



European
Commission



SMART SOLUTIONS CASEBOOK

Smart Cities Marketplace 2022



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ENERGY

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The **Smart Cities Marketplace** was created by merging the two former Commission projects EIP-SCC¹ and the SCIS² into one single platform. It is a major market-changing undertaking that aims to bring cities, industries, SMEs, investors, researchers and other smart city actors together.

What is the Smart Cities Marketplace?

The Smart Cities Marketplace has thousands of followers from all over Europe and beyond, many of which have signed up as a member. Their common aims are to **improve citizens' quality of life, increase the competitiveness of European cities and industry** as well as to **reach European energy and climate targets.**

What are the aims of the Smart Cities Marketplace?

Explore the possibilities, **shape** your project ideas, and close a **deal** for launching your Smart City solution! Get in touch with us at info@smartcitiesmarketplace.eu

What can the Smart Cities Marketplace do for you?

¹ European Innovation Partnership on Smart Cities and Communities
² Smart Cities Information System



MES BARCELONA
scaling up the delivery of solar energy
projects through co-investment
agreements

CONTEXT

From 2015 to 2019, the city of Barcelona took part in the first generation of Horizon 2020's large Smart Cities and Communities 'Lighthouse Projects' and tested the deliverability of 12 smart city solutions in European cities.

One of the solutions trialled by Barcelona was the implementation of **energy retrofitting** works on buildings across the city. Whilst passive retrofitting/insulation solutions were shown to be viable on most institutional and commercial buildings, the technical assessments showed that such solutions were not financially sustainable for most residential buildings (the costs outweighed the value of the energy savings).

Consequently, the city turned towards an alternative solution to improve the sustainability of those buildings' energy consumption: the **retrofitting with solar panels**.



CHALLENGES

Research from the Lighthouse project, [Grow Smarter](#)¹, demonstrated that solar panels have the potential to deliver significant returns on investment in Barcelona¹. However, a number of market failures prevented the market from scaling up the delivery of solar panels on private residential buildings. Challenges included the following:



↑ Photo of stairs in a Spanish city by © Sam Williams on Unsplash

COSTS

The upfront costs of solar panels/ energy retrofits can deter many property owners from investing.

¹ Smart City Market introduction by GrowSmarter

GOVERNANCE

A large share of Barcelona's residential building stock consists of apartment blocks. To install solar panels and share the electricity output/ financial receipts, the owners of each flat would need to cooperate and pool resources. This process requires expertise, time, and leadership – it is therefore **rarely a practical solution**. In consequence, property owners are unlikely to commission and finance their own solar panels retrofits in the city.

CULTURE

Large energy investors may have the capability to bring in project management expertise, leadership and funds to help property owners coordinate solar panel retrofitting projects. However, there is in Barcelona a certain amount of **mistrust between citizens and big companies**, so that property owners are often **unwilling to commission large private energy companies to deliver solar panel retrofitting projects on their behalf**.

SOLUTION

To address those challenges, Barcelona City Council adopted the following strategy under the Barcelona Sustainable Energy Mechanism (**MES Barcelona**):

Finding investors

The city organised a call for investors which would be interested in co-funding solar panels:

→ It contacted directly around 40 enterprises and investors active in the green energy sector;



↑ Photo of people working together by © Elliott Reyna on Unsplash

- Based on the expressions of interest received it assessed the suitability of prospective investors for collaborating to fund solar energy projects according to three key selection criteria:
 - ↳ *Financial capacity*: ensuring that proposed investors were in good financial health
 - ↳ *Value for money*: ensuring that proposed investors had expertise in the solar energy sector and would be able to offer high-quality solutions at fair price
 - ↳ *Willingness to cooperate*: ensuring that the selected investors were willing to exchange knowledge and work with each other.
- It formalised its cooperation with the selected investors, including SUMA Capital, a member of the **Smart Cities Marketplace Investor Network** through the signature of co-investment agreements setting out how they would cooperate to identify and fund projects within the city.

