



NET ZERO CITIES

NetZeroPlanner Model Overview

Process and model scope / methodology



Objectives of decarbonisation economic modelling process



Purpose: Adapt and refine the tool to each city, to enable quantification of the economic case for decarbonisation – to build the rationale for ambitious climate action, support strategy and identify priority areas as defined in the Climate City Contract

Key elements and benefits of the model

1. Quantification of city “Business as Usual” scope 1 and 2 emissions* in 2020 and in 2030
2. City data inputs are used to create year 2020 baseline
3. Analysis of emission reduction potential from 13 decarbonisation sub-sectors aligned with city’s Climate Action Plan
4. 13 decarbonisation sub-sectors typically make up 90%+ of city’s Scope 1 and 2 emissions
5. Quantification of economic case for each sub-sector, including co-benefits

Purpose of the city decarbonisation tool – what it can be used for by each city

1. Quantify costs and benefits of climate related initiatives to maximize decarbonisation and monetary Return on Investment (ROI)
2. Understand investments required of different stakeholder groups as the foundation for Investment Planning
3. Test impact of increasing ambition level for certain targets
4. Visualize & quantify the wide range of co-benefits from climate action.
5. Integration tool in strategic decision making to enable data driven way of working
6. Comparisons across cities to highlight and share best practices

* And scope 3 for waste disposed of outside of the city

Scope of economic case analysis



Key considerations

CO₂ scope – what emissions to include?

- Include scope 1 & 2 emissions in the economic case, as cities can often influence these emission sources
- Scope 3 emissions are included only for city waste disposed of outside of city borders

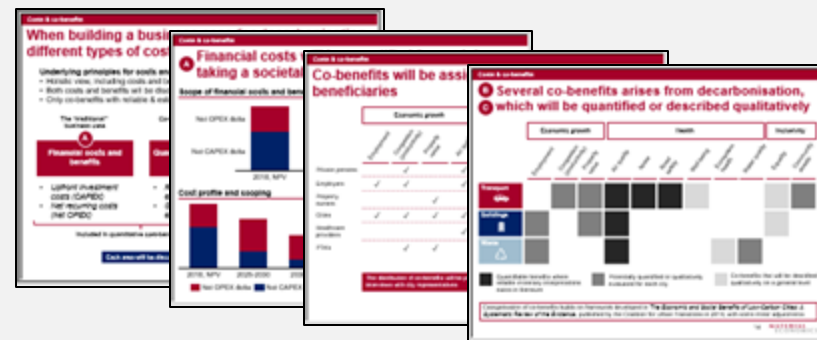
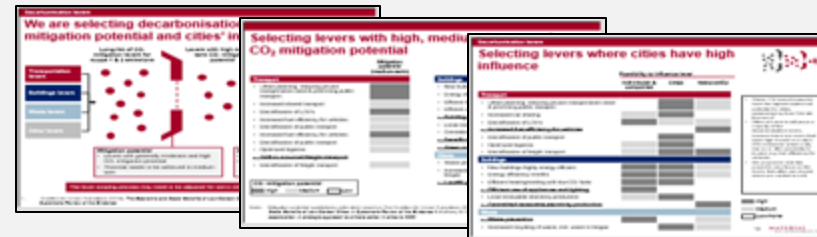
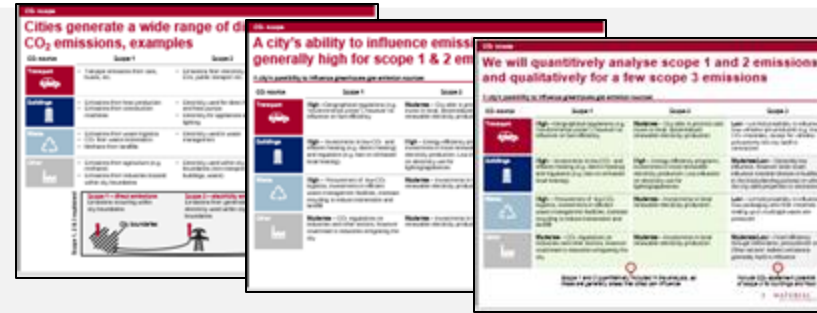
Decarbonisation sub-sectors – which sub-sectors to model?

- Quantify economic case for 13 abatement sub-sectors within *Transportation, Buildings & Heating, Electricity, and Waste*
- Selection of sub-sectors based on expected impact and possibility for cities to influence

Costs & co-benefits – which costs to include and co-benefits to quantify?

