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# The UN Sustainable Development Goals as an Investment Theme

The UN Sustainable Development Goals (SDGs) were adopted by all United Nations member states in 2015. The SDGs represent a shared blueprint for global peace and prosperity towards 2030. The 17 goals highlight how ending poverty and conflicts can be realized alongside strategies that improve health and education, reduce inequality, contribute to economic growth while safeguarding natural habitats, oceans and tackling climate change [1]. However, Figure 1 shows that the progress towards achieving the targets are far from accomplished. According to the recent SDG report, most targets only have a fair progress, and are not on track to achieve the 2030 agenda [2].

The SDGs provide a common target and language for sustainable development and facilitate business opportunities when finance flows towards sustainable projects. The UN Roadmap for SDG investing calls on the financial industry to disclose and incorporate long-term risk into investment decision making, implement sustainable investing strategies, scale up green financial instruments, as well as measuring and reporting on impact [3]. According to the Business and Sustainable Development Commission, achieving the SDG opens market opportunities in four economic systems: Food and agriculture; cities; energy and materials; health and

well-being [4]. Estimates show that a USD 12 trillion market value could be opened up by 2030 if the SDGs are realized, creating 380 million jobs in the process [5]. An estimate by The World Business Council for Sustainable Development (WBCSD) of the distribution of these investment themes is found in the figure below.

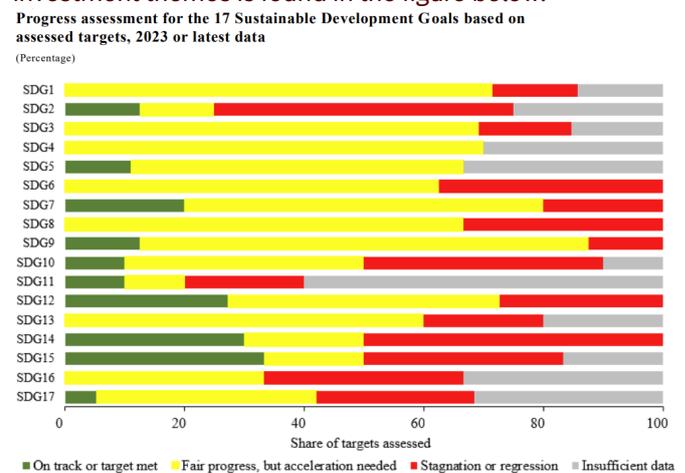


Figure 1: Share of targets assessed according to the SDGs report of 2023 [2].

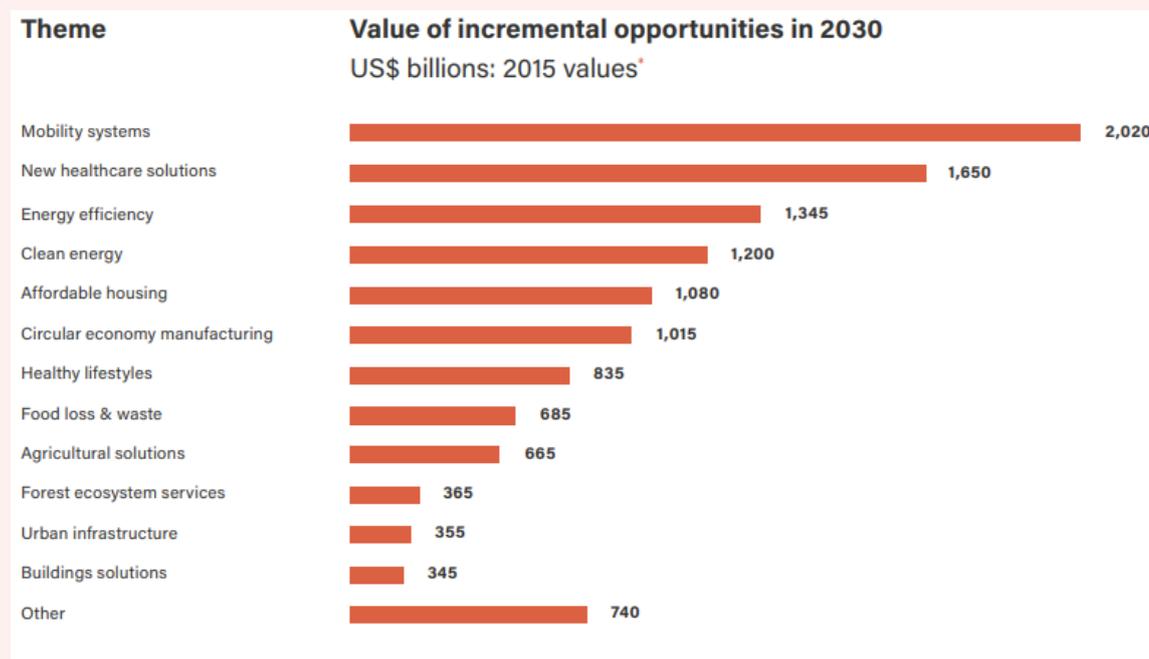


Figure 2: The 12 largest business themes in world economy heading for the SDGs. Source: Business and Sustainable Development Commission [5].