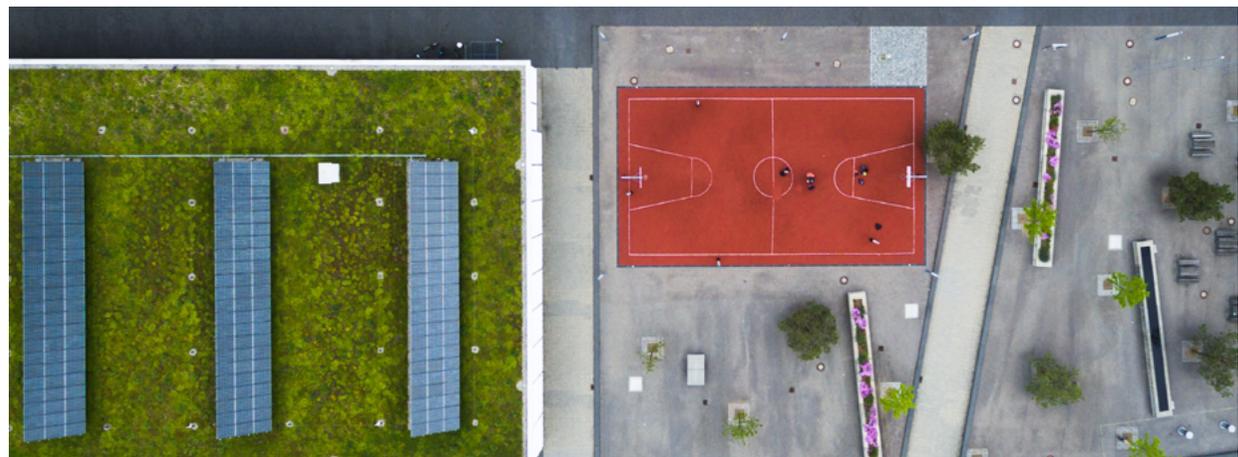
SOLUTION

- ✓ Organising a Call for investors, contacting enterprises and investors.
- ✓ Structuring expressions of interest according to chosen section criteria.
- ✓ Formalising the cooperation with selected investors.

Building up a business model

The co-investment agreement set up for MES Barcelona works as follows:

- The Council and its selected investors co-invest in residential PV projects. For any project, the Council contributes a maximum 30% of the investment requirement whilst private investors are required to provide the rest. The building owners do not have to make any financial contribution.
- Following the installation of the PVs, MES Barcelona sells the energy to recover the installation and maintenance costs and generates returns for the Council and the private investors. The Council aims to secure a minimum of 6% of return on investment on each project, whilst the returns required by private investors vary according to the project's specificities.
- The owners of the building where the PVs are installed are given the first option to purchase the energy that they generate, at an affordable price predefined before the delivery of the panels. Should the building owners not want to purchase it, or should there be a surplus of energy generated, then MES Barcelona may sell it to neighbouring property owners and ultimately to the public grid.
- Once the Council and the investors have recovered their investment and generated their targeted returns, the ownership of the solar panels is transferred to the building owners. The targeted return period generally ranges from 10 to 15 years. The Council also has an option to resell its share to the private investors earlier to re-invest the capital into other projects.



↑ Photo of PV on a public building by © Julian Wildner on Unsplash

Matching up investors with projects

To identify investment opportunities, the Council and its registered investors have published an open-ended call for expressions of interests from residential property owners.

The private investors are then responsible for engaging with the individuals who registered their interests, discussing their needs and offering them a solution.

Once the property owners have initially approved the offer made by an investor, the project is put forward to the City Council, who assesses its quality before giving it their go-ahead.

Projects are assessed by private consultants hired by the Council, based on their financial viability, legal feasibility and value for money.



↑ Further reading on PV and Battery solutions on our website smart-cities-marketplace.ec.europa.eu



Call for expressions of interests



Private investors contact interested parties



Quality assessment and approval



City Council puts the project forward

RESULTS

The funding and delivery model put forward in MES has been highly successful:

- It has allowed Barcelona to create a strong momentum within the investment community, driving the interest of the market for investing into solar panels on residential buildings.
 - ↳ As of July 2022, the city has signed collaboration agreements with fourteen investors.
 - ↳ Two additional investors are pending to sign the co-investment agreement;
 - ↳ Other investors have now become aware of MES and are contacting the city directly to be added to the list of approved investors.
- It has helped open up the solar energy markets to a diverse range of investors, giving visibility and creating opportunities for small and local companies. The investors who have been approved to date include a mix of venture capital funds, local energy companies and large energy companies;
- It has helped break down barriers to the adoption of solar panels among the local community. Owners of 1.500 different buildings have already contacted the city to put forward PV projects.
- It will lead to the rapid delivery of projects. Through MES, the city Council will invest around €50 million in projects over 2022-2024, and the first residential PV project should be delivered by the end of 2022.

→ Photo of PV installation by
© Ricardo Gomez on Unsplash



REPLICATING

The innovation coming out from Barcelona is building on solid research and the financial model is so far proving successful. For other cities – or city groupings – to replicate it successfully several things are needed:

- **Political support:** Barcelona's success with MES did not only stem from successful research, but also from a strong political commitment in the local government. Political support/ leadership is crucial both to allocate the funding required for the public share in the financing scheme, and to successfully rally the first investor group.
- **Administrative resources:** MES Barcelona is operated by the city council with the city funding the support from a consultancy to assess individual applications. This requires the designation of a project manager or similar to move the project from idea to reality.

- **Solvency:** This scheme can be deployed with smaller initial public funding (or potentially, a smaller rate of public funding) than in Barcelona, so it is available to all sizes of cities with some resources to invest. The goal is very much to attract the market attention while keeping an oversight of the energy prices and the projects being done.
- **Weather:** The sun is needed for PV projects to succeed, and hence for MES Barcelona to be replicated. This will influence the replicability in some cities based on local weather systems and heavily influences pay back periods as well rates of return.

- **Investors:** Rallying support from investors is crucial. If you represent a city, or a city-grouping, considering a scheme such as MES Barcelona, reach out to the Smart Cities Marketplace to gain support on closing deals with investors.



