The Augmented Infrastructure: Digital for climate?

FABERNOVEL & ARDIAN

Foreword

Mathias Burghardt
Head of ARDIAN INFRASTRUCTURE

"How can we dance when our earth is turning? How do we sleep while our beds are burning? "Midnight Oil, "Beds are burning", Diesel & Dust, 1987

Infrastructures must be at the forefront of the unavoidable objective to contain global warming below the 2°C set by the Paris Agreements. As long-term investors, it is our duty to fully take part in this global urgency to fight climate change.

My intimate conviction is that this objective cannot be achieved on time without a more sober approach and without technological innovation. The value creation must now be equally assessed by financial performance and by the externalities generated by an asset.

Our Augmented Infrastructure framework should thus drive the new dynamics of this approach and innovation should be considered as an enabler for a better climate impact. We also all need to be aware of the environmental impact of digital itself and find ways to mitigate it in its design as well as its usage.

How can we innovate and act for climate?
How do we prepare our infrastructure assets to face the changing dynamics of our economy and our world?

2020 is tomorrow. Once a synonym for "***future***", this key date is a symbol for new dawn where the issue of long term value can not be but linked to digital sobriety and technological responsibility.

At Fabernovel, that is why when working on transformation projects, services design or engineering, we follow a triple approach: entrepreneurial, digital but first and foremost responsible.

I am convinced that this approach can be applied to infrastructures. Regarding carbon impact issue, beyond mitigation measures and energy recycling, we need to act upstream by rethinking the way we design services and technology.

Innovation more than ever, has to be thought in a global ecosystem perspective to prevent drifts and limit impact.

Let's build this inclusive future together.

Stéphane Distinguin
Founder and CEO
of FABERNOVEL

Since climate change is one
of humanity's biggest challenges,

The Augmented Infrastructure
model must resonate
with our meta-infrastructure:

Earth

Climate urgency amplifies the importance of our global impact on the environment

Infrastructure, as a key pillar of the global economy, **needs to lead the way in carbon emissions reduction.**

Worldwide emissions growth is 70% higher than the long term objective.

The aim of the COP 21 Paris agreements in 2015 is to keep global temperature from rising above 2°C compared to pre-industrial levels.

Recognizing that climate change has a significant cost for the global economy.

In this context, there is an imperative to use connectivity not only for efficiency but also for carbon footprint reduction to be in line with the 2° target.

Combating climate change is a top priority for Ardian’s sustainability strategy

Among key actions :

- Investing in clean energy: 3GW green energy capacity and c.€1.5 billion invested
- Measuring the carbon footprint of portfolio companies
- Building trajectory scenarios and identifying reduction levers
- In 2015, Ardian co-founded Initiative Climate International, endorsed by UN PRI in 2018

This impact needs to be integrated in value creation assessments

Our conviction is that the valuation approach in the new economy needs to integrate all drivers for value creation and provide a 360° view of businesses.

Different pillars need to be integrated to assess a company's value, growth sustainability and business model resilience. Including, clients, talents, ecosystem, software <u>and</u> societal & environmental impact.

The more environmentally efficient the infrastructure is, the lower its risk premium and the better its return will be.

A reduction in the carbon footprint can lead to a lower financing rate ...

LISEA issued in Feb 2019 €905m Green Bonds on EU market. Thanks to its alignment with Clean Transportation Green Bond Principles and the project's social impact, it has benefited from:

- A decreased cost of debt
- An extended average maturity

... but failing to tackle the climate challenge can be a source of value destruction

The American energy group PG&E was accused of having caused forest fires in California due to a poor infrastructure maintenance.

Even if there are some other causes, PG&E may have not anticipated the increasing climate risk.

A crucial factor for user engagement

This positive impact on carbon footprint will now have to be monitored and communicated to users requesting transparency.

And will play on user retention and monetization.

Coming back to our conviction of value creation, we believe that the infrastructure commitments to climate and societal issues will increasingly be key for user retention and monetization. Ultimately, feeding into valuation and investor engagement

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"Many of our decisions address social or environmental concerns. (...)

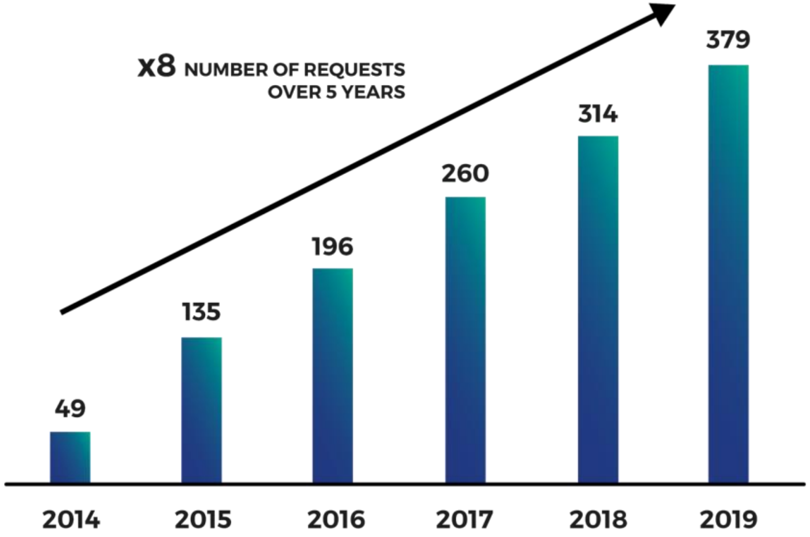
We do this not only out of conviction, but also for strategic reasons. We are convinced that this can enhance our attractiveness. (...)

We have calculated that this saves us 100 million euros per year in acquisition costs"

Pascal Demurger,
CEO

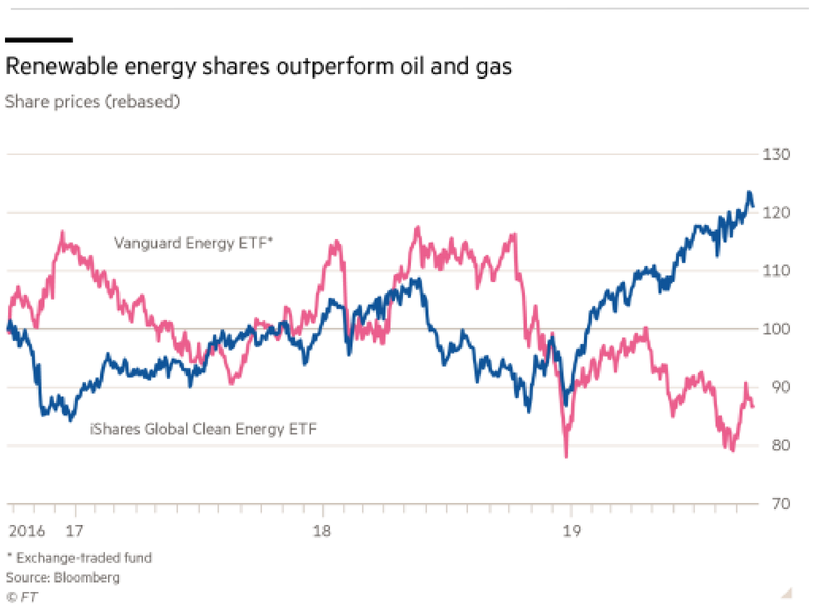
And investor engagement as well

Ardian's investor growing interest for ESG issues has accelerated ...



