Opportunities, Challenges & Solutions

# Solutions *for* Cities
## An Overview

SOLARIMPULSE
FOUNDATION

solarimpulse.com

## Bertrand Piccard

# Foreword from the Chairman

When in April 2021, we attributed the 'Solar Impulse Efficient Solution' label to the 1,000th solution, we had achieved our first goal in proving that a huge number of technological solutions exist today to protect the environment in an economically profitable way. These solutions represent systems, devices, products, materials and sources of energy, in the fields of water, mobility, construction, energy, industry and agriculture. Since then, our core belief and the evidence supporting it has only become stronger: reconciling ecology with the economy is not only possible, it is the obvious thing to do.

But the world is not moving fast enough. Each release from the IPCC paints an increasingly dire picture across ever shorter time frames. While respecting the commitments made at COP 26 in Glasgow would allow us to limit temperature rise to 1.8 °C, we also know there is a chasm between those commitments and our progress toward meeting them.

It has often been said that cities hold the key. Whilst over 55% of the global population live in cities, they are responsible for three-quarters of all $CO_2$ emissions. Notably though, they generate 80% of global GDP, meaning they have an outsize importance and decision-making power when it comes to the mitigation of climate change. They are the primary generators of economic activity and are well placed to harness the opportunities of the ecological transition.

The 'Solutions for Cities Initiative' intends to help unlock this potential by looking at the "pain points" that exist in cities preventing the widespread adoption of cleantech solutions, and guiding users through our portfolio to demonstrate which solutions can contribute to overcoming these obstacles, including feedback from cities that have implemented them.

Proving that profitable solutions to protect the environment exist was critical to moving the debate forward, but it was far from the only piece of the puzzle. It is now in the political and regulatory realm where we must progress. We are launching this initiative to aid that effort, show what is possible, and shine a light on benefits that exist in doing so.

**Bertrand Piccard**
**Founder and Chairman of the**
**Solar Impulse Foundation**

## 2022 activities

# The Solutions for Cities Initiative

**The goal of this initiative is to suggest solutions to help decision makers to harness the economic opportunities of the ecological transition whilst reducing their environmental footprint.**

Over the coming months we will launch various efforts to advance the uptake of solutions in cities. This will include a media and social media campaign, matchmaking events between solution providers and decision makers in business and government, and a billboard campaign in France highlighting the laws that, if changed or updated, could yield significant decarbonisation.

### Release of Solutions Guide for Cities – full analysis (September 2022)

An analysis of the obstacles faced by cities in their decarbonisation efforts, and the solutions that can aid them. We will also produce an interactive map to accompany the release.

### Sharing the initiative at International Fora throughout the year

Events include the ICLEI World Congress, Change Now, Stockholm+50, New York Climate Week.

### Billboard campaign

A publicity campaign in France where we will highlight laws and regulations that, if updated or adopted, could unlock significant decarbonisation.

### Media and social media campaign

Telling the decarbonisation stories of cities via podcasts, articles, videos and interviews.

### Identifying new solutions

Adding to our portfolio of 1400 solutions, we will launch a new call for solutions dedicated to overcoming the obstacles identified by cities to reduce their environmental footprint.

### Collaborating with networks of cities

We intend to run matchmaking events bringing together decision makers and buyers in business and government to engage in quality, solution-focused discussions.

# The Solutions Guide for Cities

This report is being developed in the context of the Solutions for Cities Initiative and has been designed to guide users to implement Efficient Solutions in cities. These users can be mayors, city planners and public administrations, but also private companies or citizens. It has a number of tenets, the cornerstone of which is **a full analysis to be released in September 2022.** You have in your hands an overview of this work.



## Identifying the challenges and suggesting solutions to become more sustainable

In our analysis, we look at five themes - Energy & Power Networks, Construction & Buildings, Mobility & Logistics, Waste Management, and Urban & Water infrastructure - and assess the obstacles to change and solutions that can help them be overcome. More than 200 solutions are presented in this report, ordered in accordance with how disruptive they are to existing systems, and thus how easily they can be integrated at different stages of a sector's value chain; from optimizing and upgrading current assets to changing the paradigm completely with zero-emission technologies.

These are but a subsection of the more than 1400 solutions that we have awarded the Solar Impulse Efficient Solutions Label since 2017 which cover a variety of sectors beyond the scope of this report. All of them can be viewed on our dedicated Solutions Explorer - each one evidence that clean and profitable solutions exist today to reach our climate goals.

Energy

Buildings

Mobility

Waste

Infrastructure

## Guiding users to implement efficient solutions in cities

While some large cities have begun their efforts to reach their net-zero targets, the majority of cities are not moving fast enough. Our aim with the Solutions for Cities Guide is to lead them through three steps:

- Analysis of key sectors contributing to their emissions
- Ability to prioritize their efforts
- Access to the relevant technologies and solutions, including cases where they have been implemented

# ENERGY & POWER NETWORKS

Urban areas account for 65% of the world's demand for energy, and 70% of the world's energy-related $CO_2$ emissions. To reduce their footprint, cities have countless Efficient Solutions at their disposal. Some – such as new IT tools and generation units – promote decentralized production of renewable energy in urban areas. Others – new digital tools, or new methods of consumption and storage – can adapt the grids to this energy transition.

