Karlsruhe Institute of Technology

SBE19 Graz

Session
Cities 2: Net Zero Cities & Neighborhoods

Thursday, 12 September 2019

Crafting local climate action plans:
An action prioritization framework using multiple criteria decision analysis

Dr. Maria Balouktsi

Karlsruhe Institute of Technology (KIT), Centre for Real Estate, Germany

First, some numbers…

- **Global Covenant of Mayors (GCoM)**:
  Number of cities with …
  - A commitment 9209
  - Mitigation target 8413
  - Mitigation inventory 5396
  - Mitigation plan 5286
  - Compliance 104

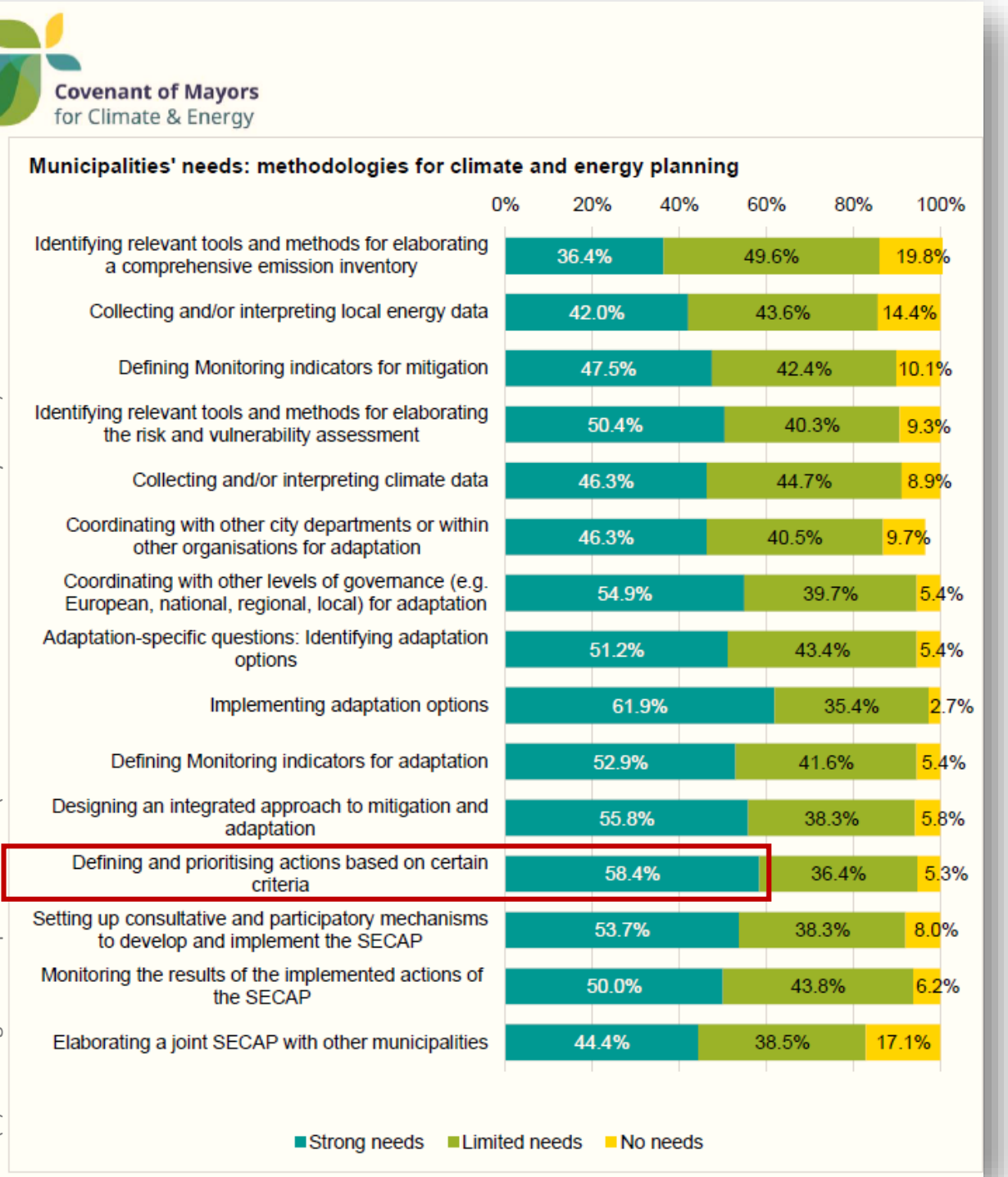
Vast gaps

Data Source: www.globalcovenantofmayors.org/our-cities/

Source: https://www.c40.org/blog_posts/eu-covenant-of-mayors-and-compact-of-mayors-launch-largest-global-coalition-of-cities-committed-to-fighting-climate-change

- **EU Covenant of Mayors (EU CoM)**:
  Number of cities with …
  - Action plans (in general) 4190 ***≈ 2/3 of EU CAPs will soon expire***
  - Action plans 2030 1555

Data Source: www.covenantofmayors.eu/plans-and-actions/action-plans.html



Source: Covenant of Mayors for Climate and Energy (2017) Covenant Community's Needs for SE(C)AP Design and Implementation (Available at: www.covenantofmayors.eu)

First, some numbers (continued)…

- **Left side:** 2017 survey by the EU CoM Office on their community's ***capacity-building needs and knowledge gaps*** for the design and implementation of Sustainable Energy and Climate Action Plans (SECAPs)
- **2nd strongest methodological need of EU municipalities:** defining and prioritising actions based on certain criteria

