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Best Practice: Intelligent Streetlights

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CITY: OSLO **POLICY AREA: CLIMATE CHANGE; TECHNOLOGY**

BEST PRACTICE

Oslo has reduced energy consumption by 70% and CO_2 emissions by 1,440 tons per year since 2004 by introducing an innovative and energy-efficient **intelligent street lighting system**. The intelligent streetlight system remotely monitors and controls the lights, dimming them based on traffic, weather and available light. It also analyzes light behavior and identifies light failures.

ISSUE

Lighting represents 15-20% of the Norwegian annual electricity demand of approximately 125 Terra Watt Hours (TWh). Of the 15-20%, 3% of the electricity is routed to Oslo's street lighting system. By implementing the new intelligent street lighting system, the city can reduce the level of electricity used when needs are low, thereby saving energy and cutting pollution.

Oslo also implemented the system as a part of its commitment as a partner in the European Commission's Energy Saving Outdoor Lighting (ESOLi) program. The aim of ESOLi is to accelerate the use of the energy saving outdoor lighting technologies across Europe in order to reduce CO_2 emissions. ESOLi has established a transnational network of key actors and is focused on improving the market conditions for energy service companies.

GOALS AND OBJECTIVES

The city's goal to reduce energy consumption by 70% and CO_2 emissions by 1,440 tons per year has been met. The city set out to replace old fixtures containing polychlorinated biphenyls and polychlorinated terphenyls (PCB/PCT) with high-performance, high-pressure sodium lights and an advanced data communication system using power line transmission.

The current goal, based on approval from the City Council, is to complete installation of 50,000 more fixtures by 2014.

IMPLEMENTATION

Overview
The intelligent street lighting system began as a joint effort by the City of Oslo's Agency for Road and Transport and Hafslund ASA, the largest electricity distribution company in Norway. Now managed solely by the Agency for Road and Transport, it is responsible for the operations and maintenance of 250,000 street lighting points in the greater Oslo area.

The new lights include electronic gears in each light that measure rates of consumption by the different consumers, including private companies, public parks and city streets. Each light can be dimmed individually when traffic and climate conditions permit. This increases the life expectancy of lights and equipment, generating huge economic and energy savings. Moreover, the powerline transmission of data to a geographic information system (GIS) database containing information on every single fixture enables the operator to easily identify lights that have or will soon burn out. This technology is estimated to increase efficiencies by 30%.

The new system not only enables the city to measure energy consumption, but also to accurately tax end users. Users are not billed on the anticipated volume of use but their actual consumption. Older systems are often based on fixed operating hours.

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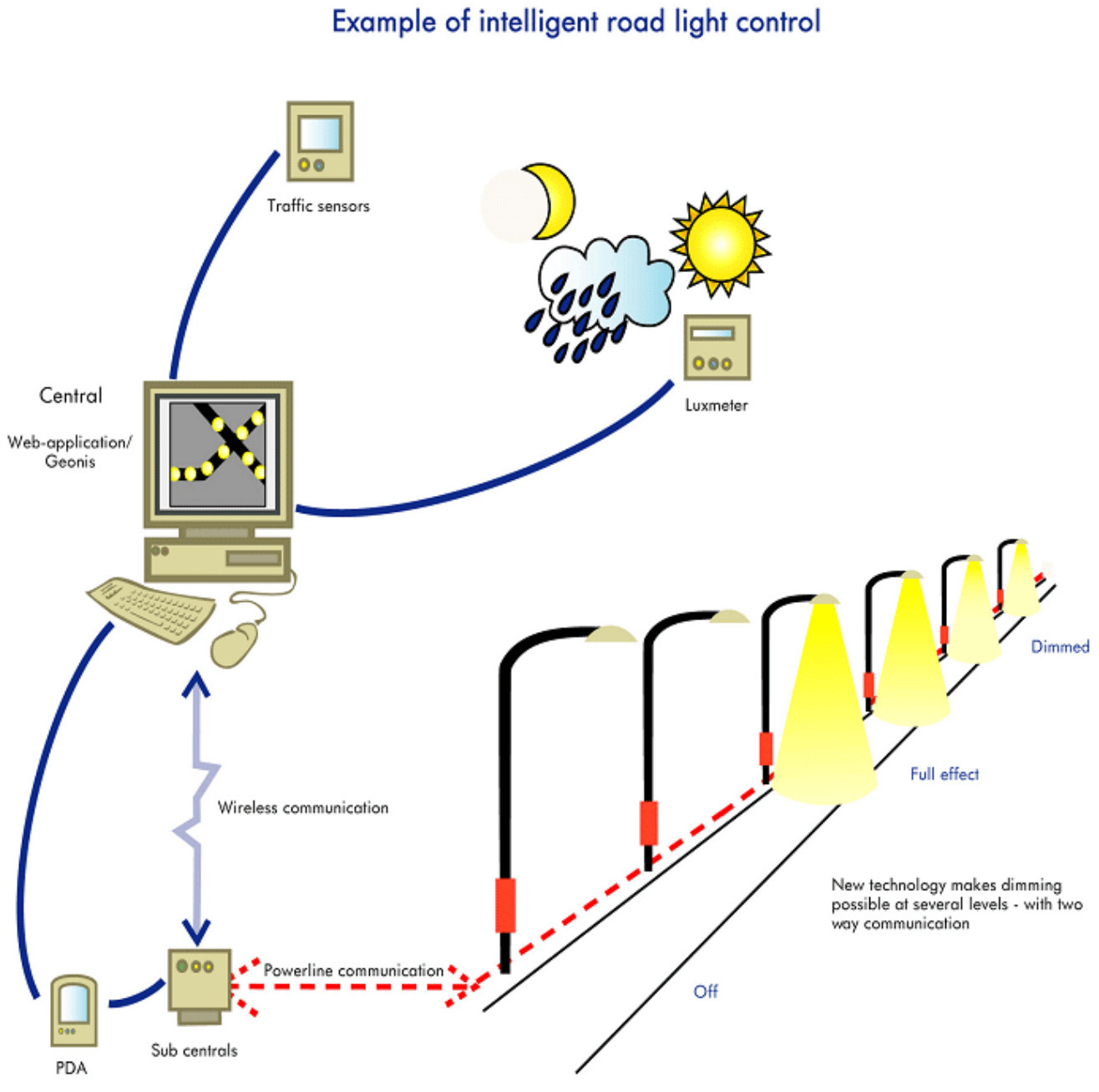

