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Lowenergy hospitals

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Why hospitals?

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- Healthcare sectore represents 10 % of the total heated area in public buildings in Norway
- Hospitals use twice of the amount of energy needed for office buildings (per m2)
- 20% of the total energy use in public buildings is related to healthcare buildings in Norway
- Aging of the population, hence more elderly care is expected

Hospital energy consumption in focus

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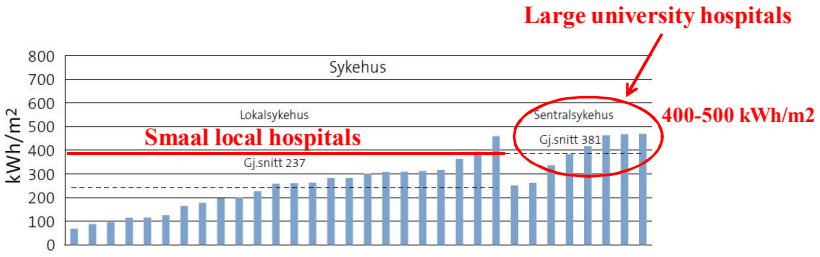
- Specific energy consumption for different kind of hospitals



Remark

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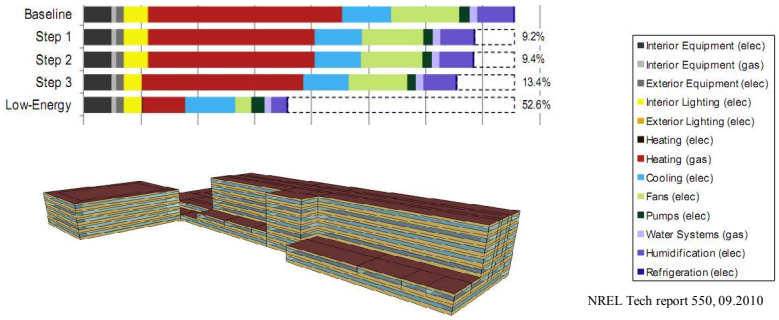
USA

- Similar research project - "How to halve the energy use in health care"
- 40 000 m^2 building , 7 floors, compact building
- Starting point is taken with energy use at about 700 kWh/m^2 . So the aim was achieved easily by using heat pumps and VAV



NREL Tech report 550, 09.2010

Hospital geometry

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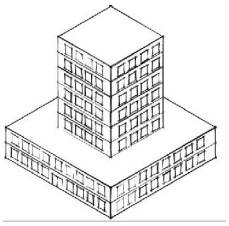
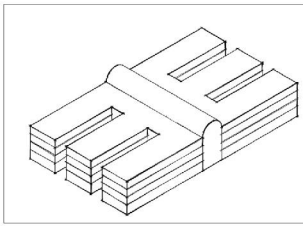
A tower on a base



Glass-covered arcade



Hospital geometry

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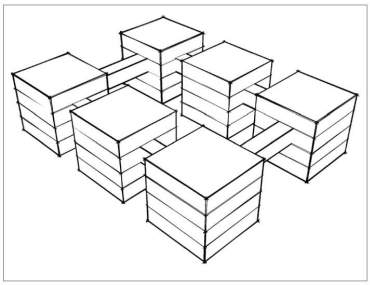
Pavillion



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Functional units

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	Functional unit	Operating schedule, h	Ventilation m^3/hm^2	Lighting W/m^2	Equipment, W/m^2	Hot water, W/m^2
1	Acute care	24	20(0)	15(0)	20	5,1
2	Out-patient clinic	16	16(5)	15(5)	20(5)	5,1
3	Nursing	24	8(0)	8(0)	12	3,4
4	Surgery	16	50(7)	15(5)	25(0)	5,1
5	Diagnostic imaging	16	16(3)	15(5)	25(5)	3,4
6	Laboratories	16	25(7)	15(5)	20(5)	3,4
7	Pharmacy	16	25(7)	15(5)	20(5)	1,6
8	Sterilization	16	25(7)	8(5)	20(5)	7
9	Medical services	16	16(3)	10(0)	15	5,1
10	Other services	16	16(3)	8(2)	15	5,1
11	Administration	12	16(3)	8(2)	11(2)	1,6
12	Hotel	16	12(3)	8(3)	10(2)	5,1
13	Research/Teaching	12	13(3)	8(2)	11(3)	1,6
14	Personnel service	16	16(3)	8(2)	12	5,1
15	Patient service	16	16(3)	8(2)	15	5,1
16	Technical areas	16	10(3)	8(2)	10	3,4

Current results

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Energy use	Glass-covered arcade	Tower on a base	Pavillion
1a Room heating	49,9	46,9	47,3
1b Ventilation heating	56,3	57,1	59
2 Hot tap water	31,8	31,8	31,9
3a Fans	64,9	64,9	64,9
3b Pumps	4,4	4,4	4,4
4 Lighting	66	66	66
5 Equipment	88	88	88
6a Local cooling	12	11	13,3
6b Ventilation cooling	14,9	15,5	15,5
Total	388,2	385,7	390,4