# Solutions Theme: Smart Cities

Today, cities consume 80 percent of global energy, emit 70 percent of global carbon emissions, and generate 80 percent of global gross domestic product (GDP) [6]. Cities are predicted to become even more densely populated and play an increasingly important role in achieving the UN Sustainable Development Goals (SDGs) [7]. In addition to the rapid urban population growth, urban areas face a multitude of challenges related to climate change, natural disasters, insufficient infrastructure, lack of access to basic services, and most recently the disruptive Covid-19 pandemic. With 70 percent of humanity expected to live in urban habitats by 2050, overcome these challenges require well-planned and governed sustainable urban development [6]. If cities are built or re-structured around long-term sustainable systems, a large share of the global sustainability challenges could be resolved. The paragraphs below will explore the transformative concept of smart cities, delving into three key talking points that shape the discussion around resilient and sustainable urban environments: Inclusive urbanization, the development of sustainable smart cities, and the growing significance of city networks.

Cities provide opportunities to lift people out of poverty and improve their standards of living. A report from 2020 by the Organisation for Economic Co-operation and Development (OECD) and the European Union (EU) suggests that urban populations have higher living standards and life satisfaction than rural populations [8]. Other highlights from the report include larger income premiums, increased

employment opportunities, better economic mobility, higher educational attainment, increased access to public infrastructure, and increased access to modern technology in urban areas, which support urban livelihoods' desirability over rural lifestyle. The accumulation of these factors increases the likelihood to escape the poverty trap and improve living standards. It is therefore important that cities facilitate for migration from rural to urban areas. However, the World Social Report from 2021 by the UN highlights the growing concern of urban poverty arising from poor living conditions in informal settlements [9]. Multi-stakeholder collaboration is needed to solve this issue. Urban planning and policy need to be revised, and increased public and private investments in affordable housing, infrastructure, and transportation is needed to bridge the gap between informal settlements and cities. The Global Steering Group for Impact Investment (GSG) estimates that the global investment need is around USD 6 trillion [10]. In this context, private companies offering products or services that can offer a solution to urban poverty and informality will play a crucial role in delivering on the SDGs.

Smart sustainable cities emerged as a concept in the 2010s and is based on efficient urban planning driven by low emission solutions. The UN Economic Commission for Europe (UNECE) and The International Telecommunication Union (ITU) have jointly developed a definition of smart sustainable cities:

70%

of humanity is expected to live in urban habitats by 2050

80%

of global GDP is generated in cities

99%

of urban inhabitants breathe air that does not comply with WHO safety standards

70%

of global carbon emission comes from cities

80%

of global energy is consumed by cities

99%

of urban expansion will be in the developing world

Rapid urbanization will set higher pressure on cities globally. Facts from UNDP [16] and WHO [17].

“ A smart sustainable city is an innovative city that uses ICTs (Information and Communication Technologies) and other means to improve quality of life, efficiency of urban operation and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social, environmental as well as cultural aspects.[11]

Smart sustainable cities have a transformative impact on urban environments by leveraging technology and innovative solutions to enhance environmental, social, and economic aspects of urban life. The development of smart sustainable cities through targeted investments and public sector strategy enables the realization of more resilient, inclusive, and prosperous cities. High quality of life is at the centre of functional services, housing, green spaces, and seamless transportation for the inhabitants. Decarbonization and re-structuring of old infrastructure in developed cities and newly built areas in emerging economies provides investment opportunities that enable social advancement and resource optimization [12]. Investors can identify companies that contribute to sustainable urbanization worldwide by re-allocating capital to companies that operate in the space.

City networks have emerged to strengthen the resilience of cities and share knowledge that can drive sustainable urban development. C40 is one of the most influential of these networks. It consists of nearly 100 cities, including the world's megacities which are all committed to addressing climate change in line with the Paris Agreement

1.5-degree target. The network's primary goal is to deliver collaboration, knowledge sharing, data collection, and accountability for sustainable action on climate change [13]. According to research by C40, substantial climate action by the C40 network cities to reduce fossil fuel usage could reduce air pollution by 30 percent and deliver 280 billion dollars of health-related economic benefits. Moreover, it can deliver 30 percent more jobs compared to current trajectory [14]. Another example is the largest city alliance for city climate leadership, Global Covenant of Mayors for Climate & Energy (GCoM), with over 12,500 signatories working together to combat climate change and move to a low emission, resilient society. In 2022, more than 800 GCoM cities totalling 340 million people have reported that they are facing high-risk climate impact, with extreme temperatures being the most reported hazard [15]. Even though the global collaboration between cities has been strengthened through C40's activities, the partnering cities are not on track to meet their emission reduction targets by 2030 [14]. Although there seems to be a productive political dialogue directed at bolstering the resilience of cities in the face of climate change, there is still a considerable need for private capital flows into making cities more sustainable. Investing in smart cities as an investment theme not only promotes liveable, sustainable, and equitable urban environments but also proves to be a solid investment case due to the potential for improved infrastructure efficiency, enhanced economic productivity, and increased quality of life for residents.

In conclusion, the rise of smart sustainable cities is a vital response to the challenges and opportunities presented by urbanization in the 21st century. By investing in private companies contributing to the development of smart sustainable cities, we can not only promote a more liveable and equitable urban future but also unlock opportunities for improved infrastructure efficiency and increased economic productivity, making it a compelling and impactful investment theme for the years to come.

## Main SDGs Linked to Solutions Theme



### **Make cities and human settlements inclusive, safe, resilient and sustainable**

Sustainable cities mean attractive business opportunities, affordable housing, public spaces, clean surroundings, resilient societies, and seamless transit. To reach this goal, investment is needed in public transport, green buildings and public spaces, sound urban planning and water and waste management.



### **Ensure availability and sustainable management of water and sanitation for all**

City infrastructure is vital to obtain more efficient use and distribution of water. Water management needs to address increased demand, threats to water security and the high frequency and severity of droughts and floods resulting from climate change. To reach this goal, investment is needed in the entire water value chain, including exploration, water utilities, water purification, wastewater treatment and infrastructure.

