City-zen: New Urban Energy

Preston 'City-zen Roadshow' REPORT

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NEW URBAN ENERGY

Preston Roadshow REPORT

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3	Universiteit van Amsterdam	UVA	NL
4	Westpoort Warmte B.V.	WPW	NL
5	Alliander	LIAN	NL
6	HESPUL Association	HESP	FR
7	The Queens University of Belfast	QUB	UK
8	Th!nk E	THNK	BE
9	KEMA Nederland BV	KEMA	NL
10	Technische Universiteit Delft	TUD	NL
11	Stichting Waternet	WAT	NL
12	Greenspread Projects BV (subject to reservation, provided acceptance by EU)	GREE	NL
13	Sanquin (subject to reservation, provided acceptance by EU)	SANQ	NL
14	AEB Exploitatie BV	AEBE	NL
15	Daikin Airconditioning Netherlands B.V.	DAIK	NL
16	Siemens Nederland NV	SIEM	NL
17	Universita'degli Studi di Siena	UNIS	IT
18	Ville de Grenoble	MUNG	FR
19	Commissariat a l'Energie Atomique et aux Energies Alternatives	CEA	FR
20	Compagnie de Chauffage Intercommunale de l' Agglomeration Grenobloise	CCIA	FR
21	Gaz Electricite de Grenoble	GEG	FR
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ABSTRACT

The City-zen Roadshow travels with a team of internationally recognized experts, in the field of energy planning and design to help develop a sustainable agenda for cities and their neighbourhoods. It will visit 10 cities in total over a 4-year period who are seeking expert guidance on how to become more sustainable and wish to move towards energy neutrality. The overall aim of the Roadshow team is to work closely with people from the hosting city, whether they be city leaders, energy planners, local architects, professionals, academics, students and citizens. The Roadshow spends 5 days in each hosting city to deliver energy and urban design fun-shops in which all local stakeholders are welcome and encouraged to join and to take ownership of the final outcomes, outcomes that will allow the cities recourses, both people and energy, to be directed effectively, by highlighting the energy challenges and potentials to be found in their neighbourhoods, and to finally present a sustainable 'City Vision'.

The following report will describe the activities and outcomes of the City-zen Preston Roadshow that took place in Lancashire (United Kingdom) between the 12th & 16th of November 2018.

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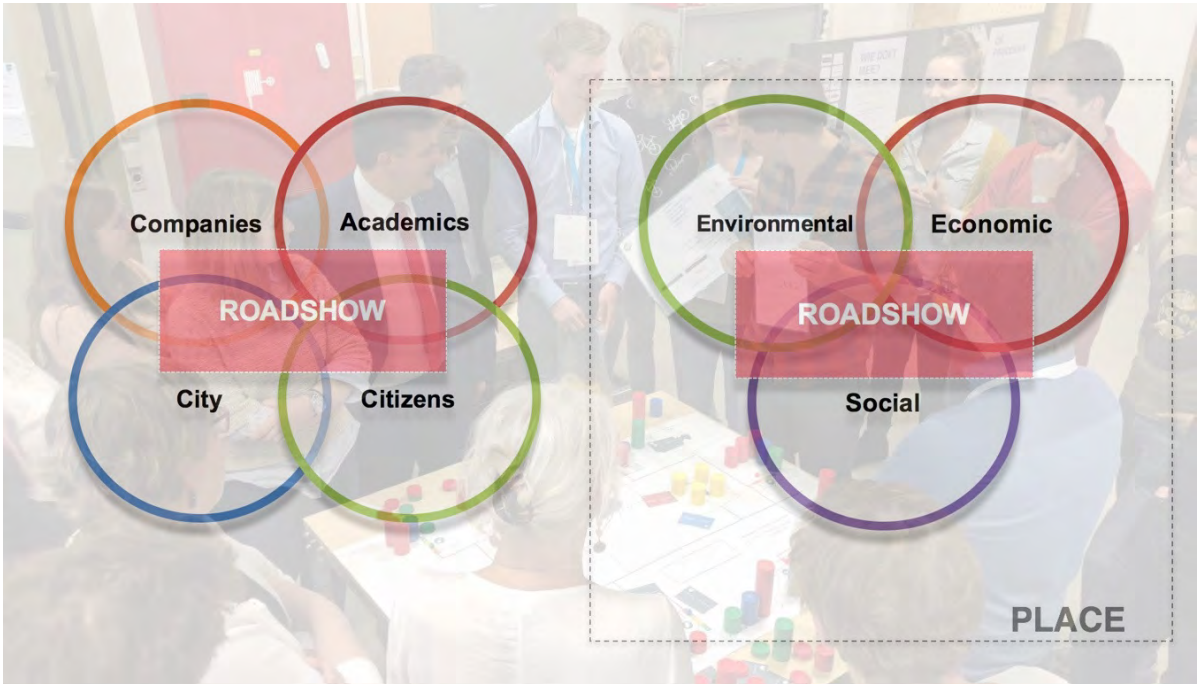
CHAPTER 1 – Introduction

1.1. CITY-ZEN ROADSHOW AND SWAT STUDIO

The Roadshow travels with a team of internationally recognized experts in the field of urban and architectural design and energy planning to co-create a sustainable 'City Vision' with city stakeholders. It will visit 10 cities that are seeking expert guidance on how to become zero energy and carbon neutral over a 4-year period. The project has already successfully collaborated with Belfast, Izmir, Dubrovnik, Menorca, Sevilla and Roeselare. The overall aim of the project team, is to work closely with people from each hosting city, whether they be city leaders, neighbourhood associations, energy planners, architects, academics, students and of course most significantly the citizens themselves. The project consists of a 5-day event model, a culmination of a 3-month preparation including an educational design studio (the SWAT Studio) that promotes the Roadshow whilst building relationships and trust between all contributing partners. Local stakeholders are welcomed and encouraged to join and to take ownership of the process and the final outcomes, outcomes that will allow the cities resources, people, knowledge and renewable energy potential to be directed effectively over a realisable timescale that will meet their energy transition. The process starts by identifying a neighbourhood's urban lifestyle and energy challenges. Then, on the final day of the event model, a definitive sustainable 'City Vision' is presented to the city, which responds to all scales of their built and natural environment.



(a) *(b)*

Fig 1. (a) The Roadshow investigates environmental, economic and social aspects of each Roadshow city to develop a 'City Vision' that is specifically tailored to respond to place. (b) The Roadshow team brings together all stakeholders, it facilitates this 5-day event to propose a sustainable 'City Vision' that is 'owned' by the city itself.

The following describes the underlying approach undertaken in Preston and the project neighbourhood of Broadgate. It will include an explanation of the Sustainable 'City Vision' that resulted. City engagement is an exciting and thought-provoking prospect. Many questions arise at the beginning of the journey. Making first contact with a prospective project location, conducting preparations, explanations and agreements are aspects that are far from an exact science. The method of achieving this successfully has evolved city-by-city and is arguably as valuable as the sustainable solutions that have resulted. There can be many political, cultural and language obstacles that must be negotiated without weakening the overall aims of a Roadshow. The outcomes have the power to inspire and potentially be realised post-project. The first questions are:

- Who is 'the City'?
- What are the city's sustainable expectations and aspirations?
- What is the current and future calculated energy demand?
- Where are the urban challenges and potentials?
- Are they purely energetic, spatial & social, administrative or a combination of all?
- Does the 'City' even realize or accept they have challenges, despite its desire to be sustainable?

To answer these questions and many more, the Roadshow team began the process of identifying the cities that need and, more importantly, want to collaborate with the expert team. First contact begins with an educational architecture design workshop studio (known as the SWAT Studio). This takes place in the months prior to the Roadshow. Developed and led by TU Delft under Prof. Dr. Craig Lee Martin, the Master's student-focused event facilitates an extended and detailed discussion with city stakeholders. The later 'expert' Roadshow then follows. This is conducted over a 5-day period based on 'themes' that guide the evolution of the vision. Here, experts deliver global input at key points. Each event is constructed to relate to individual citizen experiences and knowledge, giving confidence in the processes that are extended to relate to streets, neighbourhoods, districts, the city and, under some circumstances, the region or island. The project is not intended to be a one-way stream of information and ideas; instead the process aims to activate, convince, openly invite and encourage 'the city' to be part of the process at any level that they feel comfortable with. The method includes going out of the studio and into the wider community and to engage with various initiatives, to meet and talk with their members, no matter their age or background or expertise. The project leader selects cities that have diverse climates, urban typologies, economies and cultural backgrounds to ensure that the project develops a highly adaptable and compact, yet replicable, approach, whatever the city and its circumstances.

1.2. AIMS

The aim is to develop an event model capable of implementation in all cities, in order to co-create, with citizens from all backgrounds, a city's sustainable vision. Proposals developed exclusively by the expert team, and not by city stakeholders, would physically and metaphorically leave with the non-resident experts. Hence, a home-grown solution is key. A legacy must remain in which all participatory groups continue to exchange knowledge and speak with a common voice, making any future research bids (beyond the scope of the City-zen project) coherent, effective and impactful. The project wishes to extend its agenda by strengthening connections and bringing together a global family of project cities, where experiences can be shared together with collaborative research bid proposals across the European community.

The most important target group are inhabitants of the neighbourhood, city and wider hinterland of the hosting city. Companies and start-ups in the field of technology and sustainability are encouraged to be active participants during the project. A key objective is to reach 600 students across the EU by

visiting local universities, colleges and secondary schools. Students are the future. It has been a mutually beneficial approach to combine the energy and enthusiasm of architecture, urban planning and building technology focused 'SWAT Studio' Master's students with the stakeholders and students from the hosting city. The student projects, and more significantly the close relationships that were forged whilst conducting them, lay the foundation on which to build the intensive 5-day City-zen Roadshow. Promotion, active participation and dissemination contribute significantly to overall success. Consequently, the Roadshow and SWAT student workshop leader encourages any, and all, interested groups such as municipalities, neighbourhood associations and universities to grasp the opportunity to do so. Taking the time to discuss what is expected and allay any reservations or doubts that may arise, the Roadshow will not criticize a city's perceived lack of sustainability. Roadshow team specialists are aware of many complex global and local level challenges that must be overcome together for a renewable energy transition to take place.

Fig 2. The Preston 'SWAT Studio' (2-week 'Intervention' period - 17th to 28th of September 2018). A collaborative Building Technology MSc's 'Onsite' studio (TU Delft, The Netherlands). The SWAT is an educational precursory event that took place 2 months prior to the start of the Preston Roadshow. During the SWAT Studio, the aims and objectives of the City-zen Preston Roadshow would be disseminated to the city in various ways. The students' design proposals would be used to prompt discussions with key decision makers and stakeholders. The selected photographs and images depicted here show site investigations around Preston, formal presentations at the City Hall hosted by the Chief Executive (Adrian Phillips) and various other contributions that show the future plans of Preston city centre and the new university campus. All the stakeholders shown here would become key contributors to the Preston Roadshow. Key student images would be used in the communication material used to promote the November 2018 Roadshow.

1.3. OBJECTIVES

1.3.1 Student Engagement

A Master's level Building Technology student workshop (known as the SWAT Studio), with identical project aims as the professional 'expert' Roadshow, develops and proposes technologically innovative and contextually driven urban interventions. A key ambition of the design workshop is to demonstrate that, through building interventions at all scales ranging from façade, building, street, neighbourhood and district, that sustainable lifestyles are possible within existing cities. The identical aim of the City-zen Roadshow during its approach to zero-energy and zero-carbon cities. Students from The Netherlands forged pre-Roadshow relationships with key city stakeholders and community leaders. For the Roadshow project site at Broadgate, a key stakeholder would be Ishwer Tailor. Ishwer's support and feedback was a pivotal part of the SWAT Studio's understanding of the local context. On this basis, Ishwer would become a key stakeholder who was able to help promote and encourage local citizens to get involved with the Roadshow.

1.3.2 Process

In Preston, the process of Roadshow preparation, as described previously, began 2 months prior to the project start with a collaborative Master's level Building Technology student workshop. Both the workshop and the Roadshow itself were developed to be fun and yet 'intensive'. Components such as seminars, walking tours, design fun-shops and mini-masterclasses within the 5-day period were strategically timed and citizen focused. The outputs were synchronised with specific project team specialisms in energy and urban design. Outputs were qualitatively spatial and quantitatively energy focused, combining to form the Sustainable City Vision on the final day of the Roadshow on Friday 16th of November 2018.

1.3.3 Daily Activities

Daily activities would involve citizens, architects, Preston City Council employees, students, academics and various professionals from the city visiting the projects studio base at the Gujarat Hindu Society and various public and private chambers at the City Hall itself. The 5-day programme was devised in such a way to encourage participants to 'drop-in' and 'drop-out' so that the project fun-shop activities and mini-masterclasses could fit into their professional and family schedules. This a strategy that would increase city involvement dramatically.

'PechaKucha' style presentations (meaning 'chit-chat' in Japanese) would be the chosen format of all presentations given by partnering stakeholders and the Roadshow team. This allowed an exchange of concise and fast-paced information flows, facilitating a multiple-involvement event. A strategy giving both Roadshow 'ownership' to the residents of Preston and communicated well what participants should expect to happen through the week.

The outputs of SWAT Studio would be presented to a stakeholder audience on day one of the Roadshow, an audience comprising many individuals and companies who had collaborated previously with the SWAT and now would join with the opening of the Roadshow. These included the following stakeholders who also contributed with presentations outlining their Preston sustainability initiatives and future plans: Jenny Bennion (Lets grow Preston), RecyclingLives, John Richards (New UCLan Campus, Estates Manager UCLan), Matthew Brown (The Preston Model, Elected Leader of Preston City Council), John Bridge (StudioJB, Architect of the new Preston Markets) and Alban Cassidy (Cassidy & Ashton, Architects).

This co-creative method aims to foster an intensive working environment, yet one allowing adequate flexibility to ensure maximum stakeholder participation at whatever level they feel comfortable. It must be respected and appreciated that all stakeholders are likely to have full time jobs and a family life beyond any project, their attendance is self-financed. Therefore, a role of the Roadshow leader is to strike a balance between stakeholder commitments and availabilities. Discussions involve conveying the urgency of being part of the process, but not to an extent that distances prospective attendees. During the Preston SWAT Studio, many face-to-face preparations and negotiations took place with stakeholders at their convenience. Various visual descriptors would be shown to communicate what is expected during the Roadshow. Images taken during the previous Roadshows would be highly effective in translating what was to come in Preston. Coloured marker pens, rolls of tracing paper, laptops and notebooks are the tools of choice for the project participants.

Roadshow activities have the same aim: energy neutrality. However, each component is enjoyably diverse and offers new perspectives and skills on how to attain it. Whilst two parallel fun-shops ran continually over the week, participants signed up to play the Go2Zero Serious Game. Preston's stakeholders, which included the elected Leader of the City Council (Matthew Brown) and Chief Executive of the Council (Adrian Phillips) 'role played', having fun whilst experiencing the cause and effect of energy strategy decisions made at the regional, neighbourhood and family household level.

(a) *(b)*

Fig 3. The Go2Zero game. The serious game developed by DNV_GL was kindly hosted at the Gujarat Hindu Society. (a) Chief Executive of the City Council, Adrian Phillips (far left) and elected Leader of the City Council, Matthew Brown (second from left) are seen here getting into the game and having 'energetic' role-playing fun whilst experiencing the implications of energy choices at the large commercial and domestic level. (b) 20 stakeholders with diverse backgrounds and various age groups played the game for over 3 hours. Following the game, they took the opportunity to come into the Roadshow design studios and the Pac-Man Carbon fun-shop that took place immediately after.

1.4. ROADSHOW AT A GLANCE

The following points list 18 keywords that best describe the story and ambitions of the City-zen Roadshow:

1. **ZERO ENERGY** Aims to develop and demonstrate Zero-Energy Cities with a central role for citizens.
2. **MOTIVATE & EMPOWER** End-users to a long-term energy saving attitude.
3. **CITIZENS** Placed in the heart of a creative process that develops designs, strategies, guidelines and timelines at all scales of their own city's built environment.
4. **NUMBERS** 4 Cities completed - 3 months prep / city - 5 days onsite / city - all citizens - 7 International sustainability experts - 6 cities next.
5. **IMPACT** Healthy lifestyles, environmental comfort, building efficiency, independence from fossil fuel uncertainty. But most of all confidence that sustainability is for all who want it.
6. **TRUST** Citizen's need belief in the process, objectives and solutions, no matter how radical or unfamiliar. Students open the door!
7. **OWNERSHIP** Citizen's take ownership of their built environment without fear of hidden agendas, affiliations or political constraint.
8. **HOMEGROWN** The solutions stay with the people.
9. **WHO IS THE CITY?** Doesn't matter where the ideas come from, as long as they come and begin to be realized.
10. **DISRUPT** Project rocks the status quo to reach zero energy.
11. **GLOCAL** Specialist global expertise combined with local stakeholder energy and knowledge of context and lifestyle.
12. **GRAPHICAL** Use graphical descriptions to get your messages across.
13. **SACRIFICE?** It's not about losing, it's about what you gain. Replacing it with something better for your children and community.
14. **TIMETABLE TO SUIT** Schedule to fit stakeholders, not the other way around. Remember, stakeholders are not on the payroll, they have other daily priorities.
15. **INDIVIDUAL PERSPECTIVE** Make sure activities relate to the people and their experiences. These can be expanded later to other scales.
16. **COMPARISONS** To design what is possible is one thing, to show what has been realized or what can occur under the right circumstances is even better.
17. **HIGHLY VISUAL** Outcomes to be colourful representations of the future, before/after scenarios.
18. **BE INSPIRATIONAL** Encourage 'City Vision' participants to take the lead in the next step!

CHAPTER 2 – ROADSHOW COMPONENTS

Two parallel workshops continue throughout the project week. On arrival, stakeholders are guided to select one workshop depending on their interests or specialisms; however, migration to each is recommended in order to get a full overview of energy and urban strategies and their implementation. At the end of each day the workshops meet to summarise their findings and to agree on that evenings and the following day objectives. As an example of how the project approaches each city, the following describes the journey and activities undertaken in Preston and within one of its typical neighbourhoods - Broadgate.

2.1. FUTURE NEIGHBOURHOODS (WORKSHOP 1 – DAY 1 TO 5)

Led by Prof. Greg Keeffe, Queens University Belfast, UK

2.1.1 Aim & Objectives

The aim of the workshop was to develop strategies at a range of scales that allow a process-based adaptation of the city to carbon neutrality. The scales utilised were: the city, the neighbourhood, and the building. The city scale is important because city form is the basis for the behaviours engendered in the city. Here urban grain can encourage or discourage car usage, can allow safe routes for schoolchildren, and connect the inner city with the countryside. The neighbourhood scale allows us to visualise the commons – i.e. the things we share. This may be things such as smart grids, or other networks, but may also be spaces for meeting, playing or growing. Green networks are important too, not only allowing citizens to enjoy nature and travel free from traffic, but also that the softness helps to prevent flooding and adds eco-services to the city. Energy storage is most cost-effective at this scale too, as is car share. In addition, density is one of the key factors in making neighbourhoods function, and many behaviours are linked to this – such as car usage, local economy etc. The house or building scale is crucial, because here we see many of the technologies for neutrality being employed. Technologies such as PV cells, heat-pumps, shading devices, DHW production all have been developed to work at this scale.

2.1.2 Methodology

The workshop starts with an understanding of city form, historic and future growth, urban grain, climate, eco-system services and density. From these initial studies, an understanding of the city as a holistic super-organism is developed. This bioclimatic understanding allows new insights into current trajectories. Urban design is based on understanding urban trajectories and deflecting or manipulating them, to create new futures in a seamless way. Once a sustainable urban design strategy for the city is developed, we change to the neighbourhood and building scales to look at the issues this strategy creates at the smaller scales. More detail can be developed here, and the solutions become more technological. We then visualise the impact these technological insertions have on the built environment and the lifestyles of the residents.

2.1.3 Outcomes

The design outcomes are integrated in the presentation that was delivered at Preston City Chambers on Friday 16th November. The full presentation is illustrated in Chapter 3 'Sustainable City Vision'.

2.2. ENERGY TRANSITION WORKSHOP

Led by Prof. Dr. Andy van den Dobbelsteen, TU Delft, The Netherlands

2.2.1 Background

The Energy Transition Approach developed for and during the roadshows has evolved in time and the results depend, amongst other factors, on the availability of data of energy use and other data. The energy transition workshop, also that of the Preston Roadshow, always starts with an analysis of the characteristics of the place under scrutiny by looking at the local climate, the technical features of buildings and the urban situation, as well as a quantitive assessment by means of Carbon Accounting and Energy Potential Mapping. This concerns the definition of current energy demands, carbon emissions and energy potentials. Next, scenarios are discussed and the most feasible one, fitting the future goals, is elaborated and calculated. As basis for effective energy interventions, the New Stepped Strategy is used: Reduce, Reuse, Produce. Different energy interventions are proposed throughout all scale levels, from the scale of single households to that of building blocks and streets, up to the neighbourhood and the whole city. Finally, the proposed future scenario for the municipality is assessed again by Carbon Accounting.

2.2.2 Outcomes

The design outcomes are integrated in the presentation that was delivered at Preston City Chambers on Friday 16th of November. The full presentation is illustrated in Chapter 3 'Sustainable City Vision'.

