How Can Test Beds Accelerate Connected Lighting System Development?

DOE Connected Lighting Systems Workshop

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Lessons Learned from Early SSL Market

- Actions taken by DOE and industry did result in smoother market entry, compared to CFLs

- BUT unique attributes of LED lighting present a host of new challenges impacting market adoption

- Technological challenges with today's products

- Existing infrastructure limits full potential of SSL

- **Increased sophistication of future lighting systems presents further challenges, new questions, new players**

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The Next Revolution: Connected Lighting Systems
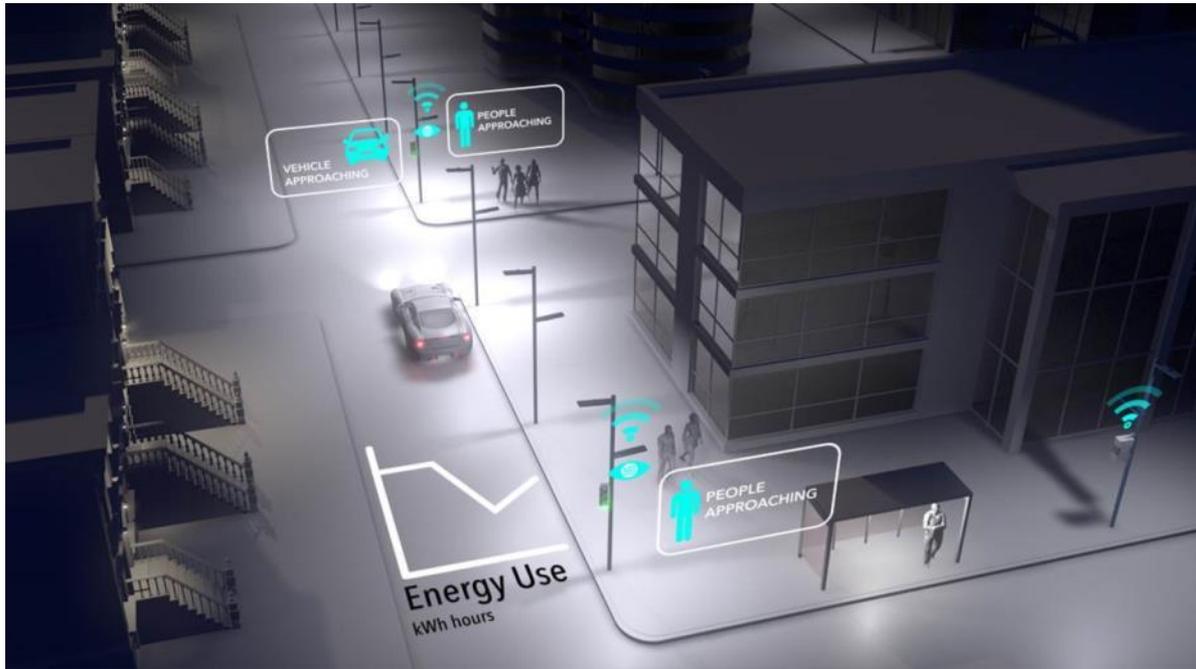
Enabling intelligent lighting devices with data provides a platform for greater energy savings in buildings and cities

Collected data enables other features and revenue streams

DOE's Role in the Next Revolution

- Facilitate collaboration

- Increase visibility and transparency in the market on what works, and what doesn't

- Create tight information feedback loops to inform technology developers of needed improvements

- Identify and implement efforts to accelerate development of connected lighting systems

