Smart Cities – ICT for low carbon solution

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What will you be doing?

Work in the IT department of a company?
Work in a software company?
Will you work in a company developing IoT solutions?
Work on Blockchain solutions? Robotics?
Data security? --- Hacker!!!???
Develop Selfdriving – autonomous vehicles? Machine learning
Develop Selfdriving – autonomous businesses? Machine learning
Work in the city/municipality/local government? Make smart cities?
Will you do a masters degree?
Will you stay in Manado?
University locations across the kingdom
- centered in the capital region
Organization

DEPARTMENTS
- DTU Aqua
- DTU Bioengineering
- DTU Bioinformatics
- DTU Chemical Engineering
- DTU Chemistry
- DTU Civil Engineering
- DTU Compute
- DTU Electrical Engineering
- DTU Energy
- DTU Environment
- DTU Food
- DTU Fotonik
- DTU Management Engineering
- DTU Mechanical Engineering
- DTU Nanotech
- DTU Physics
- DTU Space
- DTU Vet
- DTU Wind Energy

EXECUTIVE BOARD

SUPPORT FUNCTIONS
- Bioneer Ltd.
- DFM Ltd.
- Dianova Ltd.
- Pre-Seed Innovation Ltd.
- Scion DTU Ltd.

OTHER UNIVERSITY ENTITIES
- Centre for Oil and Gas - DTU
- DTU Admission Course
- DTU Biosustain
- DTU Business
- DTU Cen
- DTU Danchip
- DTU Diplom
- DTU Library
- DTU Nutech
Global Internet Device Forecast

INTERNET OF THINGS:
8 Billion Devices in Use by 2014

TABLETS:
6 Billion Devices in Use by 2014

SMARTPHONES:
5 Billion Devices in Use by 2014

INTERNET OF THINGS
40 Billion Devices in Use by 2020

There will be as many as
40 TO 80 BILLION
connected objects by 2020.

There will be 10 connected objects for every man, woman, and child on the PLANET.
There will be as many as 40 to 80 billion connected objects by 2020.

There will be 10 connected objects for every man, woman, and child on the PLANET.

Through the power of smart devices, people will not only consume data, but contribute observed data to the IoT through their phones and tablets as **human sensors**.

http://visual.ly/future-internet-things
Five global mega trends shaping the future

1. **Rapid urbanisation**
2. **Demographic and social change**
3. **Climate change and resource scarcity**
4. **Shift in global economic power**
5. **Technological breakthroughs**

- **2030**: We predict that seven of the world’s biggest 12 economies in 2030 will come from emerging markets, the ‘E7’.

- **35% more**: Expected increase in global food demand by 2030.

- **76**: Years taken for telephone to reach half of US households; the smartphone in under ten.

- **2015**: In 2015 the size of the middle class in Asia Pacific is expected to overtake Europe and North America combined.

- **1.5 million**: People are added to the global urban population every week.

- **85 richest people own as much wealth today as the poorest 3.5 billion**.

- **50%**: Of global GDP is generated by the 300 largest metropolitan areas.

- **50%**: Around half of US jobs are at risk of being computerised over the next two decades.

**Source**: PwC via @mixkequindazzi
Definition of a smart city

“The Smart Energy City is highly energy and resource efficient, and is increasingly powered by renewable energy sources; it relies on integrated and resilient resource systems, as well as insight-driven and innovative approaches to strategic planning. The application of information, and communication technology are commonly a means to meet these objectives. The Smart Energy City, as a core to the concept of the Smart City, provides its users with a liveable, affordable, climate-friendly and engaging environment that supports the needs and interests of its users and is based on a sustainable economy.”
What does it mean that we try to connect all aspects of Smart City?
Danish Power production - Import/Export

- Jutland - Sweden: Exports 728 MW
- Jutland - Norway: Exports 953 MW
- Zealand - Sweden: Exports 1.048 MW
- Jutland - Germany: Imports 284 MW
- Zealand - Germany: Imports 601 MW
- Bornholm - Sweden: Exports 2 MW

