Lean Construction Institute - Qatar

Transforming the Built Environment

NAWIC

NATIONAL ASSOCIATION OF WOMEN IN CONSTRUCTION IN QATAR

Webinar Facilitator

Hossein Shahrokni, Ph.D.

Leaner Construction for Smarter Cities

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May 13, 2020 I 9:00 - 10:30 PM

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Leaner Construction for Smarter Cities

Hossein Shahrokni, PhD
Royal Institute of Technology
Lean Construction Institute Webinar

May 13 2020

Aims of This Webinar

01

Highlighting the Increasing Value of Lean Construction and Smart City Professionals in the Marketplace

02

Exploring how the Concept of Lean Construction and the Concept of Smart Cities are Coupled

03

Acknowledging the Value of Data for Decisions – In Particular the Decisions of the Citizens

Agenda

- The Urgent Demand for Lean
- Lean Construction and Smart Cites – Two Sides of the Same Coin?
- Leaner and Smarter Processes
- Leaner and Smarter Data and Decisions
- Engaging the Central Stakeholder

Our mission

Urban Analytics and Transitions - Royal Institute of Technology

To foster sustainable urban transitions through collaborative processes informed by analytics and ICT

Agenda

- **The Urgent Demand for Lean**
- Lean Construction and Smart Cites – Two Sides of the Same Coin?
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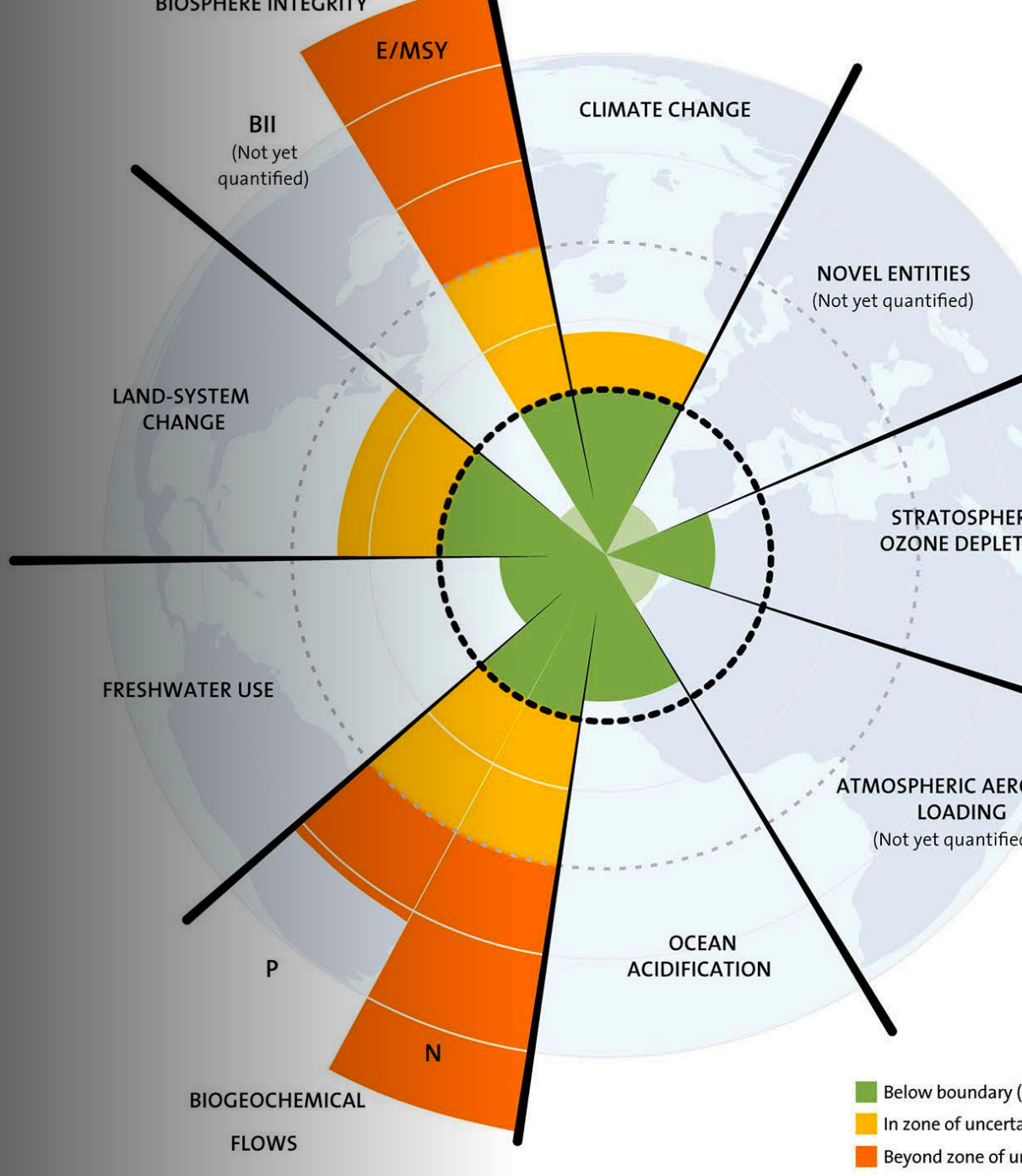
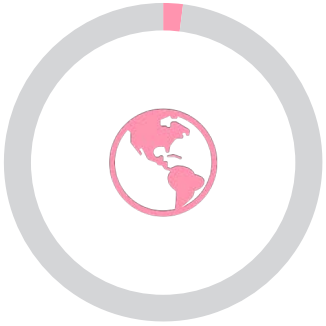
Our Cities are Pushing the Earth's Carrying Capacity Beyond its Limits

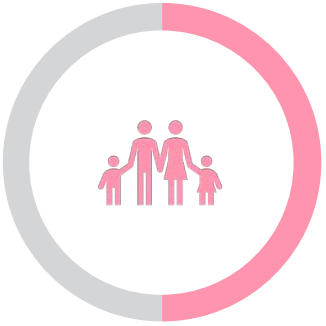


THE ROLE OF CITIES

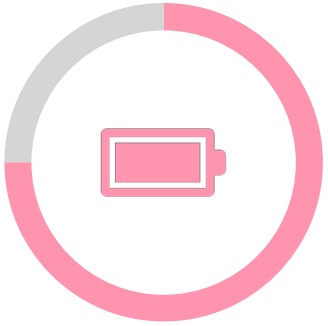

CITIES CAN BE
DEFINED IN FOUR
NUMBERS
2-50-75-80



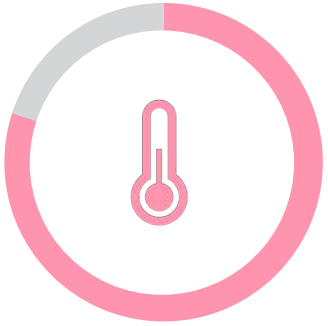
2%
SURFACE



50 %
POPULATION

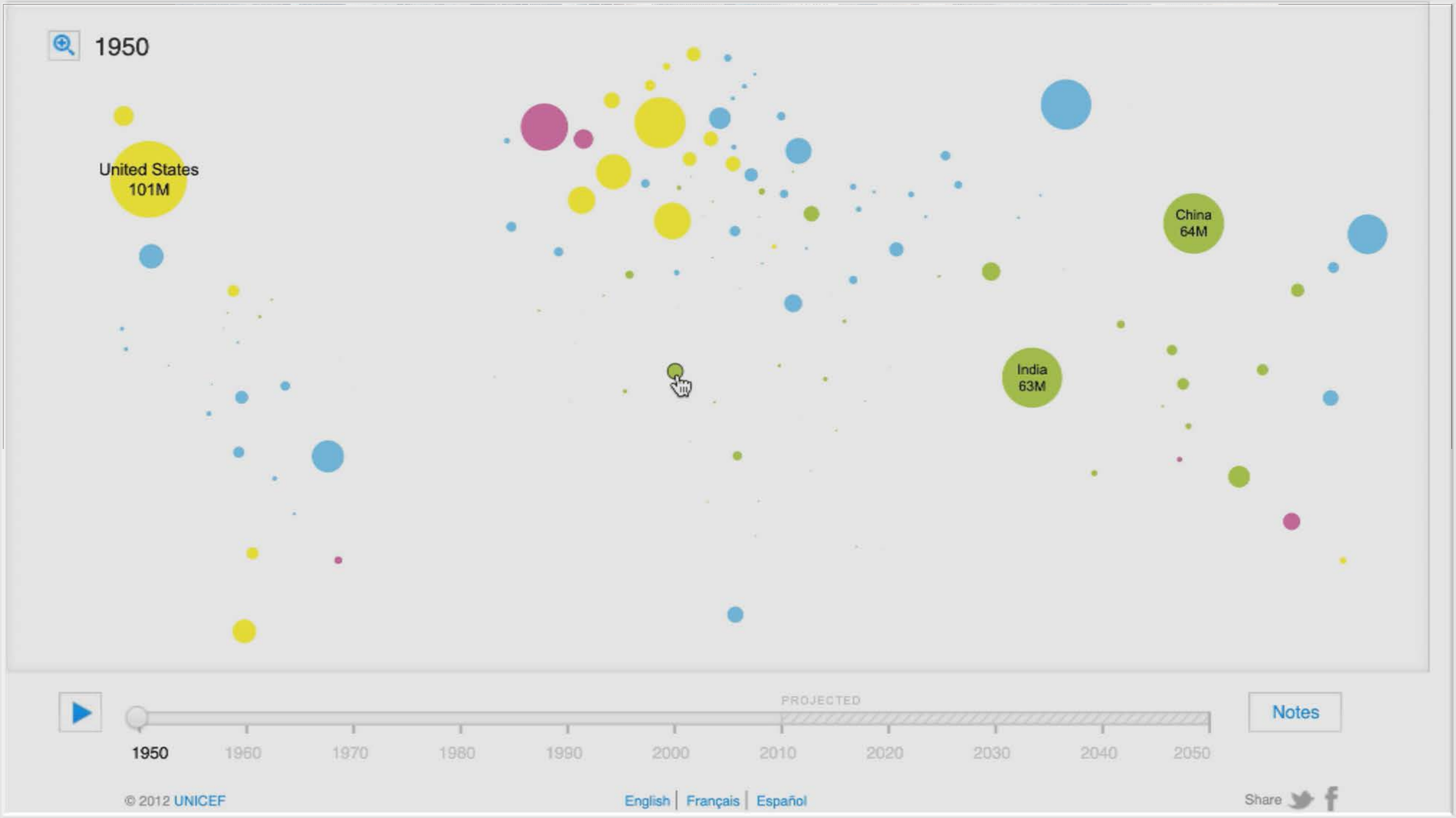


75 %
ENERGY



80%
EMISSIONS


BY 2050
WE ARE
BUILDING 40 %
NEW CITY
FOR 2.5 BILLION
PEOPLE


1950
United States
101M
China
64M
India
63M
PROJECTED
1950
1960
1970
1980
1990
2000
2010
2020
2030
2040
2050
Notes
© 2012 UNICEF
English | Français | Español
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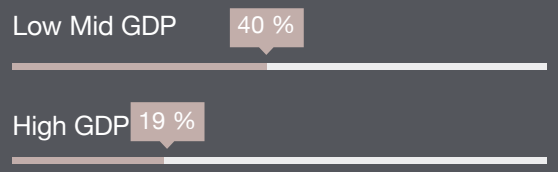
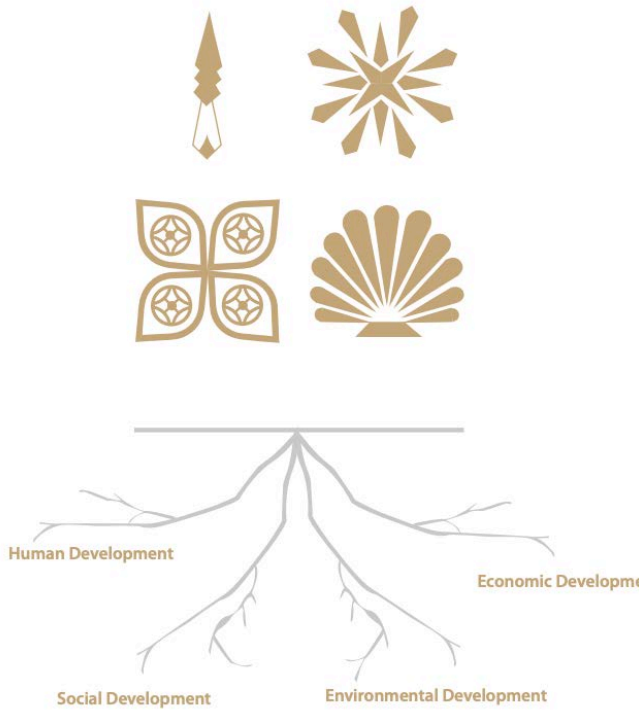
THE DEMAND FOR LEAN AND SMART IS INCREASING

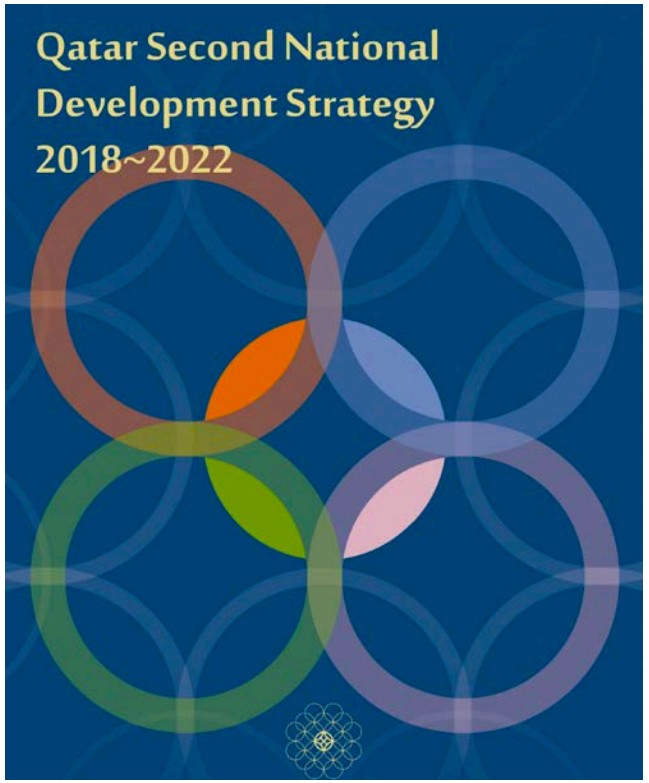
Waste Generation by 2050



The Resource Management in Creating and Operating Our Cities Is Increasingly Becoming Critical Question of Our Generation

Qatar National Vision 2030





Achievement of the Vision is a national responsibility. All sections of Qatari society and all sectors have an important role to play. This will require significant **institutional and organizational capacity building**; efficient and transparent delivery of public services; fruitful **public-private cooperation and partnerships**; the creation of a vibrant climate for business; and a larger space for civil society.

Agenda

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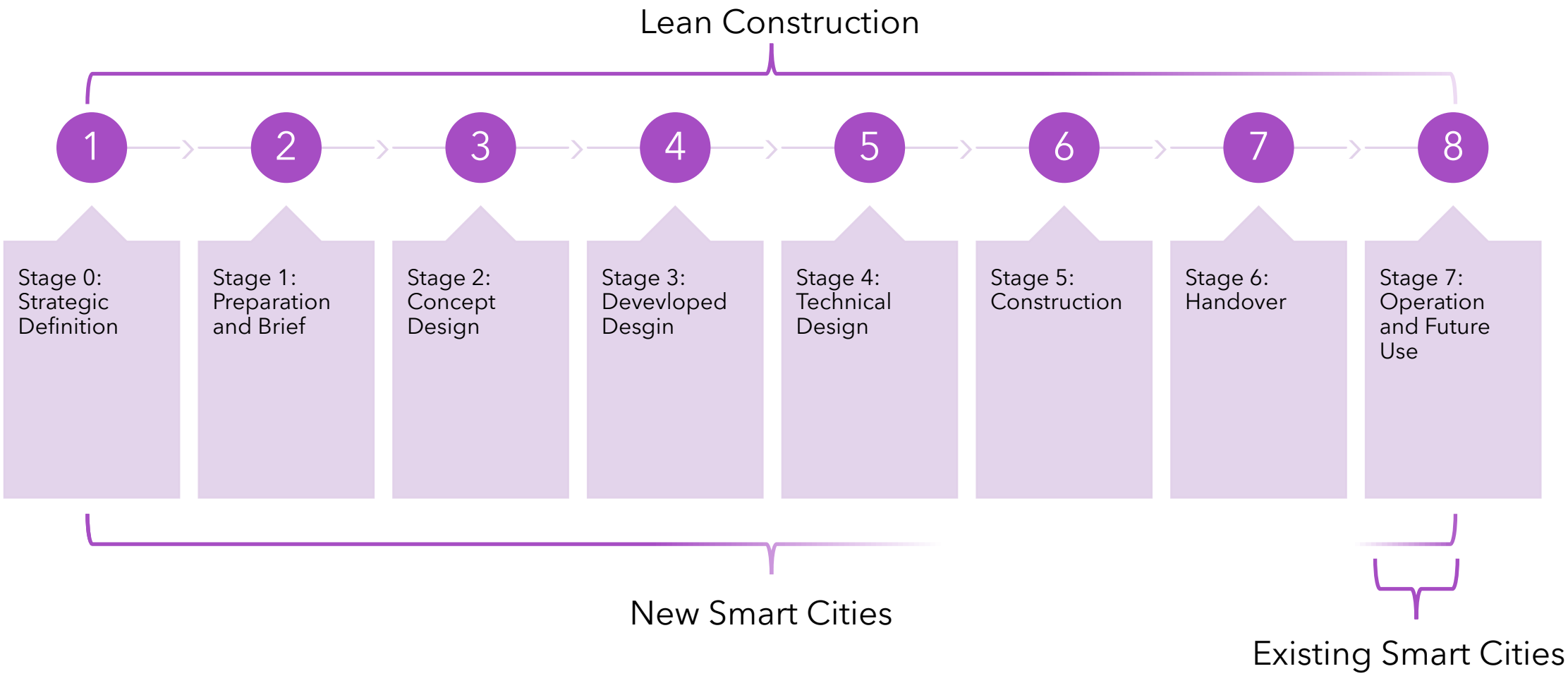
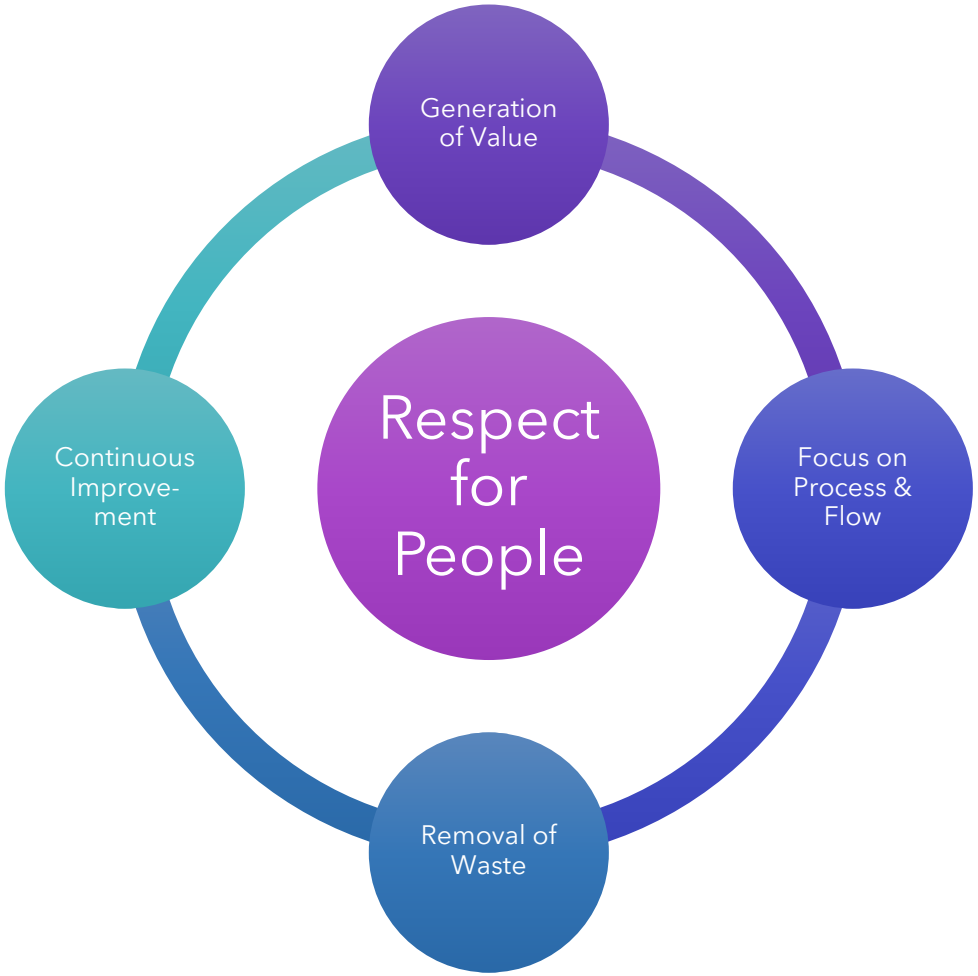
- Engaging the Central Stakeholder
  - Waste Project

Lean Construction and Smart Cities in the Project Life-Cycle



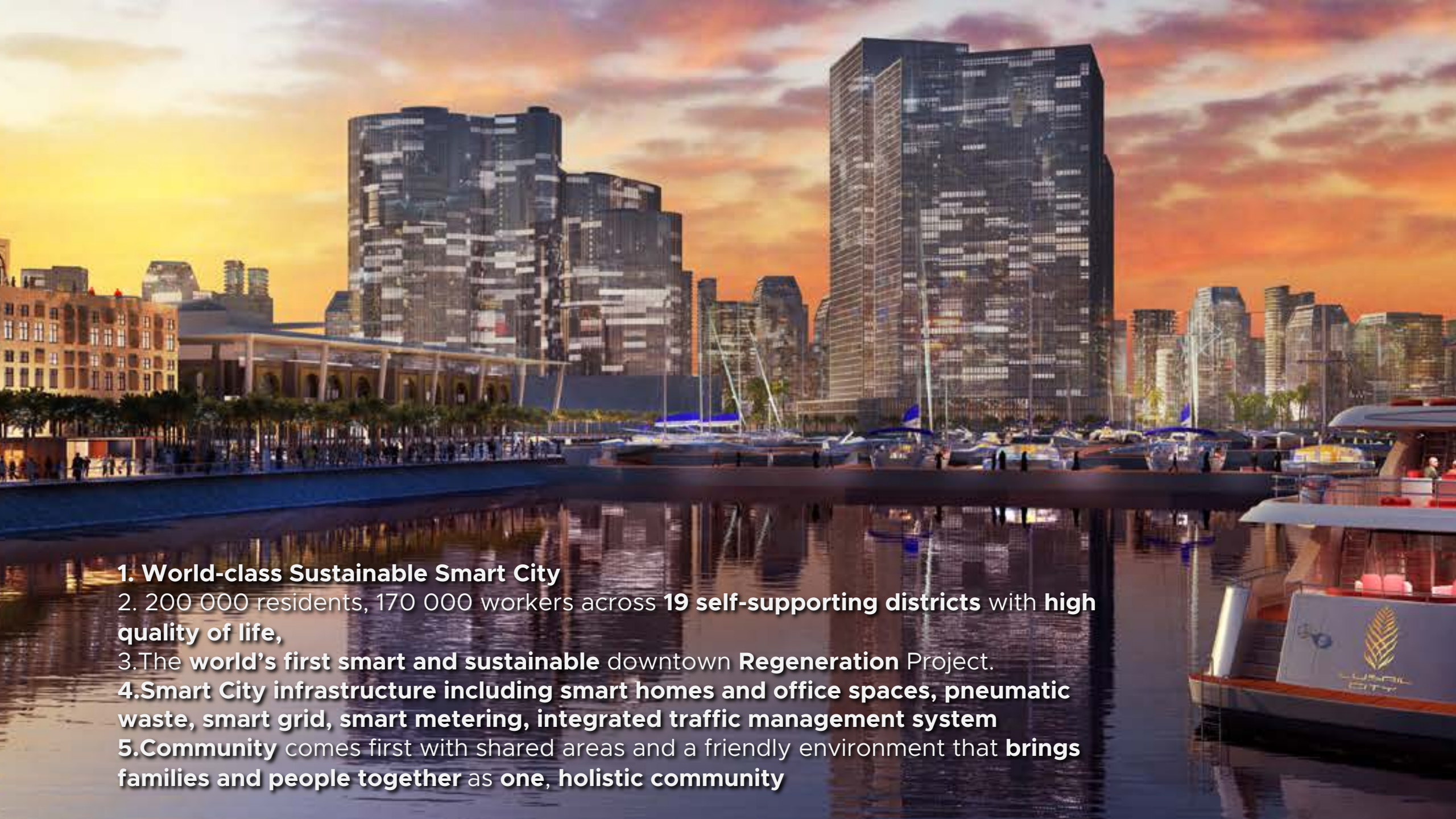
Lean Construction



How is a Smart City Defined?

