Financing the ambition: Economic value from co-benefits

Deliverable D7.6

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This document is a training material about co-benefits, including the economic value of co-benefits, case examples, and a list of co-benefits for common climate actions.

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Abbreviations and acronyms

Acronym	Description
WP	Work Package

Summary

Co-benefits are additional benefits from climate actions that address some of the most pressing issues of cities, for example improved air quality due to reduced motorized traffic and improved physical health from more walking/biking.

Co-benefits are mainly connected to either economic growth, health, or inclusivity. Several co-benefits can be quantified in monetary terms and therefore be added to an investment plan and measured. From previous experience, we see that these quantified co-benefits often can turn a negative investment into a positive one, meaning they can be important to motivate and fund climate actions.

This document gives an overview of some of the most relevant co-benefits in cities, including the economic value of co-benefits, case examples, and a list of co-benefits for common climate actions. In addition, some mechanisms that can be used to finance co-benefits are explored in the paper.

Key words

Co-benefits are additional benefits from climate actions, mainly connected to either economic growth, health, or inclusivity.

Introduction

In the sustainable transition of a city, climate solutions such as decarbonising transportation and heating can provide additional value other than carbon reductions such as improvements in air quality, noise reductions as well as increased physical activity from more 'active mobility'. These co-benefits are an essential part of the total economic case for city decarbonization and can support the investment case of solutions. Co-benefits also help cities prioritize and compare the value of different actions.

1. The economic value of co-benefits

Several co-benefits can be quantified in monetary terms and therefore be added to an investment plan and measured. Analysis and modelling from more than a dozen European cities, shows that these quantified co-benefits often can turn a negative investment into a positive one, meaning they can be important to motivate and fund climate actions.

First, an overview of different types of co-benefits relevant for cities are described. Later, how they are relevant for a city's economic case when decarbonising.

1.1 Climate solutions' co-benefits

Climate solutions can have a positive impact on both the climate and other co-benefits. Co-benefits are worth emphasizing because they often add significant value by helping to solve some of the most pressing issues for mayors in addition to the CO2 emissions, see

Figure 1: The co-benefits of climate solutions address the most pressing issues of cities

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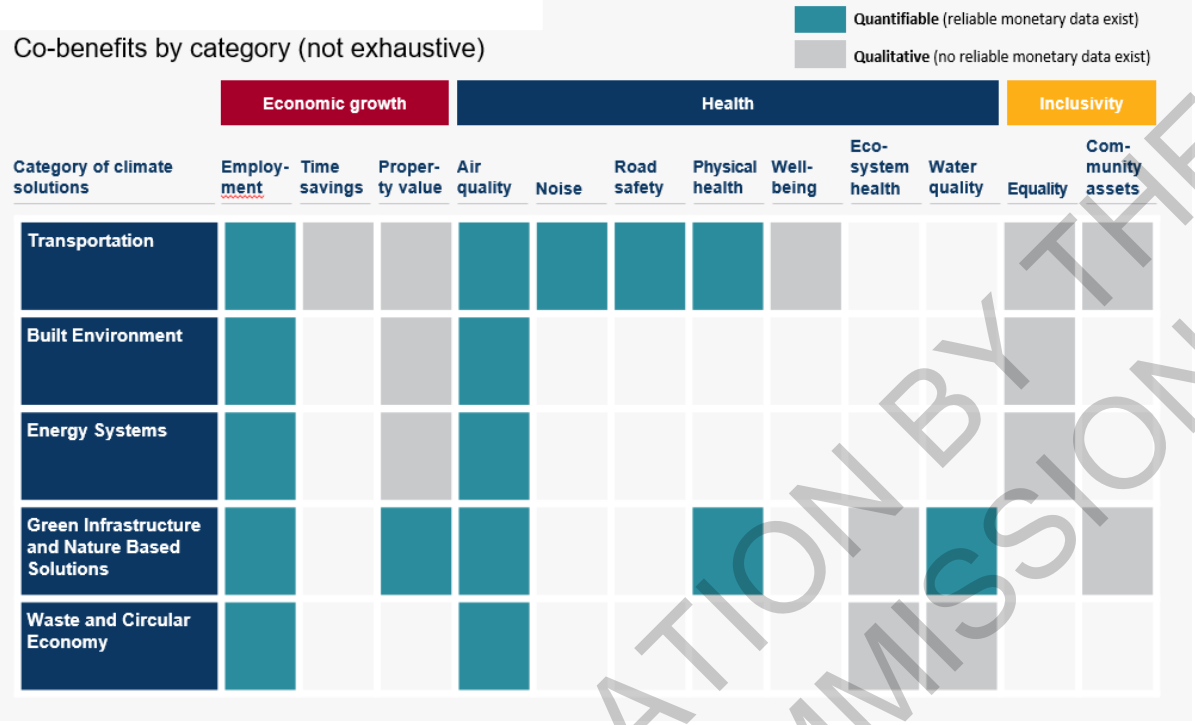
the figure below. Although some are difficult or perhaps even impossible to quantify, it is clear that almost all solutions improve some aspect(s) of health, economic growth, or inclusivity.



Examples of co-benefits in the three categories are:

- **Health**: electrification of vehicles and thereby reduced motorized traffic leads to improved air quality, reduced noise and improved physical activity from more walking/biking. pollution, a shift towards non-motorized transportation improves physical health etc.
- **Economic growth:** employment or local job creation when new public transportation, electrification of transportation or energy saving renovations of buildings are undertaken.
- **Inclusivity:** investments in the geographical coverage of public transportation may increase property value.

Below the co-benefits are described in more detail including the measurement used for each co-benefit e.g., air quality that is improved by climate solutions such as lower use of fossil fuels and waste incineration in the categories of transportation, built environment, energy systems, green infrastructure and nature-based solutions and waste and circular economy.

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NOT EXHAUSTIVE

Category	Co-benefit	Description	Measurement
Health	Air quality	Health improvements of citizens from cleaner air from e.g., reduced motorized transport and electrification of energy	kg pollutants (NOx, PM 2.5, and PM10)
	Noise	Health improvements of citizens from lower noise pollution from e.g., reduced motorized transport and shift to electric vehicles	km transport from ICE vehicles
	Road safety	Accidents avoided from e.g., reduced motorized transport	# of accidents
	Physical health	Health improvements of citizens from e.g., increased walking and cycling	km transport from walking and biking
	Well-being	Health improvements of citizens from e.g., renovated buildings (better living environment)	m^2 of insulated houses
	Ecosystem health	Ecosystems improvements in the city from e.g., reforestation	*Not quantified*
	Water quality	Water quality improvements from e.g., reforestation	# of trees planted
Economic growth	Employment	Additional jobs created in city from e.g., shift to public transport and increase in construction	# of city-jobs created
	Time savings	Time saved by citizens from e.g., reduced transport and congestion	Time saved (days)
	Property value	Increase in property value from e.g., expanded public transport and building improvements	Value of property market (EUR)
Inclusivity	Equality	Equal access to products and services from e.g., improving access to transportation	*Not quantified*
	Community assets	Publicly owned and free-to-use areas/assets by e.g., repurposing parking spaces	*Not quantified*

Figure 2: Main co-benefits for cities can be categorized in economic growth, health, and inclusivity

Below is another way of showing how some co-benefits, including nature-based solutions, can be quantified in monetary terms. One nature-based solution is planting trees in cities which not only makes the surroundings more attractive, hence can increase the property value, but also create shade and thereby lessen the effects of heatwaves and reduce the need for A/C, absorb downpour which decreases the risk of flooding.

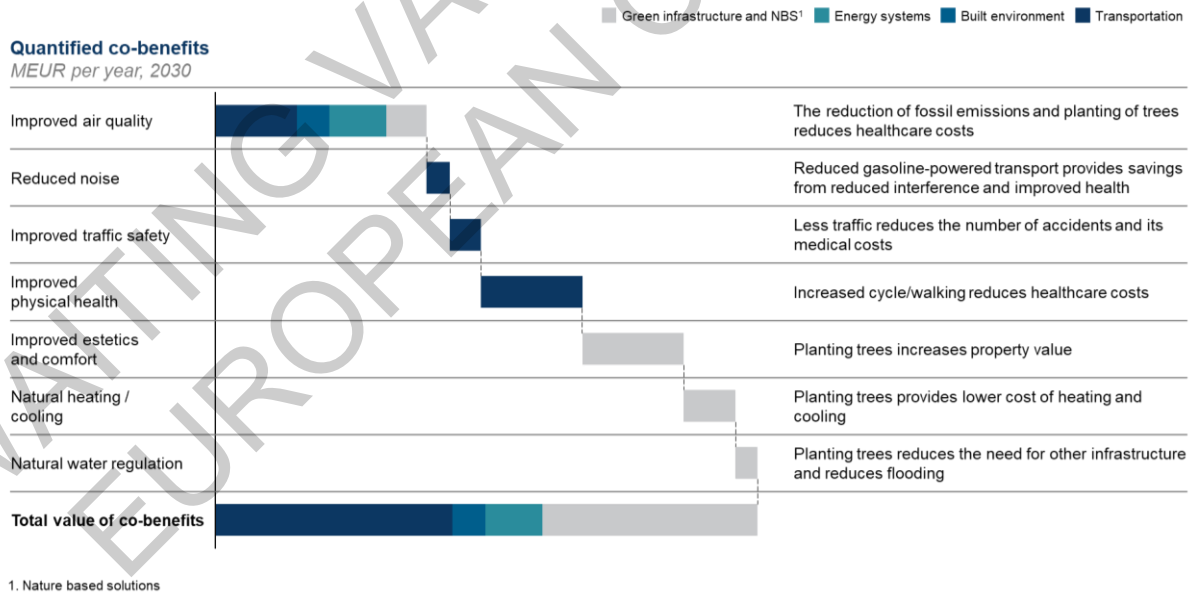

Figure 3: Some co-benefits can be quantified in monetary terms

1.2 Co-benefits and economic cases for city decarbonization

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When decarbonising a city, the investments undertaken in transportation, buildings, heating and electricity create large cost savings mainly in energy savings. The same investments also create additional co-benefits in mainly health savings I.e., air quality, physical activity, noise reduction and increased safety without additional investments.

