



**Asia-Pacific  
Economic Cooperation**



**APEC Sustainable Energy Center**

# **Urban Disaster Resilience in APEC Region**

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# APEC Integrated Urban Planning Report



## APEC Integrated Urban Planning Report – Combining Disaster Resilience with Sustainability («APSEC 2020»)

Output of self-funded project  
**EWG 09 2019 S**

First draft presented at the 5<sup>th</sup> Asia-Pacific Energy Sustainable Development Forum September 2019

Originally planned as joint co-operation project with APEC Policy Support Unit PSU, but PSU did not reach consensus to co-operate

Revised draft presented at the 6<sup>th</sup> Asia-Pacific Energy Sustainable Development Forum, September 2020

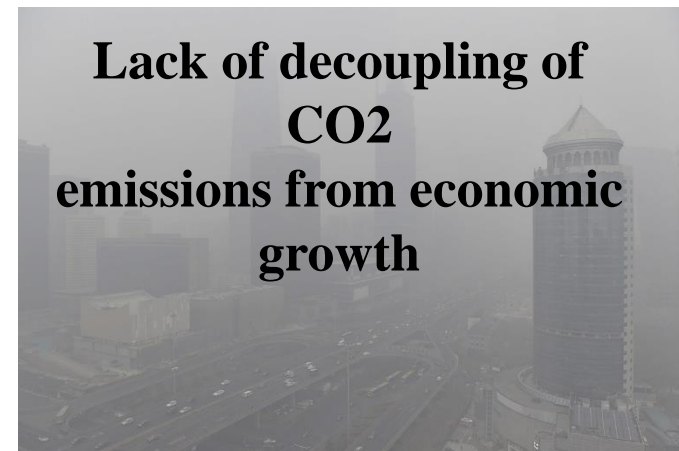
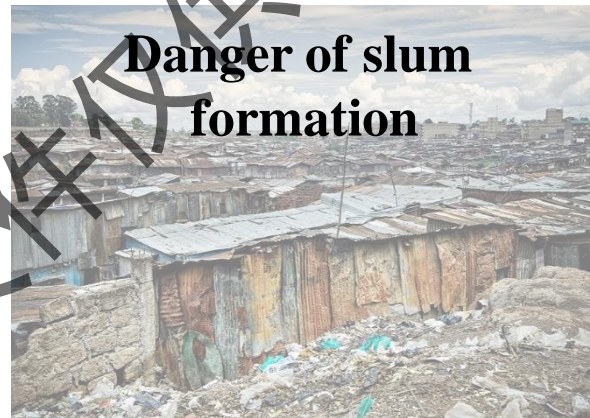
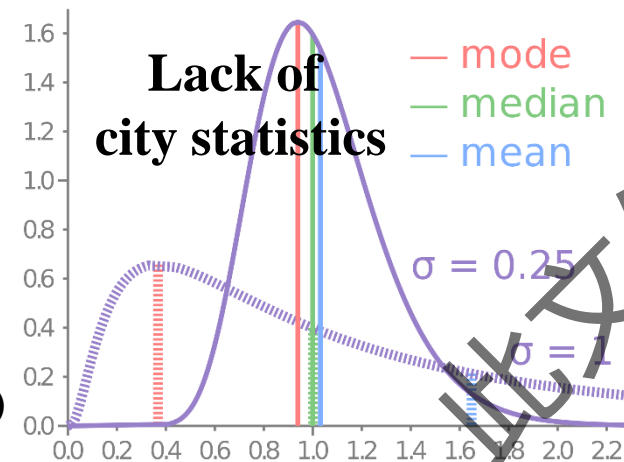
Not yet submitted for endorsement

# APSEC (2019): 5 sustainability deficits of APEC cities

## Sustainability deficits



(APSEC 2020)



(APSEC 2020)



## Threats from Climate-Related Disasters

### Disasters originating from inland waters

- **Flashfloods:** overload of local water drainage
- **Riverine floods** (possibly caused by far upstream rain)
- **Droughts**
- **Landslides**
- **Specific threats:**
  - **Locust infestation**
  - **Subsidence**
  - **River sedimentation disturbance**

### Disasters originating from coastal floodings / cyclones

Tropical windstorms

Sea level rise

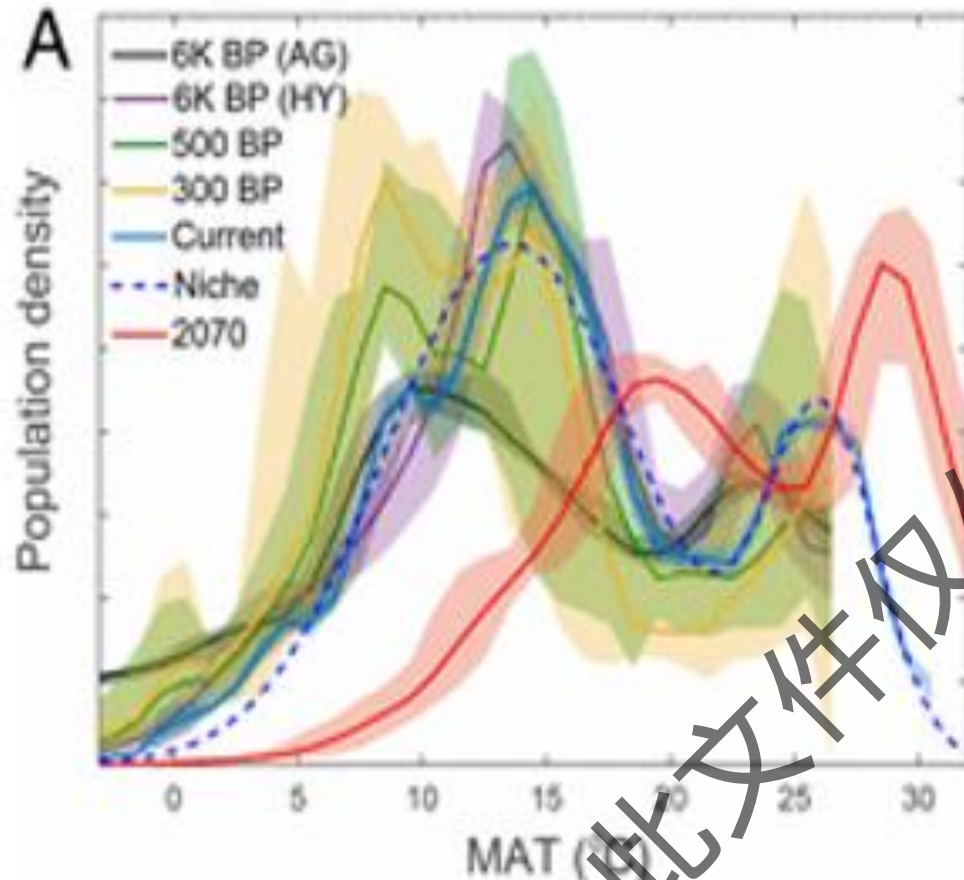
### Disasters from extreme temperatures

Change of local climate

Destruction of human climate-niches

Wildfires

## Destruction of the Traditional Climate Niches



Currently (blue) world population lives in two niches: 15°C (larger) and 25°C (smaller)

