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# BEST PRACTICES AND LESSONS LEARNED FROM OUR LIGHTHOUSE CITIES

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## Intro

This set of best practices contains advice for making towns and cities more sustainable and integrated. It is based on the experience of three “Lighthouse” cities in different countries: Valladolid (Spain), Tepebaşı (Turkey), Nottingham (United Kingdom). Together they participated in the EU-funded project REMOURBAN to develop and test a new urban regeneration model.

Thanks to the implementation of the REMOURBAN Urban Regeneration Model, overall the project achieved more than 34% energy reduction and saved 50% CO2 emissions through low energy districts, smart mobility and ICT solutions.

In this guide you will find practical insights into key overlapping areas and solutions for sustainable urban regeneration – energy, mobility, ICT and non-technical – with best practice factsheets for each. These easy-to-use factsheets provide recommendations and assessments on the best practices developed during this major 5-year project. Each best practice has been rated for replicability potential, impact and success factors on a 4-point scale:

- ★☆☆☆☆ - very difficult to replicate;
- ★★☆☆☆ - replicable with some difficulties;
- ★★★★☆ - replicable;
- ★★★★★ - highly replicable.



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# 1. ENERGY PRACTICES





## Whole project approach: integrating energy actions



A renovation action should be understood as a whole and approached from an integrated perspective to maximize its potential.

### LESSON LEARNED

Often many different industrial partners are involved in district renovation such as engineering companies, and construction companies. They all provide different skills and take on different responsibilities within a project.

These skills and roles must be harnessed within a holistic approach. The com-

bined effects of the different measures should be anticipated from the outset, before design, in collaboration with other entities such as research organisations, universities, and government agencies. This will enable the project to reach its full potential in reducing energy consumption and CO<sub>2</sub> emissions.

### ADVICE

- You should adopt an integrated approach to the project, regarding the energy measures to be implemented.
- In the strategy/planning phase, first look at reducing the energy required for indoor comfort. Then make energy supply as efficient as possible while introducing renewable sources.
- Assess the impact of the measures combined. This is usually greater than the sum of the individual measures.

### CAUTION

- Interactions with non-desired measures may reduce energy performance. Such interactions should be studied and avoided.

### STAKEHOLDERS



Research organisations



Industrial players



SMEs

### REPLICABILITY



This best practice can be easily implemented if you have effective coordination of activities and partners.

## Collaborating with stakeholders early on in the renovation process



Collaborating with stakeholders early on in the renovation process helps the project achieve its results and targets.

### LESSON LEARNED

For a project to be successful, post-renovation targets for the district lifecycle need to be agreed by all stakeholders (citizens, building owners, facility managers, construction companies, etc.). Early stakeholder engagement should

therefore be promoted and the activities of interest to them should be identified and understood. In this respect, it is crucial to set out a strategy in the early stages of the project.

### ADVICE

- Start with the end in mind: set out the approach according to the targets expected to be achieved after the renovation, during the district lifecycle.
- Engage early on with the stakeholders involved in the different project phases: energy audit, design, implementation, operation and maintenance.
- Take time in the strategy phase, before the project starts, to set out how to collaborate. This will help in the design and implementation phases.
- Seek to understand the stakeholders' perspectives in order to agree on targets.

### CAUTION

- Where buildings are publicly owned, public procurement processes don't always identify all the stakeholders from the outset. In such cases, collaboration may lack to some extent.

### STAKEHOLDERS



Public institutions



Local authorities



Research organisations



Industrial players



SMEs



Investors



Citizens

### REPLICABILITY



The early integration of stakeholders could present difficulties in public procurement processes.

## Implementing renewable heating and cooling



Traditional heating and cooling equipment uses fossil fuels and is often individual for each dwelling. By replacing such equipment with integrated district

systems based on renewable energy, you can achieve major benefits for the environment while reducing people's fuel bills.

### LESSON LEARNED

Switching the FASA district's natural gas-fuelled heating system to biomass has significantly reduced dependence on fossil fuels: nowadays, natural gas is only used for back-up. When installing such a system, sound planning and coordination are needed in order to reduce inconvenience to the neighbours.

During the implementation phase, it was critical to safeguard power supply for the neighbours for both heating and DHW. In addition, the DH renovation works had to be coordinated with the building retrofitting to perform a comprehensive intervention in one go.

### ADVICE

- Be clear with the end-users about both the benefits and the costs of the action. This will encourage citizen acceptance and commitment towards the project.
- Combine this action with a retrofitting project for the buildings to optimise the energy performance of the district.

### STAKEHOLDERS



Local authorities



Industrial players



Citizens

### REPLICABILITY



Many types of renewable energy sources exist (biomass, solar thermal, photovoltaics, geothermal, etc.) but local factors will determine the best one to use. One of the advantages with renewable energy is the range of possibilities available to choose from.

In addition, possible financial incentives should be identified such as government grants or schemes (local, regional or national) for certain types of interventions. In the same way, specific regulations may mean avoiding a particular type of energy source.

## Building Envelope Retrofitting



Façade renovation included 15cm rock wool, adhesive mortar, steel dowel, surface plaster, glass-fibre mesh, and surface plaster for strengthen coating and improve overall quality. The rock wool outer coating enabled the de-

sired U-value to be achieved for the external wall: 0.2 W/m<sup>2</sup>K. Additional 20 cm glass wool insulation was applied to the existing insulation. All of the windows were replaced with lower U-value airtight windows.

### LESSON LEARNED

A comprehensive process should be set up to identify project-specific solutions taking into account local human, financial and material resources. Engaging an experienced contractor in the design stage is ideal although some procurement processes do not allow for this.

Each project phase should be thoroughly planned and including meas-

ures to: manage a project group, break silo-thinking, and address unexpected problems.

Upfront financial planning is necessary and competent contractors and workers should be engaged in order to avoid shoddy work.

It is important for projects and stakeholders to address policy and changes in the market.

### ADVICE

- Retrofitting the building envelope requires careful planning. Just as important is a thorough inspection of the existing structure in order to correct any current problem.
- When retrofitting the building envelope, make sure to consider: occupant's health, energy efficiency, resource efficiency, environmental responsibility and affordability.
- The building envelope may be poorly insulated, leaky or energy inefficient. Understanding the options available for upgrading the various components requires research or professional help.