For Preston the Energy Transition team's work started with the carbon analysis of Broadgate, identifying a predominant factor in the neighbourhood's carbon footprint: food. Part of the proposal later presented therefore included new, localised sustainable food production, but this was not the main focus. Also, just as the Future Neighbourhood team did, mobility was identified as a challenge, being car-dominated at present, hence inducing a large portion of carbon emissions.
The energy system strategy was developed along the Reduce – Reuse – Produce line, proposing general interventions in buildings, next to attuning, exchanging, cascading and storing energy within the neighbourhood via heat networks at different temperatures, as well as schemes for a large production of renewable energy. The latter was established – in the Sustainable City Vision – by photovoltaics on rooftops and facades, biomass from park maintenance, geothermal heat sources, wind turbines along new axes for commuter cyclists and most notably, a tidal plant in the Ribble River, which turned out to have a 3-metre difference between low and high tides, appearing twice a day, hence offering the potential for almost continuous power generation between the peaks 4-times a day (2 times in, 2 times out). Receiving a percentual share of this production, a large part of the power needed in Broadgate could thus be gained.

Detailed proposals were presented for houses in different parts of Broadgate, each with specific interventions fitting the site and architecture, with post-insulation, with or without a local heat network, with or without glasshouse additions.

All interventions proposed by the Future Neighbourhood team and Energy Transition team together were assessed by their carbon-saving potential. It turned out that, starting from a forested area of almost 800 hectares, required for carbon sequestration, one of 23 hectares remained. This area can be found opposite Broadgate, in an unused marshy piece of land next to the Ribble River. The Carbon Accounting method used will be discussed hereafter.

2.3. CARBON PACMAN

Carbon accounting and evaluation of carbon mitigation scenarios for the Broadgate neighbourhood in Preston (UK)

By Dr. Riccardo M Pulselli, Ecodynamics Group, University of Siena

2.3.1 Background

The Carbon Accounting framework, developed to be easily and quickly implemented, provides a reliable ex-ante evaluation of measures that can be designed and implemented at the scale of the city, neighbourhood, building or single household as well as individual citizen (behavioural change). It provides quantitative information and visual representations, to support design and raise awareness.

For increasing attractiveness, the graphic representation simulates the original Pacman game from the 1980s, but this time our Carbon Pacman eats squares of forestland due to energy saving, renewable energy production or other emissions avoided. As far as additional energy inputs are required, the ghost appears to add new squares, for example when the use of heat pumps support the heating demand through renewable energy by using electricity (Carbon Pacman eats orange squares but new blue squares appear), or in the case of a transition to electric mobility (Carbon Pacman eats purple squares but new blue squares appear). A consistent electricity generation from renewable sources can contribute to support the electricity demand and let Carbon Pacman move forwards.

The carbon mitigation accounting and its representation through the Carbon Pacman game have been developed as a communication tool to allow a wide audience understand that, based on a collective and participative process, zero-carbon cities are an achievable goal to push forwards.

2.3.2 Outcomes

Carbon accounting has been performed in Preston in order to provide a clear picture of the current state in terms of greenhouse gas emissions, taking the Broadgate neighbourhood as case study. The resulting Carbon Footprint (hereafter CF) measures the greenhouse gas emission in kg CO_2 equivalent (CO_2-eq), corresponding with the quantity of the three main greenhouse gases released into the atmosphere, i.e. CO_2 (carbon dioxide), CH_4 (methane) and N_2O (nitrous oxide), multiplied by their Global Warming Potential (GWP): carbon dioxide GWP = 1, methane GWP = 34 and nitrous oxide GWP = 298 (Ref. 2006 IPCC guidelines). The GWP measures the potential greenhouse effect (heat trapped) of a gas relative to an equivalent mass of carbon dioxide (for instance, methane is 34 times more effective than carbon dioxide). The accounting framework

developed during roadshows has been described in detail in Pulselli et al. (2018) *[Pulselli RM, Marchi M, Neri E, Marchettini N, Bastianoni S. "Carbon accounting framework for decarbonisation of European city neighbourhoods". Journal of Cleaner Production 208 (2018) 850-868]* and has been demonstrated to represent an innovative tool to drive urban design and climate action.

Specific emission factors (hereafter, EF) have been selected to estimate the greenhouse emission of each activity, e.g. electricity use, fuel combustion, km driven by car and other transport, waste incineration or disposal, water depuration and distribution. The EF, given in kg CO_2-eq/unit, have been assessed on the basis of the 2006 IPCC guidelines, except for the EF of electricity, which depends on the local primary sources and share of renewables. For Preston this was estimated based on the national electricity grid mix (UK 2017), as shown in Table 1 (the EF used are LCA based).

Table 1. Assessment of the Emission Factor of UK electricity, based on the grid mix, i.e. 0.317 kg CO_2-eq/kWh$_e$

UK 2017	LCA based EF	DATA	%	GHG EMISSION
GENERAL DATA	**kgCO2/kWh**	**kWh**	**%**	**kt CO2-eq/yr**
ELECTRICITY DEMAND	_	**3.51E+11**	104.2%	
ELECTRICITY PRODUCTION	_	**3.36E+11**	100.0%	
INPORT	0.578	1.48E+10	4.2%	8.53E+09
TERMO-ELECTRICITY		**1.61E+11**	**47.9%**	**8.55E+10**
natural gas	0.443	1.37E+11	40.7%	6.06E+10
petrolium products	0.778	1.62E+09	0.5%	1.26E+09
coal	1.050	2.25E+10	6.7%	2.37E+10
RENEWABLES		**6.75E+10**	**20.1%**	**6.86E+08**
wind	0.010	6.15E+10	18.3%	6.15E+08
hydro	0.012	5.93E+09	1.8%	7.11E+07
NUCLEAR		**7.03E+10**	**20.8%**	**4.64E+09**
nuclear	0.066	7.03E+10	20.9%	4.64E+09
TOTAL	***0.317***	***3.13E+11***		***9.94E+10***

In order to perform the carbon accounting of the Broadgate neighbourhood, the procedure started by profiling the typical household in Preston. Data were then scaled-up at the level of the neighbourhood and the city of Preston, based on the number of households and population. In particular, the energy demand per dwelling was estimated based on a simulation model developed by TU Delft students, informed by a survey of local housing architecture. Information on mobility (private car use), waste and water management refers to statistical data locally available.

Aiming at planning possible interventions of urban retrofitting and ex-ante evaluating their potential effects, the inventory of data includes energy demand for housing (electricity, natural gas), mobility by private cars, domestic waste and water management:

- Energy use concerns energy for lighting and appliances, space and water heating, including details of primary energy sources, i.e. electricity and natural gas. Electricity use per household is around 3550 kWh$_e$/yr and natural gas consumption for space and water heating is 11,600 kWh/yr.

- Mobility was investigated based on the use of passenger cars per year and the number of cars per household (i.e. average 1 car/house). The average distance travelled by car per year is 14,000 km/yr.
- Waste management concerns the quantity of domestic waste produced (661 kg/yr per house) and differentiated rates per treatment plant according to local data (i.e. 51% of waste to landfill, 31% recycled).
- Water use concerns the quantity of tap water used (131 m^3/yr per house).

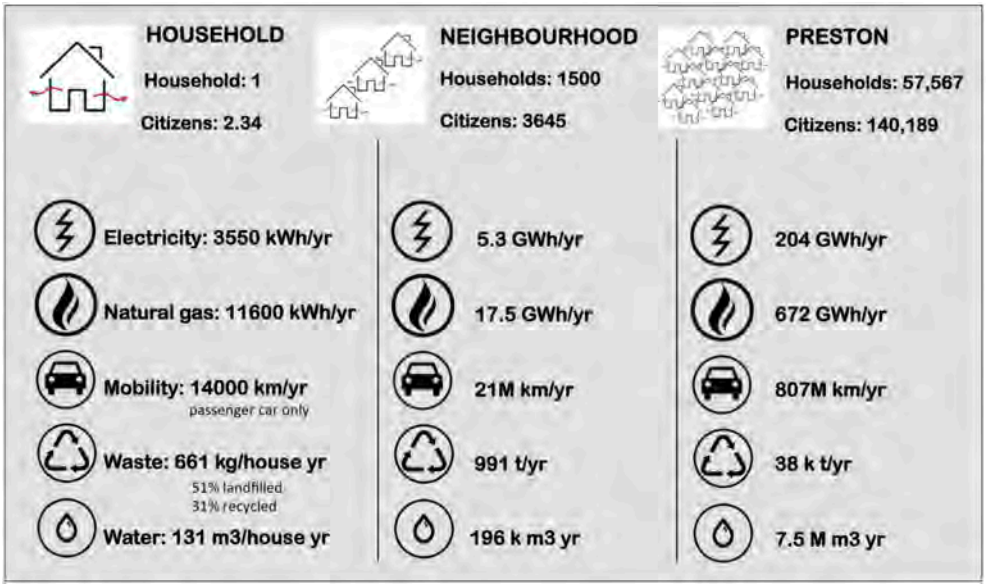


Fig 4. Raw data for carbon accounting in Preston estimated based on the profiling of typical household

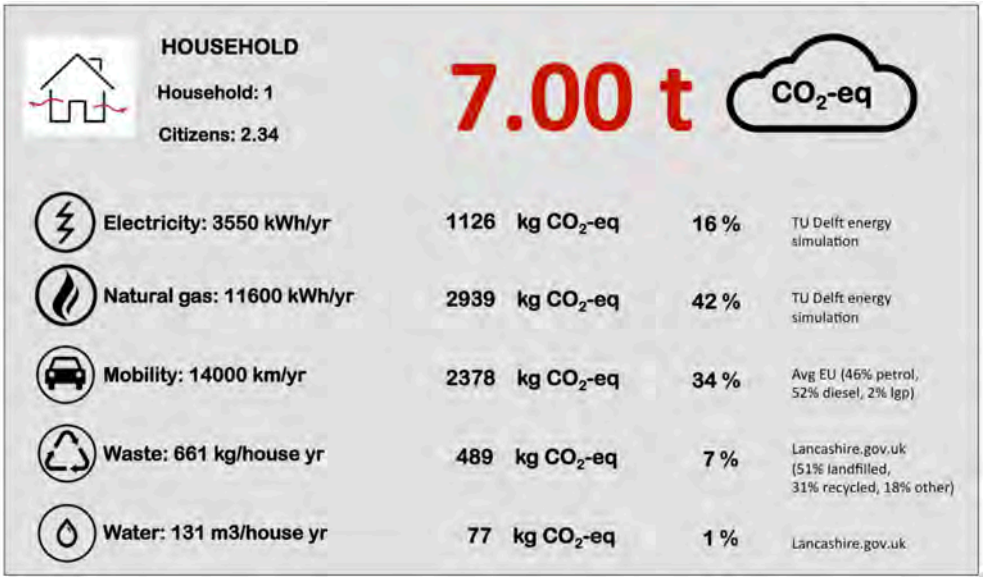


Fig 5. Assessment of the Carbon Footprint of the typical household in Preston

The CF of the typical household in Preston is 7.00 t CO_2-eq/yr. This value corresponds to an equivalent quantity of CO_2 that is yearly absorbed by 0.50 hectares of young forest. In other words, every single household in Preston should have a backyard forestland equivalent to 0.78 football fields. The carbon accounting for the neighbourhood is based on the profiling of the

household, therefore it follows a bottom-up approach. The Broadgate neighbourhood has a population of 3645 people living in 1500 households (on average 2.34 people/household) and a carbon footprint of about 10,511 t CO_2-eq/yr.

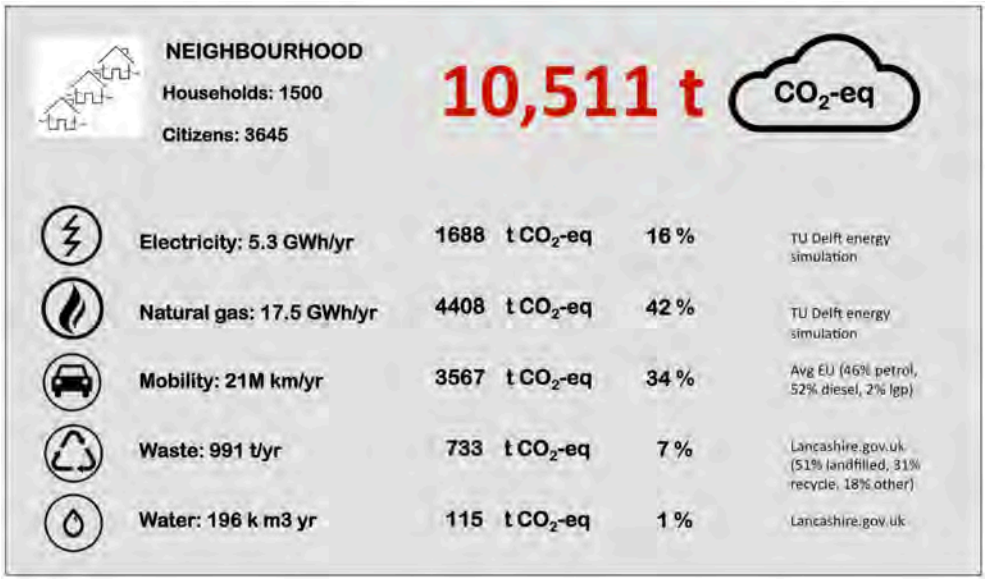


Fig 6. Assessment of the Carbon Footprint of the Broadgate neighbourhood in Preston.

The virtual forestland of the neighbourhood was estimated at 779 hectares. The representation of the equivalent forestland allows to figure out the real dimension of impacts in terms of global warming. The size of forestland, represented at the correct spatial scale on the map, is almost 20 times larger than the area of the neighbourhood. Moreover, the representation into squares of 4 ha each is functional to estimate carbon mitigation effects that can be achieved by proposed interventions by the Roadshow team.

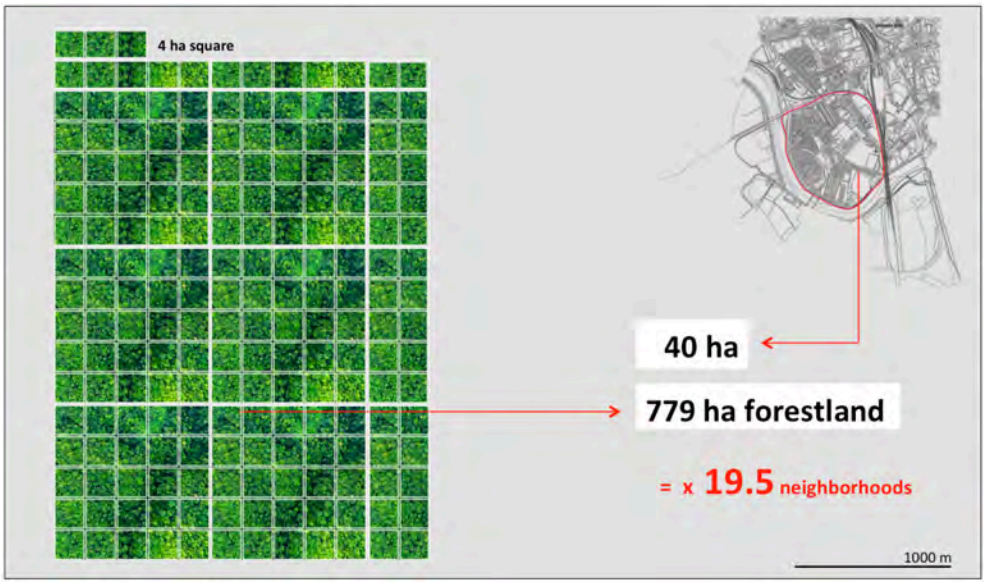


Fig 7. Assessment of the Carbon Footprint and equivalent virtual forestland (4 ha square units) of the Broadgate neighbourhood in Preston

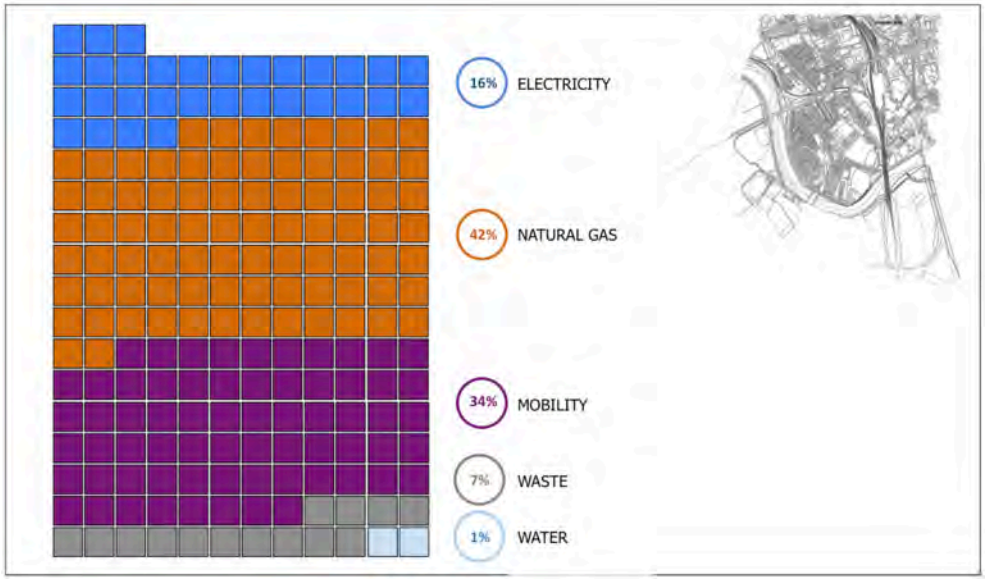


Fig 8. Virtual forestland of the Broadgate neighbourhood in Preston with details on emission sources

An additional assessment made during the roadshow in Preston concerns the estimate of impact due to food consumption. According to the dietary attitude of citizens, which includes frequent consumption of meat (almost every day), the carbon footprint of the neighbourhood increases by up to 67% due to food consumption. In the assessment, we assumed an average consumption of 1.5 kg meat per week considering a mix of beef, pork and chicken.

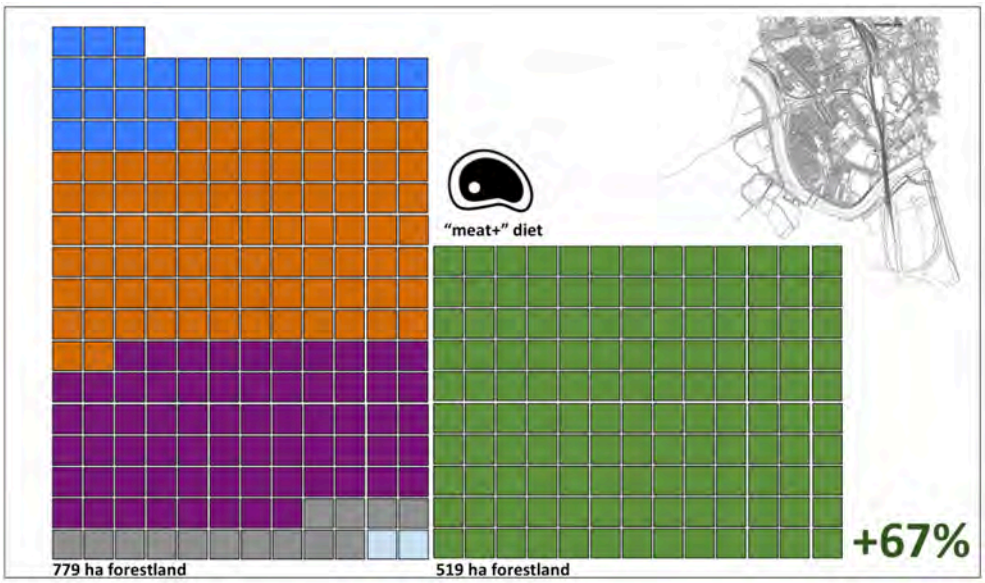


Fig 9. Virtual forestland of the Broadgate neighbourhood including food consumption

Different scenarios, also interpreted as potential mitigation measures, have been calculated. Hypothesizing a full shift to a balanced diet (just 500 g meat per week), the impact of food consumption would decrease by 35%. Moreover, a prevailing choice of local food and short production chain would further decrease the impact of food consumption by 60% compared to the current state, mostly based on conventional food from national and international food industry.

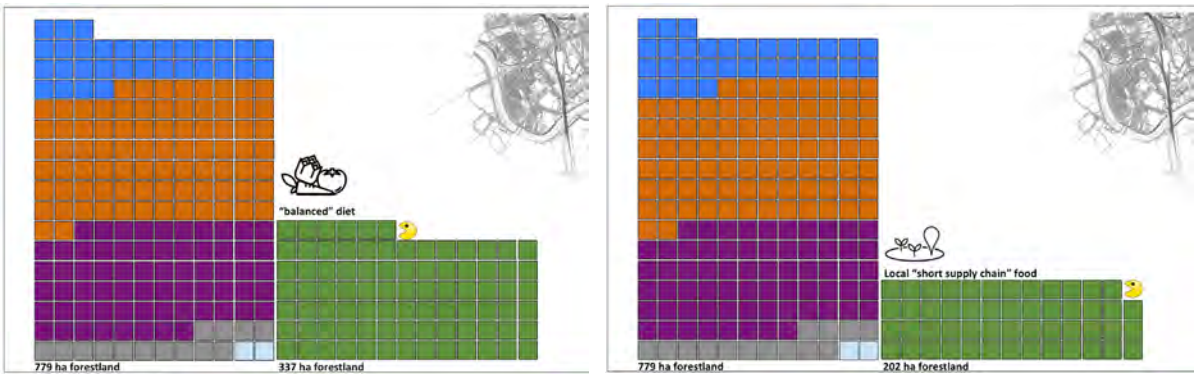


Fig 10. Virtual forestland of the Broadgate neighbourhood including food consumption. Scenarios: balanced diet and local food.

