Integrated CITIES Approach for Energy, Climate Change and Sustainable Development

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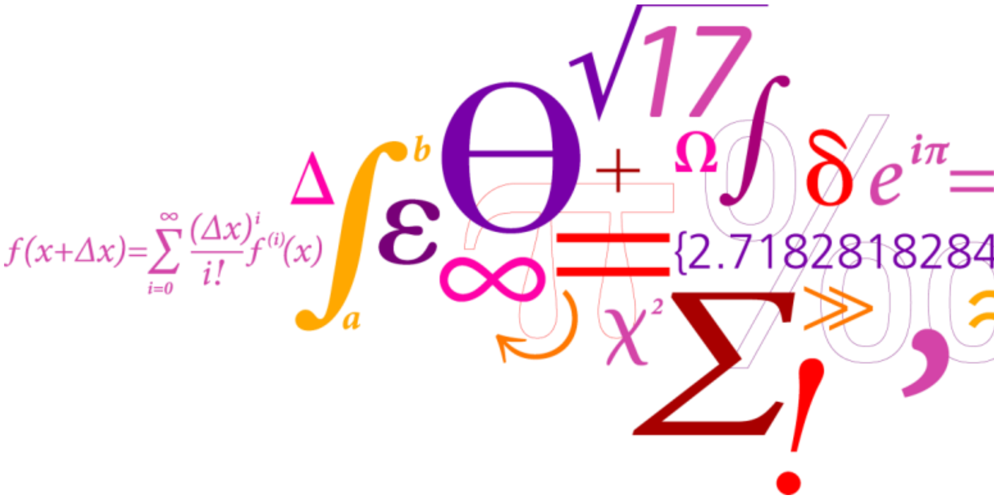


Issues

- Cities have ambitious plans for climate change, energy and "liveability" – they do not follow technical boundaries of energy supply
- Sustainable development including economic, social, and environmental challenges are important
- Many decisions taken today will have long term implications and will frame future solution – district planning, transport, energy, and water systems
- Cities are a "modern laboratory" for testing of new technical solutions and ways of living – example Copenhagen Connect

Climate, Energy, and SD Linkages

- The "social profile" of population (age, income, education, lifestyle) determines energy demand and the capacity to invest in efficiency improvements, appliances, cars etc ----------- the same is the case with the capacity for climate change adaptation
- Location of houses, business, and infrastructure and other activities determine energy demand and the costs of energy supply ------------ locations also determine climate change vulnerability
- Energy systems strongly depend on climate change and extreme events: Wind, bioenergy, hydro power, and solar:
  - Short term market perspectives
  - Long term investment perspective
- Tradeoffs and synergies:
  - Trade-offs: Dense cities imply less transport and energy, urban sprawl with green areas imply less climate vulnerability
  - Synergies: Building insulation; city space reduce heat islands effect
  - Fluctuating renewables: Will climate change require larger storage facilities? Is more market integration in Europe a coping strategy?

Decision Making Perspective

- The Smart City is a pioneering and innovative city with an environmentally clean energy and transportation system. Energy consumption is low and renewable energy has a high priority. The system integrates smart and sophisticated solutions, and the interaction between energy consumption and supply is supported by information technology. High quality of life and citizen participation in the development and implementation of smart energy solutions are important drivers in the city development.

Indicators for Decision Making

Dimension	Indicator
Innovative	?
Environmentally Friendly	SO_2, NO_x, GHG etc
Low energy consumption/Efficiency	Per capita, production, transport work Energy costs
Renewable energy	Renewable energy share (PJ)
New Technological Solutions	Load management, demand/supply interaction reflecting costs and prices
High Quality of Life	Environmental quality Health Daily transport time Social interaction facilities including parks, and shared facilities
Participation	Access to information, participation in decision making