BAU 2070 (red) world population will have to live in two different niches: 19°C (small), 29°C (large)

Agriculture severely impacted in the 29°C niche

Scheffer and others (2020)



# Deaths due to Disasters in APEC Region 1900 - 2018

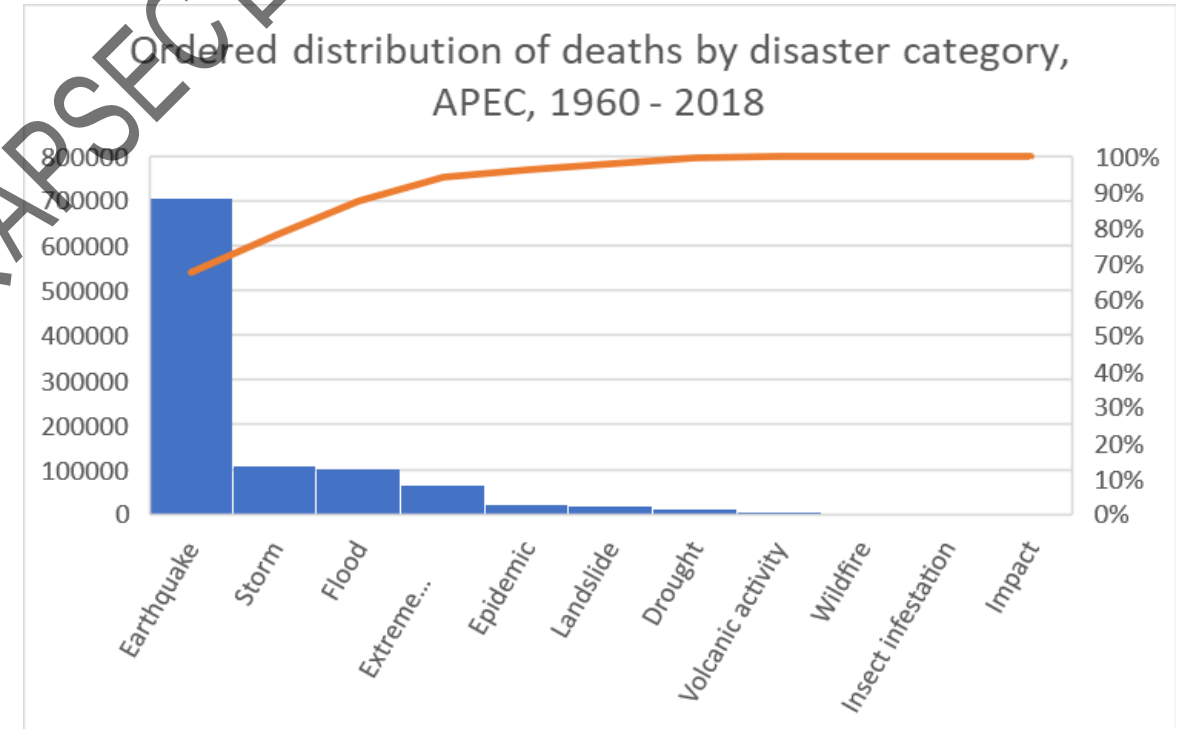
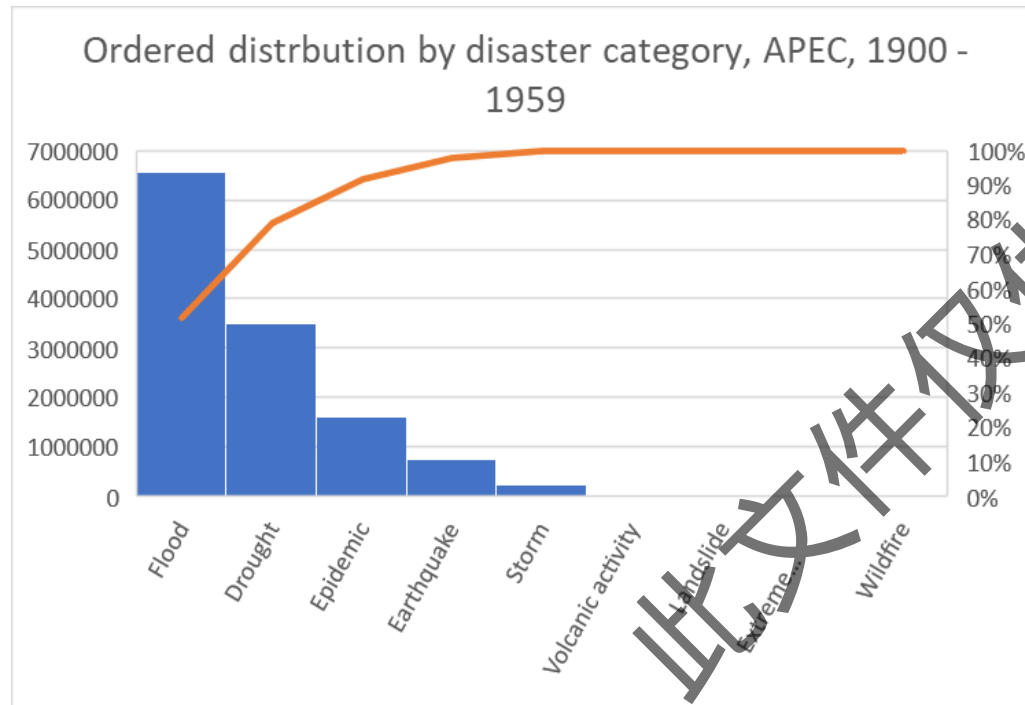
Improved resilience between period 1900 – 1959 and 1960 - 2018

**Floods: 65 times less deaths**

**Droughts: 258 times less deaths**

**Epidemics (before COVID-19): 73 times less deaths**

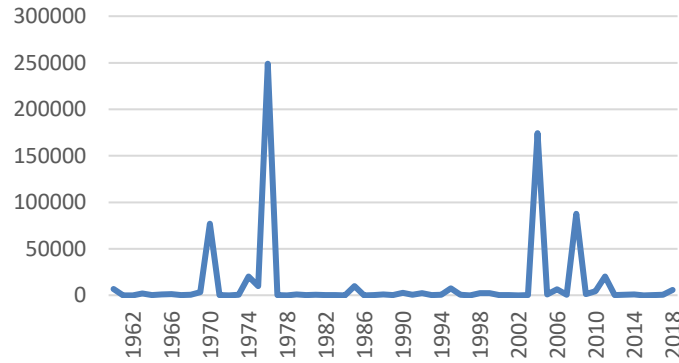
**Earthquakes: only 7% less deaths**



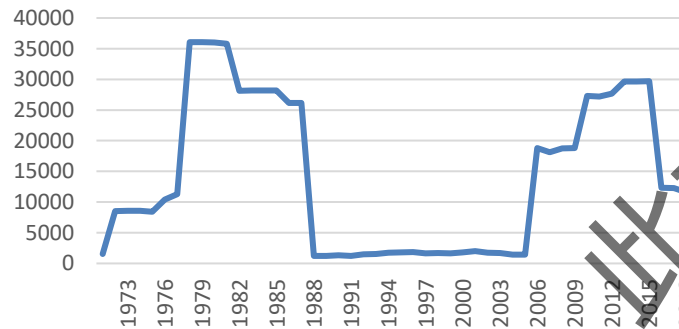
# Trends in deaths due to disasters 1960 – 2018 APEC