Agency for Road and Transport, City of Oslo

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Application
The system, comprised of 10,000 intelligent streetlights, is operated by a central database that monitors and administers commands. The system utilizes general packet radio service (GPRS) telecommunications technology between the central database and the switch cabinet located in the street. The switch cabinet receives messages from the central database and transmits these to the individual lights via the existing 230V power cables.

COST

The initial investment to install the 10,000 units was €12 million (USD $16 million) and includes the following:

- €6 million (USD $8 million) for the retrofit of old lights
- €3 million (USD $4 million) for the new intelligent technology
- €3 million (USD $4 million) for the installation

RESULTS AND EVALUATION

Evaluation
Installation began in 2007. Some minor problems occurred, mainly related to production failure in some communication units. Overall, however, the system has performed well under normal operating conditions. There has been no increase in the level of public complaints, meaning that the system is functioning at least as well as the old system.

The predicted energy savings and cost reductions – given a reduction in overall maintenance – have not yet been fully realized. This is due to the small scale of the project at present. A scale-up to the city's 250,000 lights could increase the impacts in energy savings and emissions and deliver the economy of scale needed to deliver significant financial savings.

CO_2 Emissions Reduction Results
Norway uses 98% hydropower for its electricity supply. Lighting in Oslo is completely provided by hydropower. If oil had been used to generate the required electricity, the city would have emitted 1,440 tons CO_2 per year for 10,000 lights. In real terms, the high efficiency of the lights means that 70% of the electricity used under the old system for street lighting is now diverted for other uses, which potentially reduces emissions further.

Energy Efficiency Results
The energy saving potential has been estimated to 5 gigawatt hours per year (GWh/year). The city plans to continuously replace old, inefficient streetlights. Today 15% of the streetlights in Oslo have been renovated and over the next 5 years this figure will dramatically increase.

TIMELINE

April 5, 2006	European Union enacted Directive 2006/32/EC stating: The aim of this Directive is not only to continue to promote the supply side of energy services, but also to create stronger incentives for the demand side. The public sector in each Member State should thus set a good example regarding investments, maintenance and other expenditure on energy-using equipment, energy services and other energy efficiency improvement measures. Source: Official Journal of the European Union
2006	Oslo developed its street lighting program according to a 36 month timeframe in support of Directive 2006/32/EC.

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October 2009	Oslo's Agency for Road and Transport takes over all management of streetlights in the greater Oslo area.
May 2010	Oslo joins other ESOLi partners to begin developing guidelines for new installations and contracts for easier implementation of intelligent systems in outdoor lighting.
October 2011	The out-dated copper-wire control system will be replaced with a more efficient electronic system. An electronic system will likely have energy savings of 10-15%.
October 2011	6,000 streetlights will be replaced with a more dynamic system.
2011-2013	Replace roughly 10,000 mercury bulbs.
By 2013	Acquire tele-management system to administer the entire intelligent streetlight system.

LEGISLATION

Oslo has designed its street lighting system to conform to relevant standards published by the International Commission on Illumination (CIE). These standards include the CIE standard number 115 published in 2009. The standards can be found at http://cie.co.at/.

LESSONS LEARNED

Oslo's Agency for Road and Transport had to learn how to tackle the challenge of explaining this new, relatively complex technology in a way that made sense to consumers and employees.

TRANSFERABILITY

The implementation of the intelligent streetlight system goes hand-in-hand with a European Union's E-street Project covering energy efficient activities and the development of international standards. The project's network includes 12 partners from 11 European countries.

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