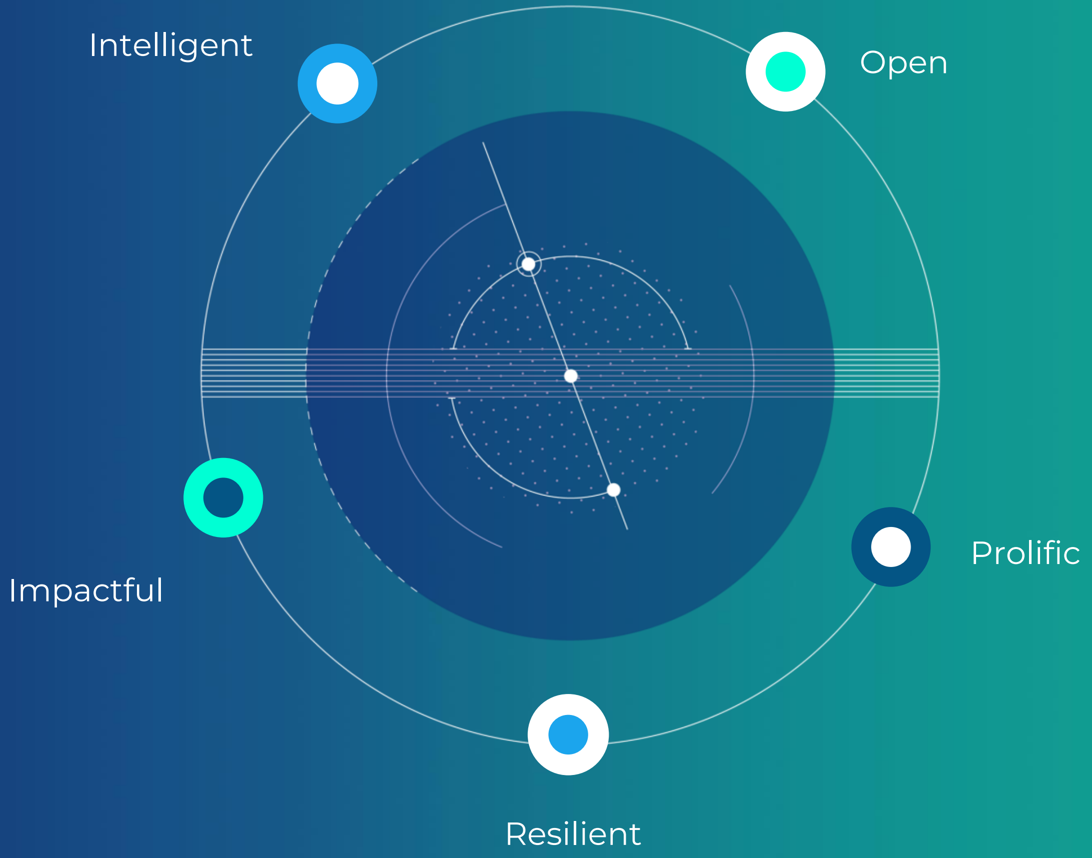
Ardian Infrastructures commits to an annual overview of its portfolio carbon footprint

... and renewable energy stocks have been outperforming oil & gas, benefiting from a sharp reduction in the cost of wind and solar and higher attractiveness for investors



The systemic approach is at the heart of the Augmented Infrastructure framework …

… as it is a strategic compass considering both digital issues and externalities



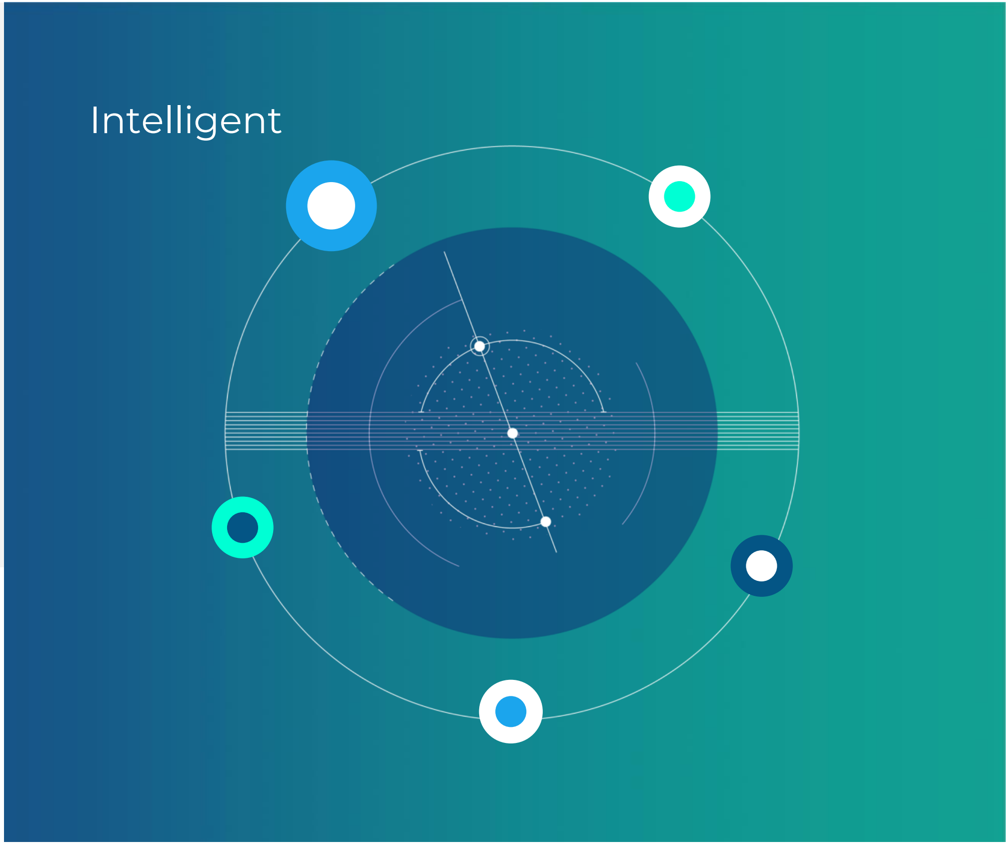
The Augmented Infrastructure needs to integrate in a sustainable way in its environment to limit its impact and ensure its long term resilience

Thus, how are digitalization and environmental stakes, at the center of this strategic compass, interacting?

Intelligence - the first step for a digital transformation

As of today, intelligence is the pillar on which infrastructures are the most mature and have initiated the highest number of key projects, facing the necessity to optimize their operations in an ecosystem which has started to move to digitalisation.

Intelligent infrastructures have the capacity to update their functional knowledge continuously in order to improve their operational efficiency and the customer satisfaction.



In the context of value chain disruption, intelligence is the first necessary step to a wider digital transformation of the business model.

Gather better intelligence to improve performance

User Centricity

Gain a better understanding of how users are leveraging the infrastructure to predict operational performance and improve user experience.

Omniscience

Become more aware and have a better understanding of itself in order to improve and adapt its operational processes.

Proactivity

Maintain its state of operation in order to keep up its performance through predictive maintenance.