Caragliu et al. 2009

"A city can be defined as 'smart' when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic development and a high quality of life, with a wise management of natural resources, through participatory action and engagement."



1. World-class Sustainable Smart City
2. 200 000 residents, 170 000 workers across **19 self-supporting districts** with **high quality of life,**
3.The **world's first smart and sustainable** downtown **Regeneration** Project.
4.Smart City infrastructure including smart homes and office spaces, pneumatic waste, smart grid, smart metering, integrated traffic management system
5.Community comes first with shared areas and a friendly environment that **brings families and people together** as **one**, **holistic community**

مشيرب
MSHEIREB
قلب الدوحة
DOWNTOWN DOHA

1. Msheireb Downtown Doha will have one of the **highest concentrations of LEED**
2. MDD is a template for developing a **new model of urban living and a smart community**, based in **Qatari identity and heritage**, that can be exported everywhere.
3. The **world's first smart and sustainable** downtown **Regeneration** Project.
4. Comfortable and **pleasant** homes, **intimate** and **friendly communities**
5. Aims to unite the Doha of yesterday with the vision of Doha tomorrow, restoring old ways of life, the **traditional sense of community**, and a strong sense of **culture and heritage**

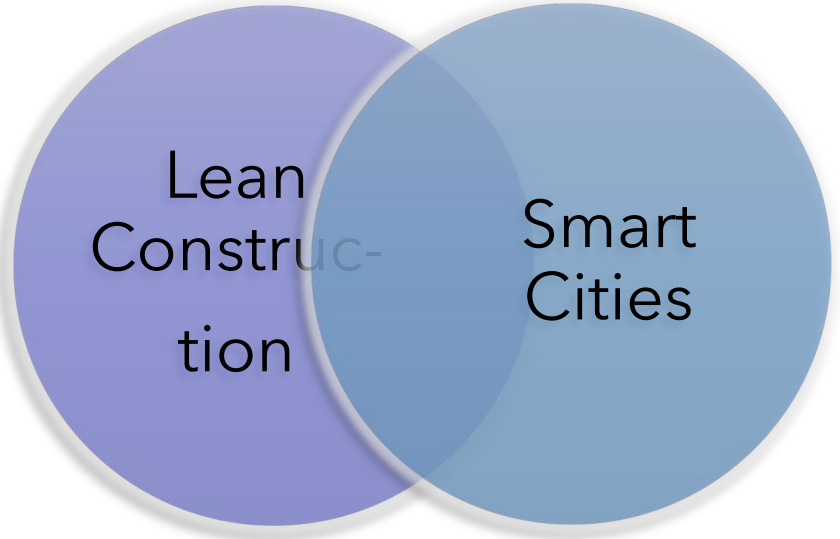
Governance & Finance Award

Awarded to the most innovative and successful projects
being implemented and developed in the fields of governance and finance.

TASMU SMART QATAR

Technology is at the heart of transforming cities and countries and we aim to harness the power of ICT to deliver outcomes to the citizens, residents and visitors of Qatar and to drive the sustainable economic Agenda set forward by Qatar's Vision 2030.

Two Deeply Connected Concepts



Is There Any Added Merit of Fusing Lean and Smart?

The Environmental Impacts of an Office Building Over its Lifetime

(Junnila, S. 2004)

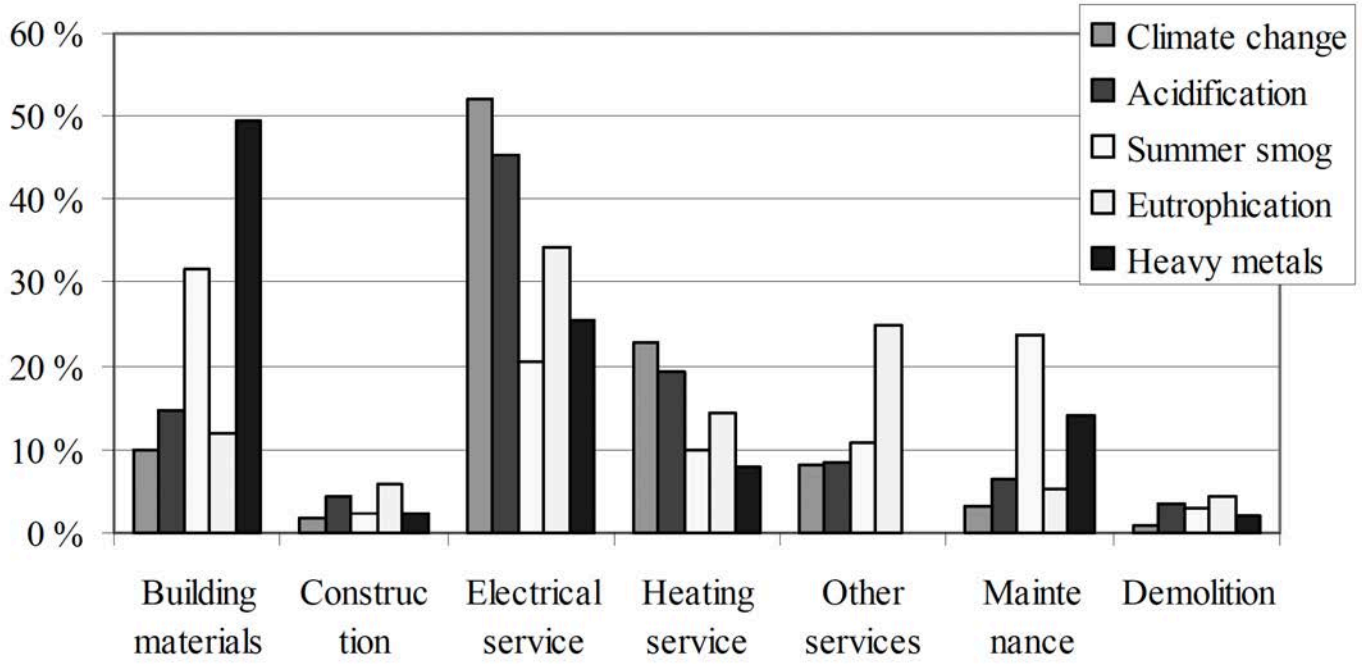


Figure 10. Environmental impact of an office building by building life-cycle phases over 50 years of service life (II).

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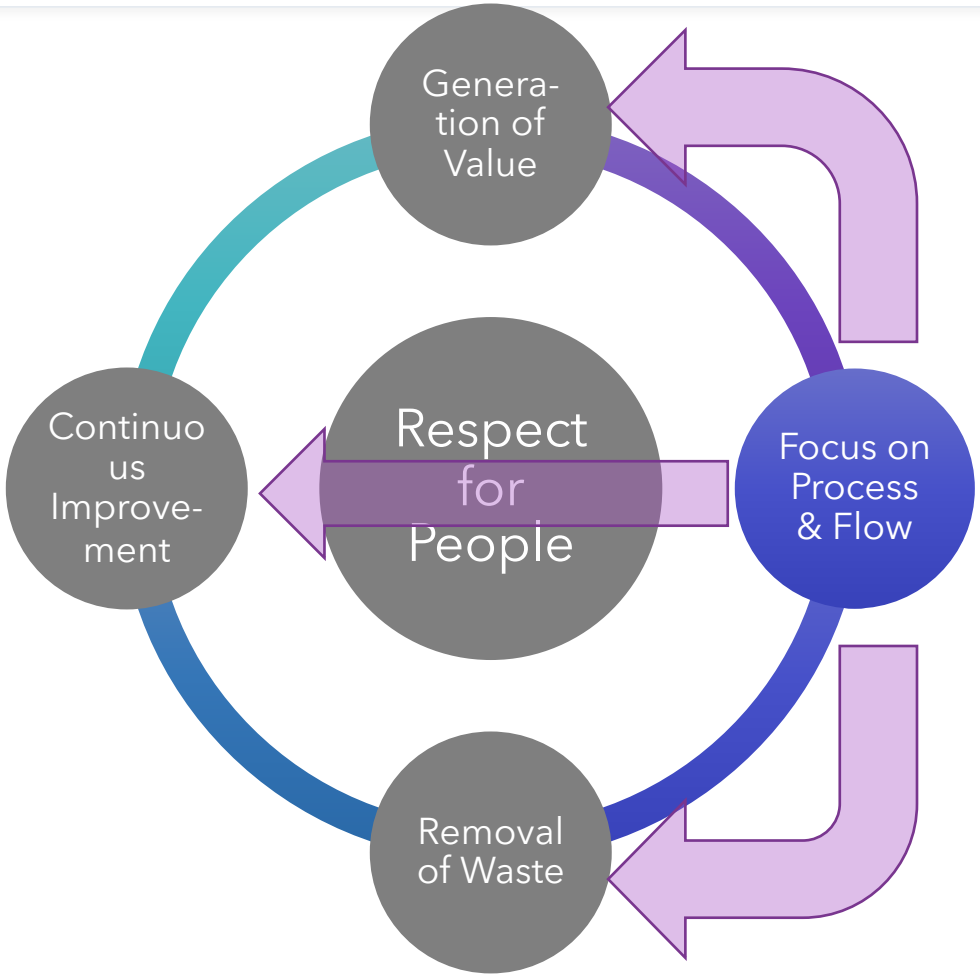
Process & Flows from a Smart City Perspective



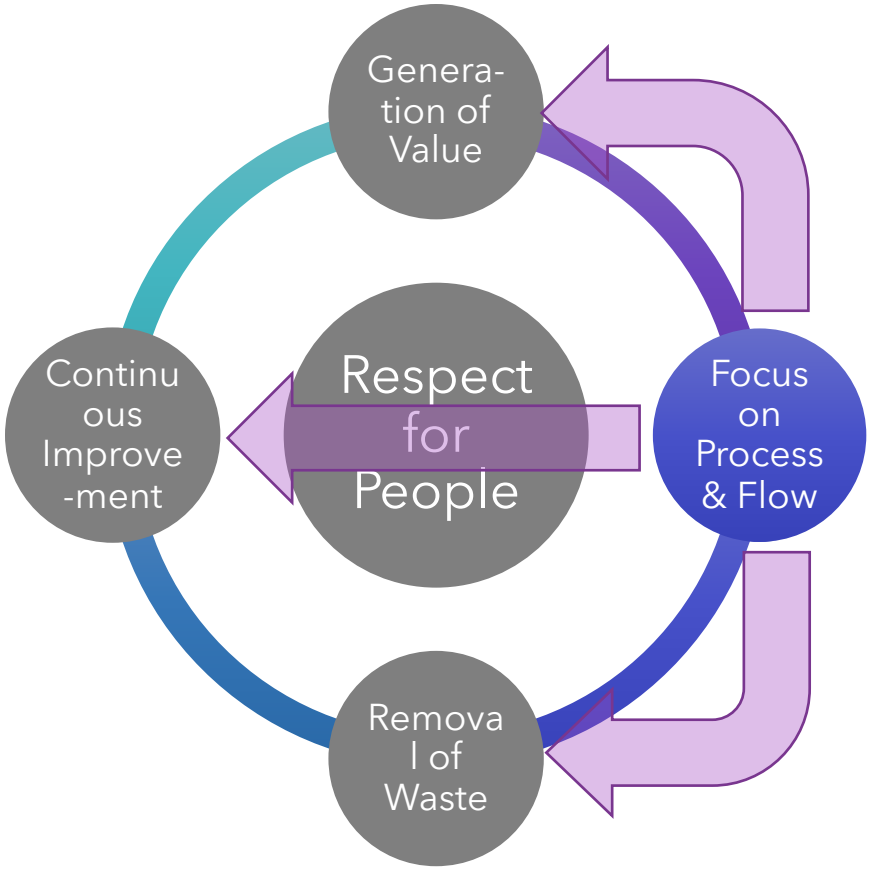
Process & Flows from a Smart City Perspective

Setting Clearly Defined Goals

Following Up Said Goals

Integrated Design Process

An Example of Lean Construction and Smart Cities Combined



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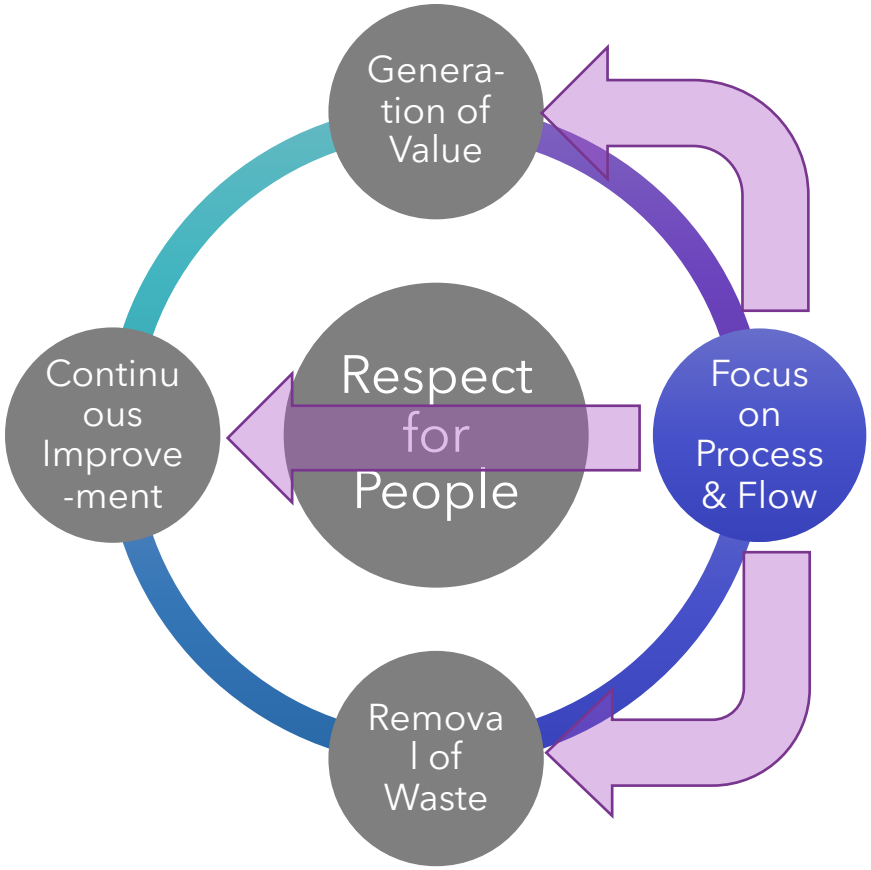
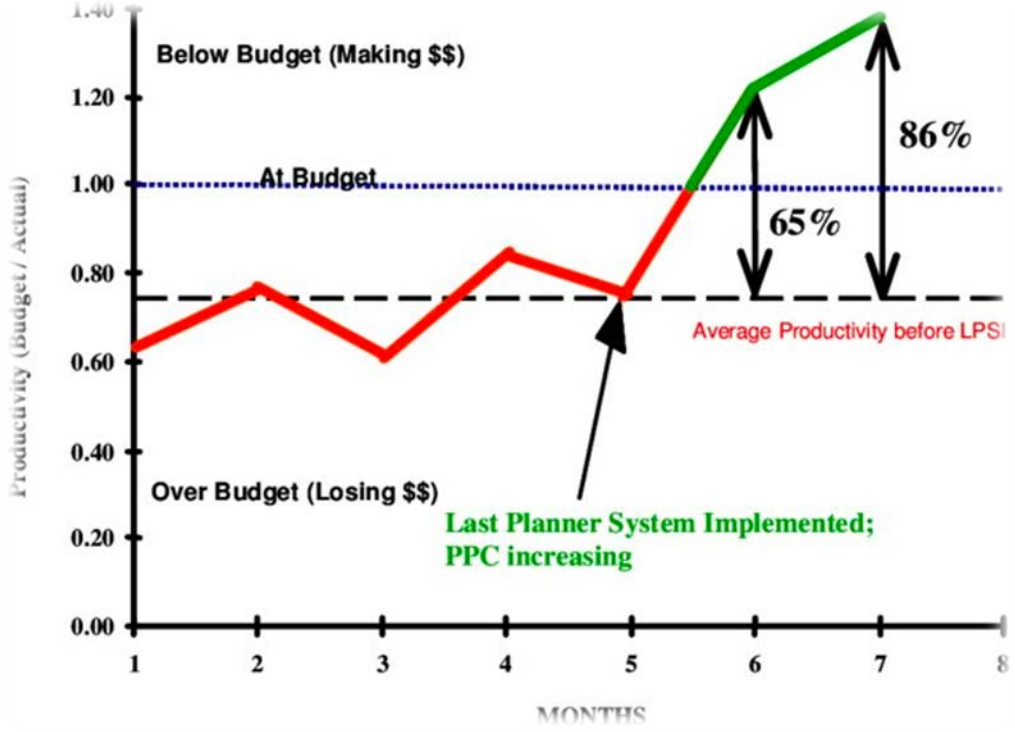


Process & Flows from a Smart City Perspective

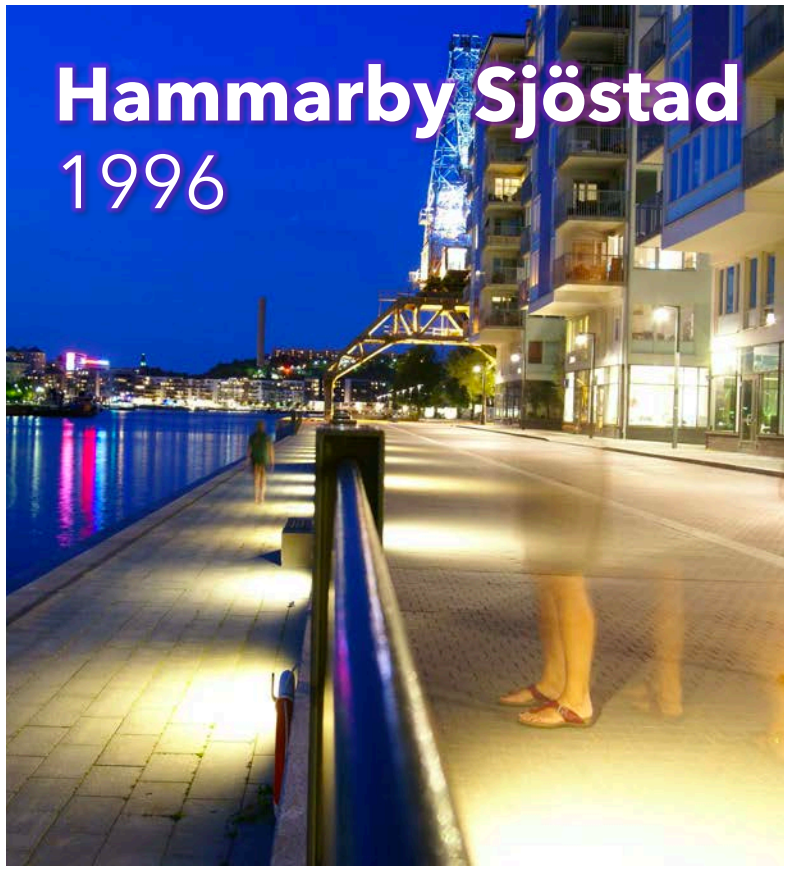
- **Setting Clearly Defined Goals**
- Following Up Said Goals with an Integrated Design Process
- An Example of Lean Construction and Smart Cities Combined



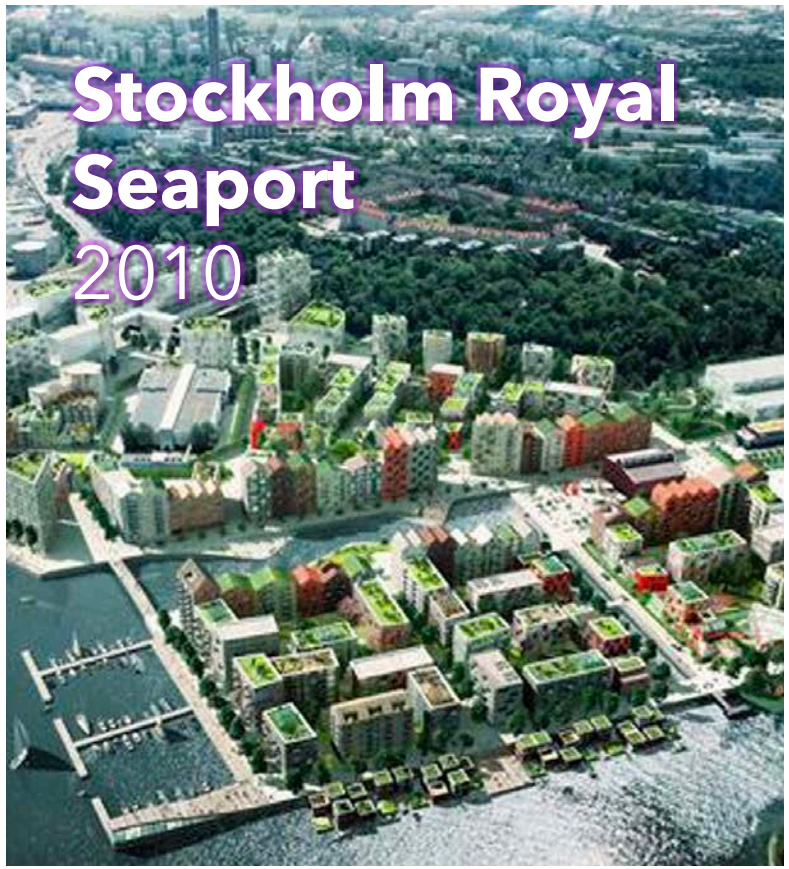
Productivity as a goal in Lean Construction
Abdelhamid, T. S., Salem, O. M., 2005