The CF of the neighbourhood is taken as the starting-point to plan integrated measures and policies for energy retrofitting and decarbonisation. The visualisation of outcomes at the scale of the household and neighbourhood allows to quickly figure out an integrated vision combining technologies with other measures. Moreover, the estimation can be easily extended at the city level considering that Broadgate neighbourhood is 2.6% of the city of Preston in terms of numbers of households. This aims to show how the designed measures as well as changes in individual behaviour can contribute to decrease the Carbon Footprint towards a zero-carbon community.

A combination of measures for energy retrofitting has been proposed together with technical and design partners. The scope is to figure out possible scenarios towards zero energy and carbon neutrality by 2050. In particular, the Carbon Accounting framework allowed for estimating the Carbon Footprint mitigation effects of the proposed measures concerning energy retrofitting and renewable energy generation, sustainable mobility, waste management and water use.

The assessment starts from the design of suitable solutions and the estimate of benefits in terms of energy saving or energy production. Based on the spatial representation of the impact of the neighbourhood in terms of virtual forestland, the contribution of designed measures to decrease the impact towards a zero-carbon community is visualized by progressively subtracting squares (4 hectares each) of equivalent forestland from the initial Carbon Footprint.

A possible scenario of 14 measures scheduled for the Broadgate neighbourhood follows corresponding to the sequence shown in the figure until the final goal of carbon neutrality:

#1 Energy saving at home – Behavioural change of citizens (e.g. use of LED lights)

#2 Biking-walking to work/school – Behavioural change + infrastructural improvement (e.g. cycling roads, electric bike sharing)

#3 Increased public transport - Behavioural change + infrastructural improvement

#4 Waste reduction/reuse - Behavioural change (reduced production of waste)

#5 Landfilled waste reduction - Behavioural change (differentiation by citizens) + infrastructural improvement (integrated waste management system)

#6 Water use reduction - Behavioural change at home + Technological solutions (e.g. rainwater harvesting for gardening)

#7 Building envelope insulation - Technological solutions at household/building scale

#8 PV on roofs – Renewable electricity generation (estimated 3.5 GWh/yr potential) on building roofs

#9 Heat pumps - Technological solutions at household/building scale (estimated additional 1.3 GWh electricity demand)

#10 Wind turbines - Renewable electricity generation (estimated 1.2 GWh/yr potential) in the neighbourhood

#11 District heating network - Renewable heat energy generation from biomass (estimated 8.5 GWh/yr in the neighbourhood)

#12 Transition to electric mobility - Technological solution + infrastructural improvement (estimated additional 0.7 GWh electricity demand)

#13 Tidal energy production - Renewable electricity generation from the river flow (estimated 2.5 GWh/yr for the Broadgate neighbourhood)

#14 Urban forestry – compensation of the remaining emission by 23 hectares of forestland.


6
Water use reduction
+ behaviour + technological
100% involved households
-30% water use
(e.g. rainwater collection)
7
Building insulation
technological
50% involved households
-50% heat demand
8
PV on roofs
Renenwable energy generation
65% involved households
3.5 GWh electricity generation
9
Heat pumps
Household scale
30% involved households
1.3 GWh additional electricity (CoP=4)
10
Wind turbin
Renewable energy generation
23% involved households
1.2 GWh electricity generation
11
District Heating Network
Renewable energy generation
50% involved households
8.5 GWh heat generation
(biomass)
12
Transition to
electric mobility
20% involved households
0.7 GWh electricity (0.16kWh/km)
13
Tidal energy
Renewable energy generation
38% equivalent households
2.0 GWh electricity

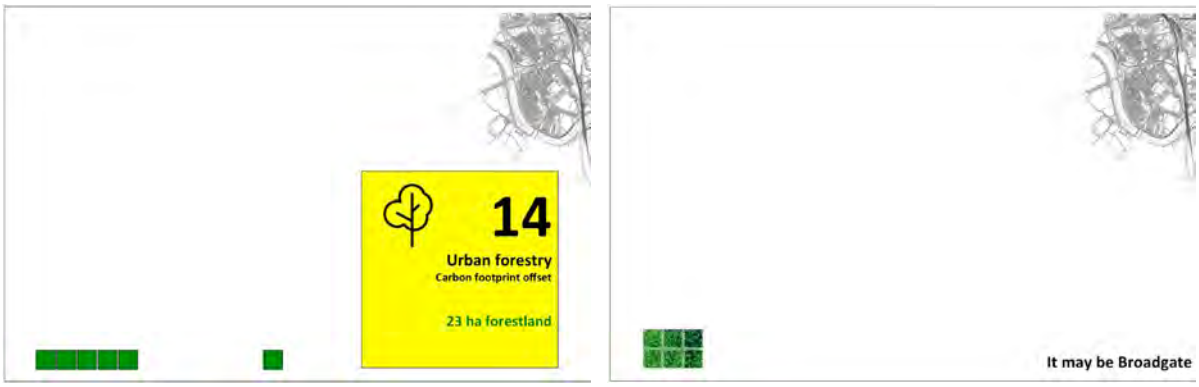


Fig 11. A possible scenario of 14 measures scheduled for the Broadgate neighbourhood. The sequence shown culminating with the final goal of carbon neutrality.

CHAPTER 3 – SUSTAINABLE CITY VISION

3.1. FINAL DAY PRESENTATION AT PRESTON CITY COUNCIL CHAMBERS

The final day of the Preston Roadshow took place in Preston's prestigious civic chambers with Preston City Hall on the 16th of November 2018. The final 'Sustainable City Vision' was presented to an audience comprising the City's Council Department Head's, and academic and professional community from UCLan and the wider city and citizens who live in the Broadgate area and Preston generally. Adrian Phillips, Chief Executive of Preston City Council began the proceedings, followed by the Roadshow team (Prof.Dr. Craig Martin, Dr. Riccardo Pulselli, Prof.Dr. Andy van den Dobbelsteen and Prof. Greg Keeffe), who presented the Sustainable City Vision.

Fig 12. Group photograph following the completion of the City-zen Preston Roadshow

The final day of the Preston Roadshow took the form of several integrated presentations. The first briefly outlined the overall objectives, ambitions, format and activities completed during the week. The second and third components composed the major body of the 'City Vision'. These being the 'Energy Transition' workshop presentation, a complementary quantitative approach focused on energy strategies, scenarios and carbon offsetting measures at overlapping scales. The 'Future Neighbourhoods' workshop, more qualitative in nature, including urban planning intervention proposals at the façade, building and neighbourhood and city scale, together with spatial, social and guidelines. These elements would be brought together by urban observations instigated by the walking event and in-depth carbon investigations that graphically demonstrated how the city would reach zero-carbon by implementing the variously scaled interventions outlined earlier in the presentation.

The Roadshow continues to build upon previous experiences and looks forward to future visits to Nicosia (Cyprus) and Amersfoort (The Netherlands).

The key to success has been to identify, reach and gain the trust of city inhabitants and 'decision makers'. To achieve this, an exchange of knowledge, experience and commitment continues to be crucial. The Roadshow will continue to develop and implement innovative methods that increase city engagement, awareness and understanding of the solutions needed to counter climate change, become carbon neutral and make cities happier and healthier places to live.

3.2. THE PRESENTATION

The Sustainable 'City Vision' presentation (Roadshow outcomes) presented in the Chambers of Preston City Council on Friday the 16th November 2018 can be found hereafter.

City-zen 'Preston' Roadshow

Team
Experts:
Prof.Dr. Andy vd Dobbelsteen
Dr. Andy Jenkins
Prof. Greg Keeffe
Prof.Dr. Craig L.Martin
Dr. Riccardo Pulselli
Egon Troch
Dr. Han Vandevyvere
Jan Verheyen

Fun-shop Facilitators:
Ekta Kapoor
Lorena Montenegro
Carmen Ramkhelawan
Liesanne Wieleman
Tania Cecilia Cortes Vargas
Linda Vos

This project has received funding from the European Union's Seventh Programme for research, technological development and demonstration under grant agreement No 608702

City-zen Roadshow Leader – Prof.Dr. Craig Martin

Preston, UK, November 2018

Aims

Co-creative

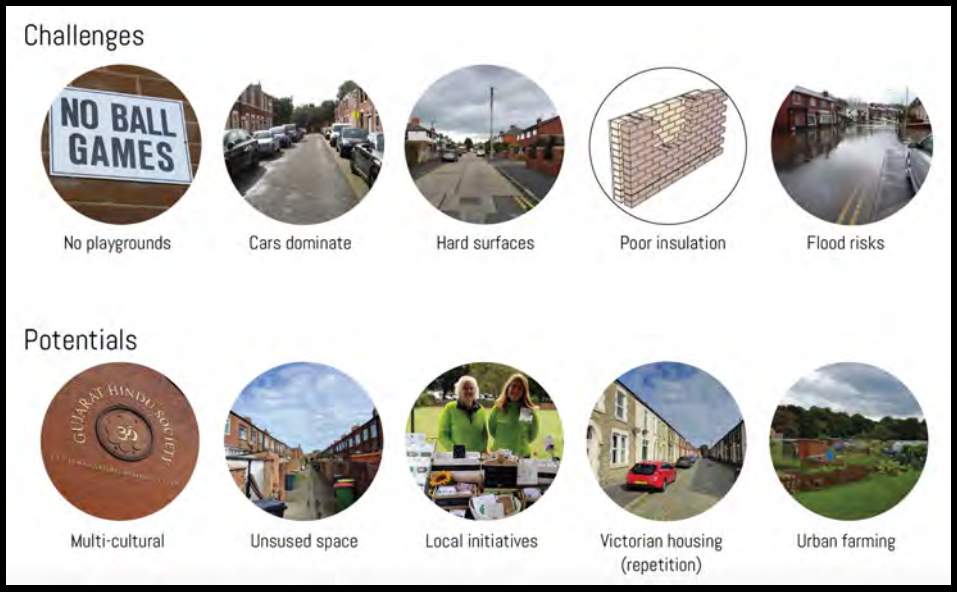
Global / local expertise combine to reach zero energy.

Home-grown solutions.

City-zen Roadshow Leader – Prof.Dr. Craig Martin

Preston, UK, November 2018

What we have learned?



Not sacrifice.

Understanding the 'cost' of not doing something.

- Health
- Enjoyment
- Economic future
- Family future
- Survival!

CITY-zen New urban energy ROADSHOW

City-zen Roadshow Leader – Prof.Dr. Craig Martin

Preston, UK, November 2018

What went on…

Mon 12th Nov
'Walk'

CITY-zen New urban energy ROADSHOW

City-zen Roadshow Leader – Prof.Dr. Craig Martin

Preston, UK, November 2018

What went on…

Mon 12th Nov
'Talk'

City-zen Roadshow Leader – Prof.Dr. Craig Martin

Preston, UK, November 2018

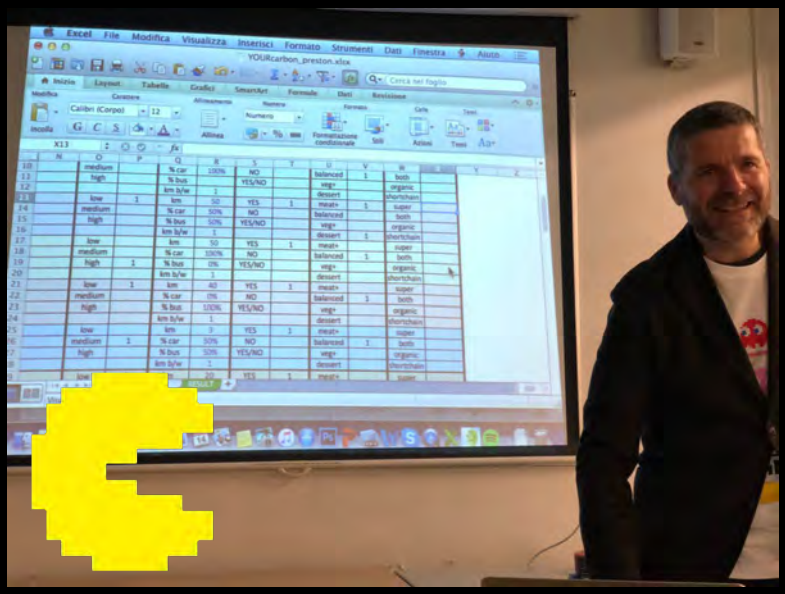
What went on…

FUN-SHOP 'Drop-Ins'

City-zen Roadshow Leader – Prof.Dr. Craig Martin

Preston, UK, November 2018

What went on…



FUN-SHOP 'Drop-Ins'

City-zen Roadshow Leader – Prof.Dr. Craig Martin

Preston, UK, November 2018

Carbon accounting

CO_2-eq

CO_2 CH_4 N_2O

UNIT kg CO_2-eq

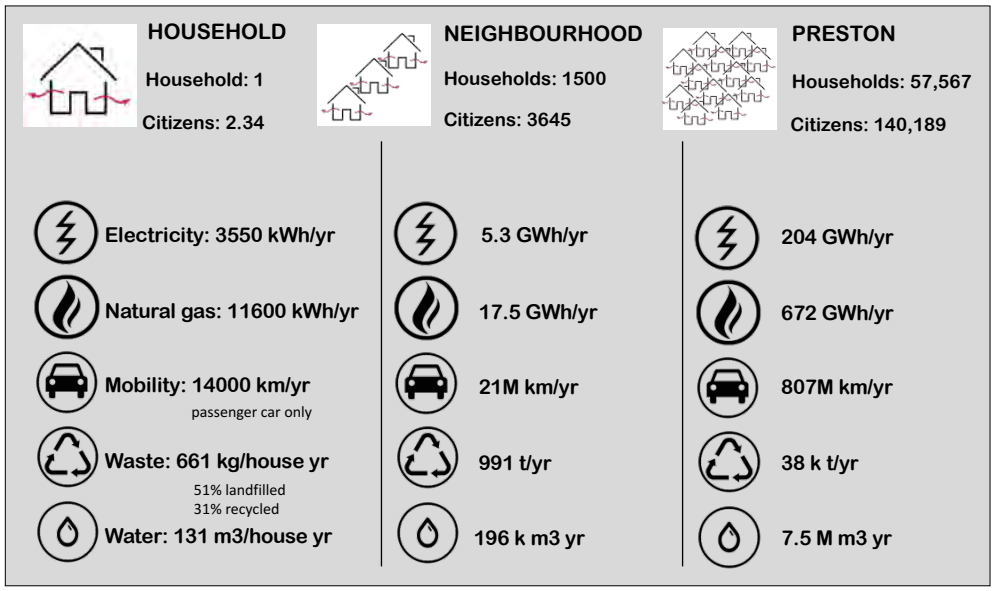
GWP CO_2 = 1
GWP CH_4 = 34
GWP N_2O = 298

EMISSION FACTORS

Carbon accounting: Dr. Riccardo M. Pulselli, University of Siena, Siena

Preston, UK, November 2018

Raw data in Preston



Raw data & scale

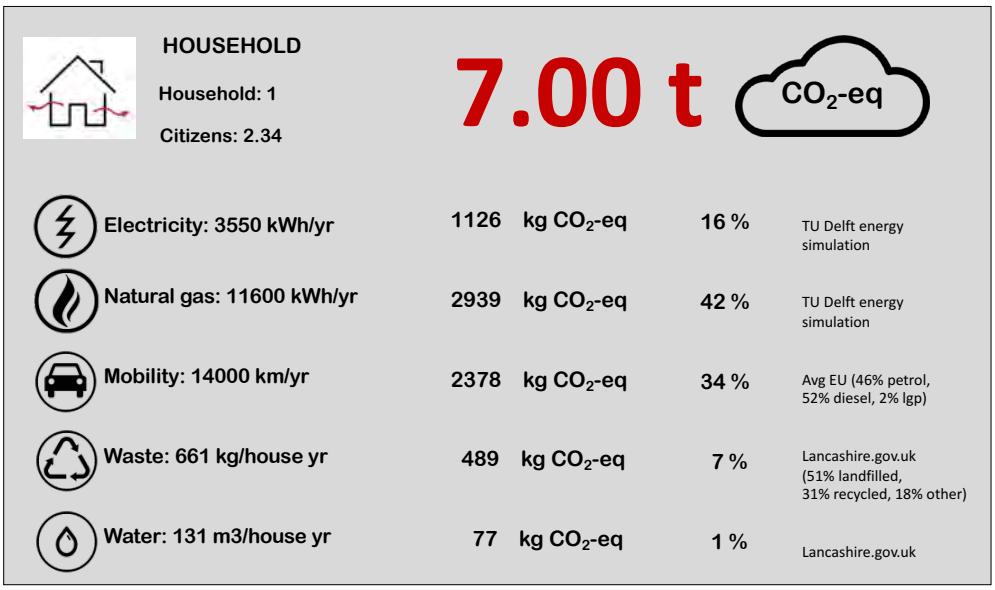
HOUSEHOLD
NEIGHBOURHOOD
PRESTON CITY

CITY-zen New urban energy ROADSHOW

Carbon accounting: Dr. Riccardo M. Pulselli, University of Siena, Siena

Preston, UK, November 2018

Carbon Footprint per household



Typical household Carbon Footprint

CITY-zen New urban energy ROADSHOW

Carbon accounting: Dr. Riccardo M. Pulselli, University of Siena, Siena

Preston, UK, November 2018

Carbon Footprint per household

Typical household
Carbon Footprint

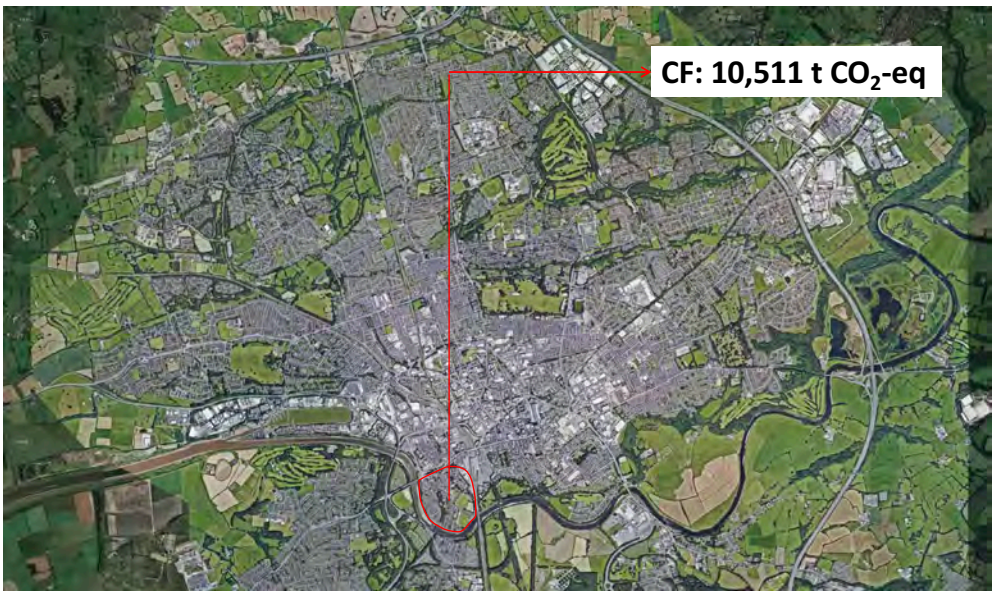
7.00 t CO_2eq / yr

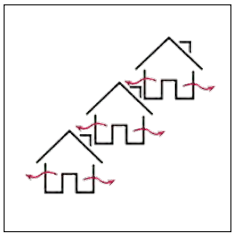
= 1.3 football fields

Carbon accounting: Dr. Riccardo M. Pulselli, University of Siena, Siena

Preston, UK, November 2018

Carbon Footprint of the Broadgate neighbourhood





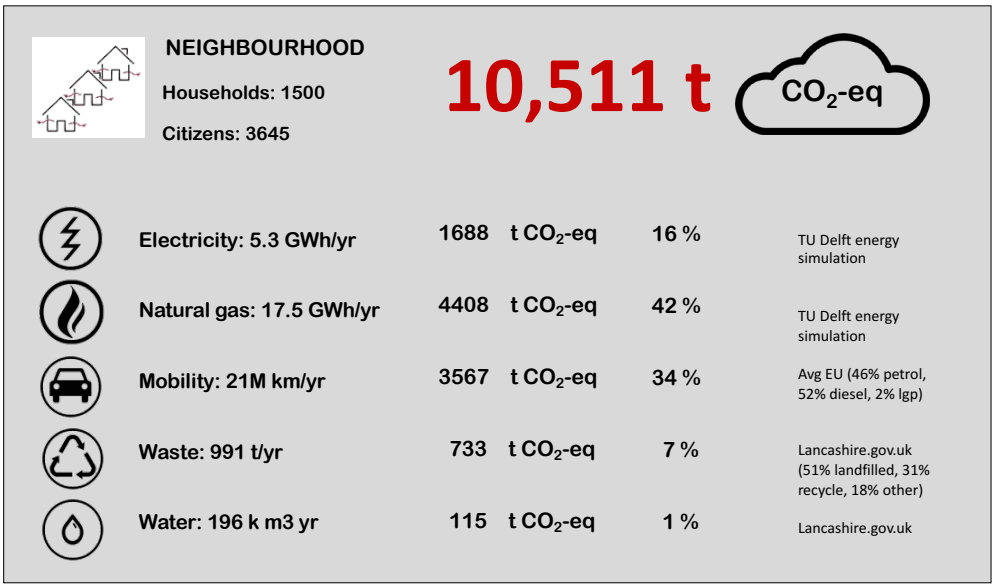
BROADGATE

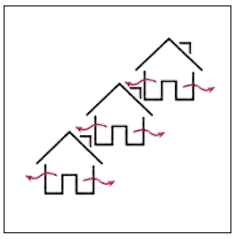
3645 inhabitants
1500 households
2.6% Preston houses
40 ha area
91 inhab./ha