Co-benefits are often an essential part of making the total economic case for city decarbonization positive. However, investments made by one part i.e., local city invests in new public transportation or charge stations might be create cost savings for another part i.e., the national or regional health care due to improved health savings.

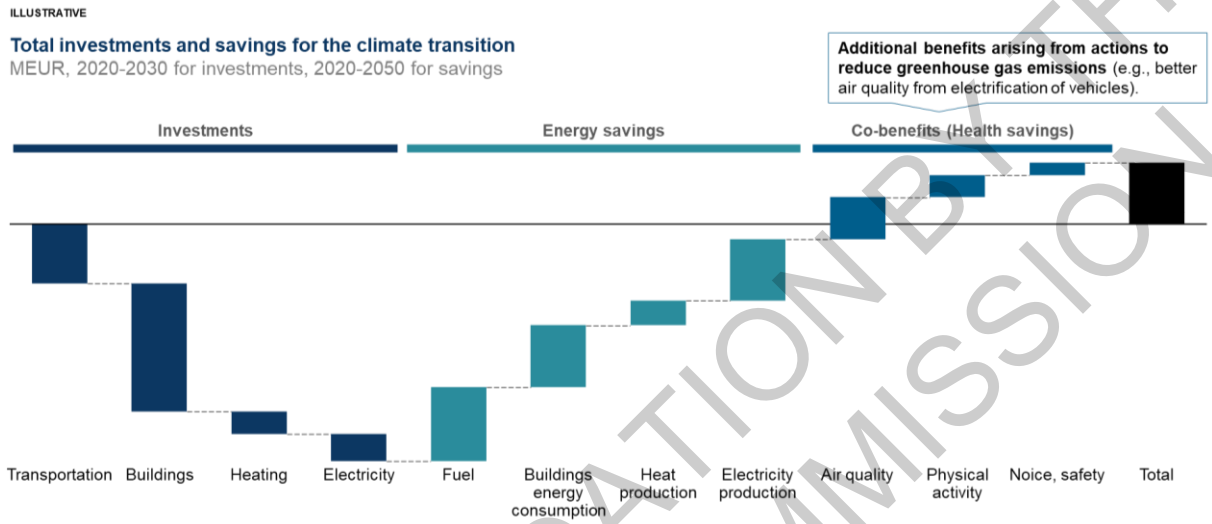
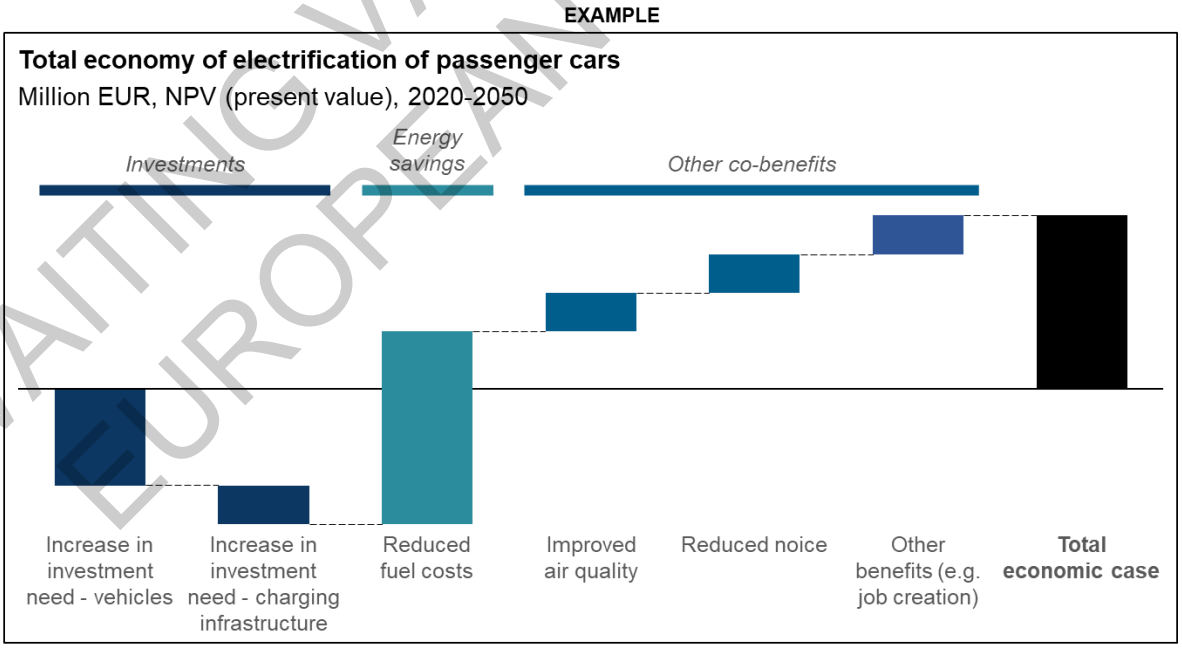


Figure 4: Co-benefits are an essential part of the total economics case for city decarbonization

Each climate solution has its own economic case including the value of co-benefits. One example, electrification of cars, is shown below. Others are shown in appendix 2.



1. Investments can include either completely new investments or making existing investments in a climate-smart way (which can give rise to an increased investment), e.g. new construction or the purchase of a new car

Figure 5: Each climate solution has its own economic case including the value of co-benefits

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2 City case examples

Below is an overview of eight different European cities and their investment plans for a decarbonisation. They differ in geographic location, size (number of inhabitants), and economic level (GDP per capita). These eight cities are real examples that have quantified and modelled their decarbonisation investment plan including the effects of co-benefits. Some abstracts of the analysis are presented in this section.

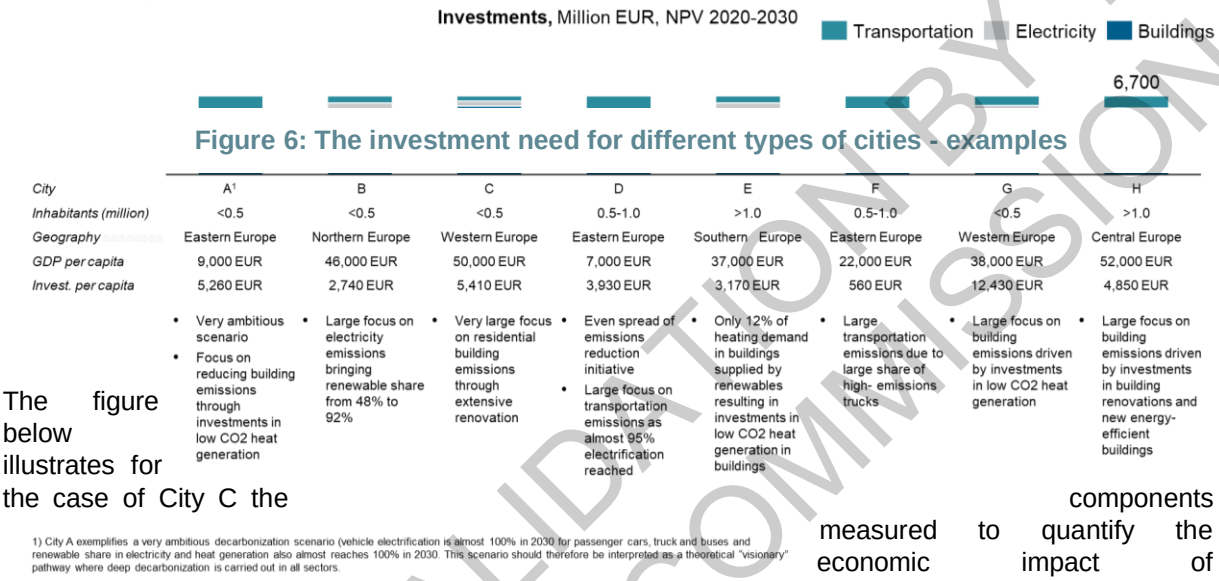

Figure 6: The investment need for different types of cities - examples

The figure below illustrates for the case of City C the components measured to quantify the economic impact of decarbonising electricity and enables to see how this lever is positive, from a business case point of view as well as for all stakeholders. The case takes into account upfront investments, net costs savings and co-benefits. City C has invested in roof-top solar and centralised solar/wind and thanks to this registers on the one hand, net cost savings enabled by the energy production of the roof-top solar and the reduction in fossil production and from other current sources, to what on the other hand, co-benefits add up thanks to improved air quality, while achieving the initial objective to reduce CO2 emissions.