Improving intelligence is driven by the overall goal to continuously improve its performance for its clients, its employees and its ecosystem.

While the first intention is to boost operational performances, operational efficiencies can also decrease negative externalities, by lowering energy consumption, reducing risk of pollution, improving employee work conditions and safety, increasing inclusivity, etc.

Combining digital technology with infrastructure creates intelligence ...

... which indirectly contributes to reduce
their environmental footprint.

Data is the cornerstone to accelerate the path to intelligence and carbon neutrality

Data and connectivity are key to enhance our understanding of infrastructure, their operational processes, the needs of their clients, and also the levers to reduce carbon footprint. The capability of infrastructures to **collect, analyze and exploit data** improve their propensity to become intelligent and thus impactful.

Collect

Collect data on infrastructure, its users and operations including carbon emissions thanks to sensors, electronic devices, new protocols and communication networks (Sigfox, LoRa, 4G, 5G)

Analyse

Analyse the data to be collected into actionable insights. Enrich collected data with real time data extracted from other systems. Ensure the quality of data.

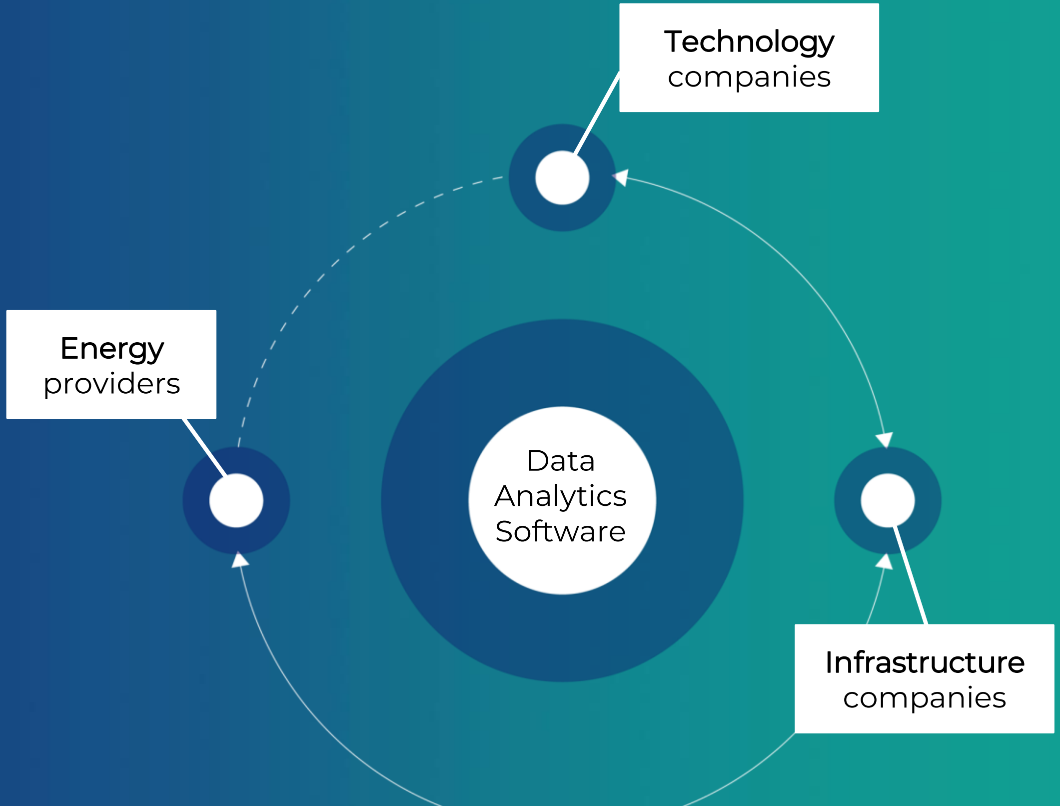
Exploit & leverage

Use of these insights to impact infrastructure business models, architecture, optimisation processes, new services, energy consumption etc.

Fuelling new monitoring and efficiency solutions

Technology startups, energy providers as well as infrastructure companies themselves are leveraging data.

They develop software that enable to monitor and optimize assets' activity and therefore reduce their external impact (carbon emissions, etc.).



[Case] Naples International Airport: digital levers enabling an energy efficient infrastructure

Naples International Airport (NIA), an Ardian Infrastructure portfolio company, uses digital tools to automate and optimize the management of its different plants and terminals.

Management of aircrafts during ground operations
NIA has developed a tool to limit the taxi time of aircrafts during their departure procedure.

Lighting and air conditioning in the terminal
It has implemented sensors on the terminal buildings to automatically manage lighting and air conditioning in terms of external conditions (air temperature, sunlight) and the airport attendance (CO2 level).

What is next?
NIA is working on developing a predictive tool to better anticipate temperature changes and increase its efficiency when managing its buildings features (air temperature notably).

-21% overall CO2 emissions from 2012 to 2017

G.E.S.A.C has obtained the Airport Carbon Accreditation Level 3+ (Neutrality) in 2018.

"Naples International Airport is committed to sustain the traffic growth with an environmental-friendly vision.

This is possible thanks to the engagement of the whole Airport community and by discussing with the local community"

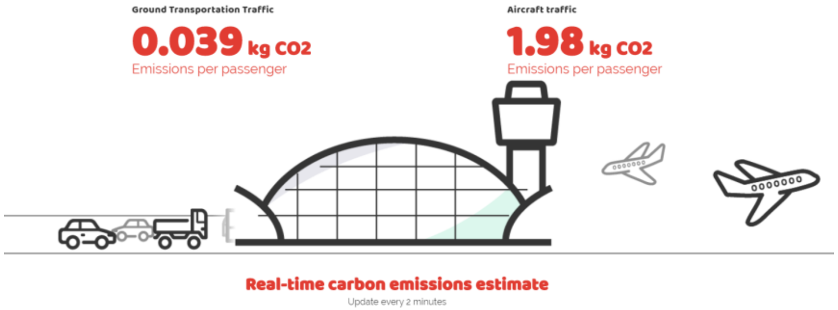
Michele Miedico
Head of Environment,
Planning and Compliance, NIA

[Case] Air Carbon: an analytics tool to monitor airports' carbon emissions and help build trajectory scenarios

Ardian Infrastructure, in collaboration with students from HEC, Ecole Polytechnique and Ecole 42, has designed Air Carbon, a data analytics platform that provides real-time estimates of airports' carbon emissions.
The objective is to **create an emission model that will enable airports to better understand and predict the impact of its future initiatives.**

Thus, infrastructures will be able to plan for different scenarios and have a clearer vision to design their operations considering environmental aspects.

To date, the model is built with public data but the ambition of Air Carbon is to integrate private data from airports such as SEA Milan. It is aimed to be used as a mapping decision tool to help them collaborate effectively with third parties.



"Air Carbon has received a very enthusiastic welcome from the management teams of our airport assets as a powerful tool to measure, monitor and find levers to reduce our carbon emissions.

The goal is to progressively implement it in all our airports."

Rosario Mazza,
Managing Director,
ARDIAN INFRASTRUCTURE

[Case] Quantcube Technology: a traffic prediction model for monitoring congestion peaks

Ardian Infrastructure and SIAS (ASTM Group) have collaborated on a Machine Learning predictive model with Quantcube Technology, a French startup, to predict short term traffic on SIAS highways in Italy and thus gain more insight on congestion and flows on the network.