Current results

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Low energy alternative

Energy	Glass-covered arcade	Tower on a base	Pavillion
1a Room heating	5,1	0,3	0,7
1b Ventilation heating	5,1	4,6	5,8
2 Hot tap water	31,8	31,8	31,8
3a Fans	14	14	14
3b Pumps	3,2	3,2	3,2
4 Lighting	23,1	23,1	23,1
5 Equipment	88	88	88
6a Local cooling	41,8	41,9	44,7
6b Ventilation cooling	6,1	6,3	6,3
Total	**218,2**	**213,2**	**217,6**

IDA ICE model

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IDA ICE geometry

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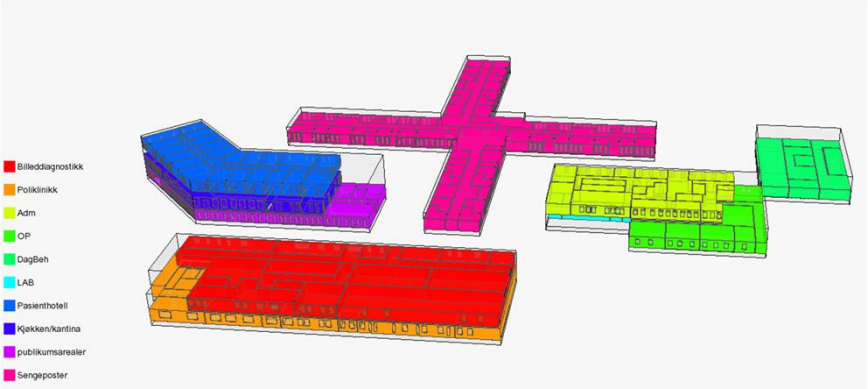

System outline

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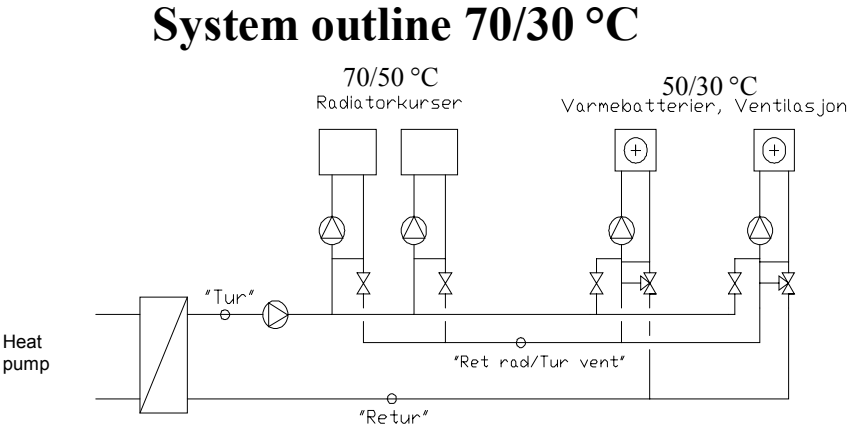

10-15% energy savings (Simien)

12

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IDA ICE model

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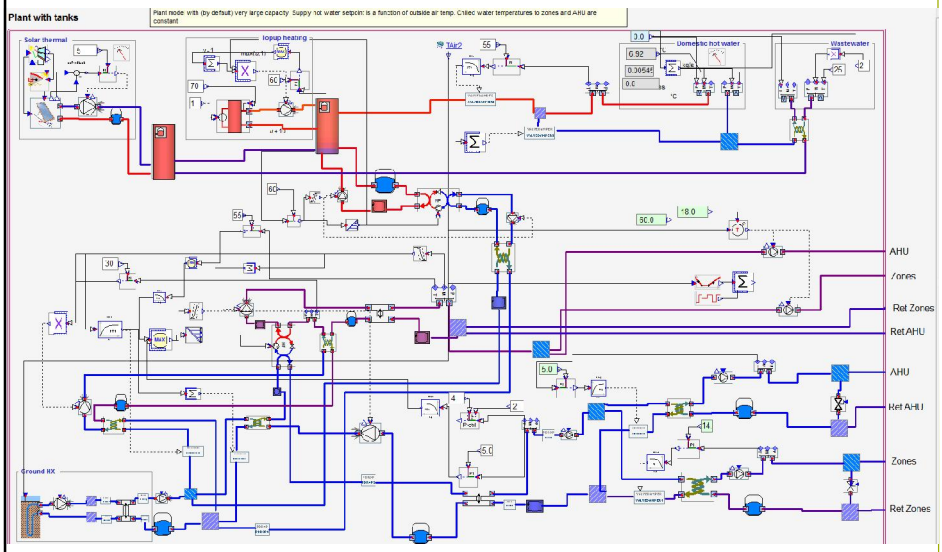

Future (ongoing) work

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Best energy practices (BEPs) are defined and are to be implemented using IDA ICE or, if possibly, other simpler tools

- optimal window area for a given functional unit
- balancing of energy uptake from boreholes
- temperature levels for energy distribution and consequences of its changing
- free cooling
- thermal integration of heating and cooling demand

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Thank you for your attention

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