Economic assessment of innercity climate adaptation

Rotterdam, september 2014

aabel

Program of this workshop

1. Introduction to economic assessment
2. Case study Kopenhagen cloudburst
3. Case study Rotterdam heat & cloudburst
4. Case study Myanmar flood
5. Case study Rotterdam/New York flood
6. Discussion

Sigrid Schenk

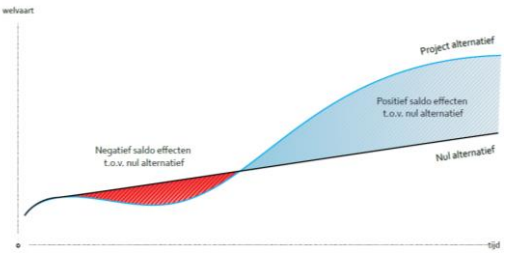
Introduction

- Who has been involved in a CBA before?
- What information should the CBA provide for a decision maker?
  - Efficiency (is the solution value for money for society, which alternative provides best VfM)
  - Distribution (which actors are worse and better off)

- What answers cannot be answered by the CBA?
  - Financial (can we afford the solution)
  - Technical (does the solution work?)
  - Legal (which actors are liable for damages)
  - Social/ethical (is the solution fair accross income groups)

Basic introduction to the methodology

1. Define the problem/ambition
2. Define minumum cost alternative
3. Define feasible alternatives
4. Assess tangible and intangible benefits (causality)
5. Quantify costs and benefits
6. Assess risks
7. Assess distribution of costs and benefits between actors
8. Present results



Focus today

- How does the application of a CBA work in practice for innercity climate adaptation?
  - Problems
  - Need to adapt methodology
  - Usefulness for decisionmakers
- Lessons learned/challenges for further development

Case Copenhagen

CLIMATE ADAPTATION PLAN - AND CLOUDBURST MANAGEMENT PLAN

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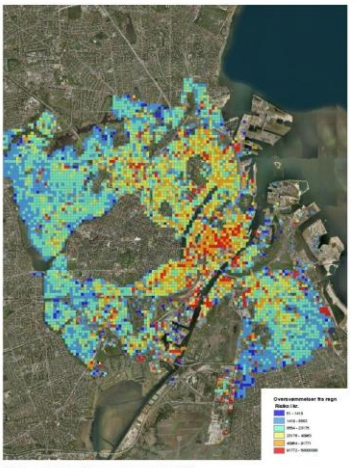
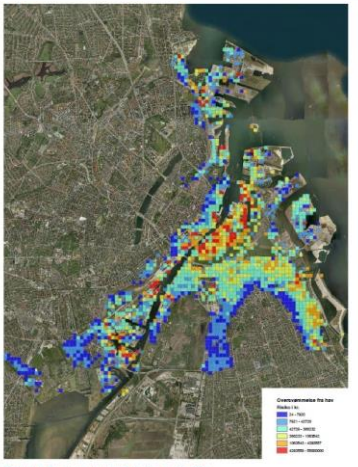
MAIN CHALLENGES



Risk map for flooding caused by rain in 2110



Risk map for storm surges from the sea in 2110

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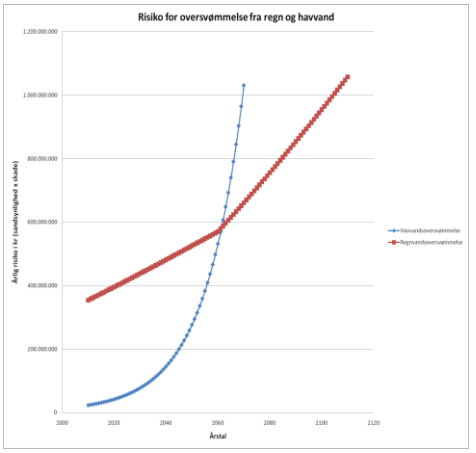
RISK ASSESSMENT - RAIN WATER AND SEA LEVEL FLOODING