There are many linkages to other SDGs, which will be described in the subsequent sub-categories. Other relevant SDGs with crossovers will be described in different thematic whitepapers.

# Investment Potential in Smart Cities Towards 2030



Finance is a critical enabler for rapid improvements in existing industries globally. The OECD estimates that EUR 6.35 trillion a year will be required globally to meet the Paris Agreement goals by 2030 [18]. The transition requires mobilization of finance from both the public sector, institutional and private capital. Investing in public transport, building efficiency and better waste management could save cities around USD 17 trillion globally by 2050 based on energy savings alone [19].

Three investment sub-themes of smart cities will be explored in this whitepaper. The three investment themes of particular interest towards 2030 are green buildings and energy efficiency, low-emission transport, and climate-smart water management. Criteria that have been evaluated are the themes' contribution to the SDG targets, weight in the EU Taxonomy on Sustainable Finance, and the investment potential in the research study on sustainable cities from the International Finance Corporation (IFC). Figure 3 from IFC provides an estimate of the investment potential in these sectors worldwide towards 2030.

	East Asia Pacific	South Asia	Europe & Central Asia	Middle East & North Africa	Sub-Saharan Africa	Latin America & Caribbean	Total
Waste	\$82 billion	\$22 billion	\$17 billion	\$28 billion	\$13 billion	\$37 billion	\$200 billion
Renewable energy	\$266 billion	\$141 billion	\$88 billion	\$31 billion	\$89 billion	\$226 billion	\$842 billion
Public transportation	\$135 billion	\$217 billion	\$116 billion	\$281 billion	\$159 billion	\$109 billion	\$1 trillion
Climate-smart water	\$461 billion	\$110 billion	\$64 billion	\$79 billion	\$101 billion	\$228 billion	\$1 trillion
Electric vehicles	\$569 billion	\$214 billion	\$46 billion	\$133 billion	\$344 billion	\$285 billion	\$1.6 trillion
Green buildings	\$16 trillion	\$1.8 trillion	\$881 billion	\$1.1 trillion	\$768 billion	\$4.1 trillion	\$24.7 trillion
<b>TOTAL</b>	<b>\$17.5 trillion</b>	<b>\$2.5 trillion</b>	<b>\$1.2 trillion</b>	<b>\$1.7 trillion</b>	<b>\$1.5 trillion</b>	<b>\$5 trillion</b>	<b>\$29.4 trillion</b>

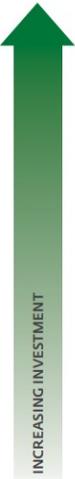


Figure 3: Investment potential in cities by region and sector to 2030 Source: International Finance Corporation (2018), Climate Investment Opportunities in Cities [20].

According to the IFC research there is a significant investment potential, totaling USD 29.4 trillion. Strategic investments in urban planning, mobility, and water management have the potential to significantly advance the progress towards the SDGs by fostering sustainable cities, improving efficient transportation systems, and ensuring equitable access to clean water and sanitation.

Furthermore, investments in these themes would be aligned with the Sustainable Finance Action Plan (SFAP) launched by the EU Commission and the EU Taxonomy classification system.

# Supporting Laws and Regulations

## The European green deal and sustainable finance

To transform the European economy, the European Green Deal was presented by the European Commission in December 2019. As a part of the ambitious plan and in compliance with the Paris Agreement, initiatives on Sustainable Finance were further introduced [29]. Sustainable finance focuses on integrating environmental, social and governance (ESG) considerations into financial investment decisions, leading to long-term investments in sustainable activities. In this manner, Sustainable Finance has a key role in ensuring policy objectives outlined in the European Green Deal [30].

To facilitate Sustainable Finance, the EU Commission announced a Sustainable Finance Action Plan (SFAP) for financing sustainable growth [31]. The SFAP is built on recommendations from the High-Level Expert

Group (HLEG) on sustainable finance and outlines a comprehensive strategy to further connect finance with sustainability. The SFAP has three objectives.

- (1) Reorient capital flows towards sustainable investments.
- (2) Manage financial risks stemming from climate change, environmental degradation, and social issues, and
- (3) Foster transparency and long-termism in financial and economic activity.

Based on the SFAP, the EU has put in place a Sustainable Financial framework to obtain the objective of Sustainable Finance [32]. The framework consists of three building blocks:

**1 A classification system under the EU Taxonomy**  
The EU Taxonomy is a classification system that defines what is qualified sustainable in terms of economic activities. The taxonomy is developed by the Technical Expert Group (TEG), which was established by the European Commission to guide financing sustainable growth.

**2 Disclosures under the Sustainable Finance Disclosure Regulation (SFDR) and Corporate Sustainability Reporting Directive (CSRD)**  
The objective of SFDR and CSRD is to improve transparency in the market for sustainable investment products, prevent greenwashing, and increase transparency regarding sustainability claims by sustainability disclosure. SFDR requirements cover a broad range of Environmental, Social, and Governance (ESG) metrics to define the disclosure requirements for selling financial products. CSRD provides a framework regarding reporting of non-financial data.

**3 Investment tools under the EU climate benchmarks**  
The investment tools include benchmarks, standards, and labels, that aim to facilitate financial market participants that try to align their investments strategies with the EU's environmental objectives).

