

By State of Green, November 01, 2018

**We have gathered 10 examples of smart city solutions to illustrate how taking a smart approach to urban development creates liveable, sustainable and prosperous societies globally.**

### **1: Nine utilities – one smart grid platform**

As the amount of available data increases and can be generated in real-time, it can be used for much more than billing costumers. Therefore, nine independent electricity, heat and water companies in Jutland, Denmark, joined forces to create a common data platform that allows technicians to use big data to optimise operations and maintenance of the infrastructure. The new data platform makes it possible to operate the networks for electricity, heating and water with the least possible loss. It also improves the maintenance of the infrastructure. Another unique feature of the solution is that data is presented for all types of consumption in the same platform, even though water, heating and electricity are supplied by different utilities. This service increases customer awareness about their consumption patterns and provides insights on how to improve them.

– *MV Group (Thy-Mors Energi, Struer Forsyningen, RAH, MES Brande, Grindsted el, vand og varmforsyning, Ringkøbing Fjernvarme, Ringkøbing-Skjern Forsyning, Ikast Værkerne, Jysk Energi), Kamstrup*



### **2: Using sensors to ensure cost-efficient waste handling**

Together with a number of waste solution sensors and system suppliers, the Municipality of Albertslund is testing different waste solutions in a living environment. The outcome will be business cases that improve knowledge on how to optimise the collection and route planning of waste. Different sensors are installed in the same living environment in order to compare their functionality and collect data. This involves the development of new sensors and technical testing of different communication methods (Lora WAN, NB-IoT, SigFox) between sensors and the underlying systems. The sensors are installed in a number of large housing associations, institutions, public areas, industries and office environments, they cover various waste fractions and include public waste bins, mini containers, semi-and buried containers and industrial pick-up containers. The expected results are closer relations between citizens and carriers, as well as cost-efficient waste handling with better services and fewer complications.

– *TDC, SEAS, Cisco, Nordsense, Joca, Wastecontrol, Sweco, Veksoe, Smart Bin, Gate21, Albertslund Municipality,*

*DOLL Living Lab**Image: Rasmus Degnbol***3: Data driven traffic management to improve air quality**

Health problems related to bad air quality has become one of the biggest global expenses. Research shows that 80 percent of the population worldwide is exposed to pollution levels higher than recommended, where pollution from traffic is a major contributor. Today, traffic signals in Copenhagen are set to reduce travel time for the citizens, but a new project is focusing on guiding the regulation of signals according to what causes least air pollution. The purpose of the experiment is to generate new knowledge about data-driven traffic management in relation to air quality. In the future, this could lead to ways of improving air quality in cities through changes in traffic management. During the testing period, two similar intersections in Copenhagen will be monitored, gathering information about air quality and traffic counting. The data is combined with external environmental data traffic speeds to create deeper insights about the connection between traffic regulation and air pollution, and understand the health benefits that can be derived from environmentally focused traffic management.

– *Leapcraft, Copenhagen Solutions Lab, Technical University of Denmark, Citelum, OrganiCity*

**4: Combining multiple data sources in automatic leakage management**

In the capital region of Denmark, they listen carefully to their water distribution networks. The country's two largest water suppliers, HOFOR and NovafoS, are transforming parts of their water distribution networks around Copenhagen with state-of-the-art technology. Here, noise loggers now listen for the sound of leaks. Smart water meters measure end user consumption. Intelligent valves and pumps enable active pressure

management, which reduce the risk of bursts. The collected data combined with SCADA and GIS in real-time hydraulic modelling and processed in online management information systems to facilitate automatic leakage management and online monitoring of KPIs. This enables leakage teams to target the weakest pipeline segments with the goal of reducing Non-Revenue water levels to 4-6 percent. The project is called LEAKman and consists of nine Danish partners representing technology providers, consultants, water utilities and the Technical University of Denmark, who have joined forces to demonstrate Danish solutions and pave the way for new technology. The ambition is to make water utilities more smart, efficient and sustainable – in Denmark as well as worldwide.