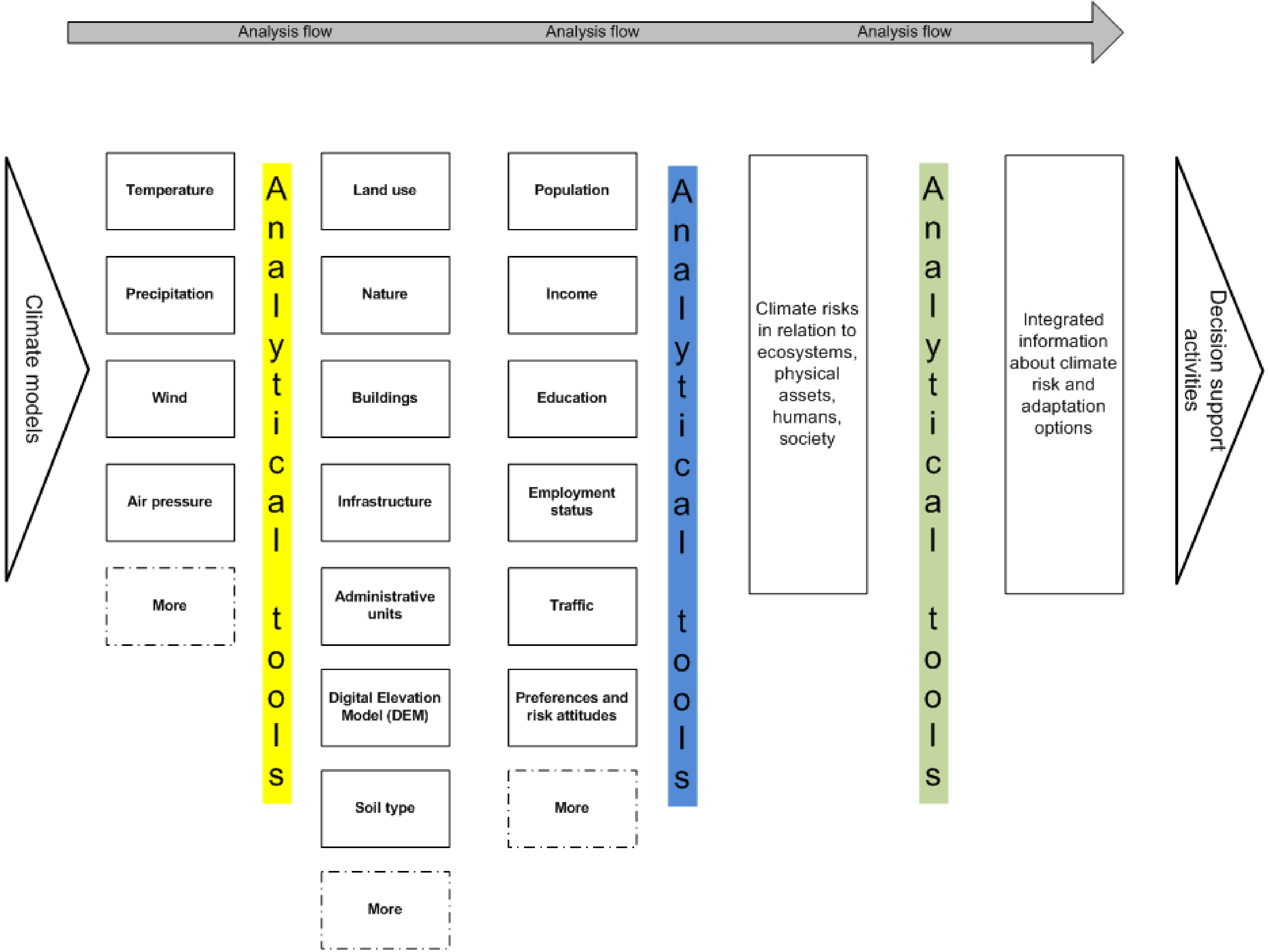
Families, Demands, and Implementation Capacity

Localised capacity for cc adaptation	Localised capacity for energy efficiency
Climate change vulnerability	Localised energy demand

Social family profile (age, income, education)	House, appliancies, car etc	Job and other activities

Participation in Decision Making

(a) (b)



