
	<b>Design of a heat pump heating system with Aquarea Designer</b>	
	Project: МАКАРОВ	Date: 17.1.2016 г.
Created by:	?, (no data provided), (no data provided) Phone: (no data provided) Email: (no data provided)	

## Hausdaten

<i>Address</i>	МАКАРОВ
	Варна
<i>Location</i>	Varna (BG) (from database)
<i>Building area</i>	90 m <sup>2</sup>
<i>Standard heating requirement</i>	6.5 kW
<i>Cooling</i>	-- kW
<i>Internal gains</i>	2700 kWh/year
<i>Solar gains (windows)</i>	1620 kWh/year
<i>Indoor design temperature</i>	22 °C
<i>Outdoor temp. limit for heating 'on'</i>	15 °C
<i>Heat distribution</i>	Underfloor heating by 100 % Radiator heating by -- % Wall heating by -- %
<i>Max. flow water temperature</i>	35 °C
<i>Max. return water temperature</i>	30 °C
<i>Solar collector area</i>	-- m <sup>2</sup>

## Service hot water

<i>Type of service</i>	Hot water with heat pump
<i>Tank volume</i>	200 litre
<i>Average daily need</i>	150 litre
<i>Cold water inlet temperature</i>	10 °C
<i>Target tank temperature</i>	50 °C
<i>Exchange losses</i>	5 K
<i>Electrical auxiliary heating necessary</i>	no

## Rate data

<i>Description</i>	BG	
<i>Shut off times total</i>	0.0 h/day	
<i>Weekends with shut off times</i>	no	
<i>Daytime rate of heat pump</i>	Time for daytime rate 7 - 23 o'clock	20.0 st/kWh
<i>Nighttime rate of heat pump</i>	Time for nighttime rate 23 - 7 o'clock	10.0 st/kWh
<i>Heat circulation pump(s)</i>	like heat pump: yes	-- st/kWh
<i>Heating element for monoenergetic operation</i>	like heat pump: yes	-- st/kWh
<i>Heating element for post heating of hot water</i>	like heat pump: yes	-- st/kWh

## Climatic data

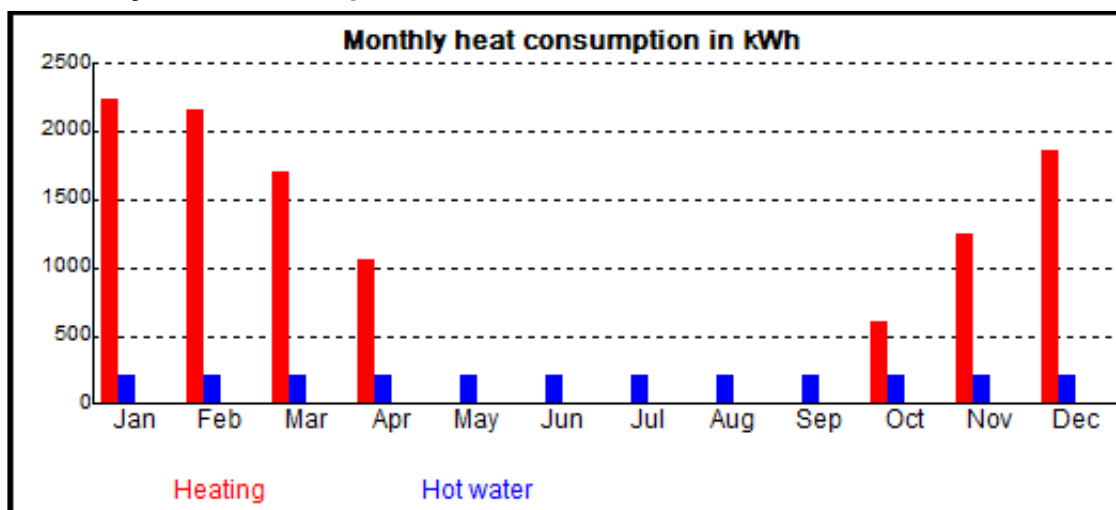
<i>Climatic location</i>	Varna (BG) (from database)		
<i>Monthly average temperatures in °C</i>			
<i>Jan</i>	1.9	<i>Jul</i>	22.0
<i>Feb</i>	2.4	<i>Aug</i>	21.8
<i>Mar</i>	5.6	<i>Sep</i>	18.5
<i>Apr</i>	10.2	<i>Okt</i>	13.4
<i>May</i>	15.6	<i>Nov</i>	8.8
<i>Jun</i>	20.0	<i>Dec</i>	4.5