– NIRAS, GRundofs, Schneider Electric, AVK, Kamstrup, Leif Koch, Technical University of Denmark, HOFOR, Novafos



### **5: Full scale energy savings in Danish municipality**

In the EU, buildings account for 40 percent of total greenhouse gas emissions. Denmark is already reducing greenhouse gas emissions in the utilities sector, and therefore energy efficiency in buildings is central to achieving further reductions. Since 2017 and for the next four years, Middelfart Municipality, in close cooperation with Schneider electric, has been using analytical software Building Analytics at the municipality's 80 properties. The software platform analyses the large data volume generated by the buildings' management systems and created action reports within energy, indoor climate and maintenance in real-time. The action report encompass specific suggestions on how to resolve an inappropriate operating situation. This enables the operating staff respond quickly and take decisions anchored in fact-based analysis. The expectation is an annual energy saving of 5 percent in addition to the 21 percent the municipality has already saved through renovations compared to 2008 levels. Thus, the Municipality of Middelfart achieves a total savings of at least 26 percent of energy consumption in buildings.



– Middelfart Municipality, Schneider Electric



### 6: The world's second-tallest skyscraper is packed with smart technology

with its 632 metres, the Shanghai Tower is the world's second-tallest building. More importantly, it is one of the world's most sustainable buildings. Shanghai tower has achieved the leadership in Energy and Environmental Design's platinum certificate and China's Three Star Green Building award. Located in one of the world's fastest growing cities, it is designed to reduce energy consumption and air pollution. To transform these ambitions into reality, several Danfoss solutions have been installed. 6,700 Danfoss valves ensure a stable water flow all around, so the temperature needed on the top floor can be obtained, regardless of the temperature required on lower floors. More than 50 percent of Shanghai Tower's total energy use goes to heating, ventilation and air conditioning. 20 percent of this has been cut by using the control valves. Additionally, 660 Danfoss variable-speed drives ensure that pumps, compressor, and fans never run faster than required to deliver the correct temperatures. This technology contributed to reducing energy consumption by 20-40 percent

– Danfoss



### 7: Digitalisation of district heating in Aarhus

In 2017, AffaldVarme Aarhus (AVA), the heating utility of Denmark's second largest city, completed the implementation of their new smart metering solution from Kamstrup, which included 56,000 remotely hourly read heat meters. This was the first step in their efforts to optimise their district heating system, which has to supply more and more buildings and support a carbon-neutral and energy-efficient future. The increased amount of meter data provided transparency in the distribution network and enabled a new level of

troubleshooting and improvement options. As a result, AVA has seen significant benefits and savings in terms of the improved operations of their meter park. In addition, the administration involved in collecting and handling meter data has been reduced, and expenses for rectifying missing or incorrect readings have been virtually eliminated. AVA is currently working on further digitalising the district heating system in Aarhus by using innovative analytics to improve customer relations, increase operational optimisation, and enable better targeting of their investments in the district heating network.