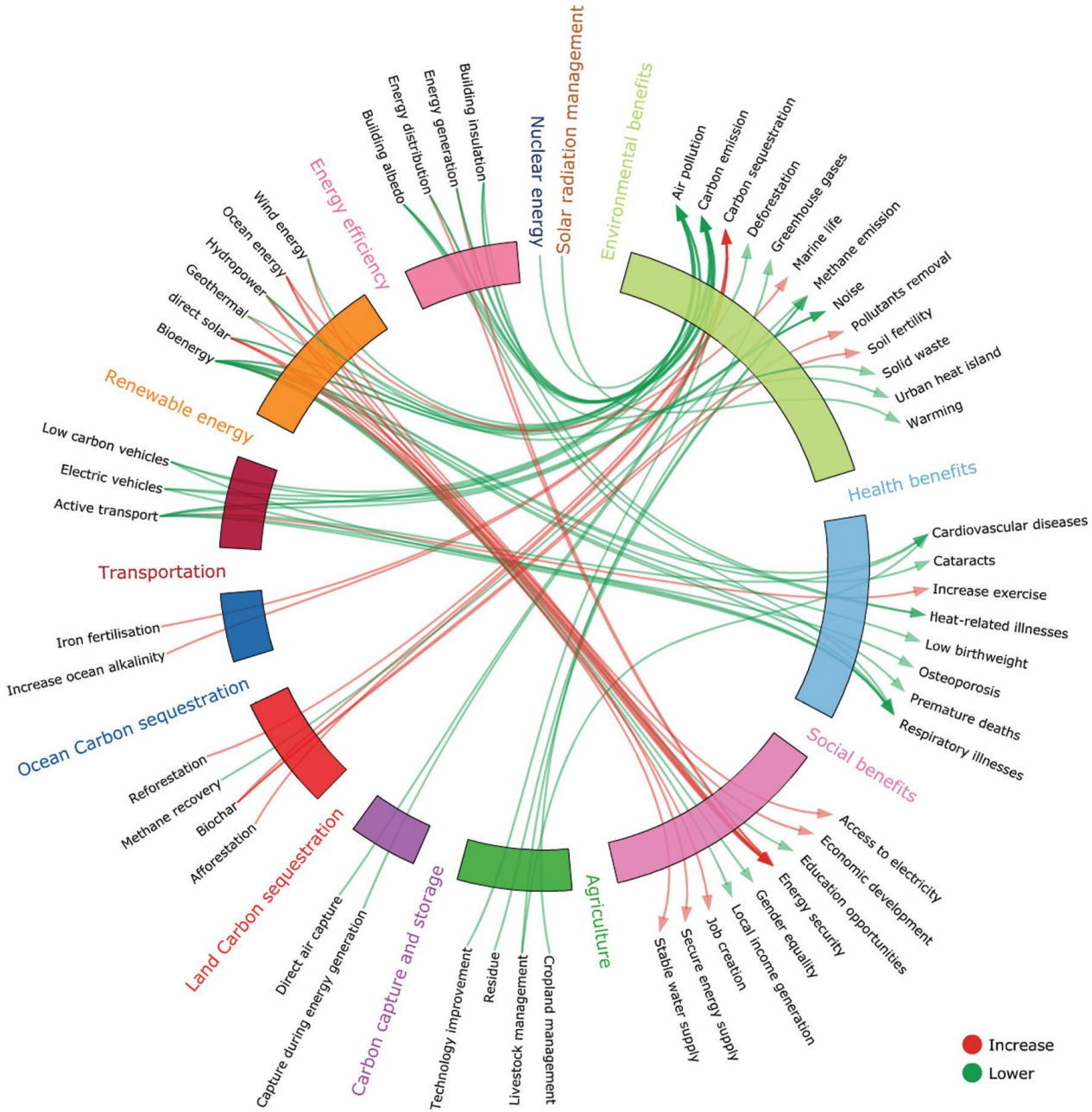
The challenge

To identify and prioritise actions that can satisfy a reduction target as close to zero as possible while balancing in parallel:

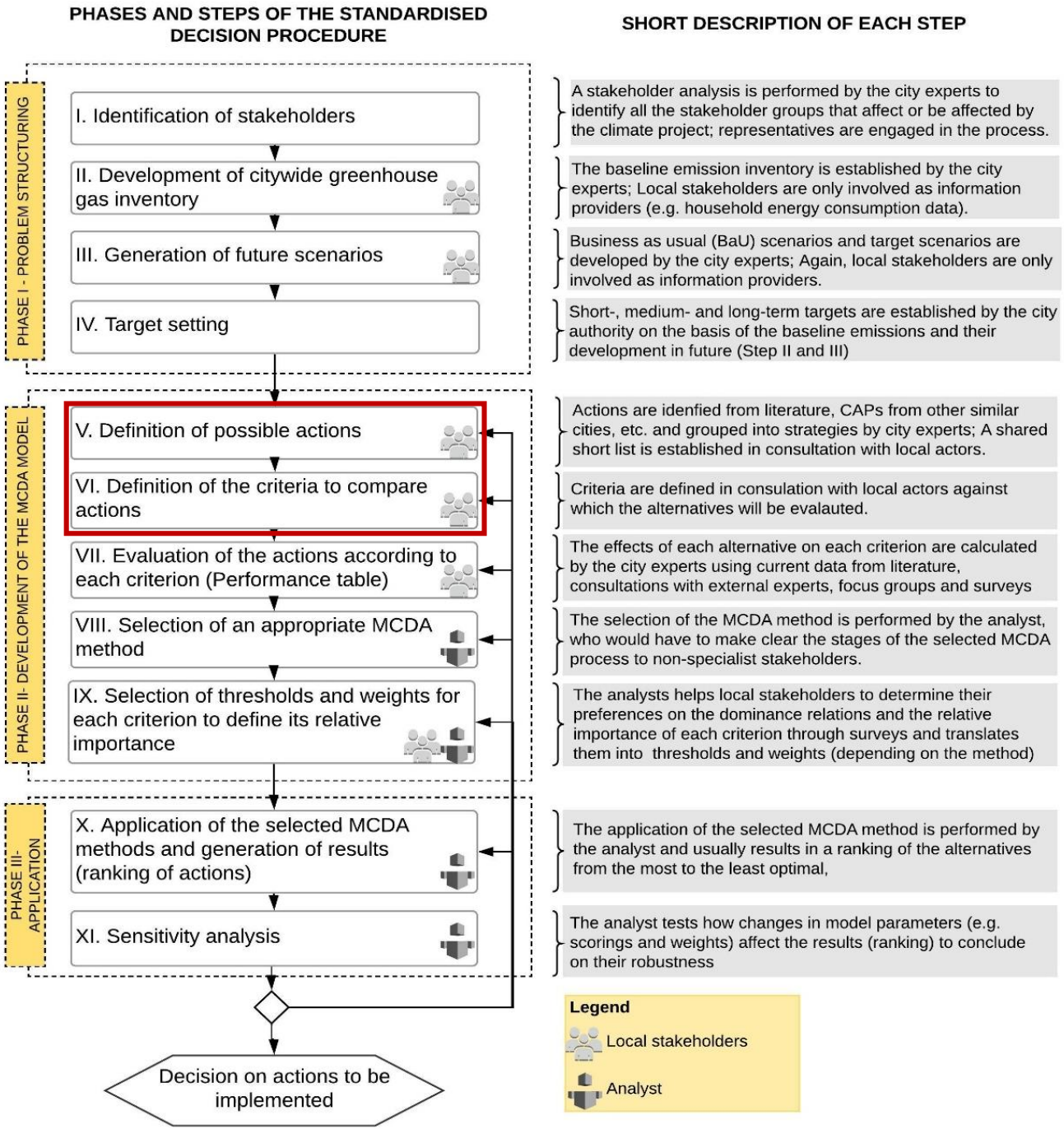
(1) (Often) conflicting and incommensurable environmental, economic, social and technical aspects

