Some ICT Challenges
for
energy-efficient buildings and neighbourhoods

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Energy efficiency

- Efficient use of energy is an essential need
  - Also socially responsible, politically correct, future generations will thank us, it makes business sense, …

- ICT-based solutions for building and home energy management exist already

- How good are they? What can be done differently, and is there any strong reason to do that?

Energy efficiency in buildings and homes

Three approaches for building energy efficiency:
- Building design and technology
  - Materials, insulation, design and architecture, etc.
  - Retroffiting?
- Influencing/instilling behaviour change
  - Important lesson: need to understand how we use energy
- ICT solutions
  - Greener technologies
  - Smart energy management systems
    - Smart Homes
    - Smart Communities
    - Smart Cities
    - Smart Grid

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History of Building & Home ICT in EU

- Energy management was identified as a key driver application for home and building electronic systems since mid '80s

- EU has supported work historically in all FPs:
  - As early as 1988-1995 it supported several projects to develop the European Home Systems specification (currently part of EN standard series)
  - In 1996-2000 it supported several trial and demonstration projects specifically for building control (e.g. ETHOS 1996-1999)

- Significant amount of knowledge, expertise and technology is readily available
  - What is needed that is different from what we do, or know how to do, now?

Theme: Home as the last ICT frontier?
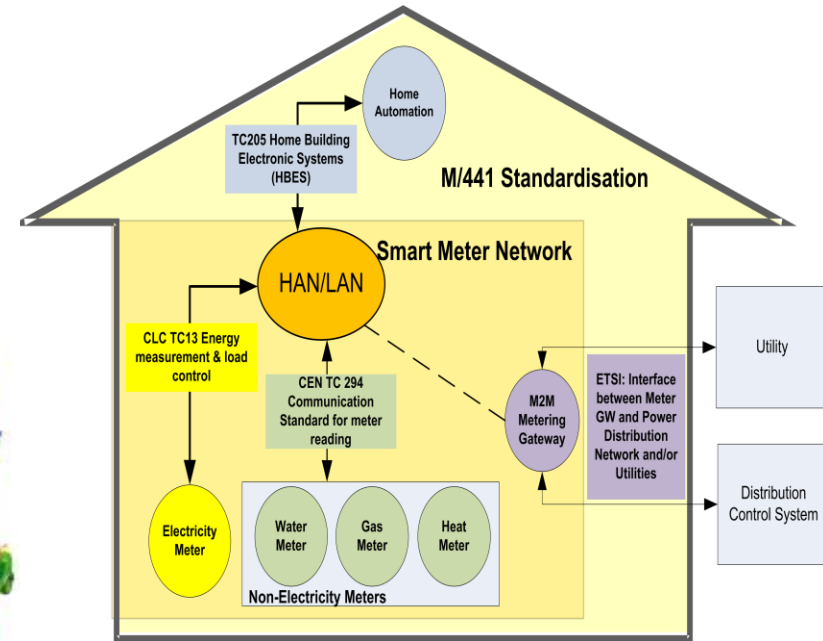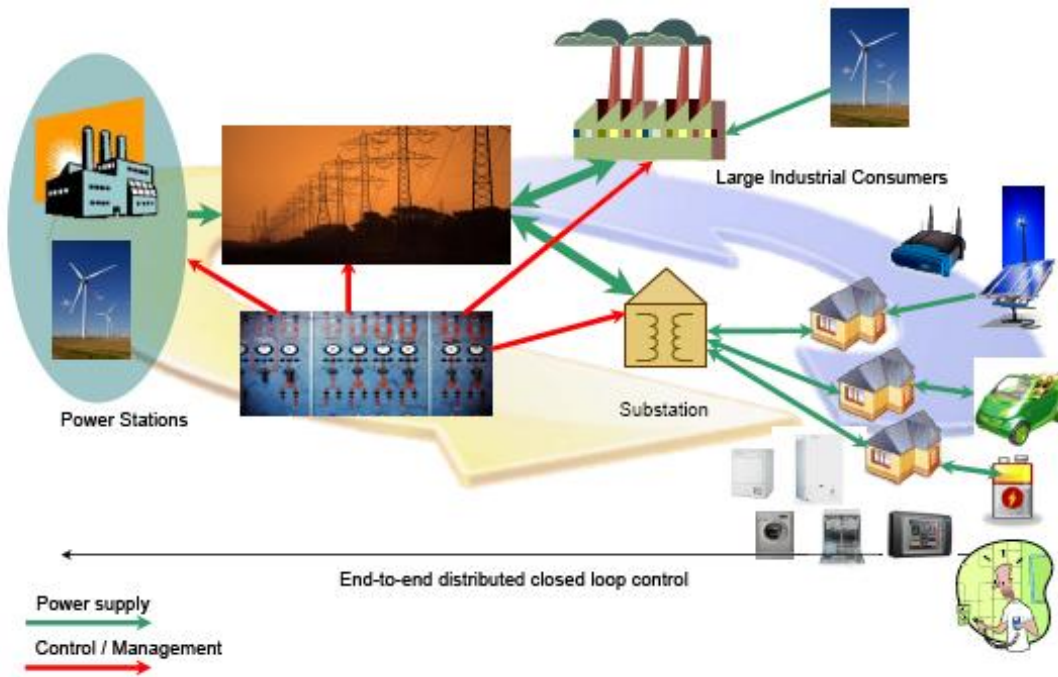
ICT challenges: Smart Homes

