Erasmus Centre for Data Analytics

Erasmus University Rotterdam

RUGGEDISED

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DATA REVOLUTION FOR A SUSTAINABLE WORLD

ecda.eur.nl

Digital worlds:
How data and digitalization drive the energy transition - towards resilient and climate neutral cities – An introduction .....

September 8, 2022 | Recharge Earth Event | Dr. Marcel van Oosterhout, Erasmus Centre for Data Analytics

4Ds: Enabling pillars of the Energy Transition

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Public governance
Right regulatory incentives
Public-Private Partnerships
Long term planning

Technology Innovation
Digitalization
Smart Energy Grid & sector coupling
Carbon capture, storage and (re)use

Societal Engagement
Psychological ownership
Social Enterprises & Self-organization
Change of behavior

Digitalization

Decarbonization

Decentralization

Democratization

Cross Sector collaboration & trust
Building new (global) value chains

Business Model Innovation
(digital/circular & nature positive)

Sustainable Finance & (Social) Investment

Green Deal Ambitions

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European green deal (Dec. 2019): Ambition of being the world's first climate neutral continent by 2050.

Key targets for 2030:
- At least 40% cuts in **greenhouse gas emissions** (from 1990 levels)
- At least 32% share for renewable energy.
- At least 32.5% improvement in energy efficiency

European Green Deal focuses on 3 key principles:

1. Ensuring a **secure** and **affordable** energy supply
2. Developing a **fully integrated, interconnected** and **digitalized energy market**
3. Prioritising **energy efficiency**, improving the **energy performance of buildings** and developing a power sector based largely on **renewable sources**

https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal/energy-and-green-deal_en

The promise of Energy Digitalization

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International Energy Agency: 

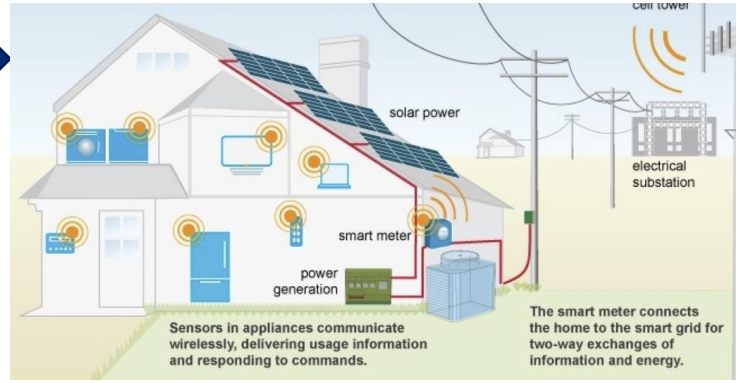
Digital technologies are set to make energy systems around the world more connected, intelligent, efficient, reliable, and sustainable.

- Data
- Internet of Things
- Analytics
- Artificial Intelligence
- Blockchain
- Platforms
- Augmented & Virtual Reality

Digitalized energy systems in the future may be able to identify who needs energy and deliver it at the right time, in the right place, at the lowest cost and the most sustainable way.

A big change in data ....

one datapoint
per year
per
connection



one datapoint
per 15
minutes
(per device)

Energy digitalization enables decision making everywhere

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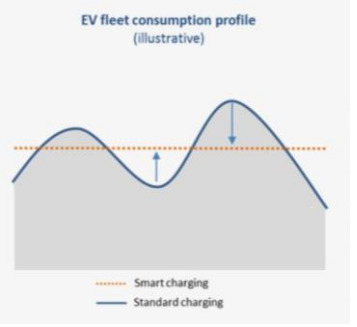
Strategy long-term decision-making

- Policy scenarios & Simulations
- Decision support on investment decisions & area (re)development
- Developing smart & sustainable buildings & infrastructure
- Citizen engagement