Most networks are not globally over-saturated, simply not optimally used. **Congestion generates high environmental costs so improving the anticipation of peaks can have a significant impact on energy consumption an air pollution:**

- In 2015, the Texas Transportation Institute analyzed congestion in 471 urban areas in the US and found that urban dwellers wasted 3.1 billion gallons of fuel

- The city of Boston estimates that only 10% of their road network accounts for 70% of traffic-related air pollution.

Predicting traffic creates the opportunity to manage and develop networks in order to minimize congestion and consequently reduce the environmental impact.

[Case] Predity, an energy efficiency platform, built to reduce Engie Cofely client's carbon footprint

Predity analyses data from IoT to better monitor its infrastructure and gain operational efficiency by optimizing technicians intervention.

Thanks to real time monitoring of their installation, Engie Cofely can anticipate problems and either take action remotely,
or plan an intervention and optimize the time of the technician.

This optimization tool and methodology to better supervise installations has been offered to its BtoB/BtoT clients, enabling them to optimize their operations and energy consumption and serving Engie's commitment to overall reduce carbon footprint.

1,66 M of CO2 tons avoided overall thanks to Cofely's expertise and tools

36
Control centers in france

25.000
Connected installations

100.000
IoT

50M
of data collected

But to address more globally the different challenges posed by the climate crisis …

… we also need to think on broader scale than that of infrastructure.

The city model as a meta-platform enables scaling the question of infrastructure impact

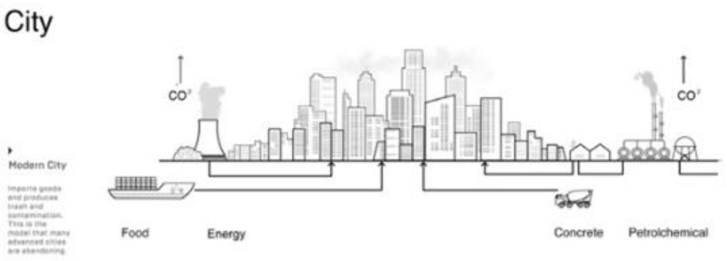
In 2050, 66% of population will be living in urban areas. Thus, the issue of carbon footprint goes far beyond the model of an intelligent infrastructure.

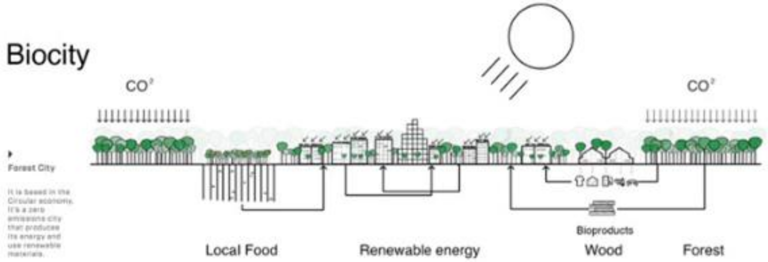
Given the acceleration in the urbanisation process, there is an imperative to consider the city scale. The city is complex, brings together these externalities and acts as an orchestrator.

The harmonious integration of infrastructures in cities will be critical, one key element being urban transports.

Digital provides tools to address the city complexity, improve its self-knowledge and its efficiency, connect systems and measure impacts.
And in the end, to make it more human and environmentally friendly.

Source : Bio Cities beyond the Digital / Vicente Guallart for the Shenzhen Biennale (UABB) 2019



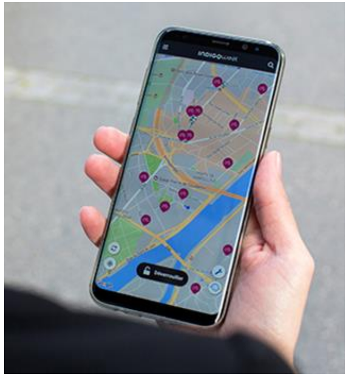


[Case] Indigo Weel: a new mobility solution, easing urban congestion and pollution

As part of the initiatives led in cooperation with Ardian Infrastructure, Indigo developed a free floating service of electric scooters and bikes in urban areas.

It launched Indigo Weel in 2017 which now covers 7 cities with 9,950 bikes deployed in France and Smovengo which operates Velib' in Paris since 2018.

These solutions are an alternative to the Public Transport Networks. The companies work alongside communities to help them solve congestion, pollution and isolation issues (lack of infrastructure for the last few kilometres). Today, they are both strongly supported by users.



"Ardian's investment in Indigo has enabled the business to accelerate Indigo's growth, most notably in Europe and the Americas. Indigo is now a leading player in individual mobility globally, and this is a position which has been both established and expanded with Ardian's support."

Serge Clemente
CEO of Indigo Group

[Case] Citymapper: an urban transport app, optimizing traffic flow

By having access to users' data, digital players are able to offer seamless transportation experiences through Mobility-as-a-service applications and start to position themselves as city orchestrators.

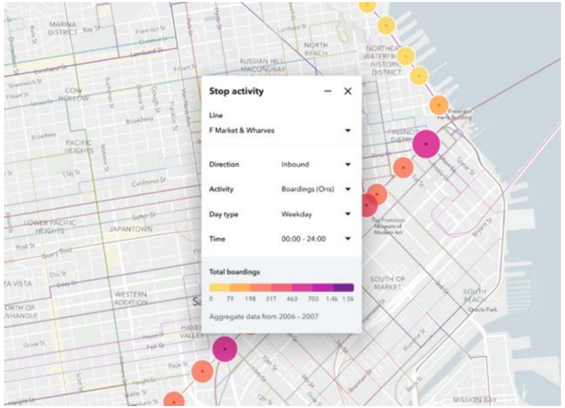
This aggregation of soft mobility solutions is a first step towards a more collective approach although it does not fully answer the needs of a greater inclusivity, the reduction of cities' carbon footprint and the development of a more sustainable environment.

After the launch of Citymapper, *Transport for London (TFL)* abandoned the idea of developing its own smartphone application.

[Case] The city as a platform: Remix

Remix develops a SaaS solution that enables public authorities and cities to have a complete vision of their infrastructure and make holistic decisions regarding transit.

They need to face congestion issues to offer a smooth experience to commuters and therefore explore the potential of shared mobility services, which leads to more sustainable cities.



The case of Providence

The city of Providence had the ambition to grow its bicycle network and needed to streamline its street design process.

It partnered with Remix to:

- Develop a conceptual design of the network
- Test scenarios in existing conditions

Therefore, digital offers powerful tools to support infrastructures’ necessary transformation which can serve both operational and environmental efficiency.