Statistically not measurable decrease

Deaths from geological disasters, APEC, 1960 - 2018

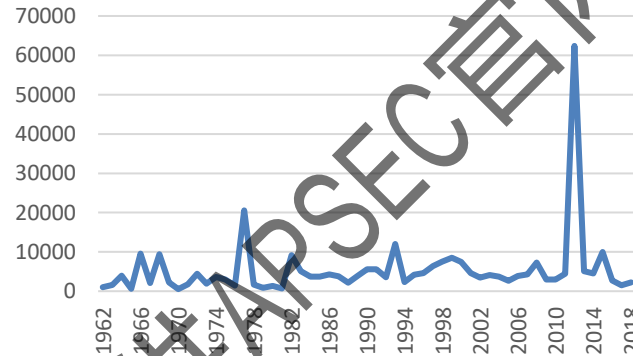


Deaths from geological disasters, 10year moving averages, APEC 1969 - 2018

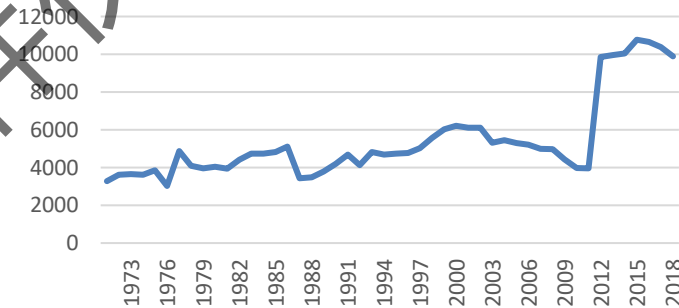


Statistically measurable increase

Deaths from hydrometeorological disasters, APEC, 1960 - 2018

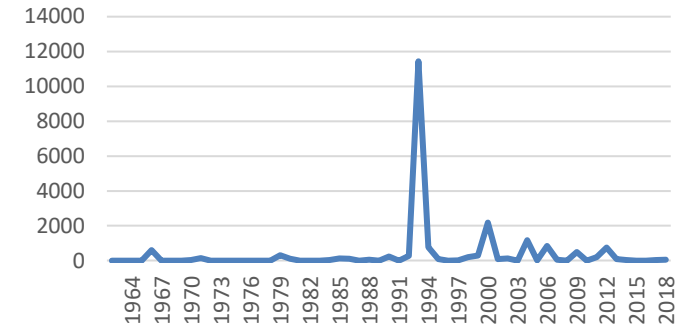


Deaths from hydrometeorological disasters, 10year moving averages, APEC, 1969-2018