Carbon accounting: Dr. Riccardo M. Pulselli, University of Siena, Siena

Preston, UK, November 2018

Carbon Footprint of the Broadgate neighbourhood





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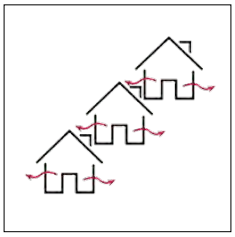
CITY-zen New urban energy ROADSHOW

Carbon accounting: Dr. Riccardo M. Pulselli, University of Siena, Siena

Preston, UK, November 2018

Carbon Footprint of the Broadgate neighbourhood



BROADGATE

C.F = 10.5 kt CO_2-eq

40 ha area

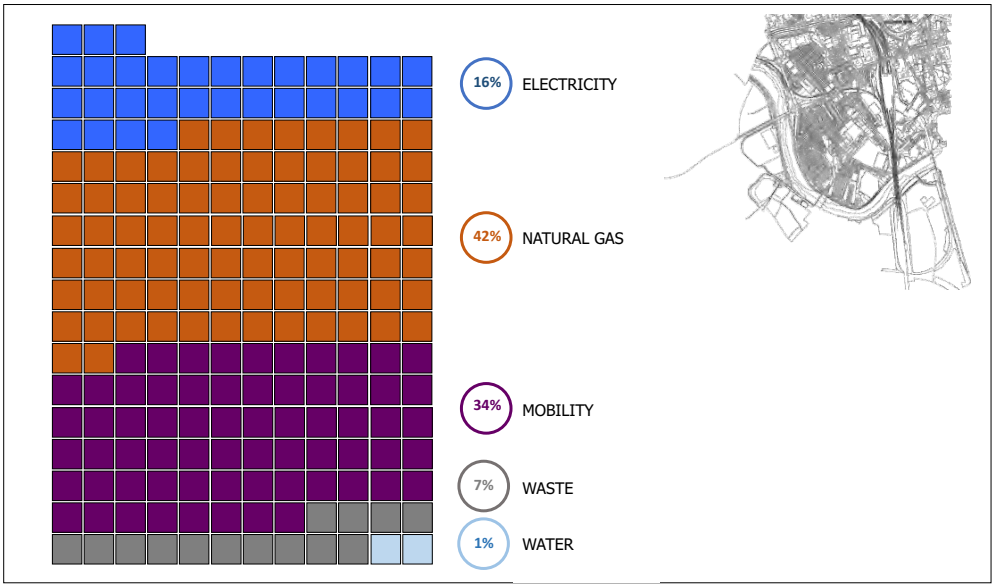
779 ha forestland

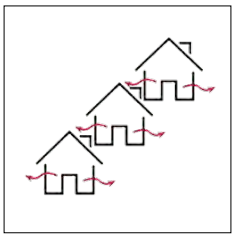
CITY-zen New urban energy ROADSHOW

Carbon accounting: Dr. Riccardo M. Pulselli, University of Siena, Siena

Preston, UK, November 2018

Carbon Footprint of the Broadgate neighbourhood



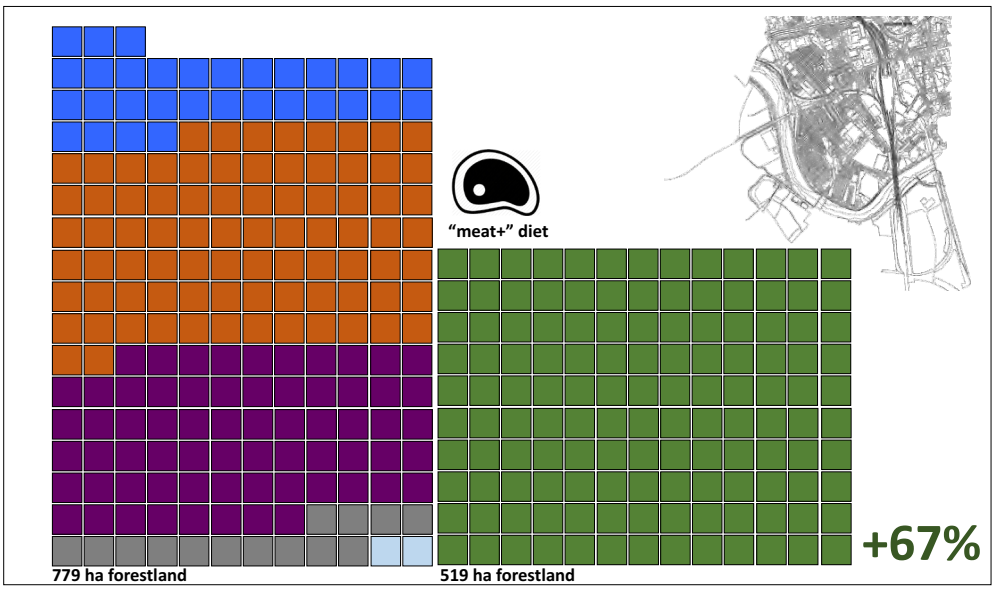


ELECTRICITY
NATURAL GAS
MOBILITY
WASTE
WATER
FOOD

Carbon accounting: Dr. Riccardo M. Pulselli, University of Siena, Siena

Preston, UK, November 2018

Food impact (meat+ diet)

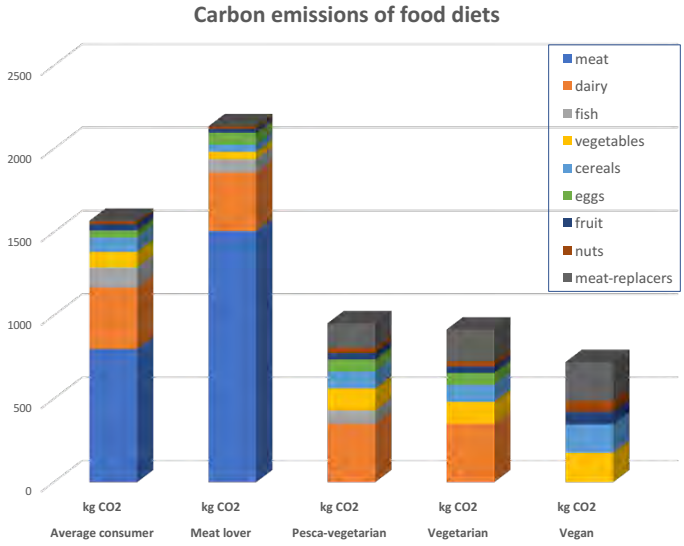


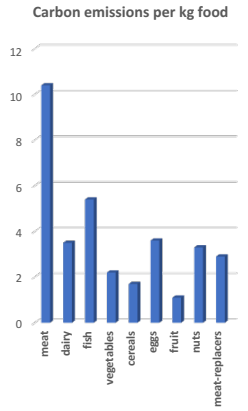
ELECTRICITY
NATURAL GAS
MOBILITY
WASTE
WATER
FOOD

Carbon accounting: Dr. Riccardo M. Pulselli, University of Siena, Siena

Preston, UK, November 2018

So we start with food…

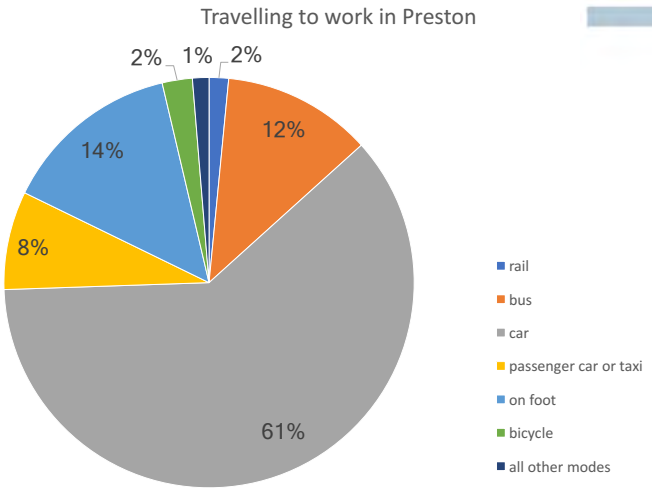




Energy strategy: Prof Andy van den Dobbelsteen, Delft University of Technology

Preston, UK, November 2018

Preston mobility today



50% of Preston workers live within 5 km distance!

Mobility strategy: Egon Troch, Th!nk-E, Belgium

Preston, UK, November 2018

Preston mobility solutions

Connection with city centre

- By light rail with cheap park+rides
- By bicycle paths

- Less visiting cars in the centre
- Clean air
- Fast access to city
- Investment in local economy

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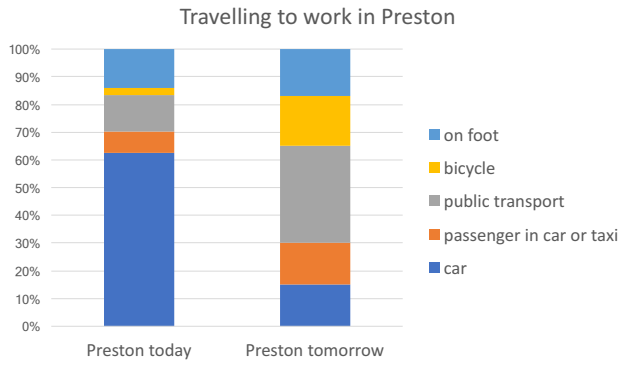
Preston mobility tomorrow



Low air quality, limited movement
Traffic jams
85 people killed or seriously injured (2016)
100 M£ per year on foreign fossil fuel
560 MWh of fossil fuel per year
150000 ton CO_2 per year

Better health
Improved reachability
Safe mobility
Better for local economy
340 MWh of renewable energy per year
0 ton CO_2 per year

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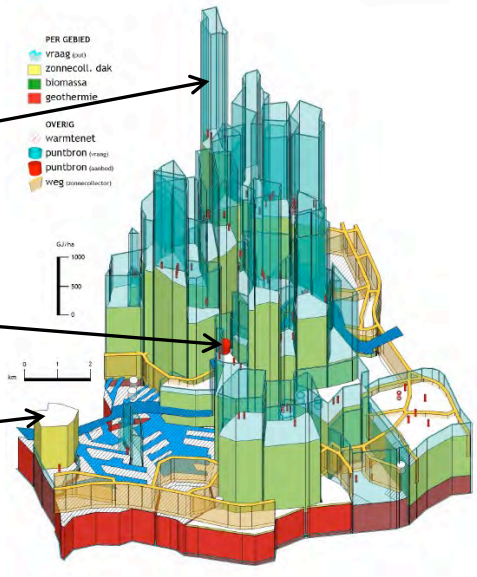
Making the built environment energetically smarter

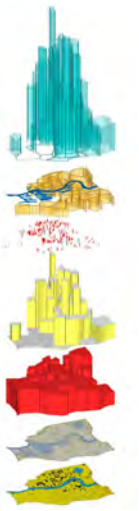
Reduce
reduce the demand

Reuse
attune programmatically, exchange, cascade, store

Produce
produce renewable energy



Heat map of Rotterdam [Broersma et al. 2010]



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Reduce

CITY-zen New urban energy ROADSHOW

Energy strategy: Prof Andy van den Dobbelsteen, Delft University of Technology

Preston, UK, November 2018

Reducing the energy demand

- **How far can we go with energy savings in the existing built environment?**
  This depends on type of neighbourhood, year of construction, building technology

- **General measures for existing buildings**
  - Post-insulation measures to the building envelope (cavity filling, wrapping, internal layers, crawl space foundation, entrance portals, conservatories)
  - Dynamic insulation: thick curtains, window shutters
  - Double or triple glazing, high-performance glass
  - Low-temperature heating: underfloor heating, air heating
  - Energy-efficient lighting, LED or e-saving fluorescent lighting
  - Energy-efficient appliances: washing machines, dishwashers, tellies, fridges
  - Exciting things: greenhouse over the building

CITY zen
New urban energy
ROADSHOW

Energy strategy: Prof Andy van den Dobbelsteen, Delft University of Technology

Preston, UK, November 2018

Example: the Home with a Skin (Prêt-à-Loger)

CITY zen
New urban energy
ROADSHOW

Energy strategy: Prof Andy van den Dobbelsteen, Delft University of Technology

Preston, UK, November 2018

Reuse

The different solutions under 'reduce'

- **Attune**
  - Programmatically combine urban functions that can be energetically in balance.
  - Combine functions in a building that can balance the demand, and use a central plant.
  - Apply peak shaving: use electricity when it is abundant and wait when it is short.
- **Exchange**
  - Reuse waste heat from exhaust air, waste water, sewage etc.
  - Exchange excessive heat with places with heat shortage.
- **Cascade**
  - Reuse waste heat at a lower temperature in a different function
  - Reuse waste heat from that, with an even lower temperature, in a next function.
- **Store**
  - Store residual energy, heat and electricity, diurnally.
  - Store residual energy, heat and electricity, interseasonally.

Energy strategy: Prof Andy van den Dobbelsteen, Delft University of Technology

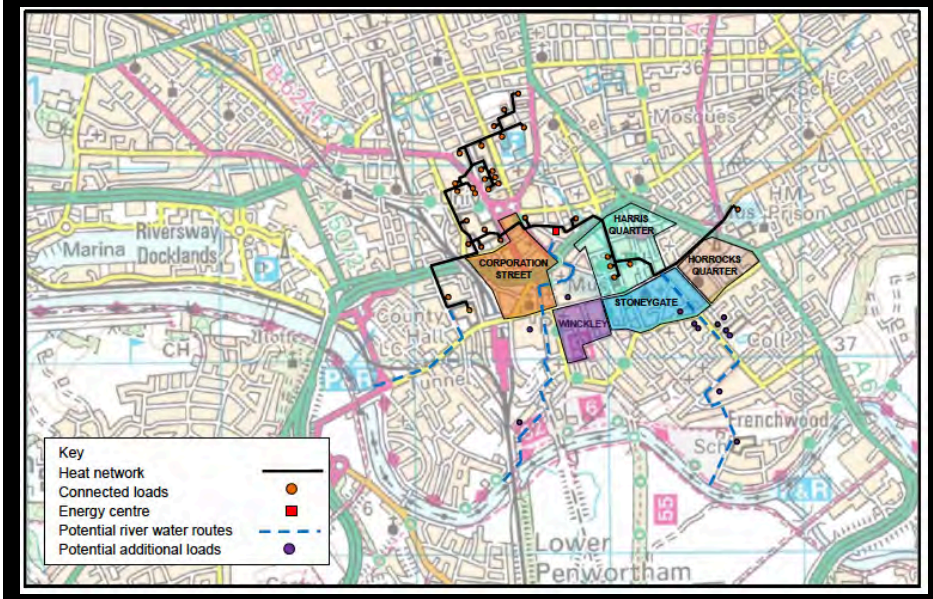
Preston, UK, November 2018

Parts of Preston that require sustainable heat

Energy strategy: Prof Andy van den Dobbelsteen, Delft University of Technology

Preston, UK, November 2018

The Preston heat network



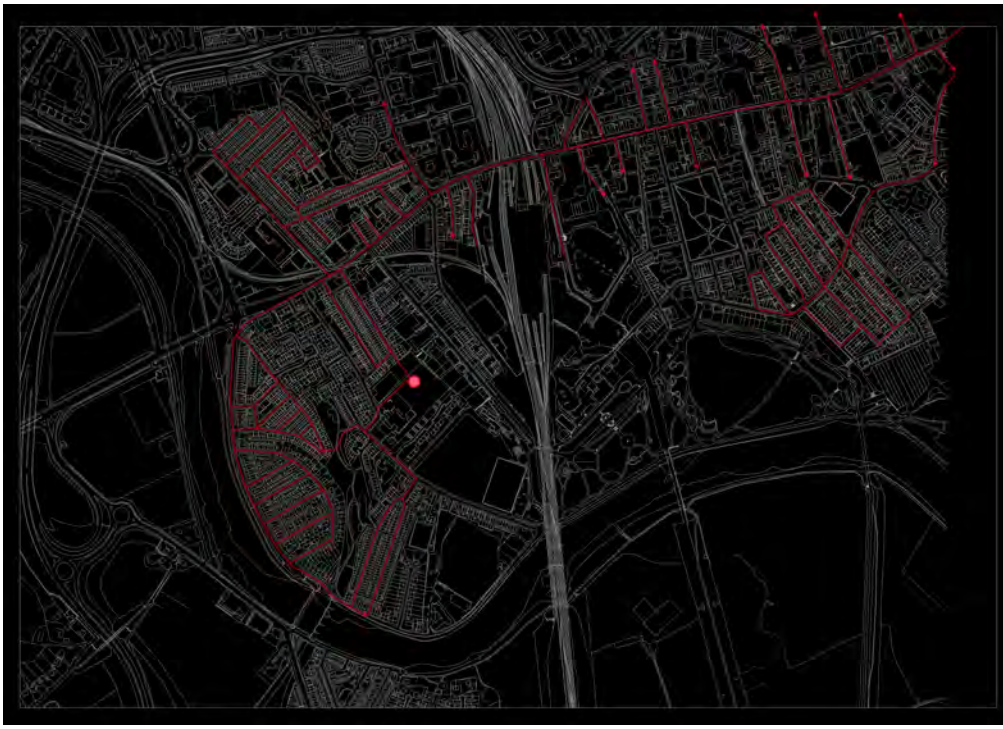
Preston City Centre Energy Master Plan [AECON 2018] identifies the need and possibility of **heat networks** in the city.

It identifies the following areas suited for a heat network:

- City centre
- UCLAN North
- UCLAN South
- Cardinal Newman

Energy strategy: Prof Andy van den Dobbelsteen, Delft University of Technology

Preston, UK, November 2018



CITY zen
New urban energy
ROADSHOW

Preston, UK, November 2018

The plan

1. The Preston HT heat network
- Fed by Recycling Lives (waste), biomass (in wintertime) and HT geothermal heat.
- Running from Recycling Lives towards the inner city, along Fishergate, to Broadgate.
- Supplying historic areas and neighbourhoods with too large a renovation challenge.

2. MT connections by return pipes of the HT heat network
- MT return temperature from HT supply.
- For newer inner-city developments and neighbourhoods renovated moderately.
- Eventually, a LT return will arrive at Recycling Lives, which is favourable.

3. Local MT heat grids
- Supplied by MT geothermal heat, solar heat (collectors and PVT), stored inter-seasonally at local energy facilities.
- Supplying neighbourhoods renovated moderately.

4. Local LT heat grids
- Supplied by LT sources as water, soil, datacentres, greenhouses, supermarkets etc.
- Supplying neighbourhoods renovated seriously.
- Individual heat pumps can boost up to hot water purposes.

