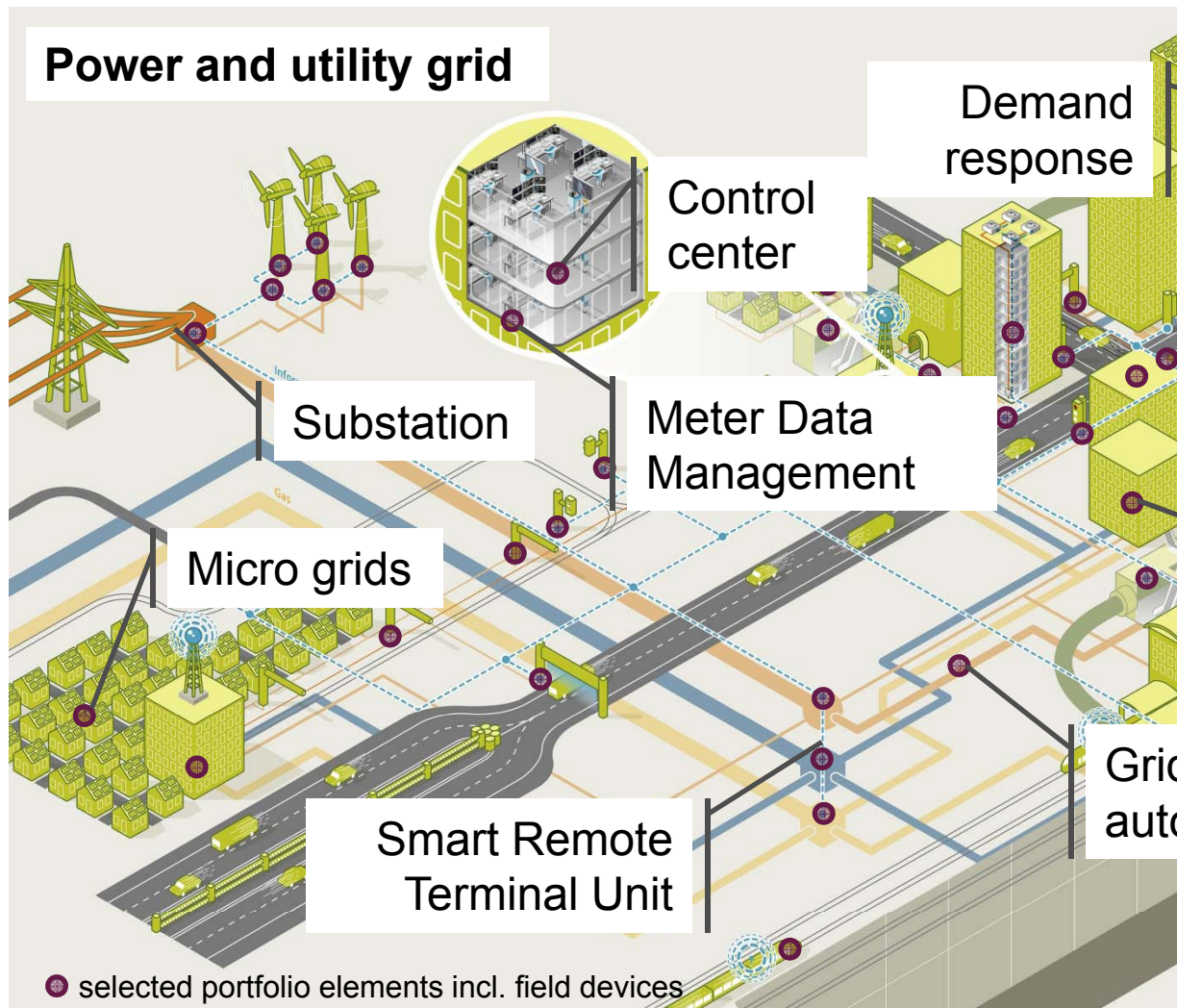
How to get to a resilience action plan



Siemens Infrastructure & Cities Sector – The power house for infrastructure automation