Smart Homes ➔ Home and Building Electronic Systems (old name) require:

- Efficient, reliable and secure communications & spectrum access
- Networking for machine-to-machine interactions
  - Information-centric networking
- Interoperability
  - Specifically for ICT Solutions for Buildings and Homes

So, what is the communications problem?

- Smart Energy and smart neighbourhoods - requirements are still being worked out !

- Communication networks still face great challenges:
  - Network management (e.g. scalability thereof)
  - New, more realistic, traffic models
  - QoS and congestion management

- Even with these challenges, internet networking currently supports quite complex distributed applications every day.
  - Again, need to identify what is *different* from what we know how to do today.

- Trials are very important – but trialling alone is not enough

Need Trials: 3e-Houses (EU FP7 project)
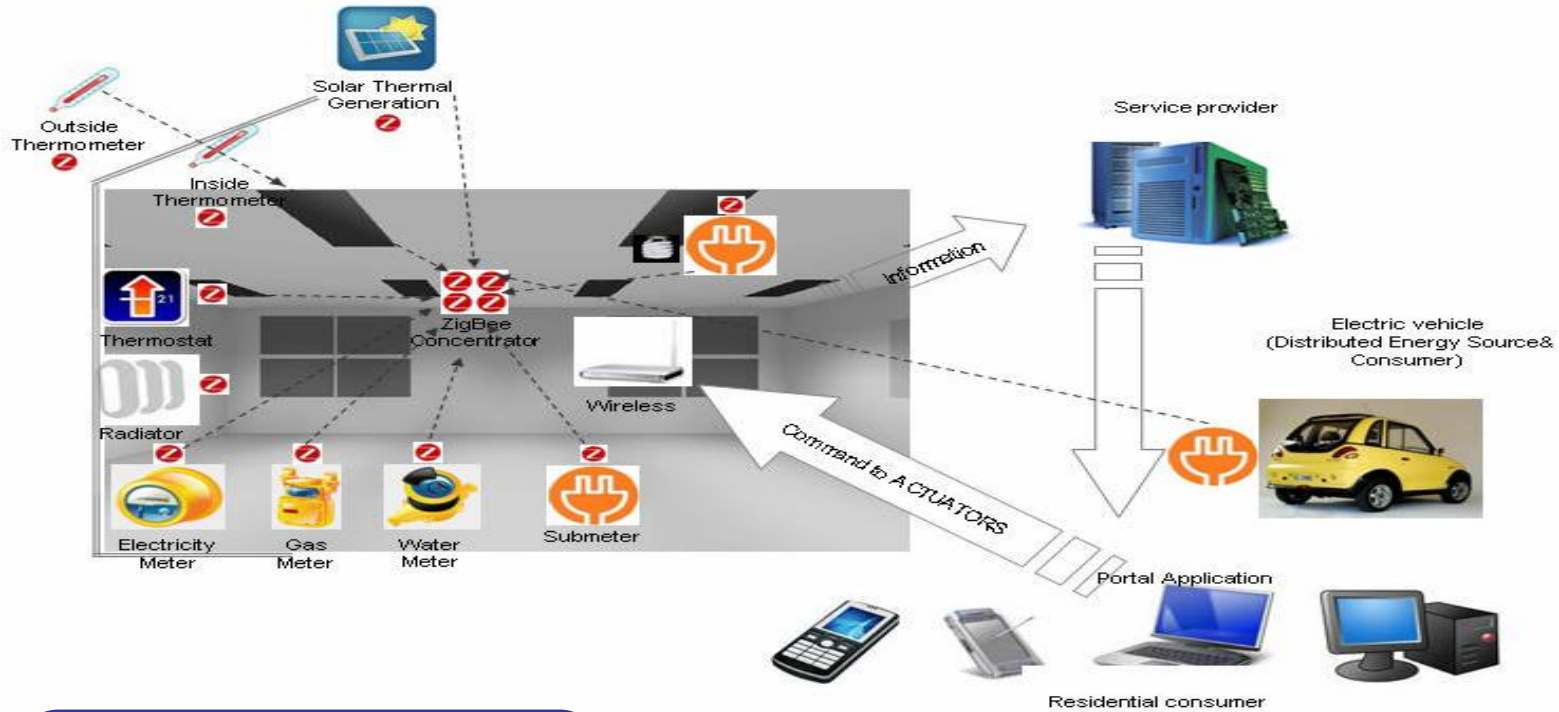
Energy Efficient e-Houses:

