Investing in My Parents House

By Jonas Herby[1]

1 Motivation

The present state of both record high energy prices and, maybe more important, record low interest rates, have made energy saving initiatives more promising today compared to just a few years ago. Moreover, as the object with the paper was to provide the (American) reader with new and useful information/viewpoints, it would be obvious to write about the Danish energy market and the choices a Danish household faces. This gave me the idea to write a paper about energy investments in a private household in Denmark. As this is a subject concerning every household in Denmark, I have chosen to write the paper as an analysis of which investments my parents could undertake in order to cut down on energy expenditures.

The rest of the paper is organized as follows: Section 2 describes some general facts about Denmark, which is needed to understand which conditions my parents must take into consideration when taking investment decisions. Section 3 describes my parents' house as it is today, including the expenditure of energy. Section 4 evaluates some of the options my parents have, with especially care taken regarding an investment in a solar heating system. Section 5 concludes.

2 Denmark

In order to understand why my parents' house is as it is we need to understand the environment they base their decisions upon. In the following I will briefly clarify some important factors that influence the options my parents have to consider.

[1] I would like to thank my dad, Knud Herby, for excellent data collecting and for helpful comments.

2.1 The Weather

With more than 7,000 kilometers (4,321 miles) of coast line compared to a total size of only 43,000 square kilometers (16,385 square miles) the weather in Denmark is highly influenced by the ocean. Appendix I shows several weather data in a 'normal' year for Denmark.[2] We see that the number of hours with sunshine each month is significant higher in the summer compared to the winter. However, due to the nearby ocean the fluctuations in temperatures are limited with a difference between the highest (in August) and the lowest (in January) day temperature of only approximately 18°C (32.4°F). In Denmark the yearly solar radiation is 1,200 kWh/m^2 on a 45 degree slope facing south.[3]

2.2 The Energy Market

The energy market in Denmark is characterized by green taxes and subsidies to renewable energy.

2.2.1 Oil for Home Heating

The energy tax and CO_2 tax on oil for home heating amounts to DKK 2,100 per thousand liters[4] ($1.32 per gallon)[5] before sales taxes. Including the 25% sales tax, the total energy tax amounts to DKK 2,625 per thousand liters ($1.66 per gallon). Including taxes my parents pay DKK 6,522 per thousand liters[6] ($4.11 per gallon) of which green taxes make up 40.25%.[7]

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[2] The definition of a normal year is based on data from 1961 to 1990.

[3] "Fokus på solenergi", a booklet from The Danish Ministry for Energy and Environment

[4] The tax is a quantum tax and is independent of the oil price. (Source: www.statoil.dk)

[5] Throughout the paper I use an exchange rate of 6.0000 DKK/USD which is close to the average of 2004. Friday December 10 the exchange rate was 5.6217 DKK/USD

[6] This price includes delivery. The oil my parents uses has a very low content of sulphur dioxide (0.05%), which allow them to avoid the sulphur dioxide tax.

[7] Contrary to the US, heating oil in Denmark is cheaper than diesel oil. It is prohibited to use heating oil in your car in an attempt to avoid taxes.

2.2.2 Electricity

The price of electricity in Denmark is stated by the Northern electricity exchange Nordpool. As Denmark only produces 10% of the electricity in Scandinavia, the price is far more responsive to the quantities of water in Norway and Sweden than to the price of coal.[8] Still most electricity consumed in Denmark is coal based, and is as such heavily taxed. Moreover the consumer is by law required to buy about 43.8% of the electricity from renewable resources such as windmills[9] (this is called green electricity).[10] The factors that make up the price of electricity is shown in table 2.2.2.1

Table 2.2.2.1 The Entries in the Price of Electricity

Entry	**Price including sales tax**
Green electricity	DKK 0.2688 (4.48 cents)
Electricity bought at market conditions	DKK 0.1819 (3.03 cents)
Electricity tax and CO^2 tax	DKK 0.7825 (13.04 cents)
Distribution and grid tariffs	DKK 0.1883 (3.14 cents)
Total	**DKK 1.4214 (23.69 cents)**

Source: Hanherred Elselskab (www.hhe.dk)

2.2.3 Firewood

My parents get their firewood from different sources. Some is bought at the store and some is bought from/given by friends. The estimated average price given the current consumption is DKK 180 per cubic meter.[11]

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[8] Borsen, October 18, 2004

[9] Approximately 20% of the Danish net electricity consumption is produced by windmills (Jyllands Posten Marts 15, 2003.

[10] The green electricity law is planned to expire in 2005, from when electricity from renewable energy sources must compete against electricity produced using fossil fuels.

[11] If the consumption increases the average price is likely to go up, as the share of free wood is expected to decrease.

3 The House

With its 260 square meters (2799 square feet) my parents' house is relatively large compared to an average Danish house. The house has two floors with the basement partly buried (see the floor plans in appendix II). The basement is almost all bedrooms and is primarily used, when we kids are on a visit. The house has pitched roof with the slopes facing north and south. The side of the house facing south has several windows to take advantages of passive sun heating.

In defiance of its size, my parents have chosen to keep the house, as three of their four kids live far away and needs a place to stay when they are visiting. Their last child moved August 2003. Hence, in the following I will as far as possible base the energy consumption on data beyond this point in time.

