Osborne Clarke

Sustainable disruption: 12 decarbonising technologies for cities

WRITTEN BY ECONOMIST IMPACT

We need clean cities. They consume over two-thirds of global energy resources and account for more than 70% of CO_2 emissions worldwide.[1] More than half (56%) of the global population currently lives in an urban area. The UN expects that number to reach 68% by 2050.[2]

A new research programme by Economist Impact, supported by Osborne Clarke, identifies technologies that can help cities achieve their carbon-emission targets while also creating jobs, lowering energy costs for residents, and improving overall quality of life. From a long list of 26 technologies across three sectors, the research highlights twelve. Critical gaps in public and private funding across all sectors prevent implementation at a large scale, but also create exciting opportunities for businesses looking to invest in new, sustainable technologies.

A note on methodology

Technologies were identified following a literature review and in consultation with an external advisory board. Our 12 technologies were selected based on their scoring for **one indicator**[3] among the following categories: **impact**, **ease of scalability**, and **level of investment**. We also chose them on the basis of the interesting (and perhaps neglected) stories that they may tell. The featured technologies do not necessarily have the greatest (positive) impact on CO_2 emissions – and for some of the featured technologies, this impact is hotly debated. Technologies are unranked.

Osborne Clarke View

Many of these decarbonising technologies will play a crucial role in helping businesses transform in response to increasing pressure around sustainability from consumers, regulators and competitors. We believe some will be a focus for the investment and financial community. However, there are also risks and opportunities to be navigated: with increased IoT deployment comes greater cyber risk; collaborative activities and industry standards can be challenged under competition law; and, in some cases, new contract frameworks and oversights will need to be developed. A strong understanding of the changing legal and regulatory environment will be crucial for every business's future net zero success.

James Watson, Head of Decarbonisation, Osborne Clarke, UK

12 technologies for cities

Technology	Impact	Scalability	Investment
Low-carbon cement & concrete alternatives	High	Very High	Low
High-efficiency heat pumps	High	Very High	Medium
Digital twins	Medium	Medium	Medium
Building automation systems (BAS)	Medium	Medium	Low
District heating & cooling system (DHC)	High	Medium	Medium
Smart grids & smart meters	High	High	High
Waste robotics	High	Very High	Low
Unified communications (VOIP)	Medium	High	High
Mobility as a Service (MaaS)	Medium	High	Medium
Autonomous vehicles (AV)	Medium	Medium	High
Hydrogen transport vehicles	Medium	Medium	Medium
Vehicle-to-grid technologies (V2G)	High	Medium	Low

Osborne Clarke View

Decarbonisation technologies are a rapidly evolving market. Finance for these technologies is quickly moving from high-risk to highly regulated. Legislators are also pushing institutional investors to back low-carbon technologies by obliging them to report on their ESG footprint. These developments may make infrastructure assets even more attractive for debt providers. Understanding legal regulations and identifying opportunities is key and this requires not only profound insight into political dynamics and technological advances, but also an anticipation of both legislative and debt/equity developments.

Konstantin Ewald, Partner, Osborne Clarke, Germany

Buildings & Construction Technologies

The United Nations Environment Programme (2017) reported that buildings and construction are responsible for over 36% of global energy consumed, and as much as 40% of energy-related CO_2 emissions. Technologies in this sector help increase the energy efficiency of existing buildings, while also reducing the carbon footprint of the construction sector as a whole.

Low-carbon cement and concrete alternatives

Low-carbon cement is created using recycled materials from traditional cement waste or by-products.

Score

Impact	Scalability	Investment
High	Very high	Low

Paris, France

The French Ministry of Ecological Transition's cement sector decarbonisation roadmap sets out €1.2bn (US$1.4bn) in decarbonisation support to the cement industry.[4]

High-efficiency heat pumps (HEHP)