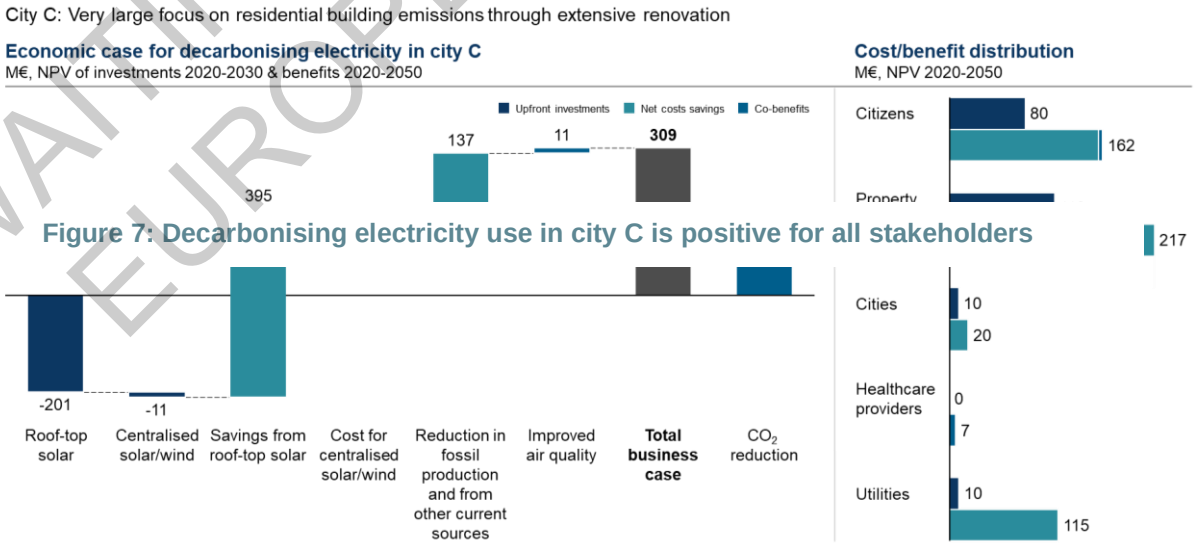

Figure 7: Decarbonising electricity use in city C is positive for all stakeholders

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2.1 Methodology: how to calculate co-benefits

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

2.1.1 Underlying principles for calculating co-benefits

The "traditional" economic case including the financial costs and benefits (A) as well as the quantifiable co-benefits (B) are included in the quantitative cost-benefit analysis. However, the co-benefits more difficult to quantify even though they have a social value, have not been included in the economic case.

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

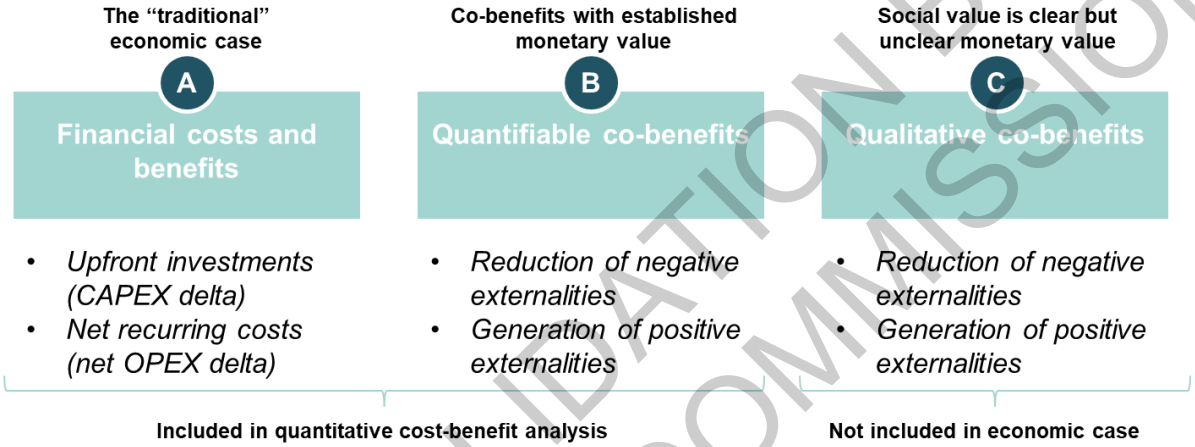


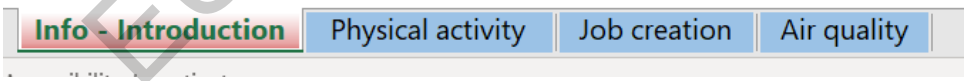
Figure 8: Types of costs and benefits to consider for an economic case for decarbonization

2.1.2 Assumptions for calculating co-benefits

The economic value of the co-benefits that has been used in the economic modelling including their assumptions are presented below. They have been based on literature and each city is advised to update the data input according to the local adaptations.

There is an Excel model attached showing how the co-benefits from city decarbonization are quantified. The purpose of this model is to give an example as to how co-benefits can be calculated, it's not meant as a one-click solution for cities to use as input and assumptions should be adapted to the specific city context.

The Excel model has four tabs; first an Introduction, followed by the calculations for the co-benefits and Physical activity, Job creation and Air quality.



The input data used (see data in blue) is an example from a city of ~90 000 inhabitants, both input and results may therefore vary significantly between cities.

Pay extra attention to the assumed discount rate of 4%. Changing this may impact results significantly, please check which rate is commonly used locally.

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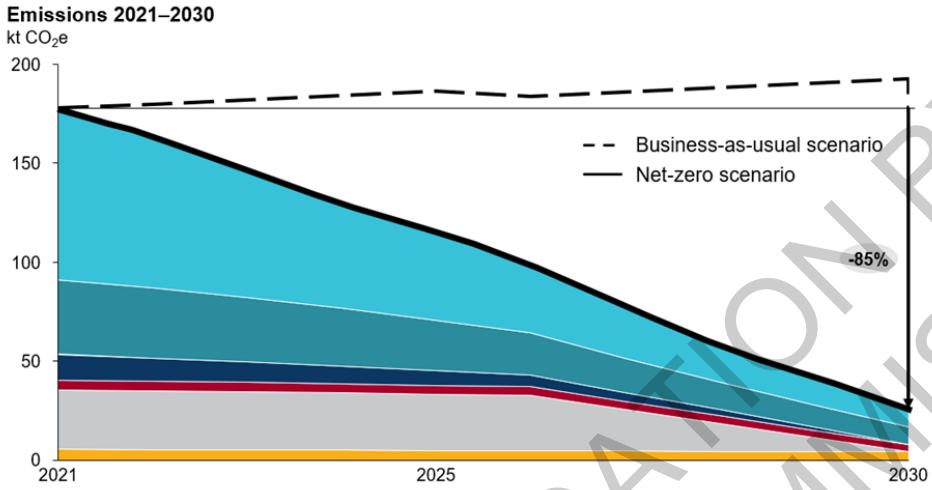
The data was extracted from a city decarbonization model that builds on two different scenarios: the business-as-usual (BAU) and net-zero scenario. The business-as-usual scenario outlines the expected emissions without any additional actions and is often increasing due to population growth. The net-zero scenario outlines the possible decarbonization pathway for a city if they implement actions for climate abatement such as building renovations, electrification of transport and similar.

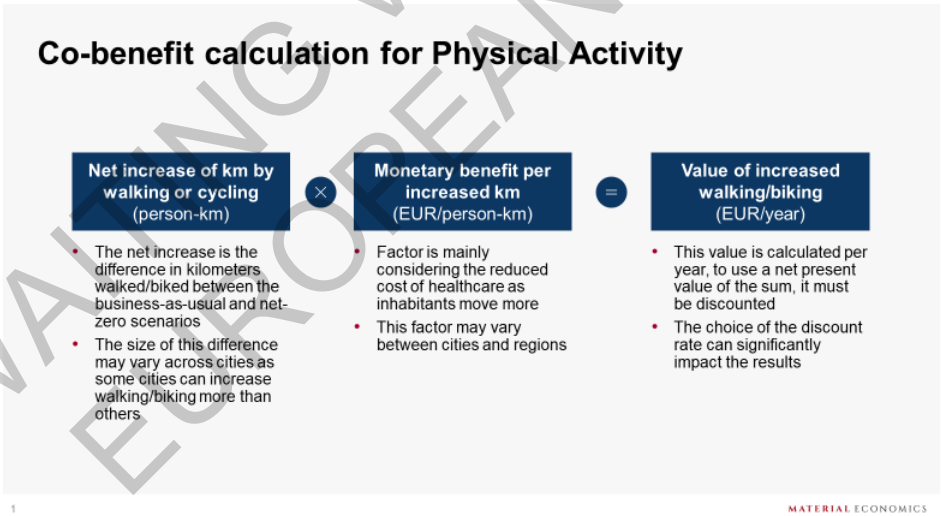
For co-benefits, all emission reduction and co-benefits are calculated as net improvements compared to baseline.