Tactical decision-making & operations

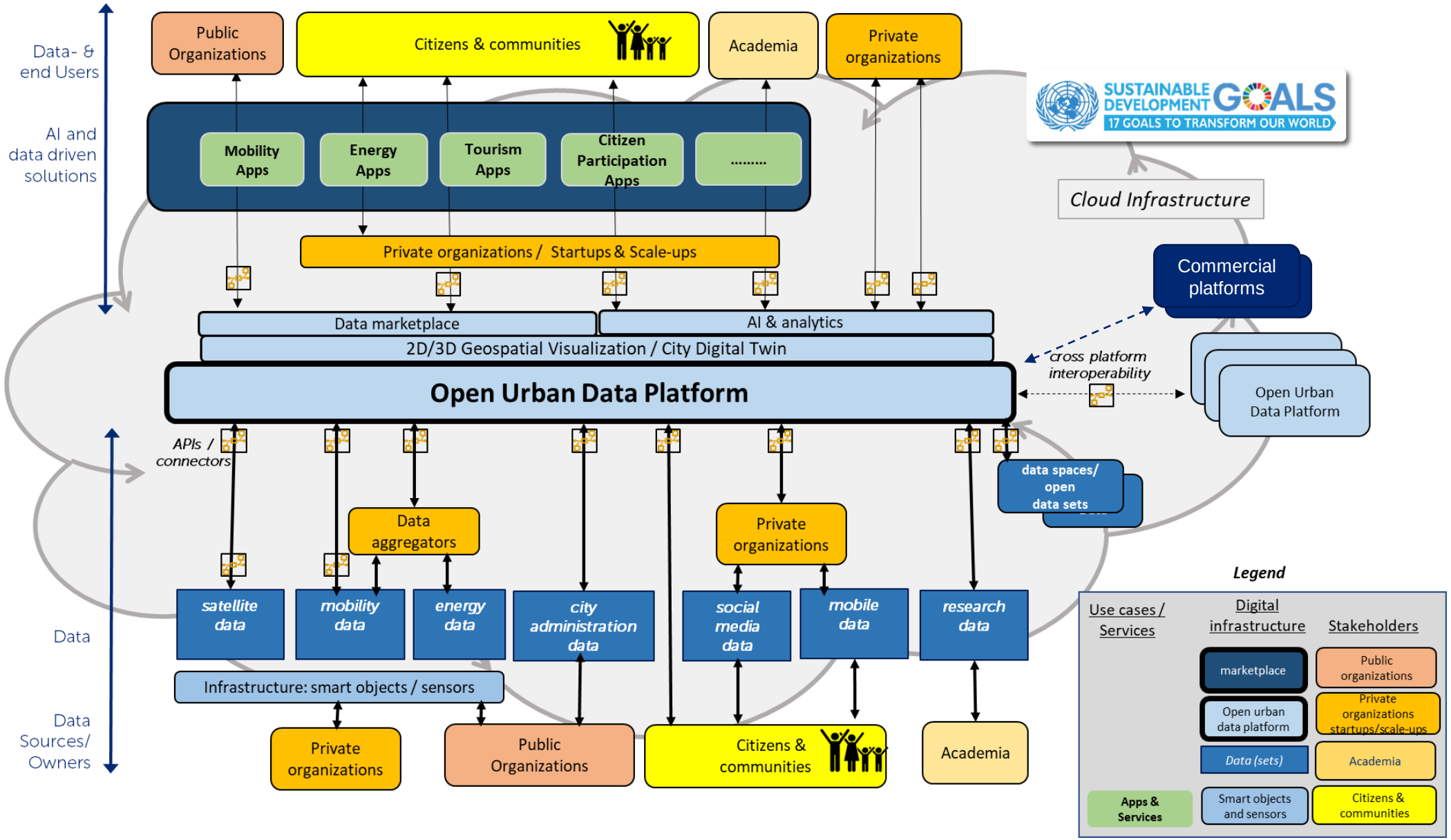


- Prediction of energy supply & demand
- Market predictions & trading support
- Energy systems coupling & optimization
- (Predictive) maintenance

Operational decision-making

- Improving grid stability, sustainability, and efficiency
- Anomaly detection, safety & security monitoring
- Decision support for energy efficiency, demand-response measures
- Smart-shared mobility, smart charging of EVs
- Local distributed energy optimization (such as virtual power plant concepts)