- Design & implementation of 4 pilots in social housing: Integration of ICT technologies into innovative control & monitoring systems, improve energy management

Interoperability as a problem

- Perception: it is a non-technical challenge
- Fundamentally it has not been an academic question
- But when technology is available – why does interoperability continues to be a problem?
  - Mostly a market problem; commonly expected to be solved within that context; very few successes (and none complete !)
- Interoperability problems arise due to :
  - Either implementation mistakes, lack of standards, knowledge gaps, do-not-care attitude!
  - Or "protectionism", first-to-market, uncertainty of benefits, no market pressure,…

Interoperability as an ICT challenge

Starting points:

- Functionality is king, not technology
- Interoperability is functional; technology is a pre-requisite – make it evolve to follow functionality!
- No single specification, standard or technology is going to win an "interoperability race" – at least not in the home!
- Implementation interop problems occurrence will most likely increase
- There is pressure on some market segments for interoperability (energy and telecare in particular)

TAHI Interoperability Ecosystem	
1.	Define an INTEROPERABILITY ECOSYSTEM
2.	Encourage participating in it THROUGH TESTING
3.	Standardise TESTING against REQUIREMENTS
4.	Demonstrate it actively

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Understanding ICT4Energy networking requirements

- What are the communication network requirements to support large-scale distributed control architectures for energy efficiency in homes and buildings and how do service levels in the two networks inter-relate?

- What are the trade-offs between communication solutions and distributed applications, and how can these be identified/quantified?

- Two choices:

  - Dedicated network for a small set of known distributed control applications (higher cost but more control of system performance),

  - Network shared by many applications: how to guarantee stability?