Power right now
Measured in MW:
- Central power stations: 1,575
- Local CHP plants: 401
- Wind turbines: 4,088
- Solar cells: 113
- Net exchange export: 1,845
- Electricity consumption: 4,331
- CO2 emissions: 179 g/kWh

LEGEND

Last updated: 15. Februar 2014 12:41
Power flow systems in Manado

Main stations: 19 interconnected locations
Transmission line: 1.447,68 kms

Power supply capacity: 409.7 MW
Peak load: 358.3 MW
Electricity production (green) and electricity consumption (grey) over three weeks in Denmark
Change towards smart networks or decentral solutions

- From centralised to decentralised production
Centre for IT Intelligent Energy Systems - CITIES

Scientific Objective

To establish methodologies and ICT solutions for design and operation of integrated electrical, thermal, fuel pathways at all scales.
Key Outcomes

- Modular **forecasting and control models/tools** for a variety of energy system components, including their interactions
- **Market structures** that support energy systems integration
- Operational **methods and scenarios** for energy systems integration and management, scenarios towards a fossil free future (Power and heating sectors fossil fuel free in year 2035)
- **2014-2019, 10 €Mio (Innovationfond Denmark 6 €Mio, 38 partners)**
- 18 Demo Projects finished, ongoing and planned.
- 80 published papers
- Setting up an Innovation Centre
3Vs of Big Data

Data Velocity
- Real Time
- Interval
- Sparse
- Batch

Data Variety
- SMS
- XML
- Video
- Text
- CSV
- Photos

Data Volume
- RDBMS
- Unstructured
- GB
- MB
- TB
- PB
- ZB
- YB

Source: http://blog.sqlauthority.com
Open Data for Smart Cities: what are the benefits?

- Transparency
- Accountability
- Efficiency
- Public Service Delivery
- Engagement
- Data Improvement
- Societal value
- Economic value
Overview of CITIES Data Platform

Data security assurance
- Data anonymization (e.g., for sensitive data)
- Secured data management (VM-based environment/private ownCloud)

- Quality assurance
  - Data cleansing quality checking
- Data fusion
  - Open data platform
  - Linked data
Components of CITIESData Platform

- Support for
  - Diverse data sources
  - Multiple processing systems
  - Different processing modules/algorithms

- Big data technologies, e.g., Spark/Hadoop/Hive
- Real-time and batch jobs
The Danish DataHub solution

From decentralized market management to centralized market management

Keywords: Digitization, unbundling, efficiency and transparency
Change towards smart networks or decentral solutions

- From centralised to decentralised production
Upcoming European protection of personal data

Regulate the use and protection of personal data.

Major changes:
- Elaborates the right of the registered
- Right to be forgotten
- Data portability: Take ALL your data from one social media to another.
- Stricter documentation requirements: Must be able to document the effort in securing data
- Greater fines: % of global sales

Intended to harmonize
- But approximately 50 areas where each country can make own legislation
- Still going to be complicated
Consequences for Science

• We as researchers need to become more aware of
  – Sensitivity of personal data
  – Data/IT security
  – Data responsibility when handed the data

• This conflicts with
  – The idea of Open data
  – Makes peer review harder as data cannot be shared
IoT sensors for monitoring air quality
SciCloud Service - *Cloud-based data and analytics service*

Cloud-based data management

Open data portal

In-place data analytics service
CTT: An IoT-based carbon track and trace system

A holistic IoT solution for air quality monitoring:
- Open source software and hardware platform
- Scalable IoT data management solution
- Real-time dashboard
Analytics and visualization

Model the correlation between traffic jam factor and CO2
Summary

You are ahead of the rest of the society with ideas which potentially can improve quality of life for its citizens.

You should remember to keep the big picture in mind in your systems development and remember where you are “right now” in this process.

Smart cities need smart people and smart stakeholders to work together. It will not happen by itself.
Thank you
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www.smart-cities-centre.org