- Estimated costs and the probability of damage show that rain water is the most immediate threat
- But in 30 years time the risk of flooding due to rising sea levels will be greater (and the damage higher)
  - Long decision making process - complicated financing
  - Consequences for urban development
  - Therefore we must start planning now



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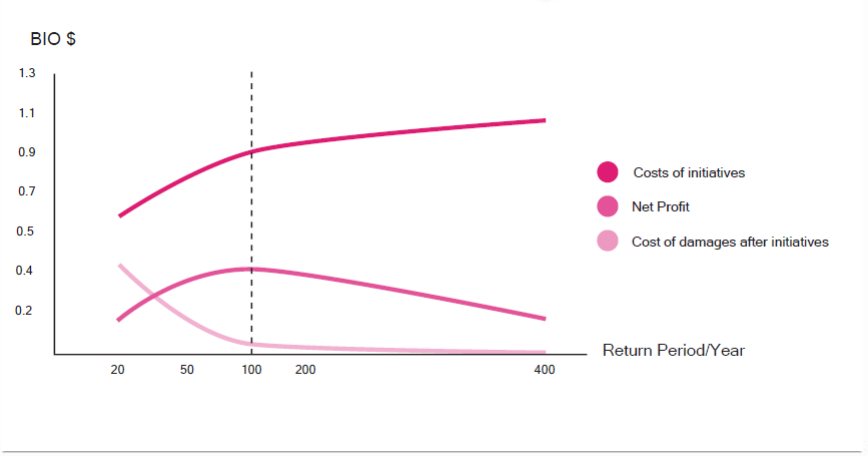
DECISION OF SAFETY LEVEL



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14th of August 2010
2nd of July 2011
14th of August 2011
31st of August 2014

THE CITY IS VULNERABLE

- July 2011 – 150 mm of rain in two hours
- Insurance claims close to 1 bill. euros
- Damage on critical infrastructure
- Hospitals – nearly had to be evacuated
- Emergency services in trouble
- And it keeps happening – it is estimated that the total costs are now around 1,4 billion euros

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7 WATER CATCHMENT PLANS

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THE PROJECTS

- Breaking down of the 7 water catchment areas into projects (only of the main structures – the backbone of the new storm water management infrastructure)
- About 300 different projects
- All have been described and collected

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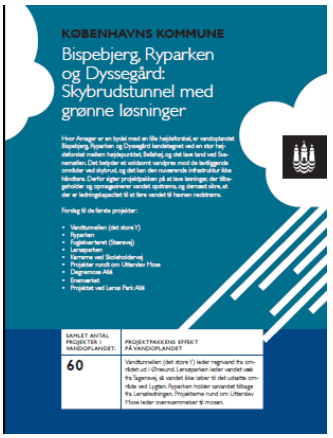
THE PROJECTS

- Each water catchment described with all projects
- A number of projects suggested as starting projects (a list to choose from)
- Room for discussion on level of ambition for urban space improvement
- Problem projects



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FINANCING ADAPTATION

- Storm water management – payed through water fees – estimated costs around 15 euro per month per family
- Urban space improvement – payed by taxes

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INVESTMENT STATEMENT

- Recalculation of the construction costs
- Cost benefit analysis
- Socio-economic figures – as part of the wider picture of the investment costs
- Synergies with other projects

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INVESTMENT STATEMENT

- Total costs of new storm water infrastructure – 1.3 billion Euro
- Expanding the existing system would be double the price
- Extra costs for urban improvement (greening etc) 100 mill Euros – or more depending on level of ambition
- Cost benefit analysis still shows that it is a good business case

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INVESTMENT STATEMENT- DEVELOPING PICTURE OF DAMAGES

- Estimated costs of damages over the next 100 years were 2.2 billion euros in 2010
- But we have already had damages worth 1.3 billion euros
- We need to revisit these figures over the next years
- So far we have kept the conservative (low) estimates