🔥 … and so CLEVERsim was developed

- CLEVERsim is a simulator platform used to evaluate the performance of Smart Energy systems end-to-end in real scale for different scenarios
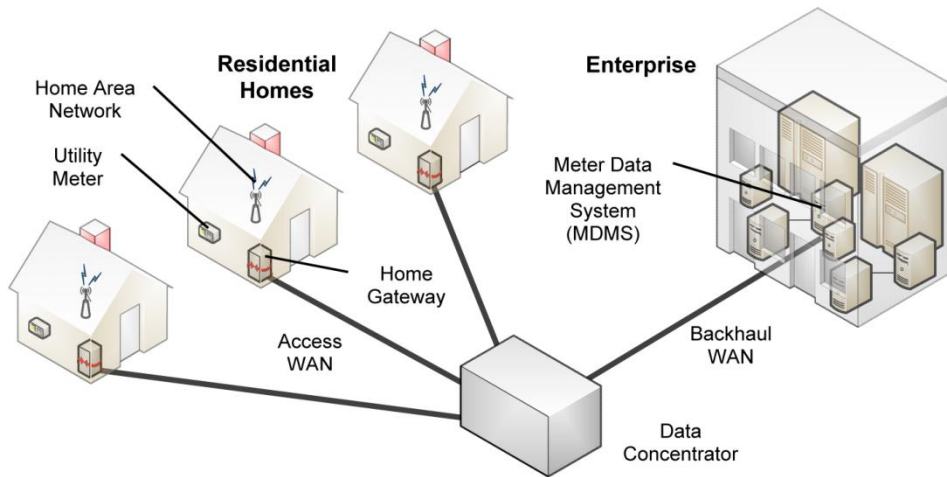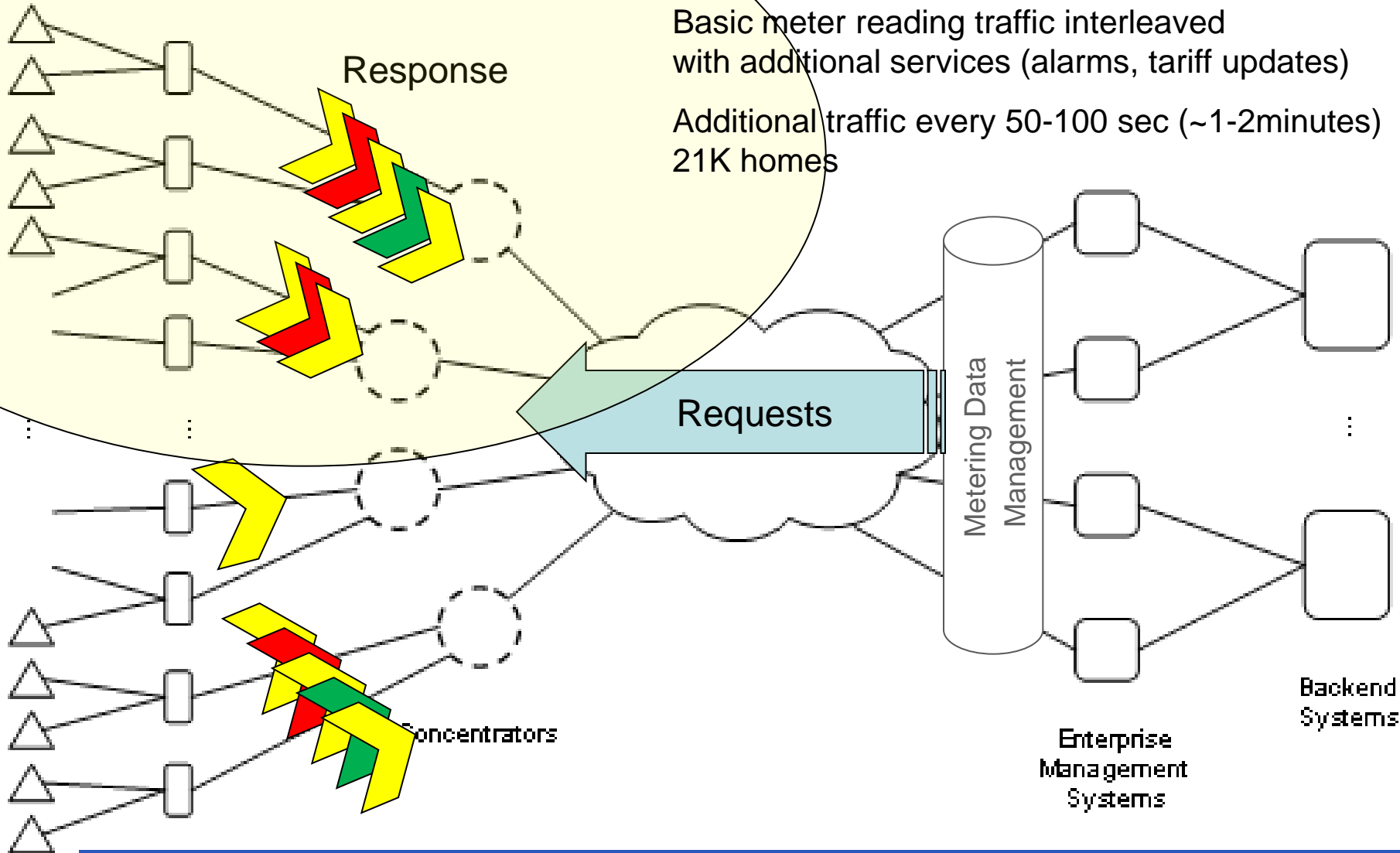