## Used Panasonic heat pump

<i>Description</i>	WH-SXC09F3E5
<i>Sanitary tank</i>	All in one
<i>Heat pump type</i>	air / water
<i>Wattage at 2/35</i>	heat: 9.2 kW, electric: 2.5 kW
<i>Recommended flow-through of air</i>	4600.0 m <sup>3</sup> /h
<i>Max. flow temperature</i>	55 °C
<i>Mode of operation</i>	monovalent
<i>Design/Bivalent temperature</i>	-11.0 °C
<i>Number of heat pumps used</i>	1
<i>Wattage of fan (included in heat pump performance data: yes)</i>	60 W
<i>Wattage of heat circulation pump(s)</i>	60 W

## Calculation results

### Monthly heat consumption



### Total heat consumption

Heat consumption supplied	Space heating	Service hot water	Cooling
<i>by heat pump</i>	10883 kWh	2522 kWh	-- kWh
<i>by second heat source</i>	0 kWh	0 kWh	

### Power consumption

by heat pump	
<i>for space heating</i>	2060 kWh/year
<i>for cooling</i>	-- kWh/year
<i>for service hot water</i>	791 kWh/year

By Hot water heating rod (additional power for non-monovalent mode of operation)	
<i>for space heating</i>	0 kWh/year
<i>for service hot water</i>	0 kWh/year

By auxiliary components	
<i>Fan (included in heat pump performance data: yes)</i>	83 kWh/year
<i>Heat circulation pump(s)</i>	317 kWh/year

### Operating time of heat pump

<i>for space heating</i>	1133 h/year
<i>for cooling</i>	-- h/year
<i>for service hot water</i>	256 h/year

### Heat withdrawal from heat source

<i>for space heating</i>	8906 kWh/year
<i>for service hot water</i>	1763 kWh/year

## Annual energy costs

### Caused by heat producers

<i>Heat pump</i>	476 lv
<i>Hot water heating rod</i>	0 lv

### Caused by heat consumers

<i>Space heating</i>	309 lv
<i>Cooling</i>	0 lv
<i>Service hot water</i>	119 lv
<i>Heat circulation pump(s)</i>	48 lv

### Total

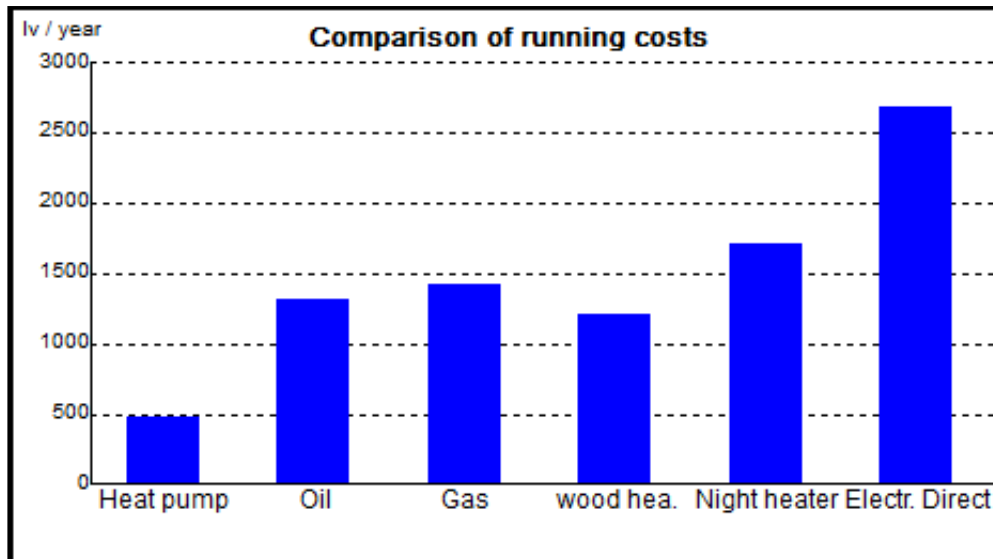
	476 lv
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### Annual C.O.P.