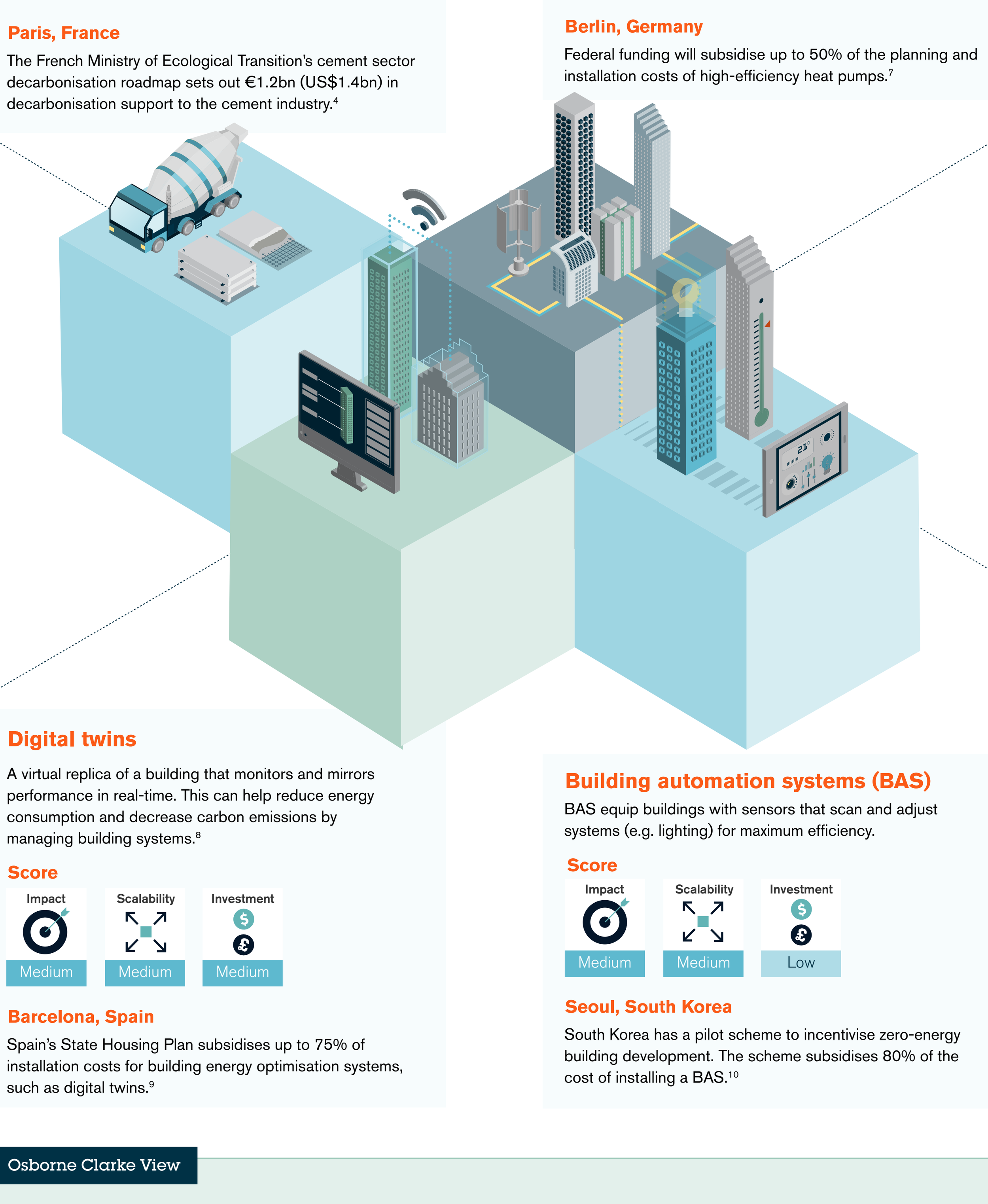
HEHP extract heat from the air or the ground and transfer it in the opposite direction of natural heat flow to heat or cool a space.[5,6]

Score

Impact	Scalability	Investment
High	Very high	Medium

Berlin, Germany

Federal funding will subsidise up to 50% of the planning and installation costs of high-efficiency heat pumps.[7]



Digital twins

A virtual replica of a building that monitors and mirrors performance in real-time. This can help reduce energy consumption and decrease carbon emissions by managing building systems.[8]

Score

Impact	Scalability	Investment
Medium	Medium	Medium

Barcelona, Spain

Spain's State Housing Plan subsidises up to 75% of installation costs for building energy optimisation systems, such as digital twins.[9]

Building automation systems (BAS)

BAS equip buildings with sensors that scan and adjust systems (e.g. lighting) for maximum efficiency.