HT: high-temperature
70+°C
challenged buildings,
poorly insulated

MT: mid-temperature
40-70°C
recent buildings,
better insulated

LT: low-temperature
25-40°C
highly efficient, well-insulated buildings

Energy strategy: Prof Andy van den Dobbelsteen, Delft University of Technology

CITY zen
New urban energy
ROADSHOW

Preston, UK, November 2018

Produce

Solar potential

Solar study

Energy strategy: Prof Andy van den Dobbelsteen, Delft University of Technology

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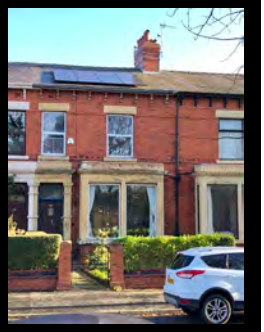
Solar potential of Broadgate



Energy strategy: Prof Andy van den Dobbelsteen, Delft University of Technology

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New urban energy
ROADSHOW

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Solar power from roofs

E = A x $\mathbf{I_s}$ x $\boldsymbol{\eta}$ (energy = area x solar irradiation x PV panel efficiency)

- Suitable roof area:
  - SE/SW: 21,416 m^2, 90% efficiency → 19,274 m^2 @100%
  - E/W: 8284 m^2, 70% efficiency → 5,799 m^2 @100%
  - S/flat: 6,122 m^2, 100% efficiency
- Solar irradiation, estimated: 800 kWh/m^2 (horizontal)
- PV panel efficiency (all included): 16% (monocrystalline)
- 50% heritage/architecture sensitive → BIPV, thin-film PV, with 12% efficiency

Energy potential:
E = 31,195 m^2 x 800 kWh/m^2 x 0.14 = 3.5 10^6 kWh = **3.5 GWh/year**

Solar power from facades

- Also vertical surfaces can be used for PV-panels or BIPV.
  - Efficiency of vertical planes (E, S, W): 0.6*16% = 9.6%
  - Suited facades of buildings ≥ 3 floors: 3,403 m^2

Energy potential from facades:
E = 3,403 m^2 * 800 m^2 * 0.096 = **0.26 GWh/year**

Total solar energy potential: E = 3.5 + 0.26 = **3.76 GWh/year**

For Broadgate only

Biomass potential in the Broadgate vicinity

Energy strategy: Prof Andy van den Dobbelsteen, Delft University of Technology

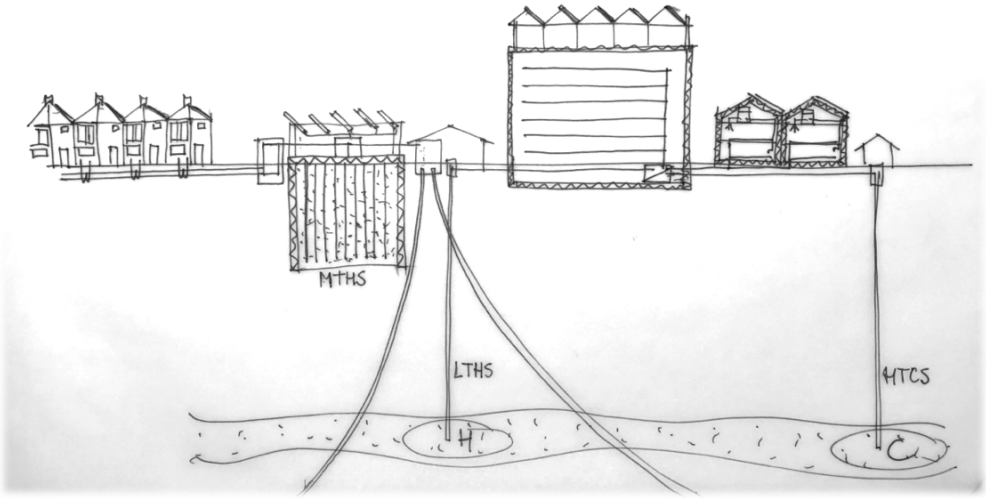
Preston, UK, November 2018

Beautiful parks and greens with biomass (from cuttings)

Energy strategy: Prof Andy van den Dobbelsteen, Delft University of Technology

Preston, UK, November 2018

Geothermal options for Broadgate



- Deep geothermal (500-5000 m) 40-120°C
- Middle level (100-500 m) 15-40°C suited for ATES
- Shallow soil (0-100 m) 5-15°C suited for BTES
- Ecovat storage solutions (MT, 40-70°C)

Energy strategy: Prof Andy van den Dobbelsteen, Delft University of Technology

Preston, UK, November 2018

Tidal energy plant in the Ribble River

E = M x **g** x **Δh** x **η** (energy = mass x gravity x height difference x turbine efficiency)

- Tidal difference: approx. 3.6 m on average; 1.8 m plus, 1.8 m minus
- River cross section: 50 m x 1.8 m flowing in or out
- Tidal speed: 7 km/h max, 3.5 km/h on average (this is approx. 2 m/s)
  Distance covered 3.5 km/h = 84 km/day
- 84,000 m x 50 m x 1.8 m = 7,560,000 m^3/day
- 7,560,000 m^3 x 1027 kg/m^3 = 7,764,000,000 kg of salt water mass @10°C
- 60% turbine efficiency

Total energy potential: E = 7.76 10^9 x 9.82 x 1.6 x 0.6 = 73.2 10^9 J = 73.2 GJ/day
→ 26.7 TJ per year = **96.2 GWh per year**

For Preston as a whole → 96.2*0.026 = 2.5 GWh for Broadgate

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New urban energy
ROADSHOW

Energy strategy: Prof Andy van den Dobbelsteen, Delft University of Technology

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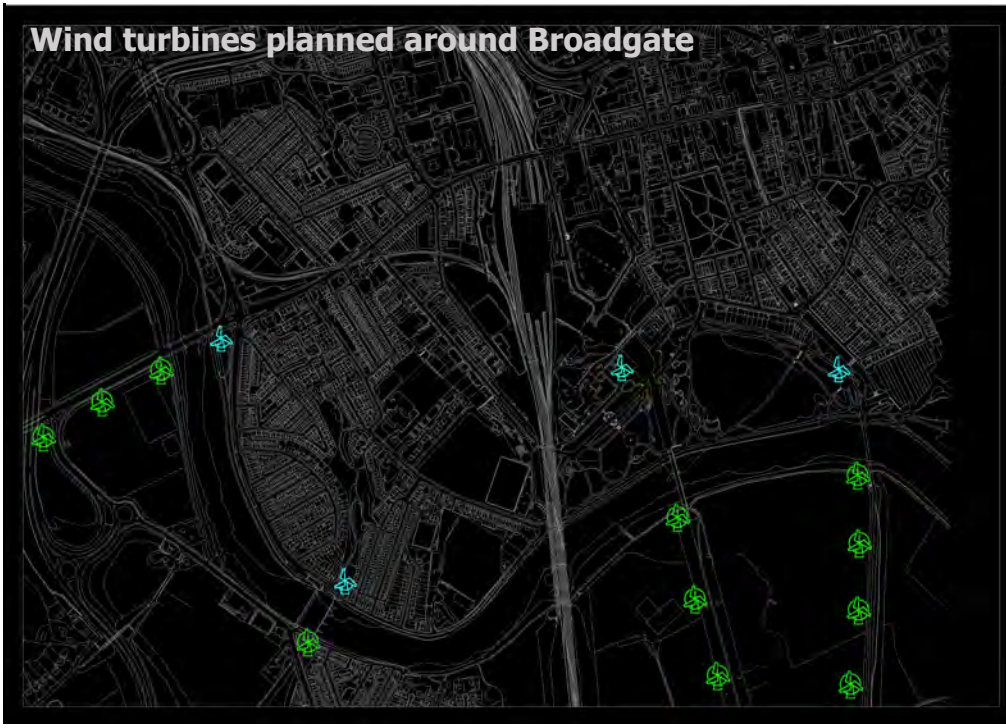
Wind turbines planned around Broadgate



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Wind energy

E = # x **P** x **h** (energy = number of turbines x turbine power x operation hours)

- Possible # of wind turbines: PM1 large ones, PM2 modest ones
- Turbine power: 3 MW (large ones), 1 MW (modest ones)
- Operation hours, pessimistic estimation: 1500 hours

Total energy potential:

E = 15 x 3 x 1500 + 4 x 1 x 1500 = 67.5 10^3 + 6 10^3 MWh = **73.5 GWh/year**

For Preston as a whole → 73.5*0.026 = 1.9 GWh for Broadgate

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New urban energy
ROADSHOW

Energy strategy: Prof Andy van den Dobbelsteen, Delft University of Technology

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Broadgate neighbourhoods

1. Terraced mirrored houses at **Lauderdale / Grafton Street**
2. Terraced houses next to the river at **Broadgate Boulevard**
3. Terraced houses near The Continental at **South Meadow Lane**
4. Apartment blocks of **Meadow Court**
5. The **Gujarat / St. Stephen's** Community Centre
6. Social housing at **Hassett Close**
7. The **Beech Street** neighbourhood

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Energy strategy: Prof Andy van den Dobbelsteen, Delft University of Technology

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1. Lauderdale / Grafton Street

Waste dump behind and in front of the houses

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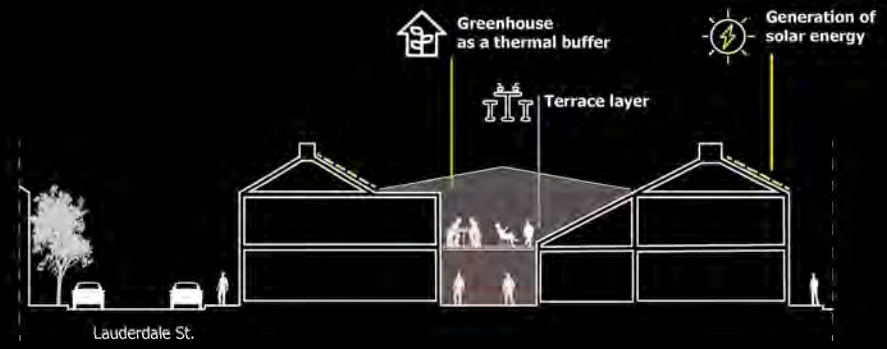
Energy strategy: Prof Andy van den Dobbelsteen, Delft University of Technology

Preston, UK, November 2018

Solution



Energy strategy: Prof Andy van den Dobbelsteen, Delft University of Technology

Preston, UK, November 2018

2. Broadgate Boulevard

Energy strategy: Prof Andy van den Dobbelsteen, Delft University of Technology

Preston, UK, November 2018

Potentially the Chiswick of Preston (not now)

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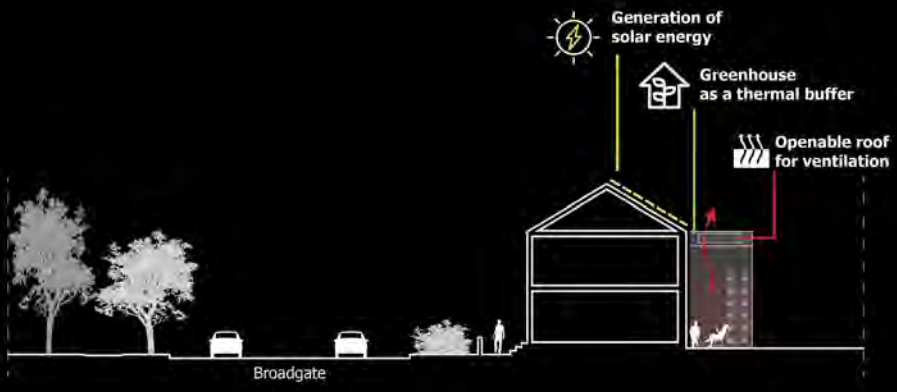
New urban energy
ROADSHOW

Energy strategy: Prof Andy van den Dobbelsteen, Delft University of Technology

Preston, UK, November 2018

Solution



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New urban energy
ROADSHOW

Energy strategy: Prof Andy van den Dobbelsteen, Delft University of Technology

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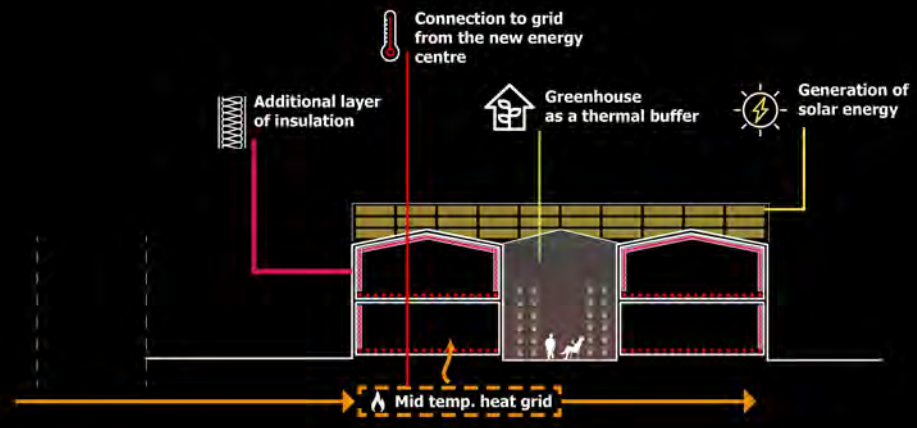
3. South Meadow Lane

CITY zen
New urban energy
ROADSHOW

Energy strategy: Prof Andy van den Dobbelsteen, Delft University of Technology

Preston, UK, November 2018

Solution



CITY zen
New urban energy
ROADSHOW

Energy strategy: Prof Andy van den Dobbelsteen, Delft University of Technology

Preston, UK, November 2018

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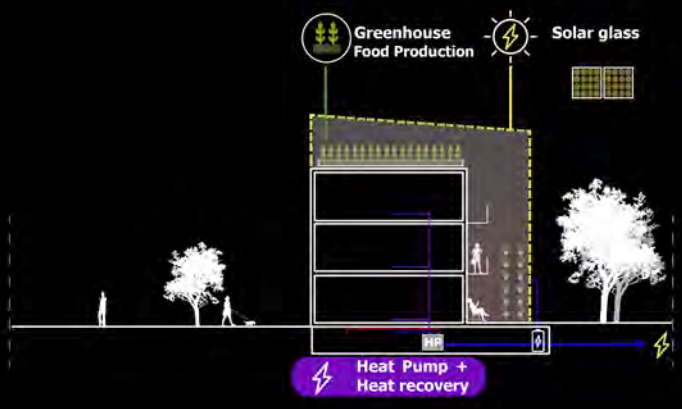

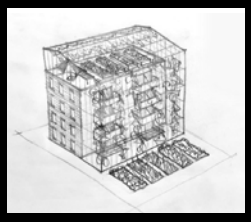

CITY zen
New urban energy
ROADSHOW

Energy strategy: Prof Andy van den Dobbelsteen, Delft University of Technology

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5. Gujarat / St. Stephen's Community Centre

Energy strategy: Prof Andy van den Dobbelsteen, Delft University of Technology

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6. Gujarat / St. Stephen's Community Centre

- **A new centre for the whole district of Broadgate**
- **Inframedion**
  - Neighbourhood energy facility: local low-temperature and mid-temperature network
  - Geothermal heat source (700-1000 m deep, 50-60°C)
  - Inter-seasonal heat storage (Ecovat for MT heat, ATES for LT heat)
  - Separated waste collection and processing, second-hand shops
  - Waste water treatment (grey water) with nutrient recovery and biogas production
- **Social community centre**

HT: high-temperature 70+°C
challenged buildings, poorly insulated

MT: mid-temperature 40-70°C
recent buildings, better insulated

LT: low-temperature 25-40°C
highly efficient, well-insulated buildings

Energy strategy: Prof Andy van den Dobbelsteen, Delft University of Technology

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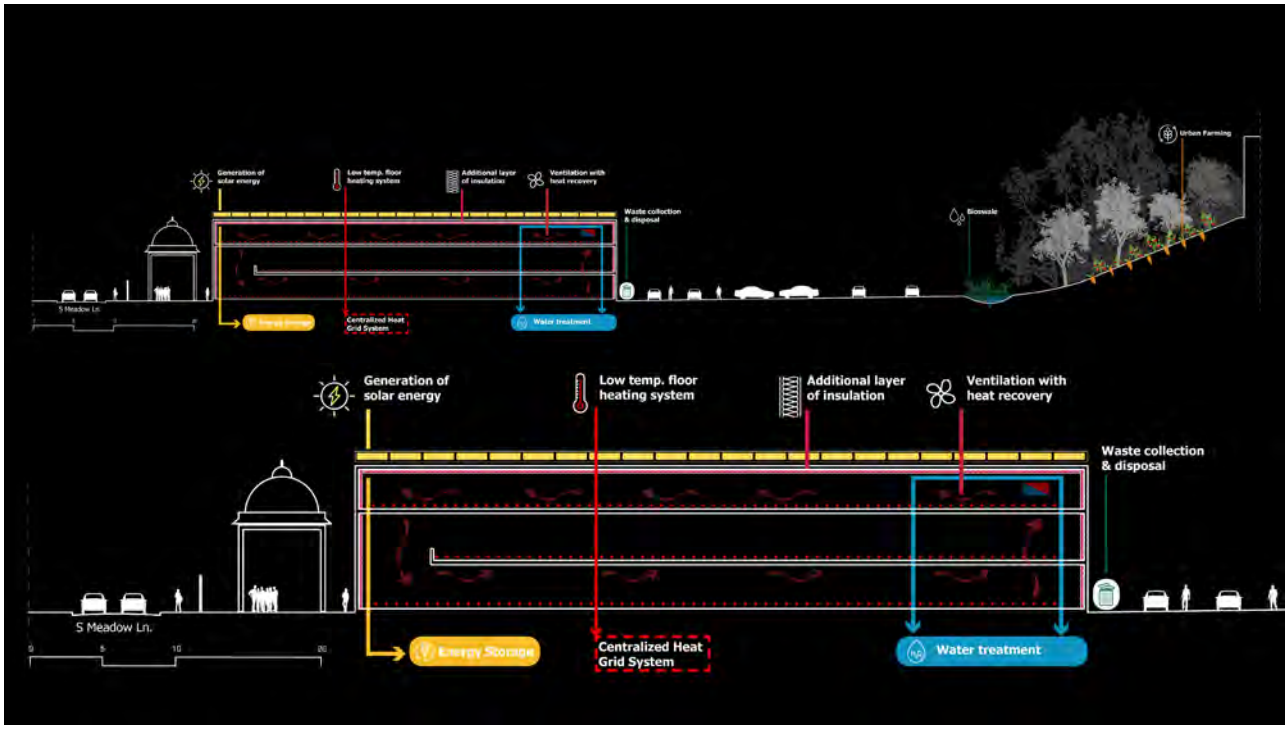

Local MT/LT heat network from the Gujarat/St. Stephen facility

Energy strategy: Prof Andy van den Dobbelsteen, Delft University of Technology

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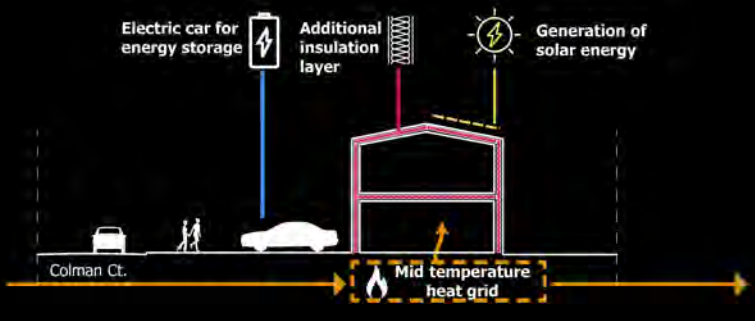
6. Hassett Close – social and sheltered housing

Solution



Energy strategy: Prof Andy van den Dobbelsteen, Delft University of Technology

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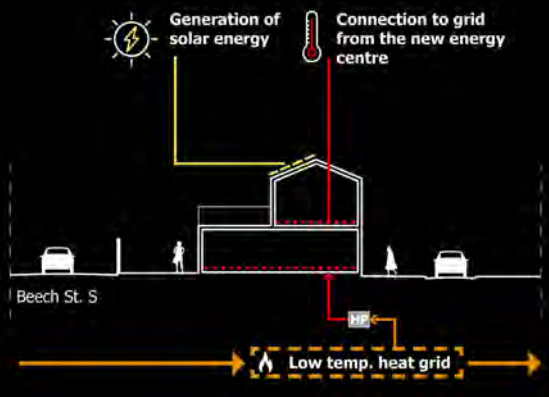
Solution



Energy strategy: Prof Andy van den Dobbelsteen, Delft University of Technology

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Greg Keeffe Urban Design Strategy

Urban design strategy: Prof Greg Keeffe, Queens University, Belfast.

QUEEN'S UNIVERSITY BELFAST

Professor of
Architecture + Urbanism
Head of School,
Natural and
Built Environment

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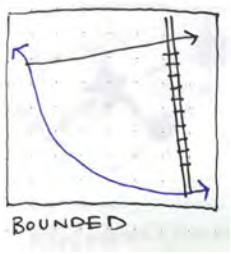
Urban Design: Context. Form of the neighbourhood



Context

Form - Bounded
Road
River
Train
City

Urban design strategy: Prof Greg Keeffe, Queens University, Belfast.

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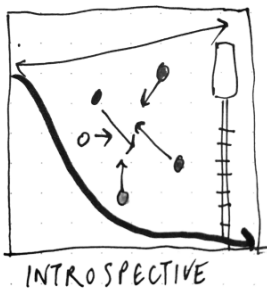
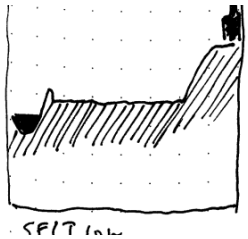
Urban Design: Context

Urban design strategy: Prof Greg Keeffe, Queens University, Belfast.

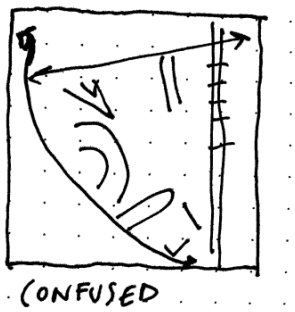




Preston, UK, November 2018

Urban Design: Context

Urban design strategy: Prof Greg Keeffe, Queens University, Belfast.



Context - Morphology

Many conflicting urban layouts

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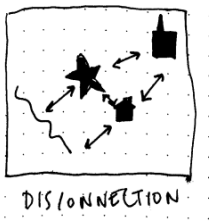
Urban Design: Context

Urban design strategy: Prof Greg Keeffe, Queens University, Belfast.



Morphology- Disconnected

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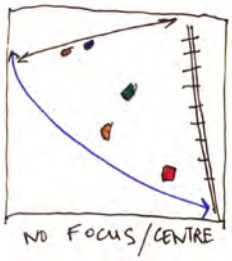
Urban Design: Context

Urban design strategy: Prof Greg Keeffe, Queens University, Belfast.



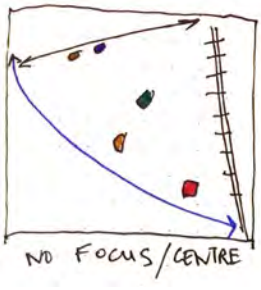
Context – Content

Low density. 37 home/ha
No other functions
No focus
Functions externalized

Preston, UK, November 2018

Urban Design: Context

Urban design strategy: Prof Greg Keeffe, Queens University, Belfast.