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INVESTMENT STATEMENT - SOCIO-ECONOMIC DATA

- Cost of investments
- Value of estimated damages
- Value of ”green solutions”
- Saved investments in expanding the present sewer system
- Other aspects like insurance, house prices, investments
- Jobcreation and green growth

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INVESTMENT STATEMENT - SYNERGIES WITH OTHER PROJECTS

- Saving money through coordination with other construction works in the city (maintenance of roads, district heating improvements etc.)
- Ongoing process that we have already started with projects like Skt. Annæ Plads and on bicycle routes on Amager

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CONCLUSIONS

- Adaptation is a good investment for the city
- Focusing on the interaction of adaptation with other urban development is positive (no-regrets solutions)

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Problem and alternatives

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Problem

- Problem: inner-city area with expected problems with **heat, drought** and **storm water**

Reference alternative

- Minimum cost alternative: accept damage

Project alternatives

- Project alternatives
  1. Behavioral adjustment and health advice
  2. Green in the street (trees, small vegetation)
  3. Insulation of buildings (homes and businesses)
  4. Adjusting albedo of roofs
  5. Water square
  6. Increase curb height and lowering of roads
  7. Green roofs
  8. Infiltrating pavement
  9. Permeable gardens and curbs

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Stepwise approach to determine, quantify and monetize effects

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Steps

Step 1	Step 2	Step 3	Step 4
Determine problem	***Quantify damage***	***Quantify effect***	***Monetize effect***
Example: heat			
• Illness • Mortality • Loss of productivy	• # of days of heat • # of extra mortality, illness, loss of productivity	• Difference in tem-perature	• Monetary value of damage prevented: – Hospital: 5000 EUR – Death: 800k VOSL: 1-5 mln. EUR VOLY: 40-100k EUR

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Results

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2% growth; Climate scenario G (NPV in € 1,000)	Health advice	Green in streets	Insulation building	Albedo roofs	Water-square	Higher curbs	Green roofs	Infiltr. pavement	Permeable gardens and curbs
Costs									
Investment (-residual value)	1	11	1.946	83	103	62	862	59	7
Maintenance	4	9	441	96	89	10	155	98	1
Benefits									
Heat stress	266	8	152	70	2	-	48	-	-
Pluvial flooding	-	-	-	-	22	11	34	61	21
Drought	-	-	-	-	10	-	-	148	437
Energy	-	-	1.192	-	-	-	-	-	-
CO^2	-	-	495	-	-	-	-	-	-
Air quality	-	-	-	-	-	-	211	-	-
Property value	-	131	-	-	946	-	-	-	-
Total									
Total costs	5	21	2.387	179	192	72	1.016	157	8
Total benefits	266	140	1.839	70	981	11	293	209	459
Result	260	119	-548	-108	789	-62	-724	52	451

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Climate problem solved?

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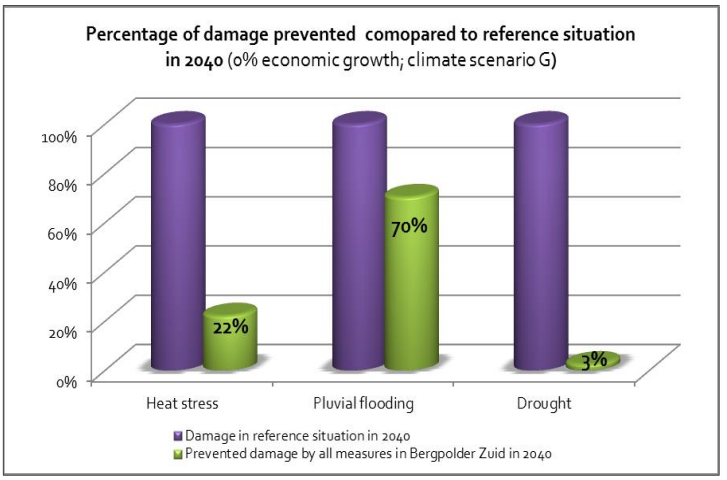