- Supports different communication solutions (PLC, broadband access, shared wireless access, mobile);
- Supports different device capabilities (from enterprise gateways to meters)
- Supports different applications (including demand control / energy management algorithms) running concurrently

CLEVERsim Exp 2: Additional Functionality

Basic meter reading traffic interleaved
with additional services (alarms, tariff updates)

Additional traffic every 50-100 sec (~1-2minutes)
21K homes

Response

Requests

Metering Data
Management

Concentrators

Enterprise
Management
Systems

Backend
Systems

Smart
Meters

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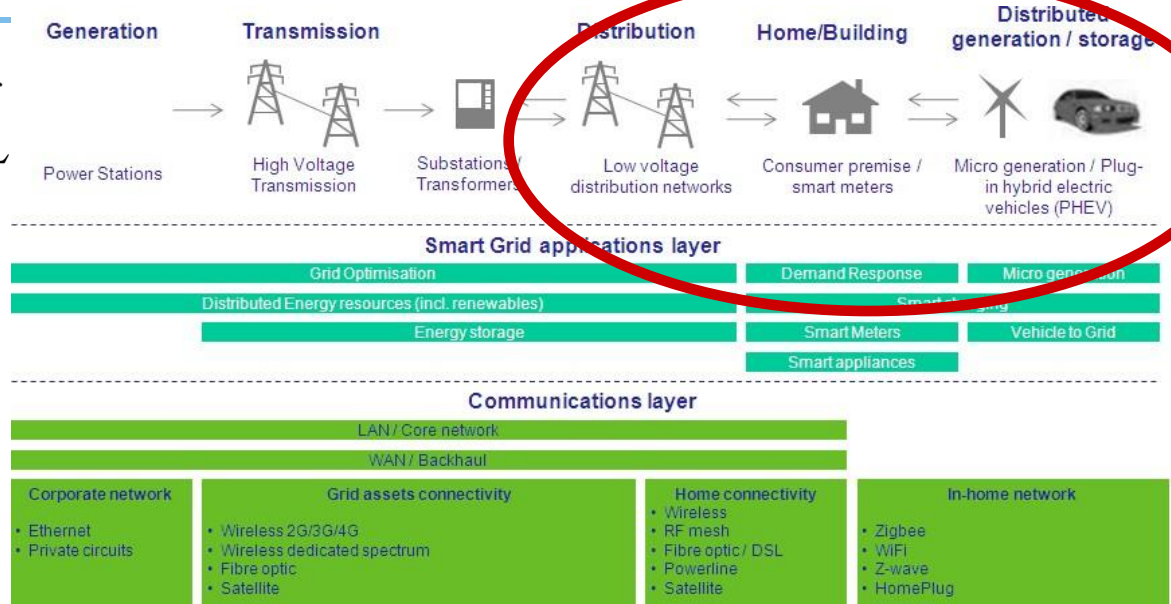
ICT for Energy

- EPSRC SUPERGEN HubNet Project (EP/I013636/1)
  EPSRC UK leadership project for Energy Networks (Smart Grid) Research

- **Design of smart grids**, in particular **the application of communication technologies** to the operation of **electricity networks** and the harnessing of **demand management for control and optimisation of power system**

- £4.7M over 5 years (2011-2016); 19 man-year RA, 16 PhDs (across 8 partners)

Summary

- We need to understand the interplay between building energy applications and networking

- Interoperability is a key (probably the most important) ICT challenge in the home and building electronic system domain

- Just trialling these systems is NOT good enough; historically evolution in this space has proven a bit slow.

- It may be necessary to tie down one side of the system (comms against applications or applications against comms)?

- Need to develop tools and methodologies to investigate the performance of such systems in an integrated way in real scale.