Analysis flow
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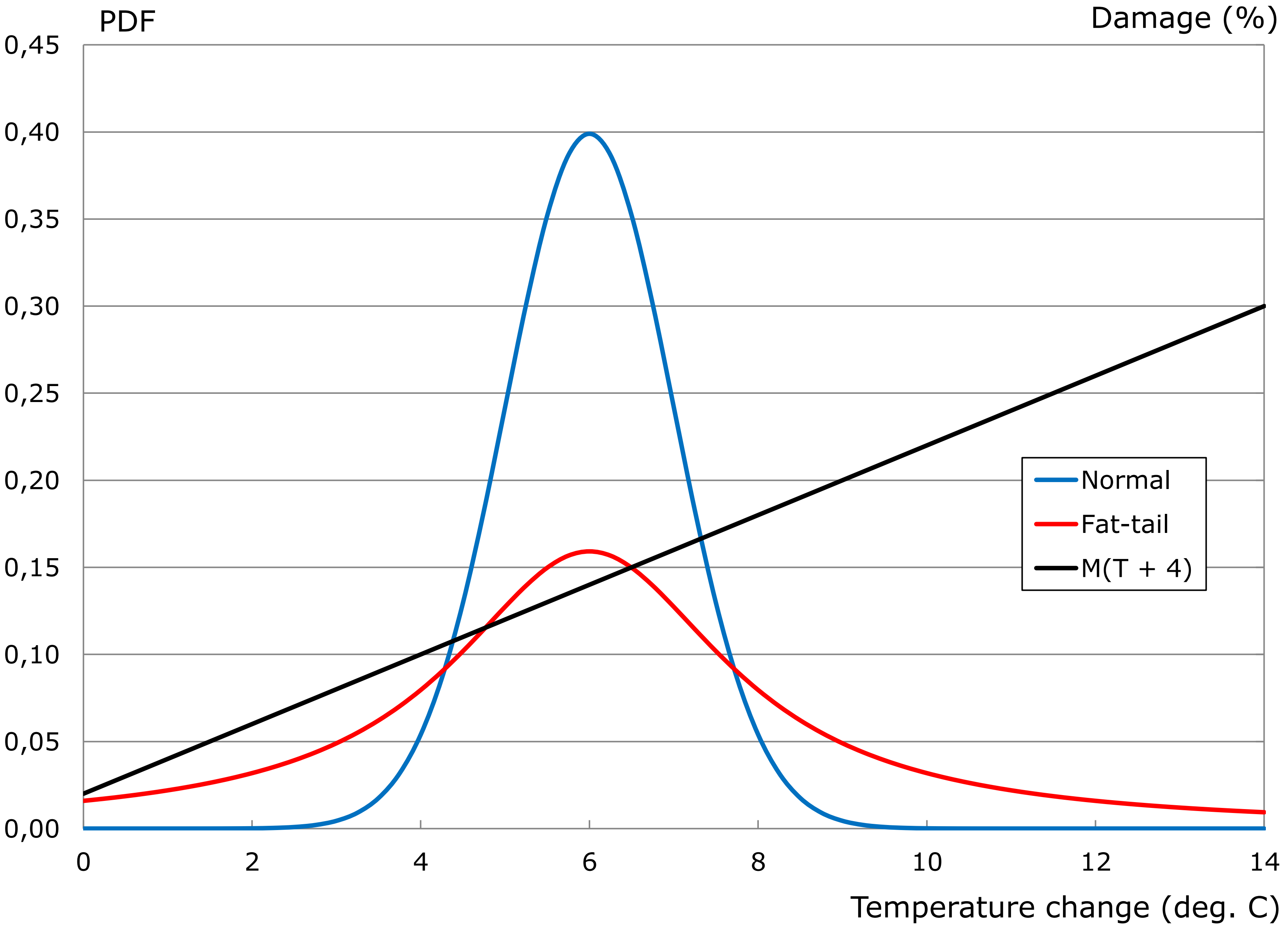
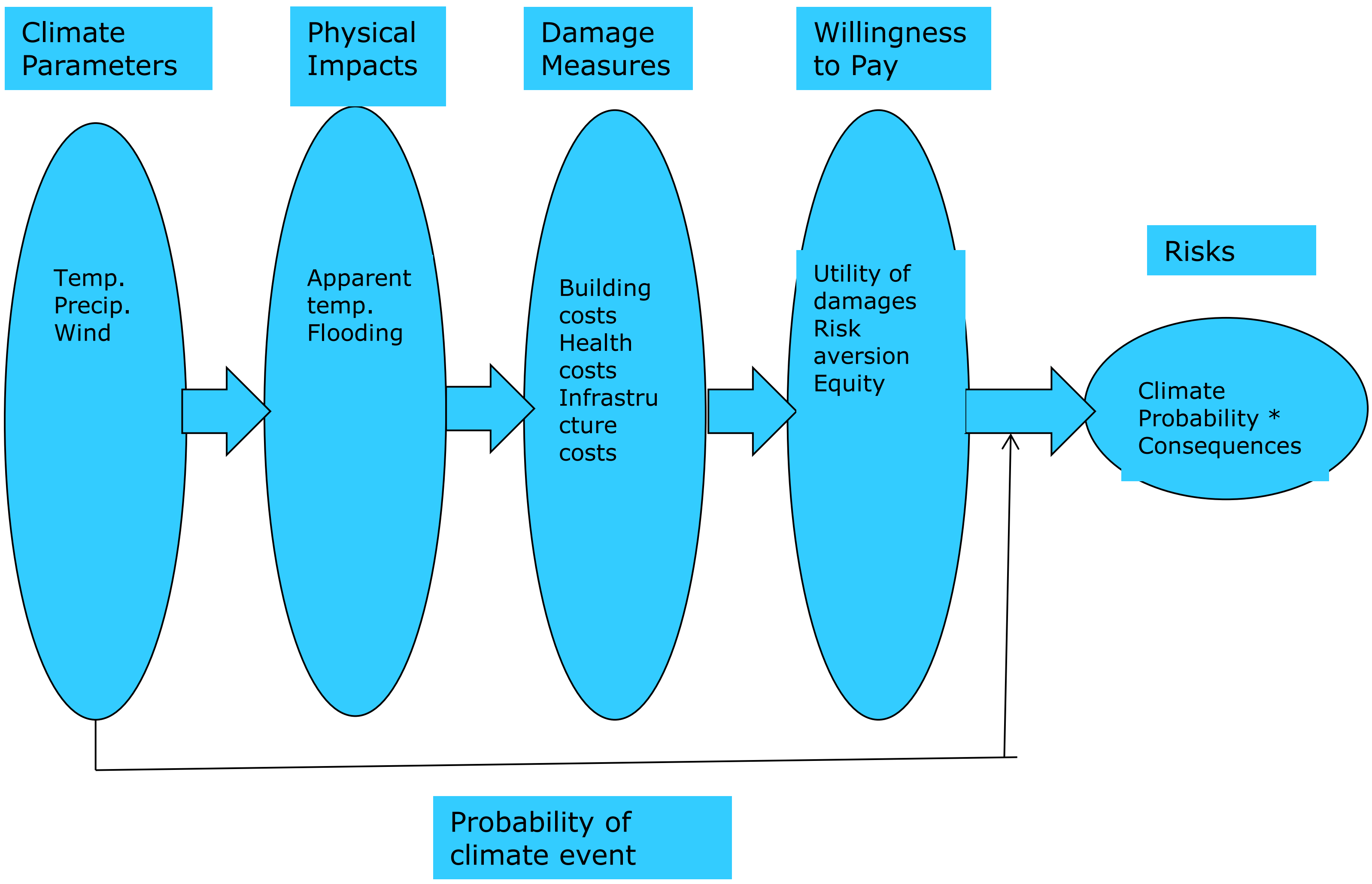
Climate models
Temperature
Precipitation
Wind
Air pressure
More
Analytical tools
Land use
Nature
Buildings
Infrastructure
Administrative units
Digital Elevation Model (DEM)
Soil type
More
Population
Income
Education
Employment status
Traffic
Preferences and risk attitudes
More
Analytical tools
Climate risks in relation to ecosystems, physical assets, humans, society
Analytical tools
Integrated information about climate risk and adaptation options
Decision support activities