### CAUTION

- Poorly detailed work can lead to moisture and mould problems.
- Improper practices can compromise the effectiveness of the work.
- You may be wasting money on retrofit work that will have little overall benefit.

### STAKEHOLDERS



Public institutions



Local authorities



Industrial players



SMEs



Investors



Citizens

### REPLICABILITY



The demo site is a good showcase for the city and awareness of the citizens has been increasing with dissemination activities. Moreover, retrofitting tends to improve the health of residents over time -especially that of people with chronic health problems, and vulnerable groups in general.



## Electric Distributed Generation

100 kW Building Integrated Photo-voltaic (BIPV) for rooftop and 50 kW PV on the car park canopy were introduced to generate electricity. At the demo site on-grid solar power panels were installed on 11 buildings out of 17 and car park canopy with a total of 150 kW AC (174,9 kWp DC) power. During the installation of the distributed generation system, 220 PV modules were used in the car park area and 440 PV modules

were used in the roofs of the blocks. In total 660 265 Wp power, Polycrystalline PV module and 8 inverters were used. Critical loads in the demo site are served via battery storage housed in the same building as the central heating plant. The storage system is important since the demo site had Alzheimer patients. Continuity of power is important and the battery has been used as backup during outages etc..

### LESSON LEARNED

Due to its geographic location, Turkey has a high solar energy potential. At the demo site, the French modules, which are a different innovative application from the other roof applications, were preferred because they ensure a structure integrated with roof tiles and waterproofing. This enabled us to reduce labour costs and maintain aesthetics.

As the demo site is under public ownership, the first and foremost lesson pertains to public procurement. One of the lessons learned during the project is that when the procurement system is not updated to take into account so-

cial and environmental benefits of bids, efforts for a low carbon city remain ineffective and inefficient. The quality of the materials and craftsmanship is quite important in terms of increasing the efficiency of the investment – more productive materials, less maintenance, etc. Other criteria should be taken into account during procurement. BIPV implementations for example require high quality architectural fittings. The Tepebaşı team has been lucky to have high quality work.

In Turkey, distributed generation remain difficult to implement due to long legislative processes and changes.

### ADVICE

- Ensure project design complies with regulations on power quality and grid connection.
- Factor in specific issues at the design stage while consulting with stakeholders and establish mitigating measures.
- Monitor new developments and standards.
- Consider Building Integrated Photo-voltaic as a new alternative to traditional systems.

### CAUTION

- As a façade element, BIPV must meet high architectural requirements and safety standards.

### STAKEHOLDERS



Public institutions



Local authorities



Research organisations



Industrial players



SMEs



Investors

### REPLICABILITY



The Turkish government now allows unlicensed PV projects with a capacity of up to 1 MW to be financed using foreign currency. Improving financing conditions and reducing red-tape has been recognised as necessary for the future.

## Lighting Optimisation

Existing lighting system consisted of compact fluorescent and incandescent light bulbs which were very inefficient compared to energy-efficient lighting systems such as LED. Interior and street lighting at the demo site were replaced with LED luminaires with the lowest energy consumption in today's energy markets. All lighting systems were replaced with LED bulbs. These last up to 10 times longer than compact fluorescents, and far longer than typical incandescent. With this intervention, electricity consumption decreased by 20.5 KWh/m<sup>2</sup>.year.

In addition, the 48 V 220 Ah battery group was integrated with the solar energy system for street lighting. In the event of a power outage, street lighting can thus continue for 3 hours.

190 MWh of energy will be saved per

year, avoiding 120 tons of CO<sub>2</sub> emissions per year with the LED conversion.

All lighting systems were replaced with LED. Besides the reduction of energy bills and CO<sub>2</sub>, the operation was easier since the life of LED appliances was much higher than conventional systems.

A small portion of the generated energy from the solar energy system was stored in the batteries for street lighting. Thanks to the integration of batteries and street lighting, when there is a power failure, the supply of the street lighting can be supplied from the stored energy in batteries for 3 hours.

Lighting is one of the major electricity consumption areas. According to simulations, the electricity consumption can decrease by 60% after existing lighting systems had been replaced with LED.



### LESSON LEARNED

There was a lack of communication with the Municipality and solution partner during procurement and the luminaires selected were not controllable remotely. The other challenge was to provide communication between the LED module and the node controlling the LED. The ones selected were not compatible. In the end another supplier was chosen who could support the existing communication requirements. After installing the nodes and sensors for the demo site and after the solution was

set up, some lamps were providing too little light. They were in general dimmer by around 20% and they didn't brighten when someone was outside. This was because the motion sensors could not detect the person in that area. The number of motion sensors had to be increased and their positioning adjusted in order to detect a much larger area so that when people are moving around they are not left in dark. Successful implementation requires good communication and planning.



### ADVICE

- When replacing fluorescent fixtures with LEDs, if the efficacy of the existing fixtures is unknown, then a wattage reduction of no more than 1/3 should be assumed.
- Lighting can affect people's health in buildings. Ensure that lighting and lighting controls meet standards. Remember that lighting can affect human health according to its spectral, optical and electrical characteristics.



### CAUTION

- LED lighting efficiency is advancing rapidly, which can be challenging when predicting energy savings and specifying upgrades.
- Without evidence of significant over-lighting, reductions in the light output should not be included as part of energy savings projections from LED retrofits.

### STAKEHOLDERS



Public institutions



Local authorities



Industrial players



SMEs



Investors



Citizens

### REPLICABILITY



By simply replacing incandescent and/or high-pressure sodium fixtures with LED lighting, you will obtain very fast payback. It appears to be a cost-effective conservation measure.

## Energy Procurement & Sub Contractors



Procuring & Sub Contracting partners for any project is an important process: thorough investigation into

the capabilities of partners, particularly SMEs, is very important to safeguard against future problems.

### LESSON LEARNED

Additional assessment, due diligence is required when subcontracting partners. Ensuring we have the balance between innovation and practical ability to implement builds at scale, to budget, on time.

Some SMEs are incredibly innovative and develop game-changing innovation. However, innovation and success-

fully completing large-scale building works are very different and require different skills sets.