Open urban data platforms and Digital Twins will have an important role



Digital Twins – fed by data and using AI – will support decision making

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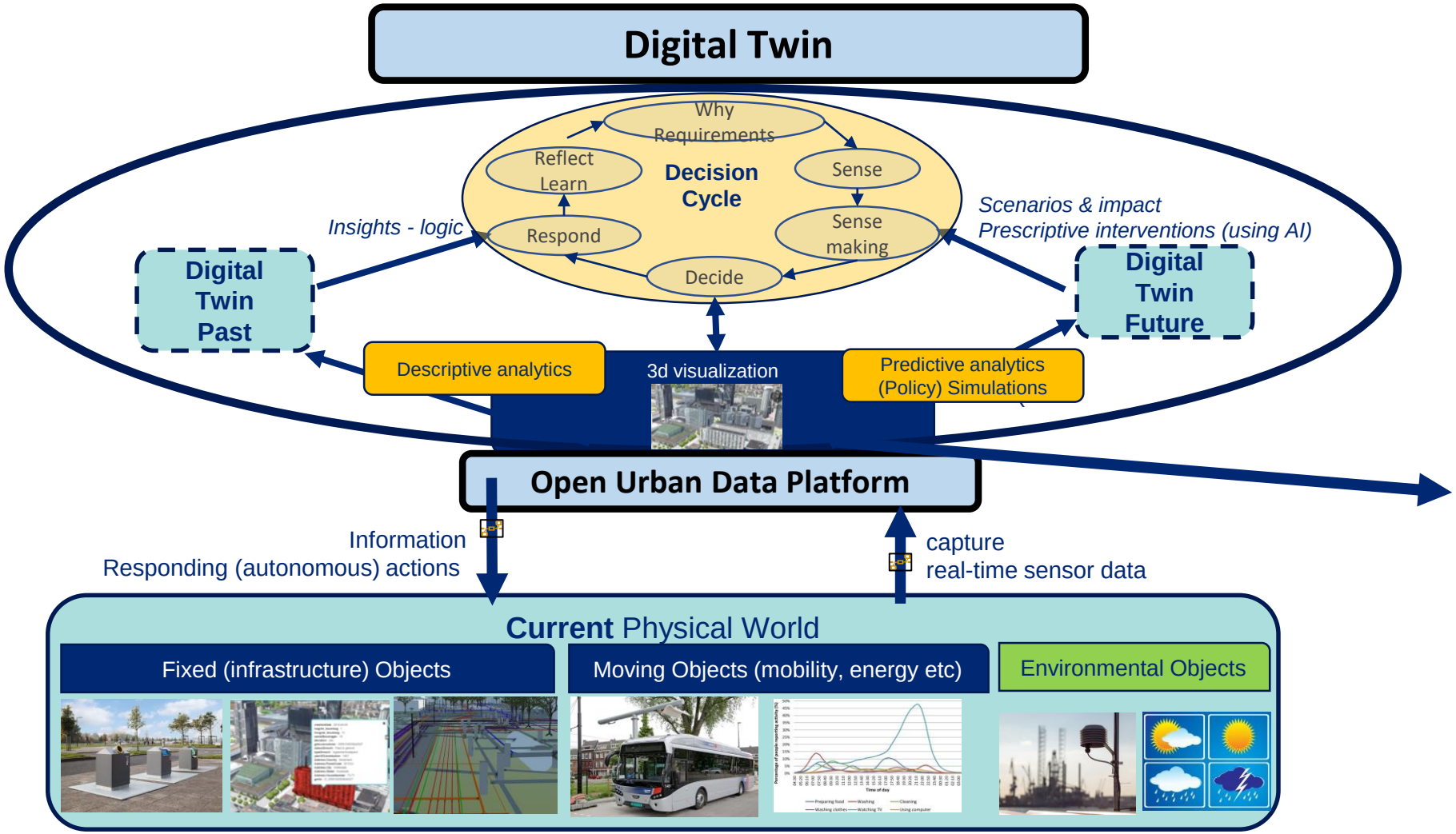
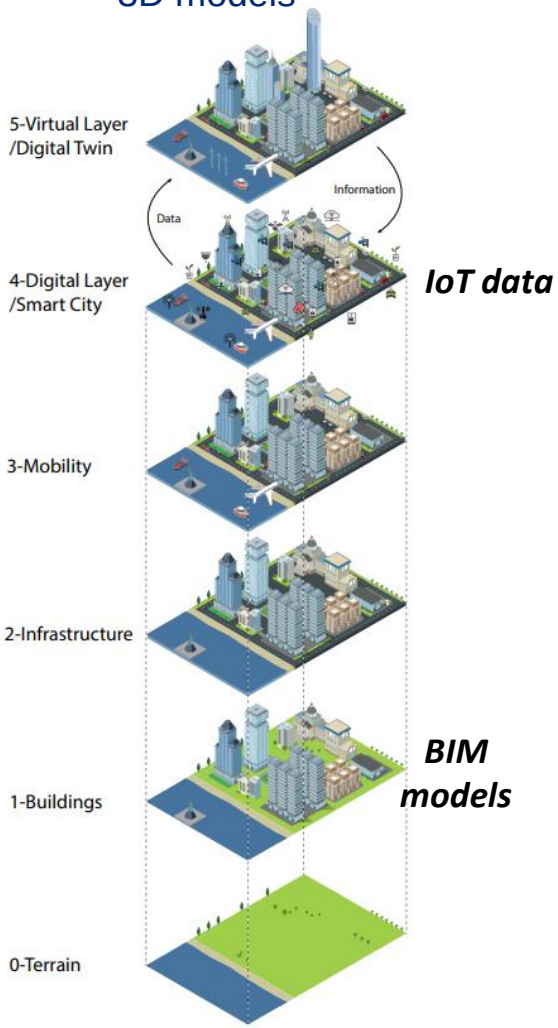


