Implementing district heating and/or district cooling networks

In a nutshell

SUMMARY
It is best practice to implement district heating networks and/or district cooling networks to provide public buildings and/or households with, respectively, space heating and hot water or space cooling. By generating them in central units, the heating and/or cooling provided to the network can be sourced from combined heat and power systems or tri-generation plants. When possible, further environmental benefits can be obtained by running these systems on renewable biomass or by employing geothermal energy or waste heat from industrial plants.
Target group
Local authorities
Applicability
This best practice is applicable to all local authorities. It is specifically relevant for newly built areas and major renovations of public building complexes or other public infrastructures (e.g. swimming pools). There are some limitations for low-density populated areas and where heating and cooling demand fluctuates considerably.
Environmental performance indicators
• Annual CO_2 emissions of the system providing heating or cooling, before and after the implementation of district heating/cooling as an absolute figure or per unit of floor area of the buildings heated or cooled (t CO_{2eq}, kg CO_{2eq}/m^2)
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N/A

Description

Increase energy performance in public buildings can be achieved by implementing energy performance contracts (EPC) which involve a contractor called energy service company (ESCo). The ESCo identifies appropriate energy efficiency improvements for public buildings (including development and design of energy efficiency and emission reduction projects, installation and maintenance of energy efficient equipment, monitoring and verification of the project’s energy savings), develops them, builds them, provides a guarantee that a set level of energy savings will be achieved, and in many cases arranges financing to pay for the projects with repayments less than the savings. The idea is that energy cost savings will exceed the cost repaying the cost of investment. The ESCo model therefore allows sharing the economic advantages gained thanks to improved energy efficiency. Usually, for public administrations, the EPC overcomes the investment barrier for implementing energy efficiency measures.

Measures for improving energy efficiency in buildings which can be adopted by ESCos are presented in the best practice on improving the energy efficiency in public buildings and involve improvements of the envelop insulation and air tightness. Furthermore, more efficient heating and air conditioning systems can be achieved by:

• Replacement/modernisation of boilers

• Replacement, reduction of water storage volumes

• Decentralisation for heat generation

• Modernization of cooling systems

• Replacement of ventilation motors/rotors/automatic control

• Operation on demand for ventilation systems (CO_2 sensors, frequency converters)

• Heat recovery for ventilation systems

Moreover, efficient lighting systems (installing electronic ballasts, energy saving lamps, control systems and sensor technology, such as presence detectors) contribute also to reducing energy consumption in buildings.

EPC consist of two main different models (Fang et al., 2012): shared-saving and guaranteed-saving models. In the shared-saving model, the ESCo and the client share the cost savings at a pre-determined percentage for a fixed number of years. In the guaranteed-saving model, the ESCo guarantees a certain level of energy saving for the customer which receives a cheaper energy bill. However, the real savings are higher compared to the guaranteed ones and the ESCo benefits economically from this difference. In Europe the guaranteed-saving models seem to be the most common.

Measures implemented by ESCos can be of different complexity. The basic ESCo approach consists in the replacement of installations and regulation of energy systems such as monitoring, light steering, heat regulation etc. These operations involve relatively simple and inexpensive technologies which have a high energy saving potential, therefore, the payback period is limited. A more complex ESCo approach consists of ESCo projects including monitoring and regulation in combination with the building envelope. Investments required are much higher than the basic ESCo approach and paybacks periods longer. Finally, ESCos may be introduced by municipalities as learning process to develop local competences on energy retrofitting to all public buildings (e.g. schools, offices, social housing etc.) and public-private collaborations. Experience from public administrations implementing ESCos can then be transferred to other private buildings (e.g. private schools). In this more complex approach investments required are much higher and paybacks longer than the previous examples.

Comparison In-house and ESCo approach

Improve energy efficiency in public buildings can be carried out by municipalities also as in-house project, investing the budget available and planning measures employing the staff already working for the public administration. The two different approaches (ESCo and in-house) are characterised by different aspects and Table 1 compares the in-house approach with the ESCo approach for energy efficiency improvement for municipalities.

Table 1: Comparison between in-house and ESCo approach (Jensen et al., 2011)

	In-house	ESCo
Financing	• Step-wise renovation due to budget limitations • Long-term financing uncertain	• Guarantee for energy savings is politically attractive • Energy savings from 'day one'
Capacity building	• Keeps competences in-house, more hands-on influence on solution	• Learning and innovation from ESCO partnership (also depends on ESCo approach)
Fixation and flexibility	• Flexible in relation to uncertain future building portfolio	• ESCo reduces the risk of reductions in future investments in energy savings due to possible changes in political priorities

However, in-house approach should not be seen in contrast with the ESCo approach but they should reinforce each other. In fact, the ESCo approach could be a first step towards improved energy efficiency able to develop in-house capacity over time. Furthermore, for small municipalities it would be difficult to carry-out an in-house model comparable with the ESCo project. Therefore, ESCos tend to develop solutions more suitable for small municipalities where it is more likely that they are going to be involved for improving energy efficiency in buildings.

Environmental benefits

The main benefit for implementing the ESCo model in public buildings is to allow implementing energy saving measures which otherwise would not be possible to realize due to the cost of investment.