# Concrete Challenges & Solutions

## Making clean electricity generation accessible and cost-effective in urban areas

### Challenge 01
**Stimulate investment in renewable energy production (centralized and decentralized)**

Develop software capable of dynamically exploiting data, to guide decision-makers charged with planning and sizing cost-effective and sustainable infrastructure.

### Challenge 02
**Educate those responsible for buildings and infrastructure about opportunities for local, decentralized clean energy production, and support them in their efforts**

Use computer tools capable of quickly evaluating the technical potential, costs and benefits of decentralized energy production schemes (solar, geothermal, wind, etc.), and of easily finding the right contacts.

### Challenge 03
**Make urban environments more suitable for solar energy generation projects**

Propose new systems that are more flexible, easier to install and more aesthetically pleasing than conventional photovoltaic panel arrays.

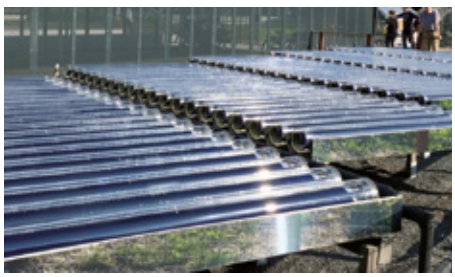
### Challenge 04
**Make wind energy production compatible with the quality of life in urban areas**

Adopt new micro-wind-turbine systems that combine efficiency, modularity, minimal space requirements, safety and quiet operation.

### Challenge 05
**Promote local heat production enabling the establishment of district heating networks**

Use efficient geothermal systems, even those covering a small surface at low depth, as well as hydrogen boilers that combine high performance with safety.





### One of the Solutions from our portfolio

**Virtu** *by Naked Energy Limited*

**Pilot test commissioned by Sainsbury's in 2017 in Crawley, Great-Britain**

The patented Virtu Solution is an evacuated tube PVT collector offering a high-energy density solution for the built environment, ideally suited to commercial flat roofs. VirtuPVT benefits from a unique modular design, generating both solar heat and power from the available space. Virtu combines a novel heat plate (heat exchanger/absorber) with vacuum tube technology to deliver a ground-breaking PVT product capable of achieving high efficiencies at up to 90C output temperature (significantly better than other PVT technologies and as good as the best solar thermal collectors, but with the added benefit of PV).

# Maximizing the resilience of electricity distribution networks in the face of the multiplication of decentralized renewable sources and electric vehicles

## Challenge 01

### Design smart and scalable distribution networks based on data that is as close as possible to actual conditions

Employ new digital tools to make network planning and management simpler and less costly, as well as the sizing of energy storage capacity.

## Challenge 02

### Ensure the quality and reliability of the electricity supply despite intermittent power generation

Adopt tools that allow for real-time, automated responses to situations such as power surpluses and shortages.

## Challenge 03

### Incentivise power consumers to take part in a better synchronization between electricity supply and demand

Use IT tools to "displace" consumption, to connect a multitude of objects/sites, and to allow consumers and producers of decentralized energy to interact directly.

## Challenge 04

### Adopt long-term thermal energy storage to ensure the continuity of heating supply in neighborhoods

Implement robust, low-cost energy storage systems (geothermal, thermochemical, aluminum, etc.) to balance consumption over time and prevent wastage.

## Challenge 05

### Make accessible and decarbonize the entire life cycle of batteries used for energy storage

Develop decentralized energy-storage systems for solar panels, and reduce the costs of stationary batteries by pooling their use.

## Challenge 06

### Capitalize on the growing need for electricity for vehicle charging to stabilize the distribution network

Put in place storage systems that allow for the withdrawal/injection of electrical current according to circumstances, and for vehicle recharging at a lower cost.

## Solutions from our portfolio

### Celsius Energy *by Celsius Energy*

**Implemented in two offices in Clamart, France in 2020 and 2022**

Celsius Energy is a geothermal solution which aims to supply a low-carbon alternative to gas boilers and refrigeration units for heating and cooling buildings. As a spin out of Schlumberger, Celsius Energy innovates in proposing a turnkey solution, available for new and existing buildings in dense urban areas. Leveraging on thermal modeling, drilling and operational expertise in the Oil & Gas domain, Celsius Energy simplifies the access to geoenergy by minimizing the footprint required to connect buildings to this local, non intermittent and low carbon energy. Celsius Energy designs an optimized solution for any building and proceeds to the drilling and installation of the integrated solution.


### Utilit-e *by Odit-e*

**Project delivered in 2021 for Gazaléc network in Péronne, France**

The Utilit-e Solution proposes an automatic digitization of Low Voltage networks using smart meters data: the grid model is automatically built from millions of pieces of information coming from the smart meters. This has been made possible by combining cutting edge artificial intelligence algorithms with a deep understanding of Low Voltage network behaviors. It enables grid operators to supervise the health of the grid, detect load and voltage imbalances that are harmful to both electrical infrastructures and customers, as well as maximize the hosting capacity for renewable energy production and electric vehicles charging stations while minimizing useless investments. Eventually, in-depth grid analysis comes along with precise and impactful rebalancing advice: not only does Utilit-e observe the pain points, but it also helps correct them.