(2) Conflicting stakeholder interests

Bottom line: Cities are faced with a multi-criteria and intricate problem…



Source of illustration : Sustainability Solutions Group (2017). Modelling Toronto's Low Carbon Future. Considerations of Co-benefits and Co-harms Associated with Low Carbon Actions for TransformTO



Proposal:

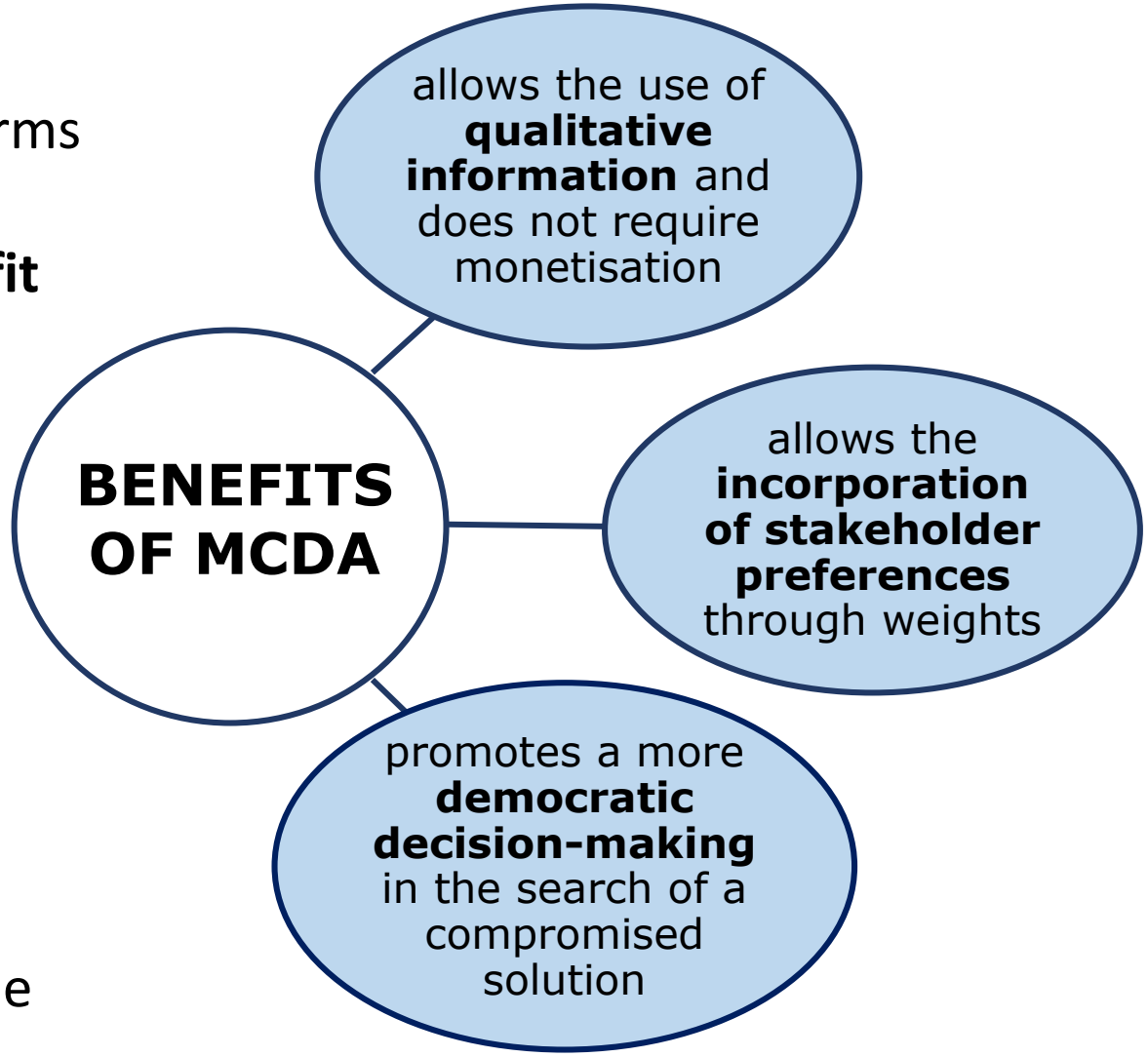
An 11-step general participatory framework for guiding collaborative action prioritisation on the basis of Multi-criteria Decision Analysis (MCDA)

FOCUS

- Step V: Definition of possible actions
- Step VI: Definition of the criteria to evaluate and compare actions

Why MCDA?

- The most employed and widely accepted forms of analysis among governments are **Cost-effectiveness analysis (CEA)** and **Cost-Benefit Analysis (CBA)**…
- **CEA:** limited to identifying the most "cost-effective" action for achieving a single objective – inappropriate for evaluating options with co-impacts
- **CBA:** can incorporate co-impacts, but necessities their monetisation
- Although MCDA is **not as standardised** as the other methods, it offers advantages:



How to define possible actions?

- Possible sources:
  - Generic catalogues and examples of climate actions
  - Climate Action Plans (CAPs) of other cities
  - Implementation experiences in other cities