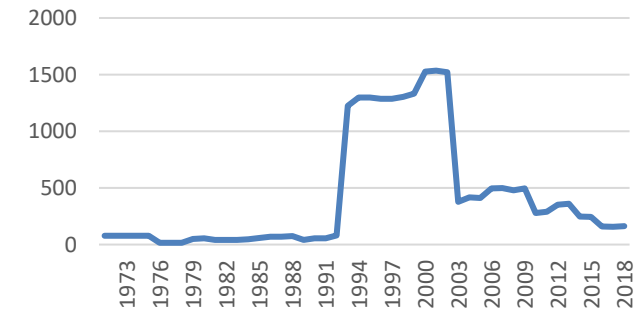


Statistically not measurable increase

Deaths from epidemiological disasters, APEC, 1960 - 2018

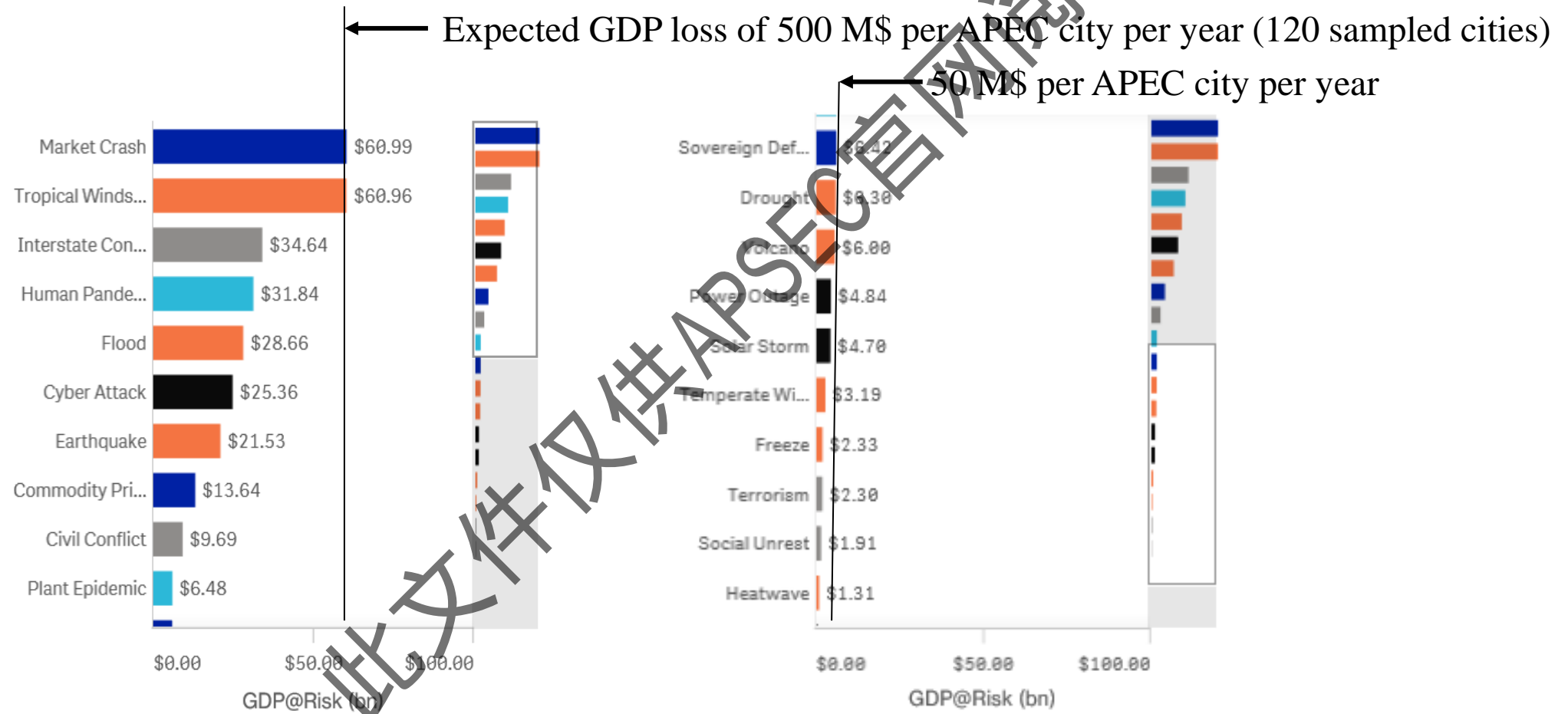


Deaths from epidemiological disasters, 10year moving averages, APEC, 1969 - 2018

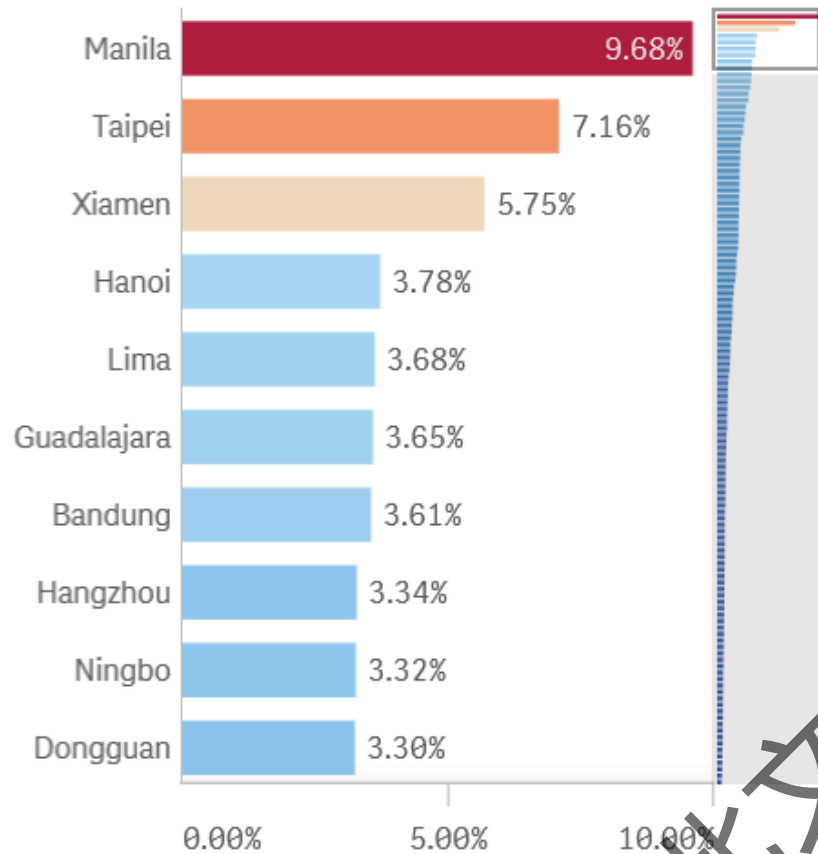




## 20 Threats to GDP of APEC Cities



## APEC Cities: highest Risk to GDP (except for war-torn cities)



Manila is worldwide the most threatened city that is not war-torn, with 9.68% GDP at risk. Manila is also the most disaster-threatened APEC city

World's most exposed cities (in %GDP) for all 22 threats cumulated are all war-torn:

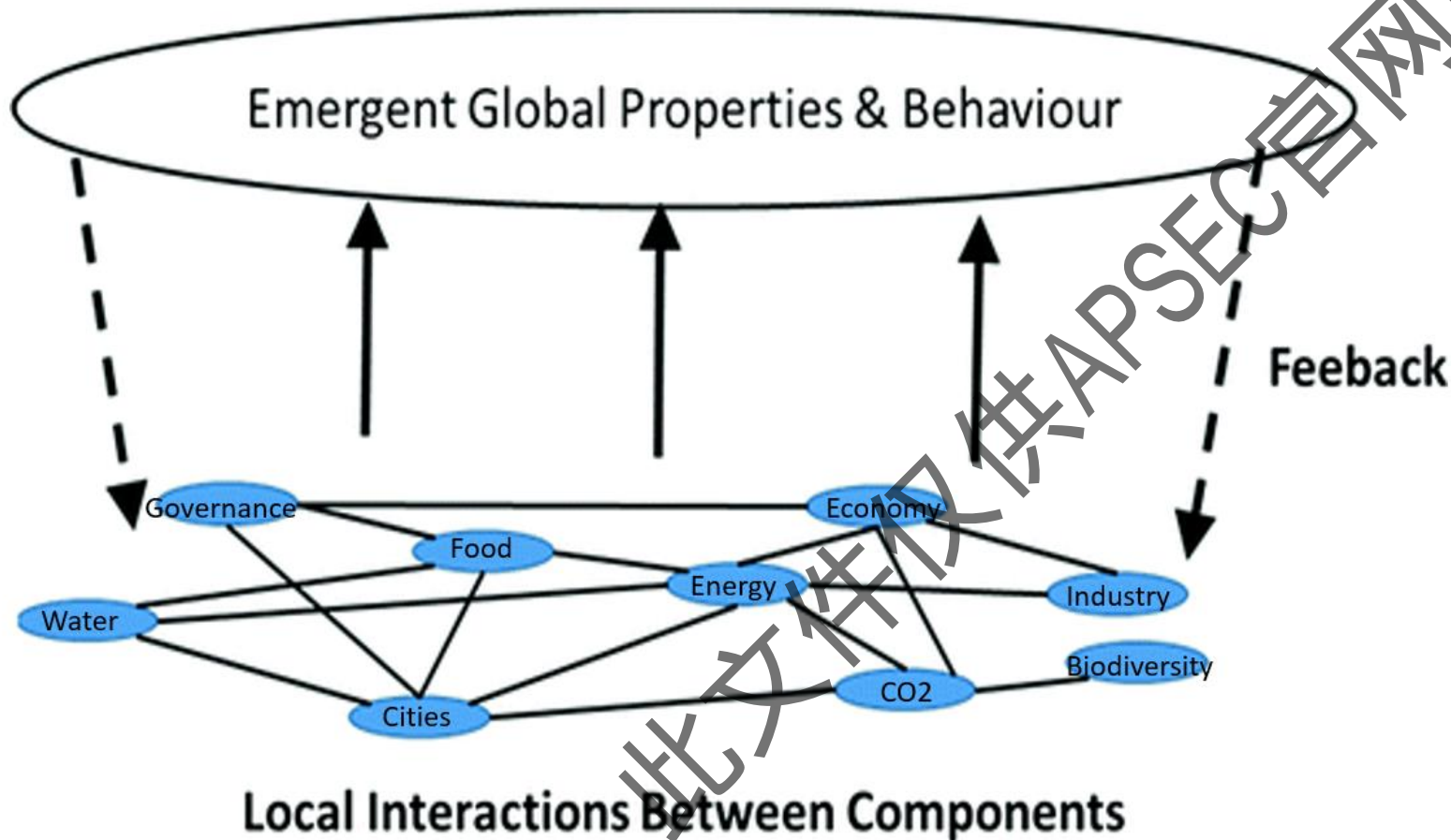
Kabul 17%,  
Tripoli 16%,  
Saana 15%,  
Baghdad 15%,  
Khartoum 13%,  
Kinshasa 11%,  
Beirut 10%