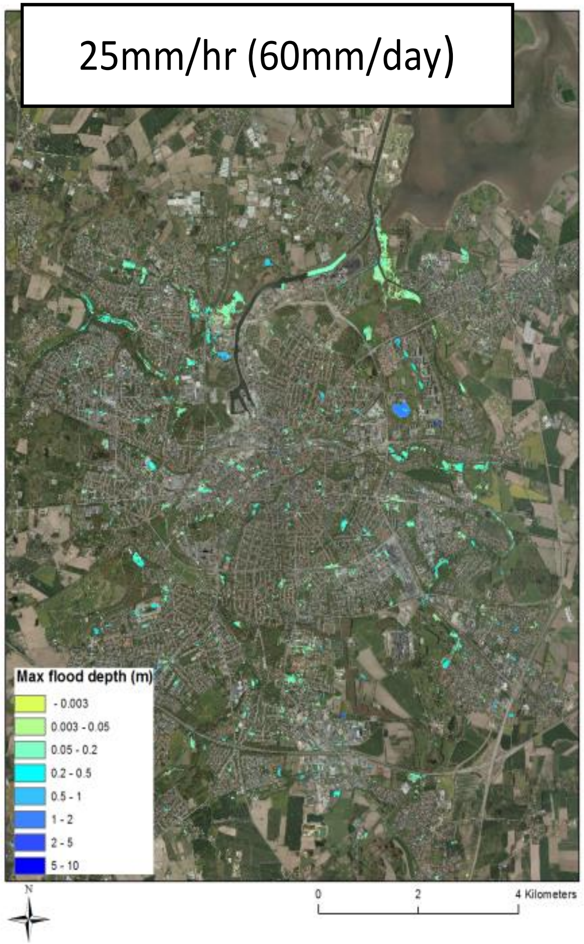
Risks: Probability * Consequence

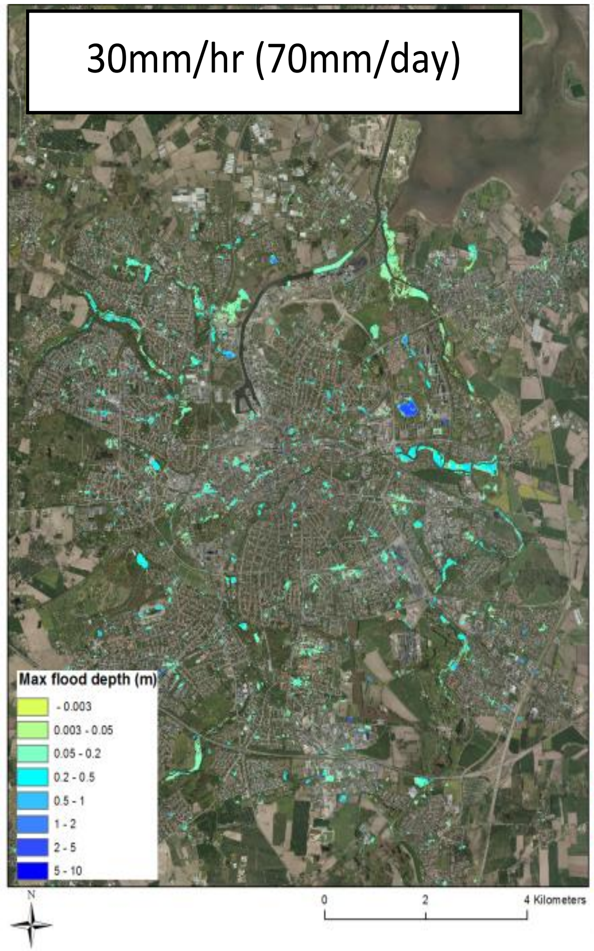


Climate Change Risk Approach

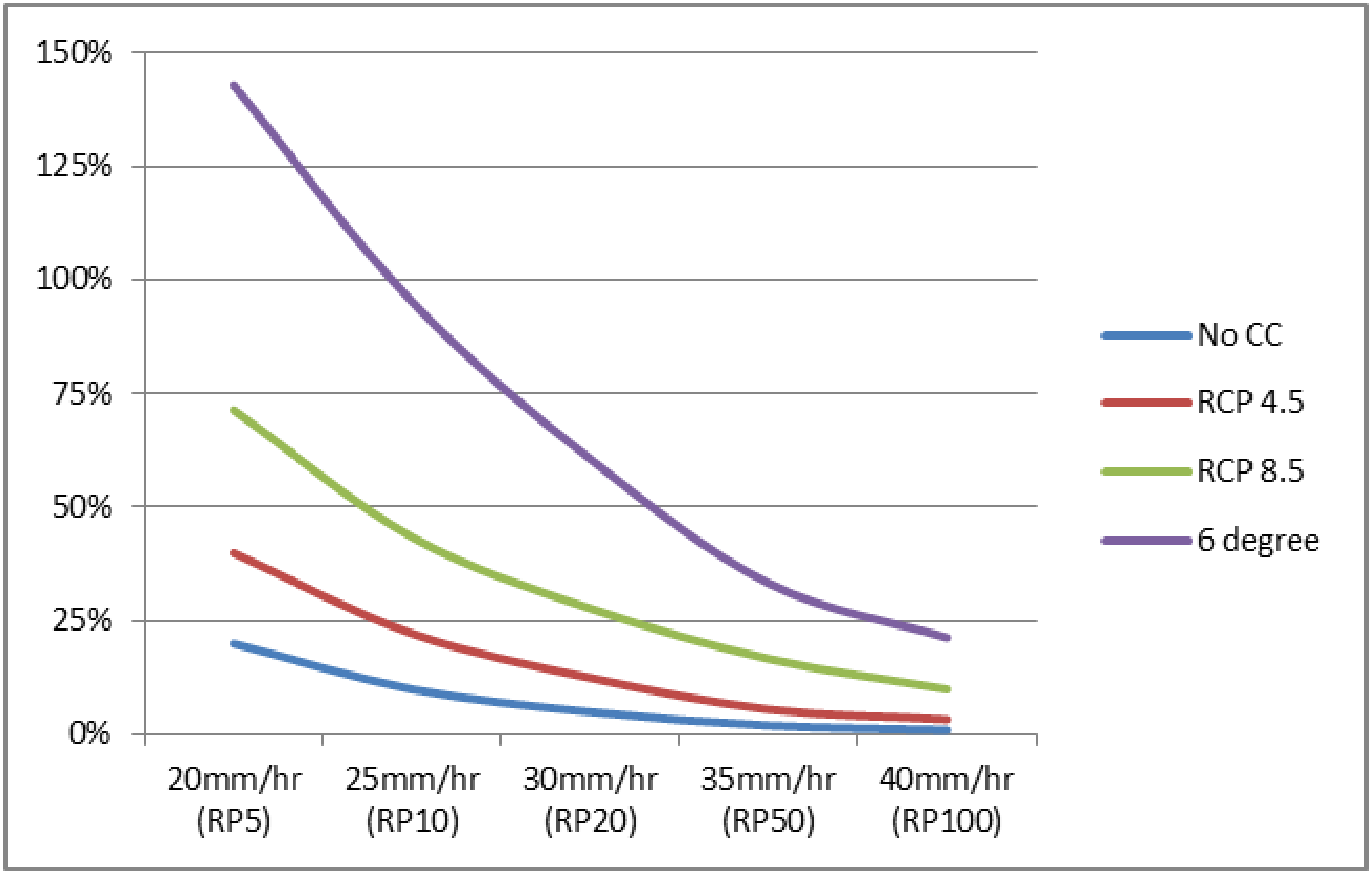


Odense Flooding Case Study

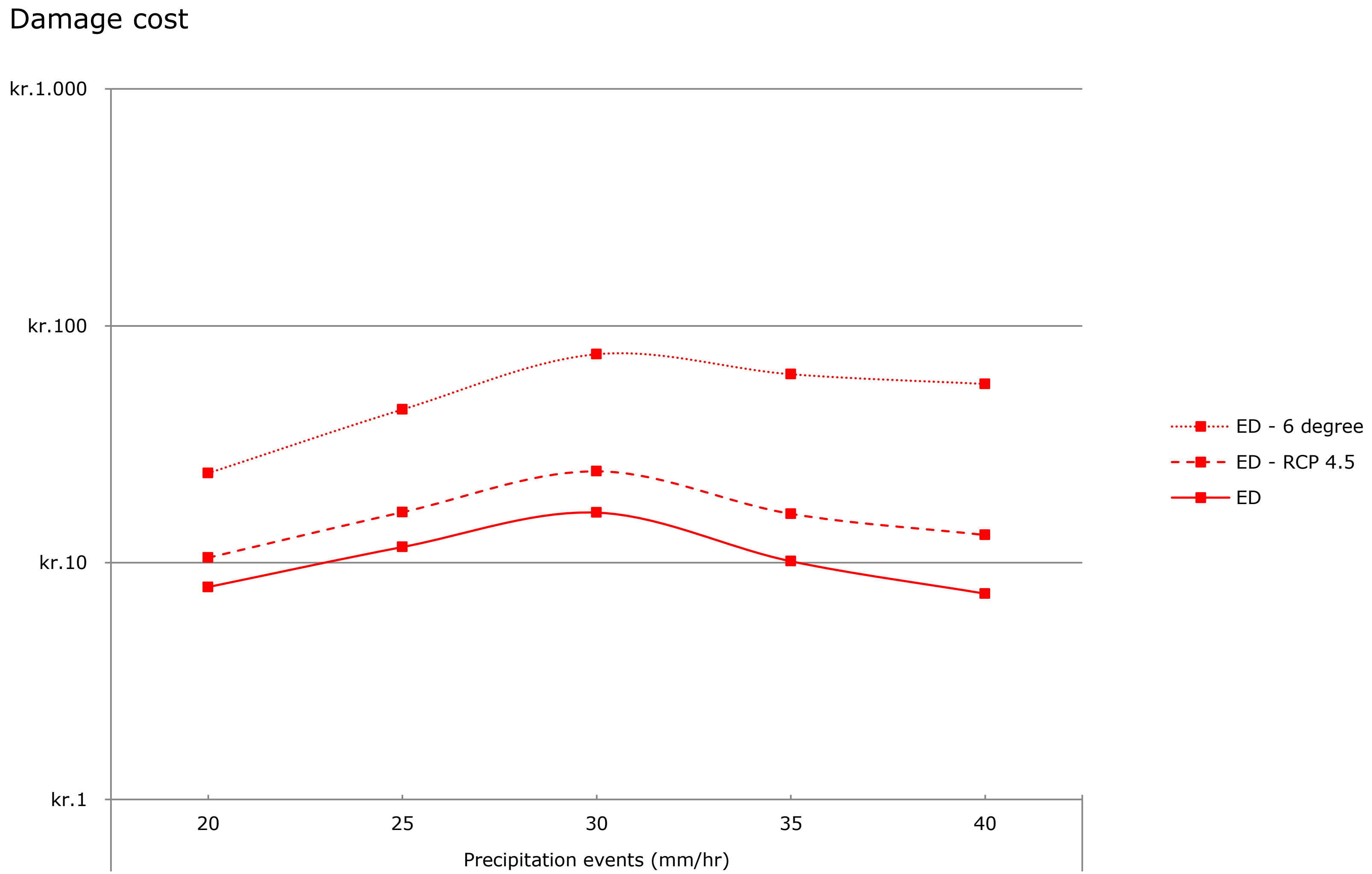




Relative Flooding Probaility