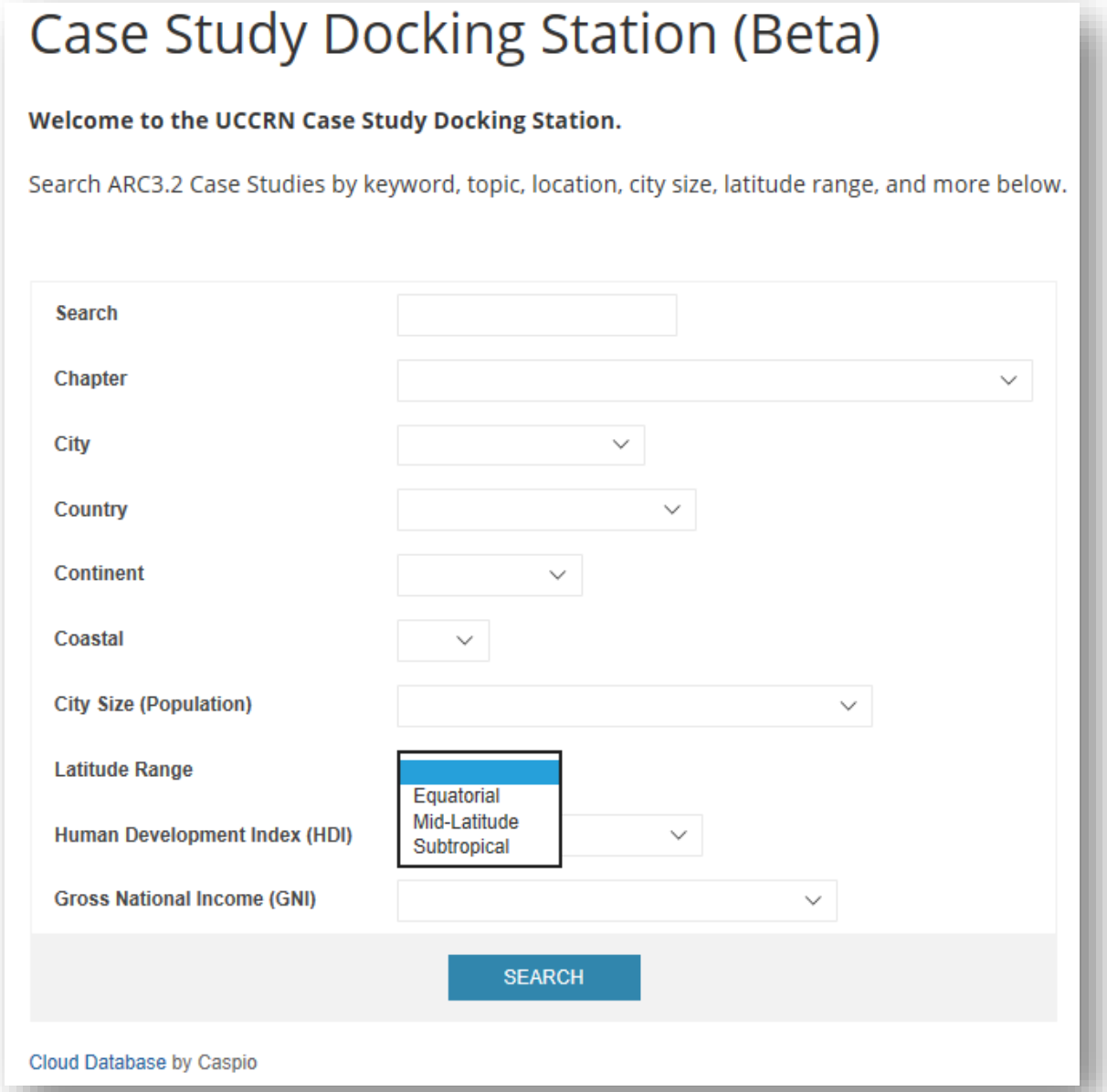
How to define possible actions?

- Possible sources:
  - Generic catalogues and examples of climate actions
  - Climate Action Plans (CAPs) of other cities
  - **Implementation experiences in other cities**

Problem/ Point of attention: Each city has its own geographic, socio-economic and political context –
An action proved to be effective in one city may not be in another!

Learning from experience: The issue of contextualisation…

- In most climate action resources for cities a lack of contextualization is evident
- **Example:** EU CoM provides a **good practice database** of more than 6000 examples of measures, with the only **context specific factors** provided to filter the provided real examples are the **population** and **country – lost opportunity of tailor-made learning experience!**



Source: Urban Climate Change Research Network Case Study Docking Station (Available at: http://uccrn.org/case-study-docking-station-overview/)

UCCRN's case study docking station: A good starting point & example…

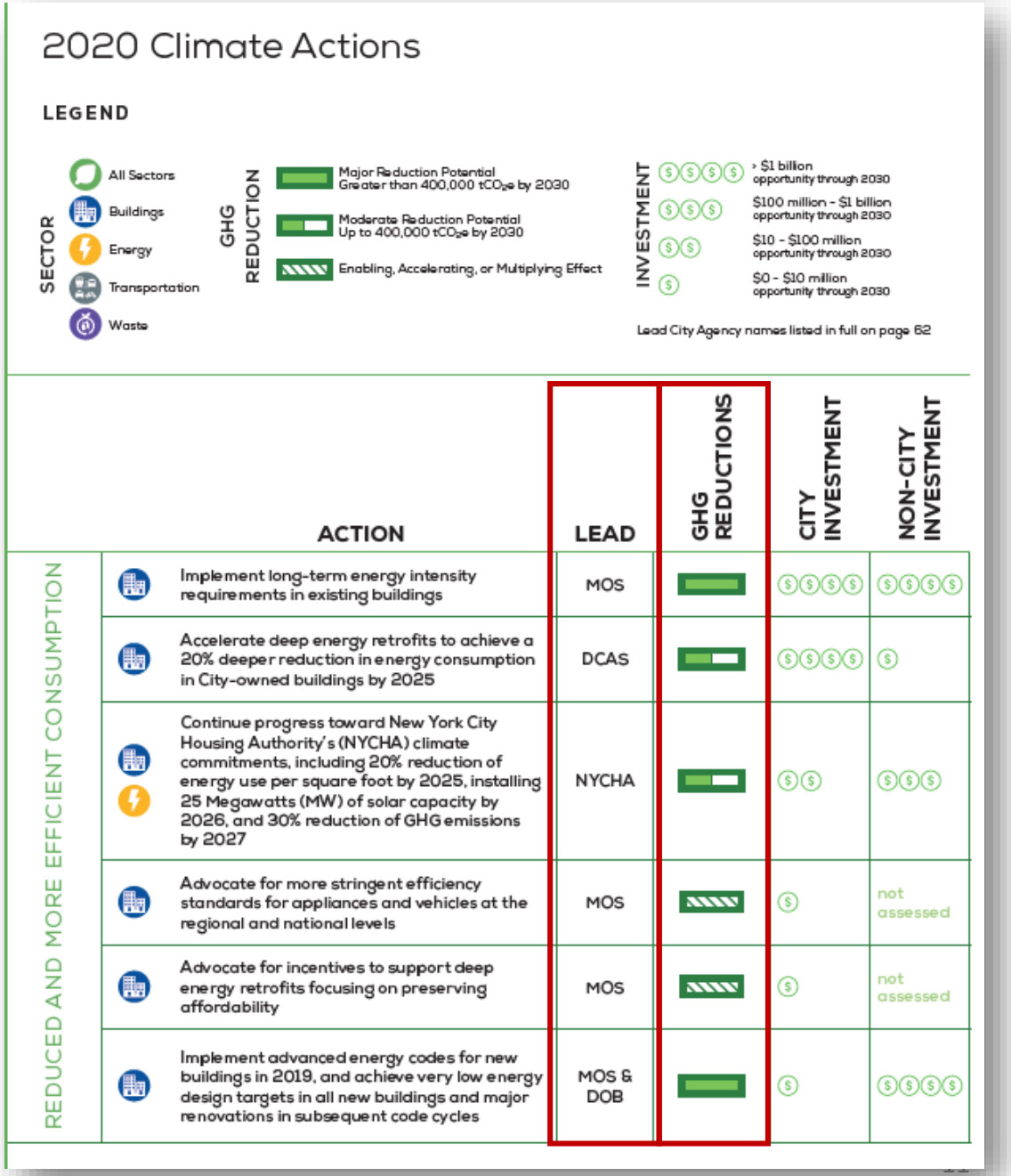
- The online case study docking-station hosted by Urban Climate Change Research Network (UCCRN)
- It currently includes more than 120 city case studies (26 European case studies).
- It allows cases can be searched and grouped by geographic, climate and socio-economic variables

How to classify actions into types?