On the whole, in Nottingham, our partners have been very competent. However, we have suffered delays due to SMEs lacking the experience or capacity required to carry out what they were contracted to do.

### ADVICE

- Ensure due diligence is carried out during the selection process for subcontractors.
- During procurement, possibly deploy a competition style process for triaging of possible subcontracting to ensure quality.

### CAUTION

- Caution must be taken when selecting SMEs based on the strength of their innovation/ideas.
- Due diligence must be carried out to ensure subcontractors have the infrastructure, business models and time to complete the project tasks.

### STAKEHOLDERS



Local authorities



SMEs

### REPLICABILITY



It is relatively easy to replicate as long as enough preparatory work is undertaken to assess suitability of subcontractors. However further work is needed with colleagues in procurement to ensure any competition aligns to procurement standards and procedures.

## Energy Monitoring & Control Systems



Monitoring of energy controls is critical. In Nottingham REMOURBAN sees monitoring equipment develop and deployed across a number of different interventions e.g. 2050 Homes, EV Car Share,

We Go Couriers etc. In doing this, a range of monitoring devices were used which provided, in some cases, some challenges which can offer learning for other cities.

### LESSON LEARNED

Great care needs to be taken in checking the suitability of monitoring devices, particularly in terms of functionality, fit with other innovation (energy genera-

tion storage, Low Temperature District Heating - LTDH), usability for residents and support for residents to adapt to the new technologies.

### ADVICE

- Due diligence and research should be carried out to assess suitability of homes/infrastructure and planned installation of devices.

### CAUTION

- Be sure to approach this collaboratively ahead of time with subcontractors.
- Ensure enough person months are allocated to this activity.

### STAKEHOLDERS



Local authorities



SMEs

### REPLICABILITY



It is relatively easy to replicate as long as enough preparatory work is undertaken to assess suitability of energy monitoring. It may just be a case of ensuring enough person months are allocated to this activity.



## Energy 2050 Homes & LTDH ‘Output Based Procurement’



As part of the REMOURBAN project, NCC have been able to pilot output based procurement on the 2050 Homes and the Low Temperature District Heating (LTDH). With output-based procurement, subcontractors are contractually required to ensure the homes provide agreed levels of energy efficiencies, which equate to financial sums. They are not being con-

tracted to build energy efficient homes with future energy efficiencies “expected” to be achieved as in other types of procurement.

For homes that fail to meet agreed energy savings, the subcontractor is contractually obliged to pay back those missed savings to the local authority that then passes on the cost savings to the Tennent.

### LESSON LEARNED

Although output-based procurement models in theory provide excellent results, in practice challenges can occur. For the LTDH, 2050 Homes and Energiesprong technology is still in its infancy. In hindsight, it might have been better to avoid

output-based procurement until the technology was fully developed. Because technology is relatively young, it is difficult to enforce output-based procurement as some delays/problems can occur, through no fault of the subcontractor.

### ADVICE

- Ensure technology underpinning the output-based procurement is fully tested and functional.

### STAKEHOLDERS



Local authorities



Research organisations



SMEs

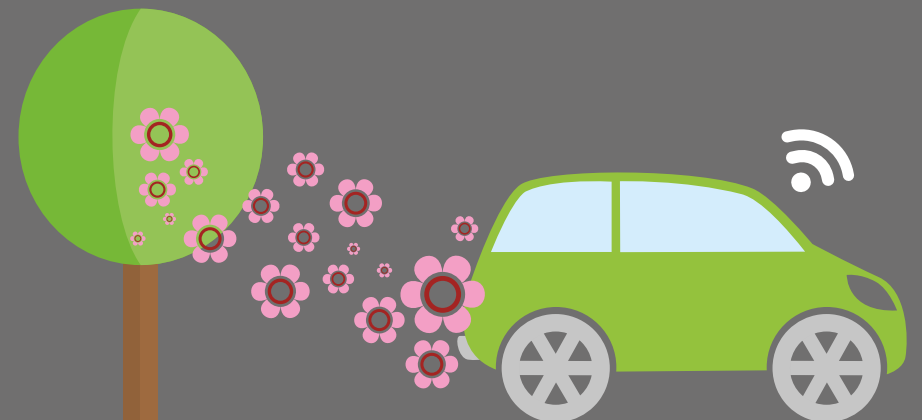
### REPLICABILITY



Output based procurement linked to highly innovative technology is difficult to successfully enforce due to the number of variables present relating to risk.



## 2. MOBILITY PRACTICES



## Data transfer framework agreement: users of electric vehicles



The goal of the data transfer framework agreement is to enable monitoring of electric vehicle use and user experience. It has two strands:

- Continuous monitoring of electric vehicles and recharging facilities followed by data analysis.
- Improvement of user experience along with promotion and commu-

nication. Business models and sustainable practices for the city can then be generated.

Under this framework, e-vehicle and recharging point data is remunerated along with other information provided: proposals for improving mobility. Participation in dissemination and communication activities is also remunerated.

### LESSON LEARNED

To avoid misunderstandings, people should be fully and clearly informed about mobility technologies.

More needs to be done to ensure a better understanding of these tech-

nologies, particularly in the taxi sector where success has been limited despite the incentives available.

Institutional support is also vital, both financial and regulatory.

### ADVICE

- Despite being long, this type of procurement is welcomed by institutions promoting electric mobility. The innovative proposals involve partners much more in the city model than direct subsidies do.
- Try to keep paperwork to a minimum.

### CAUTION

- You should educate the target groups in order to identify their needs and expectations with regard to regulations and city policy etc.

### STAKEHOLDERS



Public institutions



Local authorities



Industrial players



SMEs



Citizens

### REPLICABILITY



This kind of tendering process is 100% replicable in other cities as long as stakeholders and citizens are involved in the process.

## Electric vehicle car-sharing system

Vehicles are parked typically for around 95% of the time. By deploying a telematic control system, vehicle use can be greatly optimised and pollution and cost can be reduced.

With such a system, an equivalent service can be provided using fewer

vehicles. Older vehicles can also be replaced with more efficient and cleaner ones (preferably electric) for a lower overall budget.