# Sub-themes

This whitepaper focuses on three central sub-themes that lay the foundation of success for sustainable cities: Urban planning, mobility, and water management. This section will introduce the sub themes' connection to the SDG targets, the EU Taxonomy on Sustainable Finance, and investment opportunities.



# 1. Urban Planning

## Examples of key SDG Targets



Urban planning is an essential component in advancing the efforts in meeting the SDG targets, as it fosters transformative investments towards a sustainable and prosperous future in cities. Sustainable urban planning is key when developing cities that meet its inhabitants needs, facilitating an urban environment that offers affordable housing, inviting and accessible public spaces, and climate management, all while being energy efficient. Guided by the EU Taxonomy Technical Screening Criteria, multiple economic activities are needed for both climate mitigation and adaptation of cities. In 2021, the buildings and construction sector accounted for over 34 percent of energy demand globally as construction activities rebounded back to pre-pandemic levels alongside more energy-intensive use of buildings [25]. The EU Taxonomy highlights the need for renovation of existing buildings and construction of new buildings to improve energy efficiency, which can make a substantial contribution to climate change mitigation and adaptation of cities by reducing energy consumption and greenhouse gas emissions.

Buildings and construction contribute with tangible value creation. The value of the global buildings and construction sector increasing by 5 percent to more than USD 6.3 trillion in 2021 [25]. Real estate made up two-thirds of global net worth in 2020 [26]. The market size, tied-up wealth and historic growth represents an investment opportunity. In 2022 early-stage capital investments allocated to green building design, materials, procurement, and prefabrication technology exceed USD 2.2 billion for the first time, following a compounded annual growth rate (CAGR) in investment volumes of 84 percent in the period 2017-2022 [27].

An example of the monetary values that these investment opportunities represent is highlighted by the Business and Sustainable Development Commission (BSDC). BSDC predicted how incorporating the SDGs into core growth strategies and value chains open new opportunities and significant efficiency gains for companies. The BSDC found that the most promising segments within sustainable cities towards 2030 is affordable housing with annual business

opportunities worth up to USD 1,080 billion, and energy efficiency in buildings worth up to USD 770 billion [28].

### Affordable Housing and Public Spaces

The EU Committee on Employment and Social Affairs estimates that 80 percent of cities worldwide do not have affordable housing options for half of their population [29]. According to estimates by UN-Habitat, the world needs to build 96,000 new affordable housing units every day to house the estimated 3 billion people who will need access to adequate housing by 2030 [30] [31]. Innovation is further required to optimize the use of new land and make better use of space for development. It is likely that improved urban planning and transport logistics will free up space in urban areas, which can lead to increased housing capacity and replacement of inadequate housing. Data from the European Parliament's Committee on Enabling high standards of living through low emission construction and affordable housing is a very powerful tool to enable a just transition and even distribution of wealth among populations worldwide.

### Energy Efficiency & Net Zero Buildings

Buildings are the single largest energy consumer in Europe, responsible for around 40 percent of energy consumption and 36 percent of carbon dioxide emissions [32]. A large part of the reason is the old building stock on the continent, with 85 percent of the total building stock built before the year 2001 [33]. The old building stock is energy inefficient, with the building envelope, technical, and mechanical equipment rarely upgraded to match the energy labelling and certificate requirements of newly constructed buildings due to high cost [34]. To achieve the reduction in carbon emissions required under the Paris Agreement, the rate of building energy efficiency renovations in OECD countries must increase from around 1 percent of existing building stock to more than 3 percent per year in the coming decade [35]. Renovation of existing buildings can lead to significant energy savings, as it could reduce the EU's total energy consumption by 5-6 percent and lower CO2 emissions by about 5 percent [32].

Energy efficiency solutions in buildings has the potential to become a high-growth segment driven by continuous innovations towards 2030. Innovations such as retrofitting existing buildings with more efficient heating and cooling technologies, switching to efficient lighting and appliances creates energy efficient buildings. Investments in building energy efficiency increased by 16 percent from 2020 to 2021, totaling approximately USD 237 billion [25]. Public and private stakeholders will increasingly start to recognize the economic and environmental benefits of reducing energy consumption and emissions through the implementation of advanced technologies and practices, opening a large market for these innovative solutions.

Newly constructed buildings need to have net-zero operational emissions by 2030 to achieve the net-zero targets for the sector [36]. The UNEP Finance Initiative programme estimates that of all global carbon dioxide emissions from the real estate sector, 70 percent comes from building operations and 30 percent from construction [37]. In addition to an increased focus on energy efficiency and sustainable building materials, net zero buildings can be achieved through renewable distributed energy systems. The World Economic Forum states that the demand for net-zero buildings is increasing, and that the current disequilibrium between supply and demand will benefit early adopters by boosting rent and reducing financial risk [38]. Embracing energy efficiency and net-zero building strategies within urban planning promotes a holistic approach to sustainability, addressing environmental, social, and economic aspects while ensuring a better quality of life for urban residents.

### **Urban Heat Management**

Heatwaves kill more people each year than any other climate risk in the U.S. [39]. Cities and urban areas are prone to the "urban heat island" effect, a phenomenon occurring when temperatures are higher within cities than in neighbouring rural zones. This amplifies the effect of heatwaves in cities, with surface temperatures in cities measured to 10-15 degrees Celsius higher than in their rural surroundings [40]. Heatwaves in cities will become more frequent. The Future We Don't Want report predicts that if global warming continues its current trajectory, 1.6 billion people living in over 970 cities, will be regularly exposed to extreme heat in 2050 [41]. Air conditioners (AC) and electric fans to stay cool accounts for nearly 20 percent of the total electricity used in buildings around the world today [42]. The growth trajectory is significant: Out of 2.8 billion people living in the hottest parts of the world, only 8 percent currently possess ACs [42].