- After identifying actions and grouping them under certain strategies comes the…
  - Identification of implementing stakeholders
  - Classification of actions into direct and indirect

- **Good practice example (Right)**: New York assigns lead actor per action and distinguishes between…
  - **Major actions**: Actions for which the direct GHG emissions reduction can be quantified
  - **Enabling actions**: Indirect actions that enable accelerate or multiply the effect of the major actions – e.g. campaigns, etc.

Screenshots from NYC's CAP*



2020 Climate Actions

LEGEND

SECTOR: All Sectors; Buildings; Energy; Transportation; Waste

GHG REDUCTION: Major Reduction Potential Greater than 400,000 tCO_2e by 2030; Moderate Reduction Potential Up to 400,000 tCO_2e by 2030; Enabling, Accelerating, or Multiplying Effect

INVESTMENT: $$$$ > $1 billion opportunity through 2030; $$$ $100 million - $1 billion opportunity through 2030; $$ $10 - $100 million opportunity through 2030; $ $0 - $10 million opportunity through 2030

Lead City Agency names listed in full on page 62

	ACTION	LEAD	GHG REDUCTIONS	CITY INVESTMENT	NON-CITY INVESTMENT
REDUCED AND MORE EFFICIENT CONSUMPTION	Implement long-term energy intensity requirements in existing buildings	MOS		$$$$	$$$$
	Accelerate deep energy retrofits to achieve a 20% deeper reduction in energy consumption in City-owned buildings by 2025	DCAS		$$$$	$
	Continue progress toward New York City Housing Authority's (NYCHA) climate commitments, including 20% reduction of energy use per square foot by 2025, installing 25 Megawatts (MW) of solar capacity by 2026, and 30% reduction of GHG emissions by 2027	NYCHA		$$	$$$
	Advocate for more stringent efficiency standards for appliances and vehicles at the regional and national levels	MOS		$	not assessed
	Advocate for incentives to support deep energy retrofits focusing on preserving affordability	MOS		$	not assessed
	Implement advanced energy codes for new buildings in 2019, and achieve very low energy design targets in all new buildings and major renovations in subsequent code cycles	MOS & DOB		$	$$$$

* Source: NYC Climate Action Plan. (2017). 1.5°C: Aligning New York City with the Paris Climate Agreement. New York City Government

How to define criteria?
Review of criteria used in exist. MCDA models

- **Question 1:** Do action plans refer to the use of some kind of criteria that helped in the choice of actions ?

✓ **Survey 1**: the CAPs of the 17 city members of Carbon Neutral Cities Alliance (CNCA) were investigated - only 2 – the City of Toronto and New York City – present a distinct prioritization approach.

How to define criteria?
Review of criteria used in exist. MCDA models

- **Question 1:** Do action plans refer to the use of some kind of criteria that helped in the choice of actions ?

✓**Survey 1**: the CAPs of the 17 city members of Carbon Neutral Cities Alliance (CNCA) were investigated - only 2 – the City of Toronto and New York City – present a distinct prioritization approach.

- **Question 2**: Can a set of generic criteria against which decision makers (DM) can evaluate climate actions as part of an MCDA framework be identified?

✓**Survey 2**: 10 selected sources were investigated, including Toronto's and NYC's prioritization frameworks, open access decision support tools for city-level climate action planning, etc. – it was observed that…

Survey 2: Main observations

Criterion group		Criterion	[41]	[28]	[27]	[42]	[43]	[30]	[29]	[40]	[37]	[10]
Feasibility criteria (Efforts required)	Economic	Initial investment cost	-	✓	o	-	✓	✓	✓	✓	✓	✓
		Annual running costs	-	✓	o	-	✓	✓	-	✓	✓	✓
			-	✓	-	-	✓	✓	-	o	-	✓
			-	✓	-	-	-	✓	-	-	-	✓
		Return on investment (ROI)	-	✓	-	-	-	-	-	-	-	✓
		External funding programmes	-	-	-	-	-	-	-	-	✓	✓
	Regulatory	National regulation necessity	✓	-	✓	-	✓	-	-	-	-	-
	Technical	Level of technical difficulty	-	-	✓	-	✓	✓	-	-	✓	✓
			-	-	✓	-	-	-	-	-	-	-
	Temporal	Speed of implementation	-	-	✓	✓	-	-	✓	-	-	✓
	Social		-	-	✓	-	✓	-	-	-	-	✓
		Stakeholder acceptability	-	-	✓	-	✓	-	-	-	-	-
		Social compatibility (mainstreaming potential)	-	-	-	-	✓	-	-	-	-	-
	Governance	Level of city power	-	-	-	✓	-	✓	✓	-	✓	-
Impact criteria	Climate-related	Effectiveness (GHG emissions saving potential)	-	-	-	-	-	-	-	✓	✓	✓
	Economic	Private investment mobilization potential	✓	-	-	-	o	-	✓	✓	✓	-
	Socio-economic	Generation of additional jobs	-	-	-	-	o	✓	✓	✓	✓	-
			-	-	-	-	o	✓	-	✓	✓	-
		Affordable housing	o	-	-	-	o	-		✓	✓	-
		Energy poverty	o	-	-	-	o	-	✓	✓	✓	-
		Exemplarity/image	-	-	-	✓	o	-	-	-	✓	✓
	Enviro-economic	Deferred infrastructure	-	-	-	-	o	✓	-	✓	✓	-
		Renewable energy produced	-	✓	-	-	o	✓	-	✓	-	-
	Environ-mental impacts	Adaptability to climate change	✓	-	-	-	o	-	-	✓	✓	o
		Energy resource use	✓	✓	-	-	o	✓	-	o	✓	o
		Other resource use (e.g. water, material, land)	-	-	-	-	o	-	✓	o	o	o
		Biodiversity conservation	✓	-	-	-	o	✓	-	-	✓	o
	Socio-environ-mental	Health: Air quality	o	-	-	-	o	✓	✓	✓	✓	-
		Health: Waste management	o	-	-	-	o	✓	-	-	✓	-
		Preserve cultural heritage	✓	-	-	-	o	-	-	-	o	o
	Social	Comfort	-	-	-	-	o	✓	✓	-	✓	-
		Noise pollution	-	-	-	-	o	-	-	✓	✓	-
		Aesthetic quality	-	-	-	-	o	-	-	-	✓	o
		Social mobilisation potential	✓	-	-	-	o	-	✓	-	✓	✓

Note 1: "✓" indicates that the parameter is explicitly mentioned; "o" indicates that it may form part of a broader category
Note 2: In some sources the cost(s) and revenue(s) (financial feasibility) are examined as part of marginal abatement curves (cost-effectiveness), e.g. [40]

Most common type of criteria

2nd most common type of criteria

- The dominant pattern in prioritization: **cost-effective** and **quick-win** actions

Co-Benefits as a business case to justify the capital investment…

- Cities will need to **move beyond low cost and quick win opportunities** and pursue more investment intensive ones that take longer to play out but will be critical in achieving the required decarbonisation by 2030/2050 – such as urban densification and land-use planning.
- **Business case for including such actions**: their co-benefits – i.e. benefits that actions generate beyond their contribution to GHG emissions reductions.
- Beyond addressing climate change, **contributions may be achieved to other local sustainability objectives** in areas such as health, safety, housing, air quality, land use, poverty reduction and local economic development.