Bearable risk level (all threats) < 1-2% GDP, e.g. Hong Kong: 0.93% GDP





## Climate as Complex Adaptive System (CAS)



- Resilience is an emerging property of CAS
- Resilience of the overall system depends on interactions among its sub-systems
- Tipping point of the overall system depends on the state of the sub-systems
- Tipping point of the overall system can be quite variable, hence an overall systems collapse/major change is difficult to forecast



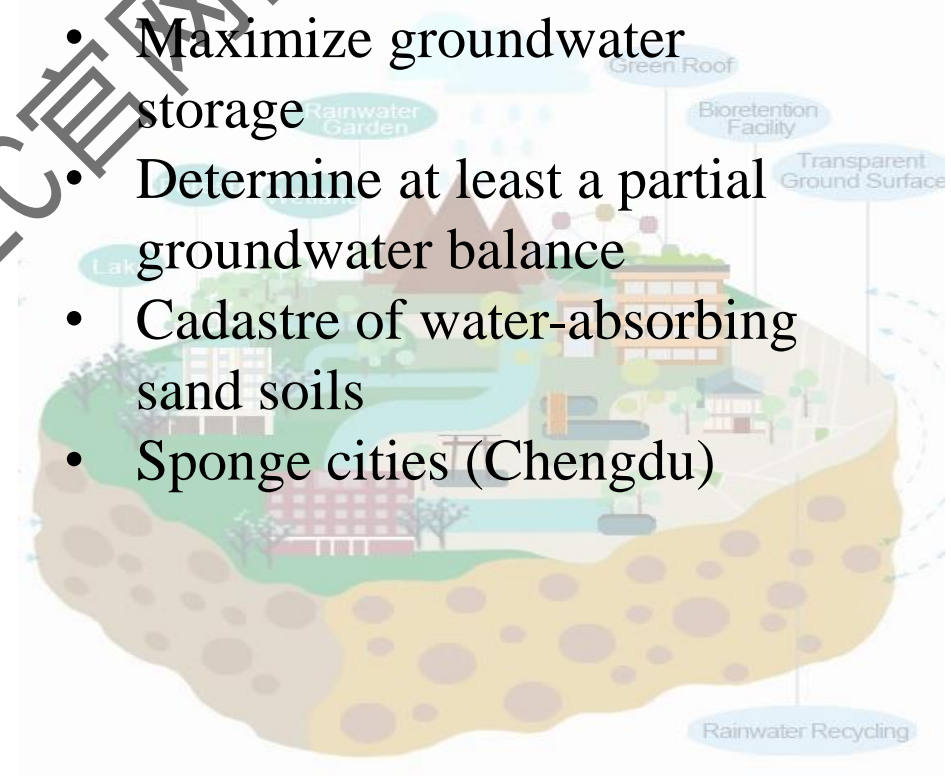
## Examples of Measures mitigating Inland Water Disasters

### River basin management

- Storage basins combined with floating PV\* and fish farms
- Highest standards for dam cascades\*
- Install variable water regulators at outflow of all lakes
- Real-time in/outflow control
- Generalize wastewater treatment\*
- Create grey-water systems
- Avoid building thermal power stations except along coasts\*
- Create flood cadastre
- Buyout chronically flooded areas

### Groundwater management

- Maximize groundwater storage
- Determine at least a partial groundwater balance
- Cadastre of water-absorbing sand soils
- Sponge cities (Chengdu)



\* Synergy with energy system

## Examples of Measures mitigating Tropical Windstorms

### Wind damage

- Improve building standards for cyclones and tropical windstorms\*
- Cyclone-resilient cityscaping (avoid freely flying objects)

\* Synergy with energy system

### Water damage

- Create coastal flood cadastre
- Buyout in unprotectable zones
- Take early and far-sighted measures against sea level rise
- Adapt Saffir-Simpson Hurricane scale to local coastal topography (local impact scale)



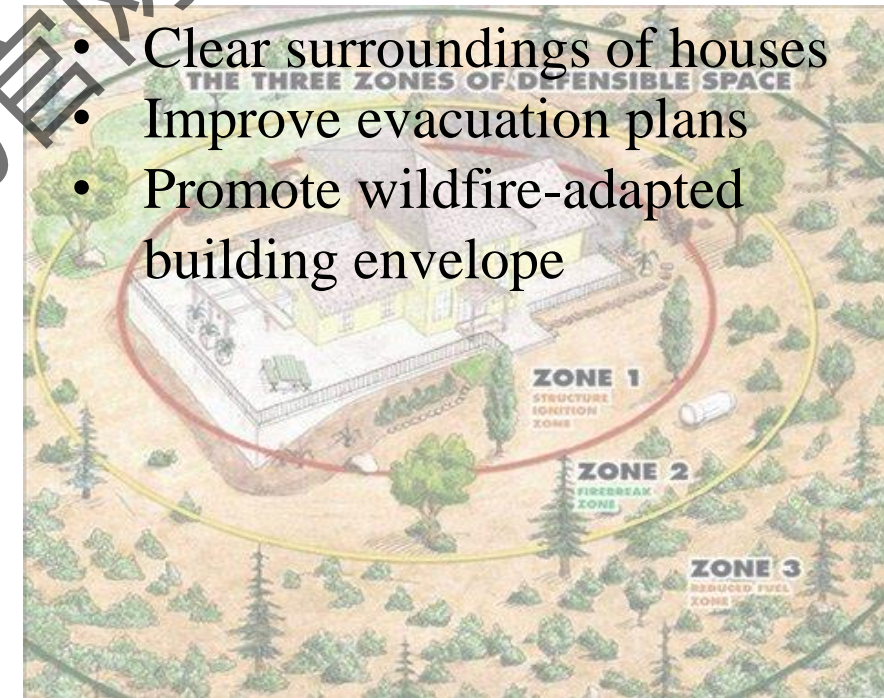
## Examples of Measures mitigating Extreme Temperatures