Side effects

The ESCo model itself does not have any environmental cross-media effect. For cross-media effects related to improve energy efficiency in buildings see instead the best practice on improving the energy efficiency of public buildings

Applicability

Public administrations can all apply the ESCo model for introducing improvements to energy efficiency in their buildings. Especially small municipalities with a small budget to be invested for energy retrofitting and limited expertise among their employees may consider more convenient and feasible the ESCo model. Big municipalities, instead, which may have larger budgets to be invested and an in-house team competent for energy efficiency measures already available may consider more the in-house approach. However, there may be different cases of big municipalities employing the ESCo model for improving their energy efficiency (e.g. Berlin).

Economics

ESCo contract have the advantage for municipalities of financing the improvements of many buildings over a short time; within a two-year period of analysis the ESCo supplier provides a sufficient basis for a full-scale implementation in the entire building portfolio, where energy savings are guaranteed by contract. Therefore, municipalities can start saving money thanks to improved energy efficiency after a short period of time. The in-house approach, instead, foresees municipalities operating with a smaller in-house staff, which prolongs the period of analysis before building retrofitting is implemented, and energy savings are reached. Results from an in-house approach are reached gradually, as a contrast to the ESCo model that includes more instant results (Figure 2). Moreover, if the municipality finances directly the measures for improving the energy efficiency, due to the limited budget, reduced energy consumption would be achieved in longer timescale.

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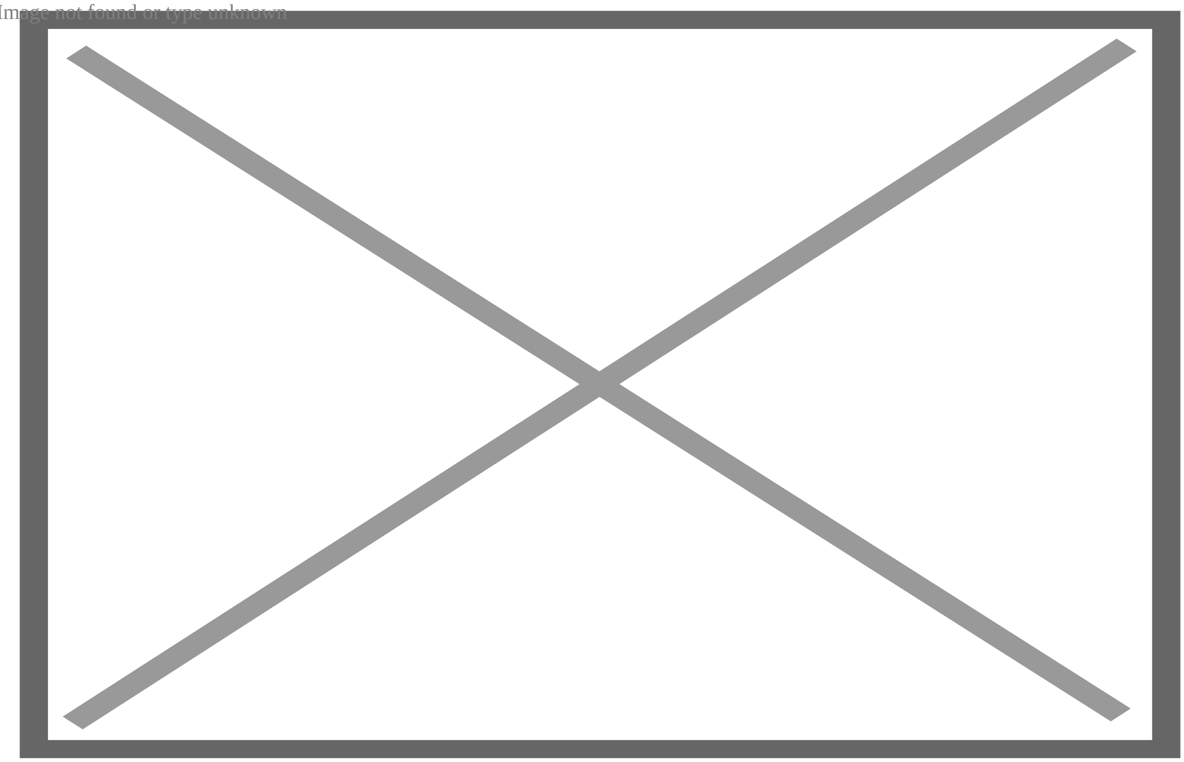

Figure 2: Comparison saving achieved with in-house and ESCo approaches (Jensen et al., 2011)

In the case of Berlin, ESCOs the city has invested nearly €52 million and the energy savings already achieved implementing the ESCo model are €11.7 million (including €2.7 million public budget savings).

Driving forces for implementation

The main driving force for municipalities to implement an ESCo model is the limited resources (economic and human) to be employed for achieving large energy savings.

Reference organisations

Berlin (Germany) sustainable energy action plan: http://helpdesk.eumayors.eu/docs/seap/2128_1316596265.pdf

Prague (Czech Republic) energy efficiency refurbishment of primary schools:

http://www.sesefficiency.eu/english/01_prague_english.htm

Hódmez?vásárhely (Hungary), energy efficiency refurbishment of buildings, lighting:

http://www.sesefficiency.eu/english/03_hodmezovasarhely_english.htm

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