Co-Benefits as a business case to justify the capital investment…

Climate strategies and actions with co-benefits…

(1) Can result in **win-win situations** and can be proved to be more **cost-effective**

(2) Are likely to be **more supported** by more diverse communities of interest (also as investors)

HOWEVER

(1) Requires understanding and quantifying complex relationships between different systems and aspects

(2) Actions may also be associated with unintended adverse impacts (co-harms).

Survey 2: Main observations on co-impacts

- Although an **increasing interest in including co-benefits** is observed, the inclusion of a larger list of sustainability indicators to account for positive side effects of actions as criteria in an MCDA model is **still not the norm**.
- Most guides solely use expressions such as “co-benefits” or “multiple benefits” introducing a positivity bias towards the impacts – **“trade-offs”/”co-harms” are not acknowledged**.

Survey 2: Main observations on co-impacts

- Attempts to develop an ordinal scoring method for quantifying the qualitative mapping the synergies and trade-offs between specific climate actions and other objectives.

- **Example**: New York City's plan employs a five-scale qualitative system:

Rating Scale

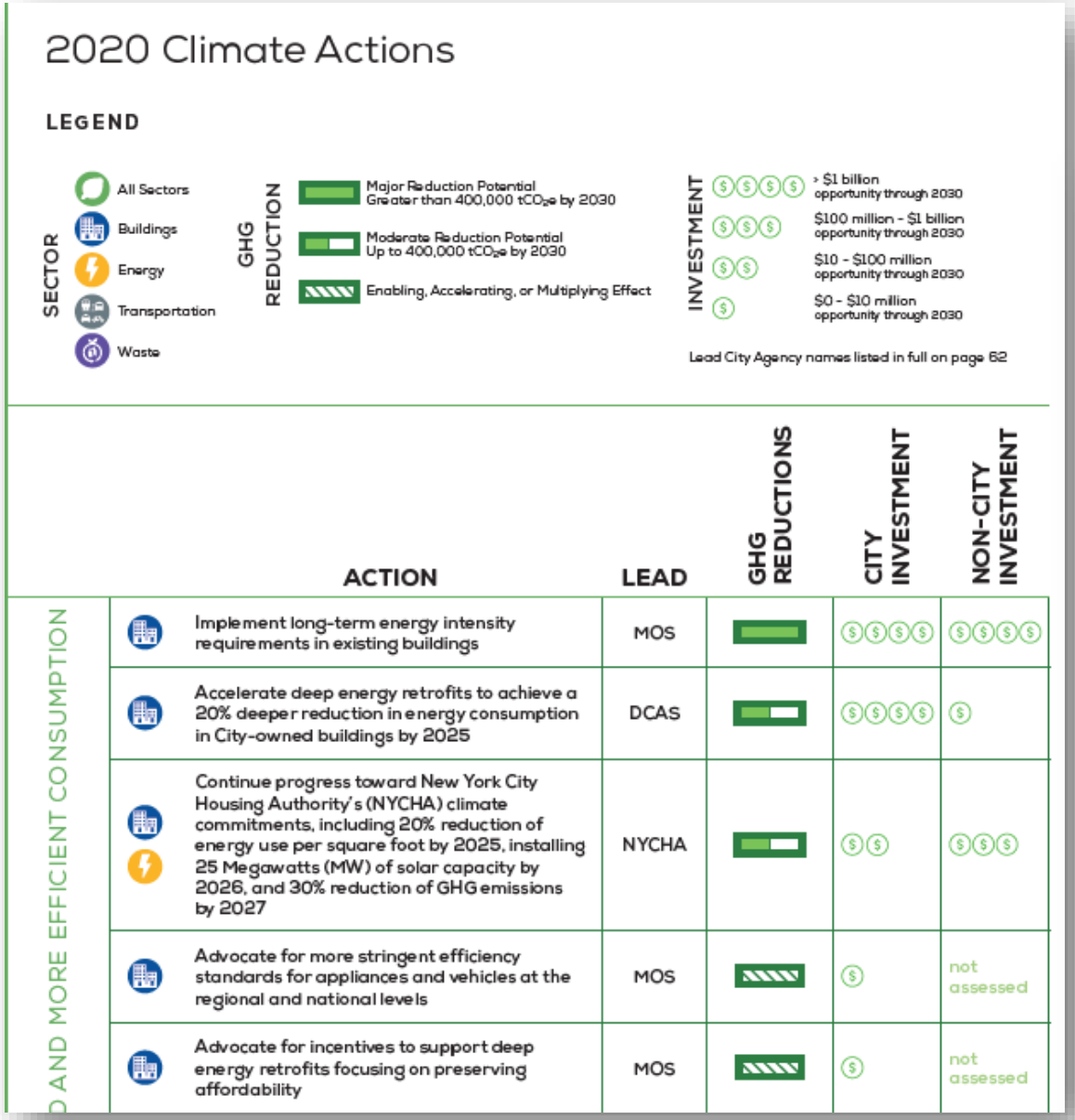
1 Major Risk
2 Moderate Benefit
3 Neutral Benefit
4 Moderate Risk or Co-harm
5 Major Benefit

