Production and distribution of domestic hot water in selected Danish apartment buildings and institutions. Analysis of consumption, energy efficiency and the significance for energy design requirements of buildings

The goal of this work has been to document the efficiency of domestic hot water (DHW) distribution systems and to propose more energy efficient and environmentally friendly solutions for DHW systems based on analyses of existing conditions. In the article, measurements from 13 apartment buildings and two institutions are presented, i.e. consumption of DHW, heat loss from circulation lines and efficiency of the DHW system. The heat load and the cooling of the district heating water for DHW are documented as well. Possibilities for improving the DHW system include new types of circulation pipes, which have the potential of a 40% reduction of heat losses. In addition to the reduction of heat losses inside the building, a low return temperature from the hot water system will have a large impact on the heat losses from the district heating network when the building is being heated by district heating. It is likely that the production and distribution of DHW in buildings will constitute a dominant share of both the present, and in particular, the future energy design requirements of buildings. The results of this project could influence not only future buildings, but also existing buildings when renovation of installations take place. © 2012 Elsevier B.V. All rights reserved.

Evaluation of approaches for modeling temperature wave propagation in district heating pipelines

The limitations of a pseudo-transient approach for modeling temperature wave propagation in district heating pipes were investigated by comparing numerical predictions with experimental data. The performance of two approaches, namely a pseudo-transient approach implemented in the finite element code ANSYS and a node method, was examined for a low turbulent Reynolds number regime and small velocity fluctuations. Both approaches are found to have limitations in predicting the temperature response time and predicting the peak values of the temperature wave, which is further hampered by the fact that the fluid is represented as an ideal fluid. The approaches failed to adequately predict the temperature wave propagation in the case of rapid inlet temperature changes. The overall conclusion from this case study was that in order to improve the prediction of the transient temperature, attention has to be given to the detailed modeling of the turbulent flow characteristics.
Dynamic Performance of a District Heating System in Madumvej, Denmark - A Case Study

General information
Publication status: Published
Organisations: Energy Engineering, Department of Mechanical Engineering, Risø National Laboratory, Lund University
Contributors: Gabrielaitiene, I., Bøhm, B., Larsen, H., Sunden, B.
Publication date: 2006

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Optimum Design of Distribution- and Service Pipes

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Publication status: Published
Organisations: Energy Engineering, Department of Mechanical Engineering, Danfoss AS
Contributors: Kristjansson, H., Bøhm, B.
Publication date: 2006

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Dynamic Heat Storage Optimisation and Demand Side Management

General information
Publication status: Published
Organisations: Energy Engineering, Department of Mechanical Engineering
Contributors: Wiegbels, M., Bøhm, B., Sipilä, K.
Number of pages: 85
Publication date: 2005

Publication information
Publisher: IEA Annex VII. 2005:8DHC-05.06.
Original language: English
Source: orbit
Source-ID: 182812
Dynamisk Varme Lagring i nettet og Demand Side Management i bygninger

**General information**
Publication status: Published
Organisations: Energy Engineering, Department of Mechanical Engineering
Contributors: Bøhm, B., Wigbels, M., Sipilä, K., Smith Hansen, B., Jensen, G., Madsen, A.
Pages: 30-33
Publication date: 2005
Peer-reviewed: No

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Journal: Fjernvarmen
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Original language: Danish
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Research output: Contribution to journal – Journal article – Annual report year: 2005 – Research

Forsøg med energirigtige stikledninger: Præsentation af forsøgsresultater

**General information**
Publication status: Published
Organisations: Department of Mechanical Engineering, Nykøbing Falster Kommune
Contributors: Bøhm, B., Frederiksen, L., Paaske Christensen, K.
Publication date: 2005

**Publication information**
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Original language: Danish
Source: orbit
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Forsøg med energirigtige stikledninger: Hovedrapport

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Organisations: Energy Engineering, Department of Mechanical Engineering
Contributors: Kristjansson, H., Bøhm, B.
Publication date: 2005

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Original language: Danish
Source: orbit
Source-ID: 182815

Operational Optimisation: Dynamic Heat Storage and Demand Side Management Strategies

**General information**
Publication status: Published
Organisations: Energy Engineering, Department of Mechanical Engineering
Contributors: Wigbels, M., Bøhm, B., Sipilä, K.
Pages: 58-61
Publication date: 2005
Peer-reviewed: Yes

**Publication information**
Journal: Euroheat & Power
ISSN (Print): 0949-166X
Ratings:
Scopus rating (2005): SJR 0.1 SNIP 0.118
**Simple modeller for fjernvarmesystemer med henblik på belastningsudjævning og driftsoptimering**