However, there is a paradox…

Today

4.0%
digital

vs

2.8%
air traffic

of GHG emissions

Using digital has a cost for climate

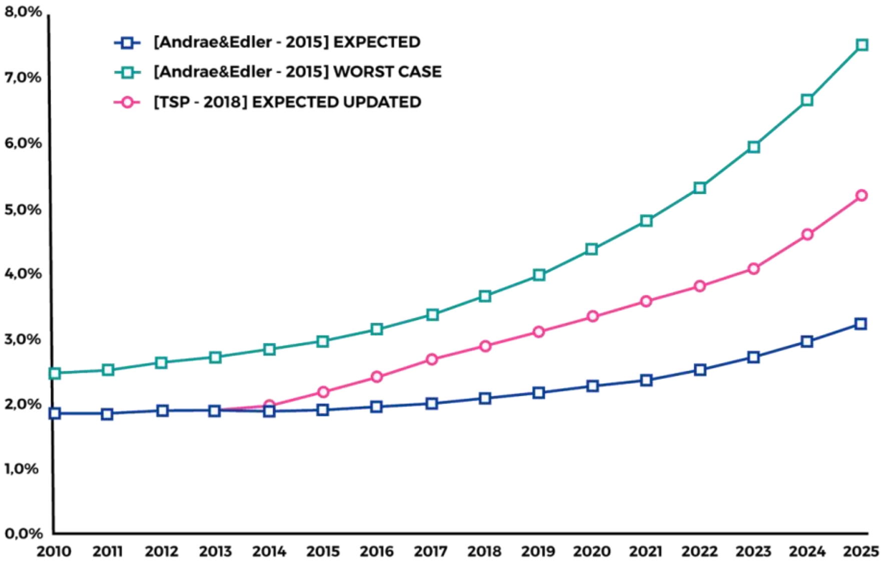
A high underlying level of energy consumption

The global energy consumption by digital means represented almost 3%* of the total world energy consumption in 2018.

Cumulatively, data centers and data transmission networks account for almost half of the digital consumption.

*Source : The Shift Project, the IEA.

Data traffic, which is responsible for 55% of digital's energy consumption, grows 25% per year, highlighting how this situation needs to be tackled.



Evolution of global energy consumption of digital between 2010 and 2025, as a proportion of total world energy consumption (source: The Shift Project 2018, as of Andrae & Edler 2015)

Amplified by digital bias

Several biases contribute to the increase in energy consumption.

Addition ...
not substitution

The digital economy does not replace the traditional one, it adds-up.

Immaterial asset

Users believe digital assets to be intangible, their impact to be neutral and their resources to be infinite.

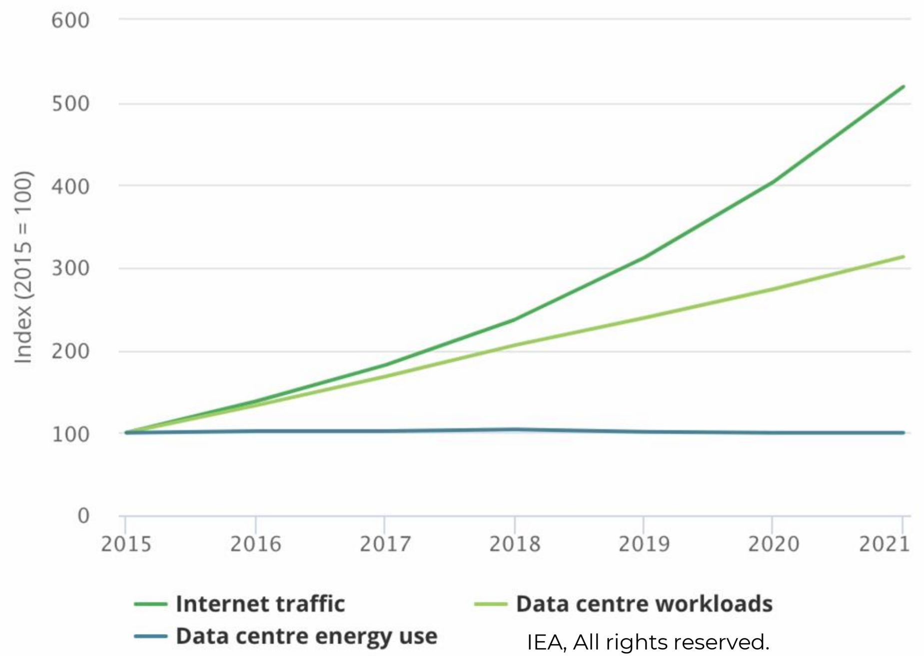
Rebound effect

Finally, optimization can create an inverted effect: asset optimization can lead to further use, increasing again the energy consumption.

But, nonetheless, this consumption can be optimized

According to IEA,
the energy used by data centers will stabilise despite the increase in internet traffic and data centers' workloads.

Global trends in internet traffic, data center workloads, and data center energy use



Minimizing the negative outcomes

We identified
three main methods

to minimize
the negative impacts
of the digital economy,

from shortest
to longest term
solutions

Optimizing data centers:
Improving power usage effectiveness of data centers as these facilities scale up, in order to reduce the amount of energy used.

Recycling energy consumption:
Recycling waste from energy-intensive activities
(and capturing the polluting discharges).

Accelerating energy transition:
Shifting to a new energy mix to power energy-intensive infrastructures like data centers.

[Case] Optimizing Google data centers

The shift away from small, inefficient data centers towards much larger cloud and hyperscale data centers creates more opportunities to minimise energy consumption.

Redesigning how power is distributed minimizes energy loss. Google reduces energy use in its data centers by installing smart temperature and lighting controls. Servers are custom-designed to use as little energy as possible, stripped of unnecessary components and are kept as busy as possible to do more with fewer servers.

By spring 2014, Google data centers used 50% less energy than the industry average.

To go beyond, Google then built a machine learning program to better predict and minimize the impact of data center operations.

Aided by Google's leading artificial intelligence research group, DeepMind, the models have produced:
a 40% reduction in energy used for cooling
and 15% reduction in overall energy.

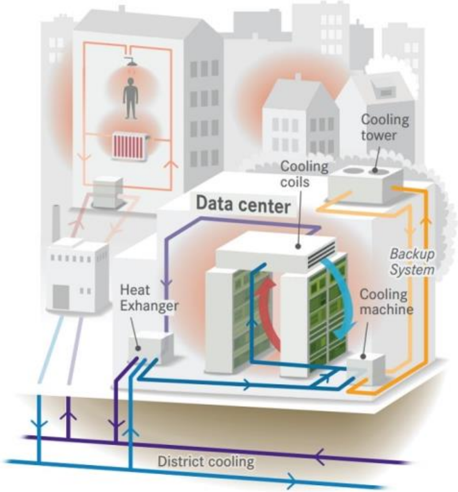
[Case] Recycling data center generated heat in Stockholm

The development of a cloud infrastructure that also serves as a heating infrastructure. Stockholm Data Parks is a programme that seeks to help large data centers maximize cost efficiency and sustainability with low cost renewable electricity and paid-for heat recovery.

Data center excess heat is a valuable resource that can be part of fighting climate change.

Stockholm Data Parks is expecting to meet 10% of the entire heating need of Stockholm by 2035. One of the main incentives for companies to join the programme in Stockholm is financial – they get to sell their waste heat.

"An establishment in Stockholm Data Parks is a unique possibility for a data center to contribute to the city's green energy mix"
Anna König Jerlmyr, Mayor of Stockholm



How it works ?
Cold water feeds through pipes into the data centre, where it's used to create the cold air they blow on their servers to keep them from overheating. The water, which has been heated by the cooling process, then runs back out of the pipes and into plants where it is distributed for heating.