Telematics also favours additional services for a more rational use of these vehicles.

### LESSON LEARNED

The introduction of such a system requires a major culture shift as some users perceive it as a loss of a privilege (giving up their own vehicle).

For professional/municipal fleets, the same service can be covered with fewer vehicles, meaning lower costs, less maintenance, less noise and pollutant emissions, and more efficient vehicle types. The system can use many types of vehicle to cater for diverse transport needs (for people or goods etc.).

As the system can provide data on vehicle use and distribution, an optimal fleet size can be more easily calculated. This

is particularly useful for replication in other areas.

Some locations such as underground car parks may lack mobile coverage and thus require a solution. A vehicle that is unavailable due to a communications black spot would create a negative image.

Users of the system should be trained in its use.

A customer support call-centre is necessary with an operation time matching the vehicle usage schedule.

Organizational support is also vital, both financial and regulatory.

### ADVICE

- Provide manuals and training for users in order to avoid many problems upfront.
- Emphasize the need for a call-centre 24/7 or at least matching the usage times of the vehicles. Measures should be in place to help users in the event of communications failures or power outages.
- Show users how the new system is fairer and improves service (more vehicles available at a given moment, improved organization of work).

### CAUTION

- Don't take communications availability for granted. There are a surprising number of places without mobile communications, beginning with parking lots.
- Don't impose operational constraints likely to leave users stranded (e.g. vehicles can only be booked at bases).

### STAKEHOLDERS

-  Public institutions
-  Industrial players
-  SMEs
-  Citizens

### REPLICABILITY



It is possible to deploy a telematics system to implement a car-sharing system and optimize the use of the vehicles.

Car-sharing can be implemented in existing fleets although it is slightly more complicated.



## Co-designing charging infrastructure with many stakeholders



Charging infrastructure needs to be designed and promoted with stakeholder involvement. It should cover the charging needs in both private and public fleets.

### LESSON LEARNED

It is important to collaborate with stakeholders in order to fulfil the following: implementation of different types of charging stations according to diverse needs, EV user training and awareness, distribution of funding by

finding new ways of collaboration with partners, creation of public-private partnerships, consultation with electric distributors and gathering driver and owner feedback on charging infrastructure use.

### ADVICE

- Study technical and economic feasibility and the possible business models. Find partnerships.
- Establish solid communication and training actions to explain how the charging services work.

### CAUTION

- Alternative locations should be available if you encounter deployment issues.

### STAKEHOLDERS



Public institutions



Local authorities



Industrial players



SMEs

### REPLICABILITY



Generally, this is a replicable practice. However, stakeholder relationships can become complex.

## Clean Public Transportation



E-buses provide clean, quiet transport and are therefore perfectly suited for busy city traffic.

As part of REMOURBAN, Tepebaşı Municipality decided to buy 4 electric buses and electric bikes for the use of citizens and 22 hybrid vehicles for the Municipality.

Two portable charging devices were purchased in conjunction with e-bus procurement to charge the batteries of e-buses.

Tepebaşı Municipality is the first town to be awarded a Conformity Certificate from the Turkish Standards Institution for e-buses in the country.

### LESSON LEARNED

For hybrid vehicles, you can choose between a standard hybrid and a plug-in hybrid. Standard ones may be easier to manage as they don't need to be plugged in at all. Public procurement practices need to be improved in many

ways. This will only be achieved if there is strong political commitment at a high level. The planning stage needs to address wide-ranging aspects (technical, financial, human resources, engagement with stakeholders, etc.).

### ADVICE

- Safety and security are important. Local measures require coordination among authorities and operators.
- You should use an integrated approach to mobility planning, with emphasis on partnerships and stakeholder involvement.
- Video systems for safety and security are quite transferable. However, you should ensure compliance with local and national legislation on privacy and data use.

### CAUTION

- Lack of technology know-how for fleet management may cause problems.
- Insufficient co-financing can hamper plans before they are even implemented.

### STAKEHOLDERS



Public institutions



Local authorities



Research organisations



Industrial players



SMEs



Investors



Citizens

### REPLICABILITY



The use of new technologies for clean transport has contributed in recent years not only to improving access to public transport but also to making fleet management more efficient.

## Smart E-bike Sharing System

The electric bicycle system consists of 30 e-bikes, 3 e-bike pay stations (Demo Site, Anadolu University and Sports Complex), and 45 e-bike charging stations.

The e-bikes have devices to track position, speed and dynamo-charging information. Zone limitations can be set by GPS.

The docking-charging stations recognise each bike, manage locking and unlocking for the right user and they communicate with the central computer system, updating data from each bike trip.

Route reports and inter-station reports on the e-bikes and density reports on the stations and system logs were monitored. Location information from e-bikes

was taken every 5 seconds.

With the e-bike system Mobile App you can reach the information as follows:

- List of e-bike stations closest to your location on the map,
- Number of e-bikes available on the map,
- Number of empty charging stations on the map,
- Get directions to your chosen e-bike station,
- Review your bike use history,
- See instructions for using the e-bike,
- Ask questions or make suggestions via a contact form,
- Manage your membership.

### LESSON LEARNED

It takes time to draw up sound technical specifications. The measures carried out under REMOURBAN have triggered public awareness initiatives about electric bikes.

You should involve both external and internal stakeholders as early as possible in order to avoid barriers at later stages. One such barrier was a lacking of funding to complete the procurement process where various departments were involved.

The role of public-private partnerships can be important in any public mobility service, especially for bike sharing. City administrators and private entities must work together to develop appropriate legislation, provide adequate infrastructure, and manage the operation and maintenance of the service.

The project may help inform policies in other place in the country.

A wide range of communication activities are key to expanding the market.







### ADVICE

- Communicate abundantly about successes and ensure the rental system is sound.
- Seek government support for low carbon environmental protection and intelligent transportation.
- Local authorities and bike-sharing operators need to work together.

### CAUTION

- You should fully grasp the growth rate of e-bikes to manage it properly. The system can quickly become overwhelmed.

### STAKEHOLDERS

-  Public institutions
-  Local authorities
-  Industrial players
-  SMEs
-  Investors
-  Citizens

### REPLICABILITY



Key factors include scale of and access to the bike-sharing system according to the size and layout of the city.