An automated power grid allows for greater optimization and security of supply



Resilience benefits

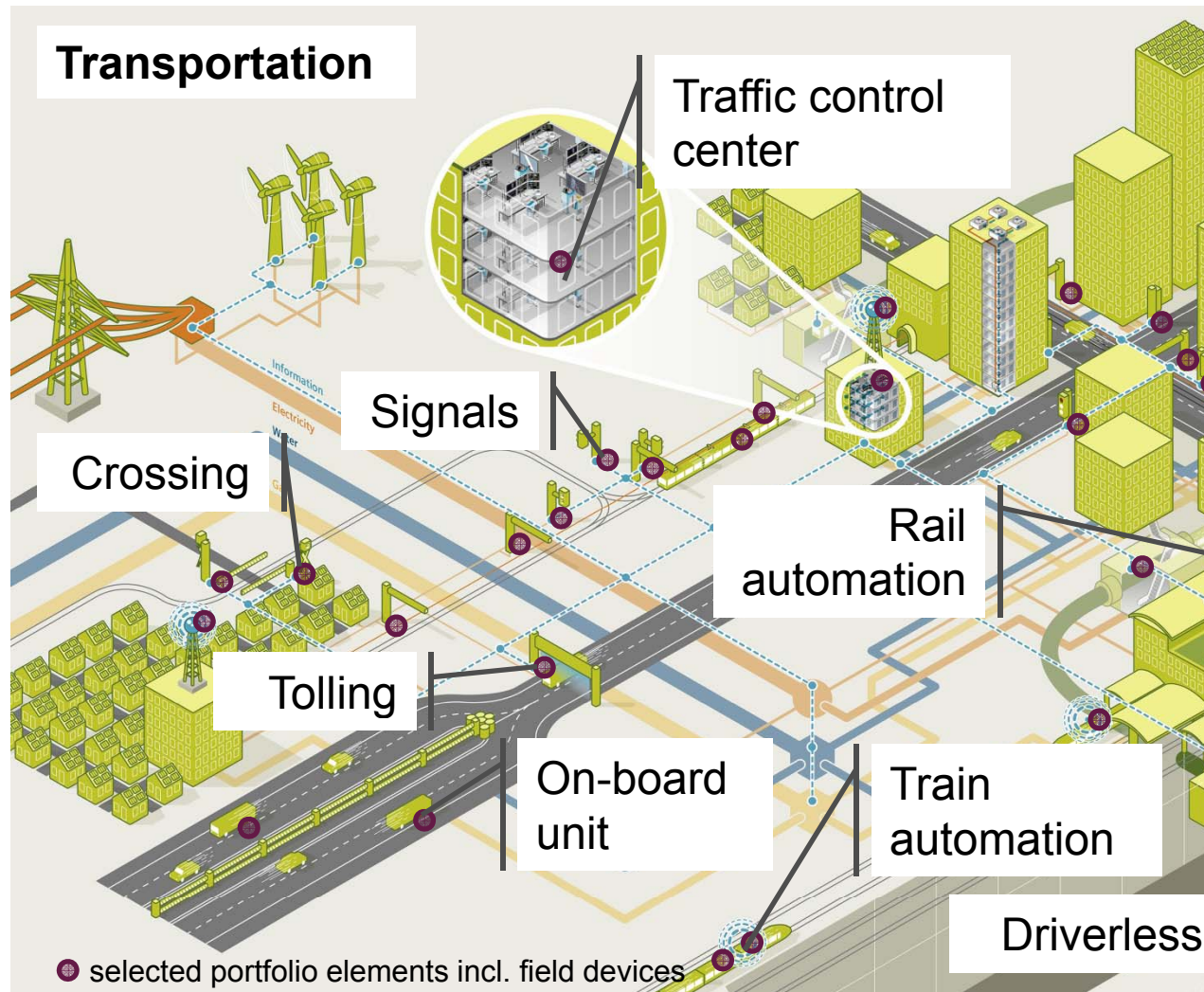
- Reduces critical peak loads
- Maintains power supply for crucial infrastructures
- Enables quick restoration
- Flexible use of sources increases **Redundancy**
- Increases **Robustness** (e.g. isolates faulty sections to prevent outages)

Example: Energy storage system Siestorage



- Protects critical infrastructure
- Compensates outages
- Provides peak power
- Stabilizes the grid
- Immediate start capability
- Allows for integration of renewables