The oil furnace is relatively new and was installed Marts 2002, together with a new hot-water tank (200 liters) and a new circulation pump.

3.1 Heat

3.1.1 Room Heating

As most other Danish homes, my parents' house is highly insulated compared to a home in the US. The house is primarily build in insulating gas concrete and besides that has a layer of stone wool.[12] Moreover, all windows are double glazed to minimize the loss of heat to the surroundings.

3.1.1.1 The Oil Furnace

The heat is primarily supplied by an oil furnace, which heats up water to circulate around the house. Each radiator in the house is equipped with a thermostat,[13] which all but one

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[12] The Danish company Rockwool, www.rockwool.com, is the world's largest producer of stone wool. Today Rockwool has 25 production sites in 16 countries, including two plants in the US.

[13] The Danfoss thermostats operate using gas as the temperature controlling material. A very nice multimedia illustration of how it works can be downloaded from http://pfheating.danfoss.com/PCMLiterature/ShowFile.asp?FileID=4787. The Danish company Danfoss, www.danfoss.com is the world's largest producer of thermostats to refrigerators and freezers. The Danfoss

has to be manually adjusted.[14] The radiators in the unused parts of the house are always turned on at approximately 18°C, in order to avoid moisture leading to increasing rates of decay. Most other radiators are set on standard room temperature around 23 to 24°C, except the ones in the living room and the bedroom, which is turned on and off as needed. The Furnace is placed in the laundry room, where it provides indispensable 'waste heat' to dry clothes during winter.

The heat of the water circulating the house is approximately 65°C during winter and 25°C during summer.

3.1.1.2 The Wood Furnace

During the winter the heat in the kitchen and the living room is to a great extent provided by a wood furnace placed in the living room. A thermostat in the kitchen combined with a small fan above the wood furnace secure that warm air is circulated when needed.

3.1.2 Warm Water

Warm water is produced in the oil furnace, and the consumption is relative stable over the year. I assume the consumption of warm water from the oil furnace is 100 liters per day.[15]

3.1.3 Energy Converted to Heat

As the data does not allow me to measure the daily consumption exactly, instead I divide the year in to a summer and a winter period. I use the dates where the wood furnace is normally put into/taken out of service as the dividing line between winter and summer. Hence, the winter is assumed to last from October 15th to April 15th equal to 182 days.

Appendix III shows the deliveries of oil the last four years. The yearly consumption of oil is estimated to be 2,328 liters. Based on the table and the figure in appendix I plus some

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Group has production facilities at 59 factories in 21 countries, and a global network of 119 sales companies and 61 agents and distributors.

[14] The thermostat in the kitchen is designed to increase the heat of the room by 4°C when my parents use the room. It turns up the heat 6 - 8 am and 1 - 8 pm on weekdays and 8 am - 8 pm on weekends.

[15] Of course the consumption is higher when the kids are home. However, as the estimate is set relatively high, the 100 liters per day is a good estimate on an average day. Later I will take peak demands into consideration.

working on the numbers,[16] I estimate the consumption of oil during summer to be 2.58 liters per day and 10.2 liters per day during winter. Given 183 summer days, this is equivalent to 476 liters during summer. The remaining 1852 liters of oil per year is used during winter for room heating and hot water. The yearly consumption of firewood is approximately 5.75 m^3 and is all used during winter.

Given the present oil price of DKK 6,522 per 1000 liters and a wood price of 180 DKK/m^3 the yearly combined heating cost is DKK 16,218 of which DKK 3,103 are spend during the summer period.

3.2 Electricity

The refrigerator, freezer,[17] and the circulation pump together with small things such as the standby functions on television and Hi-Fi, and the charger for the wireless phone form the minimum consumption of electricity. This minimum baseload has been measured to 0.27 kWh per hour.[18] There are no electrical heaters or air conditioning in the house and most light bulbs which are normally on in longer periods are energy saving bulbs. Appendix IV shows the consumption of electricity the last four years. The yearly consumption of electricity is estimated to 4,526 kWh, of which 2365 kWh comes from the minimum baseload. Given the present price of DKK 1.4214 per kWh the yearly cost of electricity is DKK 6,433 of which the baseload makes up 52.3%.

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[16] It turned out that using the lower boundary of the figure as the estimated summer consumption (approximately 4 liters per day) did not turn out a total number close to the yearly consumption with the given number of summer days. The most precise data I have is from the winter, for which reason I adjusted the daily consumption during summer. I realize this is relative imprecise, but it is the best the data allow me to. The 2.5 liters has been confirmed by my parents plumber.

[17] The refrigerator and freezer are both A-marked. The energy marking system is obligatory on many domestic appliances. The system gives the consumer a quick and easy overview over the energy efficiency of a product. An 'A' indicates the highest efficiency, while 'G' indicates the lowest efficiency. An example of the energy marking can be seen in the appendix.

[18] The estimate of the minimum consumption is based on one night observation, and, hence, may be a little insecure.

4 Investments

4.1 Solar Heating System

When analyzing my parents' energy consumption, one of the most conspicuous things was the relatively high expenditure of oil during the summer period. Even with a new furnace the idling loss is relatively large when the furnace is hardly used for anything but heating bath water. Hence, it might be cheaper to invest in a solar heating system. A combination system, which provides heat for both bath water and room heating, combined with a heating element as backup, would enable my parents' to turn off the oil furnace during summer.