### EcoStruxure ™ EV Charging Expert *by Schneider Electric*

**Implemented in Renault facilities in Guyancourt, France in 2011**

The EcoStruxure EV Charging Expert is an intelligent load management system that limits electric vehicle charging power when needed so that there is enough electricity for the whole property, including other uses. The Solution management system manages access control to EV charging, and registers charging transactions data for cost allocation or analytics. The System manages a network of up to 100 alternative current (AC) or direct current (DC) chargers, and is upgradeable to up to 1000. The EcoStruxure EV Charging Expert operates autonomously and locally, does not require a subscription, and can provide a single point of access for remote supervision of EV charging stations.

# CONSTRUCTION & BUILDINGS

The construction sector's high consumption of energy and resources has made it a large source of emissions. However, recent technological advancements in materials and construction methods are greatly decreasing this impact while maintaining cost efficiency and performance. Furthermore, data science and artificial intelligence are opening new avenues for rethinking design, streamlining logistics, reducing waste, and better managing the consumption of resources and energy in buildings.

# Concrete Challenges & Solutions

## Decarbonizing the entire life-cycle of construction materials

### Challenge 01

**Substitute or update production processes of cement and concrete while preserving the same level or quality and durability**

Target formulas enabling a global supply of low carbon cements and processes requiring minimum level of disruption in manufacturing facilities.

### Challenge 02

**Solve the insulation material dilemma between carbon intensity and efficiency**

Utilize bio-based, efficient insulation; high-performance, low-carbon insulation; and/or construction-integrated insulation.

### Challenge 03

**Make a broad type of wastes suitable for integration in construction materials formulas**

Adopt innovative waste pre-treatment to ensure maintained structural capacities and focus on locally sourced waste.

### One of the Solutions from our portfolio

**Arqlite Smart Gravel** *by Arqlite*

**Implemented in the City of Los Angeles by the Los Angeles Department of Water and Power in 2021**

Arqlite provides a solution to the up-to-now unrecyclable plastics currently sent to landfills, incinerated or dumped, contaminating our land, rivers, and oceans. Arqlite Smart Gravel is the first commodity, made 100% from mixed plastic waste. Mining landfills instead of mountains, this product takes the best of plastic polymers and generates a filler, three times lighter and ten times better insulator compared to mineral gravel. Arqlite's proprietary technology offers a sustainable alternative to waste generators, both private companies and municipalities, at a cost comparable to landfill tipping fees. Proven long-lasting and safe for the environment, this sustainable material is highly appreciated by the Civil Engineering industry, Concrete Mix companies, Precast manufacturers, Landscapers, and Hydroponic growers, among many others.

# Optimizing designs and construction sites operations to save resources

## Challenge 01

### Enable the design of energy and resource positive buildings

Provide user-friendly softwares and turnkey systems for the design and modeling of new construction methods and efficient building types.

## Challenge 02

### Move away from traditional, energy-intensive construction and assembly methods

Inspire from industrial manufacturing to introduce standardization, prefabrication, pre assembling, and material minimization in construction methods.

## Challenge 03

### Harness data to optimize logistics on construction sites

Adopt softwares and collaborative platforms to digitize the supply of materials, incentivise the monitoring of equipment use and automate business transactions between stakeholders.

## One of the Solutions from our portfolio

### 3D Printing Construction *by Holcim*

**Implemented in Lilongwe, Malawi in 2020**

The Solution aims to disrupt the way constructions are built to make housing solutions available for the majority. Developed by Holcim and CDC Group through the joint-venture 14Trees, 3D Printing Construction is a printing service which is sold to NGOs and international organisations whereby the design of the 3D printed school and the execution of the construction work is taken care of. This includes the manufacturing of Holcim 3D ink, and the operation of the printer, using only local staff. This Solution pioneered in introducing 3D printing in Africa for the construction of schools and houses.

# Making buildings hardwares part of a circular energy system in symbiosis with the outdoors

## Challenge 01

### Capture the true value of light rays in building envelopes and through windows

Adopt powerful passive lighting and shadowing systems to provide full-spectrum sunlight or shade depending on outdoor conditions.

## Challenge 02

### Prioritize low-cost, passive heating and temperature control methods

Encourage the use of easy-to-install, complementary solar-capture systems on the windows and facades of buildings to take advantage of outdoor conditions.

## Challenge 03

### Make clean micro generators or heat pumps affordable even for small buildings

Install sized-down systems relying on ground-source heat exchangers or biofuel powered CHP units.

## Challenge 04

### Boost the applicability and reliability of heat-recovery systems

Adopt affordable heat-recovery units drawing from greywater waste heat or ventilation systems that do not require heavy installation work.

## Challenge 05

### Harness the heating power and cooling needs of data processing into affordable digital heaters

Utilize heat-recovery systems in data server to heat buildings, industrial areas, or pools and decentralize the data processing units where the heat is needed.


## One of the Solutions from our portfolio



**Lepido** *by Enjay Systems*

**Implemented in all new Burger King restaurants in Scandinavia being built since 2021**

Enjay System's solution is the first in the world to offer profitable energy recovery from restaurant ventilation. Lepido, is a self-cleaning recovery coil, adapted for restaurant ventilation, enabling an end to this waste of energy. The delivered effect per converted restaurant varies from 17 to 106 kilowatts, lowering the average annual emissions of $CO_2$ by circa 34 metric tons. Lepido is entirely free of maintenance, making every kilowatt hour recycled a financial saving as well. Property owners worldwide can thus simultaneously save money and contribute to the climate.