Digital twin layers and 3D models



State of development UDPs & Digital Twins in Europe

Representative sample of 80 cities in Europe, with in total 105 respondents.
The study was executed in the period November 6, 2019 until January 10, 2020.
85 percent of the respondents were partner in one of the EU SCC projects, funded by the European Commission

Exploring & Planning for Urban Data Platform (44%)

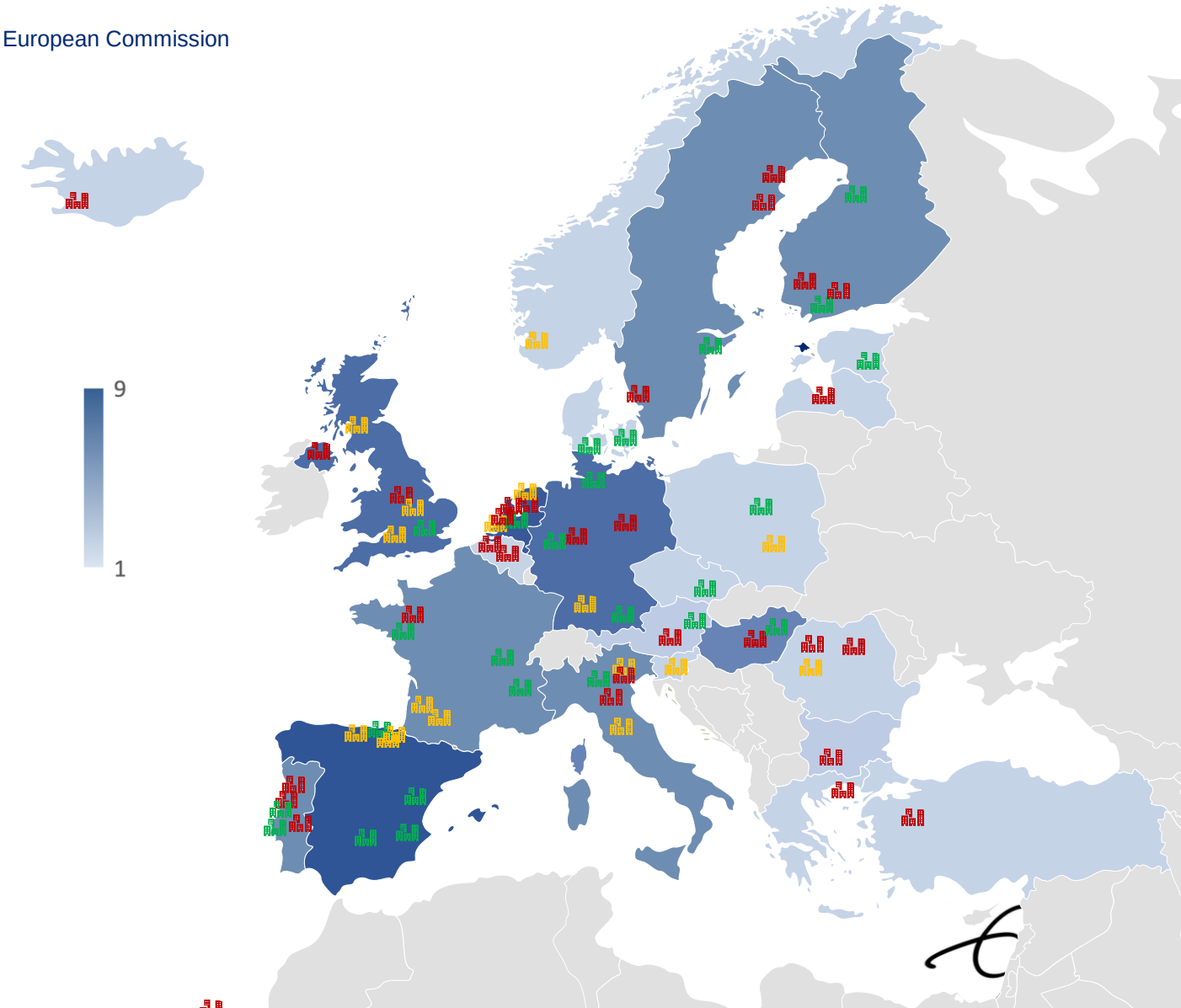
Alexandroupolis	Évora	Porto
Alkmaar	Genth	Rennes
Amsterdam	Gothenburg	Reykjavik
Bassano del grappa	Graz	Riga
Berlin	Kerava	Santa Cruz de Tenerife
Budapest	Leon	Skellefteå
Cluj-Napoca	Maia	Suceava
Derry	Manchester	Smolyan
Eskişehir	Oostende	The Hague
Essen	Parma	Umeå