Score

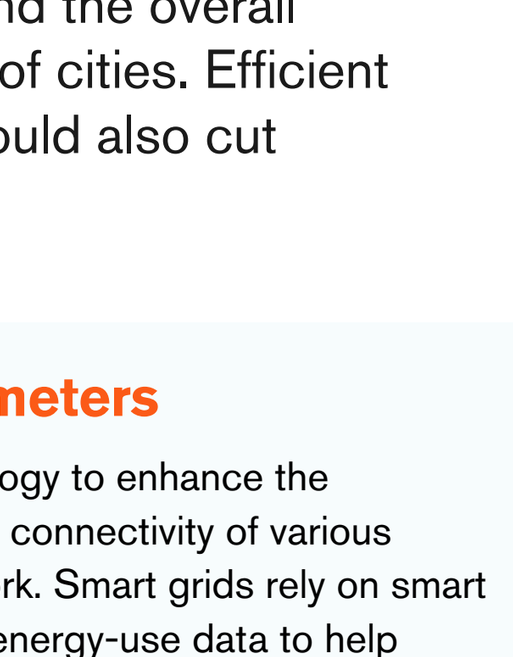
Impact	Scalability	Investment
Medium	Medium	Low

Seoul, South Korea

South Korea has a pilot scheme to incentivise zero-energy building development. The scheme subsidises 80% of the cost of installing a BAS.[10]

Osborne Clarke View

Legislators are also playing a role in tackling the carbon challenge. France, for instance, is debating a new law to reduce the environmental footprint of digital technologies, including by requiring consumer disclosures on environmental impact, penalising planned obsolescence and setting mandatory rules on eco-design and product updates. We expect to see similar initiatives in other territories.



Claire Bouchenard, Partner, Osborne Clarke, France

City Infrastructure Technologies

With over half of the world's population living in cities, the energy consumption of cities has a disproportionate impact on CO_2 emissions. More efficient energy distribution systems and the overall decarbonisation of the energy grid will have a significant impact on the decarbonisation of cities. Efficient waste management in cities, including disposal, recycling, composting and treatment, could also cut 10-15% of greenhouse-gas emissions globally.[11]

District heating & cooling (DHC)

In a DHC system, a central plant generates and channels hot or cool water via a network of underground pipes to multiple buildings.

Score

Impact	Scalability	Investment
High	Medium	Medium

London, UK

The UK Department for Business, Energy and Industrial Strategy's Heat Networks Investment Project (HNIP) has allocated £320m (US$431m, €378m) to heat-network development and offers grants and loans for DHC projects.[12]

