

1. DO²DES – Design of optimal distributed energy systems

2. What is integrated with DSM

DG

Energy storage

Smart grid technologies

3. What is the level of commercialization

Research project

Demonstration

Field test

Existing practice

4. Where to find more information?

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- http://akseli.tekes.fi/opencms/opencms/OhjelmaPortaali/ohjelmat/DENSY/en/Closing_Seminar_2007.html → Final Report

5. Objectives of the case

The goal of the project was to develop an approach for the following optimisation task: in a specific region find the optimal design and the optimal locations for production plants of both heat and electric power, the optimal routing for the district heating network pipelines and the optimal locations and design of heat storages, all in accordance with the locations of the heat and power consumers and their heat and power demands in different periods of the year.

6. Business rationale/model

7. Technologies used

Two formulations for solving the optimization problem were developed and tested: a deterministic Mixed Integer Linear Programming (MILP) formulation and a hybrid stochastic-deterministic formulation with Genetic Algorithm (GA) combined with Linear programming (LP). With the MILP approach global optimum solutions are obtained, but the approach cannot be applied in large problems due to a combinatorial expansion that causes impractical calculation times. With GA-LP approach even large problems can be solved but no guarantee on the optimality of the solutions can be given.

8. Short description of the case

In the developed optimisation model for DES a number of optional sites for heat and power production, heat storage sites and a number of energy consumers with given heat and power demands in different time periods in the region are given as

9. Achieved/expected results (operational savings, CO₂, efficiency enhancement)
The optimisation approach serves as the first step in the design process and the basis for more accurate calculations. The approach can also be used for answering what-if type questions and sensitivities of different parameters of a suggested design.
10. Lessons learnt
The work in the project showed that a distributed energy system can be optimised with the developed approach.