4.1.1 Considerations

There are several things which have to be taken in to consideration before investing in a solar heating system. Besides the price of the system and the maintenance, the expectations to the oil price must be considered. After all, the investment can to some degree be compared to a yearlong contract on oil delivery.

4.1.2 The Economic Background

4.1.2.1 The Price of the System[19]

As the house needs room heating during the summer, I have focused on combination systems. I have found a system from Varmt vand fra solen (hot water from the sun)[20] which costs DKK 27,643 including sales tax and delivery. The offer does not include the materials for connecting the system to the heat tank (approximately DKK 1,500). It

[19] There may be some other non-economic costs connected to a solar heating system, such as an increase in the number of times the load of the oil furnace must be adjusted as well as house appearance considerations. However, as the system must be placed on the back side of the house, where it is practically unseen because of the sloping backyard, this is not taken into considerations. Hence, as there also is something 'cool' about a solar heating system, I assume the negative and positive non-economic sides to set off each other.

[20] The offer can be seen at the following link (example 3)
http://www.vvfs.dk/assets/doc/Komplette_selvbyg-solvarmeanlaeg_fra_Varmt_vand_fra_solen.doc

includes a 259 liter hot-water tank[21] (value DKK 8,470) which is slightly more than existing tank, which contains 200 liters. Being very conservative I assume the price to be DKK 30,000. This price may be significant higher than the true price if the existing hot-water tank can be used, as the new tank costs DKK 8,470. A summarized form of the offer can be seen in table 4.1.2.1.1

Table 4.1.2.1.1 Solar Heating System

Prices including sales tax, DKK	à	total
Solar Panels 3 ea, 3 m^2	3,135	9,405
Hot-water tank 259 liters, including electrical heating element		8,470
Pump w/ accessories		2,690
Solar heat control		1,990
Other Parts		5,088
Total price including sales tax and delivery		**27,643**

4.1.2.2 Maintenance and the Economic Life of the System

I assume the yearly maintenance to be 1% of the costs in average. This is significant higher than the 0.5% suggested by most dealers and officials.[22] I assume the economic life of the system to be 20 years.[23] This corresponds to what is suggested by most homepages I have visited. I have not seen any estimates below 20 years.

[21] When my parents got their new furnace it was installed with a hot-water tank prepared for solar energy. This implies that a solar heating system should easily be attached to the existing system, and, hence, a new tank may not be needed.

[22] The Danish Ministry for Energy and Environment uses 0.5% in their example in the booklet "Fokus på solenergi"

[23] Pumps and other auxiliary equipment normally have a shorter life, but this is included in the maintenance.

4.1.2.3 The Financing

The system can be financed with a loan in the house. On Realkredit Danmark's[24] homepage I have found the cost of a 20 year long annuity loan. The debt service after tax (first year)[25] for a 20 year loan is DKK 216 per month = DKK 2592 per year.

4.1.2.4 The Future Oil Price

The development in the heating oil consumer price in Denmark since 1982 is shown in appendix V. The yearly increase in the oil price has on average been between 2.0% and 3.5% depending on which data is used.[26] There are no indications leading us to believe that the growth rate will be lower in the future. Again, to be conservative I choose a yearly growth rate of 2.0%

4.1.3 Calculations

It is extremely hard to estimate how much oil a solar heating system will save each year. Instead, I calculate how much there oil must be saved in order for the investment to reak even. I will then compare this to others' estimates of how much oil you could expect to save with a solar heating system.

4.1.3.1 Additional Assumptions and Notes

I make the following additional assumptions

1. The maintenance is assumed to be 0% of system price the first 5 years, 1% the next 10 years, and 2% the last 5 years.
2. As the system would be placed approximately 20 meters from the storage tank, a factor of 0.93 should be multiplied to the quantity of oil.[27]

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[24] Realkredit Danmark is the mortgage-credit institute my parents use.

[25] In reality the after tax debt service will be slightly increasing as the interests paid decreases. However, with the current low interest rate, assuming the same payment each year is not a serious flaw.

[26] The 2.0% is obtained when I use the lowest price of oil the last two years. The 3.5% is using the highest price the last two years.

[27] The factor is obtained from the booklet "Fokus på solenergi", and illustrates the loss of heat in the pipes between the solar panel and the storage tank.

3. To get the net present value of future saved amounts I discount any amount with the interest of my parents' overdraft facility. The interest is assumed to be 12%.

4.1.3.2 Results

Table 4.1.3.2.1 shows the results of the calculation. Details can be seen in appendix VI. The solar heating panel must save between 327 and 495 corrected liters of oil per year in order to be profitable with 404 liters per year as the most realistic setup.

Table 4.1.3.2.1 Needed Oil Savings per Year to Break Even

	Standard Case	Worst Case	Best Case
System price	kr 30.000	kr 37.000	kr 24.000
Annual debt service as a percent of system price	8,64%	8,64%	8,64%
Oil price, start	kr 6.522	kr 6.522	kr 6.522
Growth in oil price	2,00%	0,00%	3,50%
Interest on overdraft facility	12,0%	15,0%	10,0%
Required oilsavings in liters	376	461	305
Oil savings corrected with factor 0.93	***404***	***495***	***327***

Note: Details can be seen in appendix VI. The corrected oil saving value is the value that should be compared to data from other solar heating systems.