Smart grids & smart meters

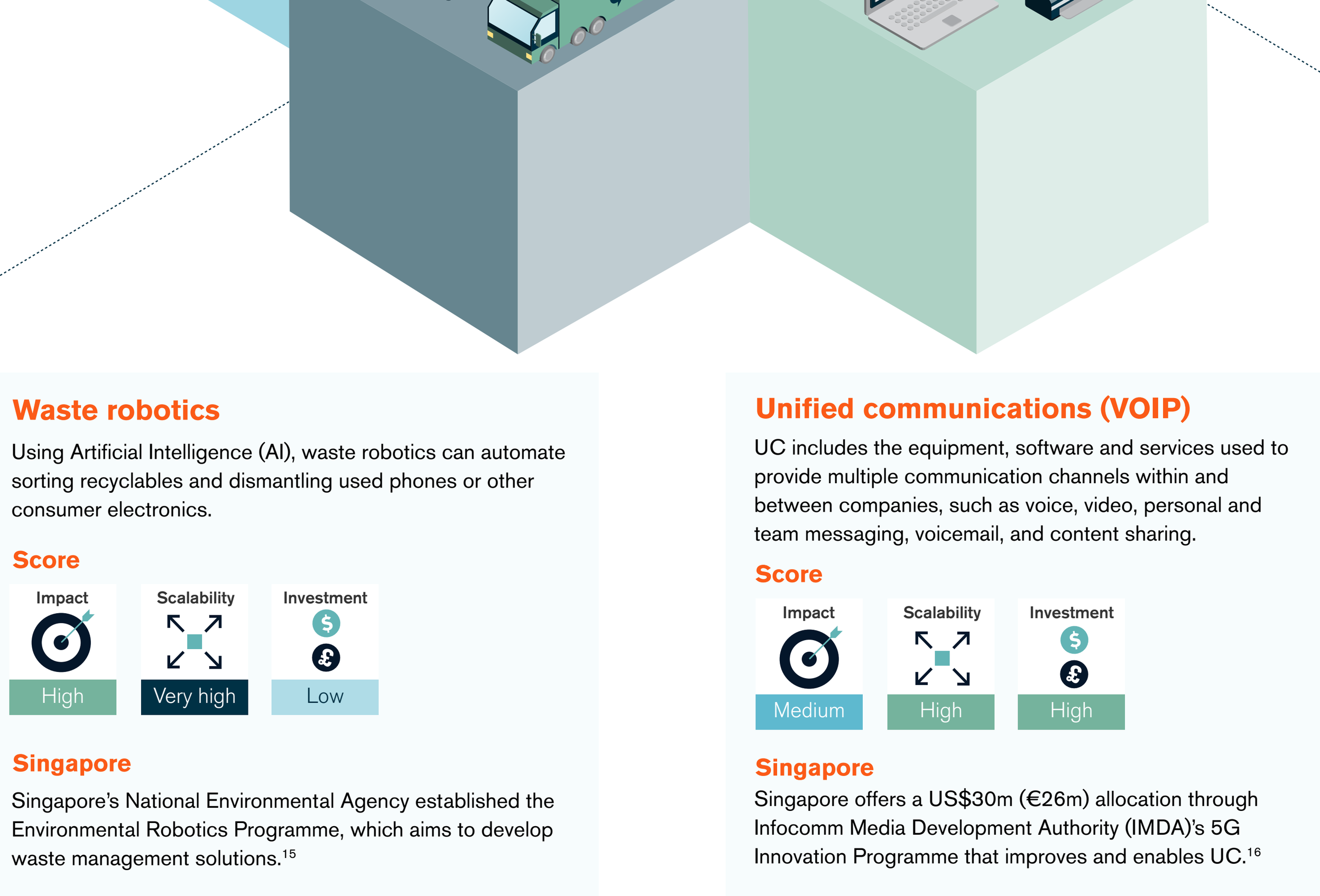
A smart grid uses digital technology to enhance the communication, automation, and connectivity of various components of the power network. Smart grids rely on smart meters that collect and analyse energy-use data to help power generation plants better manage the less predictable output of renewable energy generation - thereby supporting the switch to renewable energy sources.[13]

Score

Impact	Scalability	Investment
High	High	High

Delhi, India

The Ministry of Power's National Smart Grid Mission enables smart grid projects by providing funding for up to 30% of a project's costs.[14]



Waste robotics

Using Artificial Intelligence (AI), waste robotics can automate sorting recyclables and dismantling used phones or other consumer electronics.

Score

Impact	Scalability	Investment
High	Very high	Low

Singapore

Singapore's National Environmental Agency established the Environmental Robotics Programme, which aims to develop waste management solutions.[15]

Unified communications (VOIP)

UC includes the equipment, software and services used to provide multiple communication channels within and between companies, such as voice, video, personal and team messaging, voicemail, and content sharing.

Score

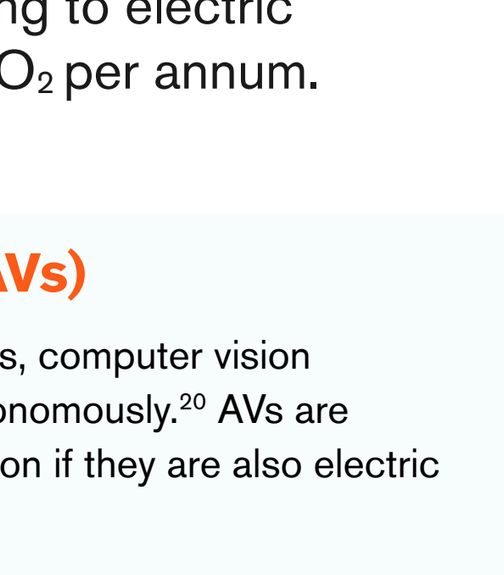
Impact	Scalability	Investment
Medium	High	High

Singapore

Singapore offers a US$30m (€26m) allocation through Infocomm Media Development Authority (IMDA)'s 5G Innovation Programme that improves and enables UC.[16]

Osborne Clarke View

Considering these technologies for their buildings has become a business imperative for our clients' long-term ESG strategies. In Europe, the legislative thought process on implementing a carbon footprint tax, especially in the real estate and transportation sectors, has matured and regulators, investors and stakeholders are holding real estate companies accountable for sustainable practices.