# Improving energy consumption and buildings management

## Challenge 01

### Highlight the most rewarding retrofit opportunities in existing buildings

Utilize digital platforms to show concrete savings opportunities and help buildings owners plan more ambitious and efficient energy retrofit projects.

## Challenge 02

### Encourage high-capacity real-estate owners to invest in smart systems to reduce resource consumption

Install sensors coupled with digital systems which allow for the real-time-monitoring of energy consumption with minimum disturbance on occupants and building management.

## Challenge 03

### Get cheap and efficient building HVAC and lighting automation systems applicable for all building sizes

Utilize non intrusive control systems that can turn regular appliances into a smart one, able to adapt electricity consumption to external conditions.


## One of the Solutions from our portfolio

### Hive Optimal *by BeeBryte*

**Operating at DHL's Advanced Regional Center in Singapore since 2018**

BeeBryte provides a remote operation & maintenance service for large heating-cooling-refrigeration systems (HVAC) using a proprietary predictive control technology. One of the benefits of the solution is up to 40% cost savings since it significantly improves the energy efficiency of the systems without any equipment replacement. Using weather forecast and activity patterns, the AI-based solution anticipates energy demand then adjusts the setpoints and operation of the equipment accordingly. It improves the reliability of the installations (early detection of anomalies) and reinforces temperature uniformity in different zones, guaranteeing compliance with prescribed constraints, such as air quality, and comfort.

# Avoiding and valorizing demolition waste at building's end-of-life stage

## Challenge 01

### Democratize the use of materials or methods which extend the lifespan of buildings

Use efficient repair techniques, innovative products which slow structural decay, and inspection methods that facilitate predictive maintenance.

## Challenge 02

### Create an appealing market for the reuse of rubble and construction waste

Utilize digital B2B platforms for the identification, optimization of reuse potential, and the buying/selling of salvaged materials that cover a broad reuse spectrum and can include other industries.