An Evolution of Three Eco-Districts in Stockholm

Three Eco-Districts



11 000 homes, completed 2020

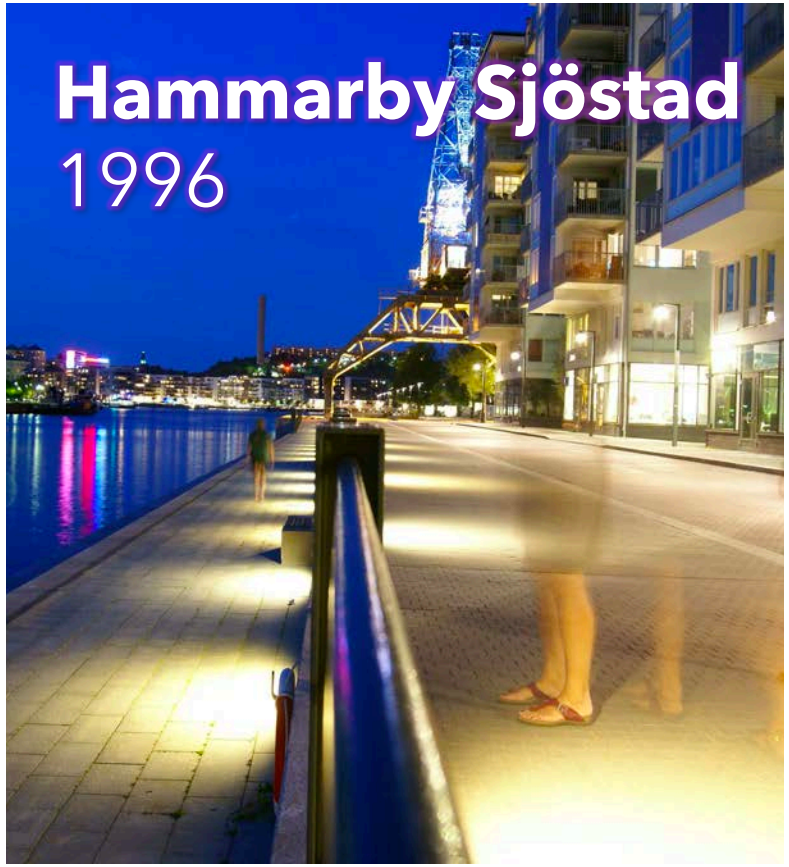


12 000 homes, completed 2030

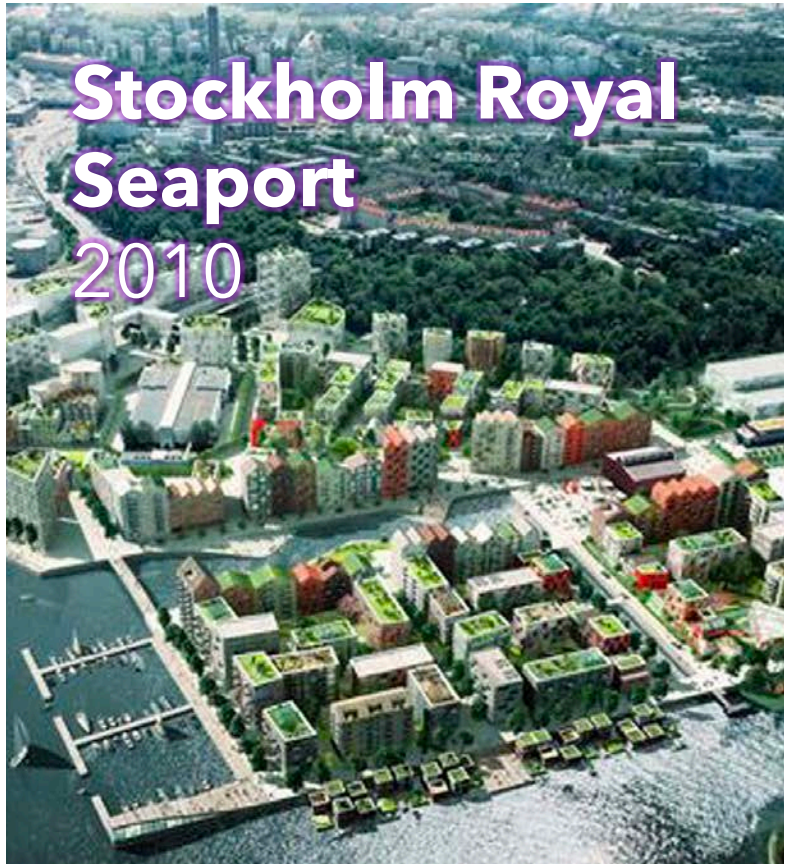
5000 homes, completed 2035

An Evolution of Three Eco-Districts in Stockholm

Goals



"Twice as good as today"

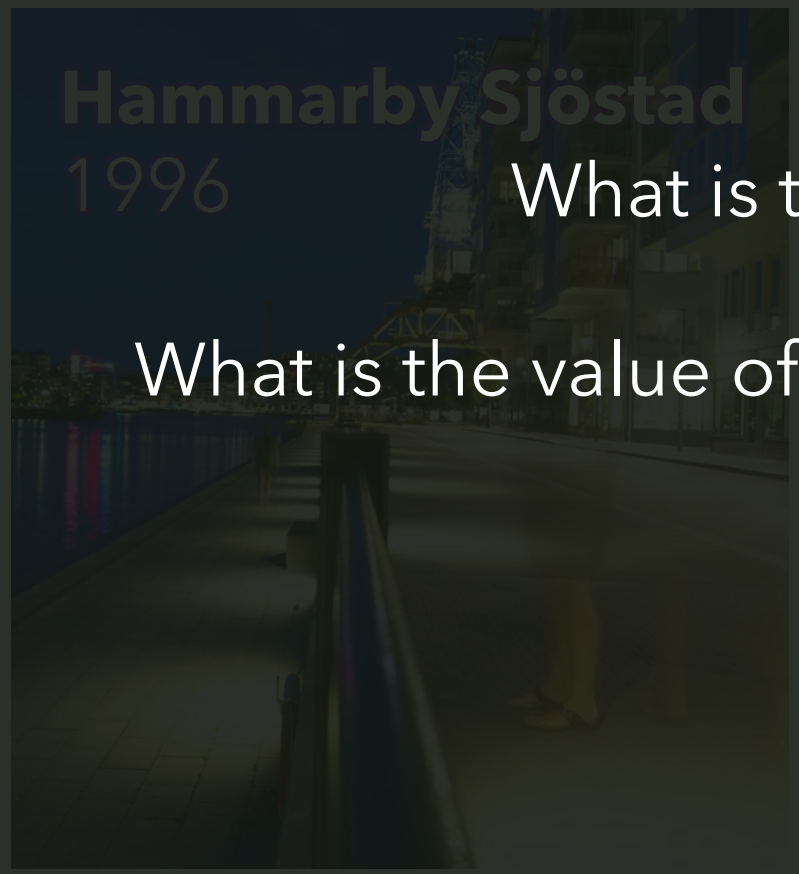


"Fossile Fuel Free" – Including Verification Plan

Climate Positive, Twice as High Social Capital, Including a Verification Plan Backed by a Digital Masterplan

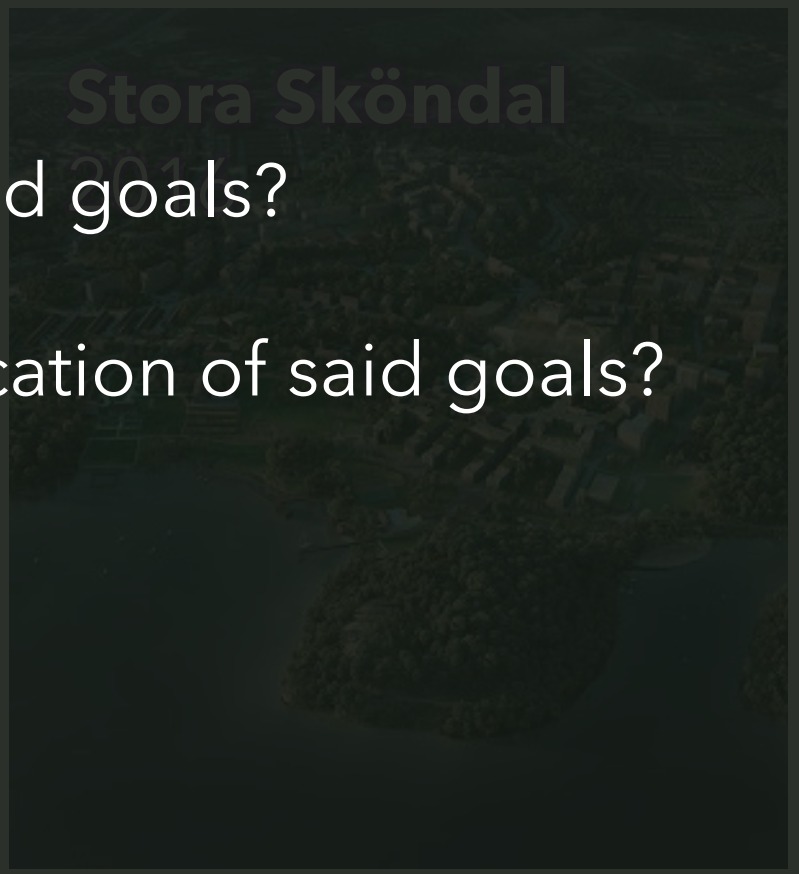
An Evolution of Three Eco-Districts in Stockholm

Goals



"Twice as good as today"

"Fossile Fuel Free" –
Including Verification Plan



Climate Positive, Twice as High Social Capital, Including a Verification Plan Backed by a Digital Masterplan

What is the value of clearly defined goals?

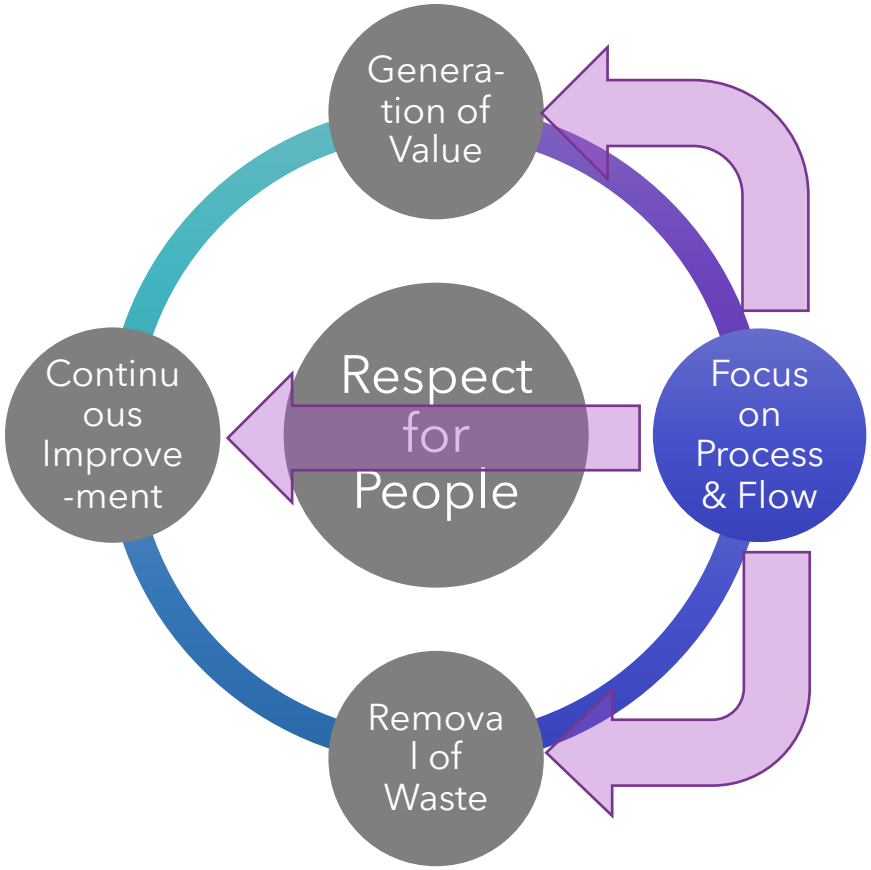
What is the value of measurement and verification of said goals?

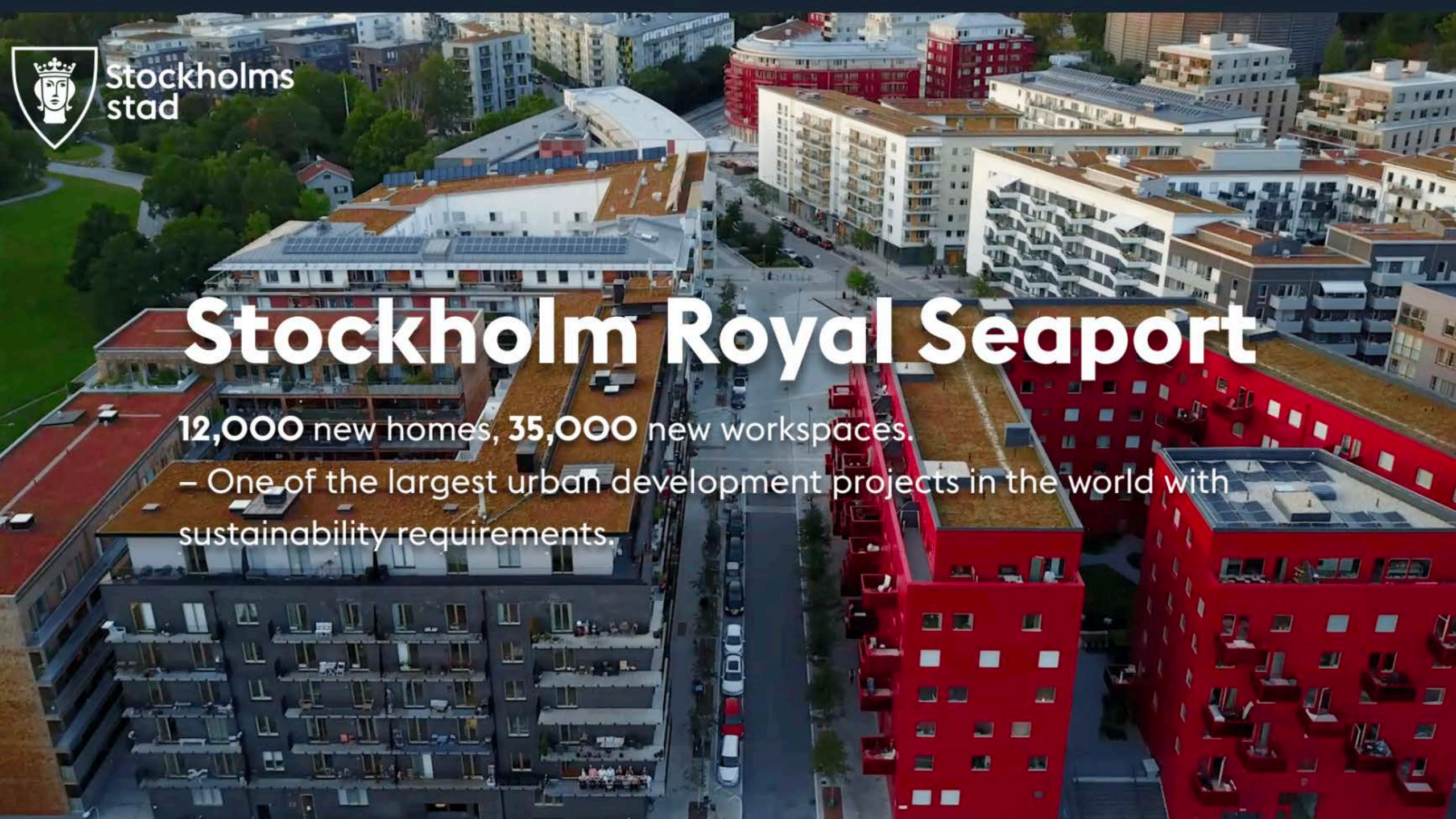
Process & Flows from a Smart City Perspective

Setting Clearly Defined Goals

Following Up Said Goals with an Integrated Design Process

An Example of Lean Construction and Smart Cities Combined



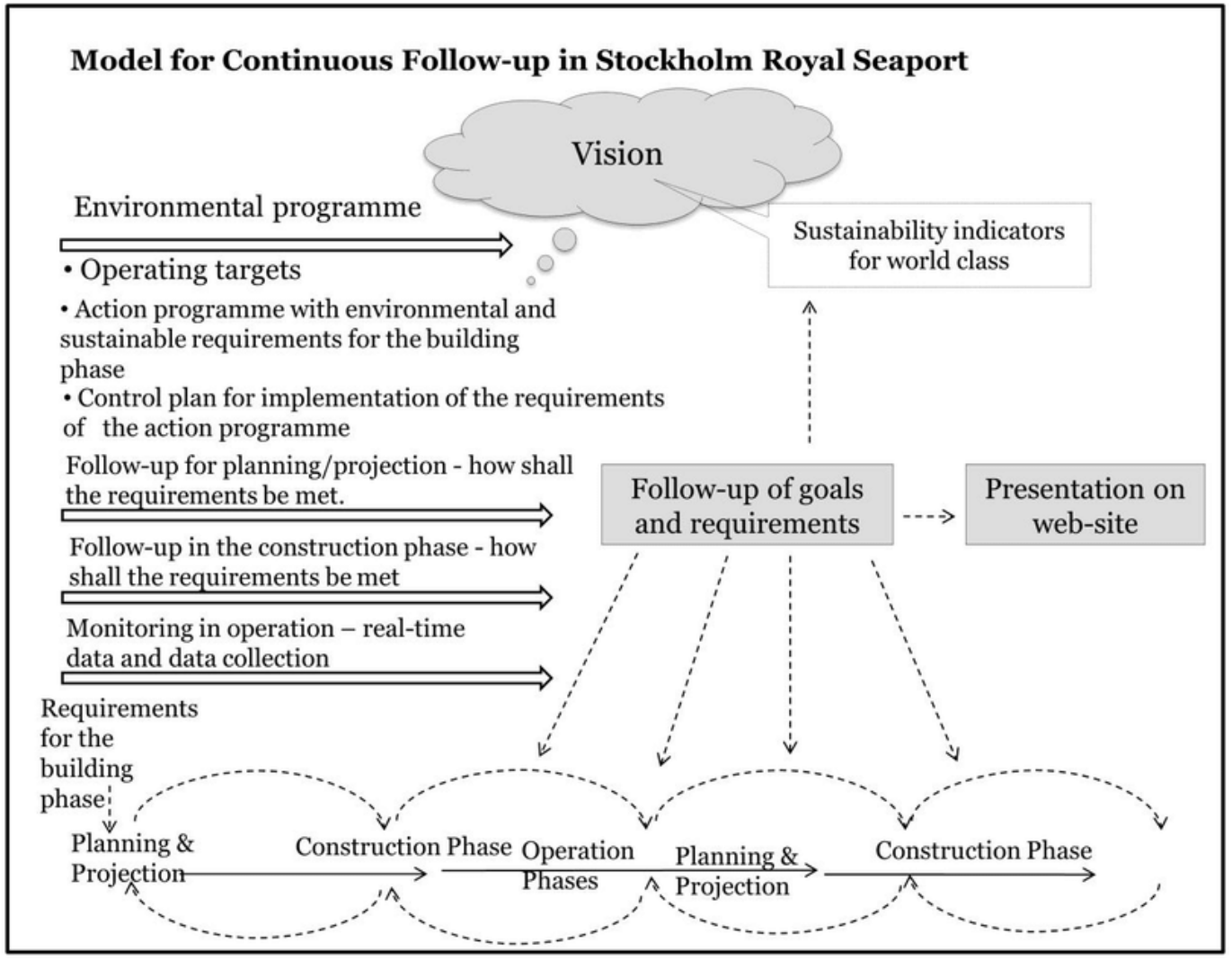

Stockholms stad
Stockholm Royal Seaport
12,000 new homes, 35,000 new workspaces.
– One of the largest urban development projects in the world with sustainability requirements.

Stockholm Royal Seaport

Nine Phases – 10-15 Years Until Buildout

Stockholm Royal Seaport

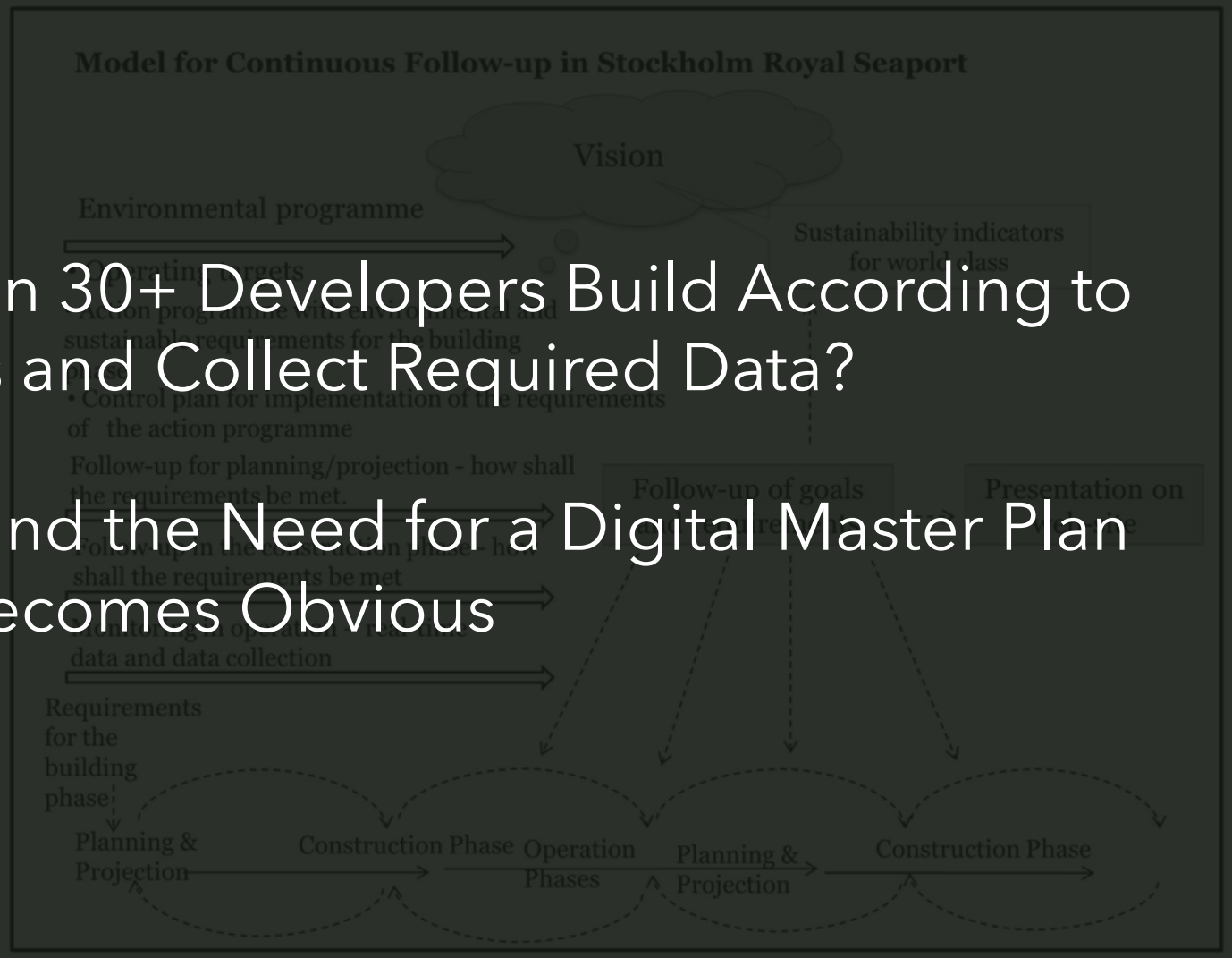
Dynamic Evaluation and Refinement of Goals, Coupled with IDP, Training, and Match-Making