In a Nutshell

- ✓ Big players
- ✓ High stakes, large $$
- ✓ Much uncertainty
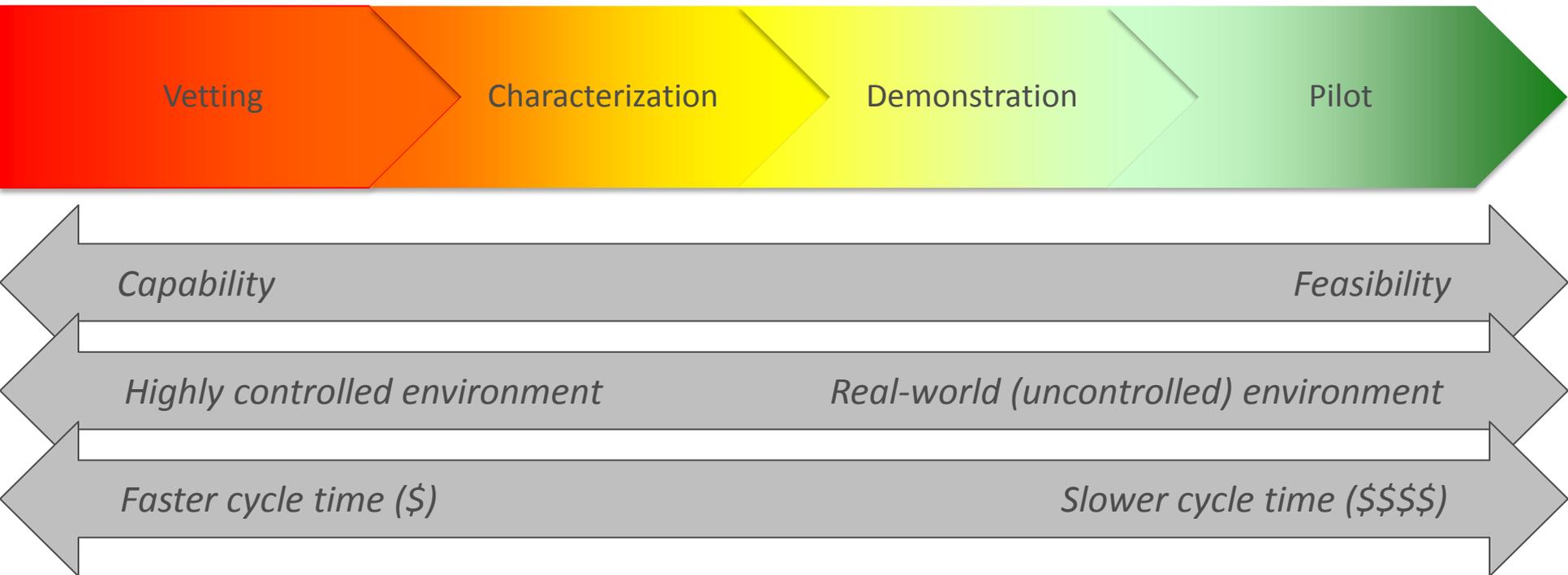- ✓ High potential for market dislocation

Sounds familiar...

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DOE Connected Lighting Focus Areas

Key New Features

System Configuration Complexity

Energy Reporting

Interoperability

Stakeholder Collaboration

Lessons Learned from early Connected Lighting Market?

- Who does what? Horizontal vs. vertical technology developer ecosystem?

- New standards needed?

- How will the data flow? Is getting data to the cloud good enough?

- Where is the business value? How is is equitably shared?

- What are the deployment risks? How are they equitably shared?

- Ownership and management of (new) networks?

- Many key new features, potential value propositions, but…
  - Killer application(s)
  - Imagination gap
  - Difficult to qualify, or (ideally) quantify them for ROI analysis

- Risk aversion: who wants to be first?

The pre-deployment spectrum

Vetting	Characterization	Demonstration	Pilot

Capability ← → Feasibility

Highly controlled environment ← → Real-world (uncontrolled) environment

Faster cycle time ($) ← → Slower cycle time ($$$$)

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DOE Resources: PNNL Lab Homes

http://labhomes.pnnl.gov/

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DOE Resources: LBNL Flexlab™

https://flexlab.lbl.gov/

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- Focused on technology and capability assessment
  - Energy reporting
  - Interoperability
  - Configuration complexity?
  - Key new featuresg
  - Cybersecurity?
- Not intended to address intersystem (e.g. lighting and HVAC) effects
- Not intended to address real-world impact

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Danish Outdoor Lighting Lab (DOLL)

DOLL is a national GreenLab supported by The Danish Energy Agency, the Capital Region and the Zealand Region.

DOLL offers a scientific state-of-the-art photometric Quality Lab & Virtual Lab at DTU, Technical University of Denmark, Campus Risø. Living Lab in Hersted, Albertslund features 10 kilometers of road, bike lanes and urban spaces demonstrating intelligent LED lighting solutions, new masts and sensor-based control systems. Every light point has an IP-address and is monitored by cameras, connected globally in a world class Internet-of-Everything installation.