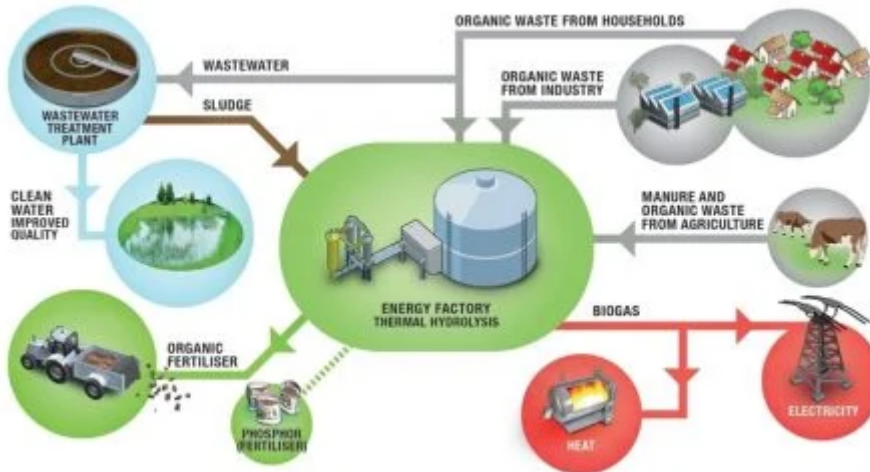
– Kamstrup A/S, AffaldVarme Aarhus



## 8: Wastewater treatment, energy production and resource recovery all-in-one

The wastewater treatment plant, Billund BioRefinery, is based on circular economy principles. Here, the resources currently stored in wastewater and waste are handled in such a way that at least 98 percent are recycled to create green electricity, heat and organic fertilizers. By combining the latest technologies in water purification, energy optimisation and biogas production in a full-scale project, Billund BioRefinery has made it possible to produce three times more energy than the refinery itself consumes, while simultaneously cleaning/recycling wastewater and waste in a more efficient manner. The immediate savings on electricity consumption are approximately 20 percent compared to the electricity used for water purification prior to the reconstruction. Energy production has doubled, and the plant's processing capacity for receiving wastewater and food waste has increased by approximately 25 percent with minimal construction investments. The project has a total payback time of just under 10 years. Billund BioRefinery creates a completely new outlook on wastewater and waste as valuable resources.

– Billund Vand, Municipality of Billund, Krüger, Aalborg University, Aarhus University



## 9: Outdoor lighting and smart city living lab

DOLL (Danish Outdoor Lighting Lab) is Europe's largest test field, showroom and innovation hub within

intelligent lighting. It showcases smart city solutions across mobility and parking, IoT communications systems, environmental monitoring, waste management and much more. Addressing the need of the emerging smart and connected cities, DOLL set out to create an innovative playground and provide transparency in new complex markets, combining research, education and innovation in public-private partnerships. Buyers and more than 45 manufacturers of intelligent street lighting and other smart city solutions meet in neutral settings that address the entire supply chain: municipalities, suppliers, advisors/architects and utility companies. Buyers can experience state-of-the-art solutions in a natural environment. This gives decision makers better insights and knowledge to make investments in new lighting and smart city solutions. The solutions are displayed and data is collected and analysed in DOLL visitor centre, located in the heart of the living lab.

– *Albertslund Municipality, Technical University of Denmark, Gate 21 and 50+ private partners*



*Image: Ramus Degnbol*

### **10: LOOP CITY – cooperation across administrative boundaries**

Copenhagen's surrounding suburbs are facing challenges of increased congestion, lack of growth and liveability, to increase green collective transport, it has been decided to construct a light rail system, connecting 10 municipalities around Copenhagen. The amount of private investments in LOOP CITY will be around EUR 4.5 billion. Furthermore, 36,500 new jobs are created and more than 32,000 citizens will move to LOOP CITY in the coming years. In order to facilitate this development, there was a need for cooperation across administrative boundaries. Therefore, the organisation LOOP CITY was formed at the end of 2014 by the ten mayors and the Chairman of the Capital Region in cooperation with the Danish Business Authority. The result is a diverse range of projects to realise the vision. Examples include building mobility networks in cooperation with private companies, developing a large data hub with specific focus on how real-time data solutions can help solve traffic congestions and create mobility changes in people's behaviour, and testing of autonomous minibuses for first and last mile along the coming light rail – all projects supporting intelligent urban development and improved liveability.

– *10 municipalities, The Capital Region of Denmark, The Danish Business Authority, Gate21, Copenhagen Capacity,*

*Rambøll, COWI, Ørsted, DDTU, RUC, TI, IBM, Nobina TEchnology*



*Image: BIG&Glessner*