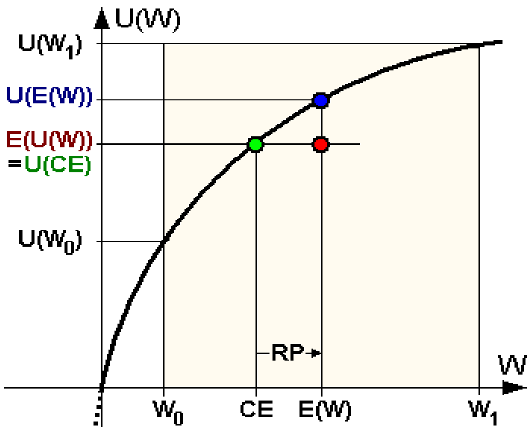


NPV of Flooding Risks in Odense

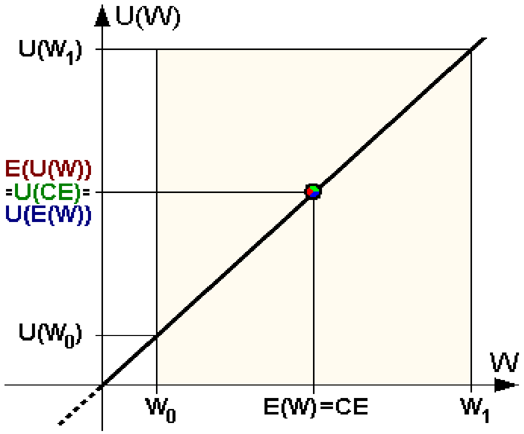


Damage Cost Categories

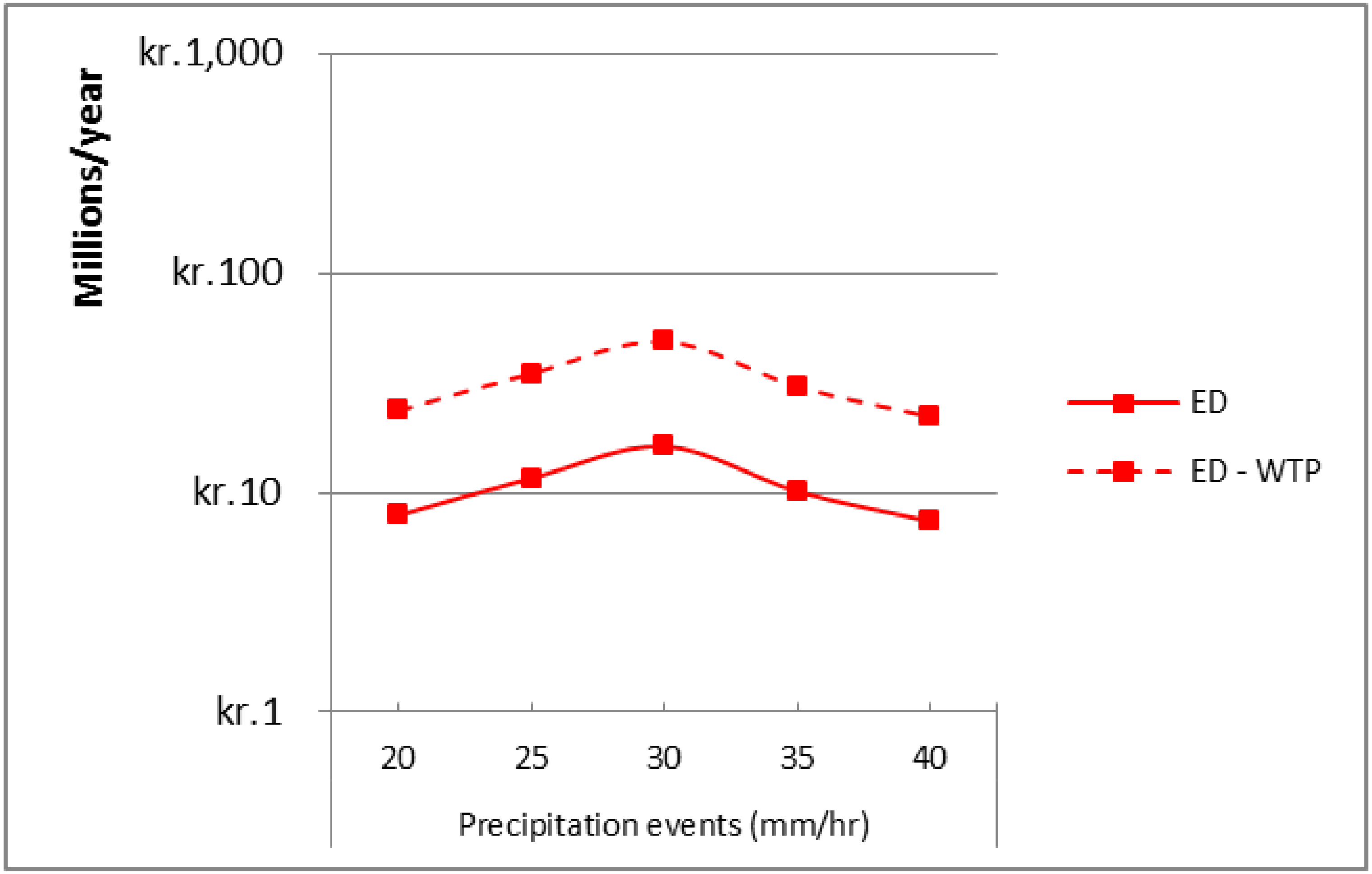
Risk Averse



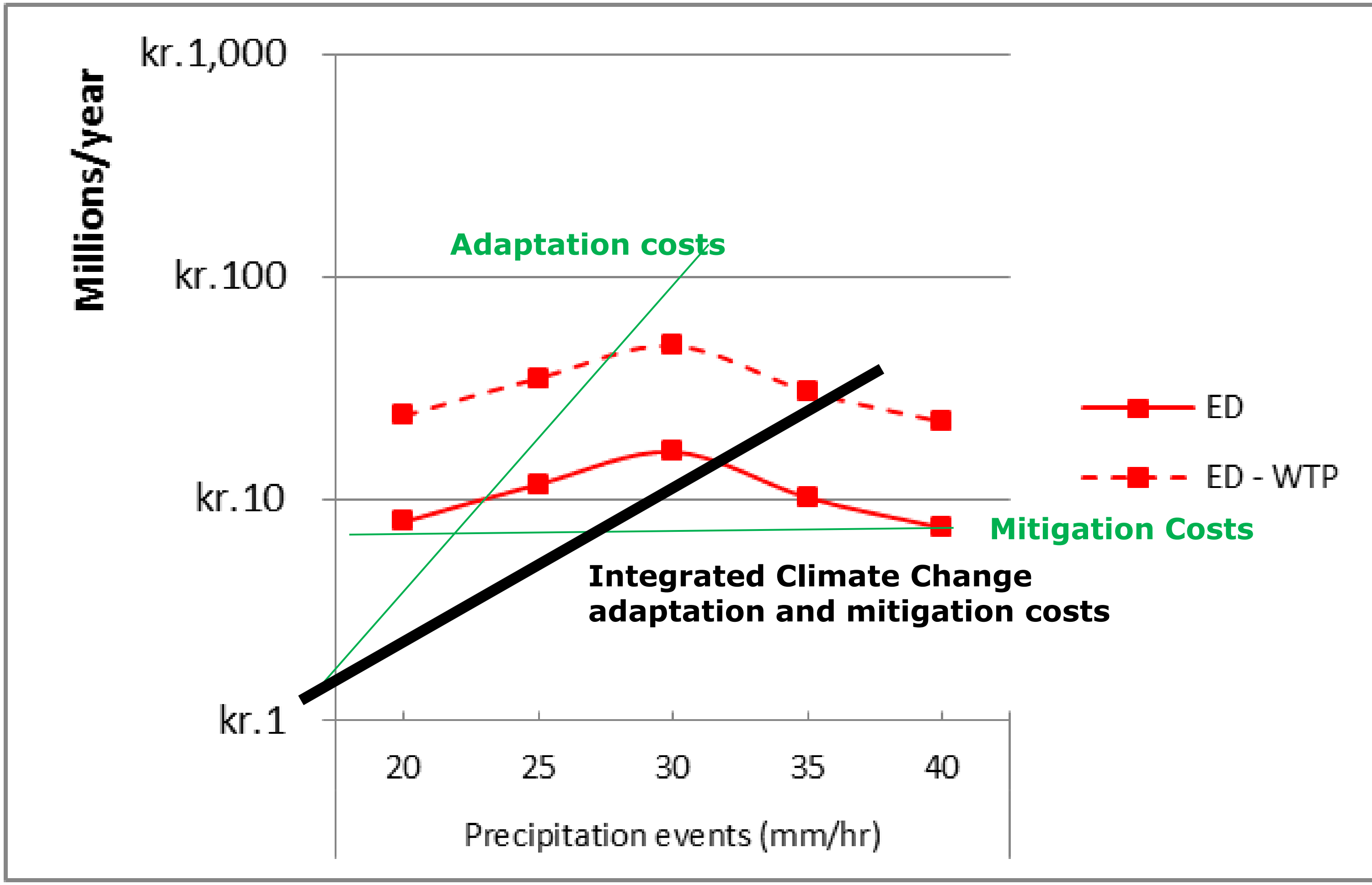
Risk Neutral