In the Visitor Center and control room, the data are analyzed, compared and visualized for the benefit of decision-makers in municipalities, construction and advisory sectors. Living Lab is enabling SMEs and LEs to demonstrate new products and encouraging public and private actors to enter innovation partnerships.

Hersted Industrial Park was built in the 1960-70's and offers more than 2.000.000 m2. In 2020 the new Ring Rail Station will complete the excellent logistic infrastructure. DOLL is leading the Hersted transition to a Photonics Science Park.

DOLL Intelligent City Control Room:

CISCO   CITELUM   GlobalConnect

- Processing data from outdoor environments, cameras and sensors.
- Visualizing and comparison available on screen walls.
- Enabling global peer-to-peer video communication and remote presence.

DOLL Sustainable Lighting Park:

SCOTIA   THORN   ENERGY   PRIESS

- CO_2-neutral lighting demonstrating integrated solar and wind energy systems.
- Flexible stand-alone solutions including advanced control systems.

Other Contributors:

DONG energy   DANintra   seas-nve   seneco   TVILIGHT

GREEN LABS DK   REGION SJÆLLAND – vi er til for dig   DTU Fotonik Department of Photonics Engineering   Vækstforum Hovedstaden   Albertslund Kommune   GATE 21

DOLL: located in Albertslund, Denmark
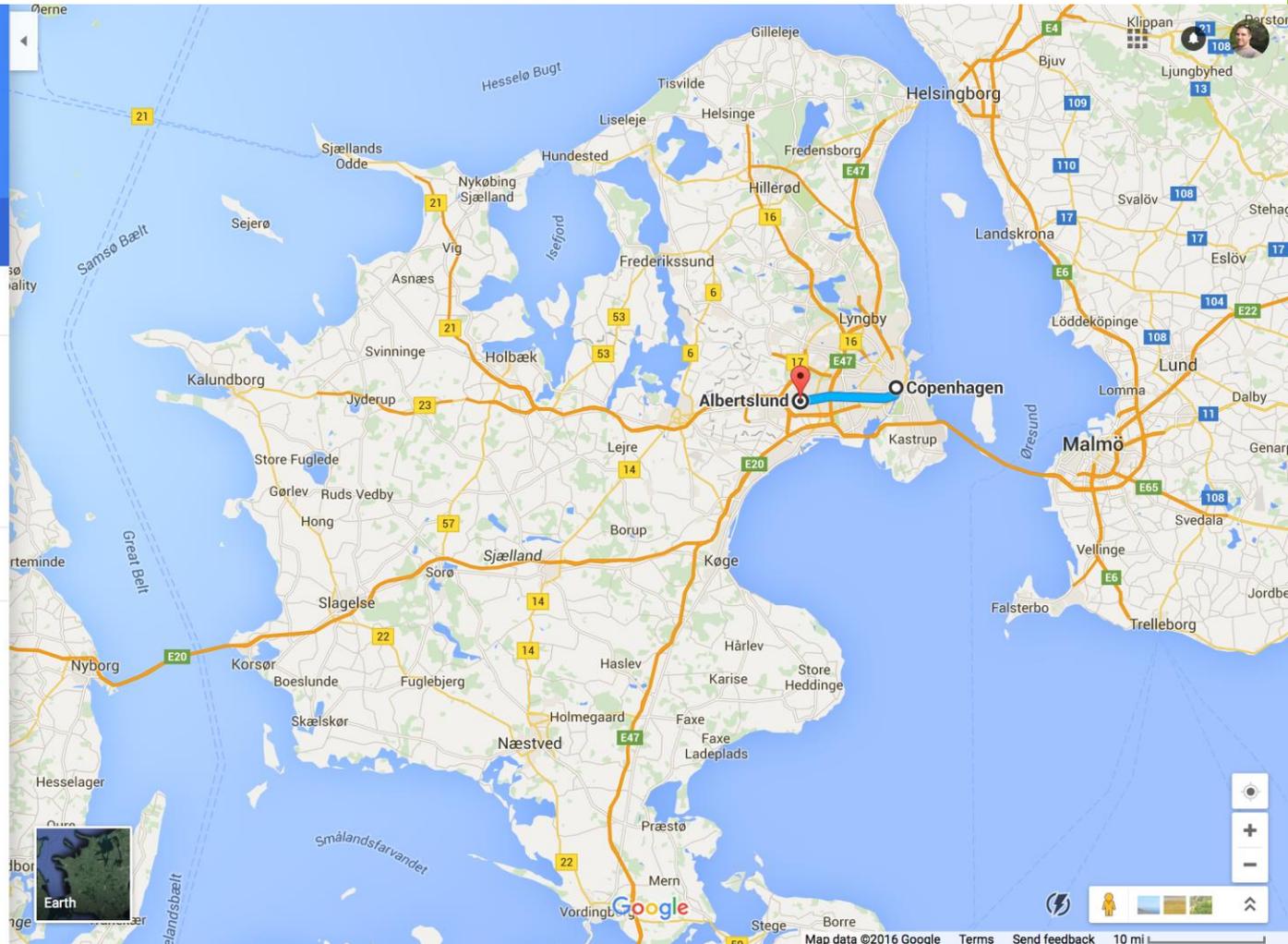
DOLL: re-imagination of Hersted Industrial Park, in north Albertslund