Fran Claes, Partner, Osborne Clarke, Belgium

Transportation Technologies

From large, sprawling mega-cities to small towns, transportation systems play a key role in the functioning of urban life. Transportation also accounts for one-fifth of global CO_2 emissions[17] and in high-income countries, transportation can be the largest segment of an individual's carbon footprint.[18] Transitioning to electric mobility, and encouraging walking, cycling etc. can cut emissions in cities by 4.7 Gt of CO_2 per annum.

Mobility as a Service (MaaS)

Using a phone or web app, MaaS integrates across different modes of public and private transport with additional, newer mobility services (such as ride-sharing or e-scooters), allowing users to travel door-to-door with a single interface.

Score

Impact	Scalability	Investment
Medium	High	Medium

San Francisco & New York, US

The Smart City Challenge funded cities across the US to create an integrated and smart transportation system that uses data, applications, and digital technology to help people achieve efficient, low-carbon mobility. It leveraged over US$350m (€302m) in public and private funds to support innovative ideas, such as MaaS projects. House Bill 5156 would restart this funding stream.[19]

Autonomous vehicles (AVs)

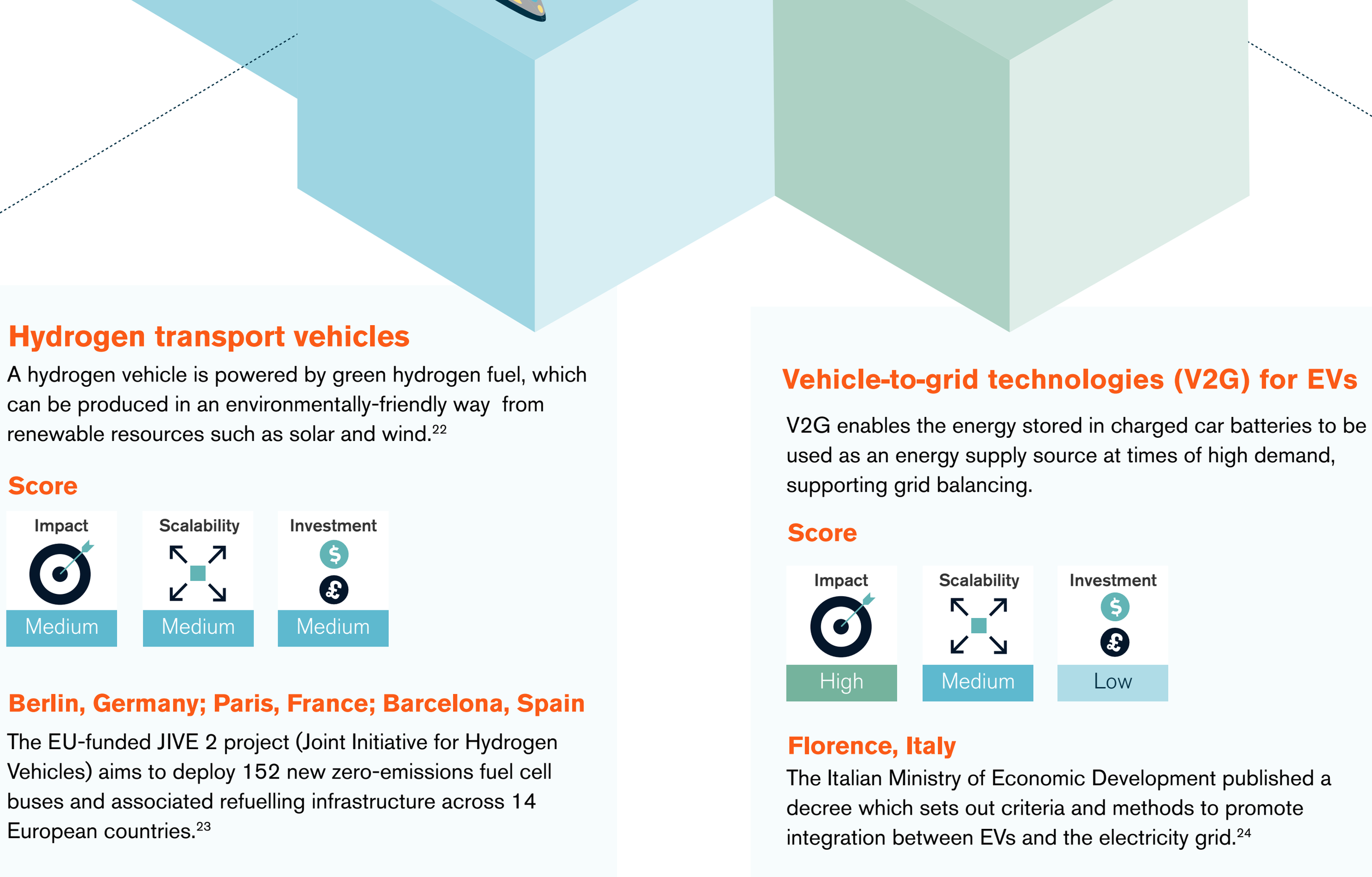
AVs rely on machine learning systems, computer vision algorithms, and sensors to drive autonomously.[20] AVs are particularly beneficial to CO_2 reduction if they are also electric vehicles (EVs).