## Mobility Commissioned Services

Each municipality has a series of existing commissioned services with external suppliers (road maintenance, lighting etc.). Projects like REMOURBAN

that carry out physical regeneration have to integrate within the broader landscape of existing commissioned services.

### LESSON LEARNED

WEGO Couriers have a number of contracts with businesses across the City for which they provide a carbon neutral delivery service.

Nottingham City Council also has a delivery contract with WEGO for the transportation of library books and goods around the city.

For the purposes of REMOURBAN, WEGO identified a number of delivery routes that would be monitored for the project monitoring purposes.

To save costs, Nottingham City Council ended the library delivery service with WEGO and brought this function in house, which meant we were at risk of skewing the monitoring by reducing the number of comparable routes monitored. Nottingham City Council resolved this

by implementing a new in-house monitoring service so that the data was consistent. However, this wasn't foreseen and could have been better managed if the broader Council Heads of Service had known about REMOURBAN. Maybe the decision to bring that part of the Council's library delivery service could have remained with WEGO.

Key lessons are:

- Ensure all council departments are aware of the objectives of new projects e.g. REMOURBAN;
- Identify early on if there is proactive action that can be taken early on to avoid any problems that may arise e.g. cessation of Nottingham City Council Commissioned Service, which was the case in REMOURBAN.

### ADVICE

- Ensure all council heads of service are fully aware of the project and the reliance on multiple interconnected partnerships.

### CAUTION

- Avoid delivering the project in municipal isolation.
- Ensure all partners are briefed.

### STAKEHOLDERS



Local authorities



SMEs

### REPLICABILITY



Sharing knowledge is relatively easy and cost effective to do and thus very replicable.



## Mobility Subcontracting



Municipalities contract with a number of external contractors to deliver services. Broadly, new projects that are commis-

sioned blend well; however, difficulties may arise and it's important that cities are alive to these risks.

### LESSON LEARNED

Nottingham City Council has a number of existing contracts with Western Power and Charge Master. These contracts relate to our long-standing network of EV vehicles and charging infrastructure, which Western Power and Charge Master manage respectively.

In these cases, contracts and programmes of works are agreed, in some instances, years before projects like REMOURBAN are commissioned.

The challenge here is that the requirements of “new” projects can sometimes expand beyond the original contractual agreement, which means amending the existing contract. E.g. new locations, different infrastructure and monitoring technologies.

Although, broadly, Western Power and Charge Master have been flexible in accommodating the needs of REMOURBAN, the recommendation to other cities is be proactive.

### ADVICE

- Try to build as much flexibility into municipal and private sector contracts as possible.
- If this is not possible, be proactive in identifying any change as soon as is possible.

### STAKEHOLDERS



Local authorities



SMEs

### REPLICABILITY



Procurement regulation differs in every city and although we have reached a solution in Nottingham, it might be more difficult for other municipalities to address.

## Mobility E-Buses & Passenger Behaviour



Nottingham City Council has deployed 13 E-buses across the wider city with charging infrastructure points located

at key strategic points. The best practice discussed in this section relates to user behaviour.

### LESSON LEARNED

Feedback from citizens confirmed using EU funds to deploy electric buses was the right decision to take. So far, we have had over 88,000 passenger journeys and 500 residents have attended promotional events in the city. Nottingham also submitted our Clean Air Plan to government, which was ac-

cepted and passed into legislation. Nottingham's electric bus network played a crucial part in detailing, as a city, how we will achieve our clean air targets. Based on this positive outcome, Nottingham will continue to invest in electric buses to expand the fleet.



### ADVICE

- Nottingham would recommend other cities investing in electric bus fleets as a way to reduce emissions, raise engagement with the public and promote the Municipality green agenda.

### CAUTION

- Ensure any investment is coordinated with broader clean air plans to maximise strategic impact of deployment.

### STAKEHOLDERS

-  Local authorities
-  Citizens

### REPLICABILITY



Although deploying electric buses is relatively easy, securing the necessary funding can be challenging.



# 3. ICT PRACTICES



## Early design of the city platform



This best practice concerns a city platform for gathering datasets relating to different intervention areas (energy, urban mobility, ICT and non-technical actions).

### LESSON LEARNED

A major challenge with the platform was to manage and interpret the data from all the devices. There were many variables to monitor, and the data retrieved came in different protocols and forms. It is therefore crucial to ensure sound technical and functional design from the outset.

### ADVICE

- Your platform needs to be able to cater for all the variables monitored and to manage various communication protocols.
- Draw up a realistic and feasible project plan based on detailed technical design for the necessary technology integration.
- Think interoperability, open data and open technologies.

### CAUTION

- It is better to avoid proprietary technologies when developing a smart city platform.

### STAKEHOLDERS



Public institutions



Local authorities



Investors

### REPLICABILITY



In REMOURBAN, each city developed its own platform but they all covered the same needs. Replication is therefore possible. The main challenges are technical complexity and the investment.

## Global ICT Platform



This best practice concerns the overall REMOURBAN ICT platform for gathering datasets relating to different inter-

vention areas (energy, urban mobility, ICT and non-technical actions) in the three Lighthouse cities.

### LESSON LEARNED

A major challenge with the platform itself was to manage and interpret the data from all the city platforms. An effective

solution is to develop a standard communications API (Application Programming Interface).



### ADVICE

- The platform should be designed to handle all the incoming variables monitored.
- Develop an open API to communicate with other platforms and diverse systems.
- Think interoperability, open data and open technologies.

### CAUTION

- It is better to avoid proprietary technologies when developing a smart city platform.

### STAKEHOLDERS

-  Public institutions
-  Local authorities
-  Investors

### REPLICABILITY



The solution is replicable. The main challenges are technical complexity and the investment.



## STILE (Smartness and Sustainability Evaluation Tool)



The STILE tool developed in REMOURBAN helps you assess and analyse the variables monitored at city level in en-

ergy, mobility, ICT and non-technical actions. Its core service can be considered a best practice for replication.

### LESSON LEARNED

STILE is highly useful for automating assessment of intervention effectiveness and for qualifying results. As such, it can form the basis of decision-making processes.

Quality control should be performed in

the cities to ensure reliability of the results obtained via STILE.