### Extreme temperatures

- Generalize passive housing and solar-powered HVAC\*
- Generalize use of renewables for space cooling\*
- Promote solar-powered district cooling\*
- Define cooling as energy product\*
- Generalize heat-reflective paint\*
- Promote integrated PV-crop cultures\*
- Promote PV-cooled greenhouses\*

### Wildfires

- Clear surroundings of houses
- Improve evacuation plans
- Promote wildfire-adapted building envelope



\* Synergy with energy system



## Example of Measures against Disasters of Geological Origin

### Earthquakes

- East Asian >1000 years old architectural techniques (taishin, seishin)
- Modern approach: base isolation (menshin)
- Regulate risk of artificial earthquakes (e.g. fracking)\*
- Existing buildings: combined seismic and energetic exterior insulation\*
- Emergency preparedness (skills and drills, resilient communities)

### Tsunamis

- All measures are necessary
- Multiple protections
- Seawall against 150-year events
- Vegetation buffers
- Vertical evacuation
- Early warning systems
- Emergency preparedness (skills and drills, resilient communities)

### Volcanic eruptions

- Small eruptions: tourist attractions
- Middle-size eruptions: Avoid construction, water collection and agriculture in danger zones
- Large eruptions: global events (e.g. Tambora 1815)

\* Synergy with energy system



## Example of Measures against Epidemics – COVID-19

### Preventing spread

2002 SARS prevention measures proved largely insufficient for COVID-19  
COVID-19 requirements:

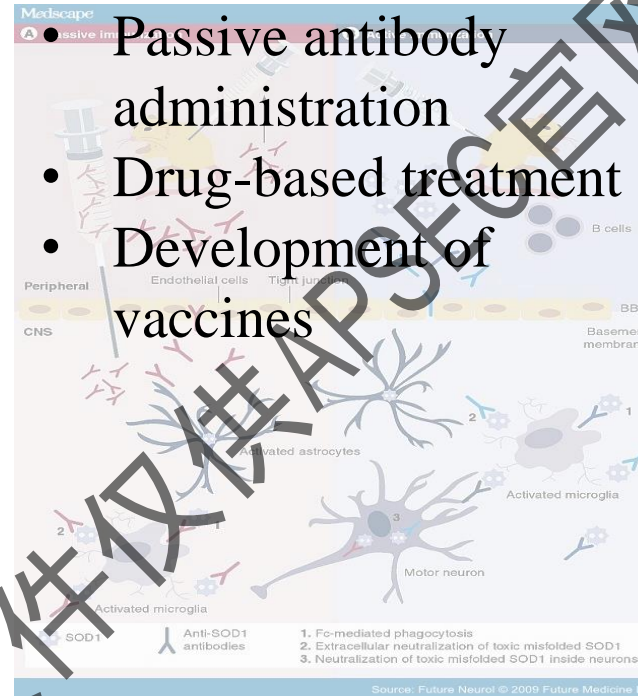
- Efficient contact tracing
- Testing, quarantining
- Physical distancing
- Dedicated hospitals

Buildings and transport infrastructure\*:

- HVAC with UV-C disinfection

### Treatment

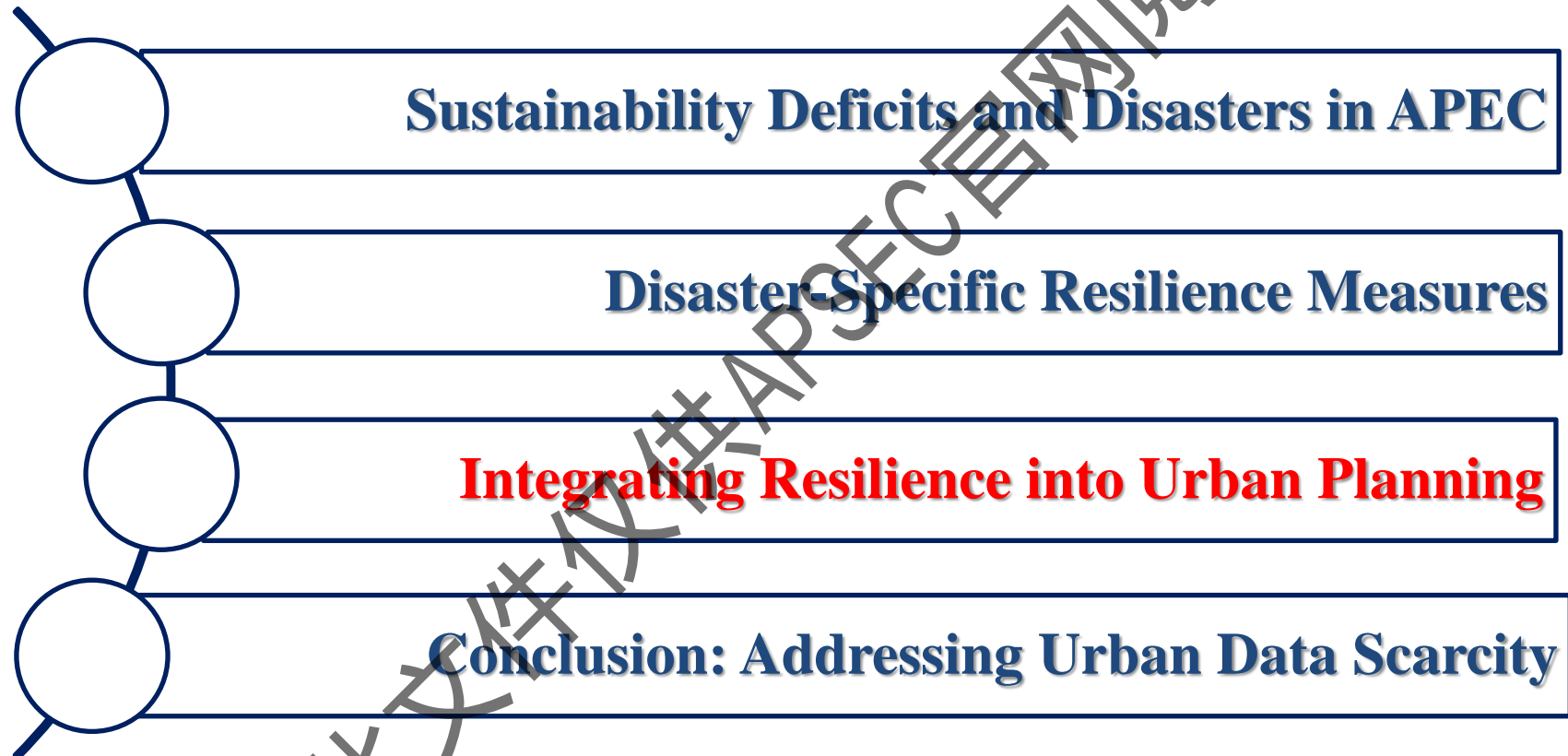
- Passive antibody administration
- Drug-based treatment
- Development of vaccines