Figure: Example of business-as-usual and net-zero scenario pathway for a city.



Calculating the co-benefits of the net-zero scenario is calculating the value of the improvement from the business-as-usual scenario. If the city implements bus electrification, air pollution will decrease by a certain amount. This is why in the coming tabs the calculation always starts with calculating a net increase/decrease.

Example calculation of the discounted monetary value of increased activity levels due to an increase in walking/cycling as a means of transport in the net-zero scenario



Example calculation of the number of jobs created from increased building renovations and installation of solar power.

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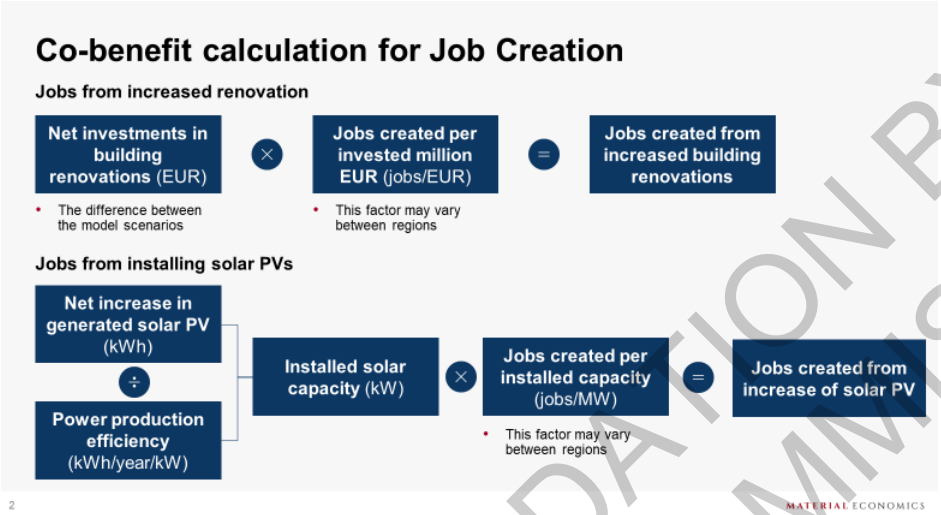
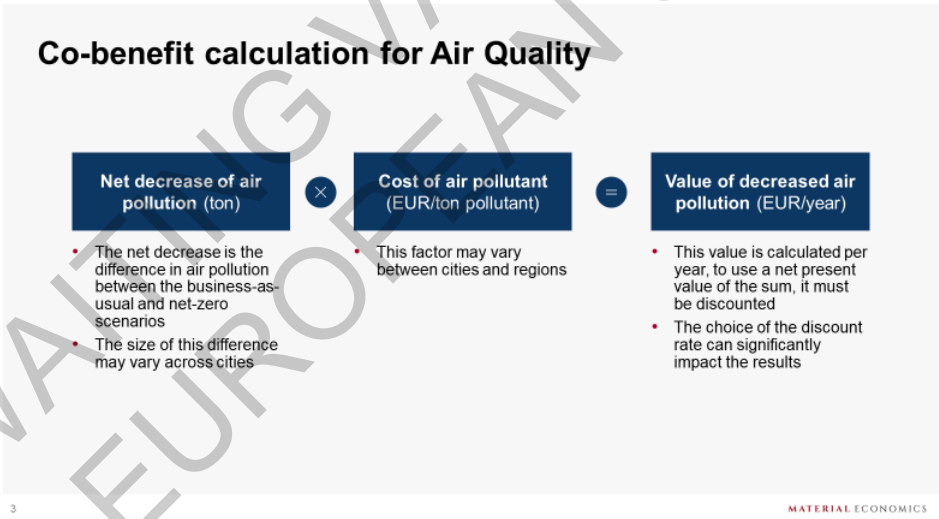
Estimated job creation potential includes jobs from energy efficiency retrofits and solar PV installation & maintenance, does not include any potential lost jobs in e.g. fossil generation. Years of employment created 2021-2030 are calculated based on investments per area using the following assumptions[1]:

- Building Envelope Renovations: est. 18 FTE/M€ invested
- Renewable Electricity: est. 7.8 FTE/MW installed capacity
- Bus Rapid Transport Network: est. 22.5 FTE/M€ invested
- Electric Vehicle Charging Network: est. 15.5 FTE/M€ invested
- Active Transport Infrastructure: est. 22.5 FTE/M€ invested



Calculation of the discounted monetary value of increased air quality from e.g. a decrease in combustion motors and increase of walking or public transport.



[1] European Parliament (2016) - Boosting Building Renovation: What Potential and value for Europe?; Dvorak, et. al. (2017) - Renewable energy investment and job creation; a cross-sectoral assessment for the Czech Republic with reference to EU benchmarks; Cuchi & Sweatman (2011) - A national perspective on Spain's buildings sector a roadmap for a new housing sector; Material Economics modelling; McKinsey (2020) - How a post-pandemic stimulus can both create jobs and help the climate.

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2.2 Example of cities economic case including co-benefits

While the cities studied all have various economic context and diverse climate solutions scenarios, the comparison of the results shows that the economic case is positive for all cities when co-benefits are included.

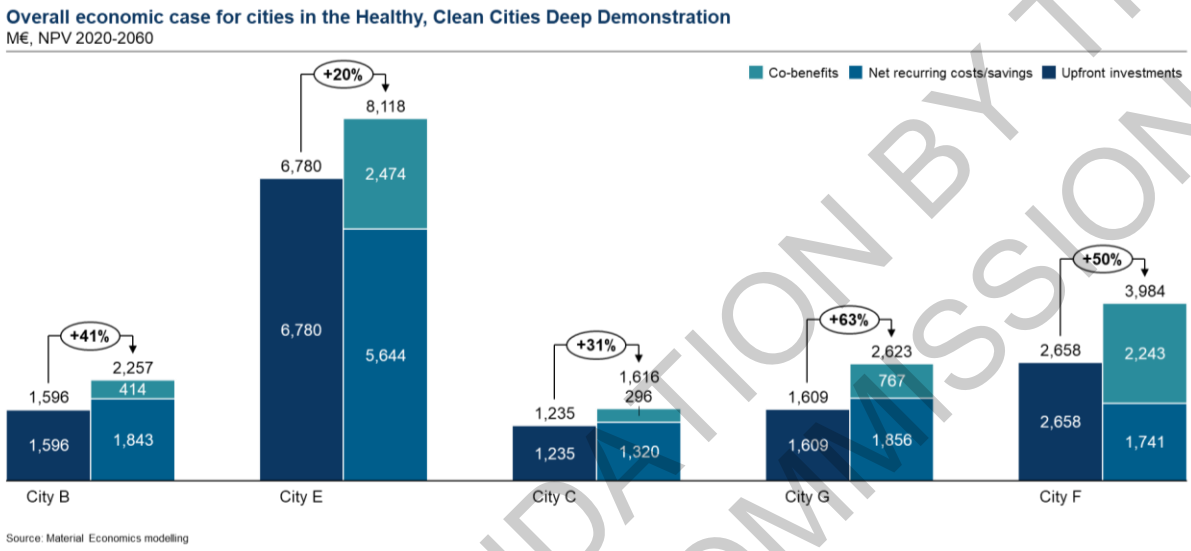

Figure 9: The economic case is positive for all cities analysed

The total economic case for a city illustrates how several levers impact the overall plan, detailing the investments, the direct costs effects (cost savings) and the measured co-benefits, resulting in "total economic case" at the end of the chart and the CO2 reduction achieved in the scenario of the city concerned. The purpose is to get some inspiration according to your city context and ambitions.

3 Financing methods for co-benefits

Valuing and realizing the potential of co-benefits pose significant challenges, as these advantages extend beyond immediate project investors. This complexity can make financing co-benefits intricate, with investors potentially not fully realizing the extent of their investments in their returns. To address this, it is imperative to establish a pragmatic, risk-adjusted return mechanism within financial instruments designed to generate co-benefits. Such financing mechanisms must not only yield their returns but also accommodate and amplify additional societal and environmental impacts.

Within this framework, this paper identifies various potential financing mechanisms capable of delivering co-benefits, along with the corresponding "investor" profiles associated with each. These mechanisms serve as essential tools for harmonizing financial objectives with broader societal and environmental goals. The following section presents an overview of these financing mechanisms and their respective investor types. Financial instruments are recommended for each of the corresponding mechanism which can be used to mobilise capital most effectively.