Compared to an annual oil expenditure of 2,328 liters the results is relatively stabile to changes in the setup with a corrected saving rate between 14.0% and 21.3% depending on the case.

4.1.4 Comparing with Estimates from Other Sources

In general the estimated savings following a solar heating panel of the size considered here varies from 300 liters[28] up to 1,000 liters[29] per year, which makes it hard to conclude anything for sure. As assistance I have calculated a guess based on the more consistent estimate of the effect per square meter of the system. Several sources have estimated the yearly production of a solar panel in Denmark to be 500 kWh/m^2.[30] As the size of the considered system is 9 m^2, this gives a yearly production of 4,500 kWh which adjusted with the 0.93 factor equals to 4,185 kWh. If we assume that 80% of this is useful energy

[28] "Fokus på solenergi", The Danish Ministry for Energy and Environment, 2000

[29] http://www.sologbio.dk/solenergi.php

[30] www.vvfs.dk, Fokus på solenergi", The Danish Ministry for Energy and Environment, 2000, www.sologbio.dk, and others.

(i.e. is present when needed), and that the oil furnace burns at 80% efficiency[31], this equals a total oil saving of 420 liters given a 35.9 MJ/l energy content of oil.
Based on the above, I conclude that an investment in a solar heating system is likely to pay its own way.

4.1.5 Improving the Effectiveness

There are several ways to improve the effectiveness of the solar heating system. The most prominent is the drainage system[32] (see appendix VII), which basically consists of a large container close to the solar panel which functions as the storage tank. An intelligent pump secures that there is only water in the solar panel, when the panel is hotter than the water in the tank. This system is specific designed for household with a relatively high heat usage during summer time.
The primary benefits of the drainage system are that it is independent of the distance to the hot-water tank (as the drainage tank can be placed anywhere) and it has a higher capacity (the system from Arcon (www.arcon.dk) has a 500 liters tank). Moreover it does not need anti-freeze liquid as the pump empties the panel when it is freezing.
Unfortunately, I have not been able to find an offer on this system. However, as the system ensures that the existing hot-water tank can be used, I believe this system will have greater economic value to my parents.

4.2 Other Investments

4.2.1 Power Saving Circulation Pump

The problem with the existing circulation pump is that it is like an outboard motor which does not know whether the boat is out of or in the water. The Danish company Grundfoss has produced an intelligent circulation pump which only pumps when it is needed. The new pump spends only 50% of the electricity compared to a normal pump, and has a pay

[31] This is in correspondence with the estimate used in calculations by Denmark's Technological Institute (www.teknologisk.dk)
[32] http://www.arcon.dk

back time of 1-2 years.[33] The expected lifetime of the pump is 10 to 15 years, and it costs approximately DKK 250 more than a conventional pump (which costs in the area of DKK 1,500[34]). Given the short pay back period, this is expected to be a profitable investment.

4.2.2 Heat Pump

I have only been able to find prices and estimates of savings for large heat pump systems which replaces the oil furnace. In general the simple repayment period is estimated to be around five to ten years.[35] These are all estimates made by distributors and in general seem a little biased towards greater economic value. Anyway, as my parents' oil furnace is only a few years old, it is as good as certain that the investment in a large heat pump circulation system would not be profitable at this point in time.

The smaller systems I have been able to find the Swedish produced Octopus Ispinne (Octopus Ice-lolly)[36] looks very interesting. First of all, it is designed to operate at temperatures between -8°C and +8 °C, which makes it perfect for Danish weather conditions. Moreover, the heat is transferred via water, which makes it possible to connect it to the existing hot-water radiator system. Finally, it has only one moving mechanical part (a compressor) which reduces the maintenance costs and prolong the expected economic life.

4.2.3 Energy Windows

Energy windows are filled with argon and have an ultra-thin coating which allows the sun light to enter through the window but reflects the radiation heat (like the green house effect). The estimated yearly effect of an energy window is 120 kWh/m^2.[37] My parents have approximately 16 square meters of windows facing south, which would imply a 1,920 kWh contribution to room heating if all windows were exchanged. Compared to a

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[33] Borsen, June 15, 2004.

[34] Several websites

[35] http://www.teknologisk.dk/varmepumpeinfo/13206, http://www.kh-nordtherm.dk/ny_side_7.htm, http://www.kh-nordtherm.dk/okonomi1.htm, and others.

[36] http://www.malmoenergigolv.se/

[37] http://www.enho.dk

yearly heat effect from the oil furnace of approximately 18,500 kWh[38] this is a significant contribution. Most companies recommend that energy windows are installed gradually, as the old windows double glazed windows puncture.

5 Conclusion

As I stated in the introduction to this paper, my parents' house is already relatively well isolated. However, there are still profitable investments which could be undertaken in order to reduce my parents' overall energy expenditure. In this paper I have primarily focused on a major investment in a solar heating system. Being very conservative I have found that a standard solar energy system is likely to pay its own way. I have argued that investing in another type of system may be even more profitable, and may not only pay its own way, but actually provide an economic surplus.