↑ Photo of PV installation by © Ricardo Gomez on Unsplash



SMART LIGHTING IN GRABOVO

Opening up for ESCOs to
finance smart solutions

CONTEXT

Smart lighting refers to a system in which street lighting is not only about lampposts providing lighting infrastructure, but about doing so using lower energy LEDs, managed by smart systems and potentially including several other capabilities such as balancing the grid and/or different sensors, charging capabilities, or in some cases even inclusion of public WiFi.

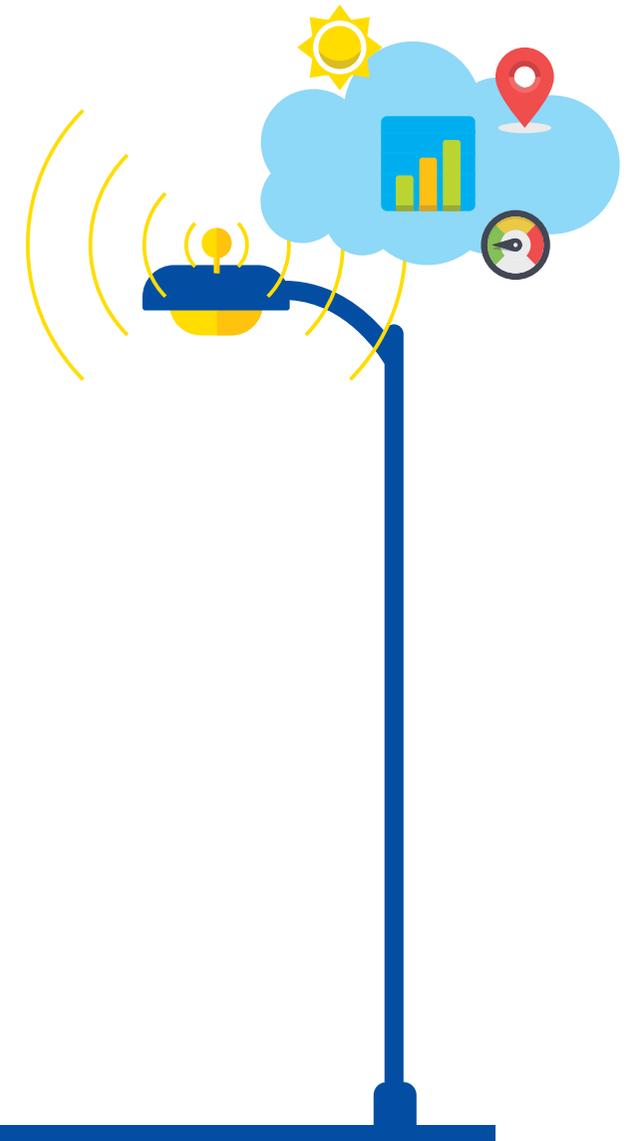
Rolling out smart lampposts has been a priority for the [Smart Cities Marketplace's Initiative 'The humble lamppost'](#), led by [Graham Colclough](#) and [Hans Nouwens](#), since 2017 [↗](#). The Initiative has ambitiously called for upgrading at least ten million lampposts in Europe and recently supported the publication of the White Paper 'Shining a Global Light' detailing cases from major cities around the world.

In order to undertake this ambitious goal however, action in major cities will not be enough. Small – and medium-sized cities will need to take part, and accessing funding and financing options is often the challenge.

This is where the Municipality of Grabovo (Bulgaria) comes in as an example other cities can follow. In 2015, the Municipality of 60.000 inhabitants identified the need to upgrade its lighting system to make it smart and more energy efficient, mainly by installing LED light bulbs and a smart management system.



↑ Further reading: 'Humble Lamppost' in a post-Covid green digital recovery [↗](#)



CHALLENGES

After having identified the need to upgrade its lighting infrastructure in 2015 they undertook a thorough energy audit in 2020, where the total costs for such an upgrade were estimated at €2.000.000. The main challenges identified were:



↑ Bulgarian rooftops. Photo by @ Teodora Yordanova on Unsplash

COSTS

Like most cities in Europe, the Municipality of Grabovo's budget allows for a limited amount of up-front investments in new infrastructure, leading to a need for financing schemes other than using resources directly from the city budget. Limits on how much debt the Municipality was allowed to take on also made a regular loan undesirable.

CHANGING ELECTRICITY PRICES

The changes in electricity prices meant that the project bankability changed accordingly. At times this led to low profitability (especially due to night-costs of electricity). In the current market (July 2022) the investment is more attractive.

EXISTING INFRASTRUCTURE

Existing lighting infrastructure was already present, including a small percentage which was already equipped with sub-par LED lights (low lifetime compared to the preference from the Municipality). Upgrading cables and refitting existing LED light bulbs were not energy cost saving measures, but necessary for the full system to improve.