Data relating to the monitored variables should be fed into the main platform early on so that results via STILE can be evaluated as soon as possible.

### ADVICE

- Develop a tool in every smart city project to assess and quantify the effectiveness of the interventions.
- Implement a flexible front-end tool to be able to manage changes in formulas and calculations.
- Use open technologies. You will thus be able to share results and feed them into other systems for better decision making.

### STAKEHOLDERS



Public institutions



Research organisations



Industrial players

### REPLICABILITY



The tool is replicable and can be adapted for each city to the specific measures and algorithms in order to evaluate their effectiveness indexes. The main challenge is to find the right technical skills to develop this kind of tool as it is complex.

## City information platform, Smart City Monitoring Portal

Tepebaşı Municipality set up a “City-on-Cloud” (CoC) solution by Olcsan as its local ICT platform to monitor and record the data for observation and analysis in all stages and is connected to the Building Management System (BMS). Through BMS, energy monitoring, thermal comfort and HVAC (Heating, Ventilation and Air Conditioning) controls, data is measured by sensors and sent to the server at the demo-site.

Local ICT platform CoC collects the raw data from the Building Management System (BMS) - Energy Monitoring, Thermal Comfort, HVAC Controls - via Modbus and for monitoring program makes necessary conversion before sending to

global ICT. CoC is also connected to a variety of platforms, such as Solar Panel System, Fleet Management System, E-bike system and Lighting System to collect all other necessary data for monitoring as well as populate the indicators. Integration with the Global ICT platform is done via the Rest API interface of the Smarkia solution by Xeridia. Via this interface, the data collected for a list of indicators are sent to the Global ICT Platform. In the Global ICT platform, all the indicators and time series are defined based on the graphical tree of entities. Same data structures and time series are also defined within the local ICT platform.

### LESSON LEARNED

Local ICT platform CoC collects data from other platforms. In some instances the other platforms might have an issue and stop sending data, stop collecting data or even stop functioning altogether. In that case there is a need to be alert the operator so that he/she can check what the problem is and can take an action to correct the problem. But alarms could not be sufficient either. Therefore daily status emails have started to be sent daily, where we only give a summary of the problematic buildings.

In the case of a data loss due to an interruption with some systems there is the ability to recover data in case the other system keeping the data and still collect the historical data. But some systems do not have historical data, or don't provide a mechanism to collect the historical data. The need to have an alternative mechanism arose. In most cases the operator needs to obtain the historical data from the other system/platform and then upload to the local ICT platform manually.

### ADVICE

- Cities should select systems and platforms with simple and standard interfaces to provide data. The data should be stored securely.
- The operator should have multiple ways of viewing the data, e.g. graphs, charts and lists and if needed export data in multiple formats (e.g. Excel, CSV, etc.).

### CAUTION

- An integrated and collaborative platform needs to communicate and manage cities in their multiple dynamics and perspectives.

### STAKEHOLDERS

-  Public institutions
-  Local authorities
-  Research organisations
-  Industrial players
-  SMEs
-  Investors
-  Citizens

### REPLICABILITY



## Smart Lighting System



An intelligent lighting system using dimmable LEDs was introduced in four streets. The system uses 25 W LED bulbs operating at 700 Lumens, more reliable and more energy efficient than convention-

al high-pressure sodium bulbs. Light is regulated in accordance with people's presence in the street. Pedestrian crossings are always lit up while other places can be dimmed when nobody is around.

### LESSON LEARNED

Smart lighting by Olcsan perfectly balances the citizens' need for safety by ensuring well-lit public spaces, while cutting back on the district's overall energy costs as the amount of light used constantly adapts to the real-time situation. These systems ultimately pay for themselves thanks to reduced energy bills and maintenance. The lampposts and the apps housed within them can be used for air quality and traffic sensors. Smart street lighting also offers better

quality and control, which can be used in a smart city platform to deal with issues such as pedestrian and driver safety, or regeneration projects.

Any city looking to deploy a street lighting network should have an outline plan for how it will engage with the growing use of digital and IoT technologies. The challenge for municipalities is to balance short-, medium- and long-term requirements against the costs and benefits of different network options.

### ADVICE

- Street lighting choices will depend on your specific needs. You should assess connectivity solutions against needs.
- If you don't yet have plans for advanced street lighting in the near future, make sure technology choices for other city issues fit with possible future plans for lighting.
- Obtain best value for money by providing the potential to add future services to the same network.

### CAUTION

- You need to consider factors other than technical comparisons when developing street lighting.
- While you should establish long-term goals, you should view these as aspirations rather than fixed requirements.

### STAKEHOLDERS

-  Public institutions
-  Local authorities
-  Research organisations
-  Industrial players
-  SMEs
-  Investors
-  Citizens

### REPLICABILITY



This smart lighting system is a good example of how street lighting networks can be extended to support other innovative urban applications.

## ICT Early Identification of Monitoring Parameters

This best practice relates to early identification of monitoring parameters.

### LESSON LEARNED

Although the Nottingham Partnership had a broad idea of what parameters would be monitored, it was relatively late in the project when monitoring of these parameters were 100 per cent facilitated, especially for the Low Temperature District Heating Courts and 2050 houses. It would have been helpful to undertake certain exercises at the beginning of the project with SMEs that would undertake monitoring in these two archetypes. The monitoring in Solid Wall Installed archetypes that was implemented by Nottingham Trent University (NTU) has been in general successful to keeping the ongoing project on track. However, NTU has encountered difficulties to secure sufficient numbers of

homes to be monitored due to the lack of understanding of the monitoring parameters and feasibilities by Nottingham City Homes (NCH), for example suitable gas meter types.

It was taken for granted that some partners knew 90 per cent about the parameters and feasibilities; but actually, further work was needed to ensure 100 per cent confirmation regarding what parameters we could monitor.

This was not a huge problem but it is something that should have been discussed and resolved early on for the benefit of all. This also closely related to the best practice 1 in non-technical actions of Nottingham: Energy Resident Engagement.

### ADVICE

- Ensure this activity is carried out as early as possible.

### CAUTION

- Partners and staff members should exchange opinions to mitigate against miss-information.
- You should not rely on what you “think” partners know. Make sure you know what they know.