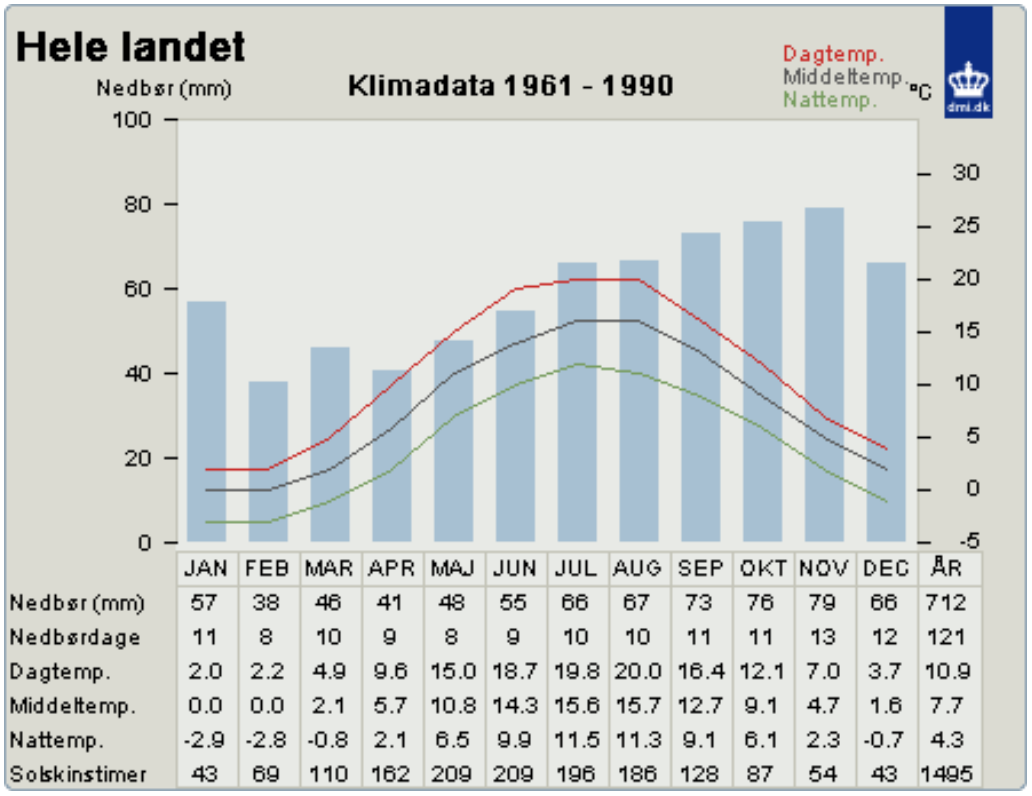
In addition to the solar heating system I have evaluated the impact of a few other energy expenditure saving installments, of which the intelligent circulation pump is safest investment.

Based on the calculations and arguments in this paper, I believe my parents can make interesting investments which, if not profitable, at least reduces the omission of polluting emissions from the burning of fossil fuels at no costs.

[38] Assuming 80% efficiency

Appendix I

Climate Standards for Denmark



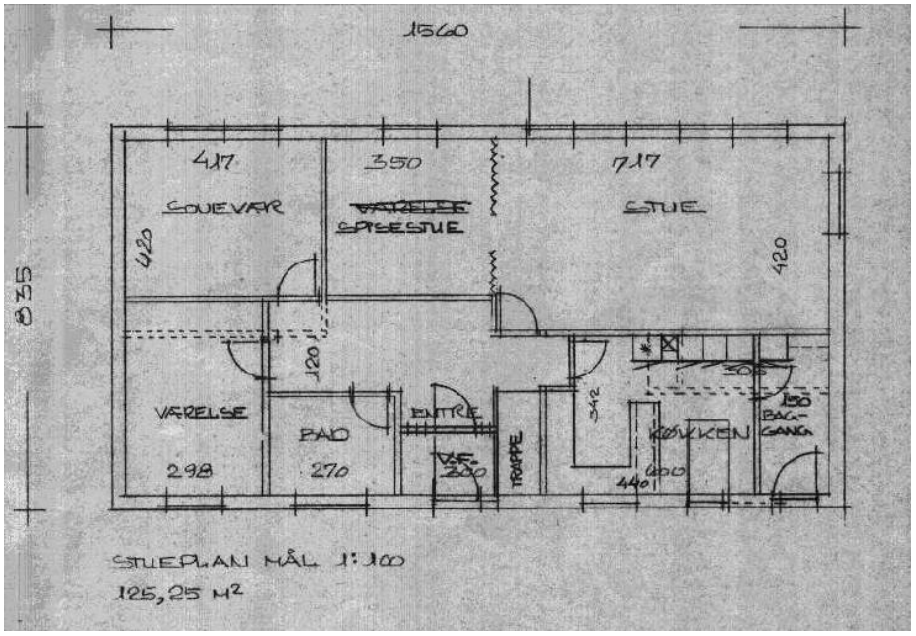
	JAN	FEB	MAR	APR	MAJ	JUN	JUL	AUG	SEP	OKT	NOV	DEC	ÅR
Nedbør (mm)	57	38	46	41	48	55	66	67	73	76	79	66	712
Nedbørdage	11	8	10	9	8	9	10	10	11	11	13	12	121
Dagtemp.	2.0	2.2	4.9	9.6	15.0	18.7	19.8	20.0	16.4	12.1	7.0	3.7	10.9
Middeltemp.	0.0	0.0	2.1	5.7	10.8	14.3	15.6	15.7	12.7	9.1	4.7	1.6	7.7
Nattemp.	-2.9	-2.8	-0.8	2.1	6.5	9.9	11.5	11.3	9.1	6.1	2.3	-0.7	4.3
Solskinstimer	43	69	110	162	209	209	196	186	128	87	54	43	1495

Source: The Danish Meteorological Institute.