**General information**
Publication status: Published
Organisations: Department of Mechanical Engineering
Contributors: Bøhm, B., Larsen, H. V.
Pages: 26-28
Publication date: 2005
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Journal: Fjernvarmen
Volume: 8
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Original language: Danish
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Source-ID: 182814

**Single, twin and triple buried heating pipes: on potential savings in heat losses and costs**

**General information**
Publication status: Published
Organisations: Energy Engineering, Department of Mechanical Engineering, Grontmij A/S
Contributors: Bøhm, B., Kristjansson, H.
Pages: 1301-1312
Publication date: 2005
Peer-reviewed: Yes

**Publication information**
Journal: International Journal of Energy Research
Volume: 29
ISSN (Print): 0363-907X
Ratings:
Scopus rating (2005): SJR 1.043 SNIP 0.841
Web of Science (2005): Indexed yes
Original language: English
Source: orbit
Source-ID: 183352

**Värmeförluster i småhusområdet Prästmarken, Växjö**

**General information**
Publication status: Published
Organisations: Energy Engineering, Department of Mechanical Engineering
Contributors: Zinko, H., Bøhm, B.
Number of pages: 126
Publication date: 2005

**Publication information**
Publisher: Svensk Fjärrvärme FoU
Original language: Swedish
Source: orbit
Source-ID: 182810
Research output: Book/Report › Report – Annual report year: 2005 › Research › peer-review
A comparison of aggregated models for simulation and operational optimisation of district heating networks

Work on aggregation of district heating networks has been in progress during the last decade. Two methods have independently been developed in Denmark and Germany. In this article, a comparison of the two methods is first presented. Next, the district heating system Ishoej near Copenhagen is used as a test case.

For the 23 substations in Ishoej, heat loads and primary and secondary supply and return temperatures were available every 5 min for the period December 19–24, 2000.

The accuracy of the aggregation models has been documented as the errors in heat production and in return temperature at the DH plant between the physical network and the aggregated model. Both the Danish and the German aggregation methods work well.

It is concluded that the number of pipes can be reduced from 44 to three when using the Danish method of aggregation without significantly increasing the error in heat production or return temperature at the plant. In the case of the German method, the number of pipes should not be reduced much below 10 in the Ishoej case.
Dynamic modeling of the thermal performance of district heating pipelines

General information
Publication status: Published
Organisations: Energy Engineering, Department of Mechanical Engineering
Pages: 184-192
Publication date: 2003

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Publisher: Begell House Inc and Lithuanian Institute
Source: orbit
Source-ID: 25640

An aggregated dynamic simulation model of district heating networks

General information
Publication status: Published
Organisations: Energy Engineering, Department of Mechanical Engineering
Contributors: Larsen, H. V., Palsson, H., Bøhm, B., Ravn, H. F.
Pages: pp. 995-1019
Publication date: 2002
Peer-reviewed: Yes

Publication information
Journal: Energy Conversion and Management
Volume: Vol. 43 (2002)
ISSN (Print): 0196-8904
Ratings:
Scopus rating (2002): SJR 1.071 SNIP 1.476
Web of Science (2002): Indexed yes
Original language: English
Source: orbit
Source-ID: 62426

RAPPORT for EFP 2001-projekt "Fjernvarmeforsyning af lavenergiområder"

General information
Publication status: Published
Organisations: Department of Mechanical Engineering, Department of Civil Engineering
On the calibration and application of heat flux sensors on buried district heating pipes

General information
Publication status: Published
Organisations: Department of Energy Engineering
Contributors: Pedersen, J. D., Bøhm, B.
Pages: 1041-1048
Publication date: 2000
Peer-reviewed: Yes

Publication information
Journal: International Journal of Energy Research
Volume: 24
Issue number: 12
ISSN (Print): 0363-907X
Ratings:
Scopus rating (2000): SJR 0.555 SNIP 0.623
Web of Science (2000): Indexed yes
Original language: English
Source: orbit
Source-ID: 177276
Research output: Contribution to journal › Journal article – Annual report year: 2000 › Research › peer-review

On transient heat losses from buried district heating pipes

General information
Publication status: Published
Organisations: Department of Energy Engineering
Contributors: Bøhm, B.
Pages: 1311-1334
Publication date: 2000
Peer-reviewed: Yes

Publication information
Journal: International Journal of Energy Research
Volume: 24
Issue number: 15
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Ratings:
Scopus rating (2000): SJR 0.555 SNIP 0.623
Web of Science (2000): Indexed yes
Original language: English
Source: orbit
Source-ID: 177265
Research output: Contribution to journal › Journal article – Annual report year: 2000 › Research › peer-review