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Financing Mechanism	Description	Investors	Financial Instruments
Outcome-Linked Financing	Outcome-Linked Financing is an approach which links payments from both public and/or the private sector to the achievement of a particular, or series of pre-defined social or environmental outcomes, which are measurable. For example, improved air quality, reduced incidence of ill health, improved heat island effect, improved employee productivity.	Investor Types: Outcome Buyers; Health Insurers (a positive health outcome aimed at reducing future pay-outs); Philanthropists (focused on positive health/social outcomes) and socially conscious Investors (such as, Family Offices and High Net Worth Individuals as part of their investor mandates) and Corporates (mostly local Corporates, where direct outcome benefits employee welfare, productivity and overall well-being).	• SLBs • Municipal Level Debt for Nature Swap • Impact bonds • Pay-for-Success Contracts
Concessional Financing	Concessional Financing refers to loans or funds provided at below-market interest rates and terms to support development projects. It can be applied as a grant, typically funding technical assistance for a project. Also, it can come in the form of 1st loss guarantee involving 3rd parties and assisting with crowding in the private sector i.e., a de-risking strategy. Concessional Financing is an ideal tool to bridge the gap between the public and private sectors' financing of projects.	Investor Types: 1st loss guarantee funding can come from national/local Government, Donors, Philanthropists and Foundations where there is no expectation on a financial return but are contributing towards positive impact projects and act as guarantors. The private sector financing includes Corporates, local Institutional Investors, Impact Investors, Financial Institutions and local Real Estate/Property developers and funds.	• Low interest loans • Guarantees • Municipal Level Debt for Nature Swap • First loss financing • Grant finance programme
Impact Based Financing	Impact Based Financing involve placing money into funds specifically targeting positive social and environmental projects. The projects will provide measurable impacts so that the Impact Investment Fund will be able to assess the viability of the project from an environmental and/or	Investor Types: Impact Investors - Core Impact Investors are the focus here and could be viewed as non-profits. Impact Investors, as an investor class, will focus on a specific project impact, which will allow for a more measurable and determined impact and for which they can demonstrate they are achieving their objectives. In addition, the financial return component will	• Green Bonds • Green Revolving Funds

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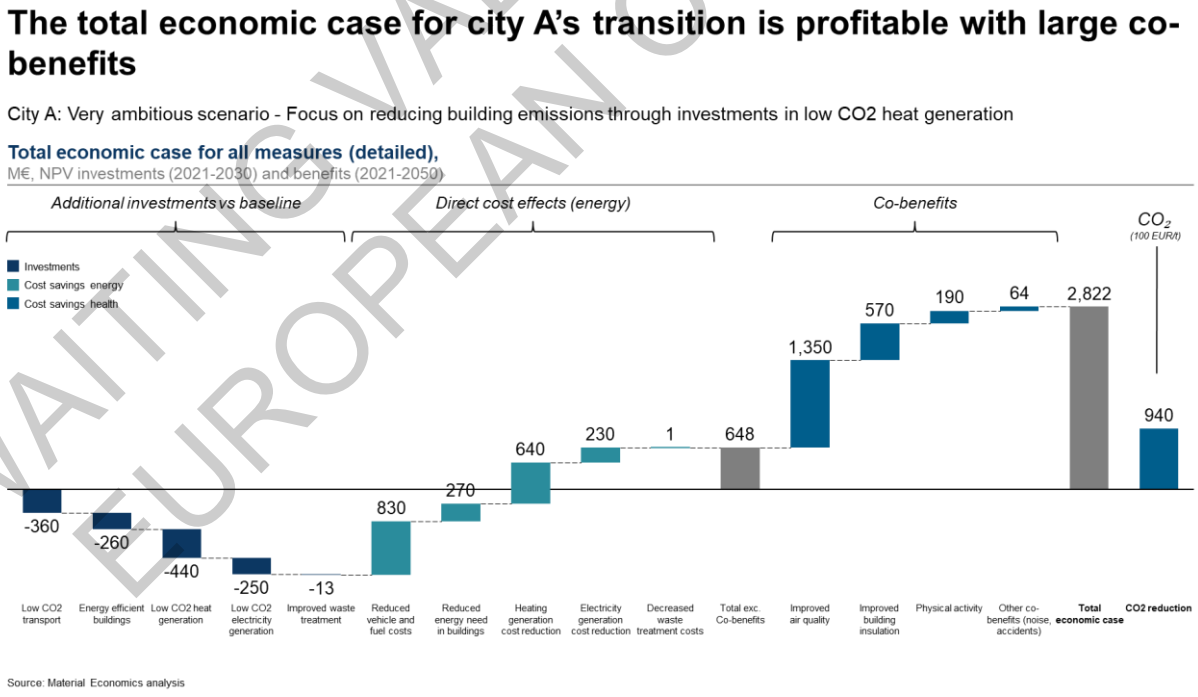
	social impact lens. Depending on the Impact Investment Fund, there can be varying degrees of a financial return component as well.	need to be clearly outlined and understood from the project. Corporates and any Financial / Institutional Investor looking to boost their ESG exposures and credentials in this area should also be considered.	

4 Conclusion

The purpose of this document is to introduce the concept of co-benefits, how to calculate them and how their economic value, if quantifiable, often can turn a negative investment into a positive one, meaning they can be important to motivate and fund climate actions. There is an Excel model attached in order for the NetZero Cities to model the economic value of their own co-benefits. Further, some aspects of how these can be financed given existing instruments and mechanisms is explored which should be considered after creating reliable cost estimates and being comfortable with the intended outcomes.

5 Appendix 1: Economic cases for cities including co-benefits



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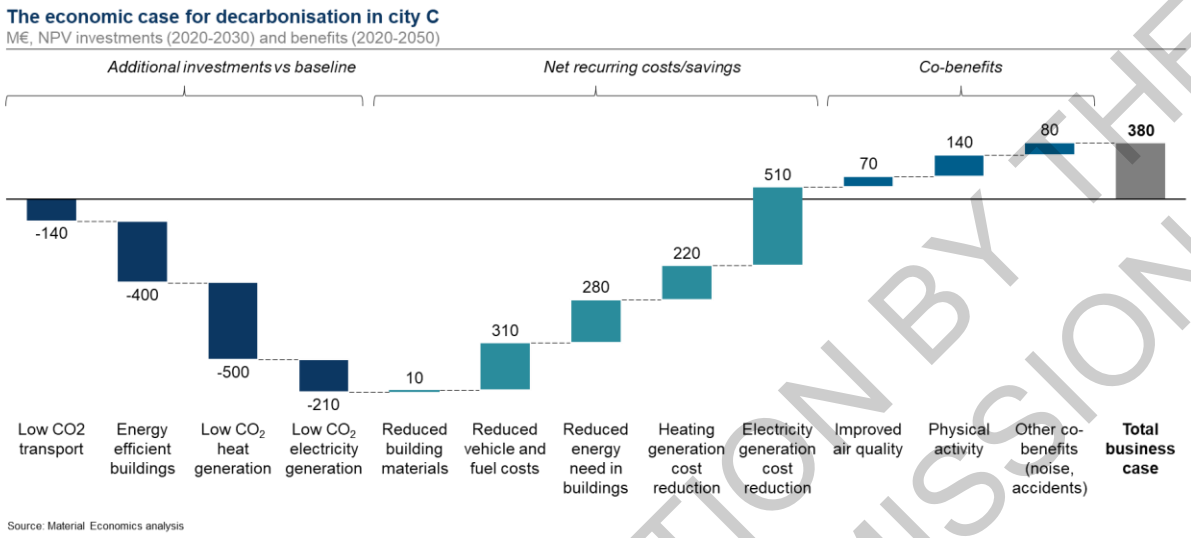
The total economic case for city C's transition is profitable with large co-benefits

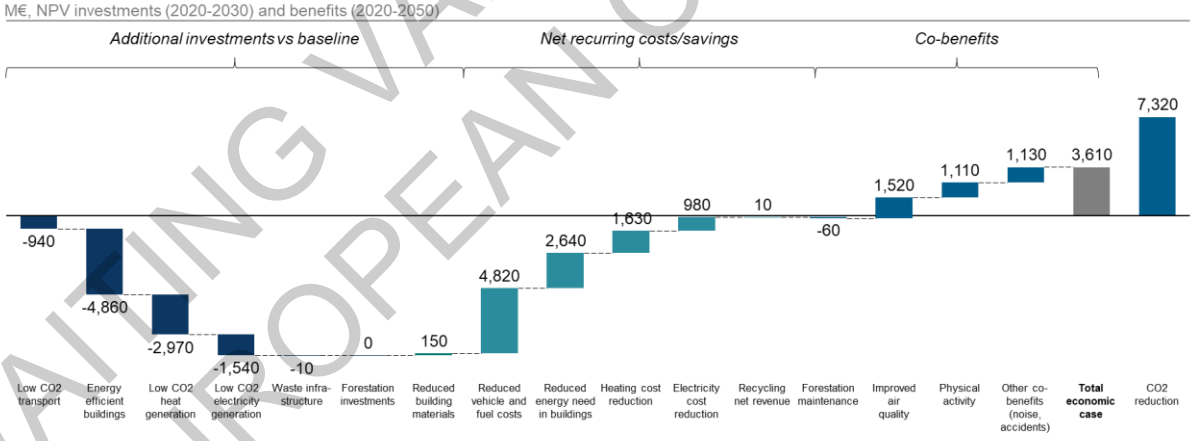
City C: Very large focus on residential building emissions through extensive renovation