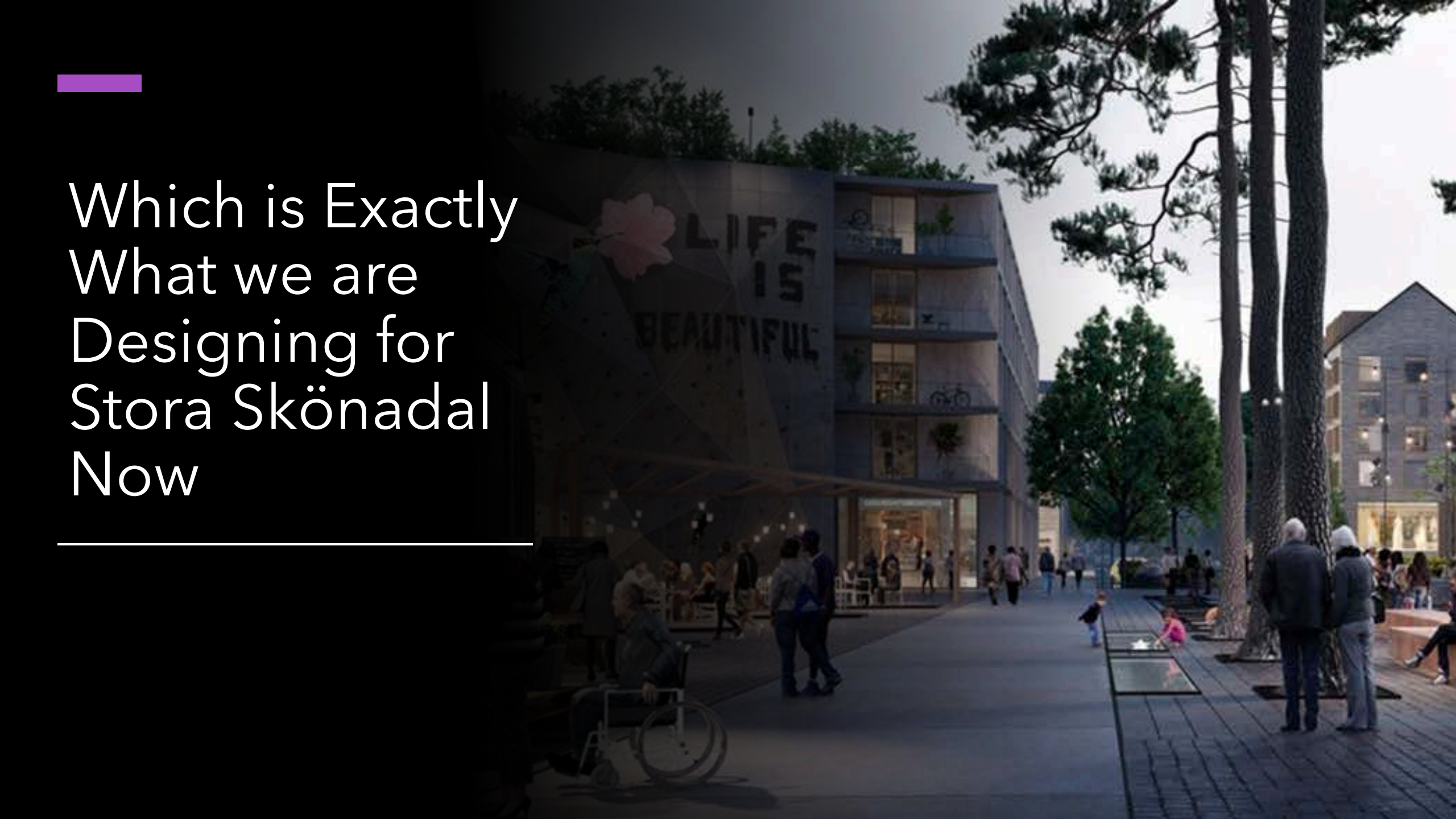
Dynamic Evaluation and Refinement of Goals, Coupled with IDP Training and Match-Making

But what Happens when 30+ Developers Build According to Requirements and Collect Required Data?

Data Becomes Messy and the Need for a Digital Master Plan Becomes Obvious



Which is Exactly What we are Designing for Stora Skönadal Now



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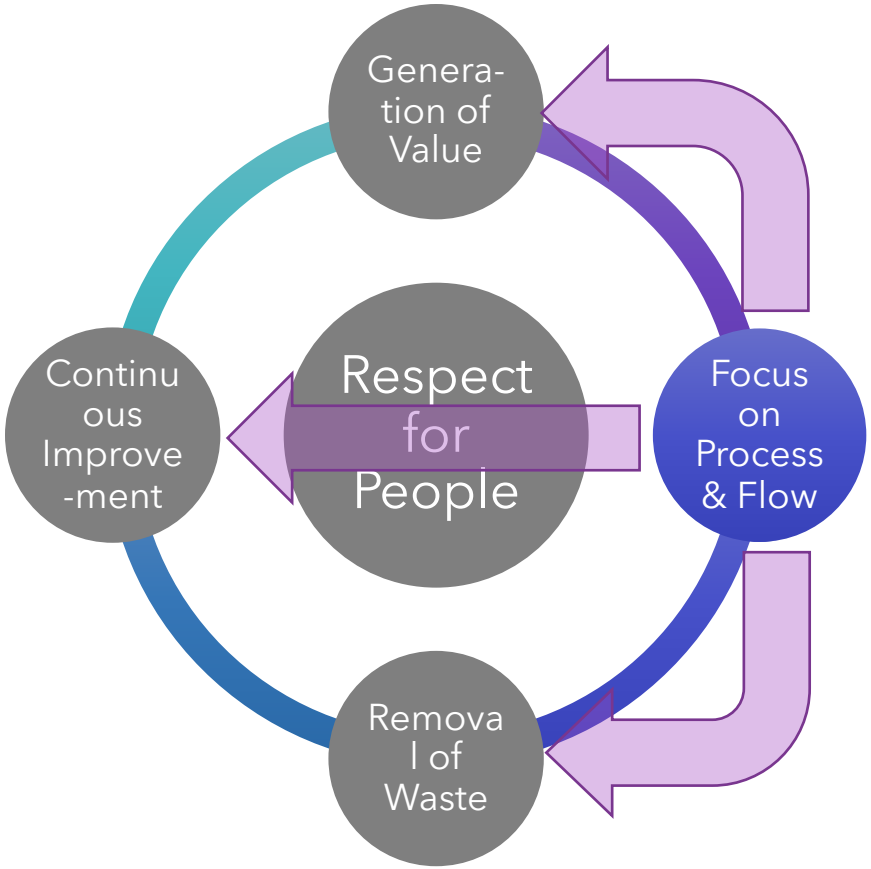

Norra Djurgårdsstaden

Bygglogistikcenter

– för ett hållbart och resurseffektivt byggande

Stockholms stad

The Capital of Scandinavia

Stockholm Royal Seaport
BUILDING LOGISTICS CENTRE

But what do we do with this facility once buildout is completed?

A Great Example of How Lean Construction and Smart Cities are Intimately Coupled. *Convert it to a City Logistics Hub*

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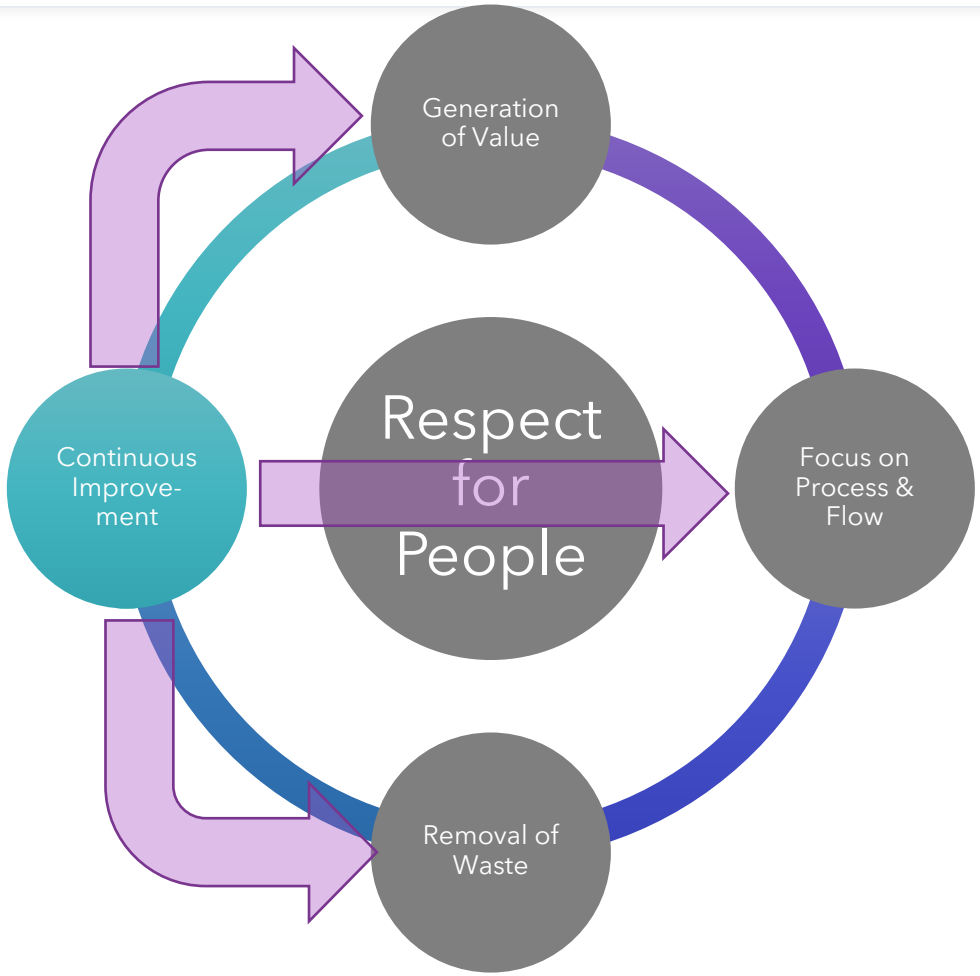
  - Waste Project

Lean Construction
Leaner and Smarter Data-Driven Decisions

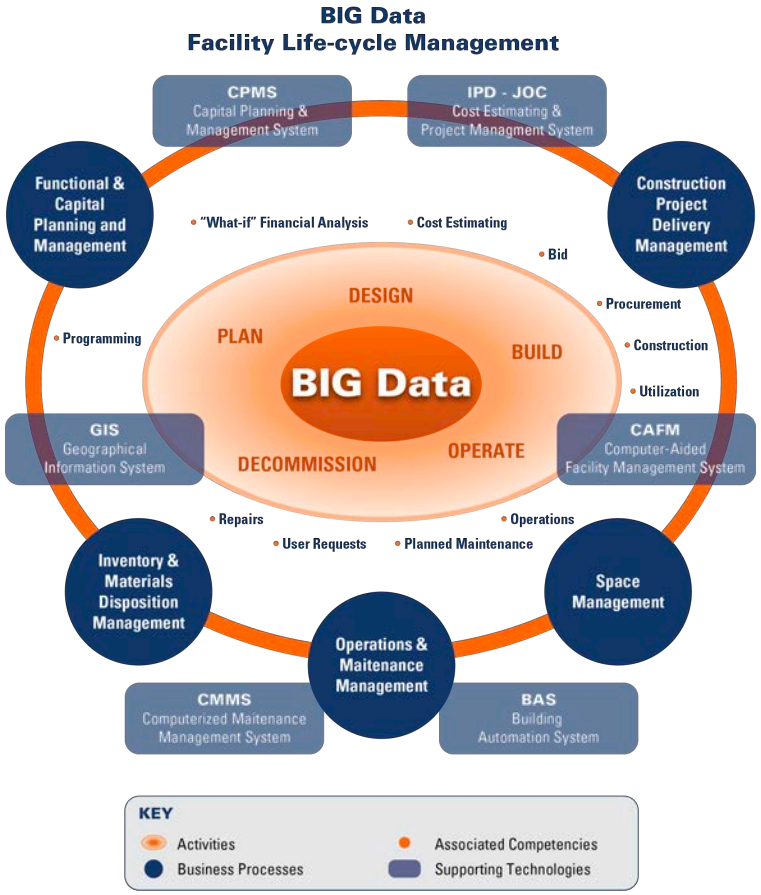


Leaner Construction Depends Smarter Data

In order to be able to better elimanate waste stronger collaboration within the industry is needed.

For these collaborative efforts to bear fruit; ***an organization needs to be able to accomplish the following: analyze data*** *across the breadth of its business; create accurate schedules based on an indepth understanding of its processes; and* ***share the data*** *effectively with team members. These efforts* ***depend on the use of data integration systems****, which can improve processes in Lean and* ***advance the construction industry into a new age of efficiency and profitabilty****.*

Lean Constructoin, Leveraging Collaboration and Advanced Practices to Increase Project Efficiency, McGraw Hill Construction 2013



Internet and Communication Technologies - An Enabler of Performance

Yesteryears Formula 1 Car

This is where our cities are today

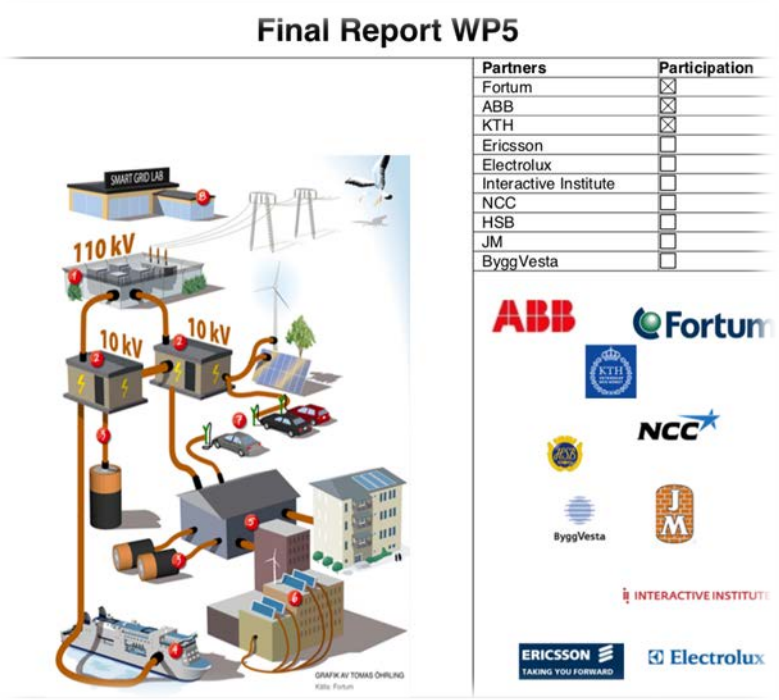
Modern Formula 1 Car

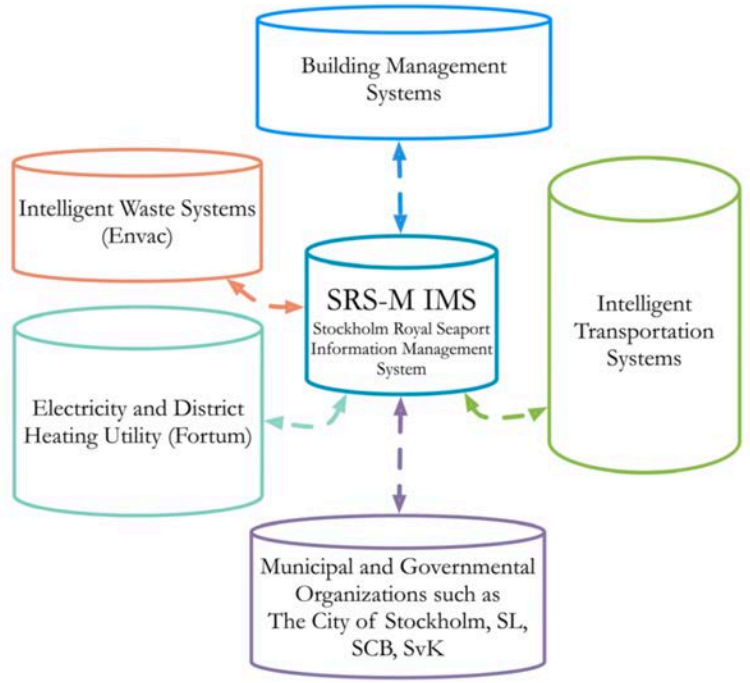
ICT – Driver for Performance

To Highlight What Data Can Do for You

Let’s Review a Case Study about Smart Urban Metabolism in the Stockholm Royal Seaport

Phase 0 - Urban Smart Grid - ”It is Possible”





Phase 1 - UDI ”A” - SRS-M IMS

Realtime Data Can Meet a Number of Needs

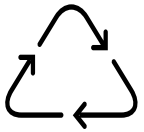
Here are the Urban Stakeholdes

Phase 2 - Smart City SRS - Case Study Research and Urban Metabolism Research - > 4 KPIs

Activity Boundaries:
All “Core”-flows excluding construction and transportation

Spatial Boundaries
Indirect Emissions: Global, Direct emissions from within geographical area

Temporal Boundaries
From construction to estimated life-time

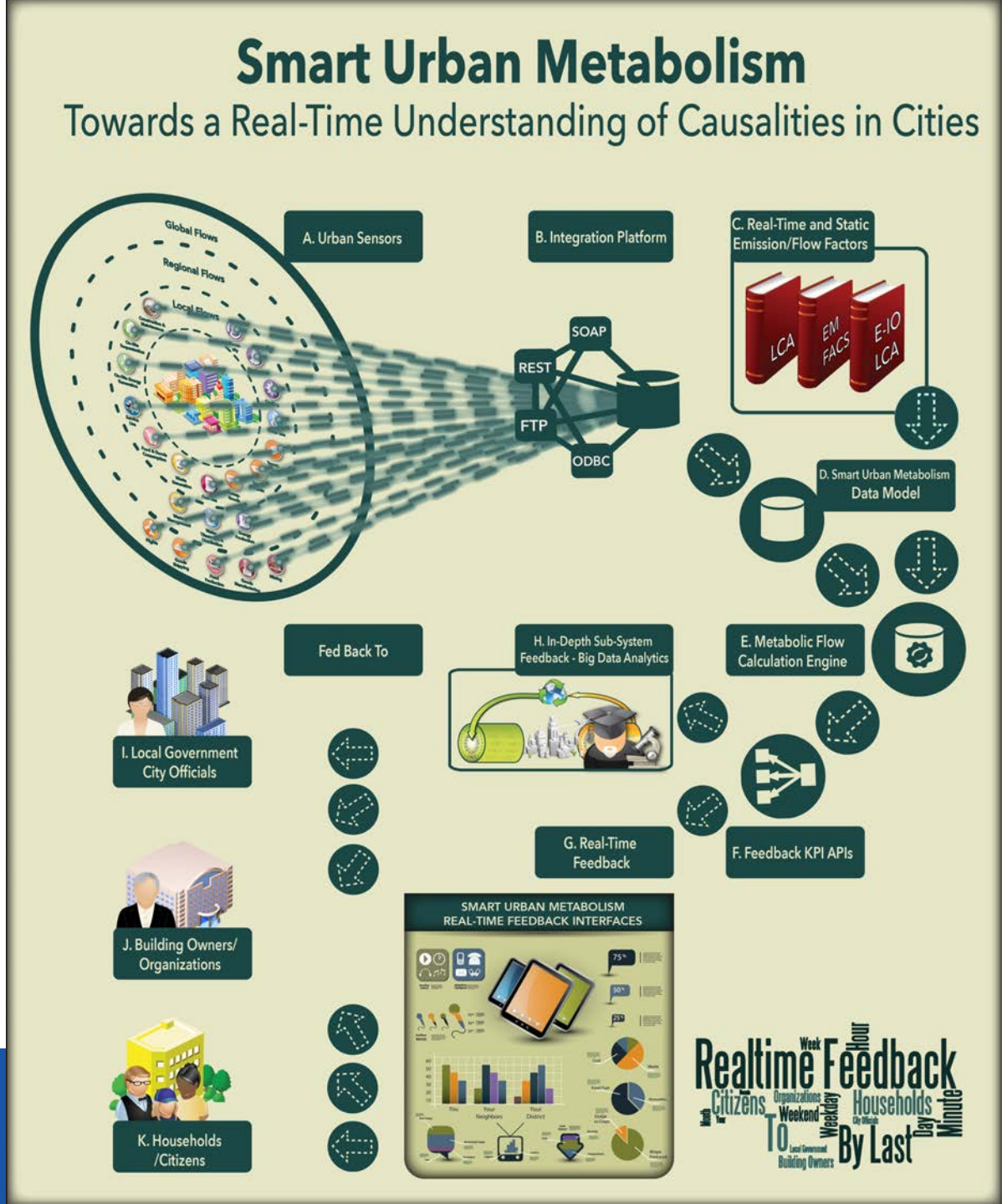


Life-cycle Boundaries
Cradle-to-Grave

Metabolic Flow Data Sources - Case SRS

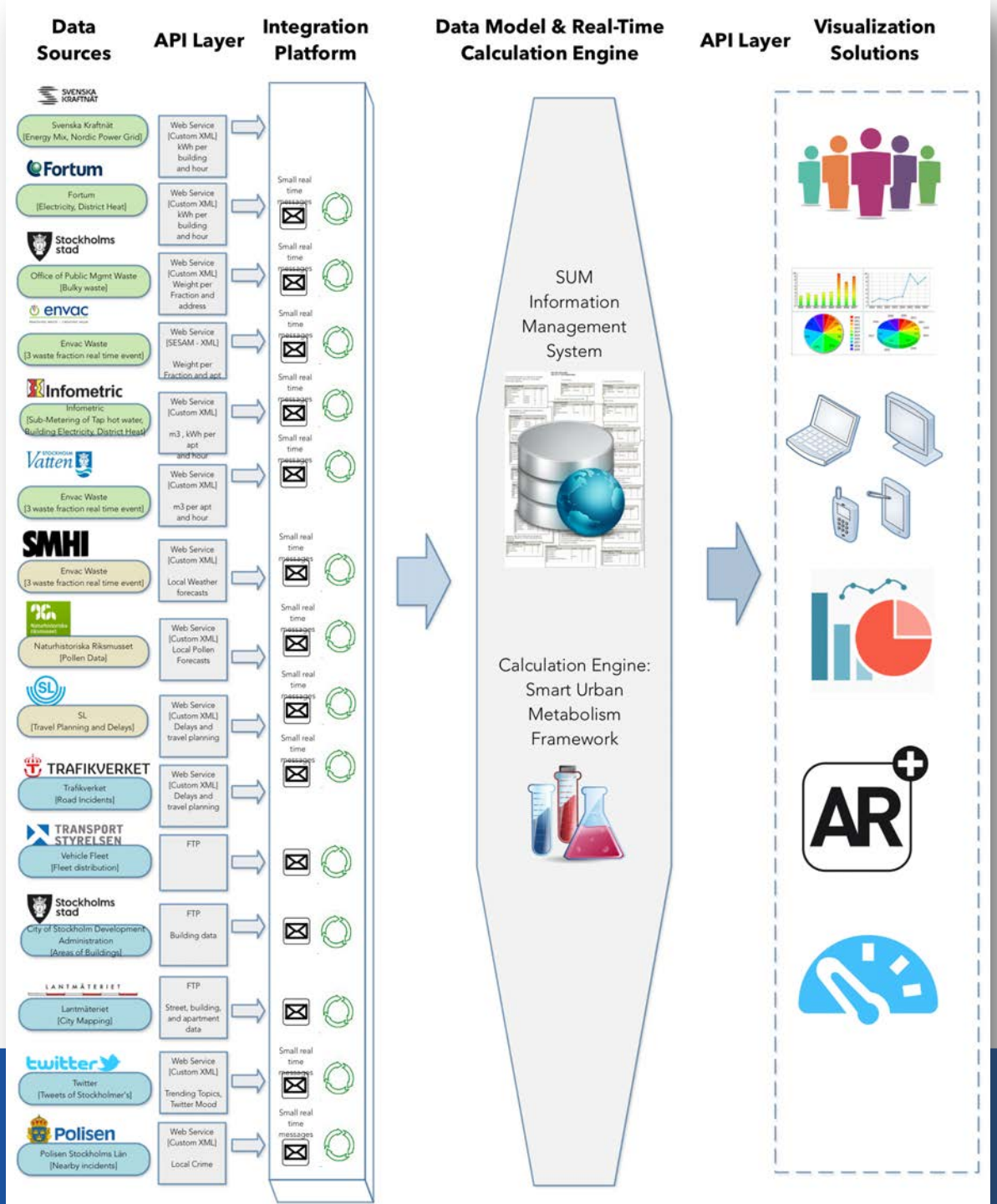
Meter	Spatial Resolution	Temporal Resolution	Data Supplier
Geospatial data, building models, areas	Household District	Static	Lantmäteriet, City's planning department, NCC (Construction developer)
Emission factors for fuels, electricity, heat, and transport	National	Static	Environmental Handbook 2011, Värmeforsk
Electricity (kWh)	Household	Hour / Minute	Infometric
Tap hot water (liter)	Household	Hour	Infometric
Waste (weight per fraction)	Household	Realtime	Envac
Electricity (kWh)	Building	Hour	Fortum Power and Distribution
District Heating	Building	Hour	Fortum Heat
Biogas generation (m3 per capita)	Municipal	Week	Stockholm Water
Bulky waste generation (weight per fraction)	Neighborhood	Realtime	City of Stockholm Traffic Department – Waste Unit
Nordic Electricity Grid	Nordic Countries	Hour	Swedish National Grid
District Heating Grid Mix	Municipal	Hour	Fortum Heat