SOLUTION

In order to address these challenges, the Municipality of Grabovo employed the following strategy:

Assessing options

Grabovo proposed three different solutions for implementing the needed upgrades:

- Using their own funding but implementing the desired solutions step-by-step, potentially benefiting from grants where possible.
- Commercial credit through a dialogue with credit institutions and/or other financial instruments.
- Realising the upgrade through an Energy Performance Contract benefiting from working with an ESCO (Energy Service Company). This would essentially outsource the need for financing directly to the ESCO.

In the end, the Municipality opted for the Energy Performance Contract following an internal dialogue that also included input from the Bulgarian National Trust Ecofund, which provided some funding for the smart management system and upgrading the old non-LED luminaries (this part of the funding ended up being 29%).

The ESCO model was chosen as the path leading to the highest quality results, with the ESCO in the end guaranteeing results while taking on the technological financial risks.

SOLUTIONS

- ✓ Implementing step by step with own funding.
- ✓ Benefiting for grants where possible.
- ✓ Opening a dialogue about a commercial credit.
- ✓ Energy Performance Contract, working with an ESCO.

Business case

After deciding to use an Energy Performance contract, the next step was to develop the business case itself.

The European Commission has published a [full brief on Grabovo](#) as part of its 'Green Public Procurement in Practice', detailing all aspects of the procurement process. Due to the fact that a first tender failed to yield the desired results using a competitive dialogue procedure, Grabovo chose the following path in an **open tender procedure**:

- The contract offered was made threefold.
 - ↳ **Aspect 1)** covered the replacement, and thus energy saving measures, of the old light bulbs.
 - ↳ **Aspect 2)** covered a smart energy management system.
 - ↳ **Aspect 3)**, roughly 25% of total value, covered operation, maintenance and upgrades to the existing network.
- The first and second aspects were supported with a 29% grant directly from the Bulgarian National Trust Eco-Fund, with the rest financed by realised savings in the coming years. These realised savings will increase as electricity prices rise (and the energy saving measures increase in profitability), thus lowering the payback period for the municipality.
- The chosen contractor committed to energy savings of about 70%.



↑ Lampost in an old town. Photo by @ Vlad Hilitanu on Unsplash

Matching up with private companies

As the Municipality of Grabovo had chosen a tender using open procedure, the financing requirement was shifted to **private companies**. Hence, the effort from the Municipality's side focused on finding the appropriate contractor.

The chosen supplier was a consortium consisting of two Bulgarian companies. Furthermore, the terms of the contract were such that repayment only began once the full system was implemented, leading to realised savings throughout the entire implementation phase, because energy savings began as soon as the first LED light bulb was installed.



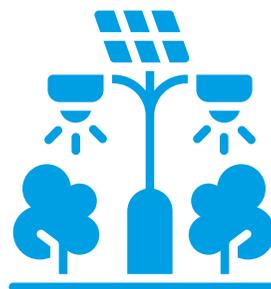
↑ Urban planning co-creation with citizens. Photo by © Smart Cities Information System (currently Smart Cities Marketplace)

RESULTS

The installation and roll-out of Grabovo's Smart lighting LED system has been finalised, with the expected savings materialising. This means:



- Grabovo's street lighting network today is made entirely of LED luminaires and includes a smart management system.
- The Municipality cut energy consumption of the replaced luminaires by more than 70%.



- With the terms of the contract, including the 29% grant from the Bulgarian National Eco-Trust, the Municipality of Grabovo has lowered its overall costs for its lighting system, even while repaying the investment to the private contractors.



- The new system is not only proving to be a financial success, but has also increased the uniformity of street lighting, making it easier to adjust lighting at specific places and times to increase comfort. It also increases the overall functionality of the system.