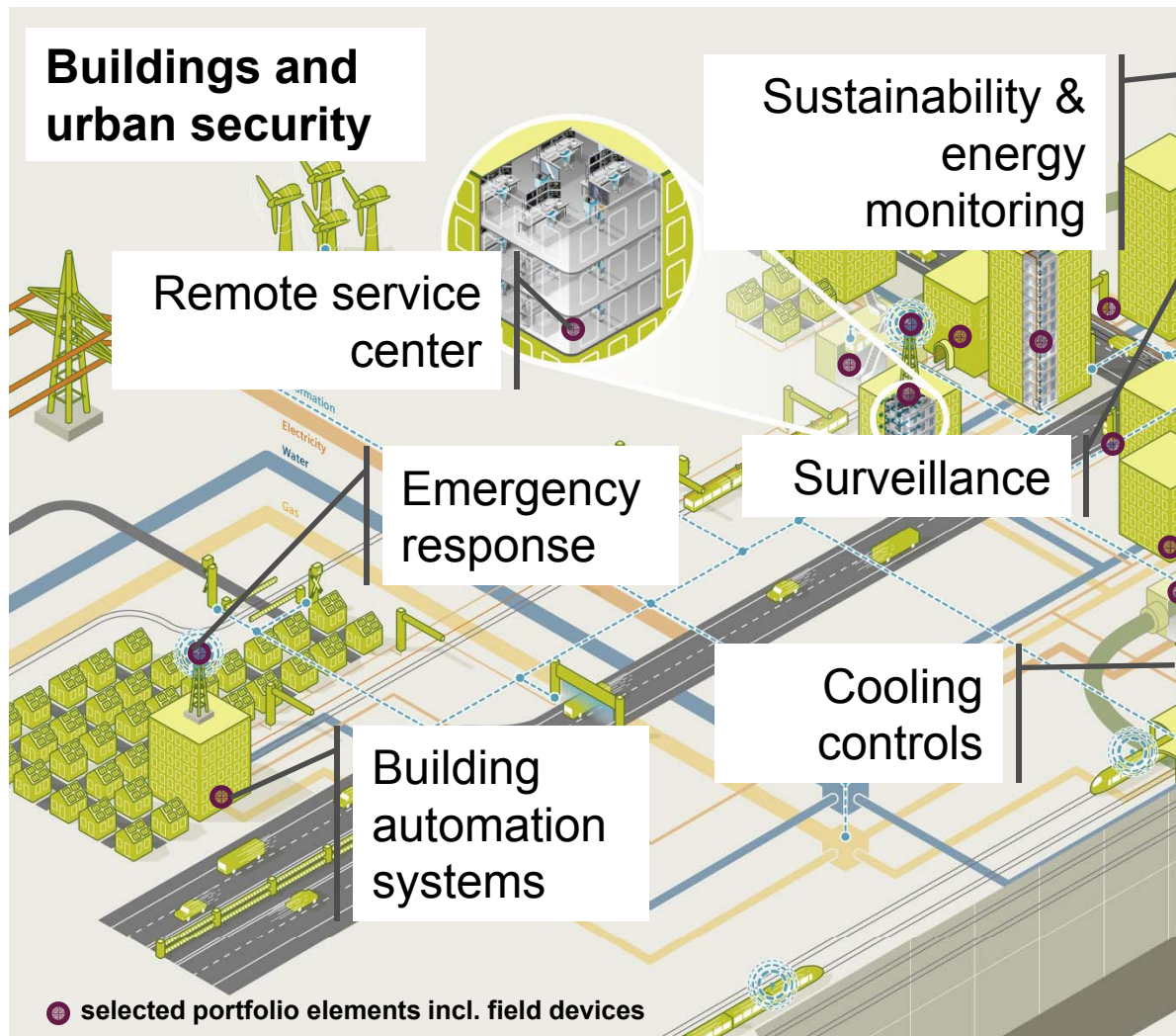
Automation allows for greater utilization of the existing transportation network



Resilience benefits

- Provides alternative modes of transport
- Re-routes traffic
- Keeps passengers informed
- Gives priority to emergency vehicles
- Prevents accidents
- Increases **Diversity and Redundancy**

Intelligent technology makes buildings and public spaces more efficient and secure



Resilience benefits

- Early detection and elimination of fire
- Early identification of suspicious activity
- Prevents unauthorized intrusion
- Integrates & coordinates emergency forces
- Swift evacuation
- Increased **security** and effectiveness of emergency **response**

Proactive Resilience: Co-Op City, Bronx, New York



- 14,000 apartment units
- 35 high rise buildings
- Decided to get off the main power grid to control price of power
- Installed 40MW CHP power plant
- When Sandy hit, lights stayed on for more than 60,000 residents

Resilience investments and enabling actions for NYC Metro area's power grid

	Short term	Medium term	Longer term
Technology and investment	<ul style="list-style-type: none"> • Gas-insulated switchgear • Flood defences • Undergrounding • Manual demand management 	<ul style="list-style-type: none"> • Smart meters & IT infrastructure • Decentralized generation • Smart grid ready appliances 	<ul style="list-style-type: none"> • Automated demand management • Relocating installations • EV to grid
Enabling actions	<ul style="list-style-type: none"> • Assessment of critical systems • Building codes • Integrated control centers 	<ul style="list-style-type: none"> • Regulatory reform • GIS asset monitoring 	<ul style="list-style-type: none"> • Real-time pricing • Integrated development and energy planning