### STAKEHOLDERS



Local authorities

### REPLICABILITY



This is highly replicable as it relies only on the timely sharing of information.

## City Information Platform



This best practice concerns a city platform for gathering datasets relating to different intervention areas (energy, urban mobility, ICT and non-technical actions).

### LESSON LEARNED

A major challenge with the platform was to manage and interpret the data from all the devices. There were many variables to monitor and the data retrieved came in different protocols and forms. It is therefore crucial to ensure sound technical and functional design from the outset.

### ADVICE

- Your platform needs to be able to cater for all the variables monitored and to manage various communication protocols. Draw up a realistic and feasible project plan based on detailed technical design for the necessary technology integration.
- Think interoperability, open data and open technologies.

### CAUTION

- It is better to avoid proprietary technologies when developing a smart city platform.

### STAKEHOLDERS



Public institutions



Local authorities



Investors

### REPLICABILITY



In REMOURBAN, each city developed its own platform but they all covered the same needs. Replication is therefore possible. The main challenges are technical complexity and the investment.



## Global ICT Platform



This best practice concerns the main REMOURBAN ICT platform for gathering datasets relating to different intervention areas (energy, urban mobility, ICT and non-technical actions) in the three Lighthouse cities.

### LESSON LEARNED

A major challenge with the platform itself was to manage and interpret the data from all the city platforms. An effective solution is to develop a standard communications API (Application Programming Interface).


### ADVICE

- The platform should be designed to handle all the incoming variables monitored.
- Develop an open API to communicate with other platforms and diverse systems.
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### CAUTION

- It is better to avoid proprietary technologies when developing a smart city platform.

### STAKEHOLDERS

-  Public institutions
-  Local authorities
-  Investors

### REPLICABILITY



The solution is replicable. The main challenges are technical complexity and the investment.



# 4. NON-TECHNICAL PRACTICES



## Photo and video competition on social media



In Valladolid, a competition on social media was organised as a way to promote and to view the “smart city” works implemented. The idea was to create a visual profile for

urban regeneration initiatives funded by the EU and which portray Valladolid as a city whose solutions can be replicated elsewhere.

### LESSON LEARNED

Citizens are good at relaying information. On social media, people can vote on issues (likes, comments, shares on Facebook and Instagram, retweets, favourites, answers

on Twitter,...). With the competition, organisers learned to detect how people feel about the initiative and to better spread the “smart city” values and projects.

### ADVICE

- The competition should show scenes of the urban innovation “in a smart city context.”
- The award should go to the most creative entry which best combines components of innovation and urban regeneration in a recognisable scenario of the city.

### CAUTION

- Be sure to comply with legislation when organising the competition.

### STAKEHOLDERS



Public institutions



Local authorities



Citizens

### REPLICABILITY



This best practice is highly replicable. (<http://www.valladolidadelante.es/node/12996>).

## Raising awareness in schools



This best practice is about raising children's awareness about smart cities. It requires coordination by a professional experienced in working with children. Three types of activity were involved in Valladolid:

- Firstly, children were given a presentation of a smart city and of the interventions taking place in Valladolid.

- Secondly, they played a game (escape room) designed to help them better understand smart city solutions and to test their knowledge.

Thirdly, the children were encouraged to think about different innovative ideas for a smart city (energy efficiency at home, sustainable mobility, apps to manage actions, etc.).

### LESSON LEARNED

A proactive procedure should be encouraged with a question-answer model in order to gauge pupils' knowledge. Children

are good at relaying information to their parents, friends, and relatives. They are objective and do not hold perceived ideas.

### ADVICE

- You should use teaching material such as a video. It could be used to bring a smart city alive in the children's minds.

### CAUTION

- Such an initiative requires working with teachers, parents and other people to make it truly educational.

### STAKEHOLDERS



Public institutions



Local authorities



Citizens

### REPLICABILITY



This solution comes highly recommended as it addresses future smart city enablers and is easy to replicate.

## The ESCO Business model



For the set of interventions in Valladolid's Fasa district, a business model known as ESCO was used to secure the necessary financing through the savings achieved. After the works, energy efficiency has improved substantially.

Part of the energy savings is used to pay for the interventions and the remainder can be used to reduce bills. Once the interventions have been paid for, energy bills will be even lower for the community.

### LESSON LEARNED

It is important to include a robust communication strategy. This should provide guidance on tax and savings, information about the improvement to

the living environment, and a contact point for residents. Financial support would encourage social acceptance of the works.

### ADVICE

- Extra funding and human resources are recommended.

### CAUTION

- You must be prepared to deal with residents who are opposed to the works.

### STAKEHOLDERS



Public institutions



Local authorities



Citizens

### REPLICABILITY



This best practice is replicable but it takes much effort, especially in designing a clear, balanced and inclusive communication and engagement strategy.





### Bikes beat traffic



Tepebaşı has defined different strategies and tools for citizen engagement. A good public communication strategy is the baseline for citizens' engagement and acceptance of innovation and new smart city solutions. As an example, on June 3, the UN celebrates World Bicycle Day to promote sustainable transportation and road safety.

Tepebaşı, a district of Eskişehir, aims to revive a once very vibrant biking culture which was largely replaced by motorised transportation. On this occasion, the city decided to promote the smart e-bike sharing system via a dedicated video, distributed to TV stations, and through other mass media and social media channels.

### LESSON LEARNED

Tepebaşı is part of a metropolitan area and there is a high need for the citizens to reach other parts of the city. Since the introduction of the system, the usage has been limited considering there are only three stations. With the expansion of the system and the smart card system of the city the system will have

more users. Tepebaşı has been preparing plans to expand and cooperate with Metropolitan Municipality.

Another important criterion is the safety of the bike lanes. Although Tepebaşı has safe lanes connecting the bike stations, now there is clearly a need to provide safe connectivity to other parts of the city.

### ADVICE

Work on easy to understand and balanced messages for all to be understood:

- More and more EU cities are tackling the problem of air quality by investing in their biking infrastructure.
- Riding a bike helps beat air pollution and is a great way to get some exercise.