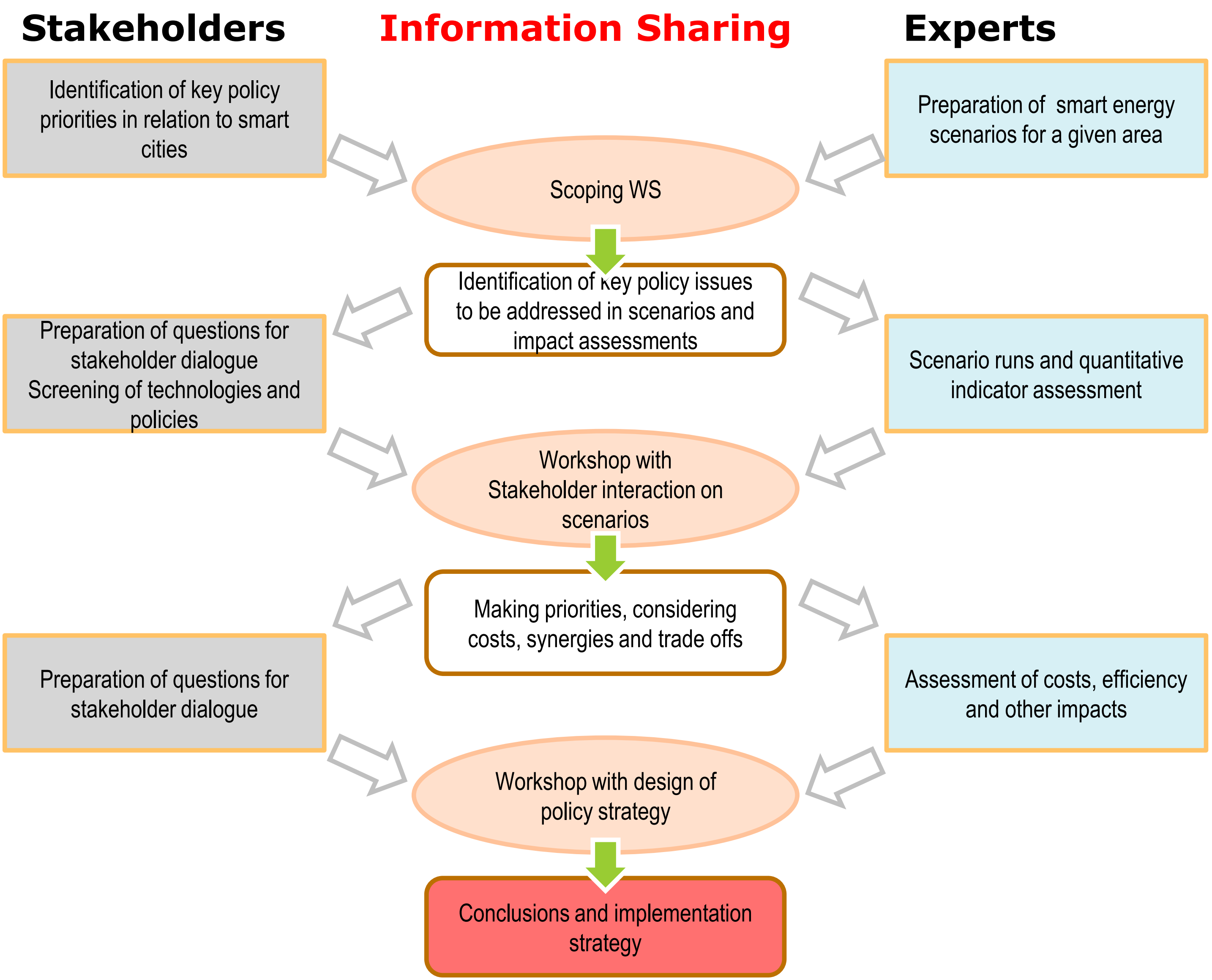
Net present Value of Flooding Risks in Odense with Risk Aversion



Decision Making Perspective



Local Vision for Copenhagen


Stakeholders
Information Sharing
Experts
Identification of key policy priorities in relation to smart cities
Preparation of smart energy scenarios for a given area
Scoping WS
Identification of key policy issues to be addressed in scenarios and impact assessments
Preparation of questions for stakeholder dialogue
Screening of technologies and policies
Scenario runs and quantitative indicator assessment
Workshop with Stakeholder interaction on scenarios
Making priorities, considering costs, synergies and trade offs
Preparation of questions for stakeholder dialogue
Assessment of costs, efficiency and other impacts
Workshop with design of policy strategy
Conclusions and implementation strategy