## One of the Solutions from our portfolio

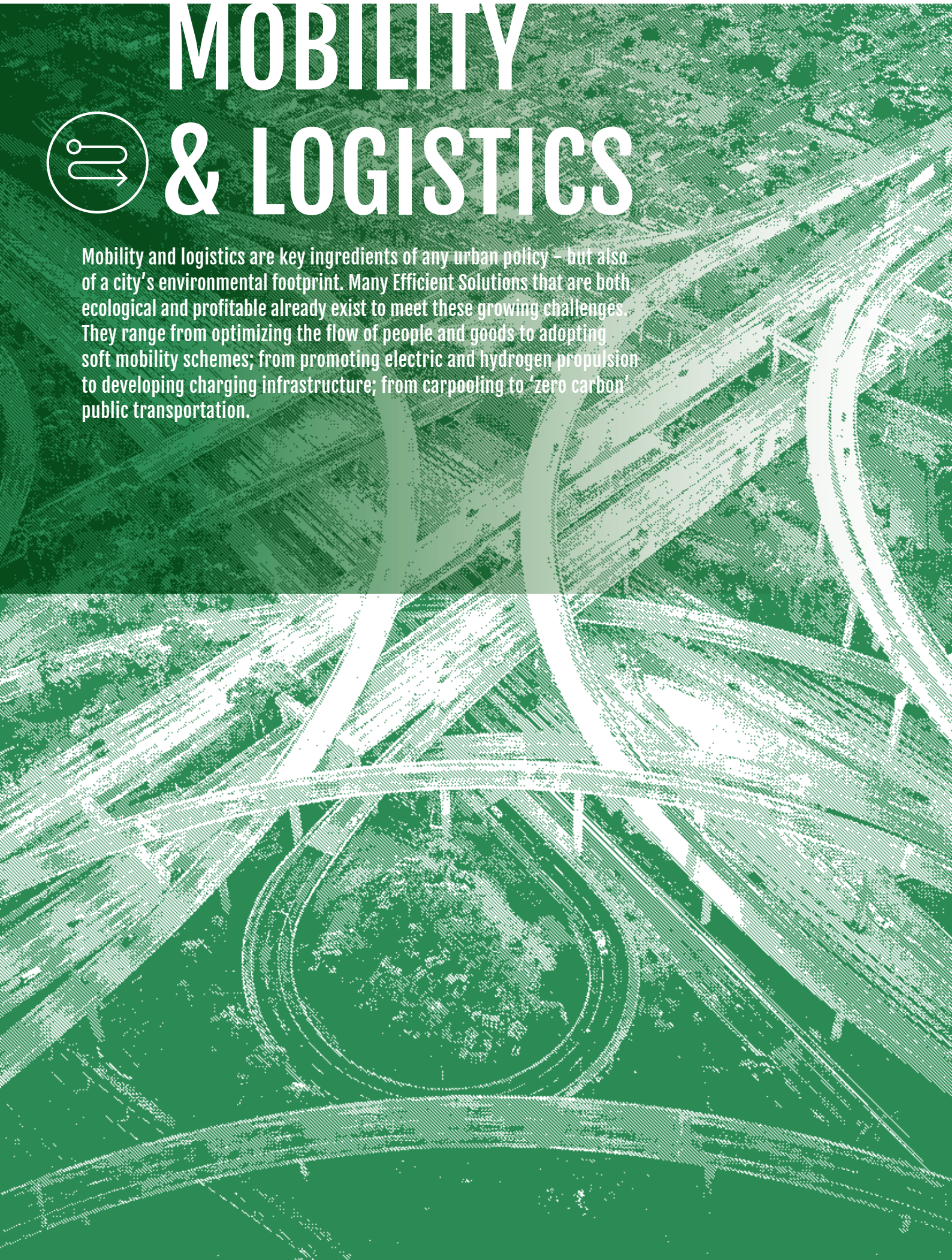
### Hesus Store *by Hesus*

**Implemented in Paris 16th arrondissement, France in 2021**

The Solution relies on its digital platform Hesus Store to centralise the needs of numerous construction sites, provide them with optimised and bespoke removal, supply services and track any movement. The circular economy focused platform allows users to connect complementary needs: excavated soil from one site could become a resource to another.

# MOBILITY & LOGISTICS

Mobility and logistics are key ingredients of any urban policy – but also of a city's environmental footprint. Many Efficient Solutions that are both ecological and profitable already exist to meet these growing challenges. They range from optimizing the flow of people and goods to adopting soft mobility schemes; from promoting electric and hydrogen propulsion to developing charging infrastructure; from carpooling to 'zero carbon' public transportation.



# Concrete Challenges & Solutions

## Reducing time and distance of travels

### Challenge 01

**Help planners interpret and use data to tackle traffic congestion**

Provide digital tools to plan infrastructure and control systems (parking, traffic lights, etc.) that take into account real-world conditions on the road.

### Challenge 02

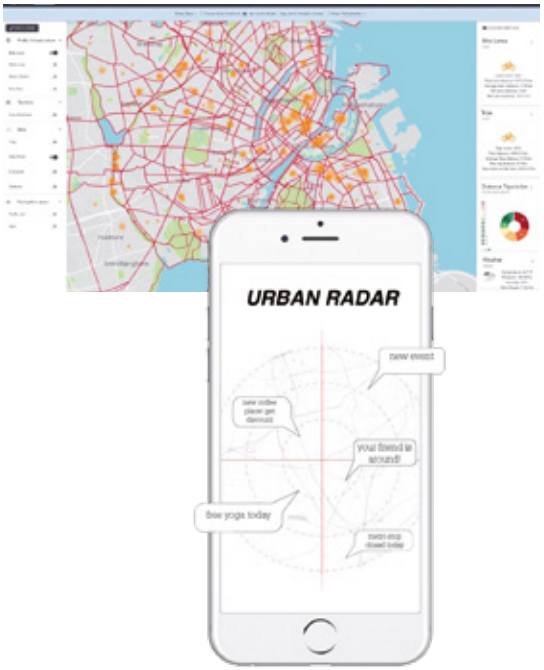
**Facilitate decision-making by companies and service-providers to optimize routing and reduce number of trips**

Process urban mobility data from individual and technical sources in a dynamic way, to enable users to plan their trips more efficiently.

### Challenge 03

**Help transportation managers planning road public transport lines with real demand data**

Integrate actual mobility data to design grouped transportation services that meet the people's needs, and so minimize underutilization.




### One of the Solutions from our portfolio

**URBAN RADAR** *by Urban radar*

**Introduced in the City of Versailles (France) in 2020**

This all-embracing data platform for 'smart cities' enables city planners and associated companies to determine more clearly which actions have an impact on the climate. It draws on (anonymized) data from multiple static and dynamic sources to provide visualizations, analyses and recommendations.

# Reducing emissions per km for private and public vehicles

## Challenge 01

**Make combustion engine efficiency measures widely accessible for road vehicles**

Propose technologies that increase the efficiency of internal combustion engines, while maintaining production standards, cost effectiveness and driving comfort.

## Challenge 02

**Make transitioning from combustion engines to clean vehicles more attractive and affordable**

Highlight "turnkey" clean mobility offers, as well as standardized, more economical "retrofit" processes for cars or light-duty vehicles.

## Challenge 03

**Incentivise the investment in alternative fuels and EV charging infrastructures in the private and public spaces**

Adopt scalable systems enabling to start small, then grow, and charging points that mutualize space and equipment (charging in unused space, charging different fuels at the same site etc.).

## One of the Solutions from our portfolio

### HYDROGEN INJECTION SYSTEM (H.I.S.)

*by Logikko*

**Put into operation in the Ile de France region in 2020 by a private company, EGIS.**

This technology, based on water electrolysis, consists of injecting small quantities of hydrogen into a combustion engine, resulting in more complete combustion of the fuel and thereby reducing consumption. The system can be adapted for all gasoline and diesel engines, requiring no change of fuel or certification. The result: a drop of up to 70% in polluting emissions and up to 25% lower fuel consumption.

# Promoting ‘zero-carbon’ modes of transport

## Challenge 01

### Motivate residents to invest in bicycles and in electric bikes and scooters for their movements around town

Advocate systems that increase the safety, comfort and versatility while lowering the cost of small, electrically assisted vehicles.

## Challenge 02

### Help cities to develop shared micro-mobility services for their citizens

Promote ready-made IT platforms that allow the establishment of fleets of vehicles by local businesses or public authorities, and encourage the population to use them.