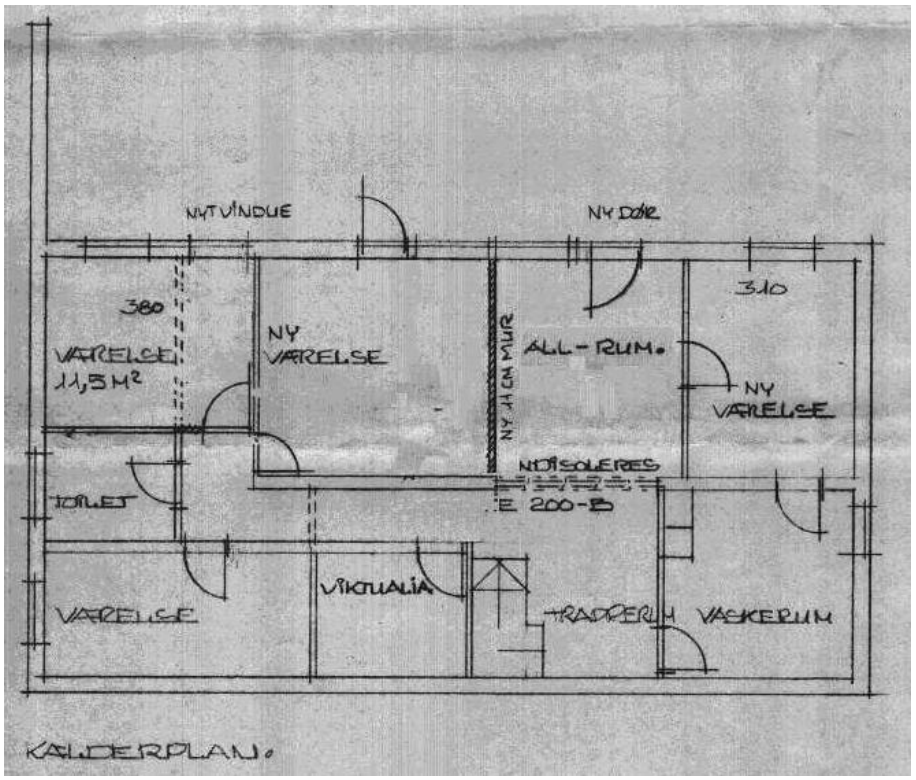
Note: The figure shows the normal weather standards for Denmark based on the period from 1961 to 1990. The left scale measures rainfall in millimeters, the right scale shows temperatures measured in Celsius. The red line is daily high, green is daily low, and the blue line is the daily average. The lower left column is from the top; rainfall, wet days, day temperature, mean temperature, night temperature, and hours of sunshine.