Sources: BBC

[Case] Supplying GAFA digital infrastructures with renewables

The increase in climate change awareness has challenged tech business models to tackle ethical and societal issues. Large companies, like Amazon and Google, have increased their green commitments, following pressure from both customers and employees. Environmental, social and governance standards (ESG) are now becoming fundamental to business performance.

"Amazon gets about 40% of its energy from renewable sources with 15 utility-scale solar and wind farms.
That will move to 80% by 2024 and 100% by 2030."said CEO Jeff Bezos.
The company aims for net zero emissions by 2040.

"In 2018, we achieved twelve consecutive years of carbon neutrality and, for the second year in a row, matched 100% of the electricity consumption of our global operations with renewable energy" - Google Environmental Report.

In 2016, Google signed a 10 year Power Purchase Agreement (PPA) with the Ardian Infrastructure portfolio company, Lyrestad Holding AB, a Swedish wind farm, thus ensuring future procurement of clean energy.

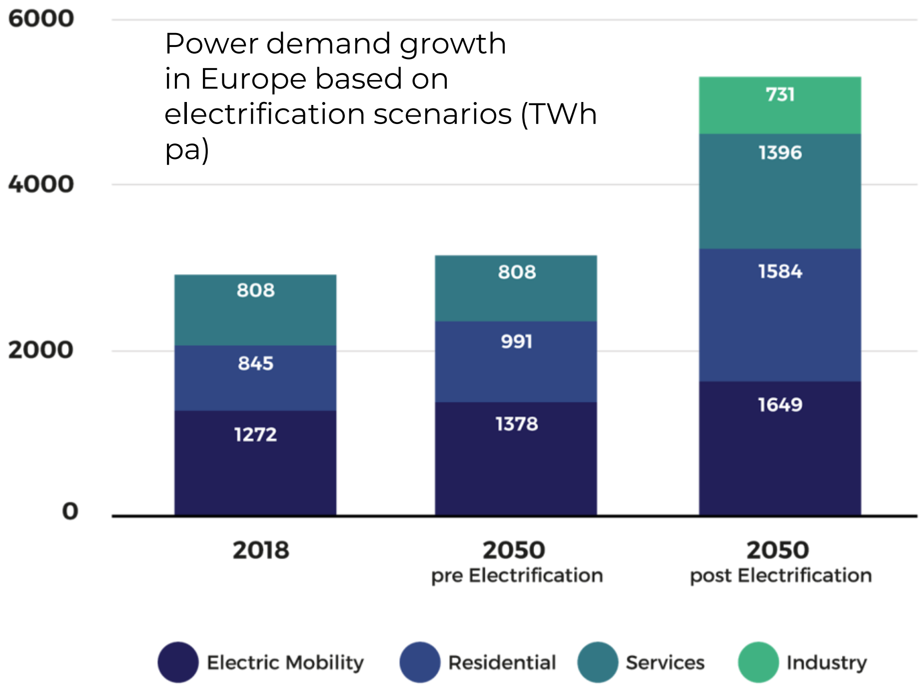
Accelerating the transition to renewable energy

Roughly 25%* of EU greenhouse gas emissions come from the generation of power.

As a result, the rising demand for power due to the electrification of the economy, (buildings and mobility solutions could increase electricity consumption from 35 to 85%*) combined with company's green commitments, requires renewables to be increasingly integrated in the energy mix.

*Source : Goldman Sachs Investment Research, EEA.

The European Commission has set a target of at least a 32% share of renewable energy by 2030 vs. 20% that should be reached in 2020.



Changing the energy mix brings new challenges

A sustainable future will require new thinking, new systems and a transformation of energy production, delivery and consumption. The shift from fossil fuels to renewable energy creates new challenges for the energy grid and the use of data is key in solving them:

The production of energy is intermittent due to the nature of renewables (solar and wind).

→ Requiring **higher flexibility of the grid** in order to match supply and demand,
as well as ability to predict the production.

Energy producers are more numerous and decentralized.

→ Requiring **new distribution systems** to link producers and consumers.

In the context of the decrease in subsidies given to renewables, all levers to optimize the asset performance will be critical to favour the energy transition.

[Case] Nordex partnership with Cumulocity IoT to optimize wind turbines' performance

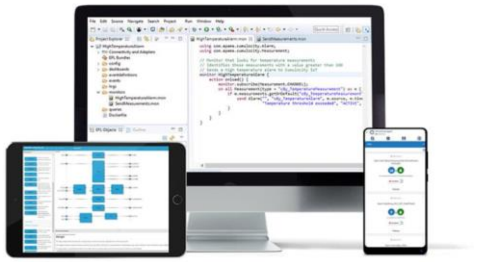
The German manufacturer Nordex partnered with Software AG to adopt its platform - Cumulocity IoT - in order to manage its wind farms.

The company plans to connect and monitor its 6,800 existing wind turbines, using Cumulocity IoT as a platform for digitalization and remote management of its turbines.

The platform offers its clients full-service monitoring, enabling optimization of the performance of their wind turbines. In the context of a reduction in grants, performance is key to ensure further flows of investment into these assets.

NORDEX
We've got the power.

software AG
Freedom as a Service



"Being able to access the vast dataset from our wind turbines globally in real-time will enable us to generate new services and drive operational efficiency."
Stefan Ewald, CIO of Nordex.

[Case] Increasing renewable assets' reliability and profitability through data analytics

Ardian renewable energy portfolio:

- **3 GW** of capacity installed across Europe, the US and Latin America
- **1 million** households could be supplied through annual production of Ardian portfolio installed capacity

Marion Calcine,
Managing Director Ardian Infrastructure

" We have started working in cooperation with Simone Tonon, CEO of 4New, our platform of Italian renewable assets, in order to improve our data analytics capabilities.
Our goal is to accompany our portfolio companies in their transition from a subsidized world to a more merchant environment in which it will be of paramount importance to have control of operations and be amongst the most efficient operators, to mitigate the intermittency of renewable energies and capture best market windows. ***This will create direct value for us and we must enable renewable assets to be more reliable in order to rely more and more on clean energies in the energy mix.****"*

Simone Tonon,
CEO, 4new

"We are working with a local university to develop a model integrating our production data and local weather data to improve our short term production forecasts and we wish to rely on digital solutions installed in our wind farms to leverage on our data management. We are working with Ardian Infrastructure team to find the right software which could be rolled out on all the assets. ***These solutions could allow substantial value creation for renewable operators as well as facilitate the proper balance of the grid if they were to be adopted globally.****"*

Mitigation has been used as an efficient response to the environmental impact of our digitalization.

But, mitigation isn't the only solution.

Addressing the problem at its core by rethinking the way we design could be an answer for this global challenge.

Limiting the impact by rethinking the way we design

Design is a process that allows us to go back to the root of problems such as the environmental impact of infrastructure.

This humanistic approach, based on the study of uses, needs and contexts, makes it possible to ground any innovation in reality and issues of our time.

“The purpose or goal of design is to improve or at least maintain the habitability of the world in all its dimensions.”