Innovative solutions to counter extreme urban heat are often driven by companies, while regulations, guidelines, directives, and urban planning standards paves the way for adaption and use of the solutions. Examples include urban planning efforts such as linear parks, green corridors, cool zones, and vegetation that provides shade and cooling evapotranspiration. Furthermore, white and reflective building materials on city surfaces like roofs, roads, pavements, and facades can counter urban heat traps. It is crucial that both mitigation and adaptation measures that support urban heat management receive capital from private and public investors. It is clear from all the efforts listed that there is not one solution to combat urban heatwaves, but a multitude of efforts working together to cool down cities is a necessary approach to urban heat management.

### **Shortcomings: Urban Planning**

The OECD has raised concerns that cities can become inequality traps without sufficient access to affordable housing. While the OECD has documented a higher reported quality of life in cities over rural areas, unequal distribution of housing availability, environmental pollution habitat destruction and resource depletion could detract the social positives like employment opportunities, healthcare, educational opportunities, access to services or modern infrastructure [43].

## Urban planning

# Solutions Company Highlight: SEKISUI HOUSE



### About

SEKISUI HOUSE is a renowned Japanese house manufacturer at the forefront of sustainable housing solutions and urban development. The company's extensive range of products encompasses residential solutions, including single-family homes, multi-unit residences, and urban development projects. SEKISUI HOUSE is a pioneer in zero emission housing, incorporating cutting-edge building and isolation technology, energy-efficient design, recycling resources, and protecting the natural environment. SEKISUI HOUSE became the first company in the housing construction industry to be certified as an Eco-First Company by the Japanese government [44]. With a focus on liveability, SEKISUI HOUSE provides a solution that contributes to a more socially and environmentally sustainable development of cities worldwide.

### Impact on SDG Targets

SEKISUI HOUSE's commitment to sustainable development aligns closely with the UN SDG targets. The group's Sustainability Vision 2050 is an important strategic driver which guides the company's vision towards a more sustainable future [45]. The strategy sets forth five medium-to-long-term goals, issues, and targets for the Sekisui House Group to sustainably create value together with its stakeholders, all tied together with UN SDGs and ESG measures.

By prioritizing environmental stewardship, social inclusivity, and economic prosperity, SEKISUI HOUSE contributes to several key SDGs:

- SDG 7: Affordable and Clean Energy, through its focus on energy-efficient housing solutions.
- SDG 11: Sustainable Cities and Communities, by promoting sustainable urban planning and development practices.
- SDG 13: Climate Action, through its efforts to reduce carbon emissions and energy usage.

## 2. Mobility

### Examples of key SDG Targets



The transportation sector accounts for 23 percent of the world's energy related carbon dioxide emissions [46], and with an increasing transport demand worldwide, the sector is not on track to reach the UN SDG targets by 2050. According to the European Investment Bank's Sustainable Transport Overview 2022, transport is the only economic sector where greenhouse gas emissions continue to rise [47]. Since 70 percent of humanity is expected to live in urban habitats by 2050 [6], the increased urban mobility demand will put an enormous strain on cities related to emissions and pollution if we continue with the current trajectory. Cities play a crucial role in ensuring that urban mobility is progressing in a sustainable and effective way to reach the SDG targets.

The EU Green Deal's mobility focus is to roll out more accessible, cleaner, cheaper, and healthier forms of private and public transport [48], and aims to reduce emission from the transportation sector by 90 percent [49]. Currently, one-third of emissions in cities come from road transport, with the major contributors being pollution emitting vehicles and air pollutants from the roads [50]. Cities can achieve such reduction by investing and developing sustainable mobility solutions and infrastructure to reduce congestion, accidents, and pollution. Additional benefit of improved mobility is that it drives economic activity by improving access to jobs, education, health services, production and distribution of goods and services. An additional focus area for cities is the development of their transport systems, both intercity and intracity transportation of passengers and freight. Sustainable vehicle and infrastructure upgrades in bus, ferry, rail transport, and road freight could help reduce pollution, accidents, congestion, emissions and improve efficiency and usability.

Analysis from Institute for Transportation & Development Policy (ITDP) and UC Davis have highlighted three revolutions in vehicle technology that can cut transport emissions in cities by 80 percent and create synergies that will reduce vehicle, infrastructure, and transportation system costs globally by 40 percent [51]. The three mobility revolutions are:

1. Electrification of the transportation fleet
2. Automation of the transportation fleet
3. Shared Mobility

The key to achieving the estimated reductions in emission and cost is that all three revolutions are implemented in a parallel manner successfully. Additionally, the EU Taxonomy Technical Screening Criteria emphasise the need to upgrade the infrastructure to support the electrification and low carbon transition of the transportation fleet. Zero emission vehicles (ZEV) and low carbon solutions depend on an electricity grid powered by renewable energy sources to have a real environmental effect.

A key to a successful mobility infrastructure is to utilize renewable energy sources to power the energy grid – and thus charge electric vehicles. Crossovers to smart grid integration and a sufficient supply of renewables will allow easier charging of EVs, which is an important aspect of smart cities.