Smart Urban Metabolism Framework



URBAN ANALYTICS AND TRANSITIONS

Integration and Analysis Platform

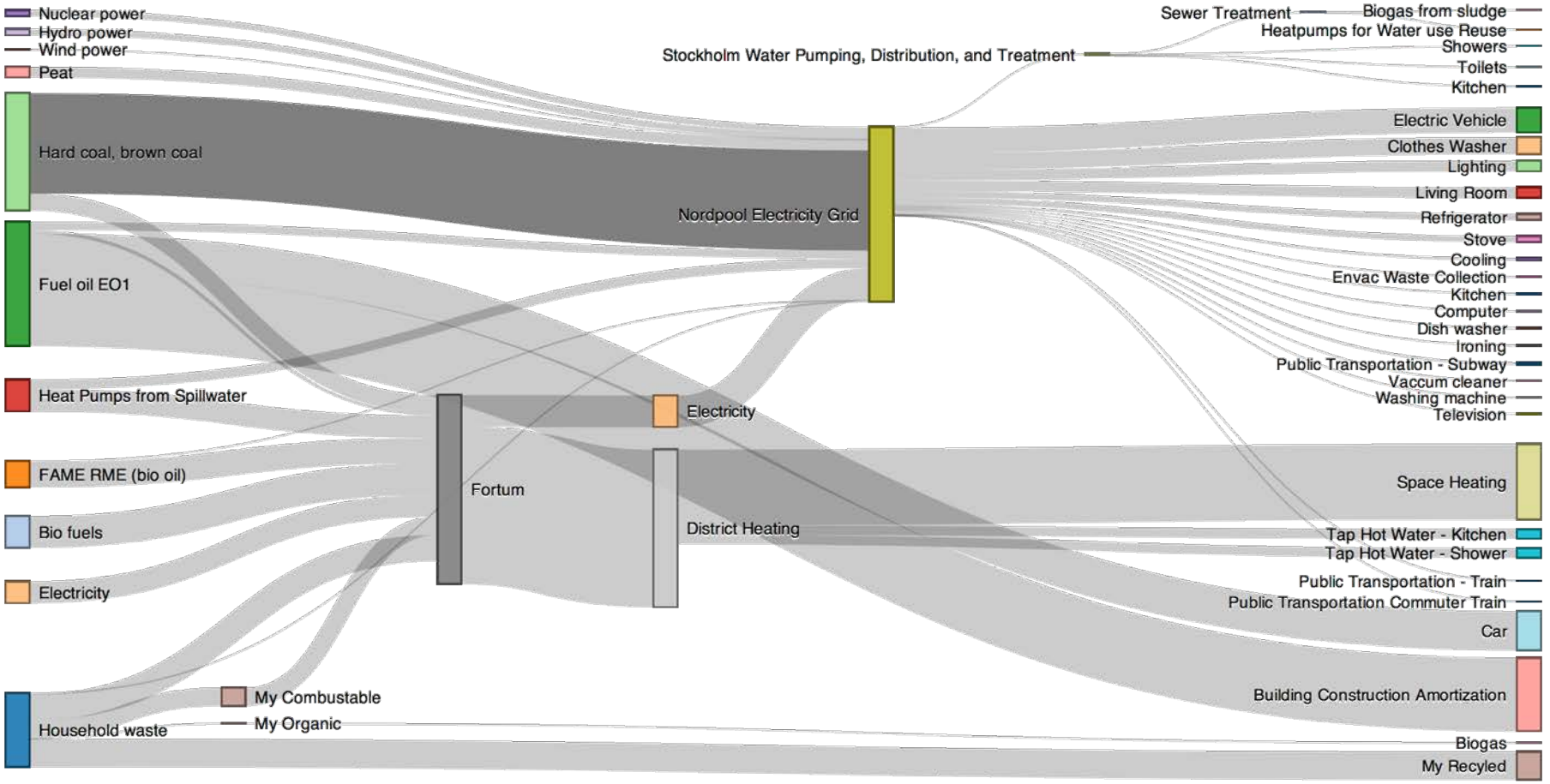


URBAN ANALYTICS AND TRANSITIONS

My GHG Emissions Today

May 22, 2012

By 19:32

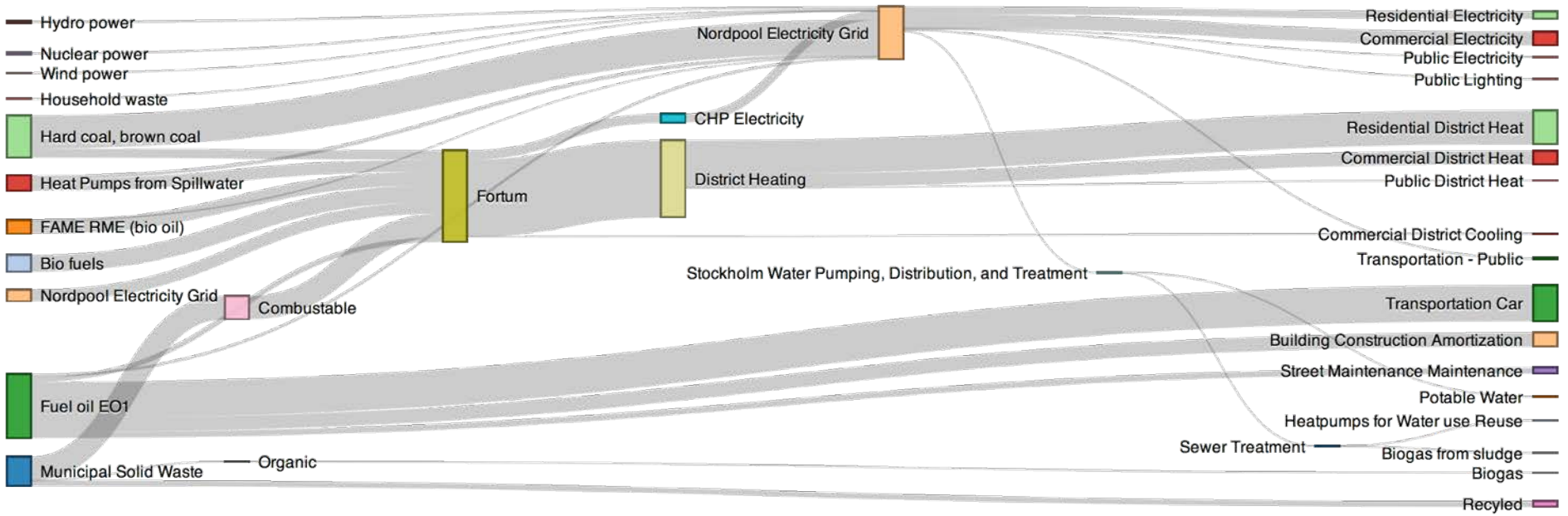


URBAN ANALYTICS
AND TRANSITIONS

My Building's Greenhouse Gas Emissions Today

May 22, 2012

By 19:32

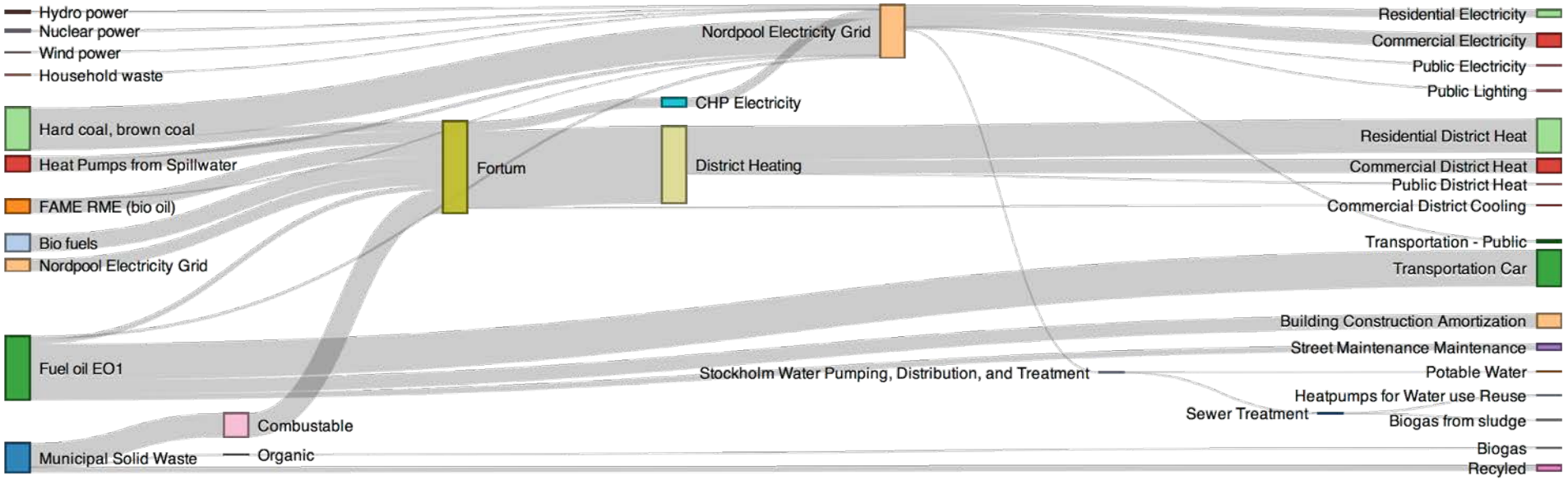


URBAN ANALYTICS
AND TRANSITIONS

My District's Greenhouse Gas Emissions Today

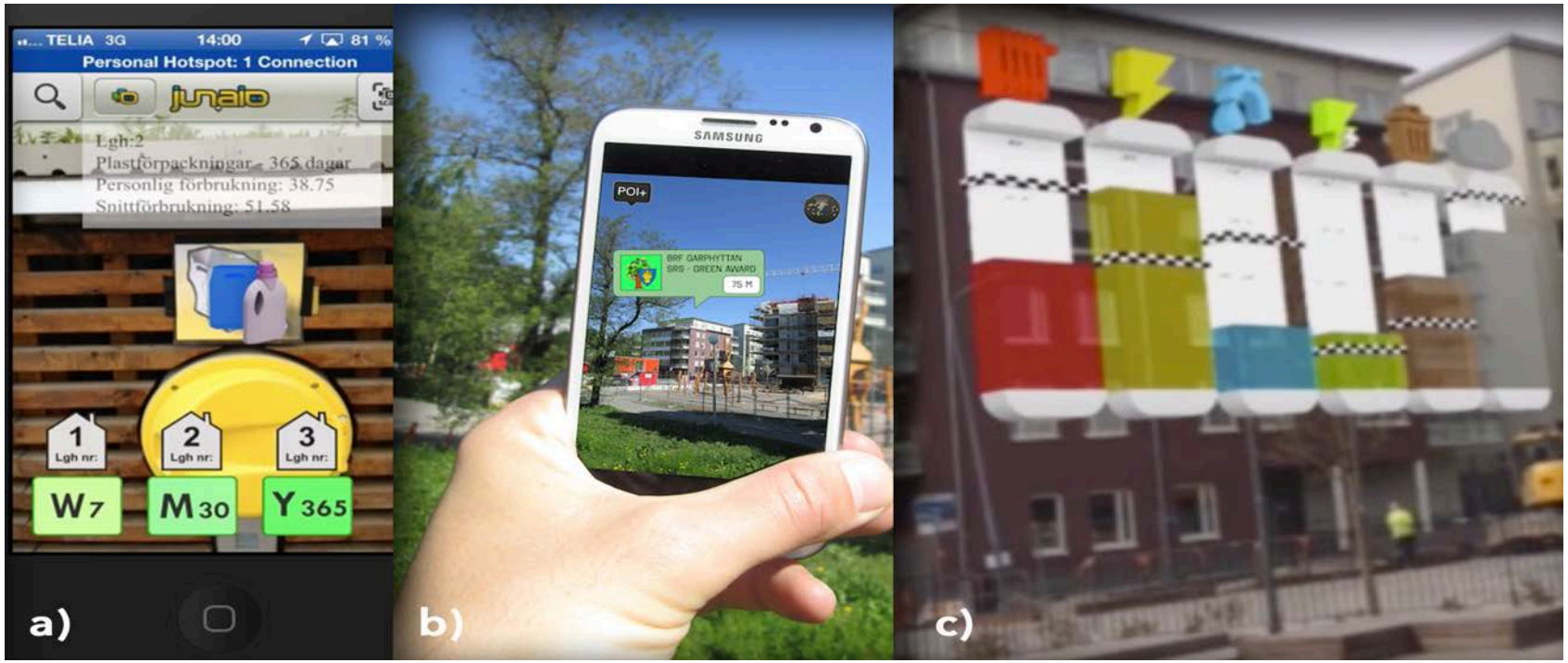
May 22, 2012

By 19:32



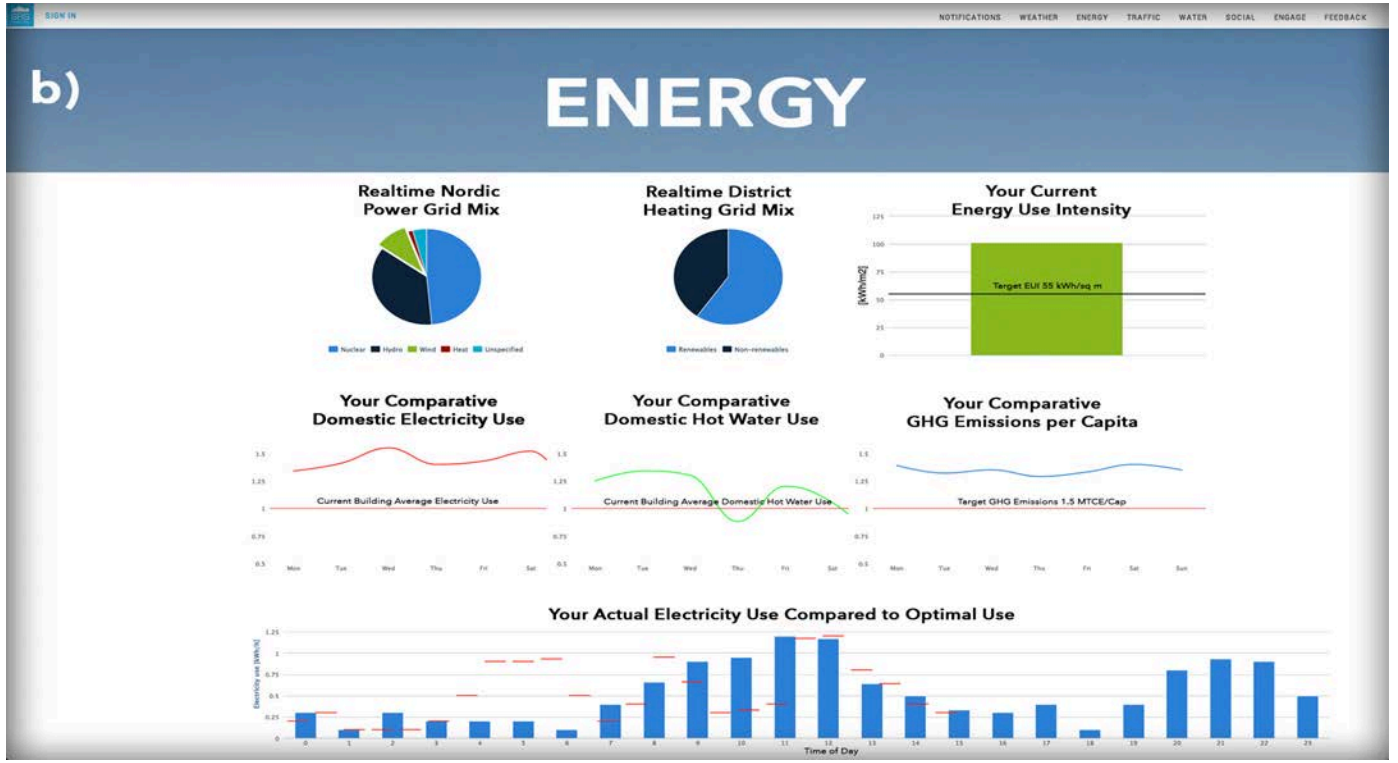
URBAN ANALYTICS
AND TRANSITIONS

Feedback Interfaces - Building Owners, Realtors, and Architects



Feedback Interfaces - To Citizens

Feedback Interfaces - To Citizens



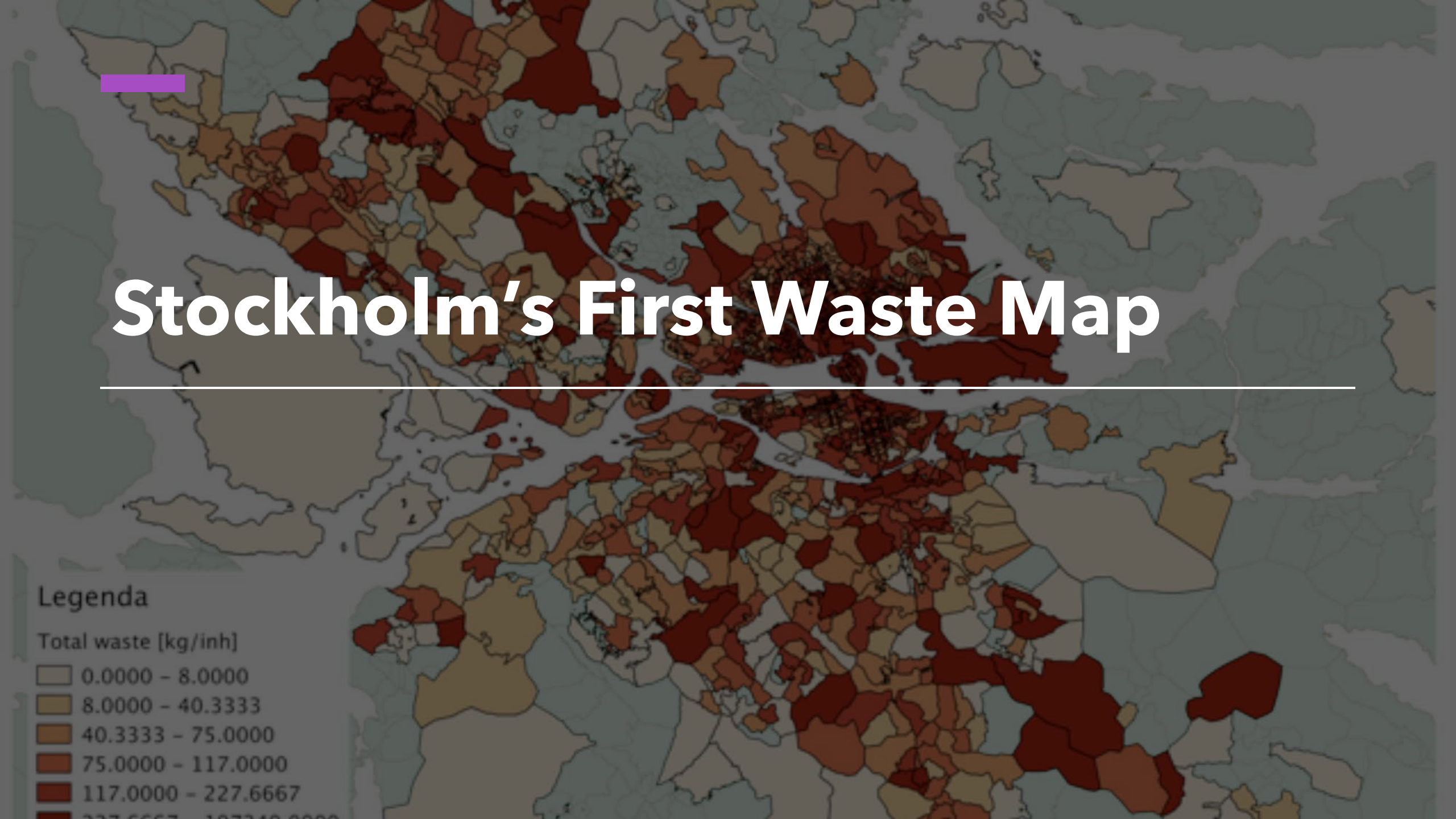
URBAN ANALYTICS
AND TRANSITIONS

Exploring the Big Data from Real-Time Data
In-Depth Sub-Sector Big Data Analytics