\* Synergy with energy system

### Favouring positive impact on other sub-systems (economy, schools, IT)

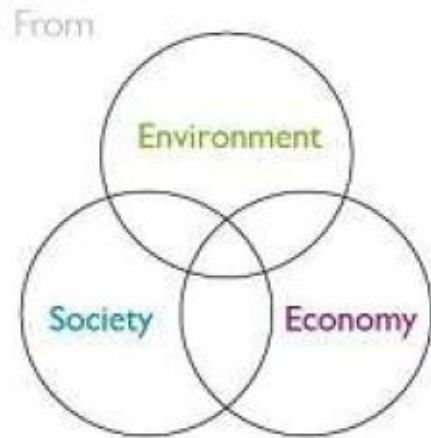
- Continuity of service planning
- Home office
- Distant schooling
- Resilient communities (skills and drills)
- Combine economic stimulus packages with key SDG targets\*





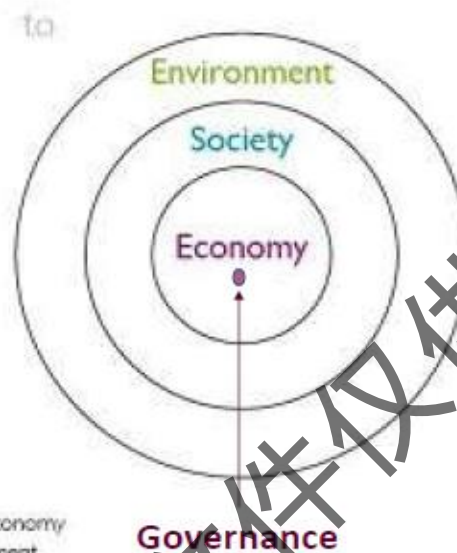
# Sustainable Development (SD) Concepts 1992 to 2019

UNCED, Rio 1992



Source: B. Giddings, B. Hopwood, G. O'Brien, Environment, Economy and Society: fitting them together in Sustainable development, Wiley-Interscience, 2002

Giddings, Hopwood,  
O'Brien, 2002



APSEC 2020



Economic goals (5)

Social goals (13)

Environmental goals (17)

Governance goal (1)

# UN Disaster Resilience Scorecard for Cities

Operational instrument of the UN Sendai Framework for Disaster Risk Reduction 2015

**Specifically applicable to cities**

10 Essentials (sets of criteria) for local disaster resilience

More than 4300 cities worldwide have started implementing this method



Preliminary assessment level: 47 indicator criteria



Detailed assessment level: 117 indicator criteria



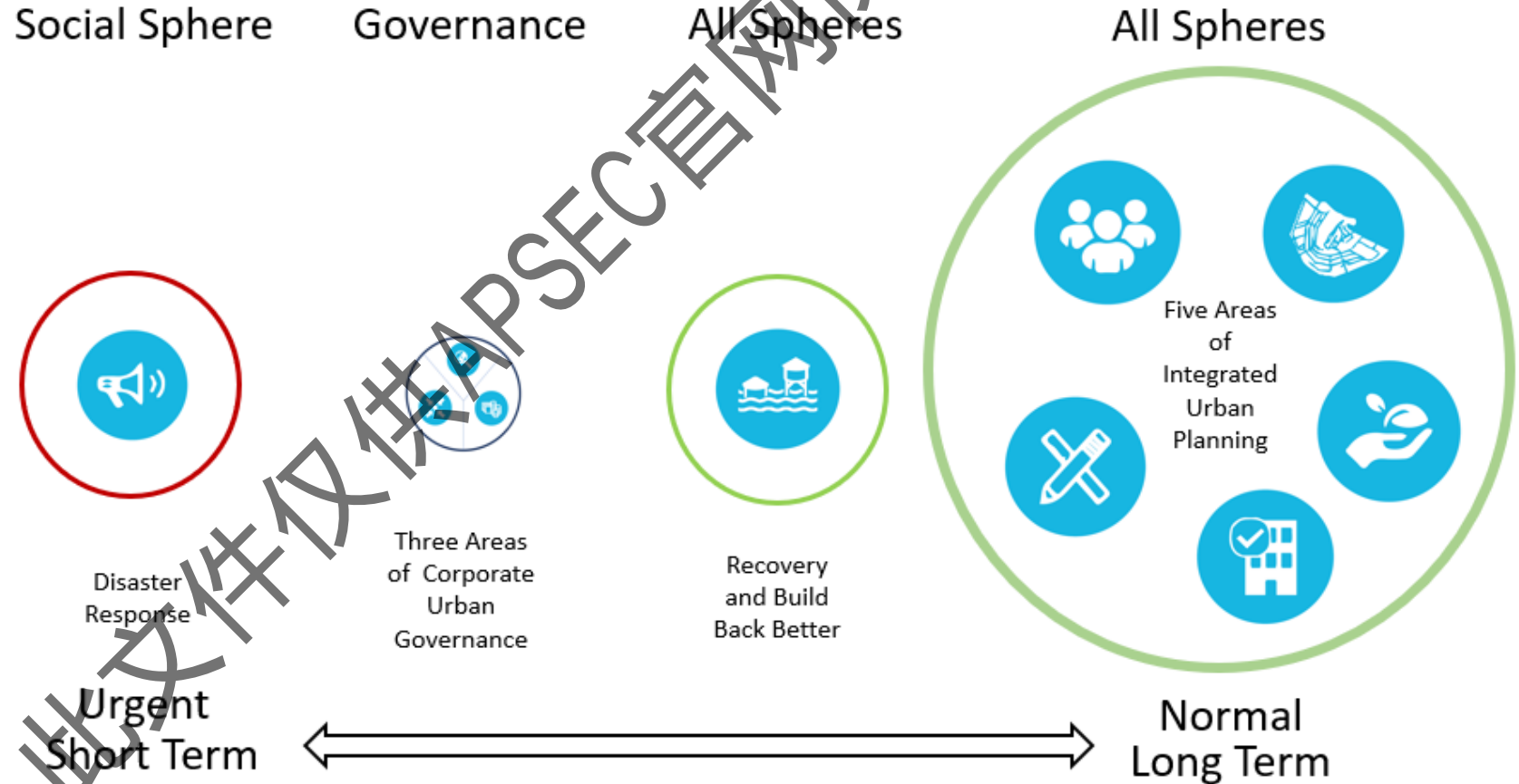
## Disaster Resilience (DR): From DR Scorecard for Cites