REPLICATING

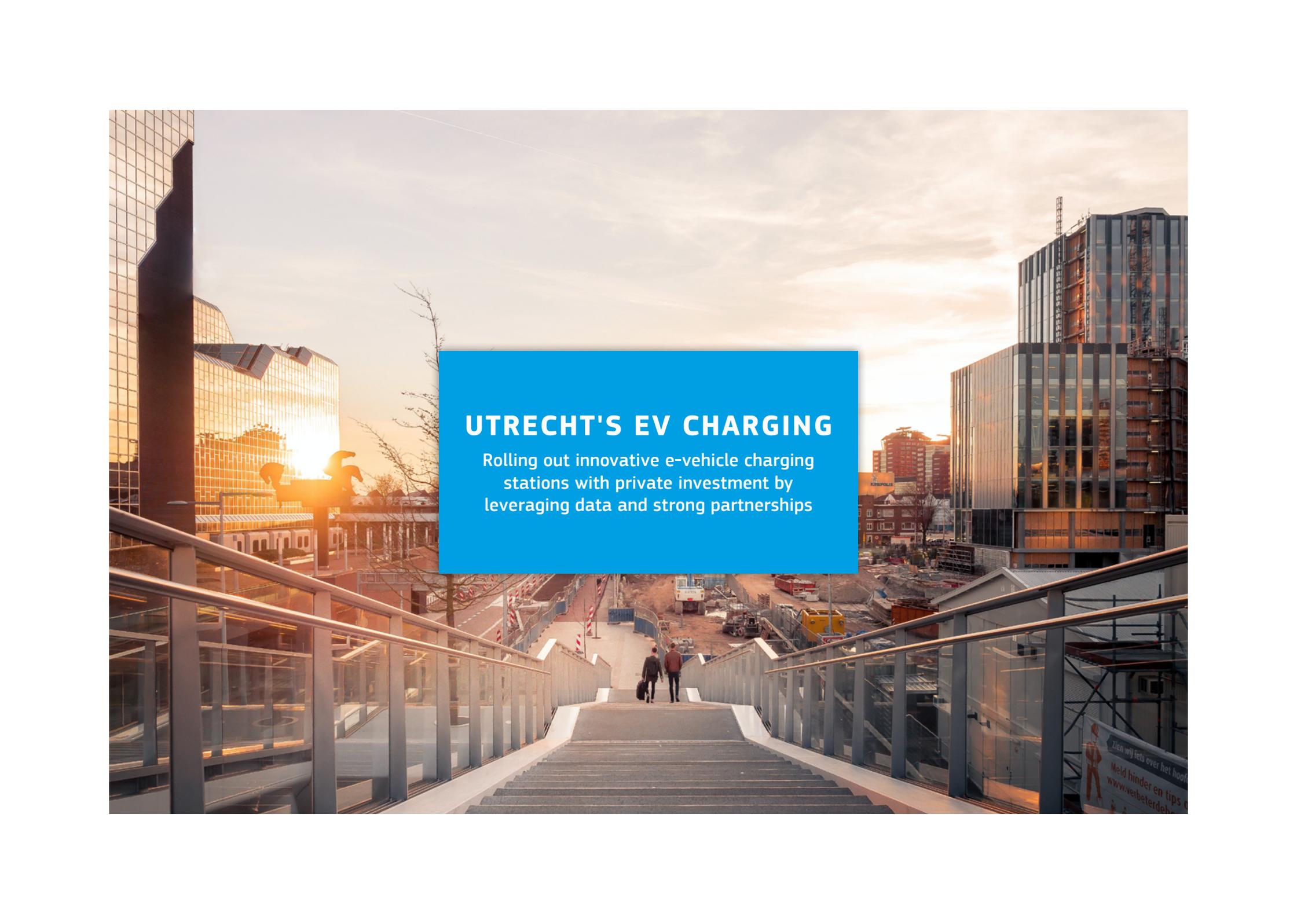
The approach taken by Grabovo is especially replicable in municipalities without fully deployed LED lighting infrastructure, as the energy saving measures are key to making the business model attractive. In these municipalities, further incentives and tools can often be national or European energy efficient support mechanisms, which in the case of Grabovo, covered 29% of the investment.

➤ Several resources are available for cities wishing to roll-out smarter lampposts, and the [humble lamppost initiative of the Smart Cities Marketplace](#) is a good place to start

➤ To learn the details on the specific tender procedure, read the [brief from 'Green Public Procurement in Practice'](#).



↑ Graphic recording summarising the Smart Cities Marketplace Forum, Action Cluster meeting in 2021 led by Graham Colclough and Hans Nouwens. Made by © Agata Smok, Smart Cities Marketplace



UTRECHT'S EV CHARGING

Rolling out innovative e-vehicle charging stations with private investment by leveraging data and strong partnerships

CONTEXT

As one of the cities chosen for the European Commission's mission to achieve [100 climate-neutral and smart cities](#) by 2030, the City of Utrecht (the Netherlands), with 360.000 inhabitants, is among the most ambitious local governments in Europe regarding sustainability.

The city excels in several areas and has led the Smart Cities and Communities Lighthouse Project [IRIS SMART CITIES](#) since 2017, gathering valuable experience for others to benefit from. One specific area of expertise that the city has been engaged in for more than ten years is rolling out electric charging stations for e-vehicles. The work is underlined by the ambition that all passenger traffic in the city centre be emission free by 2030 and all logistics traffic by 2025.

Today, the city has over 2.400 public AC charging points and is planning to reach 5.000 before 2025. This itself is an achievement, but because all new charging points will be bidirectional — allowing the electricity to flow also from the car battery to the grid — the city is making a system