### Electrification and Automation

The electrification of personal vehicles has really caught traction in recent years breaking sales records year-by-year. The International Energy Agency (IEA) expects global electric vehicles (EVs) sales to account for 18 percent of total car sales for the year 2023, up from 14 percent in 2022 [52]. This trend is forecasted to continue, and Goldman Sachs Research predicts that EVs will make up 50 percent of new car sales worldwide by 2035 and the pool of profits from EVs sales will increase from USD 1 billion to USD 110 billion in 2030 [53]. The electrification of road transport goes beyond cars, with the IEA reporting that the registration of electric two- and three-wheelers outnumber cars in emerging and developing countries [52]. In developing countries, these smaller electric vehicles offer an affordable way to get access to mobility.

However, to reduce congestion and pollution, increasing the number of individual vehicles on the road is not sustainable in the long run. Further electrification of light-, medium-, and heavy-duty vehicles is important to promote the electrification of shared mobility, and with benefits such as improved road traffic safety, air quality and reduced congestions this is an area where public and private players need to step up their efforts. The electrification of this market segment presents a great growth potential, as electric buses only account for 4.5 percent of total sales and electric trucks account for only 1.2 percent of total sales [52].

Transport automation covers technologies and control systems that can be implemented for vehicles, trucks, at ports, airports, and distribution centres. Automation enables optimization of both traffic flow and capacity utilization. There is a lot of uncertainty to when autonomous vehicles are ready for mass market rollouts. Significant technological hurdles, legal barriers, and social and cultural acceptance must be addressed before fully automated vehicles take to the roads [51]. Looking past the current challenges, automation could revolutionize the mobility experience. It may make road transport safer, more convenient, enjoyable, and accessible [54]. In cities the time spent in traffic could be used efficiently, possibly shortening workdays, and promoting a better work life-balance. Automation might also generate additional value for the auto industry and create jobs. A 2023 report from McKinsey & Company estimate that advanced driver-assistance systems and autonomous-driving systems could create USD 300 to USD 400 billion in revenues by 2035 [54]. There is also a clear spillover effect of the automation technology into other mobility segments such as public road transport and freight which will have even larger positive impact when it comes to enhanced urban mobility, reduced emissions, and pollution.

### Transport Systems

When cities prioritize modes of transportation that are environmentally friendly, socially inclusive, and economically viable, these transport systems enhance the overall quality of urban life. To create more liveable cities allocating and developing space for people and public amenities is essential [46]. The challenge cities face is that there is a very high demand for space linked to residential development, infrastructure, and commercial development. According to a study conducted by the University of California and Los Angeles' Institute of Transportation Studies, roads took up an average of 18 percent of the total land area of the cities studied in the US. In some districts this figure was almost double, with roads taking up an astounding 30 percent of city space [55]. By developing space-efficient transport systems utilizing high-capacity public transport vehicles cities does not only free up valuable space that can be used to improve liveability, but at the same time reduce pollution, congestion, and emissions [46]. Rapid urban expansion means that efficient urban planning and management needs to follow suit.

Personalised transport systems deliver tailored mobility solutions to the end user, replacing the need for individually owned vehicles. Mobility-as-a-service (MaaS) is one solution which can transform urban mobility from an ownership paradigm to an access to service paradigm [56]. The ownership paradigm is inefficient, requiring individual ownership and consumption of single-mode mobility products and services resulting in inefficiencies and additional costs for the consumer. MaaS enables holistically designed multimodal travel, delivering customer-centric access to door-to-door mobility solutions. This is desirable to improve the transport needs of citizens by offering tailored and efficient mobility at lower costs but also the availability of a wider range of transport modes.

### Micro mobility

Micro mobility refers to small, lightweight transport modes operating at speeds typically below 25 km/h and is ideal for trips under 10 km [57]. Micro mobility modes of transport can be human-powered or electric, privately owned or shared. Micro mobility is increasingly recognised as a promising short-distance urban transport solution, as it provides a flexible, sustainable, cost-effective, and on-demand transport alternative which reduces the need for private vehicles [58]. Shared micro mobility reshapes urban mobility by offering an accessible transport option for a large share of a city's population, replacing longer walks, short public transports trips and car rides [59]. Analysis from McKinsey & Company show that the global micro mobility market could more than double in value from around USD 180 billion in 2023, to USD 440 billion in 2030 [60].

Focus on micro mobility transport modes in urban planning, development, and management facilitates convenient and user-friendly mobility solutions. Safe and well-maintained walking and cycling infrastructure is required for micro mobility solutions to be considered the preferred mode of transport. Compact cities enable walking, cycling, and flexible individual transport modes. Micro mobility creates equitable access to more public infrastructure for a wider range of urban habitants shortening commute times and reducing reliance on individually owned vehicles.

## Shortcomings: Mobility

Urban dwellers expect freedom of movement. Affordable mobility can help social equality due to the increased access to work and desirable leisure activities. However, a high personal car ownership rate negatively impacts air pollution, congestion, and emissions. Electric vehicles are heavier than diesel and gas driven vehicles, which in turn leads to increased particulate matter emissions due to the wear on tires and roads. People are content to continue to travel in their own vehicles due to convenience, even if the cars are autonomous. This reinforces the ownership model that is already attractive and leads to high car ownership rates worldwide. There are limitations to MaaS solutions in emerging markets due to limited access to smartphones, connectivity and banking solutions [61], but also liked to lack of technological user adaptation in different demographic groups.

A major concern is linked to whether motorized micro mobility solutions replaces walking and public transport instead of personal vehicles. The total travelling time and cost needs to be lower, for instance by increased frequency of public transport departures combined with tailor made last-mile mobility solutions. Furthermore, large scale investments in specific mobility solutions could create an infrastructure lock-in, making it challenging to adapt to evolving technologies and new mobility trends.