<b>4.7</b>	(auxiliary power included: Heating elements)
<b>-</b>	(with cooling)

## Operational costs

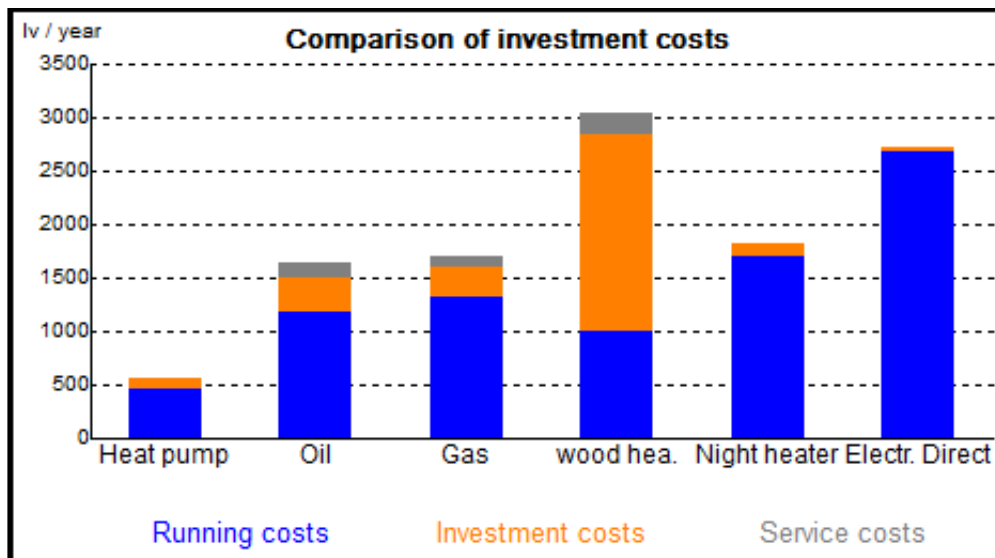
Type of heating	Price in st/kWh	Efficiency [%]	Additional costs in lv/year	Total costs in lv/year
<i>Heat pump</i>			0	476
<i>Oil</i>	6.5	85	265	1324
<i>Gas</i>	7.0	90	350	1426
<i>Electric night storage heater</i>	12.0	100	100	1708
<i>Electric heating element</i>	20.0	100	0	2681
<i>wood heating</i>	5.0	80	343	1214