Building & Implementing Urban Data Platform (25%)

Alba Iulia	Maribor	Stuttgart
Bilbao	Nottingham	Trento
Bordeaux	Pamplona	Tampere
Bristol	Rotterdam	Firenze
Groningen	Saint-Quentin	Glasgow
Lublin	Santander	
Linköping	Stavanger	

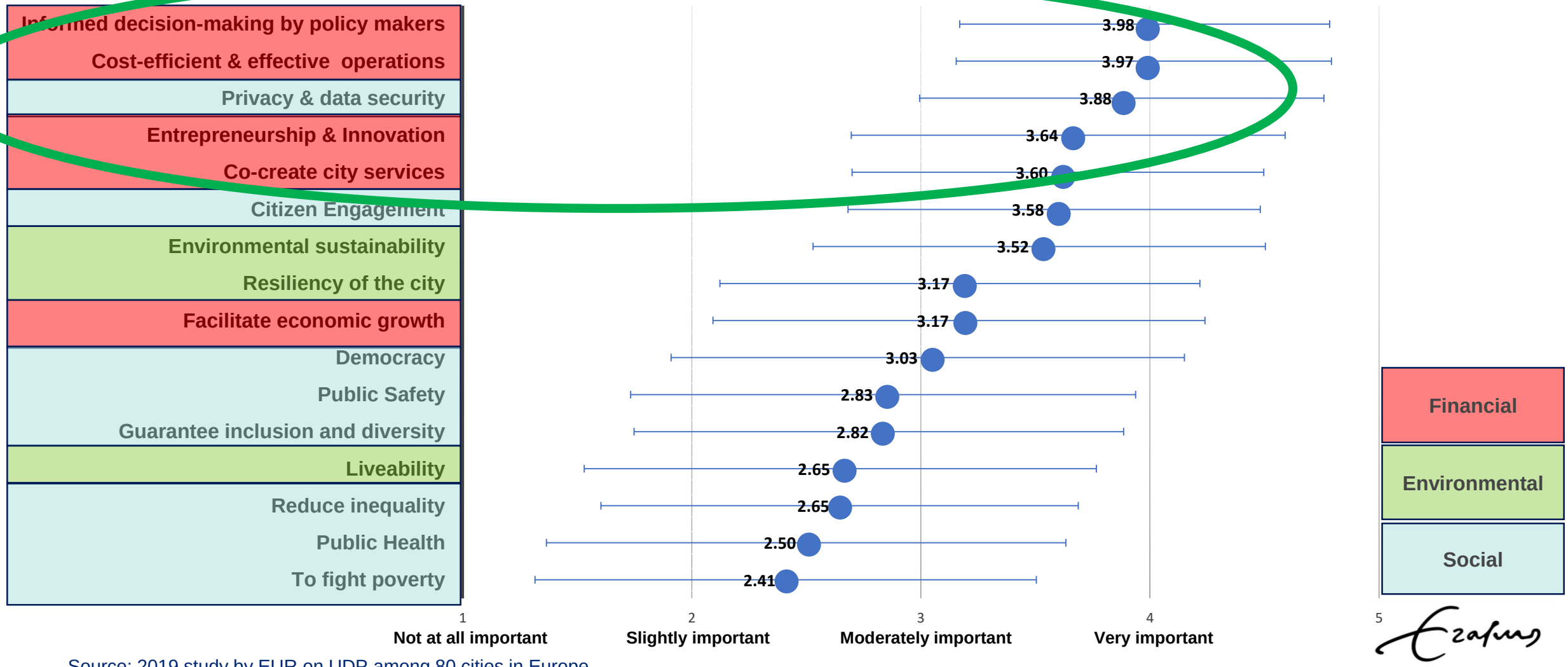
Operational Urban Data Platform (31%)