Integrating Realtime Data on

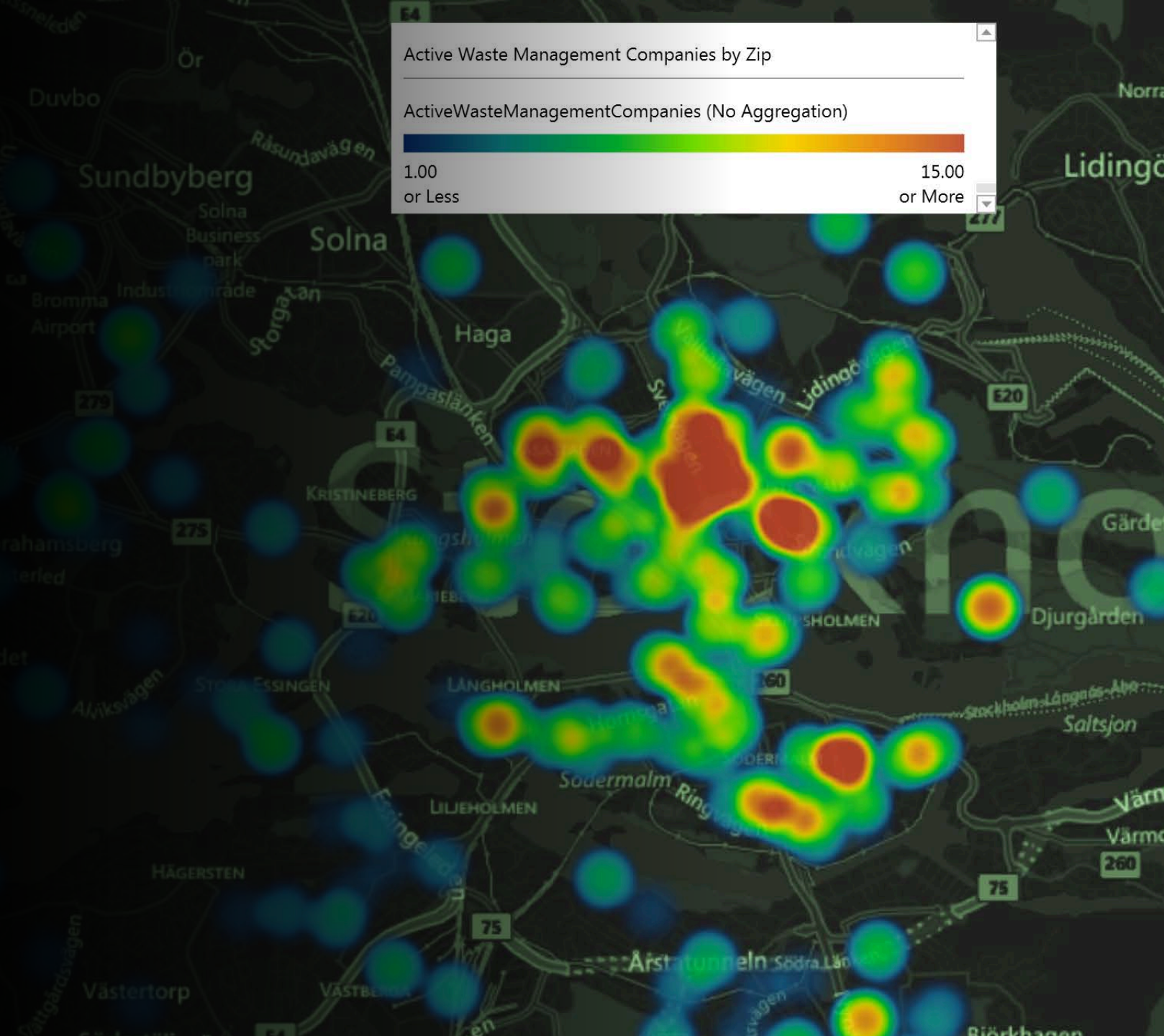
Electricity
District Heat
Household Waste
Bulky Waste
Water
Biogas generation
Transportation
Nordic Electricity Grid
Local District Heating Grid
Public Tweets, Crime, Air Quality, Pollen

Stockholm's First Waste Map



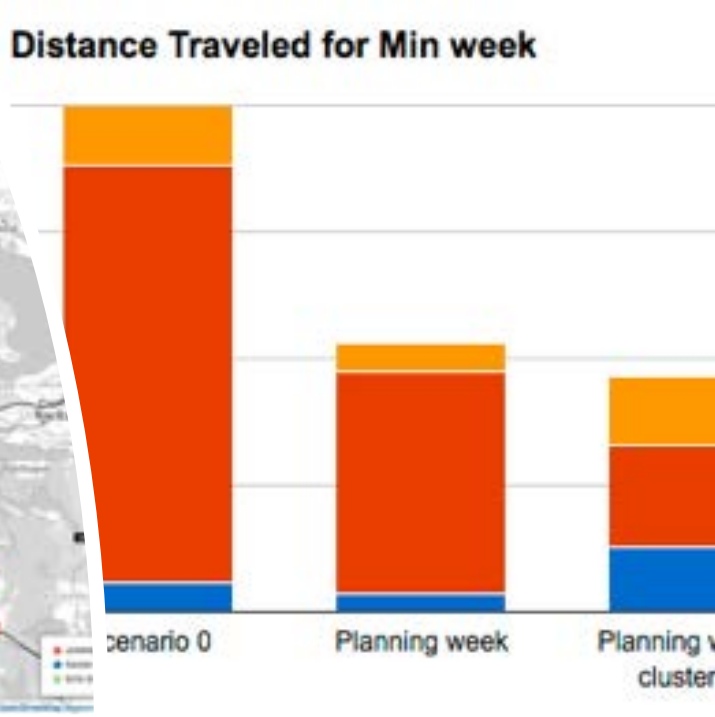
After Lots of Exploration and Analysis – "Waste" Was Found

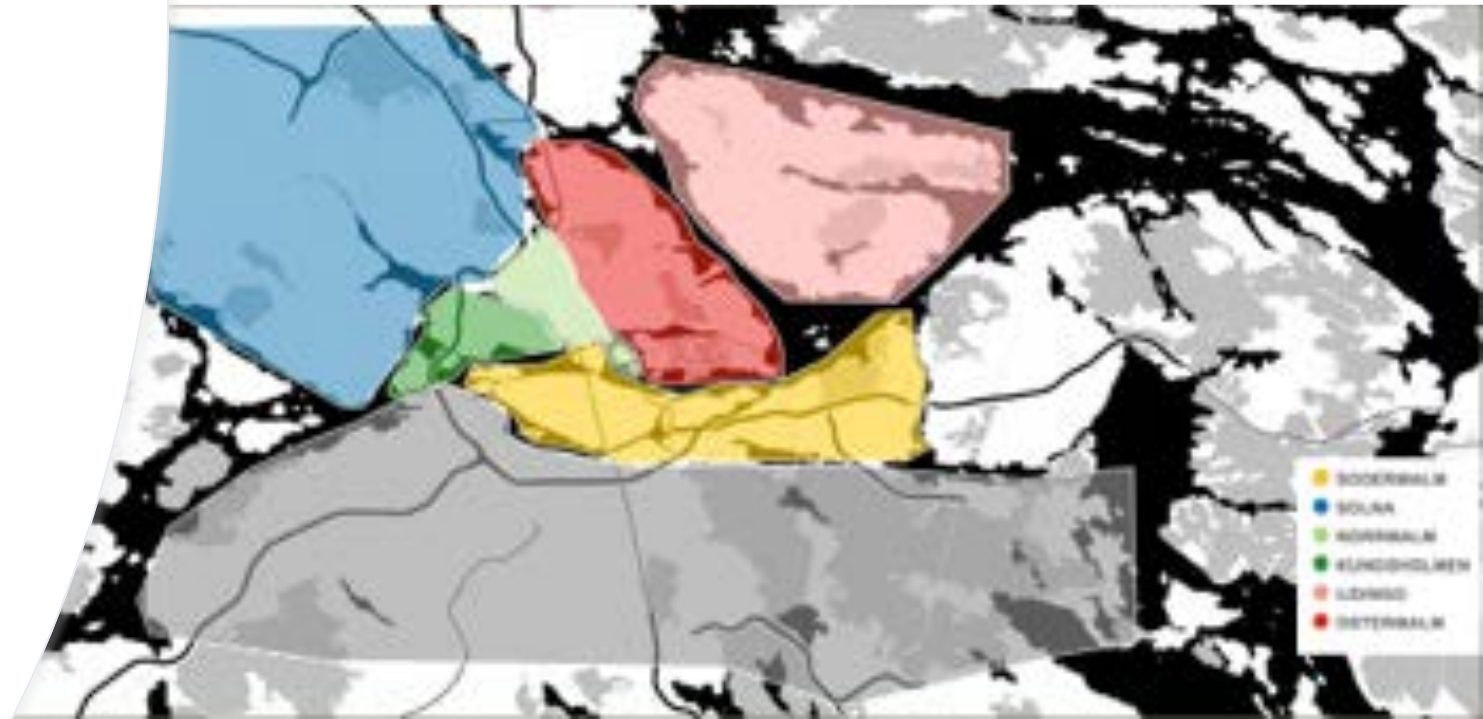
And it Was Prevalent over the Entire City



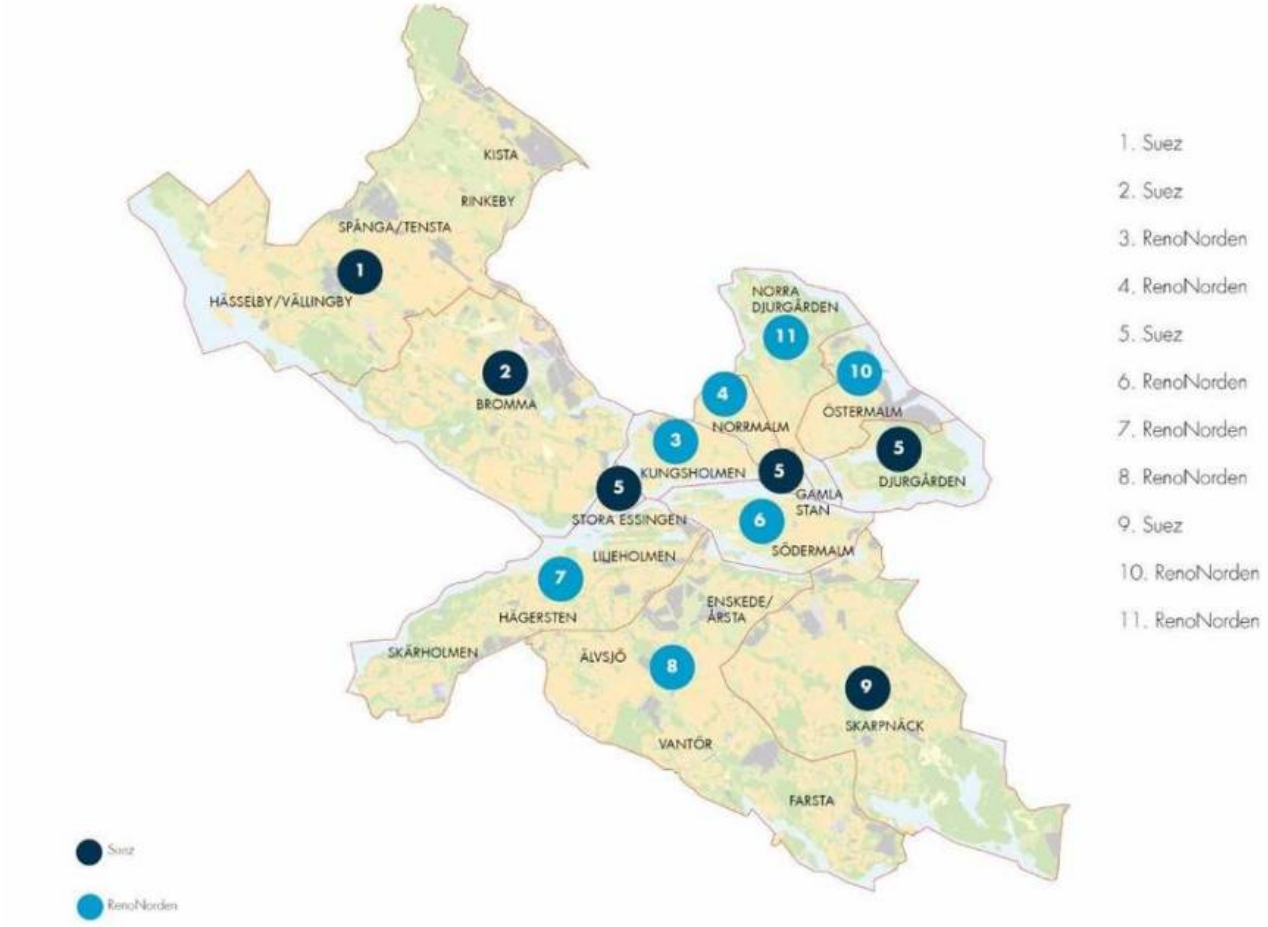
System Intervention – Zone the City

- **53 % Less Miles Traveled**
- **46 % Less Time in Traffic**





Which Recently Was Adopted and Passed in by the Municipality



Stockholm's First Energy Map


Resulting Fiscally Responsible Retrofitting Plan Stockholm
The World's First Municipal Retrofitting Plan:
Here are the 664 Buildings to Be Retrofitted with These Measures to Reach the Local Climate Goals with the Lowest Investment and Highest Return
STOCKHOLM - PROFITABLE ENERGY SAVINGS
315 GWH
19 520 GWH

NDC PARTNERSHIP

ABOUT US HOW WE WORK COUNTRY PAGES

HOME » BUILDING ENERGY EFFICIENCY AND THE NATIONALLY DETERMINED CONTRIBUTIONS

BUILDING ENERGY EFFICIENCY AND THE NATIONALLY DETERMINED CONTRIBUTIONS

THE EMERGENCE OF BIG DATA-DRIVEN, CITY-WIDE ENERGY EFFICIENCY PLANNING

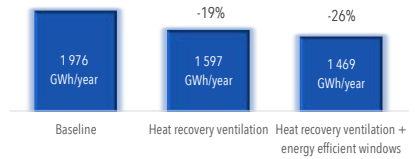
Oleksii Pasichnyi, Fabian Levihn, Hossein Shahrokni, Jörgen Wallin, Olga Kordas
oleksii.pasichnyi@abe.kth.se, @KTHUrbanT, UrbanT, IE, SEED, ABE, KTH

THE RETROFITTING CHALLENGE?

- Stockholm aims to be fossil-free by 2040
- 95% of Stockholm buildings in 2050 are already built
- At least 30% city-wide efficiency is necessary
- The city only owns 12% of the building stock
- Current national retrofitting policies are not effective enough to ensure targets

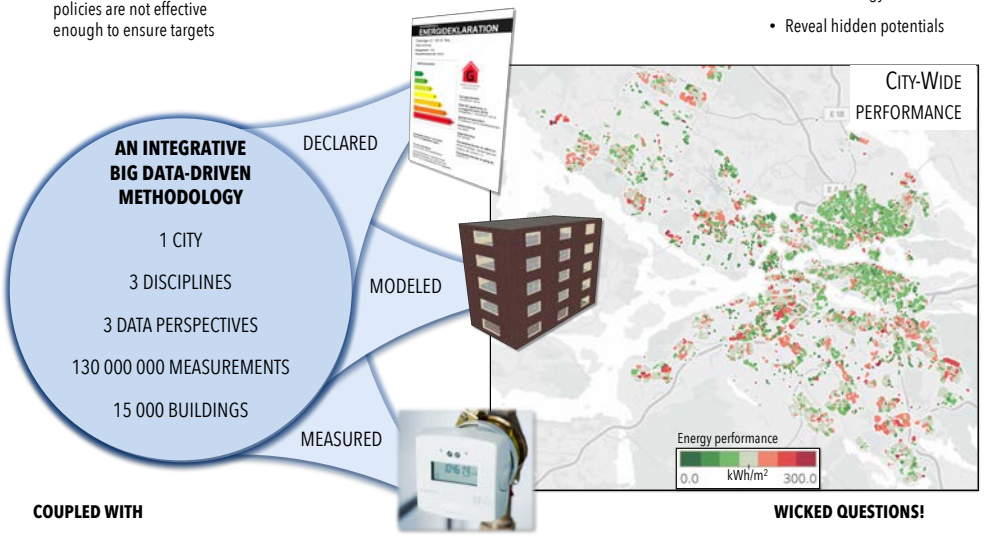
AGGREGATED RETROFITTING RESULTS FROM THE RESIDENTIAL MULTI-FAMILY SECTOR

Residential buildings constructed in 1946-1975 were selected for the 1st stage of analysis, which is 26% of the total and 33% of the residential building stock in Stockholm.



BIG ENERGY DATA UNLOCKS

- Increase knowledge of building stock
- Develop data-driven path to meets energy targets with socio-economic optimization
- Data-driven paths that meet local targets with the lowest societal investment cost
- Validate energy audits
- Reveal hidden potentials

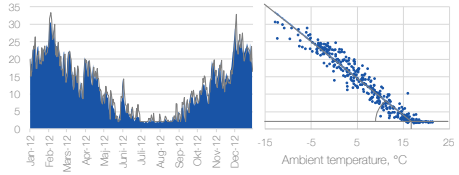


COUPLED WITH

+ COST PERFORMANCE AND INVESTMENTS
+ TRIPLE HELIX STAKEHOLDER COLLABORATION TO ROAD-MAP PRACTICAL IMPLEMENTATION STRATEGIES

CONSISTENT METHODOLOGY FROM A BUILDING TO THE CITY

Building's energy use and *energy signature*, W/m²



WICKED QUESTIONS!

- Is data science for energy emerging as a research field?
- What does this methodology mean for the entire energy system?
- What does it mean for local and national GHG Policies?
- What new knowledge does it bring to the built environment?
- <your question here>

Analytics:
UrbanT Urban Analytics and Transitions Team, KTH

Key Partners:
Stockholms stad, Fortum, Sjöstadsföreningen Hammarby Sjöstad, Fastighetsägarna, Veolia, Energimyndigheten, IQ Samhällsbyggnad

Key Take-Away on Smarter Data-Driven Decisions

Most of the Urban Data is Already Out There

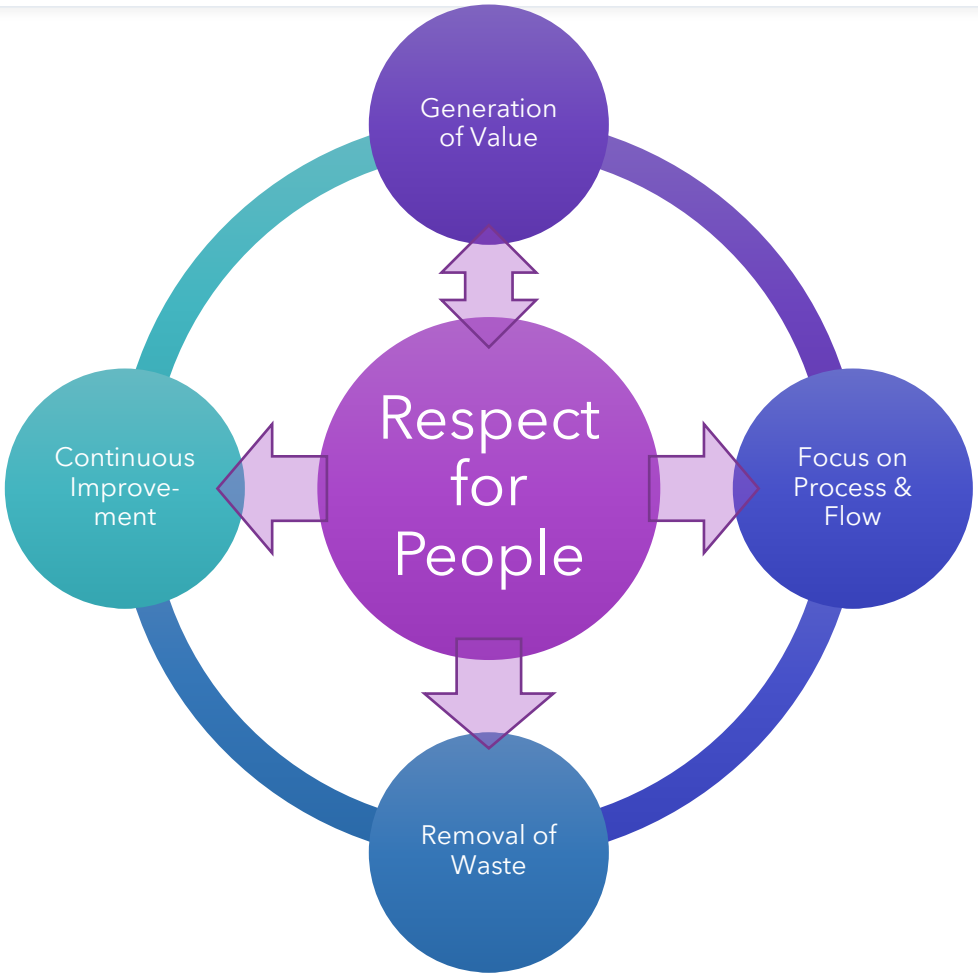
It does however require skillfully crafted collaborations to flow

A Large Share - If not the Majority of the Values of Data Will not be Discovered Until Systems are Integrated

This is a challenge from a business model perspective

We Have Only Scratched the Surface on What Data Can do For Lean Contruction and Smart Cities

Lean Construction
The Central Stakeholder: The Workers and Citizens

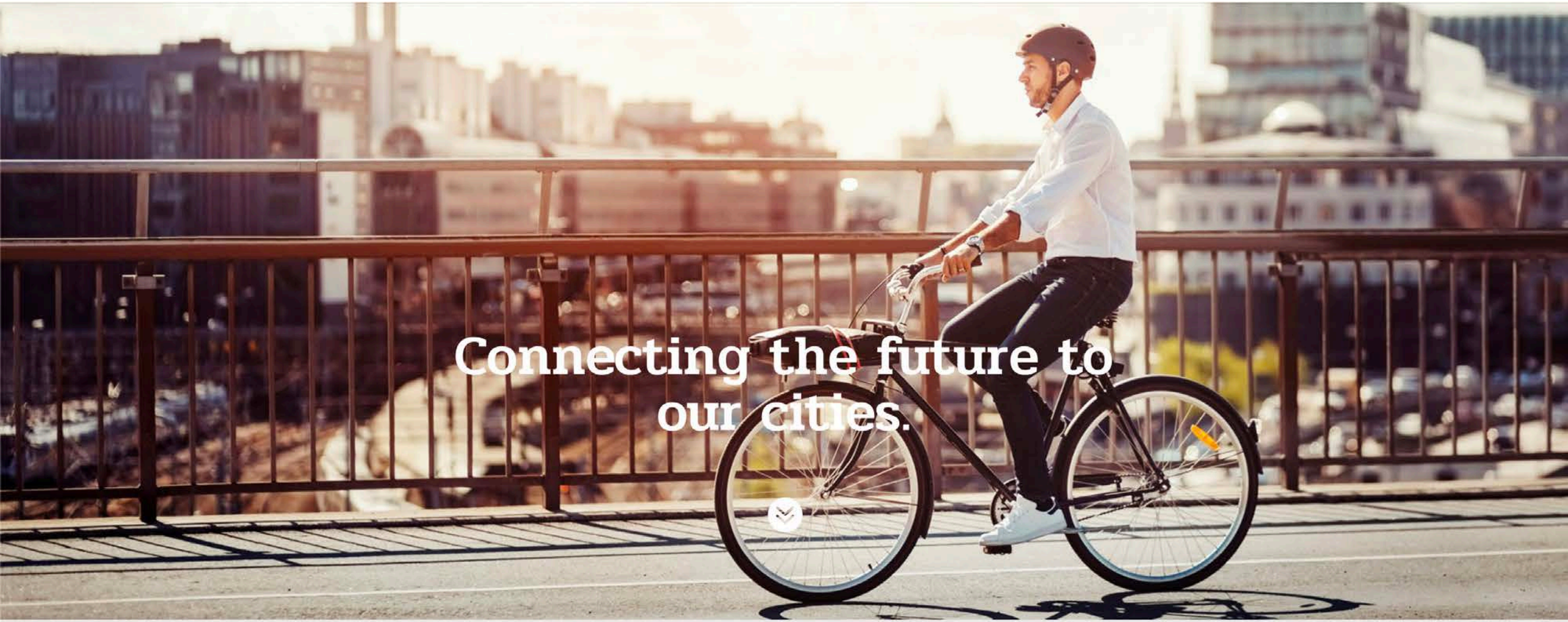


There are Two Visions of the Smart City Top Down Vs Bottom Up Smart Cities are Now Being Scrutinized

IPCC Special Report on 1.5 degree goal

*"**Behaviour- and lifestyle related measures and demand-side management** have already led to emission reductions around the world and **can enable significant future reductions (high confidence). Social innovation through bottom-up initiatives** can **result in greater participation** in the governance of systems transitions and increase support for technologies, practices and policies that **are part of the global response to limit warming to 1.5°C**."*

(Allen et al., 2018: p 40)

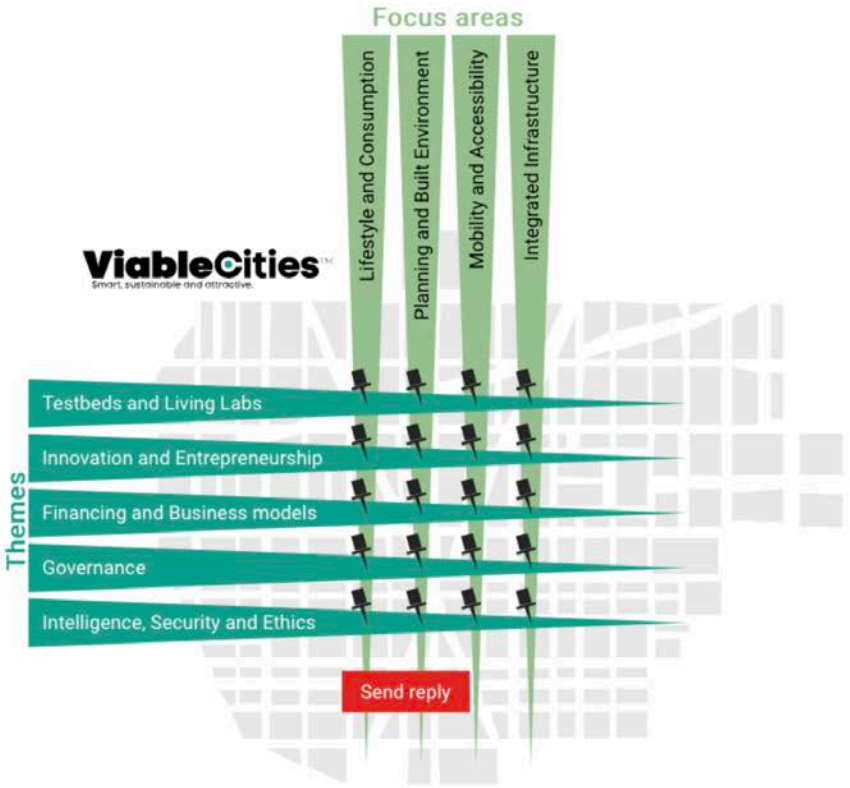


Viable Cities – the strategic innovation programme for smart, sustainable cities – is the largest research and innovation initiative taken in Sweden so far in the field of smart, sustainable cities. Viable Cities is led by KTH Royal Institute of Technology, and brings together around 50 stakeholders in various areas of research, industry, government, local authorities and civil society.