## Challenge 03

### Persuade urban delivery companies to use small electric vehicles

Improve the practicality and versatility of the types of vehicles used for micro-mobility.

## Challenge 04

### Encourage multiple delivery methods for the final kilometer

Provide IT tools or “turnkey” services that combine various modes of transport in a simple and efficient way.


## One of the Solutions from our portfolio

### VUF BIKES *by Vuf bikes*

**In service since 2018 with Oleorecycling in Toulouse**

VUF Cargo-Bikes are electrically assisted load-carrying tricycles designed to transport heavy and bulky loads (up to 250 kg and 1.7 $m^3$). These three-wheelers offer professionals tailor-made solutions for a multitude of applications such as waste collection, park and garden maintenance, city road cleaning and tool transport.

# WASTE MANAGEMENT

It is projected that between 2011 and 2025 solid waste generated by cities worldwide will surpass 1.3 to 2.2 million tons per year. There are a number of Efficient Solutions which can slow down and even reverse this trend through a variety of methods – by integrating end-of-life waste planning into the design phase, by encouraging consumers to reduce the amount of waste they produce, by improving waste-sorting systems, and by treating waste as a resource that can be reused as opposed to something that needs to be eliminated.

# Concrete Challenges & Solutions

## Address upstream production of municipal waste

### Challenge 01

**Reward consumers who help restaurants and shops to reduce their food waste**

Promote digital platforms that allow for preordering, the purchasing of unsold items, and/or the sale of food that is approaching its expiration date.

### Challenge 02

**Create a waste-reduction system at the packaging stage**

Prioritize new forms of reusable, environmentally-friendly, and multi-purpose packaging for e-commerce while encouraging bulk deliveries and refilling systems.

### Challenge 03

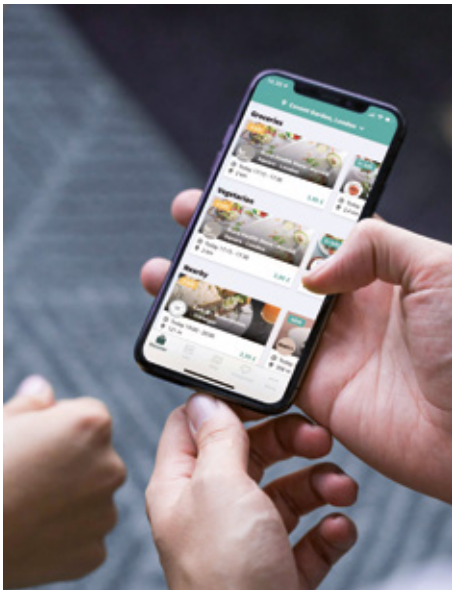
**Prioritize rent-based over ownership-based models for any type of goods**

Utilize digital platforms that allow consumers to rent a variety of products and companies to pool their stock (unsold items, spare parts, etc.) in a convenient and safe way.

### Challenge 04

**Boost the identification and value of waste to naturally incentivise recycle/repair/reuse reflexes rather than discarding**

Utilize digital platforms to collect, repair and sell products (smartphones, clothing, etc.) at the maximum of their value, as well as track the entire life cycle of products/materials in order to maximize reclamation potential upstream.



### One of the Solutions from our portfolio

**Too Good To Go** *by Too Good To Go*

**Implemented in Copenhagen, Denmark since March 2016**

Too Good To Go's innovative and scalable smart phone app acts as a marketplace for surplus food. The Solution is fighting food waste by connecting food suppliers with unsold, surplus food to customers willing to purchase the food in advance, and collect it at a specified time. As a smartphone application, Too Good To Go can become available in all corners of the world.

# Improving sorting and recycling at the local level to reduce the volume of material processed at centralized facilities

## Challenge 01

**Anticipate waste sorting and separation from the product design stage until the waste sorting facilities**

Apply robotics, artificial intelligence, and other new technologies to remove sorting needs with homogeneous waste or to integrate the sorting guidelines directly on the product in a readable way.

## Challenge 02

**Move the recycling of organic waste closer to its point of origin**

Implement compact, scalable, and cost-effective systems at the point of origin to transform local organic waste into reusable resources (energy, compost, fertilizer, water, food proteins, etc.).


## One of the Solutions from our portfolio

### Anaerobic bio-digester to proceed organic waste *by Enwise*

**Implemented in Auchan Supermarket in Shanghai, China in 2017**

The solution aims to transform organic waste into resources, to provide for all actors of the food chain a sustainable, profitable and ecologically waste treatment solution. This Solution uses dry anaerobic digestion technology that generates biogas during the waste process fermentation. Thereafter, the biogas can be turned into green energy such as electricity, hot water, cool water, steam to help users to save the energy used. The installed on-site solution is a combination of hardware and software coupled with high efficiency digesters.

# Creating an attractive market for recycled municipal solid waste

## Challenge 01

**Ensure recycled materials retain their value both as resources and economically within the market**

Instead of downgrading plastic waste, implement innovative recycling technologies that upgrade waste into high-value materials or into virgin materials that can be recycled indefinitely.