Source: Material Economics analysis

The total economic case is nearly break-even, and strongly positive when considering co-benefits for city E

City E: Only 12% of heating demand in buildings supplied by renewables resulting in investments in low CO2 heat generation in buildings



Source: Material Economics modeling

6 Appendix 2: Co-benefits per lever

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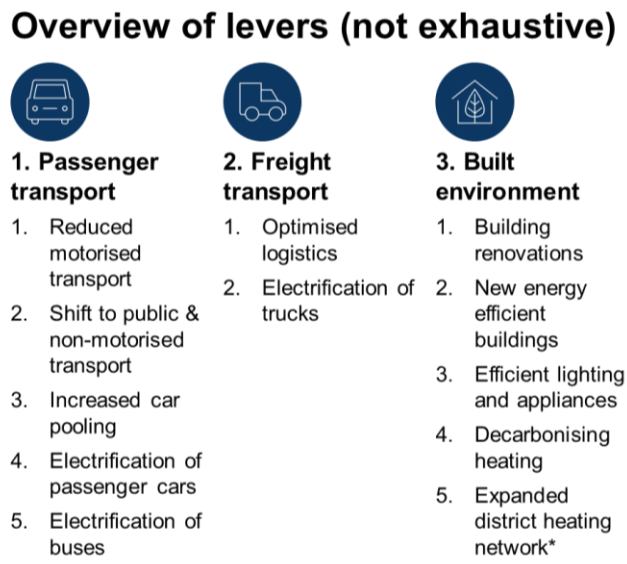
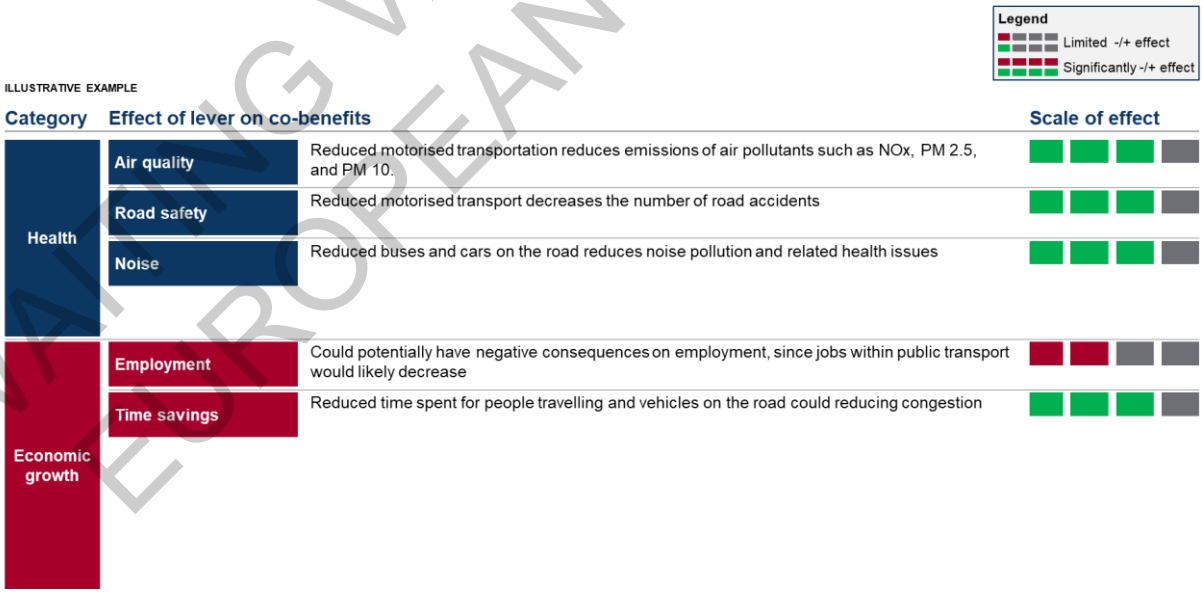
Co-benefits effects of levers can be scaled thus helping cities to prioritise actions according to their needs and challenges. The scale effect of some levers for four climate solutions categories is presented here after per category.



6.1 Passenger transport

6.1.1 Reduced motorised transportation



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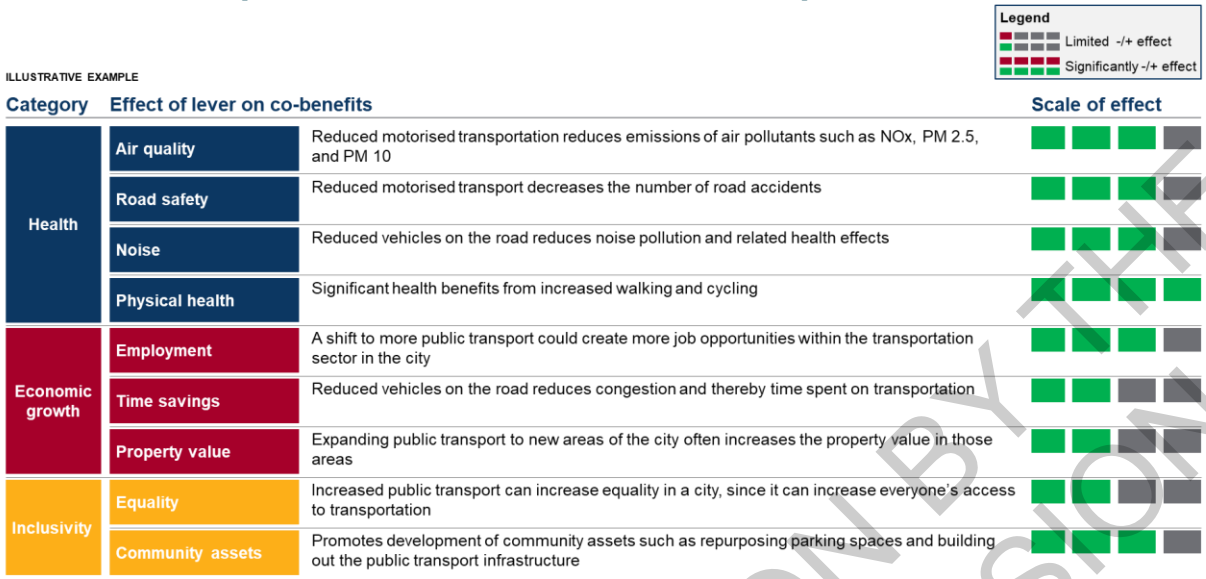
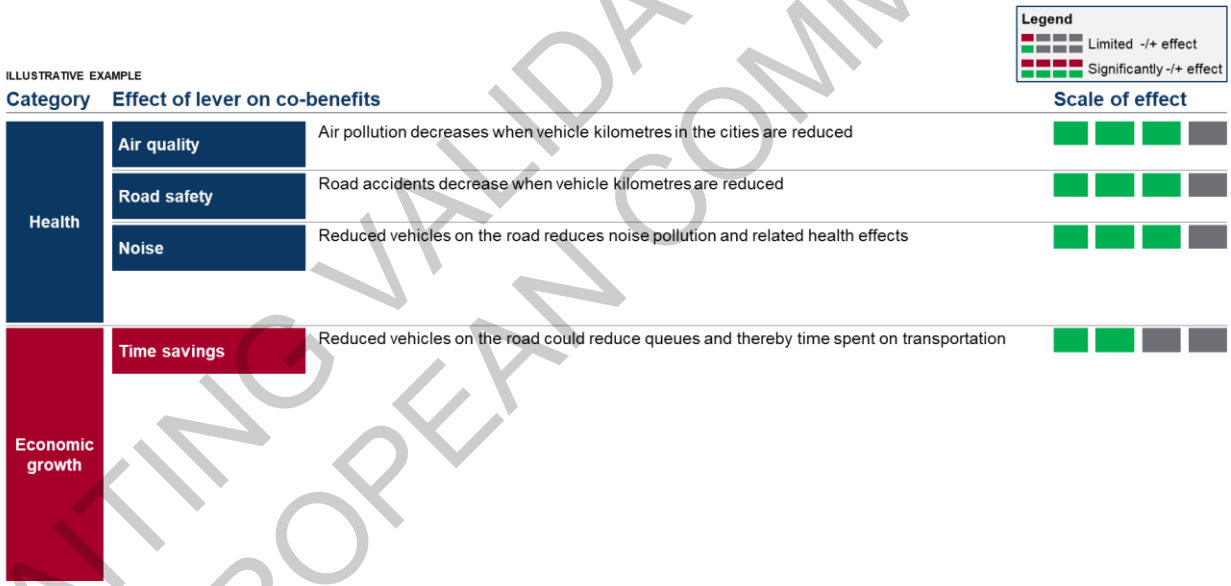
6.1.2 Shift to public and non-motorised transport