Investment into New York Metro area's grid resilience pays back through damage reduction and efficiency gains

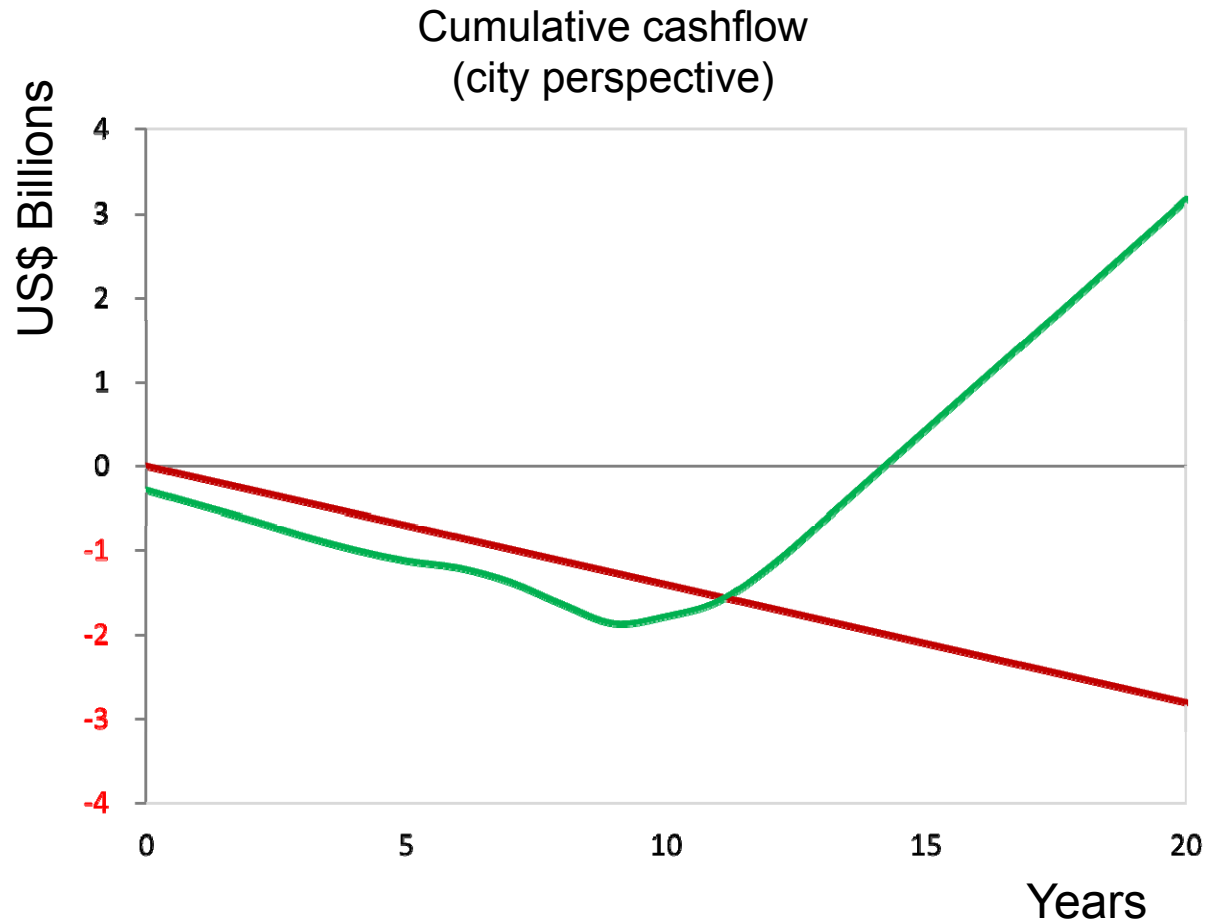
Two scenarios:

"Proactive"

- Full implementation of suggested actions
- Investment: ~ US\$3 B
- Reduced damage cost: ~ US\$2 B
- Efficiency gains: ~ US\$4 B

"Reactive"

- Anticipated damage to the power grid over 20 years: up to US\$3 B



Action points

Resilience is a must to become and remain competitive



Resilience should be an integral part of planning and can be achieved through normal operational investment cycles



Resilience provides additional benefits, e.g. energy efficiency, safety & security etc.



Intelligent, automated infrastructure is a major lever for resilience



For additional information



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