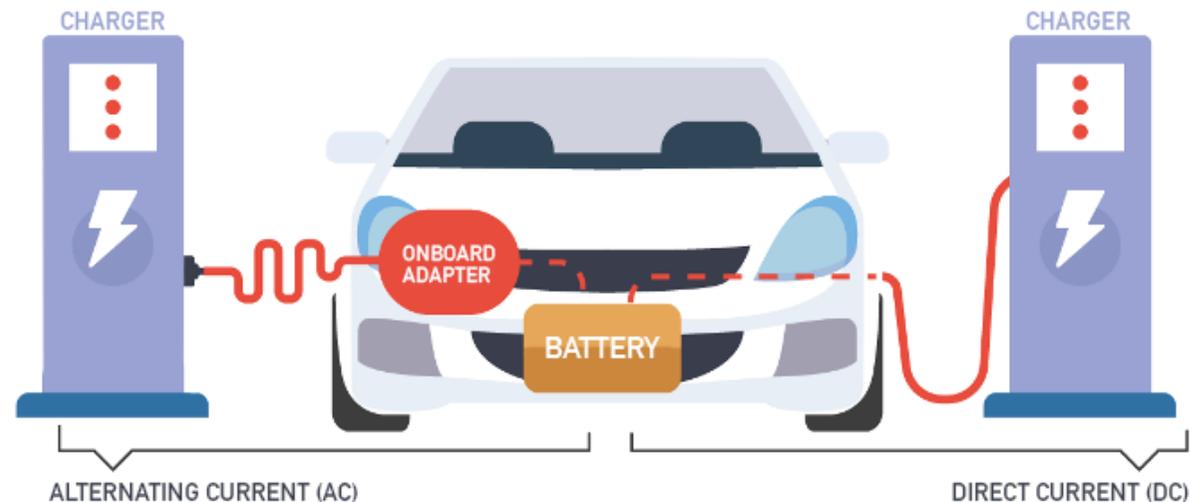
ready for a future in which the electric car fleet can support balancing the electrical grid and the ups and downs of renewably produced energy. The further increase of charging points will be achieved through strong local partnerships and extensive data use, rather than with the municipality's budget.



↑ Further reading on [Electric vehicles and the grid](#)

↓ AC and DC difference explained.

Image by © Think E



CHALLENGES

All of Utrecht's work on electric charging is based on challenges found elsewhere in European cities: the overall need to make cities more sustainable manifested locally by an increase in congestion, a growing population, and air quality levels in need of improvement.

Those factors are the basis for the urgency with which Utrecht has approached upscaling its charging infrastructure, and has approached this challenge in various ways.



↑ Utrecht old town by night. Photo by © Martin Woortman on Unsplash

TECHNOLOGY

The technology behind e-charging has developed rapidly in the past ten years, requiring the city and its partners to stay up-to-date on the newest developments and plan accordingly.

FINANCING

The financing required for implementing large-scale e-charging stations is not perceived as suitable for direct public funding through the municipal budget.

CITY PLANNING

With roughly 70% of all parking in the city taking place on public land, the city is important in pushing change. For the roll-out to be coherent, and taking into social, environmental, and aesthetic considerations, it is preferable for the implementation to be city-guided.

SOLUTION

To address the above challenges, the city of Utrecht has engaged in several strategic partnerships, covering different perspectives of its overall ambition. One foundation of this has been constant political support for increased e-charging infrastructure roll-out. Other key actions have included:

- **Engagement with both public, private, and research partners** in the Utrecht Region to support using a standard for bidirectional chargers (AC 15118). This has been strongly supported by Utrecht Sustainability Institute, a local car sharing company called We Drive Solar, through various projects supported by Horizon 2020, ERDF, and the Dutch Government. We Drive Solar has, for example, signed agreements with both Renault and Hyundai to deliver cars with bidirectional batteries supporting this standard to be used in the City of Utrecht.
- Utrecht has included this **new standard for bidirectional charging in all public tenders** on e-charging infrastructure, ensuring the charging stations are future-proofed.
- The city has collected and used extensive amounts of **data on the current installation** and use of all its e-charging stations so that future public charging station placements are carefully considered.



↑ Bidirectional V2G charging station installed for the City-zen VPP pilot. Photo by @ Alliander

Building up a business model

With clear political backing to transition towards electric vehicles, the City of Utrecht has leveraged different innovative projects into a model for others to follow. The basis for the business model is a rise in private ownership of electric vehicles complemented with the data-based approach mentioned above.

The city is thus able to use a **concession-based approach in which no taxpayer money is invested. Instead, the city allows private contractors to install, operate, and charge users of new charging stations**, being responsible for the investment and getting a return of that investment through a 10 year contract based on user charges. The user charges are fixed by the Municipality in the tendering process and follow a fixed rate, adjusting alongside electricity price fluctuations.



↑ Ruben van Loon presenting Alliander's Smart Grid solution during City-zen Days in Amsterdam, 2019. Photo by © City-zen project.

This business model is attractive for all parties because:

- Using data and understanding how the chargers are used ensures the grid is expanded according to current and future use. This supports the profitability of each charging station, minimising the risk for the private contractors.
- With the clear political ambition to transition towards e-vehicles, all the partners in the ecosystem — private companies (implementers), investors (risk takers), public bodies (the city) and even the citizens (users) — are engaged in a positive feedback loop. All parties can credibly expect the number and use of charging stations to increase, making e-vehicles or their infrastructure a sound investment for both citizens and companies/investors.
- The concession process includes a small concession fee, which allows the city to fund the municipal team working on expanding the system. As such, the costs for keeping the current system running is covered for the municipality.
- Using standards means private companies are able to upscale their solutions elsewhere. This is already happening, especially in the Netherlands.
- The finance needs are sourced by the private contractors through various means, including large scale investment, and all of the above considerations support this financial source for private companies.