6.1.3 Increased car pooling



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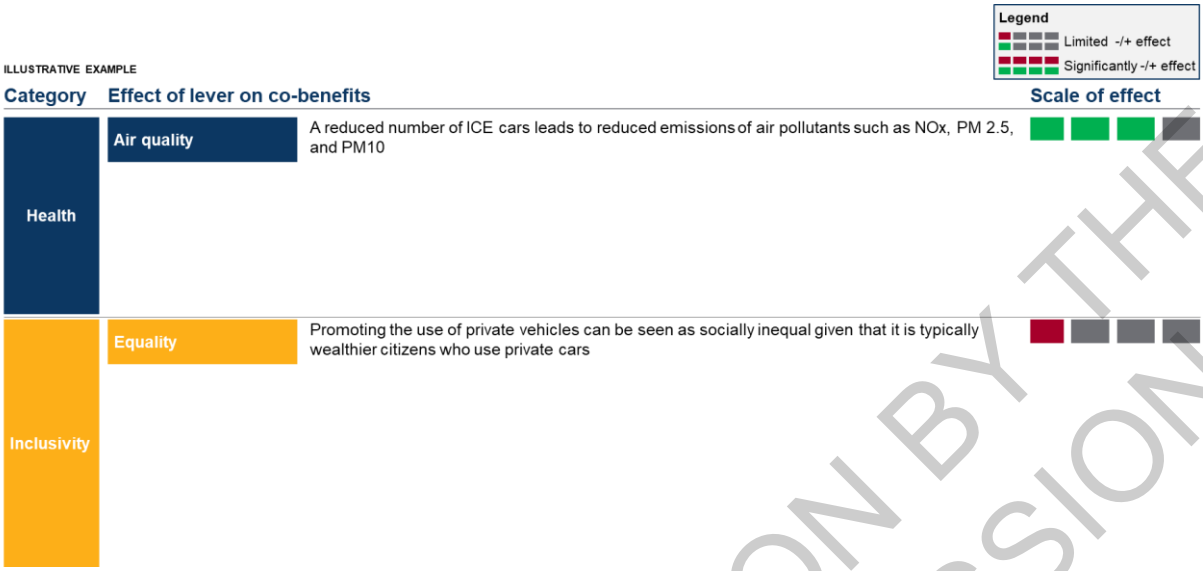
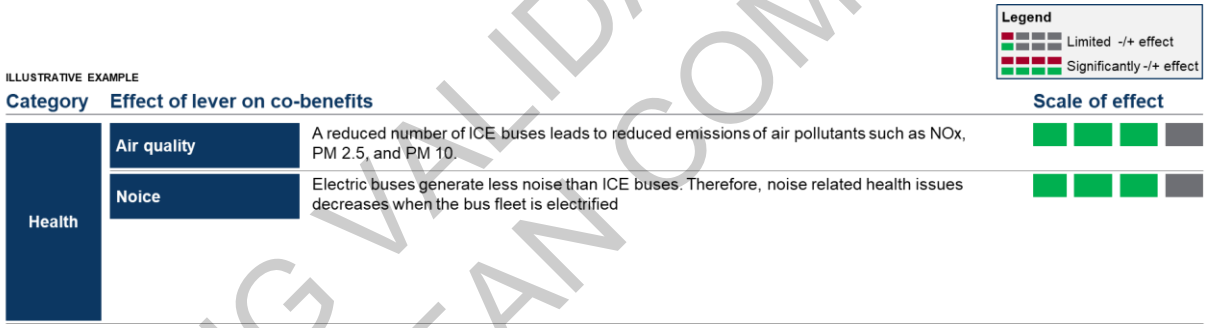
6.1.4 Electrification of passengers cars



6.1.5 Electrification of buses



6.2Freight transport

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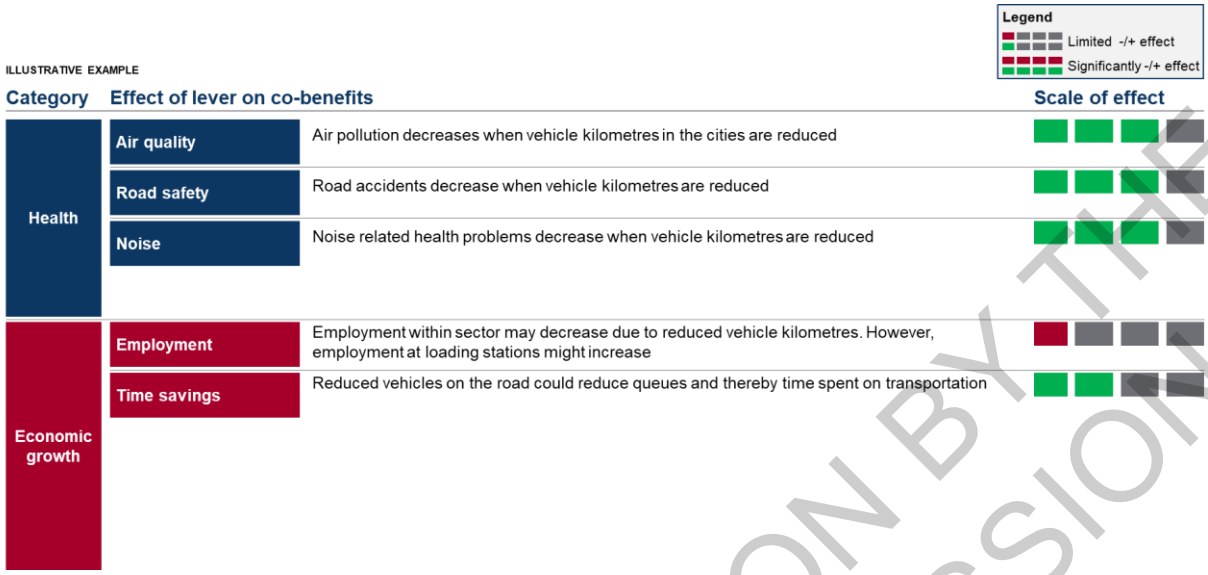
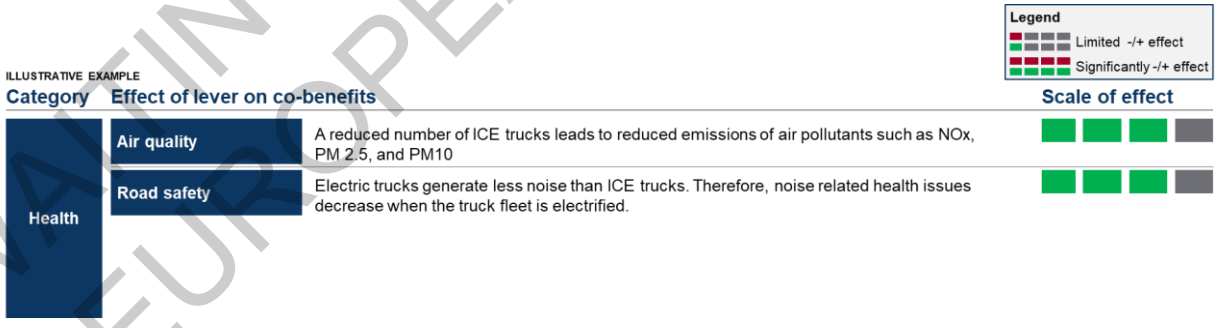
6.2.1 Optimised logistics