Appendix II

First floor



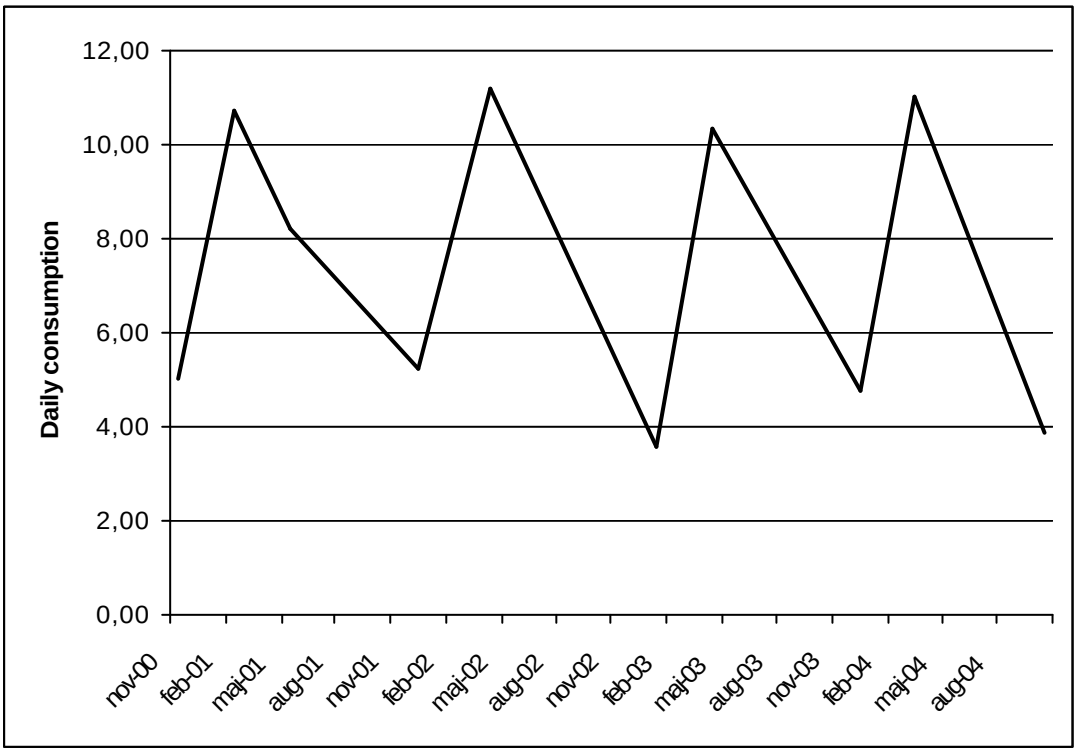
Basement



Appendix III

Date	Liters of oil delivered	Days since last delivery	Daily consumption
27-apr-00	1065		
21-nov-00	1043	208	5,01
13-feb-01	900	84	10,71
25-maj-01	831	101	8,23
6-dec-01	1016	195	5,21
3-apr-02	1320	118	11,19
17-jan-03	1023	289	3,54
28-apr-03	1043	101	10,33
8-dec-03	1064	224	4,75
12-mar-04	1047	95	11,02
15-okt-04	838	217	3,86
Per year	2328		

Note: The yearly consumption is calculated as the sum of oil delivered from November 21st 2000 until October 15th 2004 divided with 47 months and multiplied with 12. I use these dates in order to get as close to a whole season cycle as possible given the data.

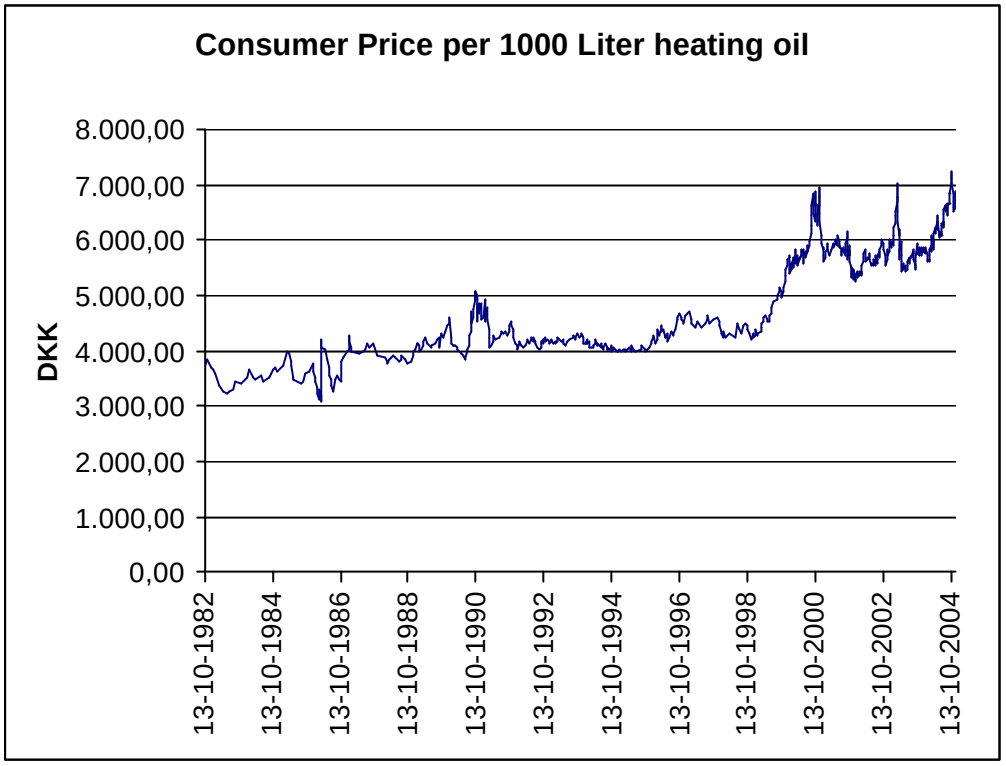


Appendix IV

Date	Reading, KWh	Daily Consumption
2-apr-00	185.187	
27-apr-00	185.697	20,39
31-maj-00	186.287	17,35
25-jun-00	186.689	16,08
25-jul-00	187.076	12,90
28-aug-00	187.675	17,62
10-sep-00	187.940	20,35
7-nov-00	189.122	20,38
13-dec-00	189.967	23,47
28-jan-01	191.015	22,79
9-maj-01	192.839	18,06
18-jul-01	193.963	16,06
6-nov-01	196.059	18,88
6-nov-02	203.108	19,31
15-dec-02	203.861	19,30
4-nov-03	209.208	16,50
11-nov-03	209.318	15,64
4-dec-03	209.689	16,15
5-mar-04	211.067	14,97
14-nov-04	213.843	10,93
Per year	4.526	12,30

Note: The yearly consumption is based on the last year. As the consumption of electricity is relatively independent from weather conditions which can differ from year to year, this is not a serious flaw. The recent drop in consumption is ascribed to the last child moving out August 2003.