Hersted Industrial Park: built in the 1960-70's for industries no longer in Denmark

DOLL National GreenLab

Europe's largest Showroom & Test Field for
Intelligent Lighting & Smart Urban Services

9.3 → 17 km roads
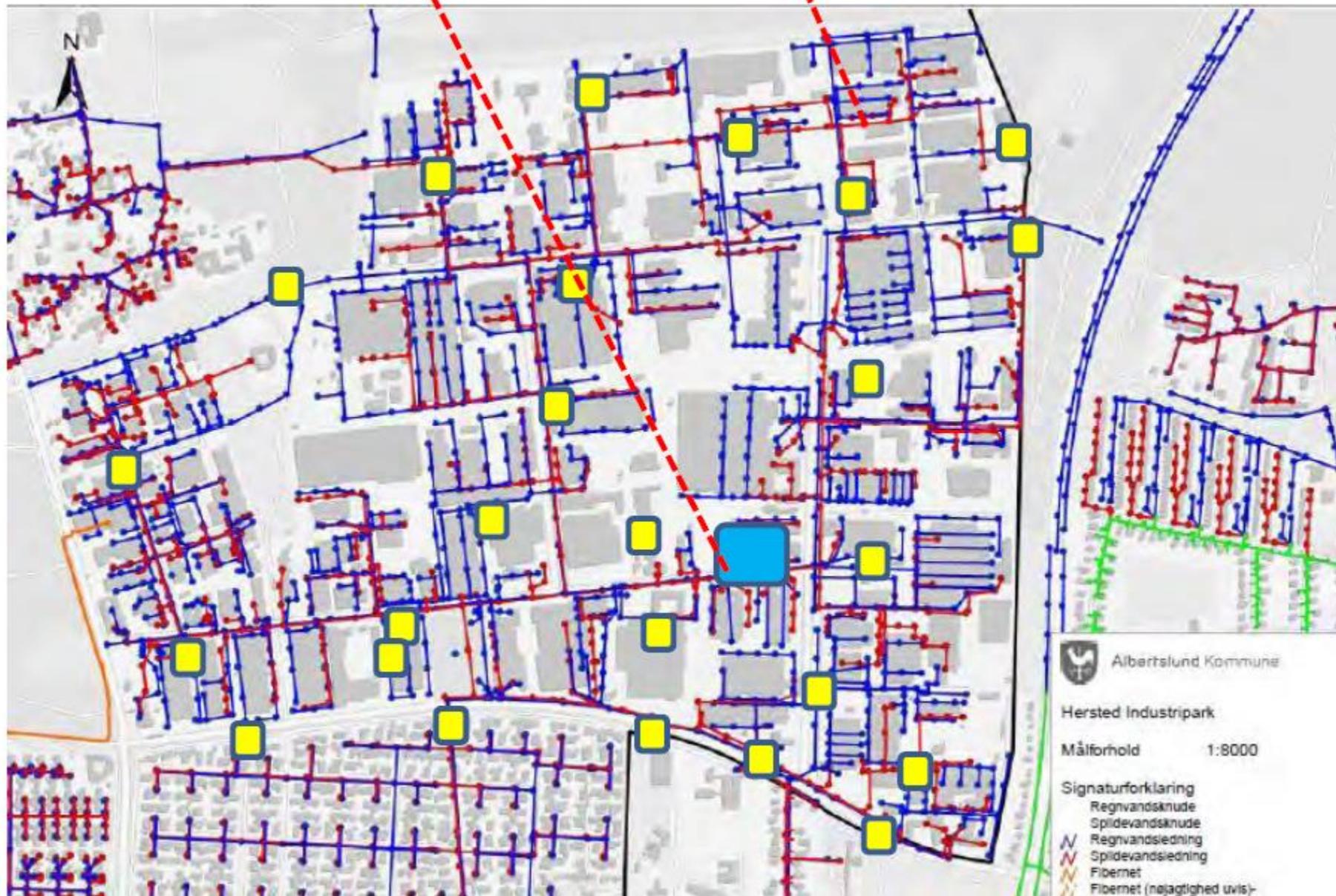300 LED luminaires
9 management systems
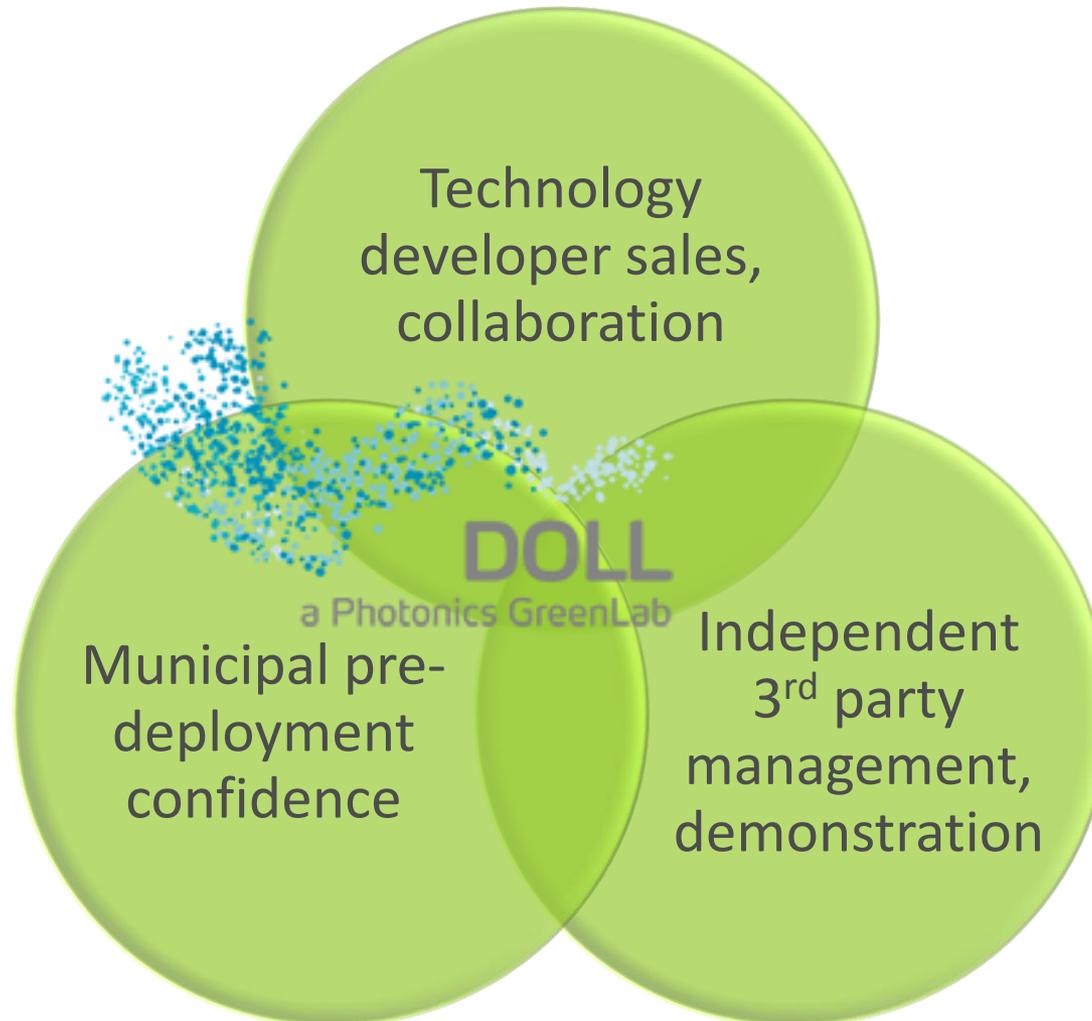
25 companies, 3-year contracts