6.2.2 Electrification of trucks



6.3 Built environment

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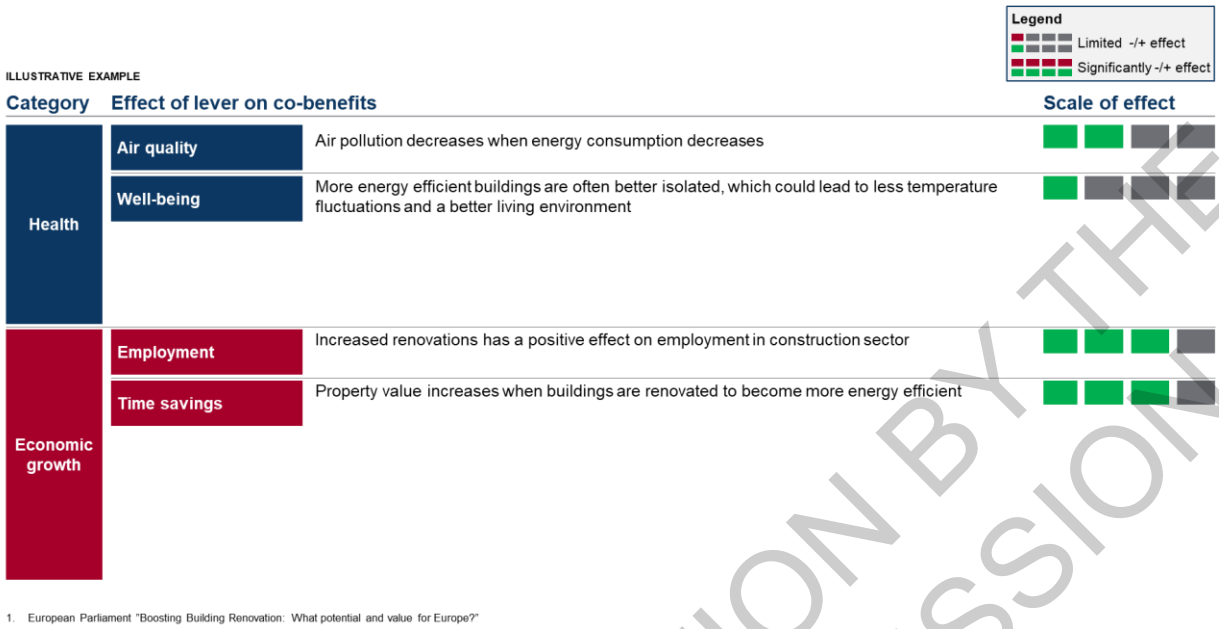
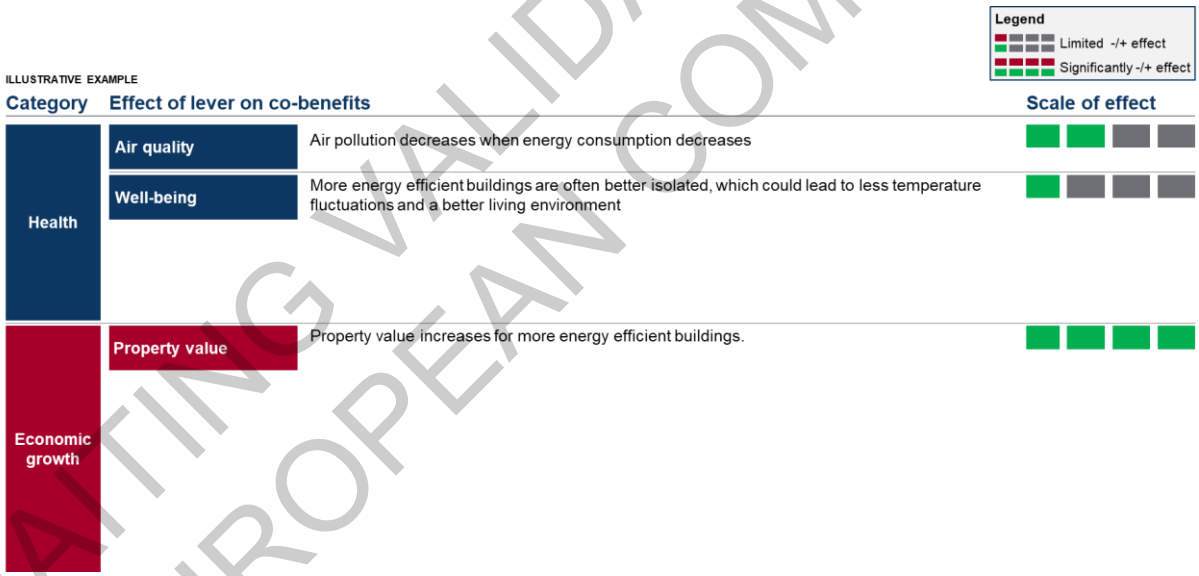
6.3.1 Building renovations



1. European Parliament "Boosting Building Renovation: What potential and value for Europe?"

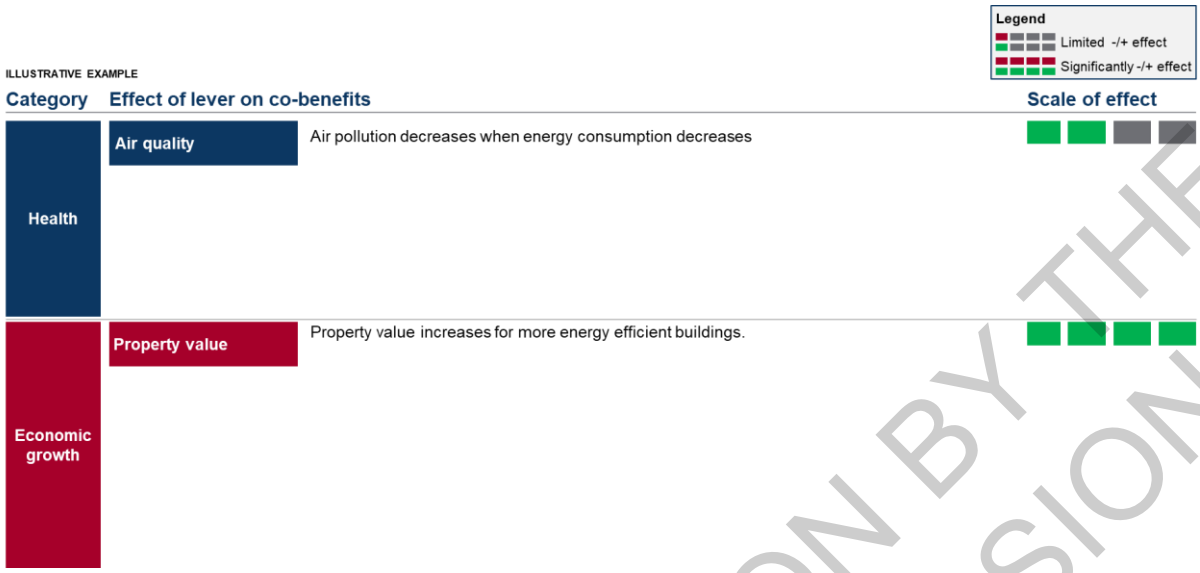
6.3.2 New energy efficient buildings



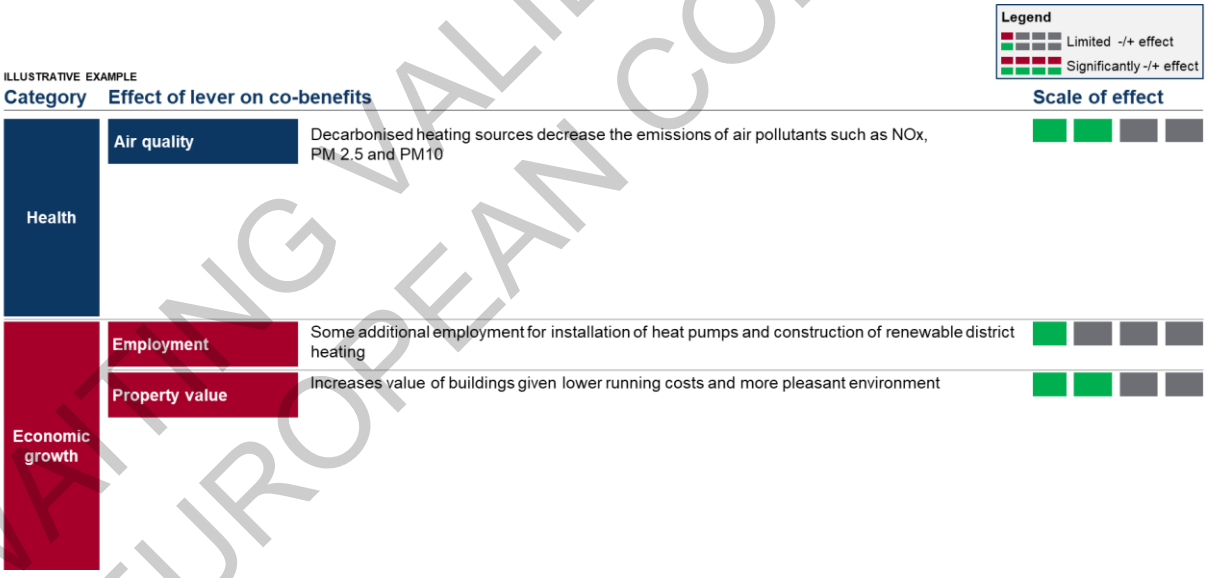
6.4 Energy systems

This project has received funding from the H2020 Research and Innovation Programme under the grant agreement n°101036519.

6.4.1 Efficient lighting and appliances



6.4.2 Decarbonising heating



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6.4.3 Decarbonising

ILLUSTRATIVE EXAMPLE

Category	Effect of lever on co-benefits	Scale of effect
Health	Air quality	Decarbonised electricity decreases the emissions of air pollutants such as NOx, PM 2.5 and PM10

electricy

Fields of Action	Action / Indicator	Indirect impacts (co-benefits)*
Transportation	e.g. Pedestrian and Cycling Infrastructure	Increased air quality, physical health, job creation, time savings, and less noise pollution and development of community assets
	e.g. Metro / Light Rail	Increased air quality, road safety, time savings, property values, equality, and less noise pollution and development of community assets
	e.g. Fleet Electrification	Increased air quality and equality, and less noise pollution
	e.g. Shift to public & non-motorized transport	Increased air quality, physical health, job creation, equality, time savings, and less noise pollution and development of community assets
Built Environment	e.g. energy saving building retrofit	Increased air quality, job creation, property value, and well-being
	e.g. district heating and cooling	Increased air quality, job creation and property value
	e.g. indoor and public lighting	Increased air quality and property value
	e.g. infrastructure re-use and urban re-design	Increased well-being, job creation and property value
Energy Systems	e.g. community energy and PED	Increased air quality, job creation and property value
Green Infrastructure & Nature Based Solutions	…	Increased air quality, well-being, and water quality
Waste and Circular Economy	…	Job creation and increased physical health
Cross Cutting Costs	These can include any supporting activity needed across different sectors, such as citizen engagement, communication with relevant stakeholders, governance and planning exercises, capacity building, the setting-up of SPVs for project management, etc.m	

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