Toshiba "Smart City" vision & experience

Joe McGeehan

Outline

- **Vision**

- **Technology areas/expertise**

- **Experience**

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Leading Innovation >>>

Toshiba Smart Community Vision
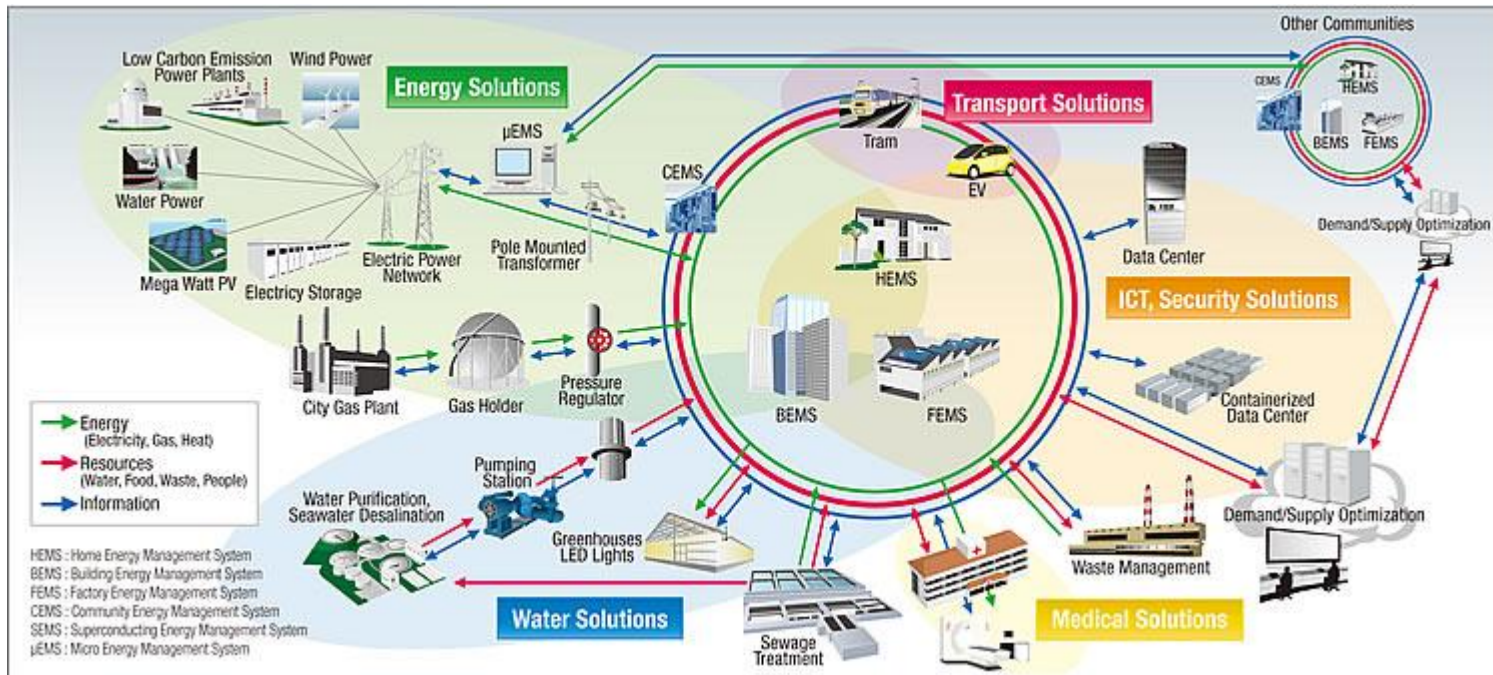
- .. Comprehensive integrated system solutions encompassing power supply and distribution, information and security systems, water systems, transportation systems and medical and hospital information systems….