–
*Alain Findeli**

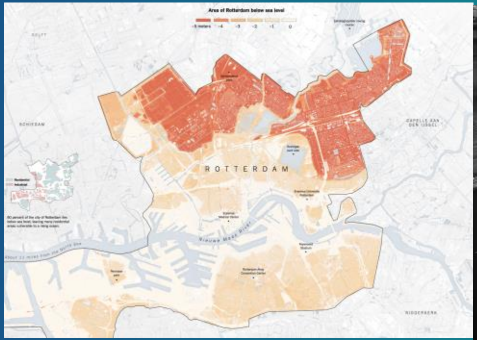
*Alain Findeli is design researcher who focused his career and research interests on the human and social aspects of engineering, technology and design.

Constraints fuel creativity in design, regardless of whether economic, social or cultural...

Constraints make designers creative. They impose boundaries, force us to look for formal, technical and practical solutions, to think "out of the box" to circumvent problems and meet the challenges that conventional thinking cannot address.

Our definition of designers: anyone who imagines and creates - designer, engineer, architect... - and takes part in the design process of services, experiences, products, spaces.

Constraint is an opportunity for all designers to innovate.



[The case of Rotterdam] Much of the Netherlands sits below sea level. This geological constraint, amplified by climate change has been turned into an opportunity with the innovation program Room for River. Now Dutch firms dominate the global market in high-tech engineering and water management and the Netherlands are a source of inspiration for cities such as Jakarta, New York or New Orleans.

One of the biggest constraints of our time — and therefore crucial opportunity — is the environment.

The environment is under pressure.
Limited resources should drive innovation in infrastructure, with energy constraints - structural constraints - social constraints...
and more.

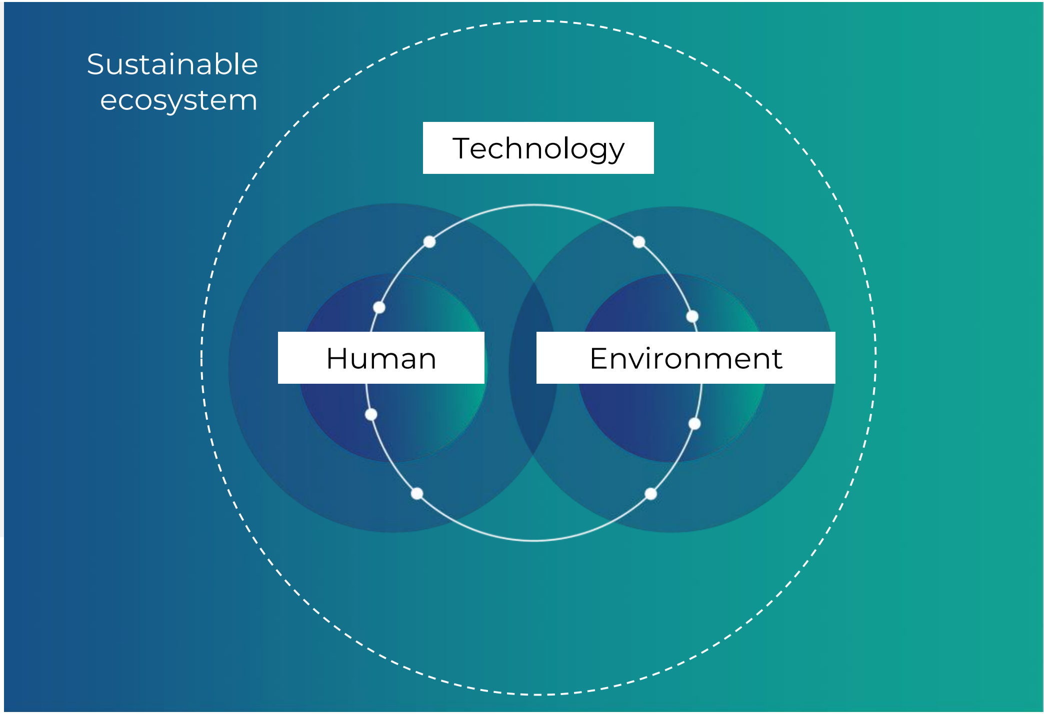
It profoundly redefines the way designers conceive services, products, spaces
and technologies.

Systemic design makes it possible to think and design, by integrating human, environmental, and digital characteristics to establish an interconnected system.

In the 21st century, we need to consider a holistic approach to encompass human, environmental, technological variables and establish them as an interconnected ecosystem. Each component of this ecosystem needs to be considered as an element of equal importance, in order to build a sustainable system.

In this context, designers need to think globally, considering direct and indirect impacts of their innovative decisions in these 3 areas.

This eco-systemic thinking enables repositioning technology as a whole. It becomes a tool and not an end in itself, which can contribute a desirable future.



Systemic design enables
a commitment to sustainability,
through identification
of synergies and externalities,
taking into account direct
and indirect impacts.

[Case] The systemic approach to enhance livability in cities

Systemic Design Insight

Designers using this approach consider the **relationship between complex systems,** rather than focusing on a single part. This is essential for most of the challenges we face in the city, as the infrastructures are interconnected and cannot be solved separately. **By taking an overview and considering every stakeholder, every flow of synergy and action is identified.** Opportunities and new ideas arise and can be incorporated early in the process.

Nantes was elected Green Capital of Europe in 2013, and Innovation Capital in 2019. This recognition is the consequence of a systemic approach mobilizing the actors at all levels for a collective intelligence approach.

How ?

Nantes manages this systemic approach by:

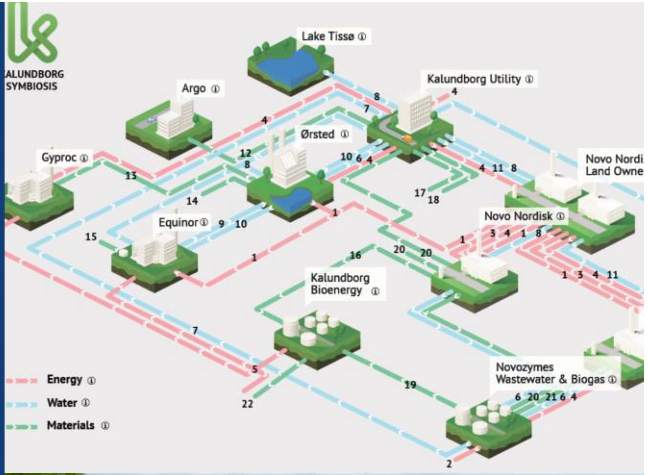
- co-running 165 projects with citizens through an online platform
- setting up an open governance on specific topics through 10 councils, 5 re-founded and 5 new ones
- creating 8 to 10 citizen workshops
- founding a City Lab for companies, universities and associations to test their urban projects with a co-creation required criteria

By taking into account the aspirations of various stakeholders, Nantes has built four areas of excellence: public transport, biodiversity, water management and the Climate Plan, recognized by the European Commission.

[Case] The systemic approach to innovate with symbiosis and sobriety within the industry

Systemic Design Insight

Designers are facing a change of paradigm where **innovation increasingly correlates with using as few resources as possible.** In the context of infrastructure, the notion of **sobriety is essentially based on the principle of optimization,** which aims to limit the pressure exerted on natural resources **through circular exchanges.** The residue from one entity becomes a resource for another and works in a symbiosis.



The Kalundborg Symbiosis is a partnership between nine public and private companies in Kalundborg.

Since 1972 they have developed the World's first industrial symbiosis with a circular approach to production.