SOLUTION

- ✓ Strategic partnerships, political support.
- ✓ Engagement with both public, private, and research partners
- ✓ New standard for bidirectional charging in all public tenders.
- ✓ Collecting installation data

RESULTS

Installing e-charging stations in Utrecht has been highly successful and the bidirectional capability is increasing the future value of this investment. The success can be highlighted by a few facts:



→ Utrecht is planning for 5.000 public AC charging stations in 2025. This will be in addition to private or semi-public AC stations in homes or at business premises.



→ Several companies are bidding on the different tenders, and four different companies are currently operating the charging points. This includes both multinational corporations and a local SME, which has experienced rapid growth and taken in significant investments while being a strong partner in Utrecht's e-charging journey.



→ Of the total 5.000 charging points planned for 2025, at least 4.000 will be bidirectional, supporting a future balanced grid.

REPLICATION

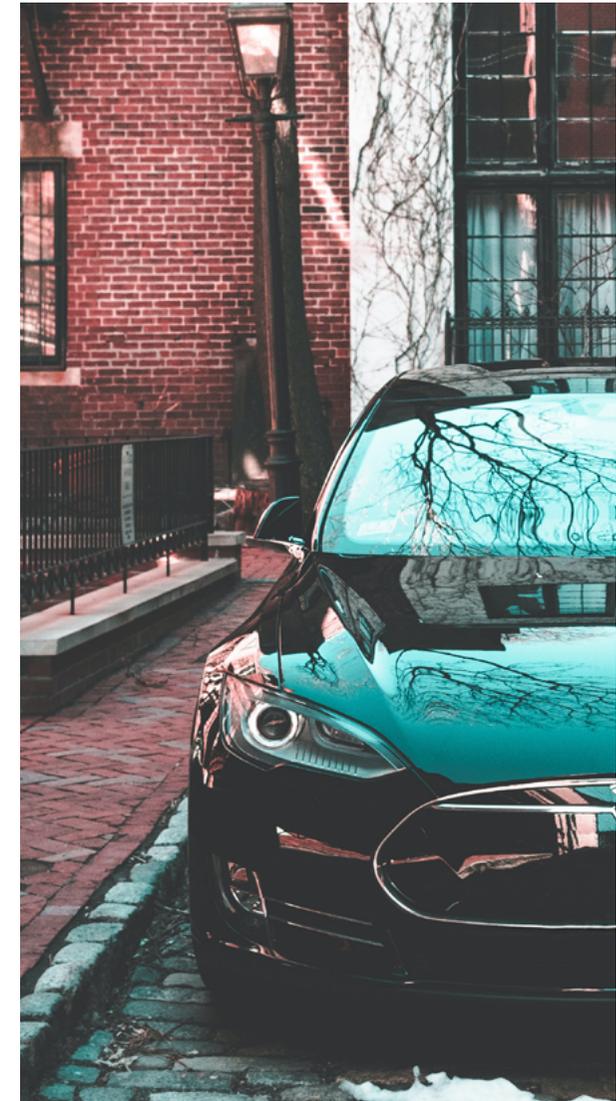
The key to Utrecht's success is close partnerships with all relevant stakeholders, including the grid operator, private operators, research institutions and citizens. This partnership has also been achieved throughout the Utrecht Region and for municipalities smaller than Utrecht.

Another key aspect is their extensive data usage, which allows the city to clarify its business model for private operators and thus ask them to provide the necessary financing for future earnings. Finally, using standardised bidirectional standards make the system future proof and entirely replicable elsewhere.



↑ Amsterdam's smart charging approach to reduce peak demands. Photo by © elaad.nl

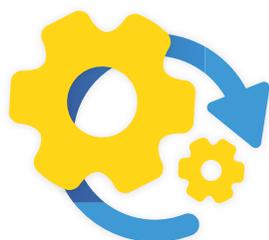
→ Electric vehicle in an old town contexts. Photo by © Alex Iby Gill on Unsplash



ABOUT THE SMART CITIES MARKETPLACE

The Smart Cities Marketplace is a major market-changing enterprise supported by the European Commission bringing together cities, industries, SMEs, investors, researchers and other smart city actors.

The Marketplace offers insight into European smart city good practice, allowing you to explore which approach might fit your smart city project. [Discover our digital brochure here](#) .



Matchmaking

The Smart Cities Marketplace offers services and events for both cities and investors on creating and finding bankable smart city proposals by using our Investor Network and publishing calls for projects.

[Investor network](#)

[Call for projects](#)

[Project finance masterclass](#)



Community

The Smart Cities Marketplace community consists of a number of Action Clusters and Initiatives with a variety of activities to help shape the market for Smart Cities in Europe.

[Action clusters](#)

[Initiatives](#)

[Community charter](#)



EU initiatives

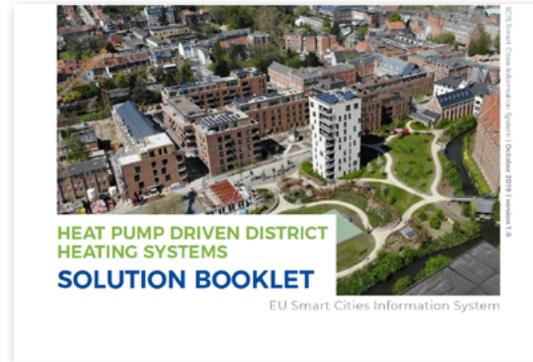
Apart from the smart cities marketplace, there are a number of adjacent EU initiatives focussing on making European cities better places to live and work.