Context – Content

Low density. 37 home/ha
Mainly housing -
poor choice –
not urban

Urban Design: Issues

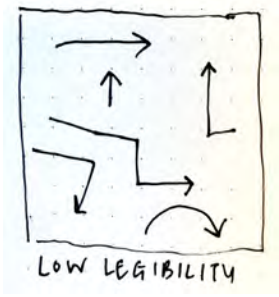
Urban design strategy: Prof Greg Keeffe, Queens University, Belfast.

Issues

Poor stock
Energetically.
Market.
little economic investment

Urban Design: Issues

Crescent
Squish
Ladders
Higgledy Piggledy
Loopville
Stuff



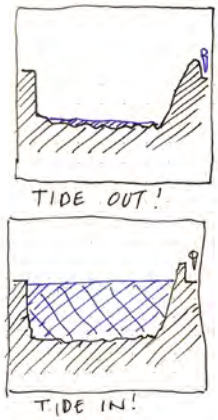
Issues

Low legibility of space difficult to address.

Urban design strategy: Prof Greg Keeffe, Queens University, Belfast.

Preston, UK, November 2018

Urban Design: Issues



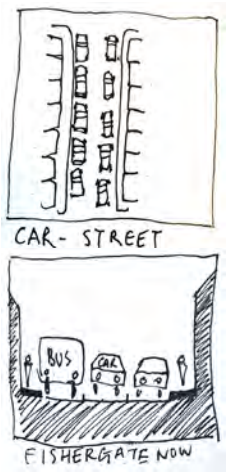
Issues
River -
What river? –
River seen as a danger

Urban design strategy: Prof Greg Keeffe, Queens University, Belfast.

Preston, UK, November 2018

Urban Design: Issues

Urban design strategy: Prof Greg Keeffe, Queens University, Belfast.



Issues
Car – Road dominating
Car - Street parking

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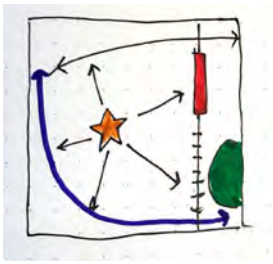
Urban Design: Solutions

Urban design strategy: Prof Greg Keeffe, Queens University, Belfast.



Solutions
Connect….

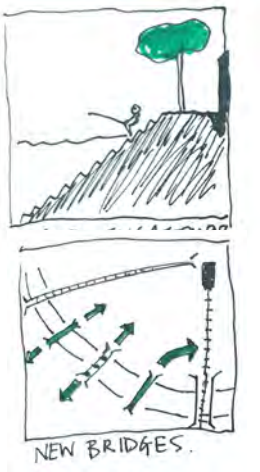
To the city
To itself

CITY-zen New urban energy ROADSHOW

Preston, UK, November 2018

Urban Design: Solutions

Urban design strategy: Prof Greg Keeffe, Queens University, Belfast.



To the river
To the greenspace

Preston, UK, November 2018

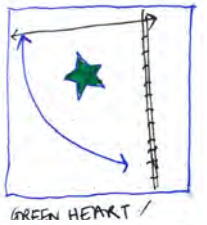
Urban Design: Solutions

Urban design strategy: Prof Greg Keeffe, Queens University, Belfast.

Preston, UK, November 2018

Urban Design: Solutions

Urban design strategy: Prof Greg Keeffe, Queens University, Belfast.



Connect
To greenspace
Greenspace to communi

CITY-zen New urban energy ROADSHOW

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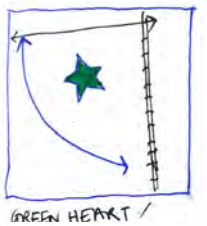
Urban Design: Solutions

Urban design strategy: Prof Greg Keeffe, Queens University, Belfast.



Connect
To greenspace
Greenspace to communi

CITY-zen New urban energy ROADSHOW

Preston, UK, November 2018

Urban Design: Solutions

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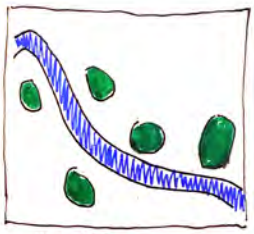
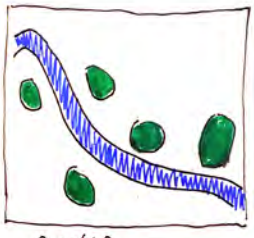


CITY zen
New urban energy
ROADSHOW

Preston, UK, November 2018

Urban Design: Solutions

Urban design strategy: Prof Greg Keeffe, Queens University, Belfast.



CITY zen
New urban energy
ROADSHOW

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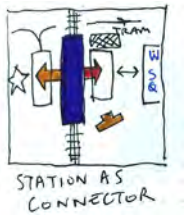
Urban Design: Solutions

Urban design strategy: Prof Greg Keeffe, Queens University, Belfast.

Preston, UK, November 2018

Urban Design: Solutions



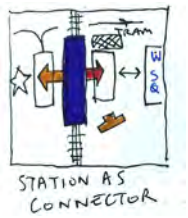
Connect to city
New gateway

Urban design strategy: Prof Greg Keeffe, Queens University, Belfast.

Preston, UK, November 2018

Urban Design: Solutions

Urban design strategy: Prof Greg Keeffe, Queens University, Belfast.



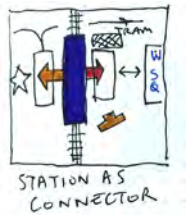
Connect to city

CITY-zen
New urban energy
ROADSHOW

Preston, UK, November 2018

Urban Design: Solutions

Urban design strategy: Prof Greg Keeffe, Queens University, Belfast.



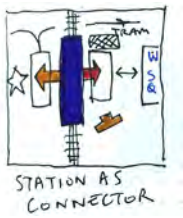
Connect to city
New gateway

CITY-zen
New urban energy
ROADSHOW

Preston, UK, November 2018

Urban Design: Solutions

Urban design strategy: Prof Greg Keeffe, Queens University, Belfast.



Tram station

CITY-zen New urban energy ROADSHOW

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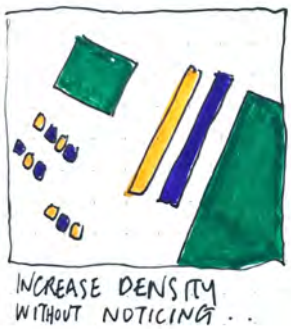
Urban Design: Solutions

Urban design strategy: Prof Greg Keeffe, Queens University, Belfast.



Solutions
Increase density.
by stealth

CITY-zen New urban energy ROADSHOW

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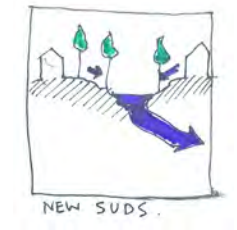
Urban Design: Solutions



Urban design strategy: Prof Greg Keeffe, Queens University, Belfast.

Preston, UK, November 2018

Urban Design: Solutions

Give people
Green space

Urban design strategy: Prof Greg Keeffe, Queens University, Belfast.

Preston, UK, November 2018

Urban Design: Solutions

Urban design strategy: Prof Greg Keeffe, Queens University, Belfast.

Free greenspace for kids

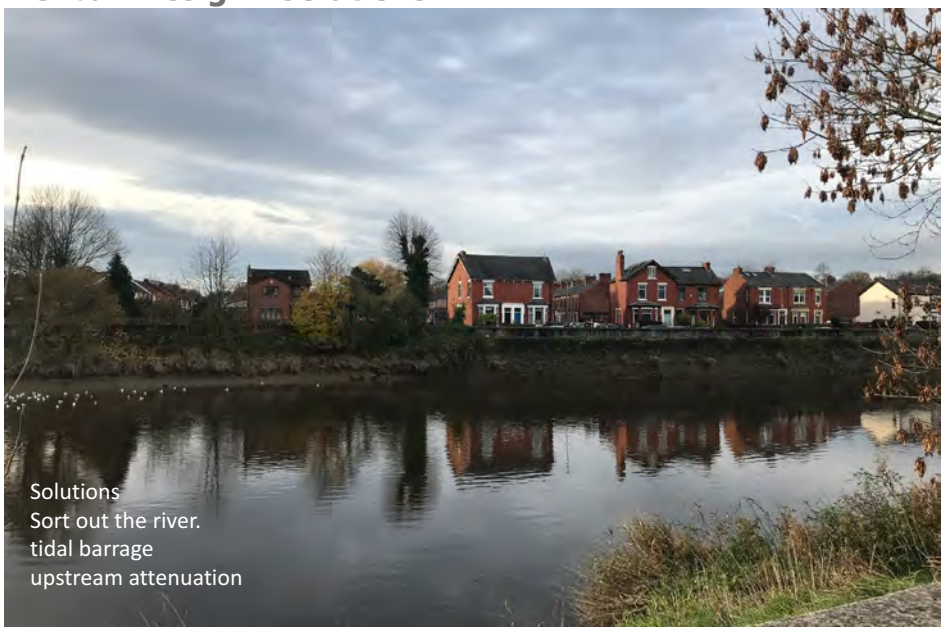
Preston, UK, November 2018

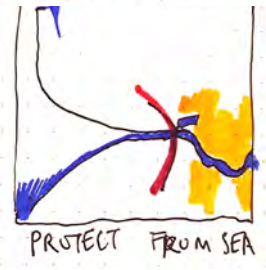
Urban Design: Solutions

Urban design strategy: Prof Greg Keeffe, Queens University, Belfast.

Preston, UK, November 2018

Urban Design: Solutions





Urban design strategy: Prof Greg Keeffe, Queens University, Belfast.

Preston, UK, November 2018

Urban Design: Solutions

Solutions
Sort out the river
Weirs
City attenuation

Urban design strategy: Prof Greg Keeffe, Queens University, Belfast.

Preston, UK, November 2018

Urban Design: Solutions

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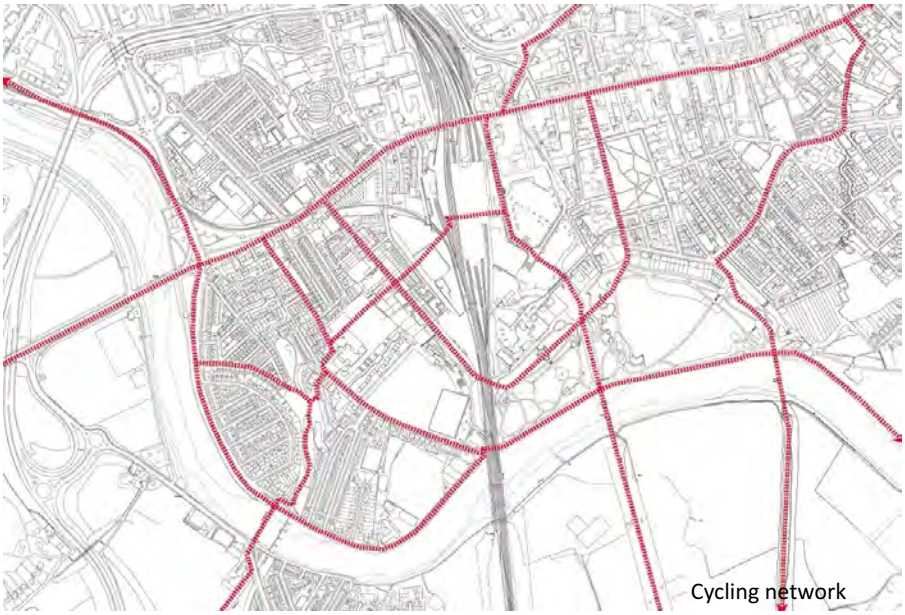
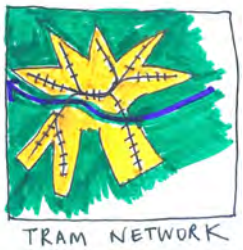




Urban design strategy: Prof Greg Keeffe, Queens University, Belfast.

Preston, UK, November 2018

Urban Design: Solutions

Urban design strategy: Prof Greg Keeffe, Queens University, Belfast.

Solutions

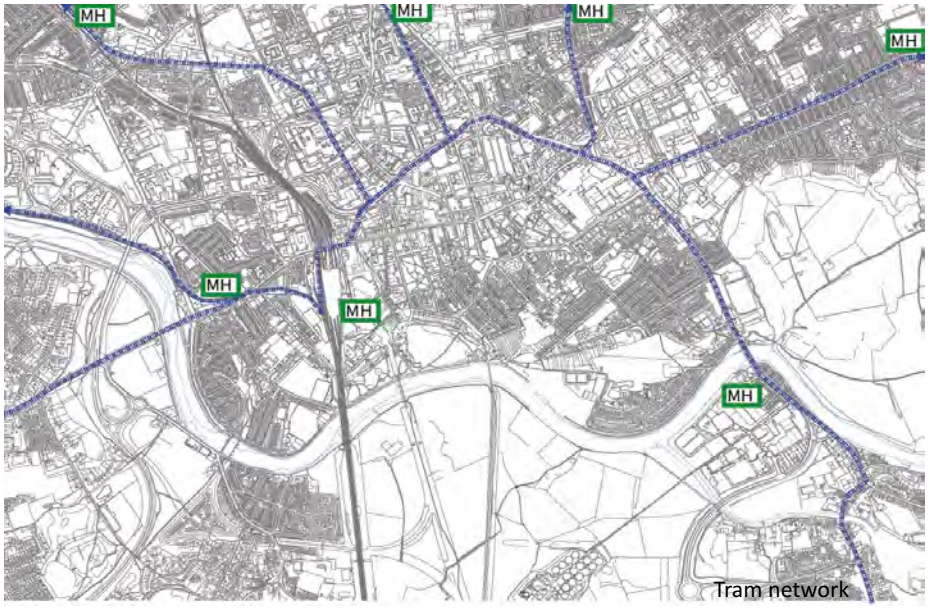
Sort out the river.

new boulevard cycling
softer engagement
energy landscape. Turbines

CITY zen
New urban energy
ROADSHOW

Preston, UK, November 2018

Urban Design: Solutions



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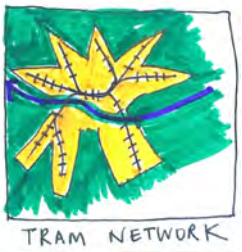
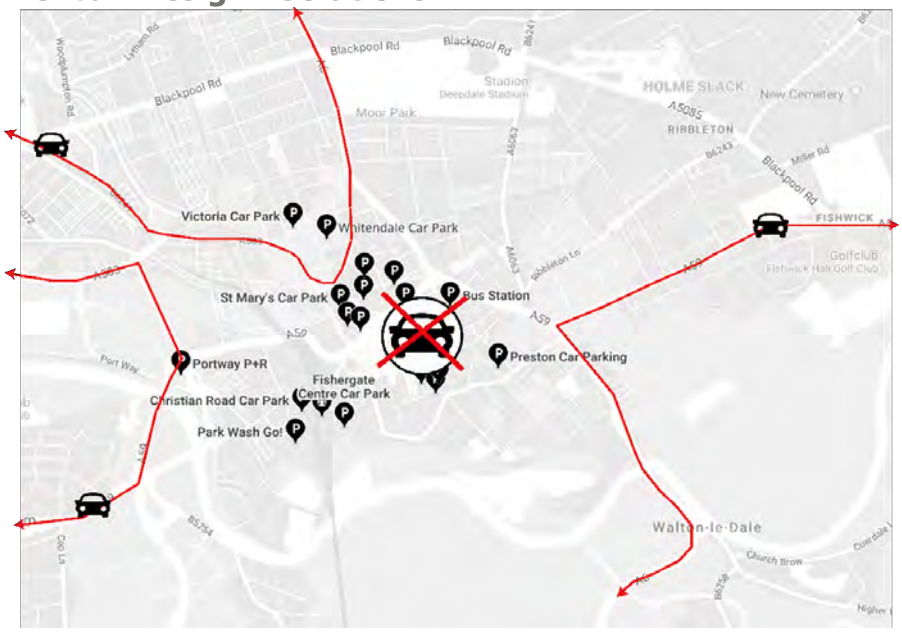


CITY zen
New urban energy
ROADSHOW

Preston, UK, November 2018

Urban Design: Solutions



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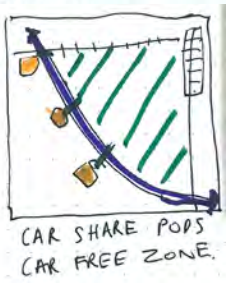

CITY zen
New urban energy
ROADSHOW

Preston, UK, November 2018

Urban Design: Solutions

Urban design strategy: Prof Greg Keeffe, Queens University, Belfast.

CITY zen
New urban energy
ROADSHOW

Preston, UK, November 2018

Urban Design: Solutions

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CITY-zen
New urban energy
ROADSHOW

Preston, UK, November 2018

Urban Design: Solutions

Urban design strategy: Prof Greg Keeffe, Queens University, Belfast.

Centre of the neighbourhood.

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New urban energy
ROADSHOW

Preston, UK, November 2018

Urban Design: Solutions

Urban design strategy: Prof Greg Keeffe, Queens University, Belfast.

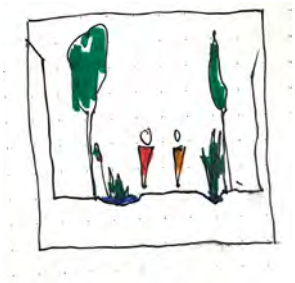
New neighbourhood
Centre:
Creche
Shops, Public space

CITY zen
New urban energy
ROADSHOW

Preston, UK, November 2018

Urban Design: Solutions

Urban design strategy: Prof Greg Keeffe, Queens University, Belfast.



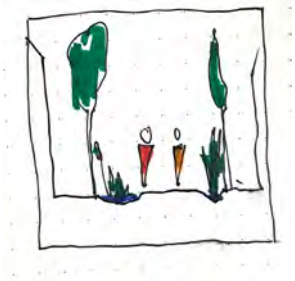
Solutions

Neighbourhood
shared space

CITY zen
New urban energy
ROADSHOW

Preston, UK, November 2018

Urban Design: Solutions



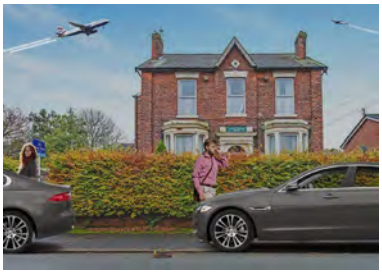
Solutions

Neighbourhood shared space

Urban design strategy: Prof Greg Keeffe, Queens University, Belfast.

Preston, UK, November 2018

Urban Design: Real lives



"Hi I'm John,
I work as a lung consultant I the hospital. I live in South Ribble. I see daily, the issues air pollution causes in the population, particularly in the inner-city.

Being forced to drive my diesel Audi everyday was killing me: I wanted for some time to make a difference, but my wife said it was too dangerous to cycle to work. The new cycleway along green routes and through Broadgate allows me a safe and faster way to town, without polluting. I'm feeling fitter myself.

Stopping on the way home to pick up some Okra, made me realise that people aren't just a pair of lungs."

Urban design strategy: Prof Greg Keeffe, Queens University, Belfast.

Preston, UK, November 2018

Urban Design: Real lives

Urban design strategy: Prof Greg Keeffe, Queens University, Belfast.

Hi I'm Deepti,

"I've lived in Broadgate for some time, and my kids are teenagers, so I have a little more time on my hands than I used to have. I've started my own urban farm growing hard-to-get Asian vegetables, which I sell at the weekend in the new public space.

I'm meeting so many more people now, and the new public park allows my kids to hang out in the evening without annoying people. The new river works are much safer, and I don't worry about my kids drowning any more. "

CITY-zen New urban energy ROADSHOW

Preston, UK, November 2018

Urban Design: Real lives

Urban design strategy: Prof Greg Keeffe, Queens University, Belfast.

Hi, I'm Satish,
"I've just graduated from UCLAN and I'm working in IT in the city. I like the urban lifestyle and I'm a fitness geek. I row on the River, play Cricket and cycle. Broadgate is a great place to live: I have all the urban stuff, but I'm also part of a great community, and I help out at the Gujarat Centre.

The mix of urban and rural, and old and new cultures is perfect for me… housing is cheap and with low energy costs and no need for a car, I'm saving to buy my own place.

The electric car share is great: I can hire a van to go mountain-biking in Gisburn with my mates, and a hatchback to take my mum to the Trafford Centre."

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Urban Design: Real lives

"Hi, I'm Lauren,
I'm a young mum and I live with my partner and my two kids (5 and 1) in Broadgate. It's a very green neighbourhood, and brilliant for families. I can leave the youngest at the new creche and my 5-year old at School and go to work in the shop on Fishergate, knowing that they're nearby.

My partner cycles to BAE Warton on green routes each day, and we go cycling with the kids upstream for miles without seeing a car.

The new streets are car-free, so the kids will be able to play outside without me worrying and the urban greenery cleans the air and connects us with nature. Our house is fossil free, so it costs nothing to run.

It's great to have such a compact lifestyle, with no need for a car…"

Urban design strategy: Prof Greg Keeffe, Queens University, Belfast.

Preston, UK, November 2018

Urban Design: Celebrate and enjoy your amazing city!