## Challenge 02

**Introduce less energy intensive alternatives to the incineration of hazardous and non-recyclable waste**

Utilize new machines that convert plastics and hazardous wastes into low-carbon fuels or chemicals to be fed back into the market without the need for high energy supply to run.

## One of the Solutions from our portfolio

### Large-scale solution for urban and ocean plastics carbon recycling *by Enerkem*

**Implemented in Edmonton, Canada by Enerkem Alberta Biofuels (EAB) since 2014**

This cleantech solution converts urban and ocean plastics into low carbon transportation fuels for cars, ships and planes. The company's proprietary carbon recycling technology uses non-recyclable, non-compostable municipal solid waste - namely plastics - to produce low-carbon liquid transportation fuels and chemicals while providing a smart alternative to incineration or landfilling. This technology can help with the transition by using waste as a resource to produce sustainable products.

# WATER & URBAN INFRASTRUCTURE

The reliability of water supplies has become a large problem worldwide. Managing this precious resource is also become a major issue for cities. There are many solutions that limit waste during the water distribution process and allow water treatments to adapt to growing urban populations. Many tools exist aimed at improving the quality of life for residents by greening cities, reducing the urban heat island effect, improving outdoor/ indoor air quality, and limiting the impact of urban services such as lighting.

# Concrete Challenges & Solutions

## Planning and maintaining resilient, efficient water distribution systems

### Challenge 01

**Produce energy efficiently from low-pressure water distribution networks**

Install hydraulic micro-turbines throughout the water distribution networks that can generate power anywhere on the network, even very low water flows.

### Challenge 02

**Prevent water leaks before they damage our infrastructure and reduce metering errors**

Introduce comprehensive self-learning tools that detect all types of defects at once (leaks, pressure drops, asset failures, water quality problems) with a sensitivity high enough to prevent escalation of problems.

### Challenge 03

**Improve inspection and maintenance processes carried out on aging water infrastructure**

Implement low-cost, non-intrusive (contact-less and excavation-less) inspection and repair systems that enable to prioritize the most pressing replacement of upgrades to be done.




### One of the Solutions from our portfolio

**Shayp** *by Shayp*

**Implemented in Région Grand-Est, France in 2021**

The Solution is a simple, smart and interactive tool for building managers and maintenance services, that gives immediate insights on water loss and increases the success rate of repairs. Shayp's state of the art IoT can be self-installed within 5 minutes, has a battery lifetime of 10 years with an end-of-life notification and a high data granularity enabling rapid leak detection. It assesses water leaks in real-time and dispatch maintenance when the calculated costs and risks are high. As an end-to-end solution from diagnosis to facilitating repair, it allows customers and partners to effortlessly include Shayp in their organization.

# Adapting wastewater treatment processes to population growth and increasingly strict regulations

## Challenge 01

### Increase the capacity and efficiency of existing wastewater treatment plants

Upgrade existing plants using modular, energy-efficient systems relying on new, clean technologies for wastewater treatment while minimizing new infrastructure requirements.

## Challenge 02

### Reduce the percentage of sewage sludge in wastewater treatment plants

Treat and valorize sludge with more energy efficient processes (microbial activation, pyrolysis) or decentralize part of the sludge treatment right at the building stage, before it becomes more contaminated.

## Challenge 03

### Save and recycle water at the building stage to reduce the strain on centralized wastewater treatment plants

Nudge people to save grey water with user-friendly interfaces coupled to sensors, while providing reliable systems to recycle it locally.


## One of the Solutions from our portfolio

### Hydraloop *by Hydraloop Systems BV*

**Implemented in the city of Sydney, Australia by Sydney Water in 2022**

The Solution is an innovative & award winning in-house greywater recycling system which can recycle 85% of mains water, reduces the sewage load & saves energy. Hydraloop is a real consumer product that collects bathroom and washing machine water; cleans and disinfects it, herewith saving water by recycling it. The unique and patented Hydraloop technology - that is the heart of the system - works without using a filter, membrane or chemicals. The treatment system combines 5 technologies to remove dirt, soap & other particles from the water; Sedimentation, Flotation, Dissolved Air Flotation, Enforced Skimming & an Aerobic Bioreactor. The 6th technology, which is the final treatment, is disinfection using UV light. Hydraloop only uses 20 Watts of electricity, resulting in ± 200 KwH/year.

# Improving quality of life and energy efficiency in the public space

## Challenge 01

### Encourage the creation of green spaces and heat mitigation projects in urban areas where they are most needed

Provide urban planners with digital mapping tools able to combine complex data on vegetation and climate impacts to make informed decisions on urban development projects.

## Challenge 02

### Combine stormwaters recovery, vegetalisation and temperature regulation in urban spaces

Install vegetal structures that respect the existing surfaces of roofs and curbs and mutualize space for storm water recovery, watering high potential evapotranspiration (PET) plants while providing quality spaces for people.

## Challenge 03

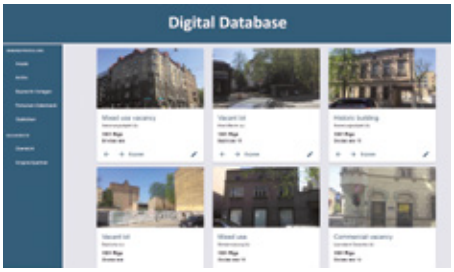
### Democratize access to air quality monitoring and air cleaning assets in both indoor and outdoor spaces

Deploy inexpensive sensors which continuously monitor air quality on streets and in buildings, link them to automate indoor HVAC controls, and remove air pollutants with passive or energy efficient technologies.