Score

Impact	Scalability	Investment
Medium	Medium	High

Seoul, South Korea

The Seoul Metropolitan government created an ordinance to provide administrative and financial support for testing the operation of AVs in designated areas. The government plans to invest KRW1.1trn (US$932m, €802m) in AVs between 2021 and 2027.[21]



Hydrogen transport vehicles

A hydrogen vehicle is powered by green hydrogen fuel, which can be produced in an environmentally-friendly way from renewable resources such as solar and wind.[22]

Score

Impact	Scalability	Investment
Medium	Medium	Medium

Berlin, Germany; Paris, France; Barcelona, Spain

The EU-funded JIVE 2 project (Joint Initiative for Hydrogen Vehicles) aims to deploy 152 new zero-emissions fuel cell buses and associated refuelling infrastructure across 14 European countries.[23]

Vehicle-to-grid technologies (V2G) for EVs

V2G enables the energy stored in charged car batteries to be used as an energy supply source at times of high demand, supporting grid balancing.

Score

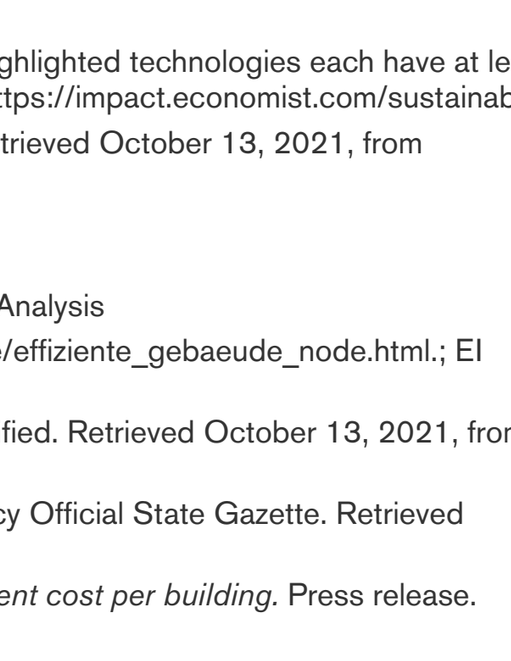
Impact	Scalability	Investment
High	Medium	Low

Florence, Italy

The Italian Ministry of Economic Development published a decree which sets out criteria and methods to promote integration between EVs and the electricity grid.[24]

Osborne Clarke View

We need fundamental change in how we move people and things through our cities, and transport technologies are at the heart of that. To decarbonise, we need to incentivise the switch by making future transport better than what has gone before. Convenient, sustainable options for the end user often mean a great deal of complexity behind the scenes, and creativity is needed to shape the contractual and legislative frameworks, collaborations and partnerships that underpin the shift to green mobility. These are incredibly exciting times.



Alessandro Villa, Partner, Osborne Clarke, Italy

Endnotes

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3. Our three scoring categories, impact, scalability, and investment, each have 3-4 underlying indicators making up their score for that category. The highlighted technologies each have at least one indicator which scores as high or very high among at least one category. For more details the workbook with the full research can be found at https://impact.economist.com/sustainability.
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