Urban design strategy: Prof Greg Keeffe, Queens University, Belfast.

Preston, UK, November 2018

Urban Design: Celebrate and enjoy your amazing city!

But what's the cost
Of doing it???

CITY-zen
New urban energy
ROADSHOW

Urban design strategy: Prof Greg Keeffe, Queens University, Belfast.

Preston, UK, November 2018

Urban Design: Celebrate and enjoy your amazing city!

But what's the cost
Of NOT doing it?
Socially….
Economically….
Climatically…..

CITY-zen
New urban energy
ROADSHOW

Urban design strategy: Prof Greg Keeffe, Queens University, Belfast.

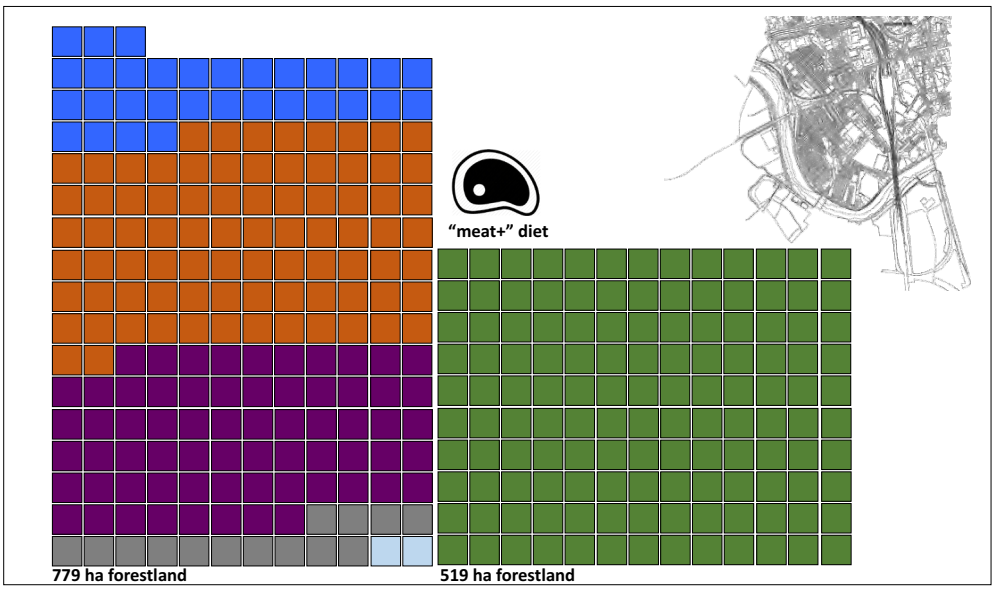
Preston, UK, November 2018

Now, let's see how much of the carbon emissions can be reduced…

Energy strategy: Prof Andy van den Dobbelsteen, Delft University of Technology

Preston, UK, November 2018

Food impact (meat+ diet)

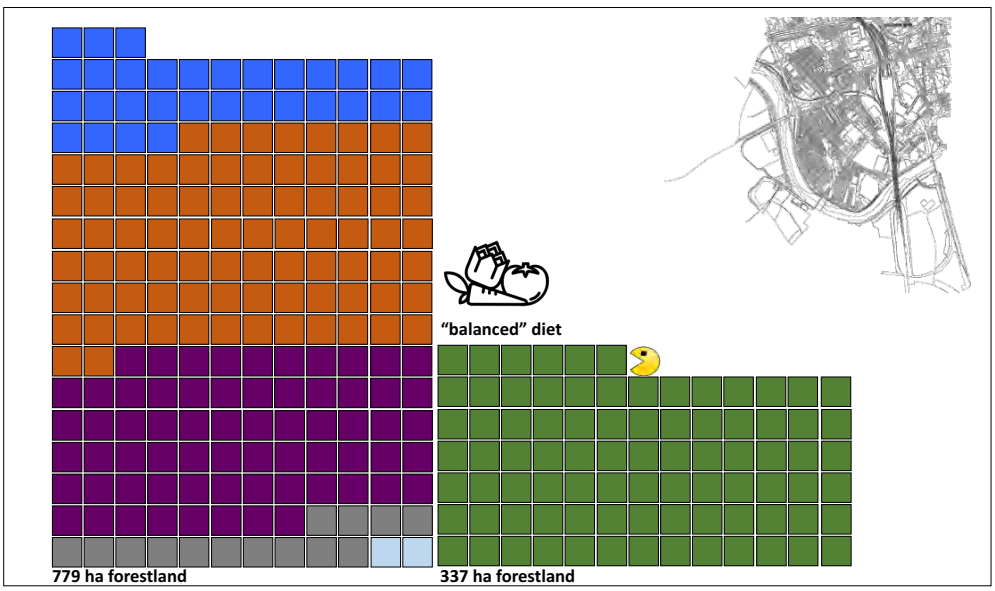


ELECTRICITY
NATURAL GAS
MOBILITY
WASTE
WATER
FOOD

Energy strategy: Prof Andy van den Dobbelsteen, Delft University of Technology

Preston, UK, November 2018

Food impact (balanced diet)



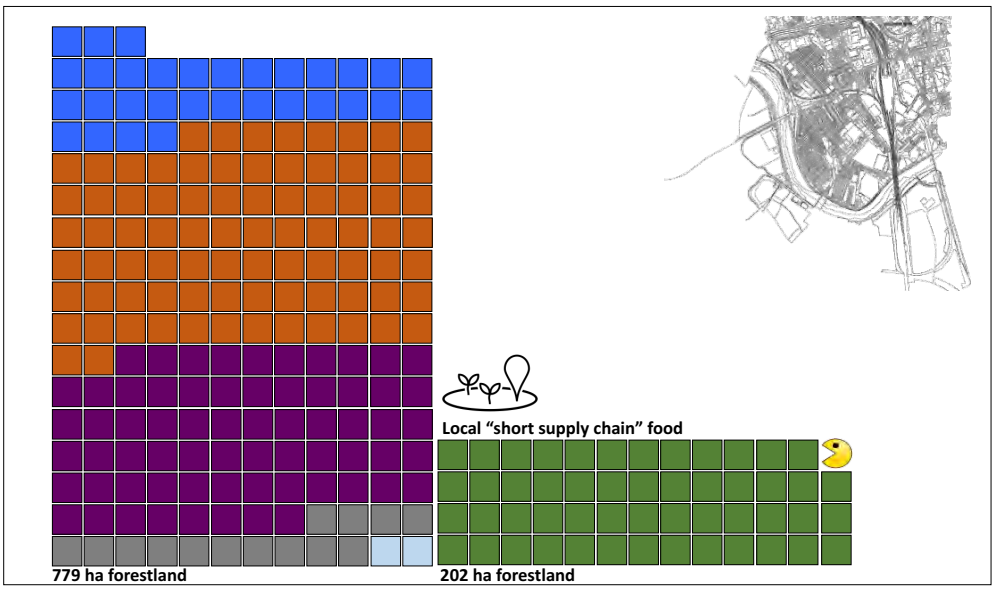
ELECTRICITY
NATURAL GAS
MOBILITY
WASTE
WATER
FOOD

CITY-zen
New urban energy
ROADSHOW

Carbon accounting: Dr. Riccardo M. Pulselli, University of Siena, Siena

Preston, UK, November 2018

Food impact (short supply chain)



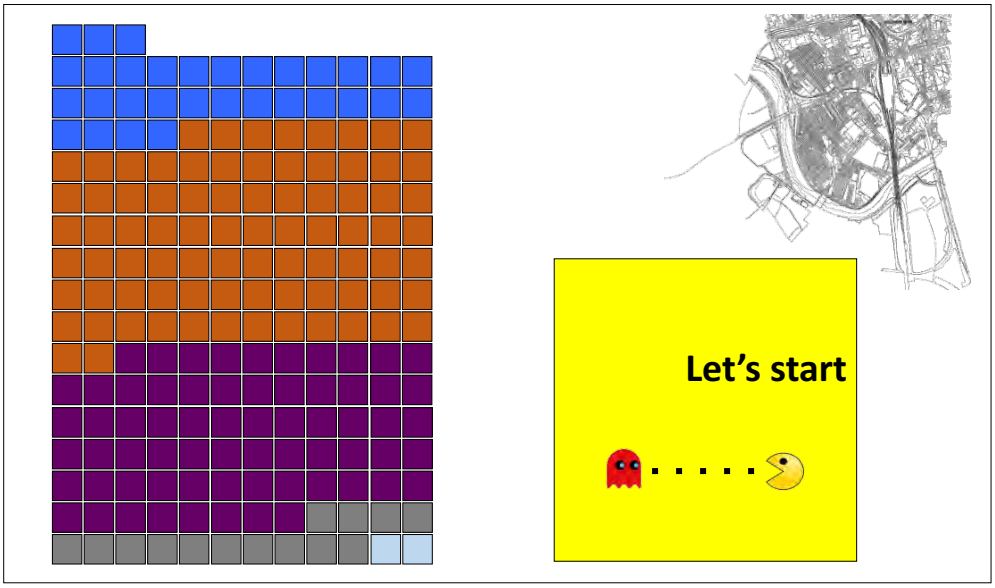
ELECTRICITY
NATURAL GAS
MOBILITY
WASTE
WATER
FOOD

CITY-zen
New urban energy
ROADSHOW

Carbon accounting: Dr. Riccardo M. Pulselli, University of Siena, Siena

Preston, UK, November 2018

Carbon Footprint mitigation of the Broadgate neighbourhood



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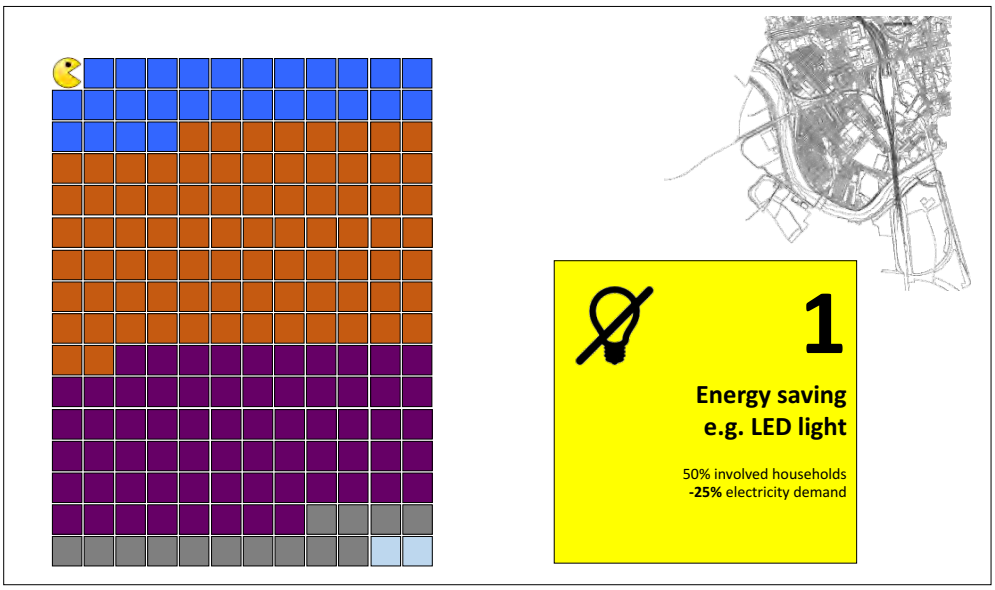

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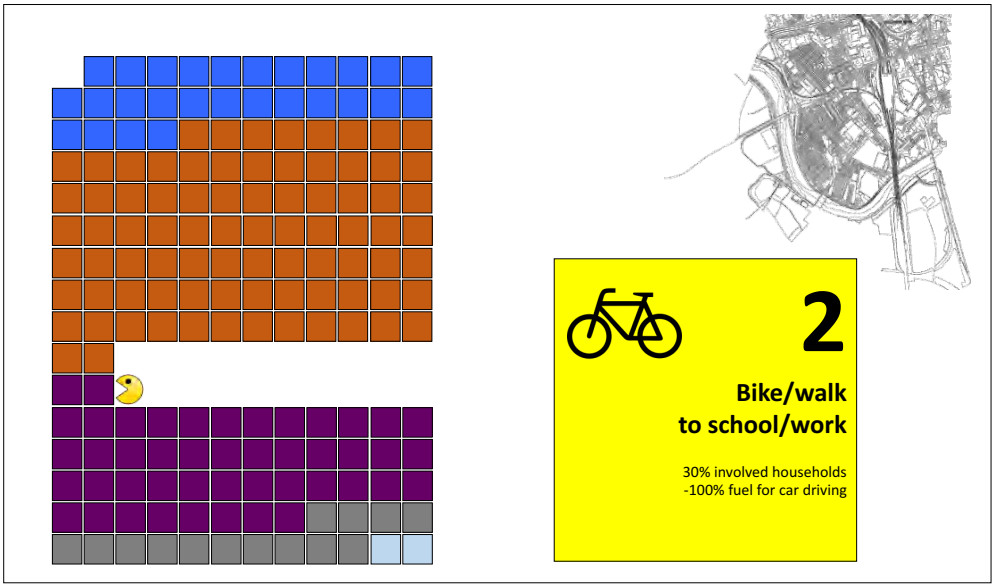

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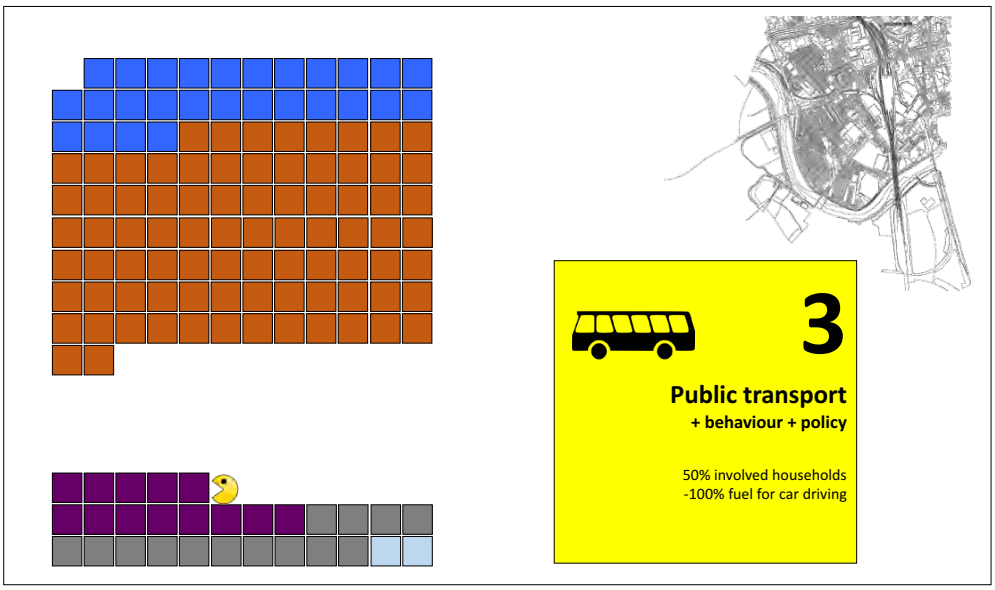

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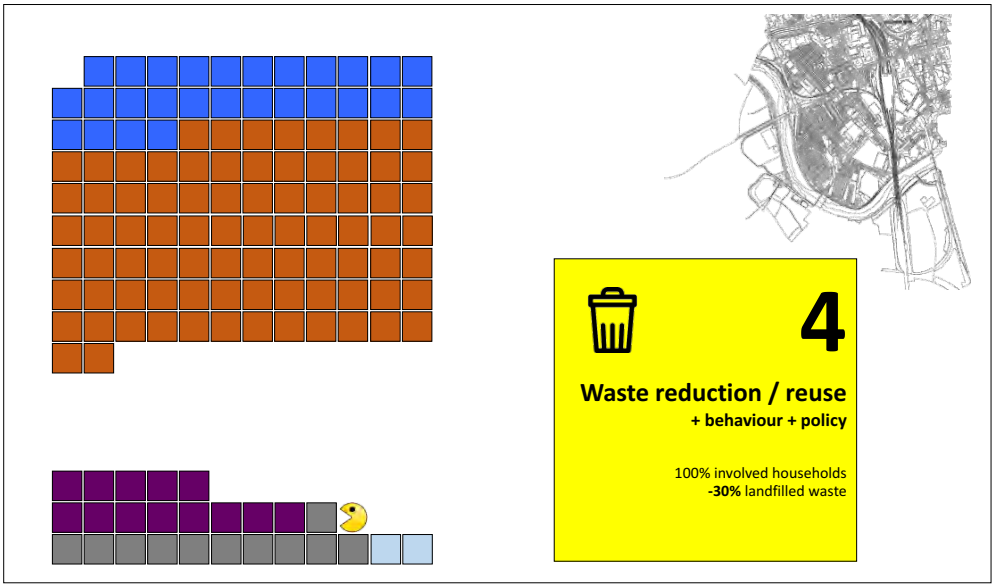

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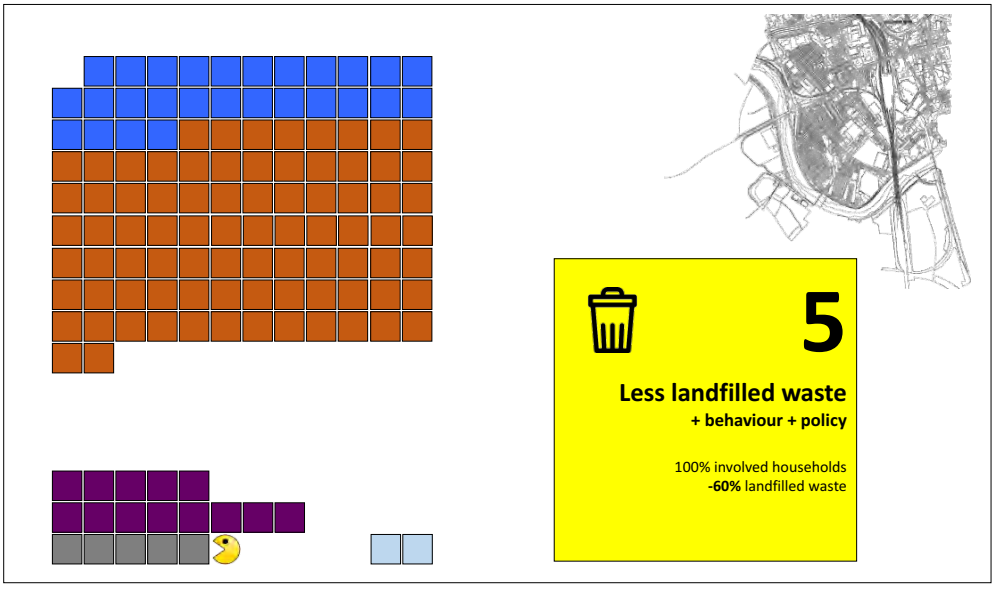

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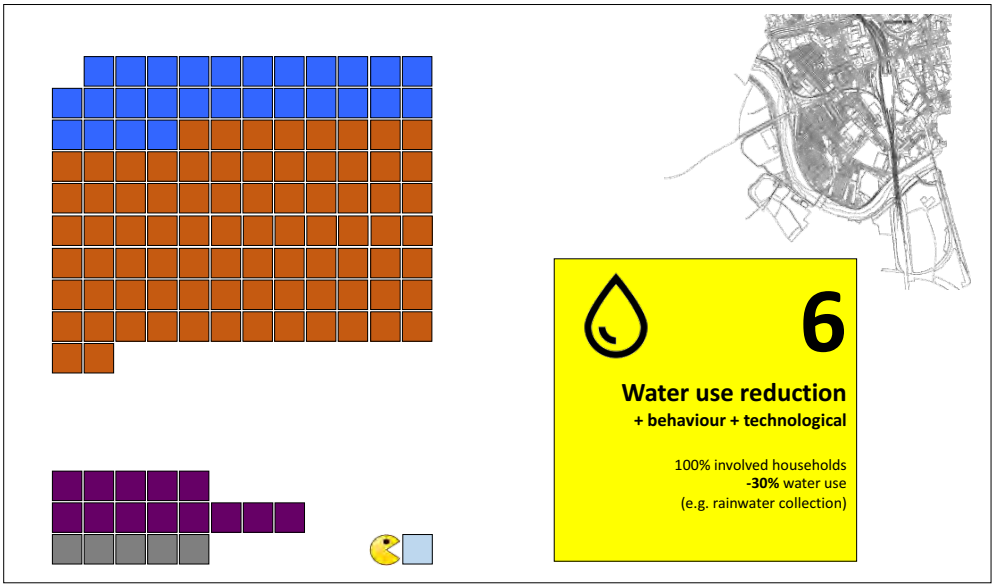