[Other EU initiatives](#)

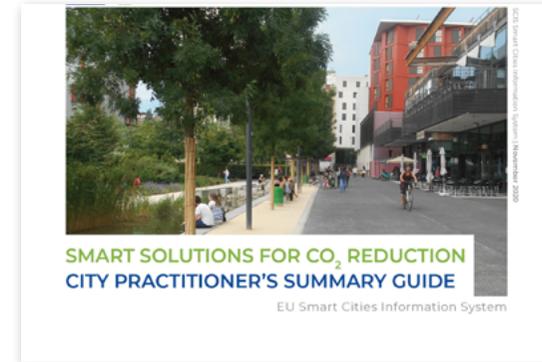
Suggested further reading



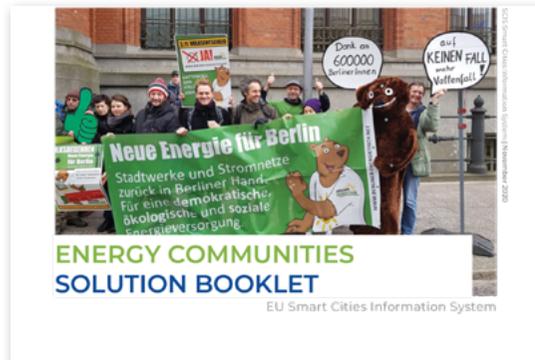
Urban Freight Logistics
SCIS Solution Booklet



Heat Pump driven District Heating systems
SCIS Solution Booklet



Smart Solutions for CO₂ Reduction
City Practitioner's Summary Guide



Energy Communities
SCIS Solution Booklet



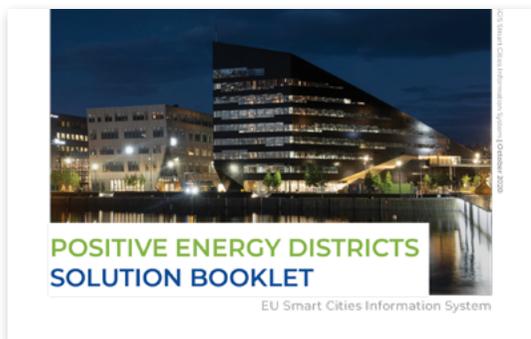
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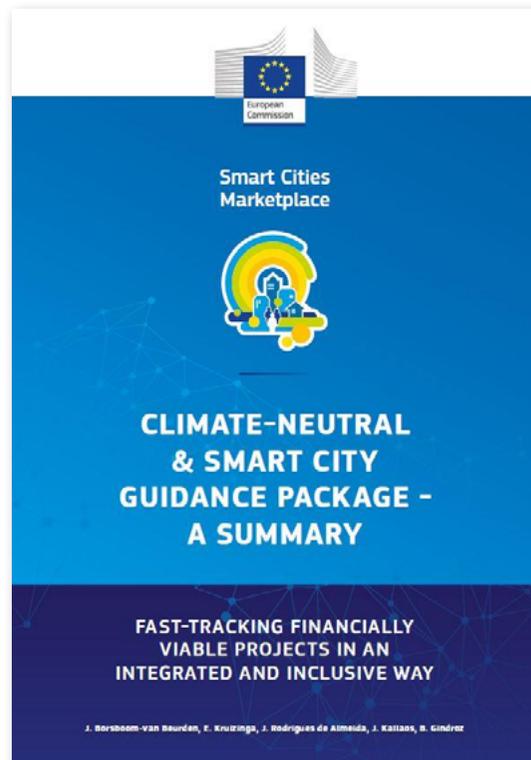
Building Integrated PV
SCIS Solution Booklet



Citizen Engagement SCIS Solution Booklet



Citizen Engagement and Positive Energy Districts SCIS Solution Booklets



Smart Cities Guidance Package Summary



Smart Cities Guidance Package

This case book provides examples of inspiration from cities working with private and financial partners to deliver smart city solutions for the benefit of their local residents and the planet as a whole. Cases range from empowering private finance to deploy renewable energy systems ([Barcelona](#) ↗), over using public purchasing power to roll-out smart solutions ([Grabovo](#) ↗), to a case highlighting how constructive cooperation with a range of partners, and a sound use of data, can help deploy the local infrastructure needed to power the future ([Utrecht](#) ↗). Other cities can use these case studies to propel their own smart cities plans.

Additional case studies featuring cooperation with private partners, ensuring a financially sustainable roll-out of smart city solutions, can be shared via the Smart Cities Marketplace (info@smartcitiesmarketplace.eu ↗).

For support connecting with private finance to deploy smart city solutions, the Matchmaking of the Smart Cities Marketplace is available to serve those needs. For more information, visit the [Matchmaking website](#) ↗.

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