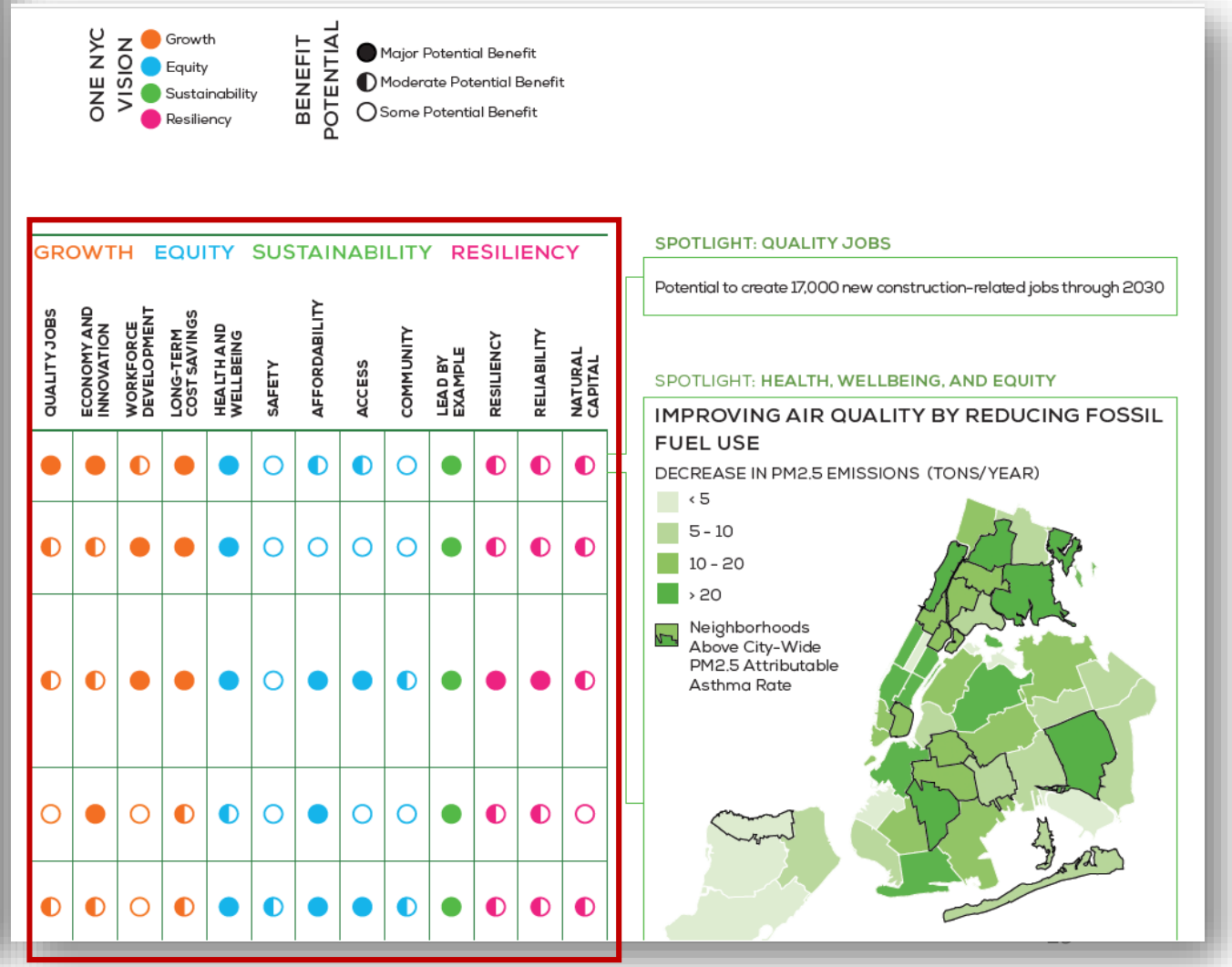
Source: C40 2017 Case Study: Action Prioritisation Methodology Applied for New York City's 1.5 °C Climate Action Plan (Available at: https://resourcecentre.c40.org/)

How NYC presents the co-benefits per action

Screenshots from NYC's CAP

Source: NYC Climate Action Plan. (2017). 1.5°C: Aligning New York City with the Paris Climate Agreement. New York City Government





Survey 2: “Level of power” as another underrepresented criterion

- It is also **significant that cities consider their “level of power”** - either as a criterion in the overall action prioritization exercise or as the starting point for a first shortlisting of actions, which are later evaluated and prioritized against all other criteria
- Again, this criterion is **not as highlighted as expected** in the different guides.

Example: Ordinal scale for "rating" mayoral powers by C40 Cities

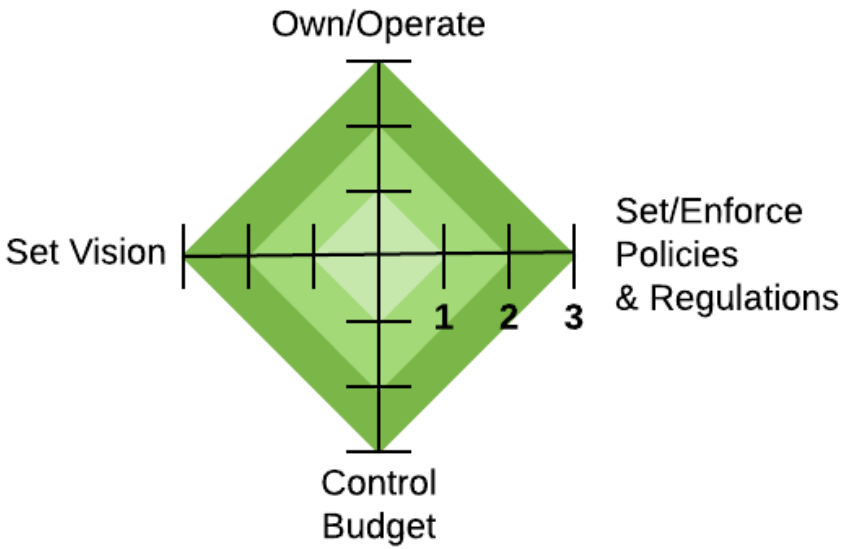
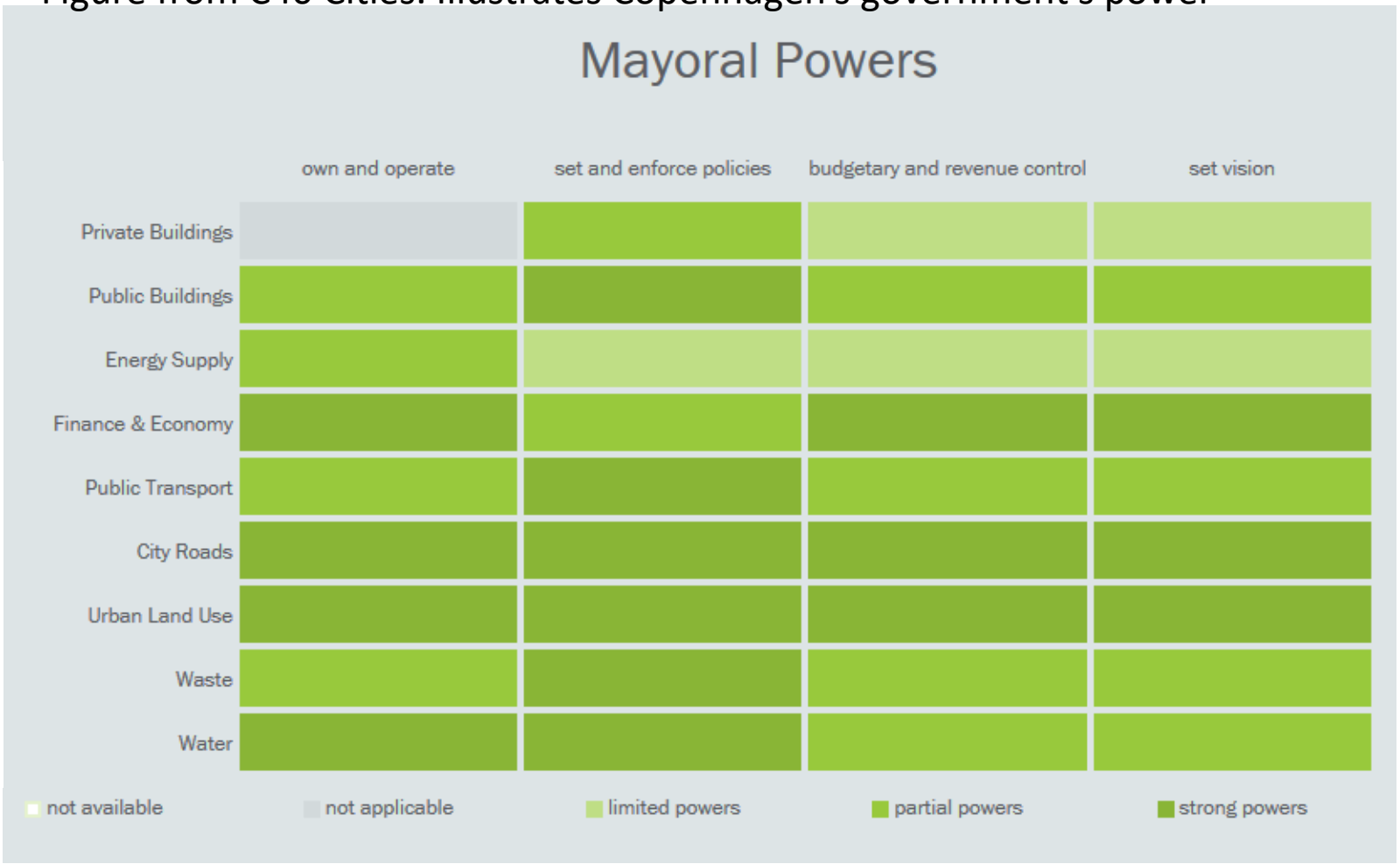