## Mobility

# Solutions Company Highlight: BYD



### About

BYD is a global leader in sustainable clean-energy transport solutions, battery, and energy storage founded in 1995. The company specializes in the development and production of a wide range of innovative zero-emission solutions. BYD is the world's leading producer of rechargeable batteries and owns the complete supply chain layout from mineral battery cells to battery packs [62]. The firm is also the first automaker in the world to have full expertise and intellectual property in the three core technologies of electric vehicles [63]:

1. Batteries
2. Electric motors
3. Electronic controls

The BYD 7+4 strategy is a full market electric vehicle strategy, designed to electrify most forms of ground transport. It comprises seven conventional types of transportation (passenger vehicles, taxis, buses, coaches, urban logistics vehicles, urban construction vehicles and urban sanitation vehicles) and four specialized types of transportation (vehicles for mining, ports, airports and warehousing) [64].

Other zero-emission solutions offered by BYD are rail transit, energy storage systems, solar panels, and electric mobility solutions. The BYD SkyRail is another innovative public transit system solution, which can transport between 10 000 and 30 000 passengers per hour [65]. BYD builds the entire SkyRail system, including the complete vehicle, tracks, stations, and communication systems.

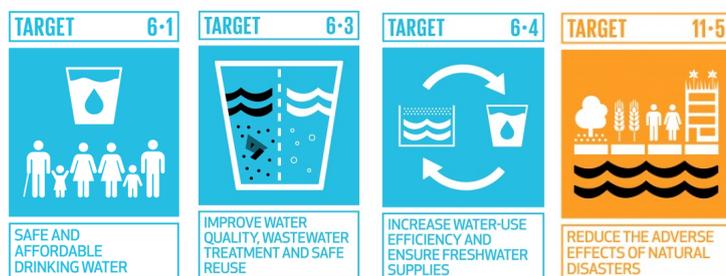
### Impact on SDG Targets

By providing cutting-edge and eco-friendly mobility options, BYD actively contributes to the following UN SDGs by promoting clean and sustainable mobility solutions that reduce greenhouse gas emissions, improve air quality, and increase access to mobility solutions:

- SDG 3: Good Health and Well-being, by providing a mobility solution that limits emission and air pollution.
- SDG 9: Industry, Innovation, and Infrastructure, by promoting green and sustainable mobility innovation and infrastructure solutions.
- SDG 11: Sustainable Cities and Communities, by making cities inclusive, safe, resilient, and sustainable.

# 3. Water Management

## Examples of key SDG Targets



Access to clean water is a prerequisite for human settlement. In 2020, 2 billion people lacked access to safe and clean drinking water and 771 million people lacked access to basic drinking water [66]. Out of the people that lacked access to basic drinking water, 80 percent lived in rural areas where the water management infrastructure was poor or non-existent. However, with the rapid increase in world's urban population discussed earlier in the paper, the number of inhabitants in cities that lack access to safely managed drinking water has doubled since the year 2000 [66]. The world is not on track to achieve SDG 6, which is to ensure availability and sustainable management of water and sanitation for all. The current rate of progress needs to quadruple to reach the global target of universal access to safely managed drinking water, safely managed sanitation, and basic hygiene services by 2030 [66].

In the last 20 years, terrestrial freshwater storage has dropped at a rate of 1 cm per year, as a result of climate change and population growth leading to increased demand [67]. With only 0.5 percent of all water on Earth being usable and available freshwater, this drop in freshwater storage is alarming. Water demand is projected to increase by 55 percent globally between the year 2000 and 2050 [68]. Thus, stable supply and careful conservation is necessary to ensure sustainable water consumption over time to meet the increasing demand.

As cities face accelerated challenges related to water scarcity and the lack of access to clean water, the impacts of climate change and extreme weather events have further intensified the urgency of addressing these issues. Climate change-induced alterations in precipitation patterns, combined with more frequent and severe droughts, floods, and storms, have disrupted traditional water supply systems and worsened existing water scarcity concerns. The World Health Organisation (WHO) estimates that between 80 and 90 percent of all documented disasters from natural hazards during the past 10 years are from floods, droughts, and severe storms [69]. Water management in urban planning can therefore ensure less damage with increased precipitation patterns, secure efficient water treatment and integrate nature-based solutions to safeguard the water resources available.

There are also exiting opportunities and solutions that can help tackle the freshwater supply shortage. Innovative solutions to desalinate saltwater is particularly interesting for coastal cities facing water stress and offer the potential to tap into an abundant but underutilized resource.

Additionally, the development of innovative water waste reduction technologies holds immense potential. From advanced leak detection systems to smart irrigation techniques, these innovations enable efficient water use, minimizing waste and optimizing water distribution. Embracing these opportunities can alleviate water scarcity concerns together with a shift in consumption behaviour. Implementing sustainable water management practices can ensure a more resilient future for cities worldwide.

### Water Management and Flood Relief

Flooding is the most frequently occurring natural disaster in the world, and globally since 1980 floods have killed over 250,000 people and has caused over USD 1 trillion in economic damages, totalling around 40 percent of natural catastrophe economic losses since 1980 [70]. The global trend is on an upward trajectory, with a 181 percent increase in annual reported flood events and a 275 percent increase in average annual economic losses when comparing the time-period 1980-1989 to 2010-2019 [70]. The impact on both humans and ecosystems is disastrous. The 2022 flooding in Pakistan is a recent example of the catastrophic consequences floods can have. The floods affected 33 million people, one-third of the country was under water, and more than 8 million people that are displaced are facing a health crisis [71]. Flood damages and economic losses are estimated to be around USD 30 billion, and with another USD 16 billion needed for reconstruction [72].