Appendix V

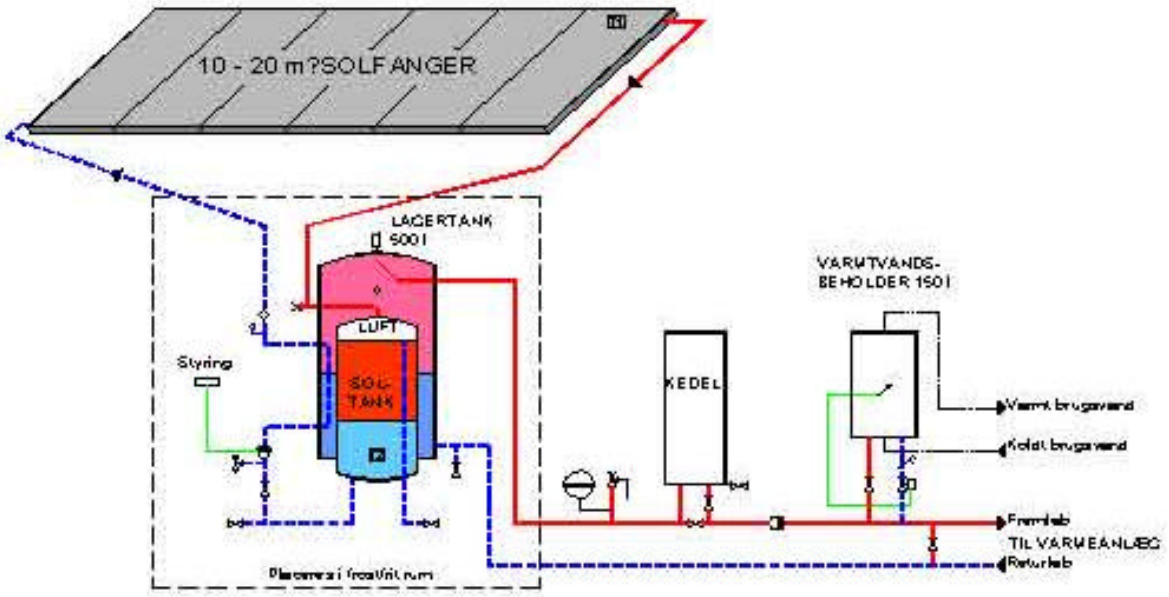


Source: www.oil-forum.dk/Priser/Prisudvikling.aspx

Appendix VI

	Standard Case	Worst Case	Best Case			
System price	30.000	37.000	24.000			
Annual debt service as a percent of system price	8,64%	8,64%	8,64%			
Oil price, start	kr 6.522	kr 6.522	kr 6.522			
Growth in oil price	2,00%	0,00%	3,50%			
Interest on overdraft facility	12,0%	15,0%	10,0%			
Required oilsavings in liters	376	461	305			
Oil savings corrected with factor 0.93	***404***	***495***	***327***			
Year	**1**	**2**	**3**	**4**	**5**	**6**
20 year loan	kr 2.592,00	kr 2.592,00	kr 2.592,00	kr 2.592,00	kr 2.592,00	kr 2.592,00
Maintenance	kr -	kr -	kr -	kr -	kr -	kr 300,00
Total costs	kr 2.592,00	kr 2.592,00	kr 2.592,00	kr 2.592,00	kr 2.592,00	kr 2.892,00
Oil price	kr 6.522	kr 6.652	kr 6.785	kr 6.921	kr 7.060	kr 7.201
Amount saved	kr 2.449,03	kr 2.498,02	kr 2.547,98	kr 2.598,94	kr 2.650,91	kr 2.703,93
'Profit'	kr (142,97)	kr (93,98)	kr (44,02)	kr 6,94	kr 58,91	kr (188,07)
Year	**7**	**8**	**9**	**10**	**11**	**12**
20 year loan	kr 2.592,00	kr 2.592,00	kr 2.592,00	kr 2.592,00	kr 2.592,00	kr 2.592,00
Maintenance	kr 300,00	kr 300,00	kr 300,00	kr 300,00	kr 300,00	kr 300,00
Total costs	kr 2.892,00	kr 2.892,00	kr 2.892,00	kr 2.892,00	kr 2.892,00	kr 2.892,00
Oil price	kr 7.345	kr 7.492	kr 7.642	kr 7.794	kr 7.950	kr 8.109
Amount saved	kr 2.758,01	kr 2.813,17	kr 2.869,43	kr 2.926,82	kr 2.985,36	kr 3.045,07
'Profit'	kr (133,99)	kr (78,83)	kr (22,57)	kr 34,82	kr 93,36	kr 153,07
Year	**13**	**14**	**15**	**16**	**17**	**18**
20 year loan	kr 2.592,00	kr 2.592,00	kr 2.592,00	kr 2.592,00	kr 2.592,00	kr 2.592,00
Maintenance	kr 300,00	kr 300,00	kr 300,00	kr 600,00	kr 600,00	kr 600,00
Total costs	kr 2.892,00	kr 2.892,00	kr 2.892,00	kr 3.192,00	kr 3.192,00	kr 3.192,00
Oil price	kr 8.271	kr 8.437	kr 8.606	kr 8.778	kr 8.953	kr 9.132
Amount saved	kr 3.105,97	kr 3.168,09	kr 3.231,45	kr 3.296,08	kr 3.362,00	kr 3.429,24
'Profit'	kr 213,97	kr 276,09	kr 339,45	kr 104,08	kr 170,00	kr 237,24
Year	**19**	**20**				
20 year loan	kr 2.592,00	kr 2.592,00				
Maintenance	kr 600,00	kr 600,00				
Total costs	kr 3.192,00	kr 3.192,00				
Oil price	kr 9.315	kr 9.501				
Amount saved	kr 3.497,82	kr 3.567,78				
'Profit'	kr 305,82	kr 375,78				

Appendix VII



Source: www.arcon.dk