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Toshiba's Smart Community

- **An Industrial Town has upgraded its basic infrastructure while contributing to the surrounding region to become the Perfect City.**

- **As a further development, we propose solutions that will make the Industrial Town more sustainable and eco-friendly 'Perfect Smart City'.**

Smart Community –Technology Areas

- **Energy**

- **Building-House**

- **Water**

- **Environment**

- **Transportation**

- **Health**

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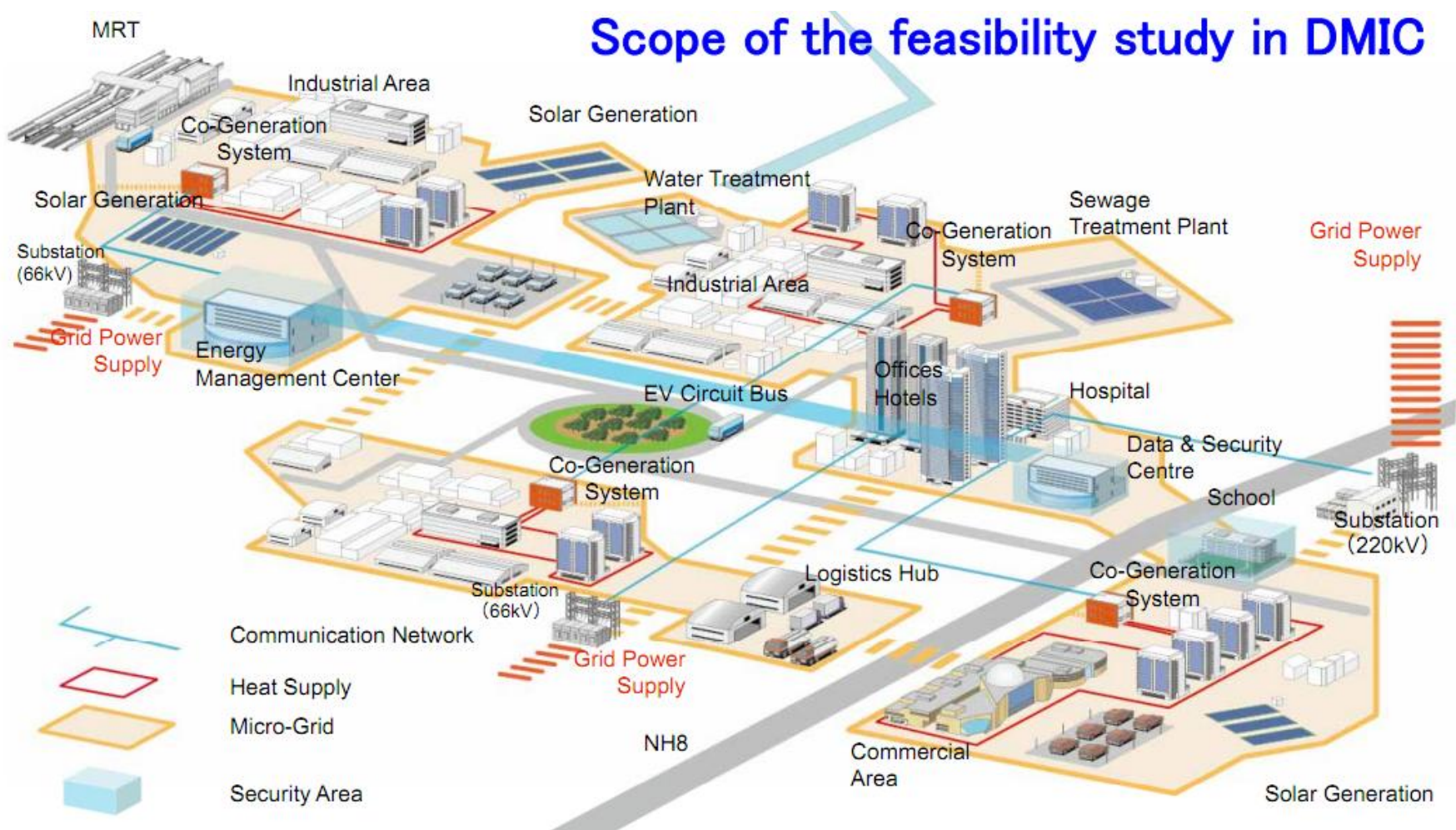
Smart Community Development in Tianji

Smart Community is a solution of solutions.

Toshiba will cooperate with TEDA to provide various solutions toward possible Smart Community realization at the area.

Smart Community Development in India

Scope of the feasibility study in DMIC

Toshiba …

Thank You for your Attention