Focus areas

The programme's focus areas are based on citizens' interests, motivations and needs, and are implemented with the close citizen involvement. Lifestyle and consumption, together with planning and the built environment, mobility and accessibility, and integrated infrastructure, are the four main sectors of energy use in a city. The focus areas are described in more detail below:

Citizen Engagement is the Standard



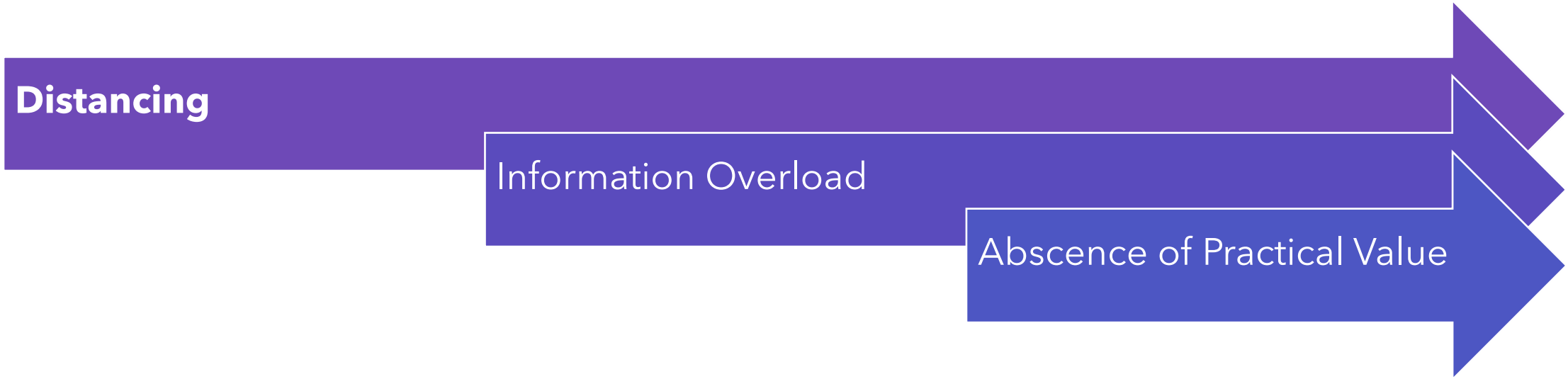
No Viable City projects receive funding without citizen engagement

So How to Engage Citizens?

- Also called: Customer Engagement / User Engagement

- *Sustained Pro-Environmental Behaviors that are Manual or Aided by Systems, Automation, Interfaces, and Signals*

3 Related Barriers



Sustainability Ethics, Behavioral Economics, and Psychology

One of the key barriers to ethical/sustainable decisions-making: transparency (Kibert et al 2008):

Princen (2008) calls this phenomena "**distancing**":

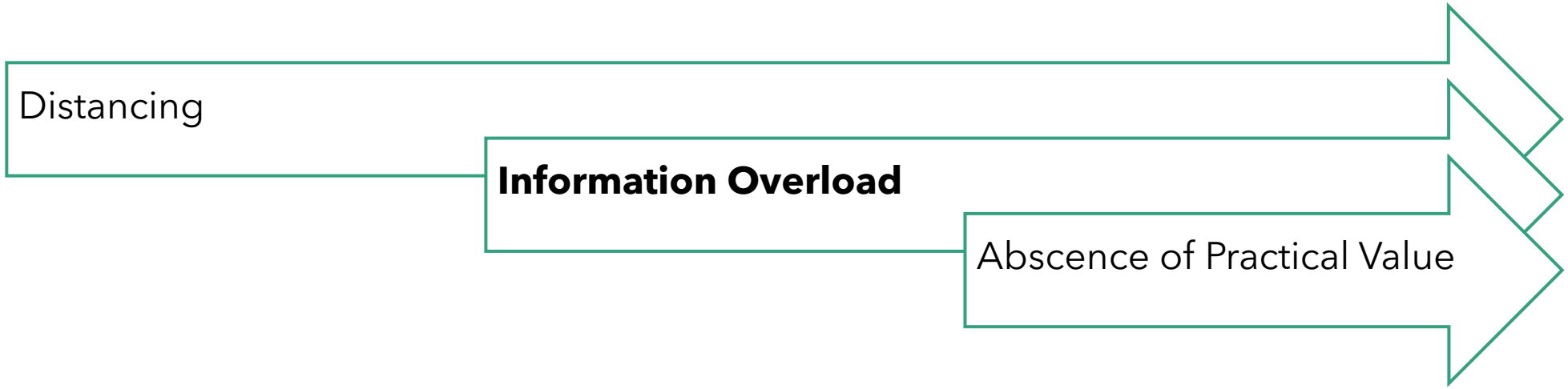
"The loss of negative local feedback loops from the environment, displacing environmental problems.

Q: Will full transparency automatically translate into better decisions?

Feedback – Necessary but Not Enough

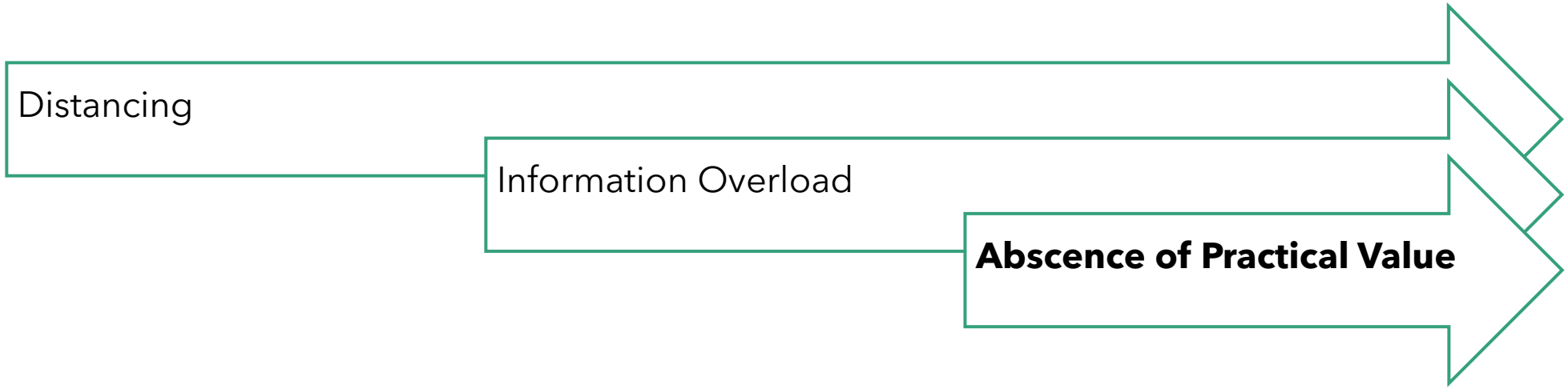
- So feedback to residents has proven to be necessary but inadequate to lead to long-term **behavioral changes** towards **resource conservation.**

3 Related Barriers

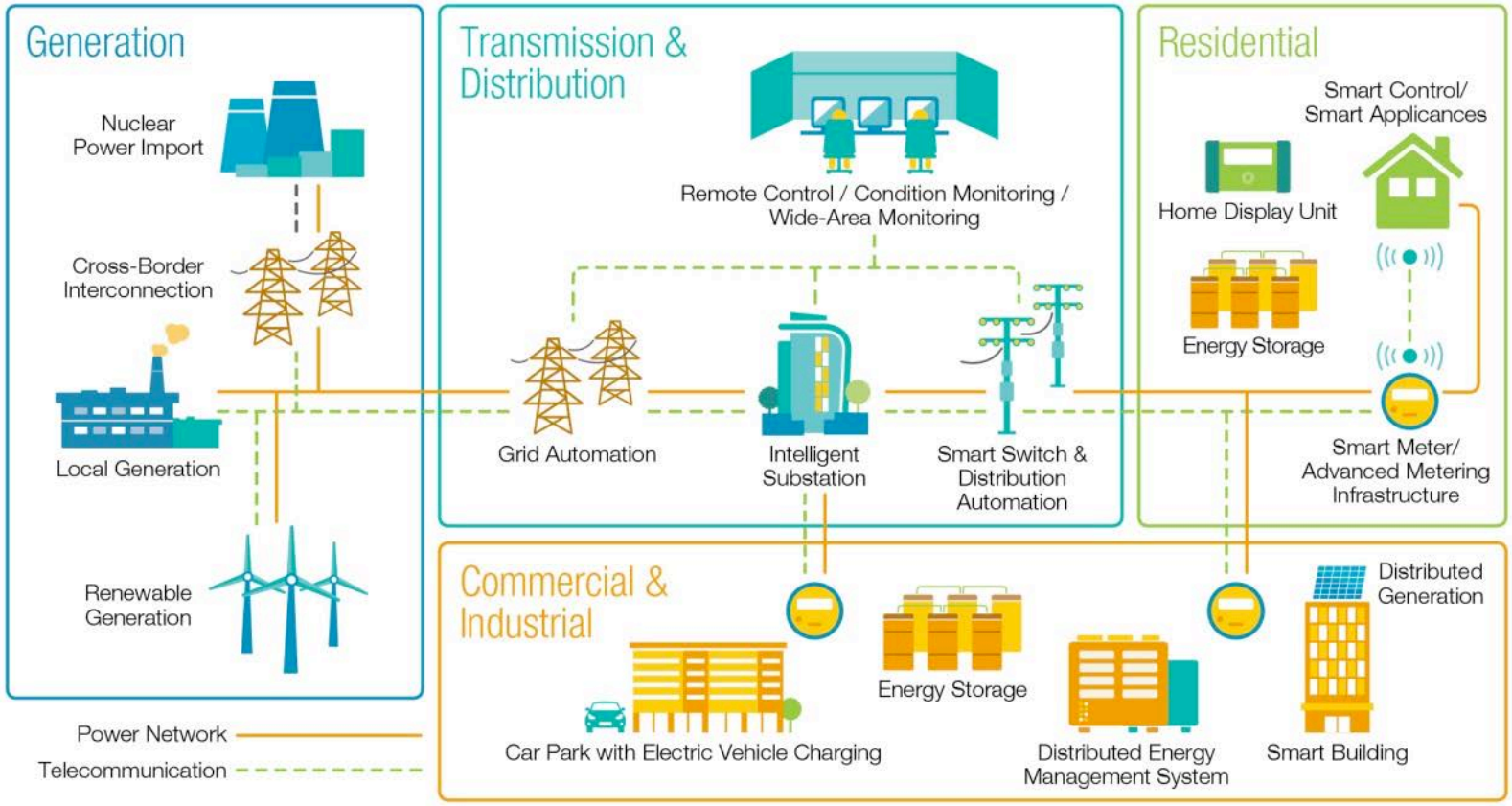



BUY
WORK
MIND
JOB
BILL
FAIL
MONEY

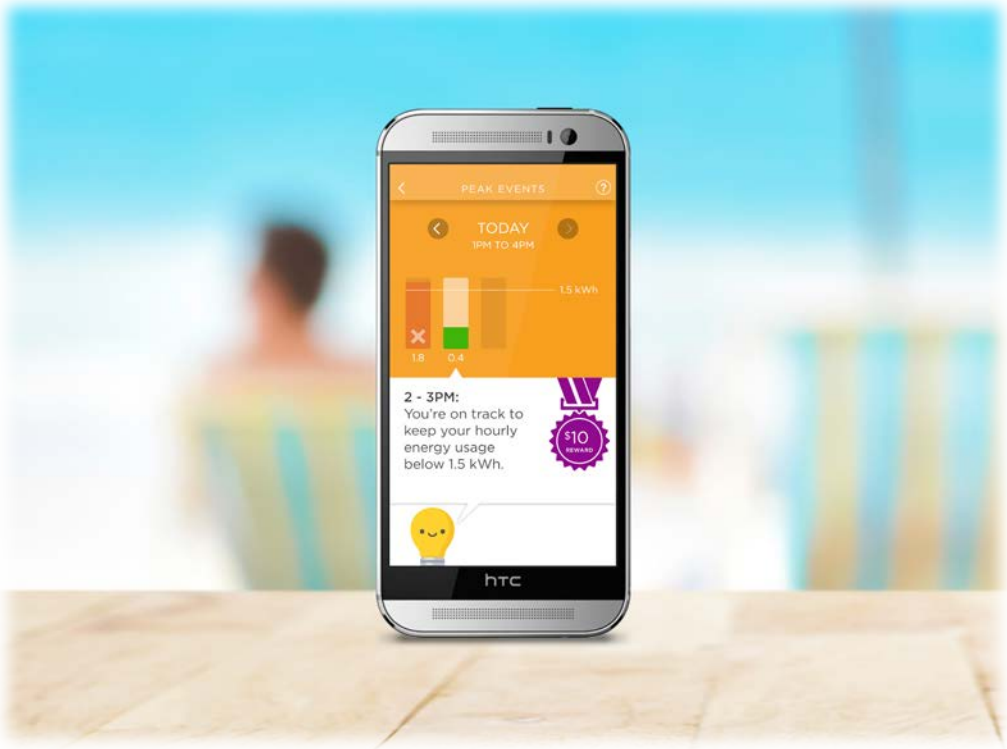
3 Related Barriers



Engagement by Engineers 1 - There is an app for that...



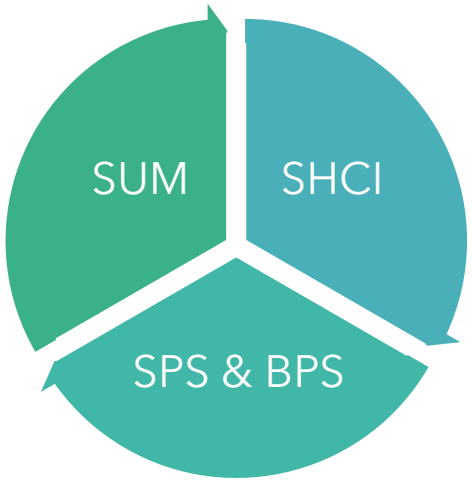
Engagement by Engineers 2 … We Brought in the Best UX / UI Designers



BRIDGING DISCIPLINES TO ELEVATE CITIZENS TO THE CENTER OF THE CIRCULAR ECONOMY

Smart Urban Metabolism

How to **quantify correct feedback metrics to citizens** from high spatial and temporal resolution urban data? Apply urban material and energy accounting principles from the industrial ecology toolbox



Sustainable Human Computer Interaction

Engage long-term by solving a problem for the citizens intestead of viewing them as a problem. **Then apply best practices** of human computer interaction in design.

Social Psychology and Behavioral Psychology

Change **behavior long-term by strengthening social identity**, and **utilize collective goals** (and rewards**)**

BRIDGING DISCIPLINES TO ELEVATE CITIZENS TO THE CENTER OF THE CIRCULAR ECONOMY

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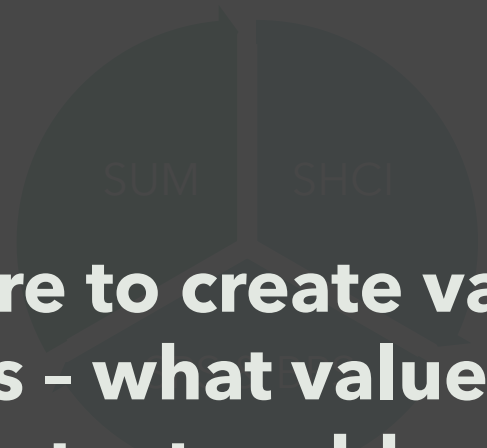


Sustainable Human Computer Interaction
Engage long-term by solving the problem for the citizens instead of viewing them as a problem. **Then apply best practices** of human computer interaction in design.

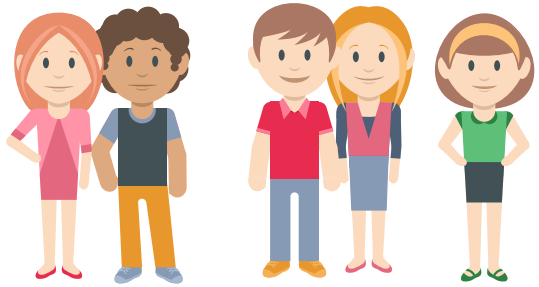
If we are to create value for the citizens – what value should we try to address?

Social Psychology and Behavioral Psychology
Change **behavior long-term by strengthening social identity**, and **utilize collective goals** (and rewards)


… our colleagues
… our interests
… our friends and family

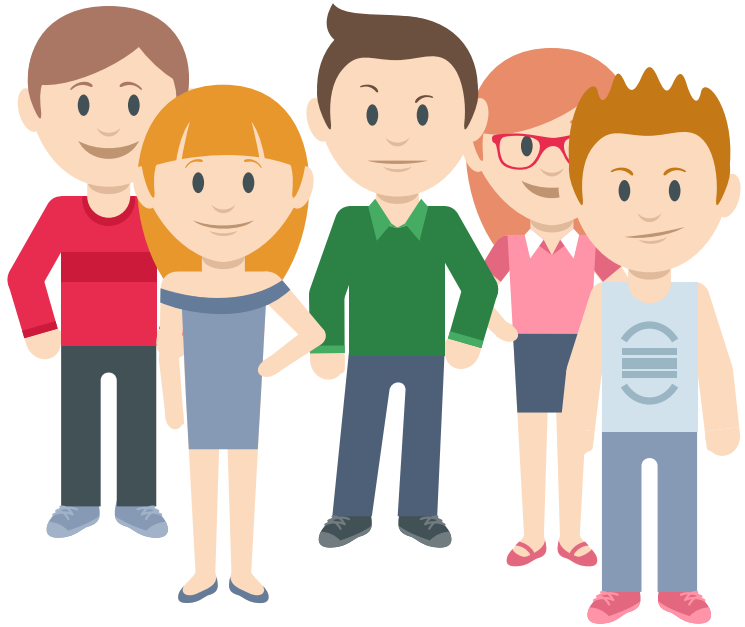
But how does our relations look like with our

… own communities?



… our neighbors?

… our local organizations?



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Sustainable Human Computer Interaction
Engage long-term by solving for the citizens instead of viewing them as a problem. **Then apply best** of human computer interaction in design.