### Three major areas:

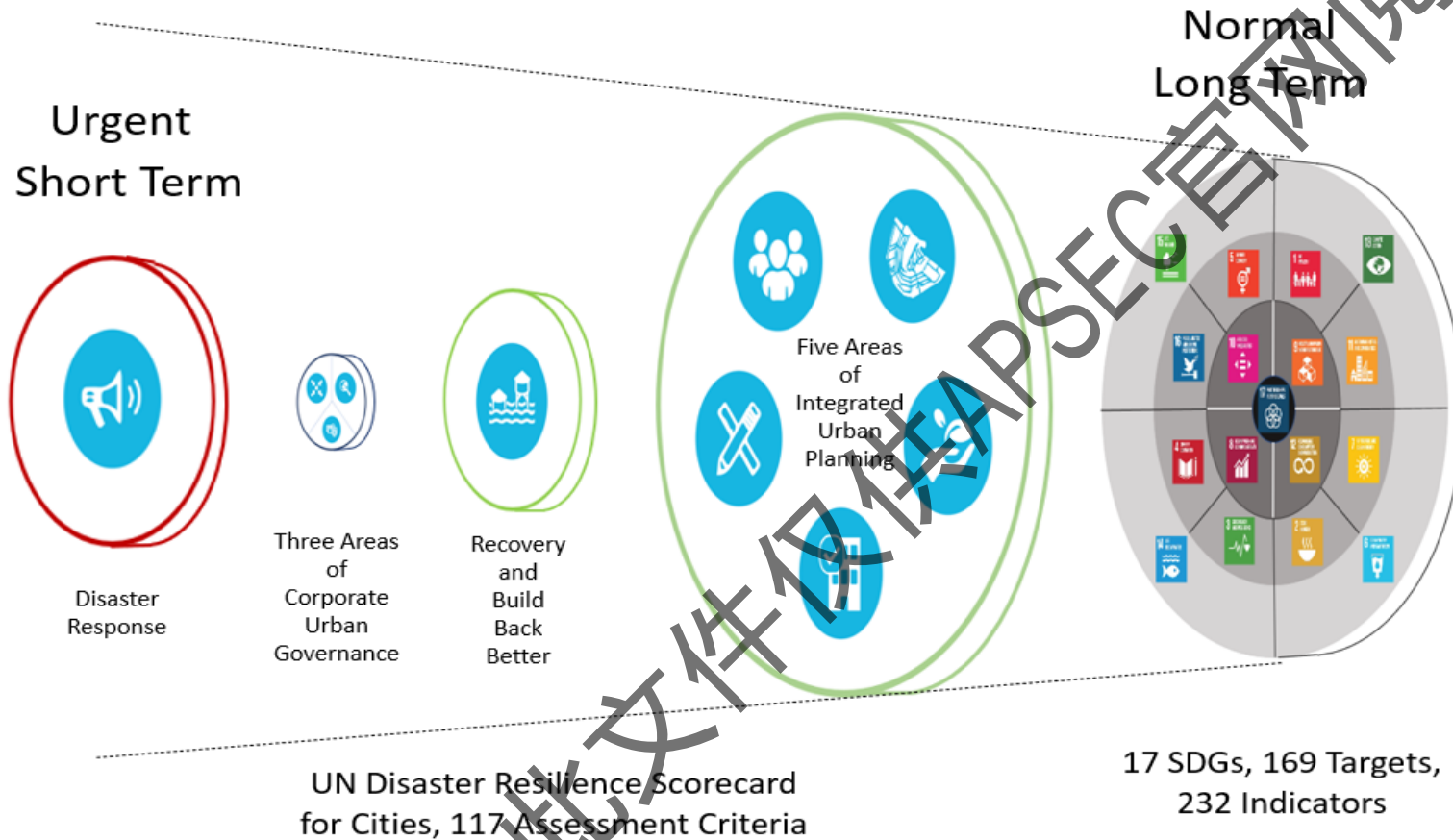
Response planning

City governance

Integrated planning



# Integrating DR with SD



Systems-theoretical elements:

SDGs = objectives or targets

Each target needs at least one instrument to attain it

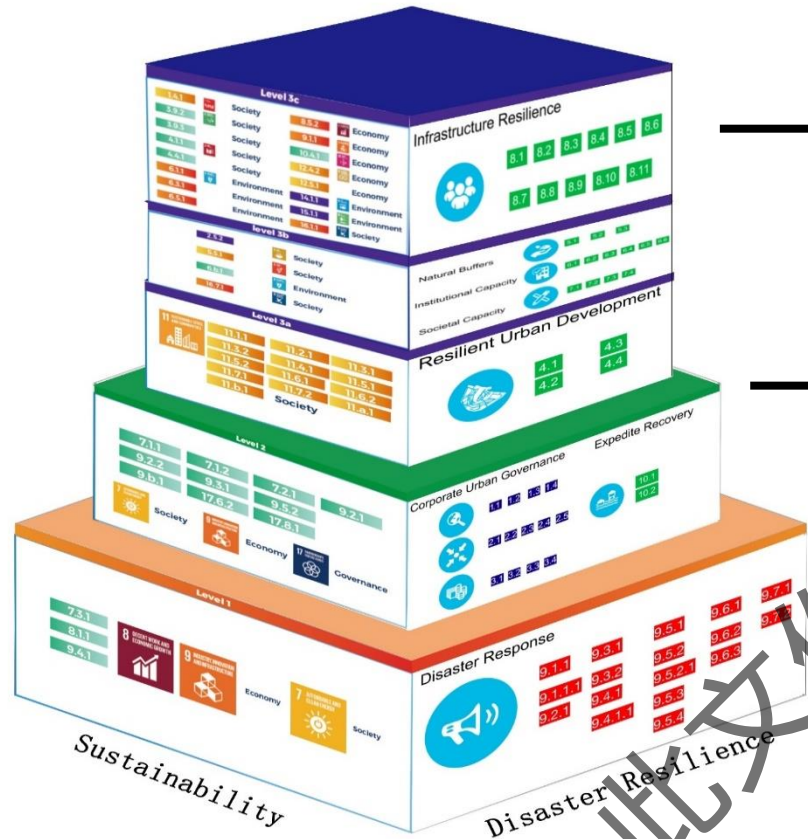
Disaster Resilience = instruments to attain the targets





# Urban SDG Tracker (will be separate APEC Project)

Step-by-step build-up according to Commitment Levels within the Cooperative Network of Sustainable Cities (CNSC)



**Commitment level 3:** Implementing and evaluating local action plan  
**Objective:** In-depth transformation towards integrated sustainable development and disaster resilience. Data requirement aiming at monitoring equilibrated in-depth development in all major urban areas

**Commitment level 2:** Local 2050 vision, 2030 targets, elaborating integrated holistic local action plan  
**Objective:** Data requirement aiming at achieving rapid progress, driven by key areas (energy, industrial innovation, IT, urban governance)

**Commitment level 1:** Improve sustainable development and disaster resilience and showcase results  
**Objective:** Allowing APEC communities of any size to participate in the CNSC city network with little data requirement (population, GDP, energy, CO2, land area, disaster response)





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***“Joining Hands Toward Sustainable Energy Development in the Asia-Pacific Region.”***