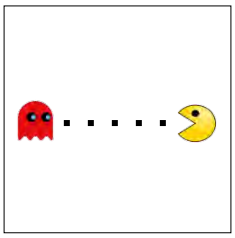

ELECTRICITY
NATURAL GAS
MOBILITY
WASTE
WATER

Carbon accounting: Dr. Riccardo M. Pulselli, University of Siena, Siena

Preston, UK, November 2018

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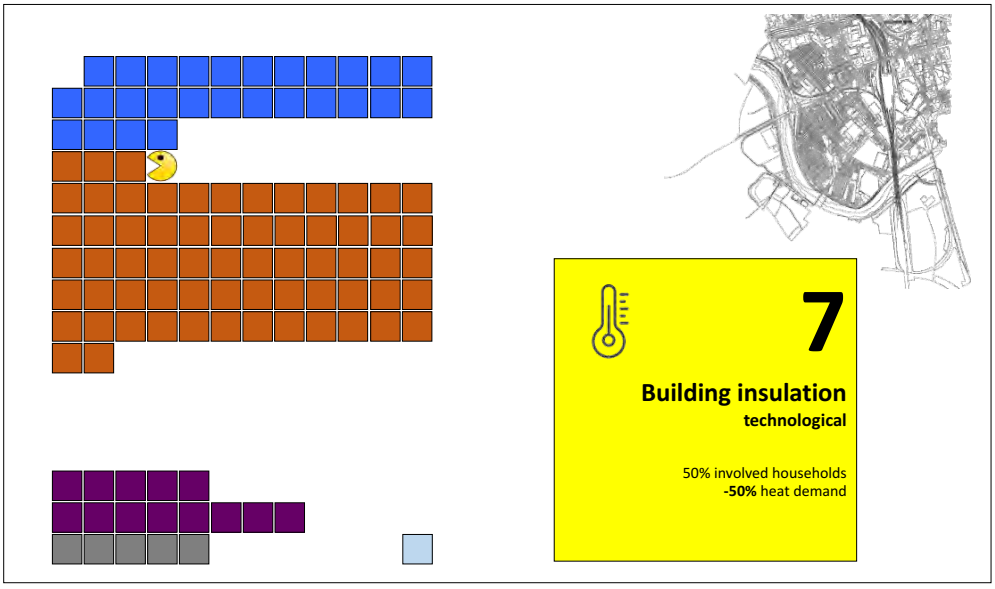

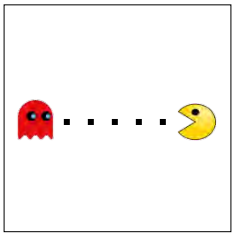

ELECTRICITY
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MOBILITY
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Preston, UK, November 2018

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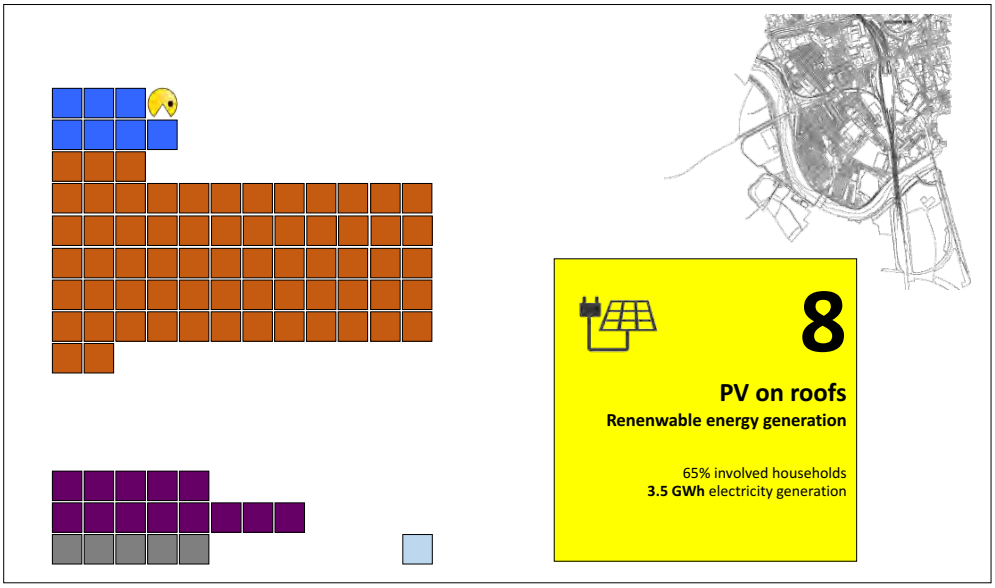

ELECTRICITY
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MOBILITY
WASTE
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CITY-zen New urban energy ROADSHOW

Carbon accounting: Dr. Riccardo M. Pulselli, University of Siena, Siena

Preston, UK, November 2018

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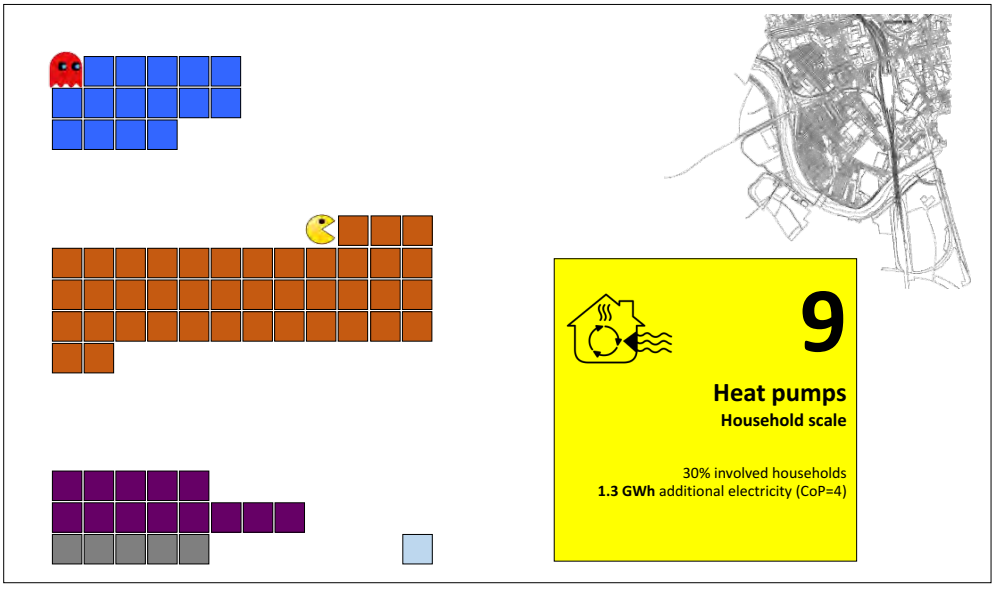

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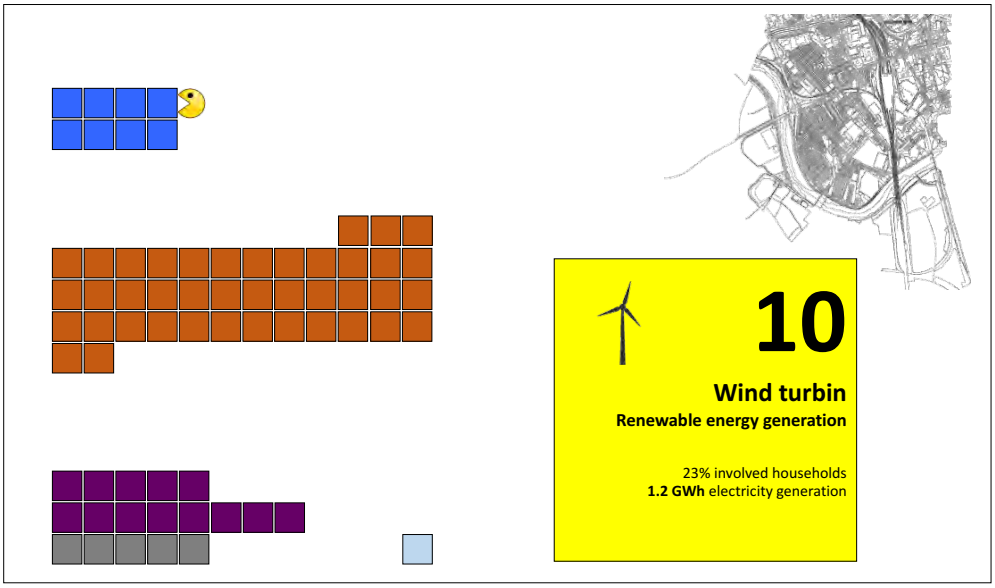

ELECTRICITY
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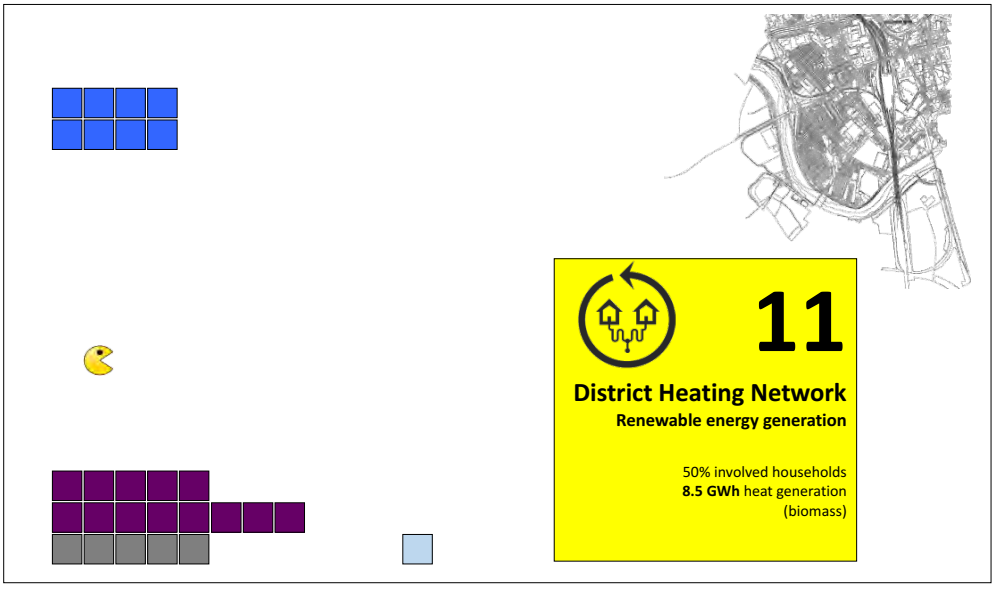

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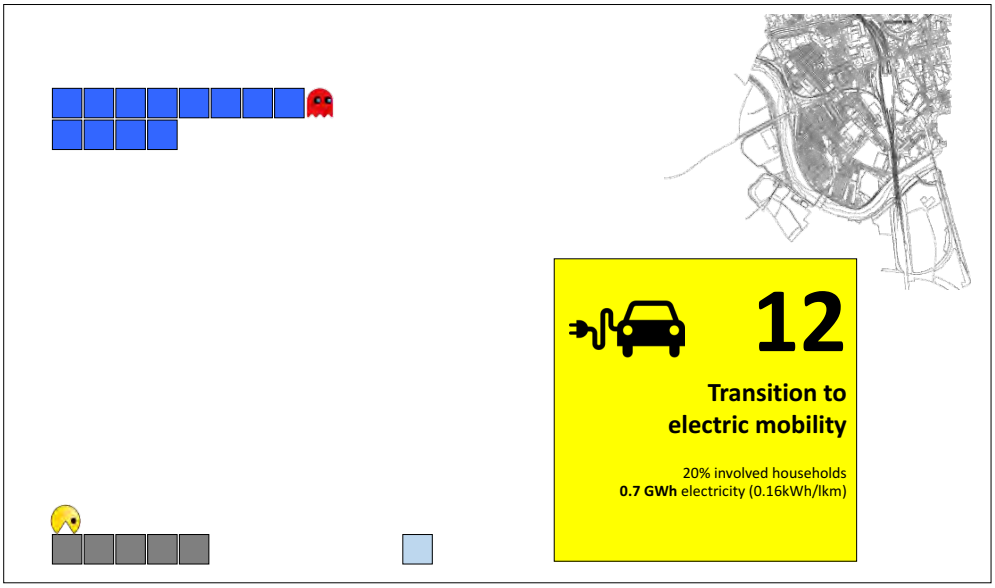

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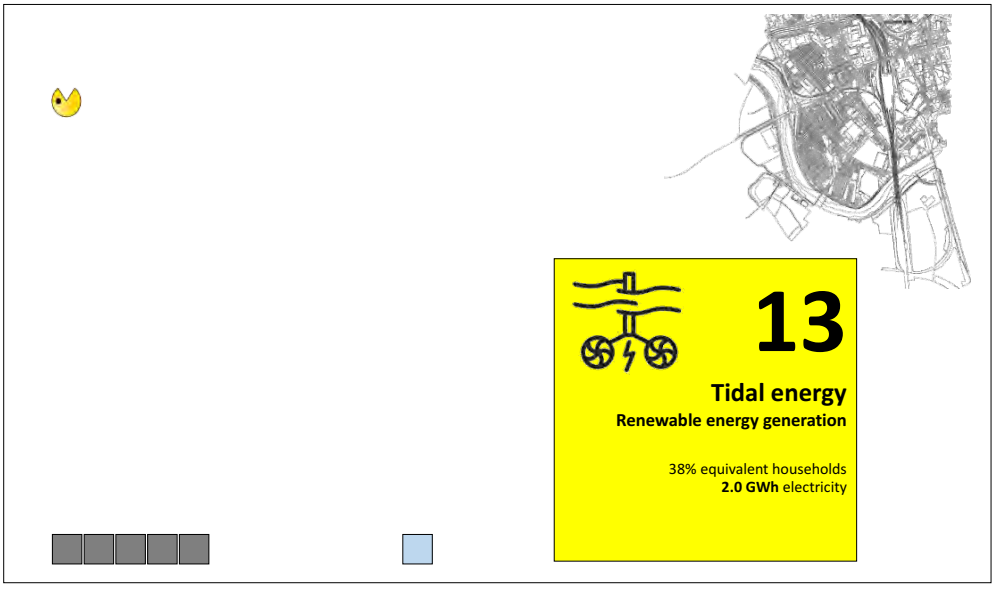

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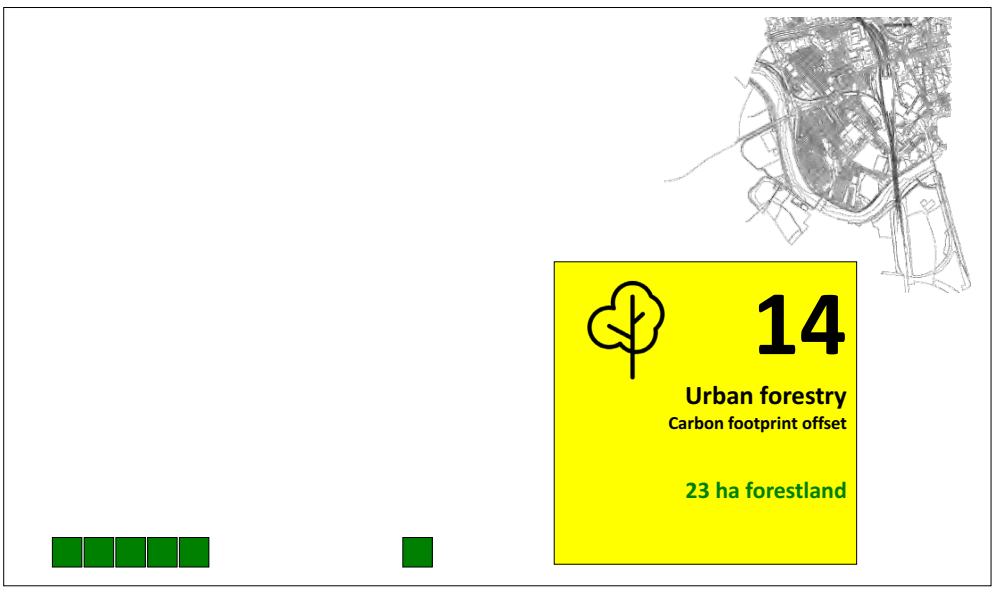

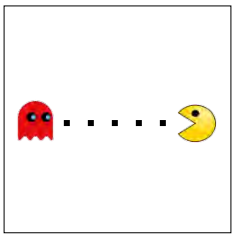

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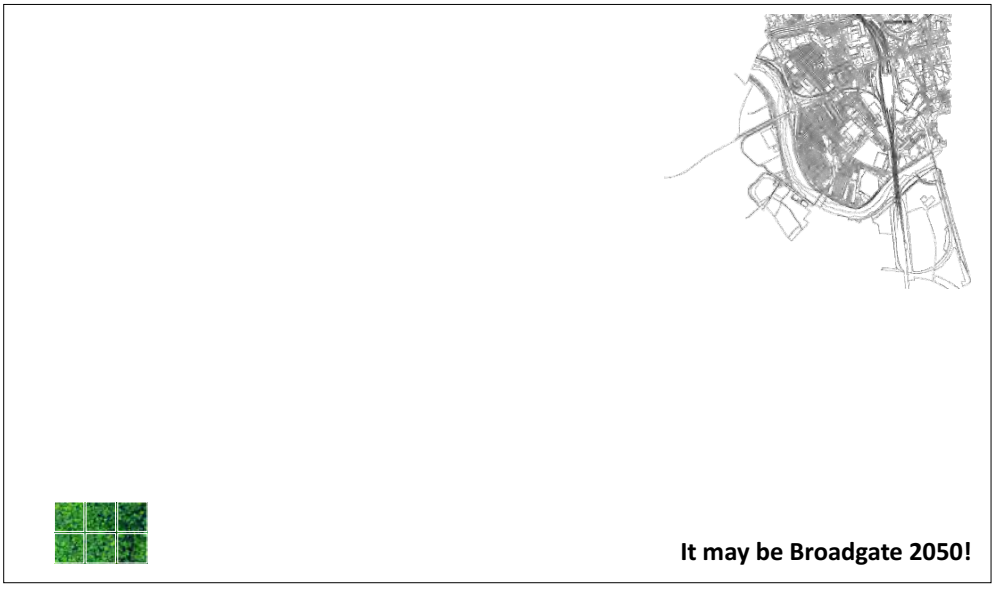

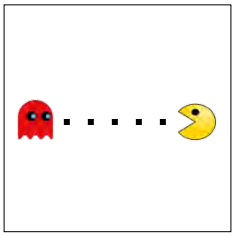

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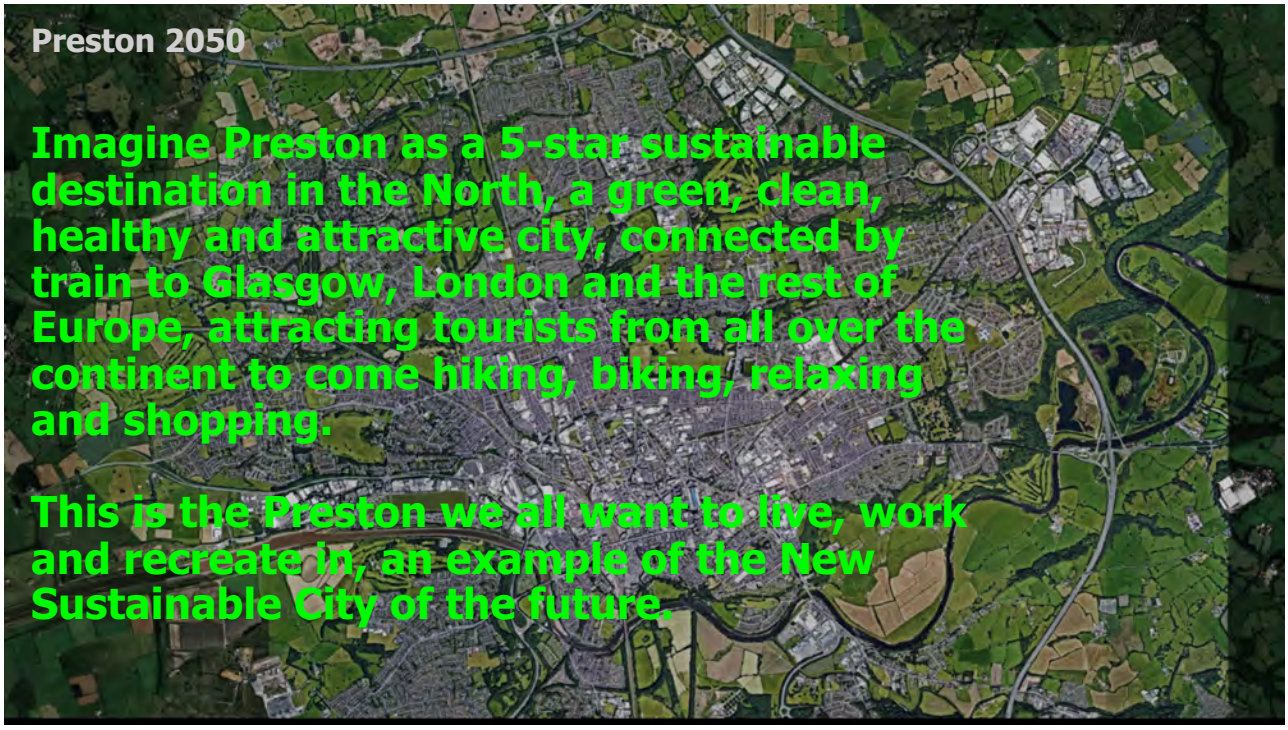

Lead, not follow…

Web:
https:// www.cityzen-smartcity.eu/nl/home-nl/

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Roadshow Contacts:
Prof.Dr. Craig Martin – Roadshow Leader (*e*: c.l.martin@tudelft.nl)
Tamar Raey – Roadshow Contact, PCC (*e*: T.Reay@preston.gov.uk)

CITY-zen
New urban energy
ROADSHOW

City-zen Roadshow Leader – Prof.Dr. Craig Martin

Preston, UK, November 2018


Thank you!