Equivalent Models for District Heating Systems

General information
Publication status: Published
Contributors: Bøhm, B., Pålsson, H., Larsen, H. V., Ravn, H. F.
Pages: 1-16
Publication date: 1999

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Place of publication: Lund
Publisher: Nordic Energy Research Programme
Editor: Frederiksen, S.
ISBN (Print): 91-971587-7-4
Equivalent models of district heating systems: for on-line minimization of operational costs of the complete district heating system

General information
Publication status: Published
Number of pages: 183
Publication date: 1999

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Original language: English
Source: orbit
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Equivalent models of district heating systems for on-line minimization of operational costs of the complete district heating system

General information
Publication status: Published
Organisations: Risø National Laboratory for Sustainable Energy, Systems Analysis Division, Energy Systems Analysis, Department of Energy Engineering
Contributors: Pálsson, H., Larsen, H. V., Bøhm, B., Ravn, H., Zhou, J.
Publication date: 1999

Publication information
Place of publication: Lyngby
Publisher: Technical University of Denmark. Department of Energy Engineering
ISBN (Print): 87-7475-221-9
Original language: English
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Source-ID: 174500
Research output: Book/Report › Book – Annual report year: 1999 › Research › peer-review

Heat losses from buried district heating pipes, with specific interest in the transient behaviour

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Publication status: Published
Organisations: Department of Energy Engineering
Contributors: Bøhm, B.
Number of pages: 170
Publication date: 1999

Publication information
Place of publication: Lyngby
Publisher: Polyteknisk Press
Original language: English
Source: orbit
Source-ID: 174503
Research output: Book/Report › Book – Annual report year: 1999 › Research › peer-review

In-situ determination of heat losses from buried district heating pipes

General information
Publication status: Published
A simple quasi-dynamic model of a district heating system used for operational optimization. ET-ES 98-09, December 1998.

Evaluation of the dynamic performance of a hot water tank with built-in heating coil.

Fjernvarmesystemers levetid (Durability of district heating systems)
The Tx-model - A quantitative heat loss analysis of district heating pipes by means of IR-surface temperature measurements and simulations

General information
Publication status: Published
Organisations: Department of Energy Engineering
Contributors: Zinko, H., Bøhm, B.
Pages: 1-11
Publication date: 1997

Host publication information
Title of host publication: The Tx-model - A quantitative heat loss analysis of district heating pipes by means of IR-surface temperature measurements and simulations
Place of publication: Reykjavik
Source: orbit
Source-ID: 168885
Research output: Chapter in Book/Report/Conference proceeding – Annual report year: 1997
Research: peer-review

A Comparison of Different Methods for In-situ Determination of Heat Losses from District Heating Pipes

General information
Publication status: Published
Organisations: Department of Energy Engineering, Technical University of Denmark
Contributors: Bøhm, B., Borgström, M.
Number of pages: 43
Publication date: 1996

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Publisher: Technical University of Denmark. Department of Energy Engineering
Volume: ET-ES 96-01
ISBN (Print): 87-7475-169-7
Original language: English
Source: orbit
Source-ID: 165916
Research: peer-review

A Comparison of Different Methods for In-situ Determination of Heat Losses from District Heating Pipes

General information
Publication status: Published
Organisations: Department of Energy Engineering
Contributors: Bøhm, B.
Pages: 81-88
Publication date: 1996

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Title of host publication: the international district heating conference
Place of publication: copenhagen
Source: orbit
Source-ID: 166068
Research output: Chapter in Book/Report/Conference proceeding – Article in proceedings – Annual report year: 1996
Research: peer-review

A method for using thermistors to measure thermal conductivity

General information
Publication status: Published
Organisations: Department of Energy Engineering, ET
Contributors: Margaretha, B., Bøhm, B.
Number of pages: 12
Nødvendig fremstøbt temperatur for eksisterende fjernvarmemiljøer - med tilhørende afkøling (The necessary supply temperature for existing district heating house stations and the corresponding temperature difference).

General information
Publication status: Published
Organisations: Department of Energy Engineering
Contributors: Hansen, K. K., Bøhm, B.
Number of pages: 30
Publication date: 1996

Quantitative Heat Loss Determination by Means of Infrared Thermography - The Tx Model.

General information
Publication status: Published
Organisations: Department of Energy Engineering
Contributors: Bøhm, B.
Number of pages: 114
Publication date: 1996

Quantitative Thermography and Methods for In-situ Determination of Heat Losses from District Heating Networks.

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Publication status: Published
Organisations: Department of Energy Engineering
Contributors: Bøhm, B. (ed.)
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