- Societal perspective on costs and benefits (not limited to city boundaries), net OPEX & CAPEX delta
- Quantify financial costs/benefits, *air quality, noise and road safety*





Proposed scope

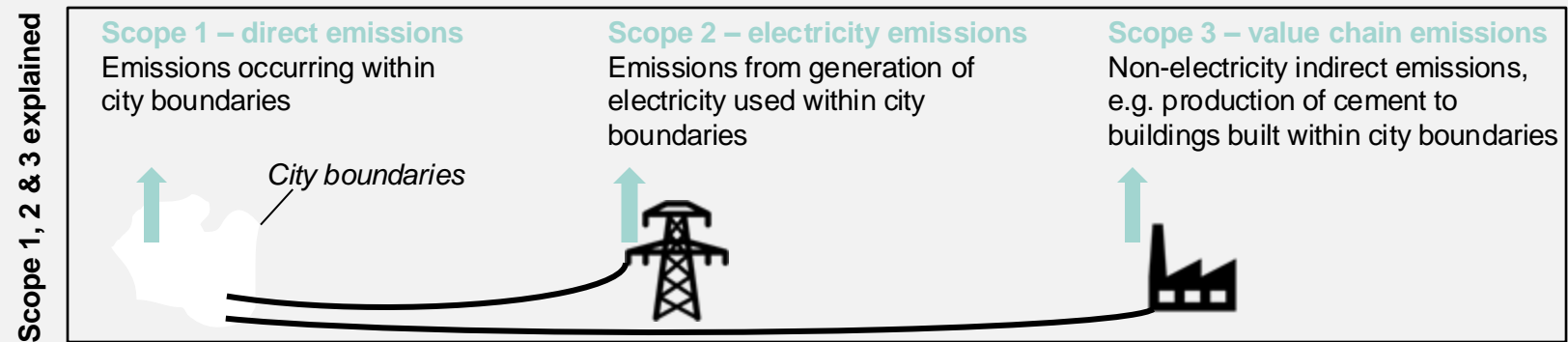


Cities generate a wide range of direct and indirect CO₂e emissions

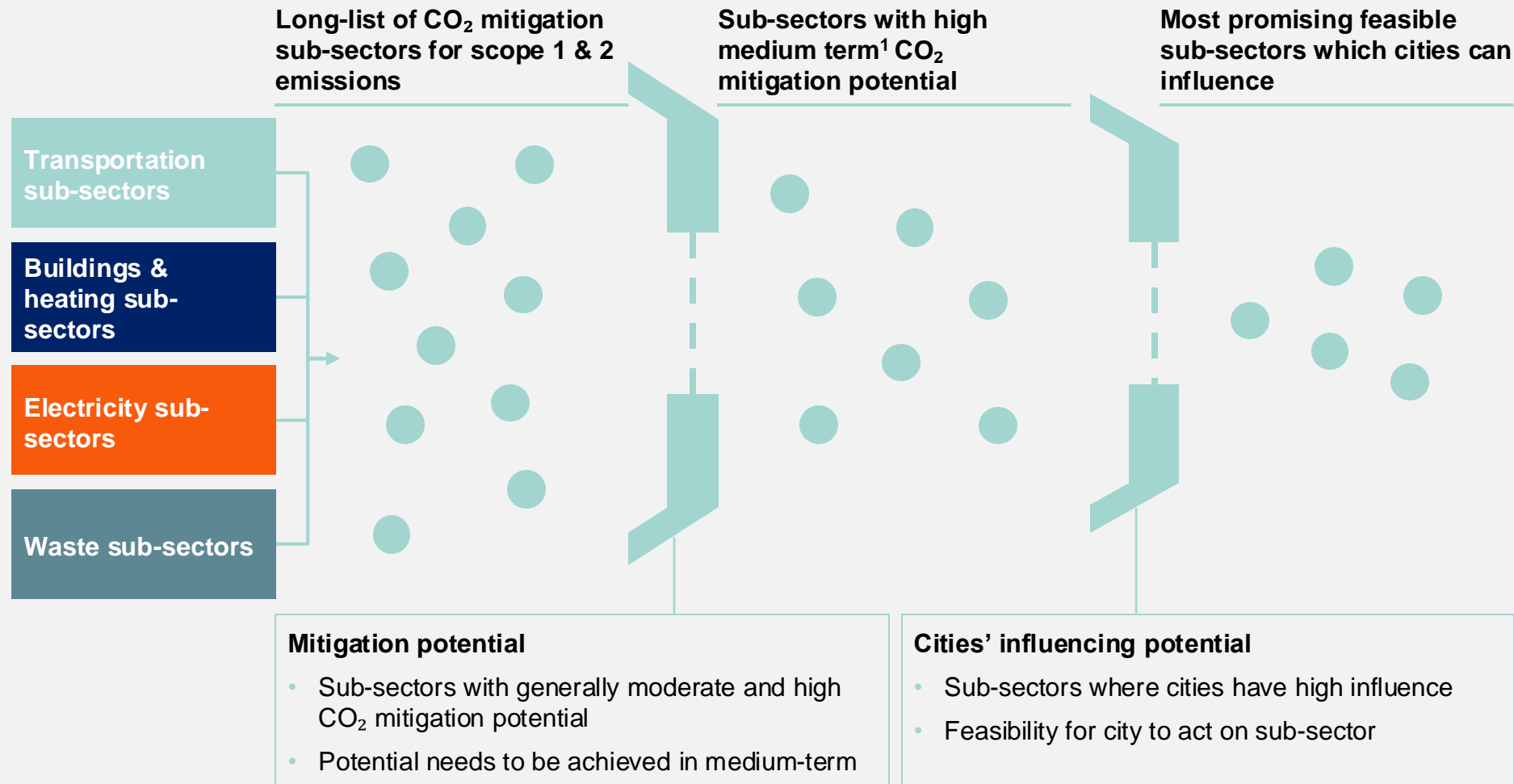


Non-exhaustive

CO ₂ source	Scope 1	Scope 2	Scope 3
Transport 	<ul style="list-style-type: none"> Tail-pipe emissions from cars, buses, etc. 	<ul style="list-style-type: none"> Emissions from electricity used in EVs, public transport etc. 	<ul style="list-style-type: none"> Materials emissions from production of vehicles Transportation of fuels
Buildings & energy 	<ul style="list-style-type: none"> Emissions from heat production Emissions from construction machines 	<ul style="list-style-type: none"> Electricity used for direct heating and heat pumps Electricity for appliances and lighting 	<ul style="list-style-type: none"> Material-related emissions, e.g. process emissions from cement production
Waste 	<ul style="list-style-type: none"> Emissions from waste logistics CO₂ from waste incineration Methane from landfills 	<ul style="list-style-type: none"> Electricity used in waste management 	<ul style="list-style-type: none"> Material embedded emissions in waste (e.g. plastic packaging)
Other 	<ul style="list-style-type: none"> Emissions from agriculture (e.g. methane) Emissions from industries located within city boundaries 	<ul style="list-style-type: none"> Electricity used within city boundaries (non-transport, buildings, waste) 	<ul style="list-style-type: none"> Food value chain emissions Other indirect emissions (non-electricity related)



13 decarbonisation sub-sectors selected based on mitigation potential and cities' influencing potential







1. Until 2030

Economic case quantifies carbon abatement and costs for emissions that city can more easily influence