Albacete	Lisboa	San Sebastian
Barcelona	London	Sonderborg
Brno	Lyon	Stockholm
Cologne	Matosinhos	Tartu
Copenhagen	Milan	Utrecht
Grenoble	Munich	Valenica
Hamburg	Nantes	Vienna
Helsinki	Oulu	Warsaw



Purpose for Digital Twins and UDPs

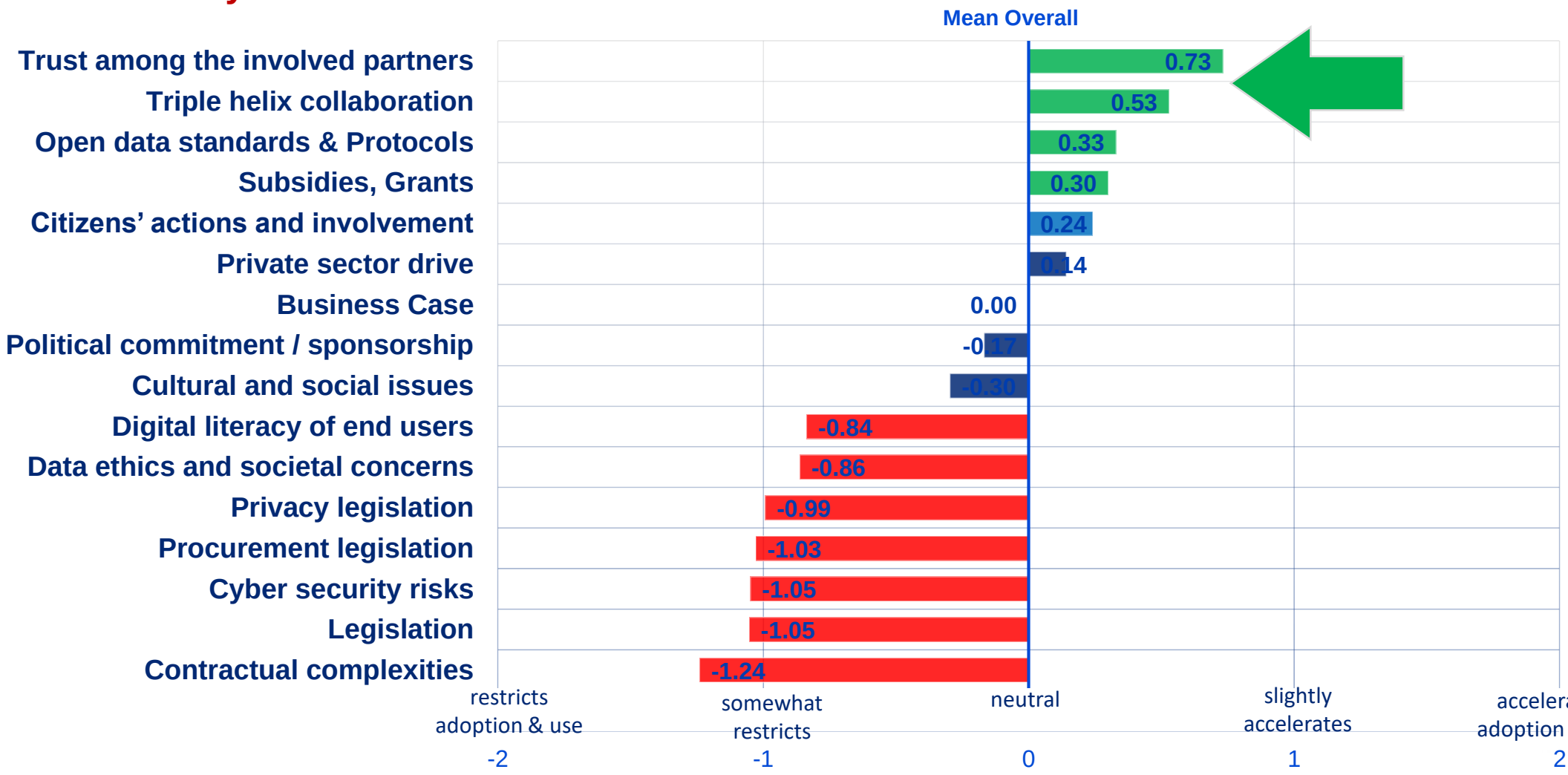
N = 80, Frequency distribution



Source: 2019 study by EUR on UDP among 80 cities in Europe

Trust is the core success driver of an UDP ecosystem
Capabilities – Collaboration – and Governance breed Trust

What are the key accellerators and inhibitors of UDPs?



Source: 2019 study by EUR on UDP among 80 cities in Europe

Source: 2019 survey

Challenges for Energy Digitalization

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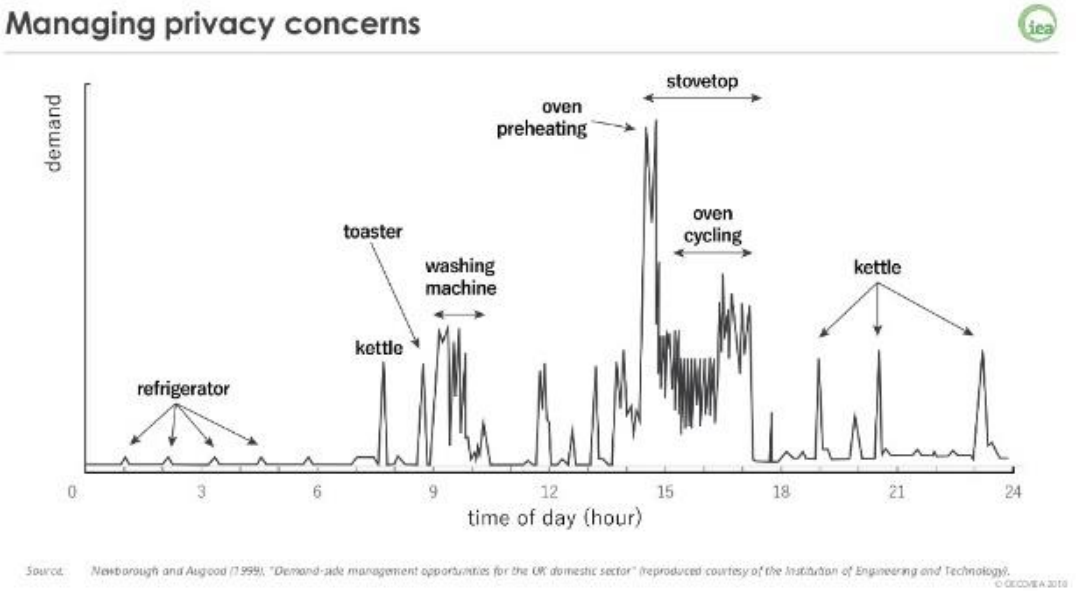
- Lack of public acceptance/trust with new technologies.
- **Market design challenges**
- **Additional energy demand**
- Cybersecurity
- Data ownership/privacy (e.g. energy demand profiles)
- **Economic disruption and transformation (job losses)**



Key take-aways

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1) Energy digitalization and data is one of the key pillars of the energy transition

2) This creates opportunities to
   1) improve energy efficiency
   2) facilitates system coupling
   3) enables required levels of flexibility needed to incorporate renewable energy

3) Energy digitalization applications enable strategic up to operational decision-making

4) Urban data platforms will be an important element of cities energy digitalization infrastructure

5) Trust, interoperability/standards and Quadruple Helix collaboration are key drivers

6) Use agile mind set and continuous improvement approach: Think big, start small and learn (from failure) fast!

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Passion provides purpose, but data drives decisions

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