So the Value We Create is to Connect People that Live Close to Each Other and Thereby we Gain the Opportunity to Engage them Long Term

Social Psychology and Behavioral Psychology
Change **behavior long-term by strengthening social identity**, and **utilize collective goals** (and rewards)

Globally connected yet locally isolated

Issue:	Global-ICT 2007
Article no.:	12
Topic:	Globally connected yet locally isolated
Author:	William T Hayes
Title:	President
Organisation:	IEEE Broadcast Technology Society
PDF size:	192KB

Published in Global-ICT 2007

Inbjudan till boendeplattform Kvarteret Hornslandet

Du och dina grannar
är bättre tillsammans

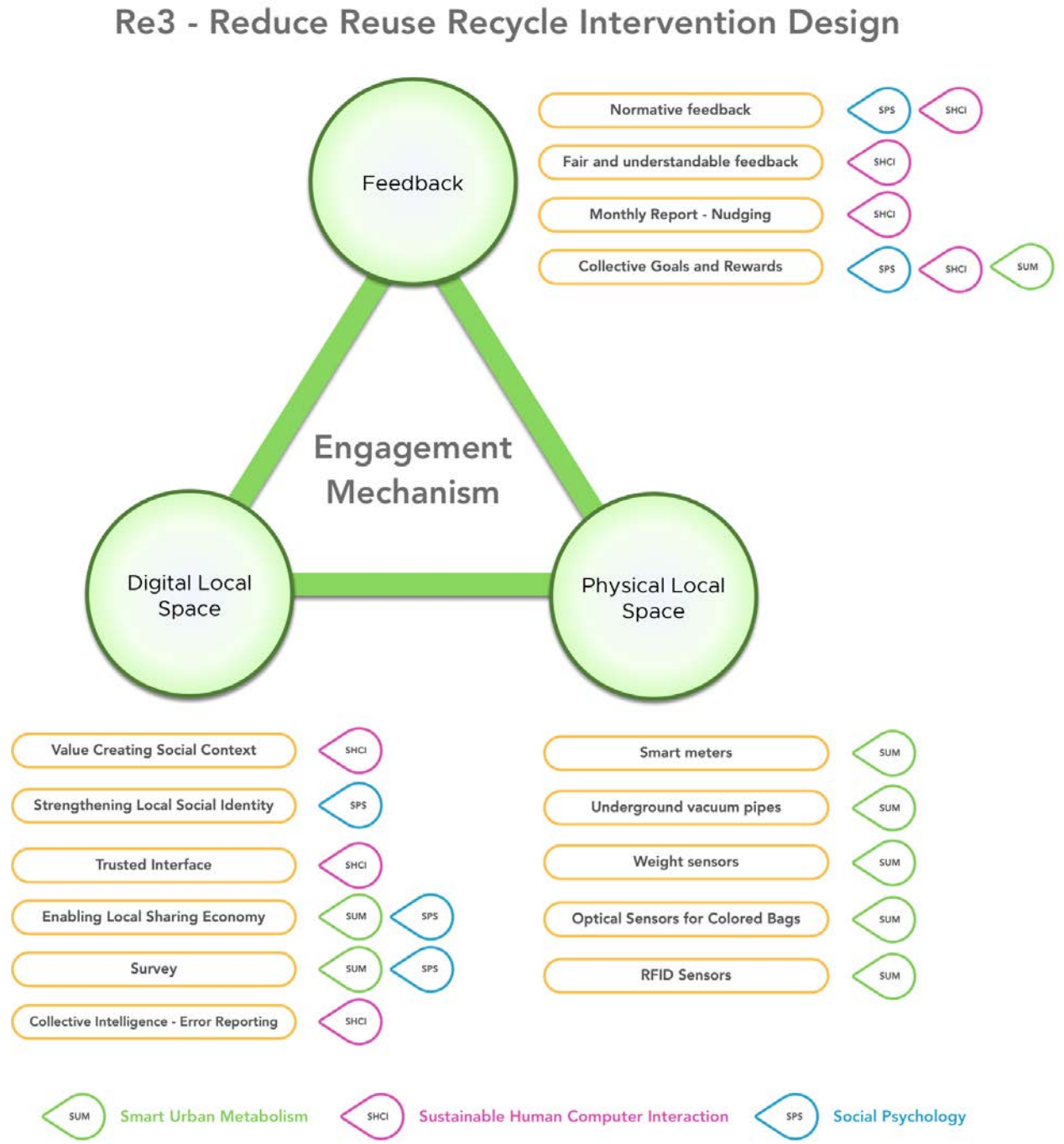
Case Study 1 with the Inventor of the Pneumatic Waste System - Envac

Behavioral Intervention:
Re3 – Reduce – Reduce – Recycle
Stronger Local Sharing Economies

Envac has a physical infrastructure with data on recylcing, and the **social network adds a digital infrastructure to** track **sharing** (reduce), and local **classifieds** (reuse)

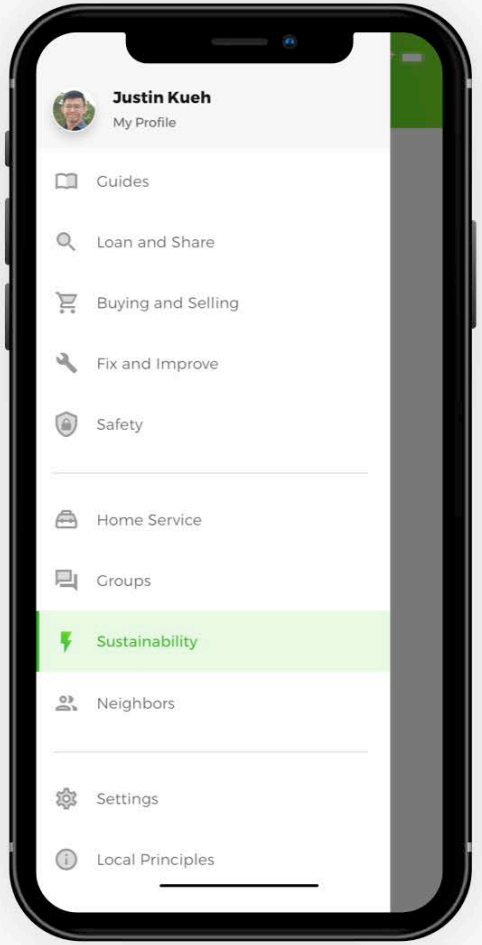

1. APARTMENT
2. BUILDING
3. NEIGHBORHOOD

A Multidisciplinary Engagement Strategy

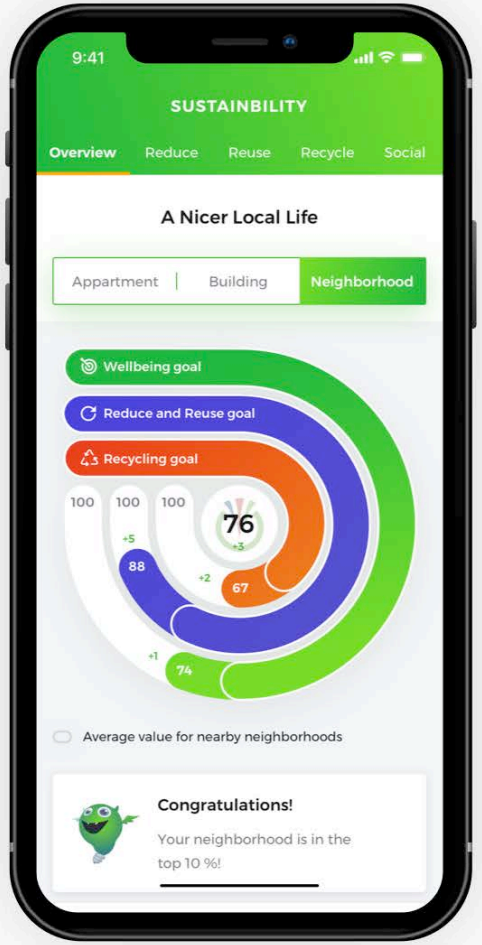


Envac Community

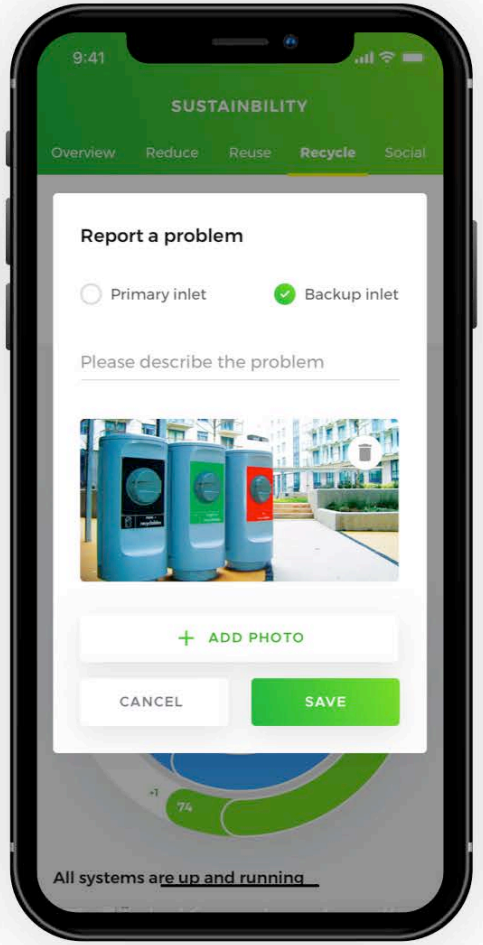
Menu



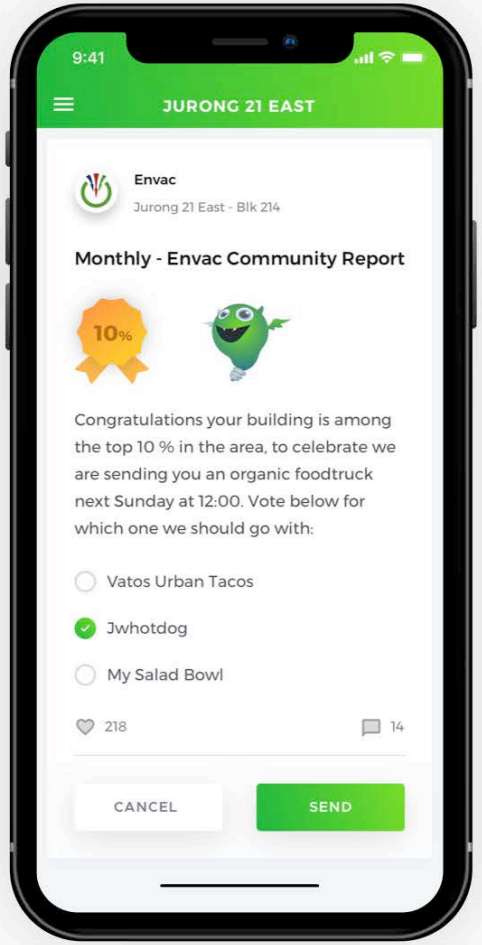
Sustainbility



Report a problem



Success screen



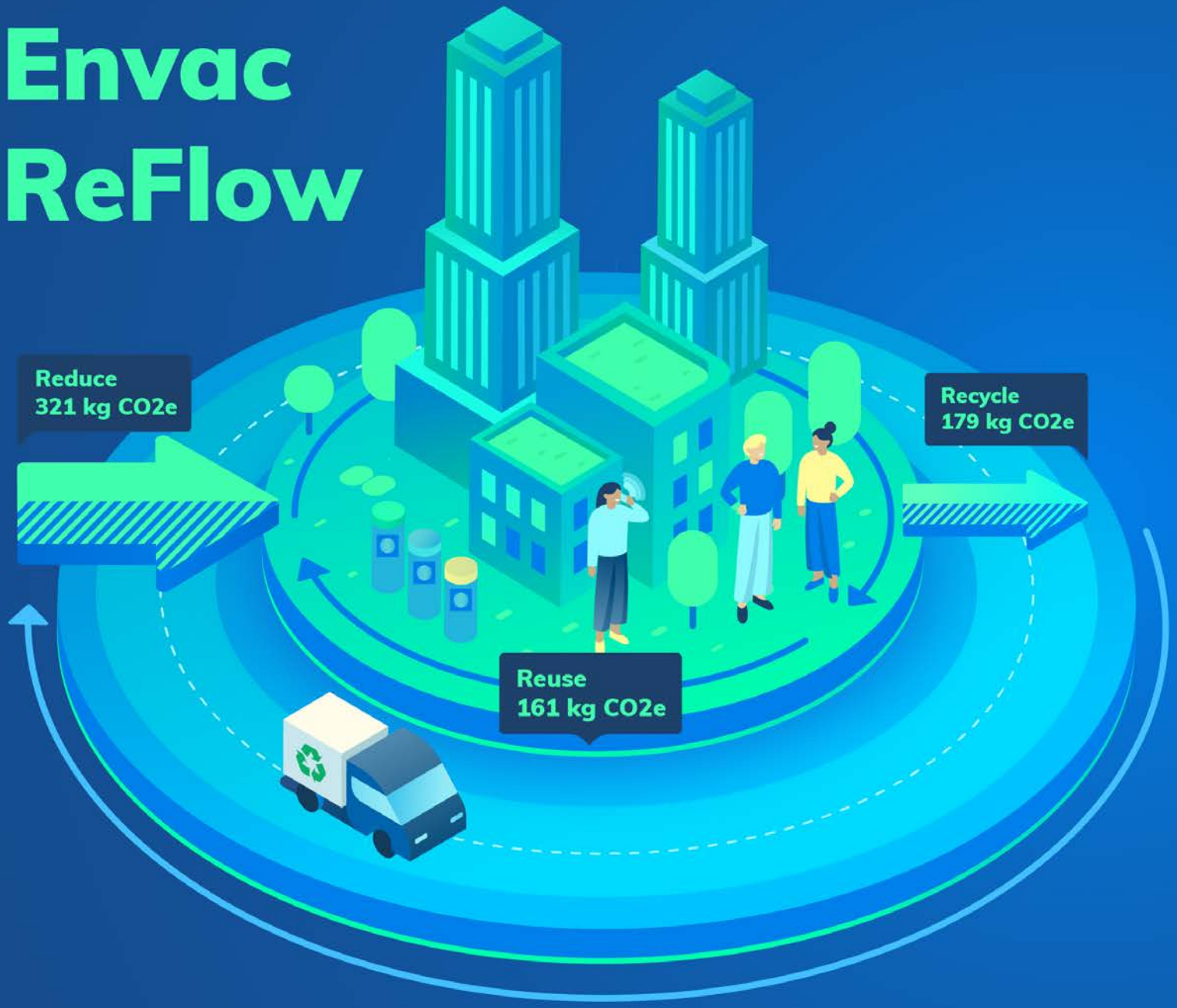

envac


locallife™
envac


locallife
SUSTAINABILITY
A Nicer Local Life
Report a problem
JURONG 21 EAST

Envac ReFlow

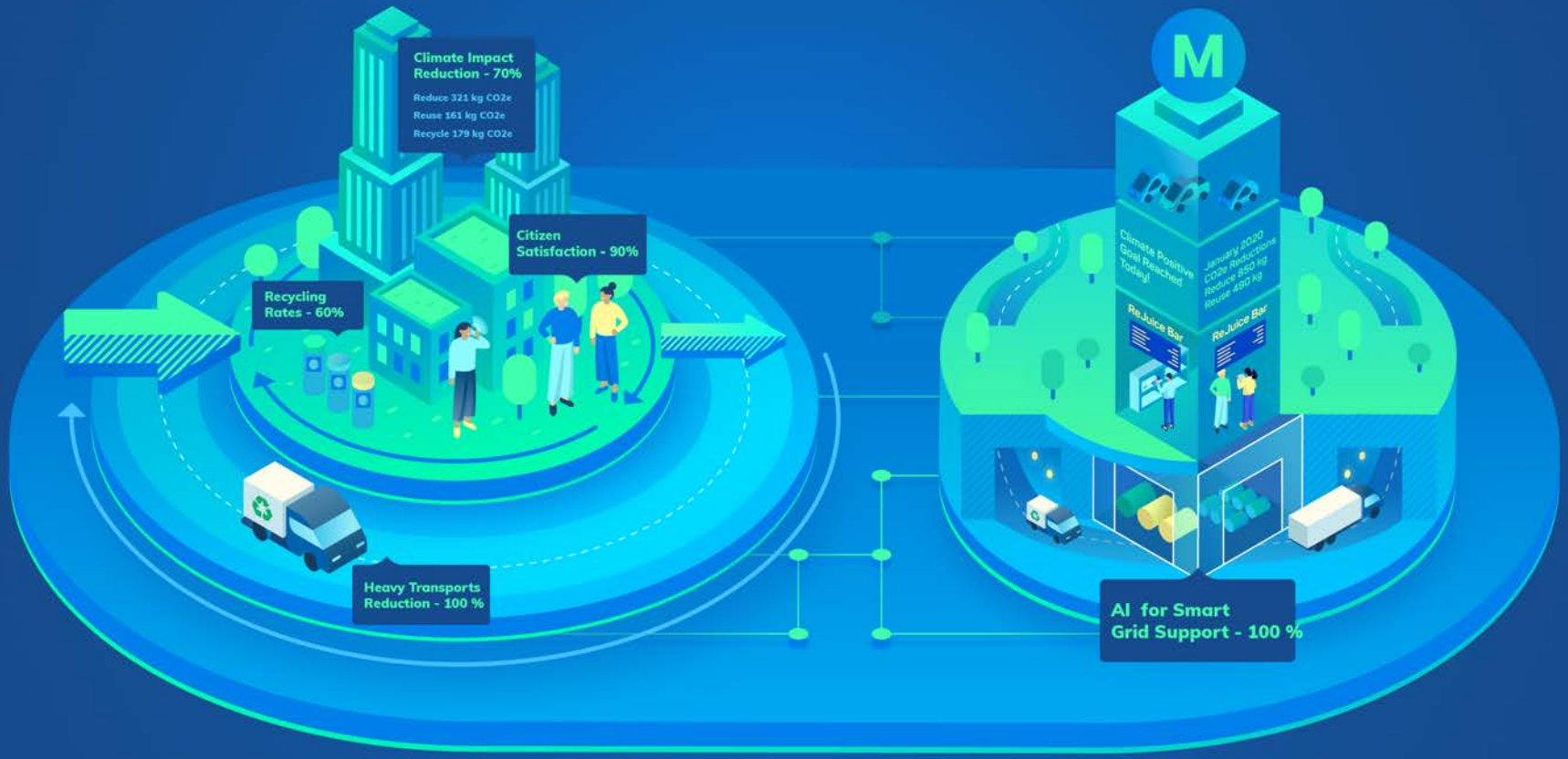
Envac ReFlow



Envac ReFlow Premium

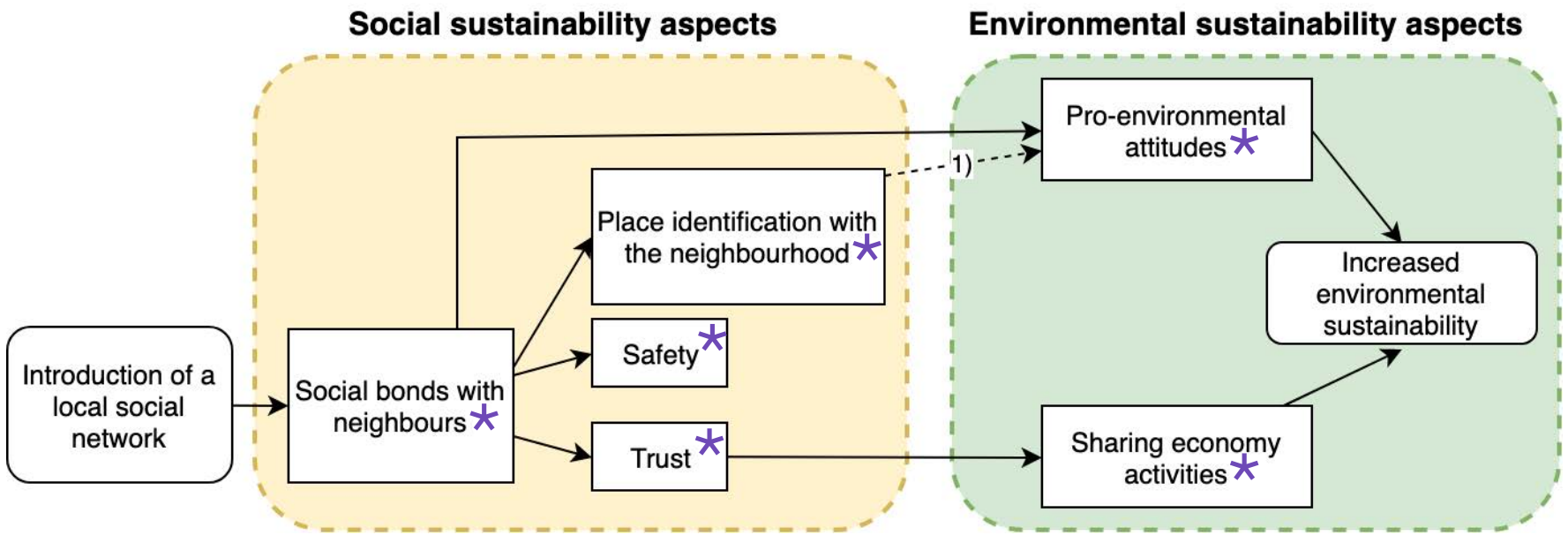
Envac ReFlow

Quantifiable Impacts / Effects



Case Study 2 in an EU Smart Grid Project Called InteGrid: We Engaged 150 Residents to Reduce their Peak Loads through the Social Network and Behavioral Sciences

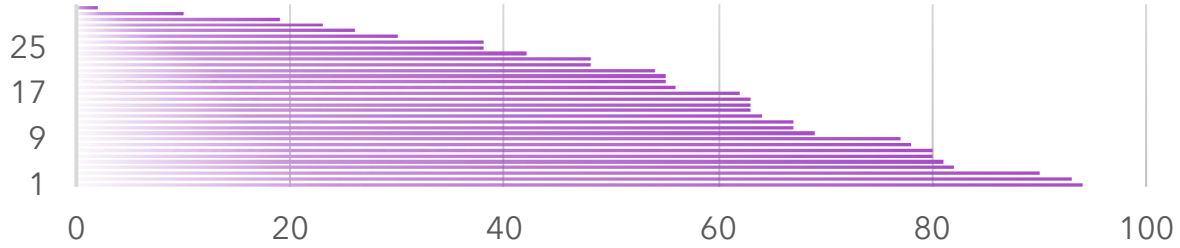
What changes could the introduction of a local social network bring about?



*aspect measured in household survey

Results:

AVG PEAK LOAD REDUCTION OF PARTICIPATING HOUEHOLDS: 56 %



- Primary Obstacles for Participation
  - Data availability
  - Few flexible loads in households

Conclusions:

- High peak load reduction in participating households (56 %)
- Some households have a recurring behavior to change consumption during pause hour
- Average peak load reduction for all 14 %

Please note these are interim-results that are pending a final analysis and verification.

Comparison Between Social Network and Smart Homes

Intervention Design	Active House (PUC1.11)	LocalLife (PUC2.11)
Recruitment	Leasing agreement	Signup via postcard or move-in-material
Onboarding / Activation	Door-knocking + UX	UX
Meter	Smart meter for household	Smart meter for household
Data delay	"Real-time"	24 hour delay
Automatic Controls	Clotheswashers, Dryers, EV, Lights, Thermostats	-
Scheduling	Washer/Dryer, EV	-
Engagement Trigger	Comfort	Social influence
Pre-Conditions	HEMS installation	Smart meter installation
Total cost per household (CAPEX + OPEX over 5 years)	€2800 /hh	€75 /hh
Energy Reduction	10% (mean value)	In D5.4
Peak Reduction	5% (mean value)	14 %
Peak Reduction in Participating Households	N/A	56 %

Please note these are interim-results that are pending a final analysis and verification.

In Summary

There is an Urgent Demand for us Professionals in Lean and Smart to Advance Our Skillsets to Meet the Global and Local Demands on Us

The Concepts of Lean Construction and Smart Cities are Deeply Connected

Any City Serious About the Environment Need for Leaner Construction for Smarter Cities

Setting Clear Goals and Following Up on the With the Extended Teams is A Critical Success Factor in Lean and Smart Projects

In Summary

The Ability of Finding, Connecting, Analyzing Data from Related Stakeholders Holds Immense Potential – We Need to Develop These Abilities

Our Projects are Neither Lean nor Smart if We Do Not Find a Way to Engage the Often Overlooked Stakeholder: The Workers and the Citizens.

We do that by Creating Value for them

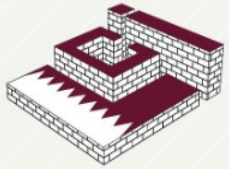
Thank You for Your Time and Patience

Hossein Shahrokni

hosseins@kth.se

Urban Analytics and Transitions

Department of Sustainable Development, Environmental Science and Engineering
School of Architecture and the Built Environment
Royal Institute of Technology (KTH), Stockholm



Lean Construction Institute - Qatar

Transforming the Built Environment

NAWIC

NATIONAL ASSOCIATION OF WOMEN IN CONSTRUCTION IN QATAR

Certificate of Appreciation

The Lean Construction Institute - Qatar and National Association of Women in Construction (NAWIC) Qatar are honored to extend their greatest appreciation and gratitude to

Dr. Hossein Shahrokni

For his unwavering support and invaluable contributions that led to the success of organizing

"Leaner Construction for Smarter Cities"

May 13, 2020

Dr. Abdulla Yaqoub Al-Sayed
President, LCI-Qatar

Billie Teshich
President, NAWIC Qatar

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May 27 and 28, 2020

May 27 I Time: 5:30 - 10:00 PM May 28 I Time: 5:30 - 8:15 PM

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Challenges ahead in CONSTRUCTION Field & Available Technology Tools

NAWIC Tech SERIES

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TMF GROUP Global reach Local knowledge

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Istidama.. NAWIC to SUSTAIN

UN Sustainability Development

SUSTAINABLE DEVELOPMENT GOALS

Financial Literacy

NAWIC Key Speaker

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Qatar Financial Centre
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PARSONS

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Connect • Lead • Diversify

Q&A

Hossein Shahrokni

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Urban Analytics and Transitions

Department of Sustainable Development, Environmental Science and Engineering
School of Architecture and the Built Environment
Royal Institute of Technology (KTH), Stockholm