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Allocation and stakeholders

- Most alternatives for heatstress:
  - Investment: city and landloards
  - Benefits: residents, companies, insurance companies

- Permeable gardens:
  - Investment AND benefit for landloards/ owners
  - Positive net present value

Challenges and lessons learned

- Need for 'a problem'
- Data
- Gap in terms of scientific study and practical need for assumptions
- General instrument -> specific case, different results
- Complexity
- Usefulness for decisionmakers (Corjan Gebraad)


Case Myanmar


Case Kop van Feijenoord

Problem and alternatives of Kop van Feijenoord

- Problem: **Flood damage** because of situation outside the dike ring
- Minimum cost alternative: accept damage
- Project alternatives

Current policy
- Elevating buildings + outdoor area
- Early warning

1. **Keeping water out**
   - Elevating embankment
2. **Living with water**
   - Dryproof + wetproof building
   - Elevating (electric+tram) infrastructure
   - Early warning
3. **Basic safety**
   - Elevating edges of area
   - Elevating (electric+tram) infrastructure
   - Early warning

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Results

2% growth; Climate scenario G (NPV in € 1,000)	**Altern. 0** *Current policy*	**Altern. 1A** *water out 3,60*	**Altern. 1B** *water out 3,90*	**Altern. 2A** *living with water 3,60*	**Altern. 2B** *living with water 3,90*	**Altern. 3** *basic safety 3,40*
Costs						
Investment (-residual value)	8.468	1.362	1.481	22.656	29.174	1.017
Maintenance	3.221	587	639	5.500	7.045	475
Benefits						
Flood prevention	6.754	8.080	8.080	8.386	8.254	8.080
Total						
Total costs	11.689	1.949	2.120	28.156	36.219	1.491
Total benefits	6.754	8.080	8.080	8.386	8.254	8.080
Result	**-4.935**	**6.131**	**5.960**	**-19.770**	**-27.968**	**6.589**

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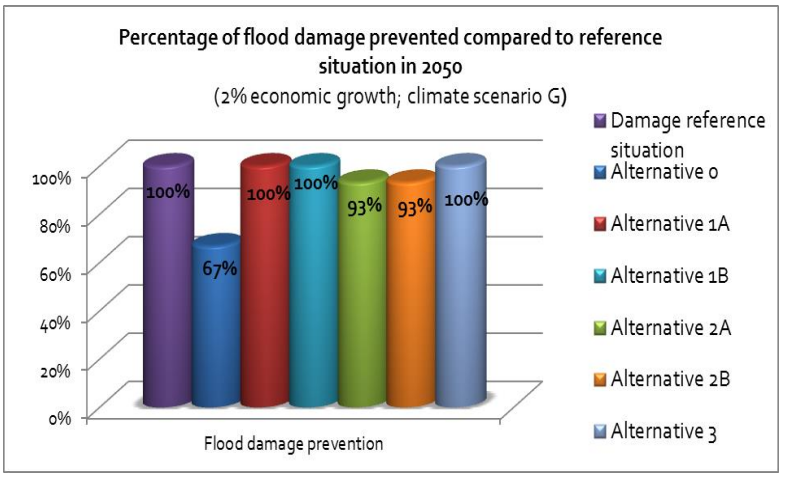
Climate problem solved?



Allocation and stakeholders

- 80% of damage prevented is 'damage to real estate'

→ beneficiaries: landloards and companies

- Keeping water out (embankment)
  - investment: no clear responsibility
  - benefit: various stakeholders

- Intensive stakeholder process:
  - Creating awareness for the climate problems in the area
  - Provide input for local damages
  - Platform for discussion on funding of solution

Case New York

Rebuild by Design

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Water park, purifying storm water, attractive public place

Impermeable asphalt replaced by permeable berm for parking and bioswale

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