## Challenge 04

### Decrease impact of public lighting by considering the variety of lighting functions in a city

Utilize smart platforms for a more efficient management of public space services, as well as lighting technologies that are adapted to the specific function and lighting power needed in the city (traffic lights, billboards, street lights).





## One of the Solutions from our portfolio

### Urban Heat Vulnerability Map

*by Ecoten Ubran Comfort*

**Implemented in the Municipality of Vienna, Austria in 2019**

The Urban Heat Vulnerability Assessment is a service based on the analysis of the UHVI (Urban Heat Vulnerability Index) and the UHVM (Urban Heat Vulnerability Map), designed to provide valuable information to city administrations and urban development stakeholders on the level of vulnerability to extreme heat of each area. The service is based on a collaborative approach with the city at the very early stage, when the city takes the initiative for a change. Data is collected and analyzed, maps are built and finally a report with the study and recommendations is provided. The Urban Heat Vulnerability Map highlights the vulnerability of urban areas to extreme heat to help cities find the optimal location for heat mitigations strategies.


## Want to discover more Efficient Solutions?

# Check the Solutions Explorer!

## The search-engine for climate action

**All the Solutions to be highlighted in the 'Solutions Guide for Cities' and even more can be found on the Solutions Explorer search engine, a dynamic free-access database allowing in a few clicks, to discover the clean and profitable products, processes and services that can help everyone achieve their sustainable development objectives, from decision-makers to citizens.**

The result of five years of continuous research and analysis, the Solutions Explorer is a one-of-a-kind search engine. This dynamic, free-access database showcases today 1400 clean and profitable solutions from all over the world which have been assessed by independent experts for their environmental and economic performance. Businesses, public authorities, and individuals can navigate the Solutions Explorer to help them work towards their climate objectives in a cost-competitive, profitable manner. The Solutions Explorer's user-friendly filtering tool enables solutions to be selected based on sectors, clients, applications, environmental benefits, and technologies. This unique instrument allows the user to discover new and efficient ways of producing, consuming, and adding value to resources with already available innovations.

From the design, the choice of materials, the manufacture of the product to its transport and recycling, the Solutions apply to all stages of the value chain in these sectors to consume less fossil energy, improve the quality of air, protect ecosystems, reduce and recover waste in a circular economy, and save water.

400 independent Experts to assess the solutions

Solutions coming from 72 different countries

- 9 sectors to define the area of interest
- +50 profiles to define yourself or your entity
- 25 different applications to specify your position in the value chain
- 5 environmental benefits that let you choose the impact area
- +300 tags to browse

## 9 sectors

## Filtering Tool



202 I am a construction business...

94 ...looking for materials...

**21** ...in #thermal insulation

**Solutions**

167 I want to discover solutions in the sector of food & agriculture...

**33** ...that can help reduce land use directly or indirectly

**Solutions**

97 I am an NGO....

31 ...I want to discover all the solutions that can be applied to supply/produce water...

**20** ...in #developing countries

**Solutions**

## Access to Solutions Explorer

# Conclusion

## Beyond 1000 Solutions... leveraging a powerful community to boost Efficient Solutions adoption

The task of identifying 1,000 solutions that are able to reconcile ecology and economy and prove that protection of the environment is indeed profitable was critical to changing the narrative around sustainability. Proving that they existed and were ready to be used helped move this conversation forward.

Yet beyond the technologies, what we created was a powerful community comprised of innovators, specialised experts, key industry players and institutions from across the globe. Herein, there is a wealth of knowledge that can inform decision makers around the world.

The Solutions for Cities Initiative is the result of activating this community. It makes use of the extraordinary knowledge to understand – when it comes to solution implementation - what works and what doesn't, what is preventing them from being adopted at scale, and where success has been achieved.

## How can Efficient Solutions be implemented widely enough to help cities reach their environmental and economic targets?

Later this year, we will be releasing a complete Solutions Guide for Cities that will propose a more comprehensive description of opportunities to seize, including challenges ranging from psychological barriers to technology stereotypes that have kept actors stuck in the old ways of thinking and doing.

We spoke to many great entrepreneurs who have been seeking to differentiate themselves and commercialize more sustainable and resource Efficient Solutions. We learned much about the kind of features that matter most when seeking to integrate sustainable, economically sound solutions into a city: modular, plug & play systems, ready-made, powerful and insightful data analysis software, flexible "one-fits-all" equipment, non-invasive sensors and energy recovery units, ecosystem matchmaking platforms, enablers for the mutualization of assets and space. These are the types of features that are common across the solutions presented throughout the five chapters of this Guide.

In addition, we will highlight case studies from more than 200 Solutions used in cities, dozens of regulatory examples tested in real life conditions in order to boost the adoption of specific technologies along with the results.

**We look forward to presenting you with this information later this year!**

Want to be part of it?
Reach out at foundation@solarimpulse.com
and follow our hashtag #Solutions4Cities

We wish to express our gratitude to all the individuals and their respective organizations
for their ongoing contributions to the Solar Impulse Solutions for Cities Initiative

# Solutions *for* Cities Initiative

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