DOLL Visitor Center and Control Room

Wifi access points (35, will be upgraded)

Albertslund Kommune

Hersted Industripark

Målforhold   1:8000

Signaturforklaring
Regnvandsknude
Spildevandsknude
Regnvandsledning
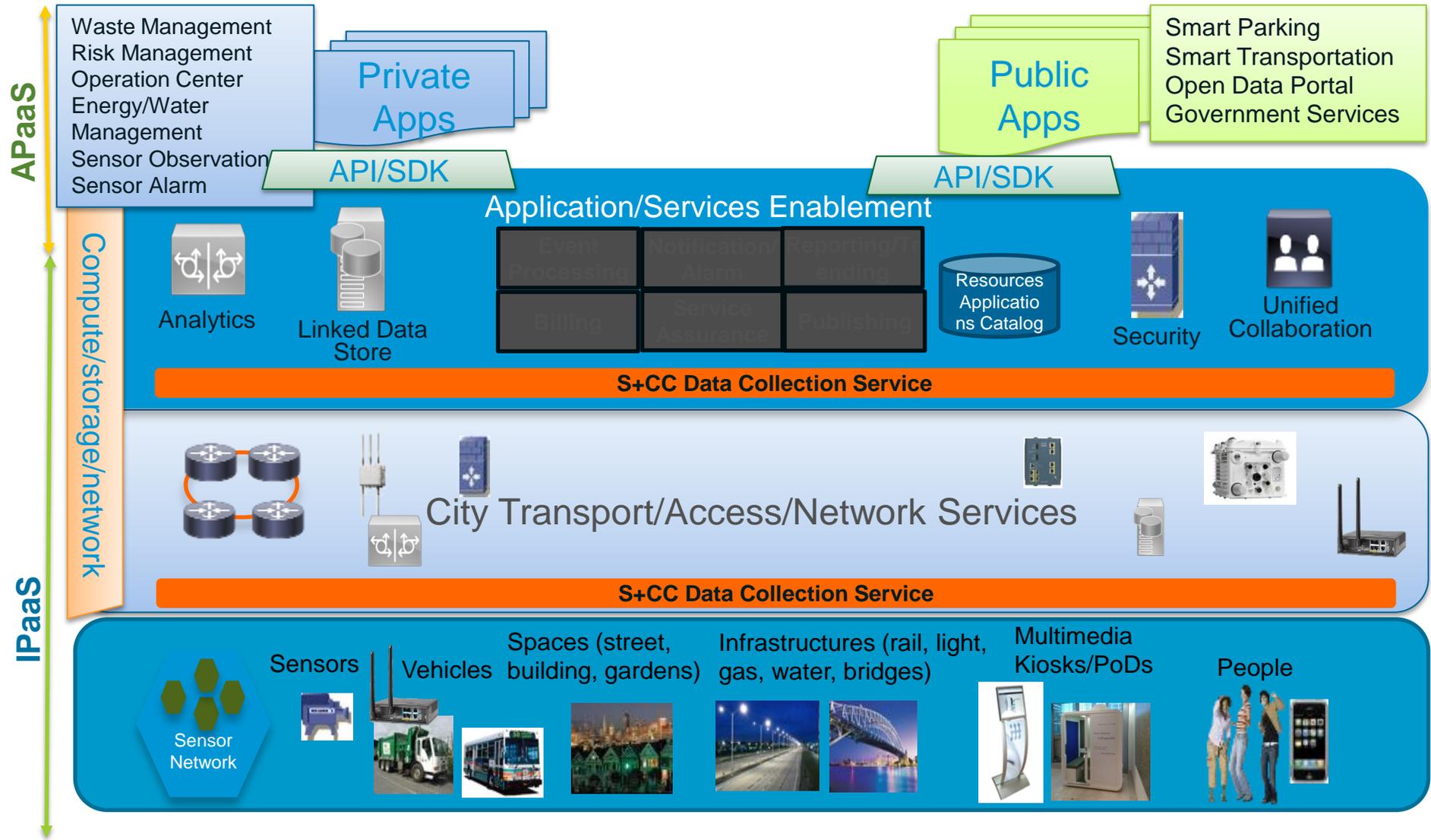Spildevandsledning
Fibernet
Fibernet (nøjagtighed uvis)

The sensors will be connected through the city wifi Access points and separated into clusters, enabling parallel tests.