### CAUTION

Negative messages must also be taken into account:

- Cycling in busy cities can be very dangerous. According to the World Health Organization 54% of traffic-related death are among pedestrians, motorcyclists and cyclists.

### STAKEHOLDERS



Public institutions



Local authorities



Investors



Citizens

### REPLICABILITY



The smart e-bike system solution is highly replicable. However, people know that only a few cities have managed to establish an adequate cycling infrastructure. Therefore, the lack of infrastructure discourages people from using their bicycles.



## Stakeholder engagement via webinars

Tepebaşı has defined different strategies and tools for stakeholder engagement. On such tool was a webinar, held as part of REMOURBAN, on the smart applications implemented in the Lighthouse city of Tepebaşı, Turkey entitled “Smart applications for smarter cities: How the ICT platform “City on Cloud” is making the Turkish city of Tepebaşı greener?”

It allowed attendees to remotely explore the various smart applications implemented at the REMOURBAN demonstration site – a care home for the elderly called Life Village. Applications included a building management system, smart street lighting, solar panels and smart mobility solutions. The “City on Cloud” platform was already presented.

### LESSON LEARNED

Through the interactive question and answer segment, this webinar allowed us to get to know our target audience, their comments and their greatest challenges. In doing so, it was possible to develop a real understanding of our audience's needs, allowing us to tailor our services and advice.

In this webinar, we had the time to al-

low our attendees to get to know us as people and trust us from the insights. Thankfully, our webinar benefited from the low-costs associated with internet broadcast, requiring little more than a broadband connection, microphone and webcam to get started. The audiences could chat, share their opinions, ask questions, answer questions, and more.

### ADVICE

- Internet speed must be adequate to allow participants to view the presentation without distortion or lag time.
- The webinar can be recorded so that other people can view in if they can't attend the webinar.
- The average length of the webinar should be between 45 and 60 minutes.
- Mobile devices are also making it easier to attend Webinars. Being able to listen and/or view a session from your tablet or smartphone gives you the option to view them at any time, in any place.

### CAUTION

- Unexpected technical or connection problems with running or viewing a webinar may occur.
- Audience environment may be subject to interruptions or disruptions such as side conversations.
- Other types of technical problems could also occur.

### STAKEHOLDERS



Public institutions



Local authorities



Research organisations



Industrial players



SMEs



Investors



Citizens

### REPLICABILITY



The webinar is a powerful communication and dissemination tool to support the smart city development strategy. Unlike traditional conferences, it is extremely easy and cost-effective.

## Energy Resident Engagement



Resident engagement is important to facilitate a number of functions e.g. monitoring, surveys, case studies. Over the four years of implementing

REMOURBAN solutions, we have encountered challenges as a result of under-resourcing this citizen engagement activity.

### LESSON LEARNED

Further resources should be allocated to ongoing resident engagement. Failure to do this limits our ability to have

access to properties for fixes/changes, gain monitoring data, and develop cases studies.

### ADVICE

- Ensure Cities have sustainable citizen/resident engagement resource in place for duration of project.

### CAUTION

- Do not underestimate the amount of time required to develop and sustain “good” resident engagement. This makes a significant difference when it comes to managing/mitigating periods of disruption.
- Monitoring for the final reporting period requires good resident engagement beforehand.

### STAKEHOLDERS

-  Public institutions
-  Local authorities
-  Citizens

### REPLICABILITY



Managing or replicating citizen engagement methods is challenging both in terms of how much resource/person months it consumes and different personalities of the residents, of which all needs to be managed. Again, more person month allocation to this activity would be helpful.

## Engagement with schools



Nottingham undertook a series of engagement activities with schools to raise awareness of REMOURBAN

and provide opportunities for young people to inform future REMOURBAN activity.

### LESSON LEARNED

This was a very positive experience for a number of reasons. First, engaging with schools to promote REMOURBAN and sustainability helped young pupils, teachers and parents “buy into” the green agenda.

It increased understanding of the importance of moving towards Net Zero

Homes, smart net controllers to efficiently manage energy consumption and it provided a useful test bed for REMOURBAN to gauge whether the project was making a difference in people’s hearts and minds.

Would highly recommend this as a priority citizen engagement strategy.

### ADVICE

- Explore opportunities as early as possible to establish a schedule of schools engagement to run throughout the duration of the project.

### CAUTION

- Only select a small group of schools e.g. two or three, as managing these relationships and planning activity is time consuming.

### STAKEHOLDERS



Public institutions



Local authorities



Citizens

### REPLICABILITY



As long as this activity is resourced sufficiently, schools, young people and parents are relatively easy to engage with.

## Integrated Urban Plan Webinars and Workshops



Nottingham Partners have led and taken part in a number of Webinars and Workshops promoting the Inte-

grated Urban Plan which have provided a number benefits for Nottingham as a city.

### LESSON LEARNED

These Webinars and Workshops have been helpful from a Lighthouse City perspective in a number of ways. REMOURBAN cities often presents suggestions that can enhance the development of IUPs. For example, it could relate to how cities have developed Sustainability Leadership Councils, or how they have approached stakeholder engagement.

Sharing Lighthouse City lessons with non-technical REMOURBAN partners has also helped cities avoid some of the pitfalls Nottingham, Valladolid or Tepebasi have encountered e.g. under-resourcing citizen engagement. We would fully recommend regular webinars and workshops to maintain collaboration and sharing of knowledge and ideas.

### ADVICE

- Establish a schedule of webinars/workshops.

### CAUTION

- Try not to limit the audience to Smart City related partners. Cities that are undertaking major infrastructure projects like rebuilding shopping centres, cinemas may also have useful information to share and likewise, could provide useful feedback on approaches.

### STAKEHOLDERS



Public institutions



Local authorities



SMEs



Citizens

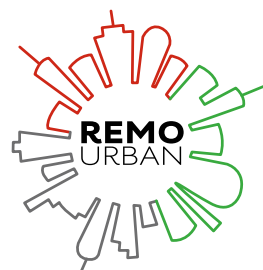
### REPLICABILITY



Establishing these forums is very simple to do.







All the public resources of the REMOURBAN project, including the Urban Regeneration Model, are available on **[WWW.REMOURBAN.EU](http://WWW.REMOURBAN.EU)**.

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