How ?
The main principle is that an output from one company becomes a resource for another, benefiting both the environment and the economy. Exchange concerns energy, water and materials.

Systemic design requires new methodologies and tools to guide the approach

Prospective

Project into a plurality of scenarios, and choose the most positive option from a social, environmental, economic point of view.

Collective intelligence

Bring together the different stakeholders, citizens, public partners etc. at differents steps of a project to co-design the best scenario adapted to the territory.

Impact Measuring

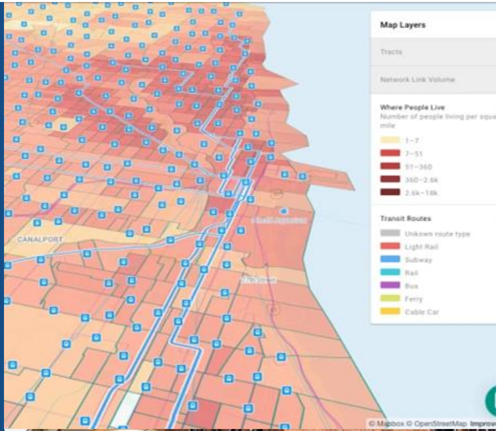
Define and prioritize key evaluation objectives and criteria to define coherent human-environment solutions and be aware of the impact in the short and long term.

[Case] Prospective design as an effective approach to simulate possibles futures and guide planning decision

Systemic Design Insight

To create a future environment and infrastructure, **prospective design approach helps to understand and shape multiple possible futures,** allowing us to design tomorrow's products, services and infrastructures in a constantly changing world. Thanks to this approach, designers have the opportunity **to explore, experiment, create and design projects oriented towards the future.**

It will help inform, design and create processes. Additionally, it promotes pursuit of objectives such as sustainability, **to provide long-term value and overall well-being.**



Replica is a software that models and simulates possible living scenarios of the city mainly for transportation. Toronto, Chicago and Kansas City are already using Replica. Through an understanding of the current situation and changes, Replica drives their planning decisions.

How ?
Thanks to de-identified location data from citizens' smartphones, which provide the answer to the question of who uses the streets, and why and how. These models can become the basis for things like inclusive street design, which would help planners explain the impact that various options might have on different populations.

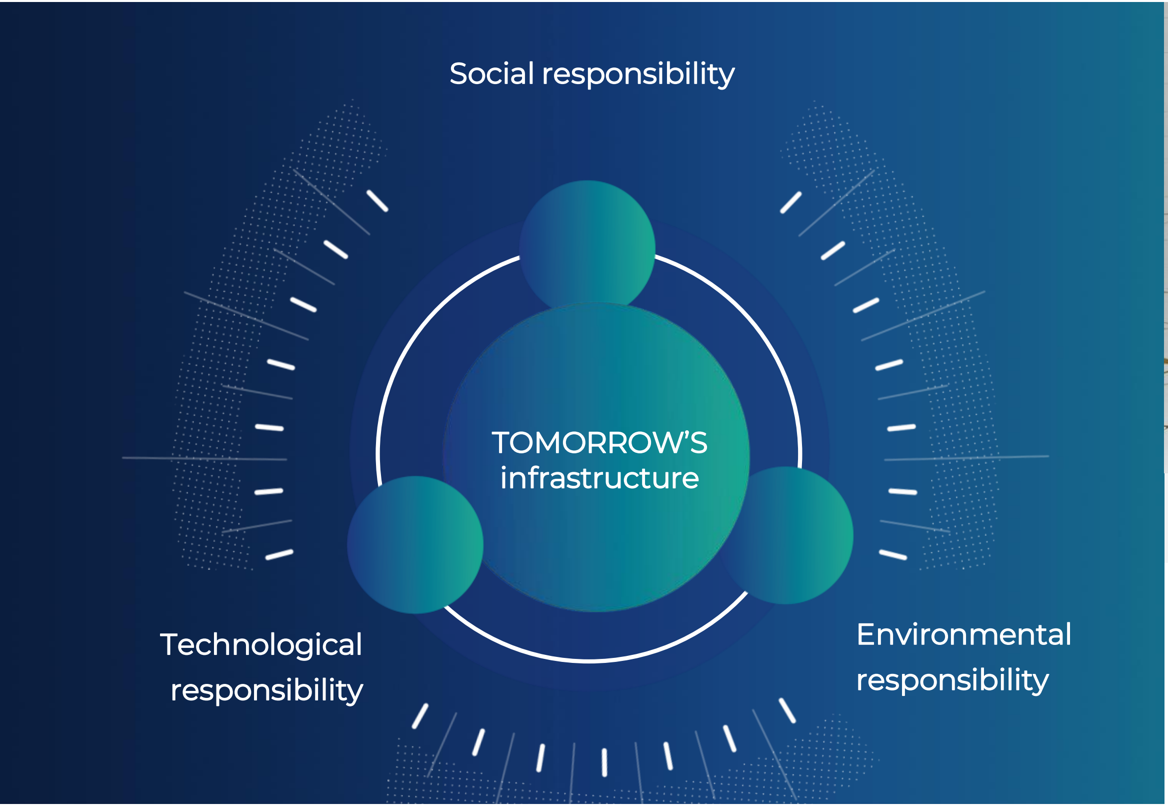
A systemic approach is the solution to design augmented infrastructures that are valuable and sustainable in the long run, taking into account the next challenges of our society, within the limited resources of our environment.

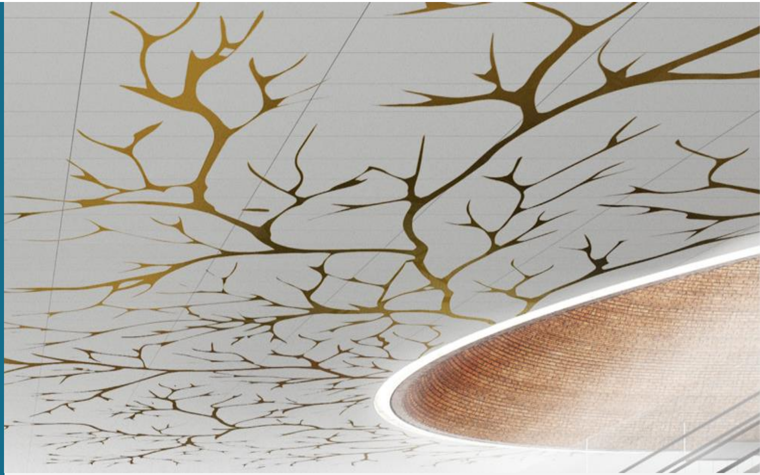
Building efficient solutions minimizing negative externalities, preventing risks in advance and establishing awareness of potential impact.

Thinking and designing by integrating the notion of "system" - human, environment - at the same level of importance. Consider digital as a key enabler.

Designing with social, environmental and technological responsibility in mind

Infrastructure must serve the commons, and embody its shared responsibility for the future





Made by Duy Anh Nhan Duc
La Courneuve Six-Routes

Like this piece of art, to be installed in a station in the context of the Grand Paris, these projects should be sources of inspiration to remind us that we all have a responsibility to put nature at the center of our usages.

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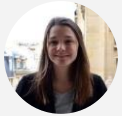

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