After flooding, drought is the disaster that affects the second-highest number of people [73]. The global urban population facing water scarcity is projected to double from 2016 to 2050, affecting nearly 2.4 billion people [74], and around half the world's population experienced severe water scarcity for at least one month in 2022 [75]. Water scarcity leads to great unrest, as experienced by Cape Town when record droughts from 2015 to 2018 almost made the city's taps go dry in 2019.

The UN Office for Disaster Risk Reduction estimates that every USD 1 invested in making infrastructure disaster-resilient saves USD 4 in reconstruction [76]. Solutions to more resilient infrastructure includes monitoring systems for holistic water management, coastal wave breakers, dikes, drainage, retention, storage, infiltration, recapture, and integration of water in urban ecosystems.

### Water Treatment and Efficiency

Non-revenue water (NRW) is water that has been pumped, treated, and produced but lost or unaccounted for in the water distribution system before reaching its destination. The global volume of NRW has been calculated to be around 346 million cubic metres per day, totalling 30 percent of water system input volumes globally [77]. The financial cost of these losses amounts to USD 39 billion per year [77]. NRW has a substantial negative impact on climate change, as water infrastructure systems are responsible for 323 million tonnes of carbon dioxide emissions [78]. The amount of energy required to extract, treat, and distribute water is wasted when a significant share does not reach the intended consumer, leading to unnecessary energy use and emissions.

NRW significantly diminishes the availability of water for consumers, exacerbating water scarcity and limiting access to clean water. Addressing NRW through comprehensive leakage detection, efficient metering, and improved infrastructure maintenance is facilitates a sustainable water supply, reduces water stress, and mitigates the climate impact associated with inefficient water distribution systems. These solutions will often pay for themselves in the long run since it reduces the non-revenue water and saves the associated energy costs, as avoiding penalties for exceeding carbon emission budgets [79].

There is a promising growth and investment opportunity in companies that focus on providing innovative solutions to water inefficiencies and NRW challenges. Public-private partnerships (PPPs) have emerged as a key driving force in this domain, fostering collaboration between governments and private entities to tackle water supply challenges effectively. The current water treatment and supply environment is pushing towards a more customized approach where private companies can be a mechanism

to support governments and cities by offering innovative technology and expertise [80][81].

### Nature-based Solutions

Nature-based solutions could provide an answer to the challenges of flooding, rising sea levels, storms, and draughts. Nature-based solutions can be defined as "solutions that are inspired and supported by nature, which are cost-effective and simultaneously provide environmental, social and economic benefits to help build resilience. Such solutions bring more, and more diverse, nature and natural features and processes into cities, landscapes, and seascapes, through locally adapted, resource-efficient, and systemic interventions" [82]. In the context of water management, typical examples are the preservation of ecosystem functions through natural and built solutions to preserve water resources.

Solutions include water recycling, water harvest and water retention hollows to recharge groundwater and the protection of watersheds that supply urban areas [83]. These solutions utilize natural ecosystems and processes to provide effective flood mitigation and coastal protection. Added benefits beyond enhanced resilience to climate change are habitat preservation, biodiversity conservation, and improved water quality. Integration of nature-based solutions into urban and coastal planning can remediate challenges posed by flooding, drought and rising sea levels while fostering sustainable and resilient communities.

## Shortcomings: Water Management

Up-front costs and the practical logistics of water infrastructure improvement could easily discourage local and national authorities from taking on large water related projects. Failure is not an option due to the inherently vital nature of water, so an unplanned disruption of water supply is perhaps the most severe breach of urban services. A conflict between water flow and mobility arises when replacing old water pipes. Major traffic jams can occur due to blocked roads since water pipes usually follow road networks. Furthermore, there is a danger that resilient water management only becomes affordable for wealthy cities and citizens due to its resource intensive nature.



# Water Management Solutions Company Highlight: Xylem



## About

Xylem Inc. is an American leader in water technology, dedicated to solving the world's most pressing water challenges. It is the world's largest pure-play water technology company after the acquisition of Evoqua Water Technologies in 2023. With a comprehensive portfolio of products and services, Xylem delivers innovative solutions that address water scarcity, water quality, and water efficiency. The unique offering encompasses a wide range of cutting-edge technologies to deliver a holistic water service solution with advanced monitoring. This includes water pumps, filtration systems, analytical instruments, and advanced treatment solutions. By providing these products, Xylem empowers communities and industries to efficiently manage and conserve water resources while improving access to safe and clean water for all.

## Impact on SDG Targets

Xylem's commitment aligns closely with the UN SDGs, particularly SDG 6 (Clean Water and Sanitation), through its expertise, products, and collaborations with stakeholders to create a more water-secure and sustainable world.

Xylem's emphasis on innovation and technology-driven solutions also contributes to SDG 9 (Industry, Innovation, and Infrastructure) by fostering the development of resilient and sustainable infrastructure [84].

# Appendix

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# Team Solutions

The Solutions Investment Team is responsible for identifying solution companies, for use across Storebrand Asset Management, as well as for Solution funds: Storebrand Global Solutions, Storebrand Renewable Energy, Storebrand Smart Cities and Storebrand Equal Opportunities.

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SDG Target Icons: Global Goals, available at <https://www.globalgoals.org/resources>

SDG Icon grid: UN, available at <https://www.un.org/sustainabledevelopment/news/communications-material/>