*Figure from C40 Cities. Illustrates Copenhagen's government's power



*Source: https://www.c40cities.org/cities/copenhagen

Conclusions

- **Prioritizing implementation efforts**: In a constrained environment, resources should be allocated to those actions which deliver the most benefits from a holistic point of view as well as the least co-harms.
- **Maximizing GHG emission savings from those actions with the greatest co-benefits**: Municipalities should seek to innovate with strategies with co-benefits in order to achieve more GHG emissions reductions instead of choosing actions resulting in fewer co-benefits.
- **MCDA allows for a systematic and transparent evaluation of the co-impacts** that actions will generate.

However, not as easy as it sounds…

- quantifying stakeholder's preferences and a great number of criteria may be a laborious and time-consuming process.
- For this reason, city governments, when faced with limited resources, should make effective use of all ready-at-hand existing tools to support this task.

Call for action: Next steps in research to improve & accelerate the implementation of such a framework

1. TO FACILITATE/ACCELERATE THE DEFINITION OF ACTIONS…

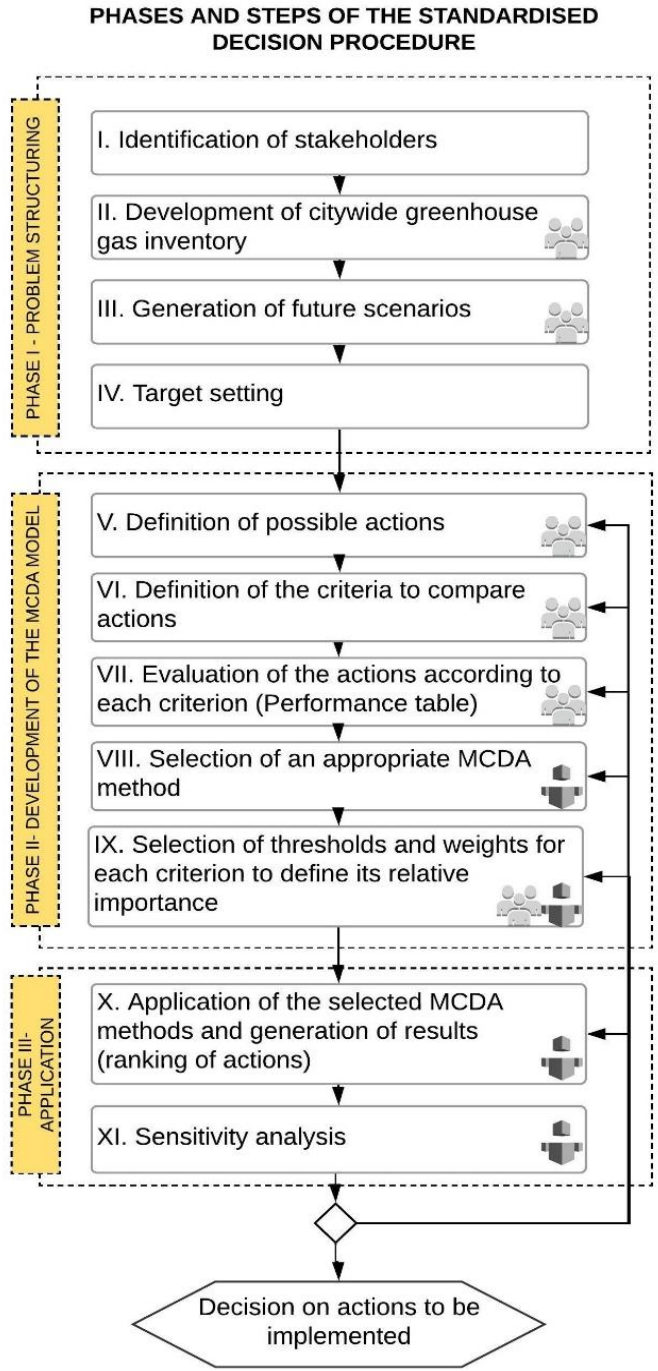
- create a **common database of best practice climate actions** in cities **with "filters"** to enable local authorities to focus on cities with similar geographic and socioeconomic context – this can become part of the future activities of GCoM

2. TO FACILITATE/ACCELERATE THE EVALUATION OF ACTIONS…

- develop **"co-impacts" tools** assisting their integration into the prioritization of actions.

3. TO FACILITATE/ACCELERATE THE ENTIRE PROCEDURE…

- create **group-decision making software tools especially designed for the action planning task** to guide municipalities throughout the entire action prioritization process/ streamline the communication process between stakeholders



Thank You!

Contact: maria.balouktsi@kit.edu