DOLL: cooperative framework
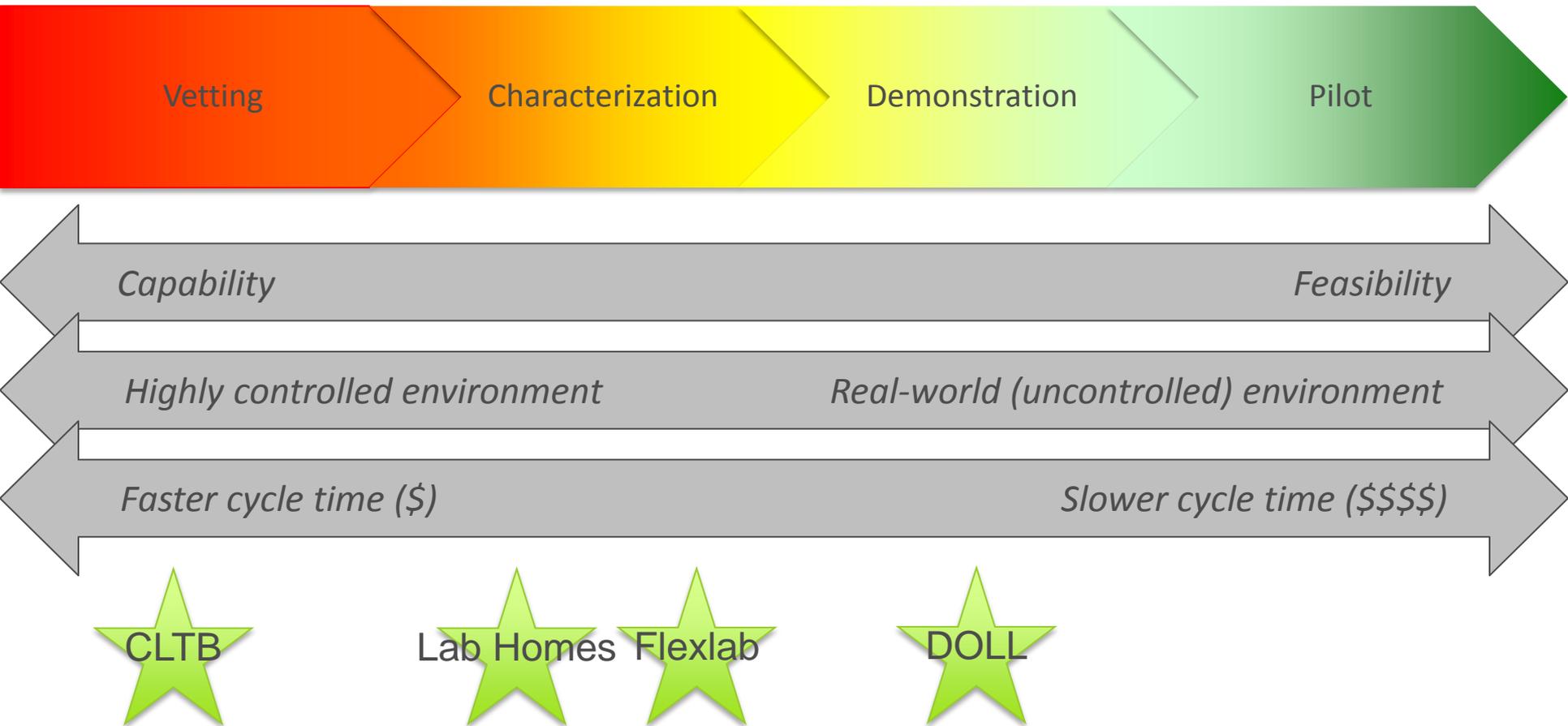

Technology developer sales, collaboration

Municipal pre-deployment confidence

Independent 3rd party management, demonstration

DOLL
a Photonics GreenLab

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DOLL dream: City Management Reference Architecture

The pre-deployment spectrum…

Questions

- What lighting applications could most benefit from a dedicated cooperative real-world test bed?

  Municipal/ Smart City Commercial office Parking lot, Garage Other?

  Healthcare Retail Hospitality

- Who could/would host a real-world test-bed?
  - Cooperative framework
  - Limit/manage vs. accentuate/celebrate visibility
- What role could DOE play?
  - Catalyst, framework development
  - Co-manager

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Discussion!

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