A city's possibility to influence greenhouse gas emission sources

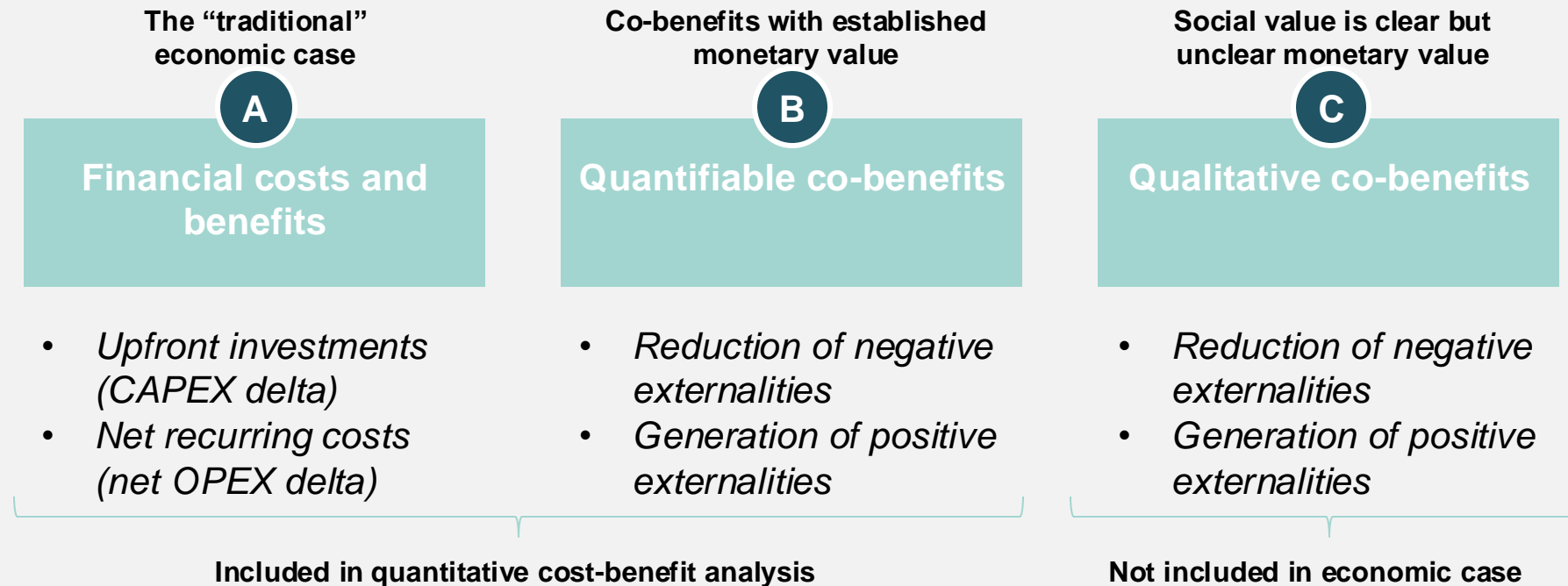
CO ₂ source	Scope 1	Scope 2	Scope 3
Transport 	High – Geographical regulations (e.g. “environmental zones”), however no influence on fuel efficiency	Moderate – City able to promote and invest in local, decentralized renewable electricity production	Low – Limited possibility to influence how vehicles are produced (e.g. low-CO ₂ materials), except for vehicles procured by the city itself or contractors
Buildings 	High – Investments in low-CO ₂ and efficient heating (e.g. district heating) and regulation (e.g. ban on oil-based local heating).	High – Energy-efficiency programs, investments in local renewable electricity production. Low influence on electricity use for lighting/appliances	Moderate/Low – Generally low influence, however cities could influence material choices in buildings in the local planning process or when the city sells properties to contractors
Waste 	High – Procurement of low-CO ₂ logistics, investments in efficient waste management facilities, increase recycling to reduce incineration and landfill	Moderate – Investments in local renewable electricity production	Moderate/Low – Influence waste management outside of city boundaries. Limited possibility to influence how materials ending up in municipal waste are produced.
Other 	Moderate – CO ₂ regulations on industries and other sectors, however could lead to industries emigrating the city	Moderate – Investments in local renewable electricity production	Moderate/Low – Food efficiency through information, procurement etc. Other sectors' indirect emissions generally hard to influence

When building an economic case for decarbonisation, different types of costs and benefits are considered



Underlying principles for costs and benefits

- Holistic view, including costs and benefits for citizens, businesses, and city
- Both costs and benefits are discounted, NPV 2020-2030/40/50 depending on the cost/benefit
- Only co-benefits with reliable & established cost data are quantified in the project



Financial costs have been quantified for each sub-sector taking a societal perspective



Scope of financial costs and benefits



- Calculated with “total societal cost” approach (depending on literature), e.g. cost of a modal shift to public transport = cost of private cars vs public transport per person
- Net CAPEX delta: Difference between investments required to realize sub-sector vs. baseline development
- Net OPEX delta: Difference between recurring net costs (including potential savings) required to realize sub-sector vs. maintaining existing system
- Assumptions are developed for each sub-sector and confirmed with city

Economic case includes a number of quantifiable co-benefits arising from decarbonisation



	Economic growth			Health				Inclusivity		
	Employment	Time savings	Property value	Air quality	Noise	Road safety	Physical health	Well-being	Equality	Community assets
Transport		■	■	■	■	■	■	■	■	■
Buildings & Energy	■		■	■					■	
Waste	■			■						

Quantifiable benefits where reliable monetary interpretations exist in literature
 Qualitatively evaluated co-benefits

Investments, recurring costs/savings, and co-benefits are assigned to six different types of asset owners / beneficiaries



Distribution of co-benefits across beneficiaries

	Economic growth			Health				Inclusivity		
	Employment	Time savings	Property value	Air quality	Noise	Road safety	Physical health	Well-being	Equality	Community assets
Citizens		✓		✓	✓	✓	✓	✓	✓	✓
Businesses			✓							
Cities	✓	✓	✓	✓	✓			✓		✓
Healthcare providers				✓	✓	✓	✓	✓		
Transport operators		✓	✓							
Utilities										

Investments and recurring costs / savings are distributed across all beneficiaries

Typically, 90+% of investment required will not be under the control of the city and will need to be made by citizens and businesses. In addition, benefits do not always accrue to the group making the investment.