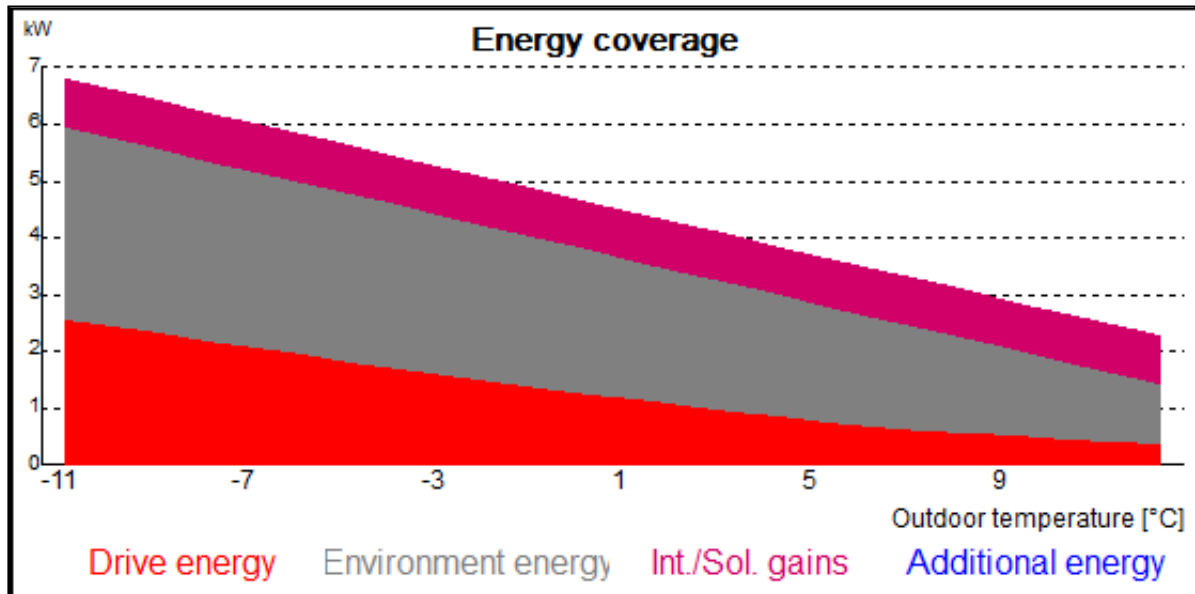
## Investment costs

<i>Reference period:</i>	20 years
<i>Rate of interest:</i>	6.0 %

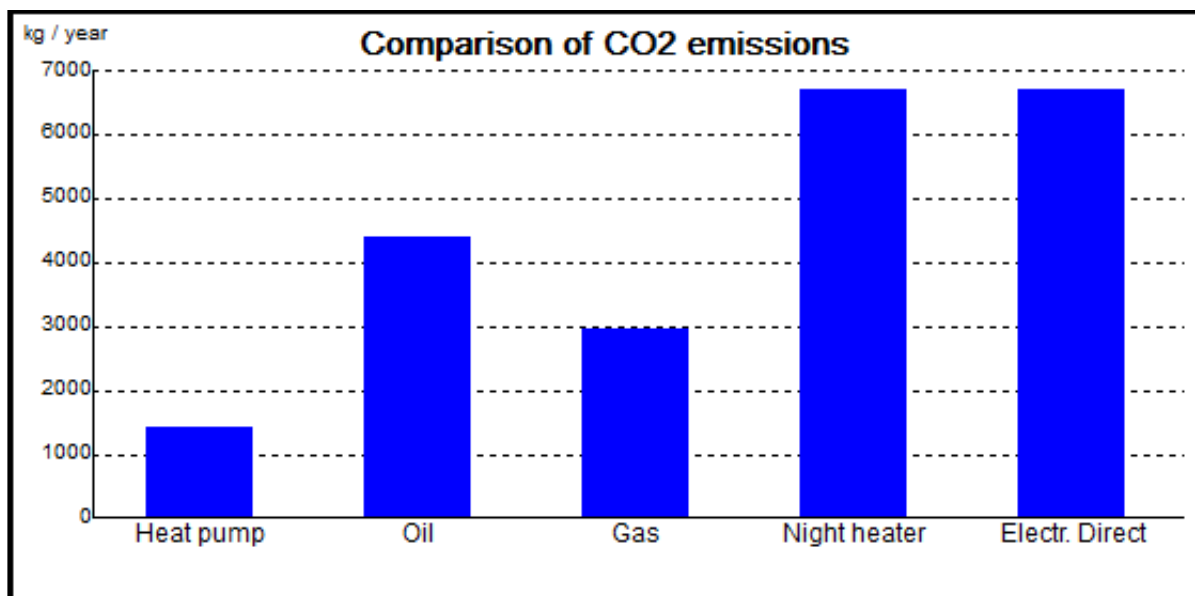
Type of heating	Sum of investment costs in lv	Operational costs in lv/year	Investment costs in lv/year	Total costs in lv/year
<i>Heat pump</i>	--	476	--	--
<i>Oil</i>	4000	1324	319	1643
<i>Gas</i>	3700	1426	276	1702
<i>Electric night storage heater</i>	1500	1708	130	1838
<i>Electric heating element</i>	500	2681	43	2724
<i>wood heating</i>	21500	1214	1845	3059

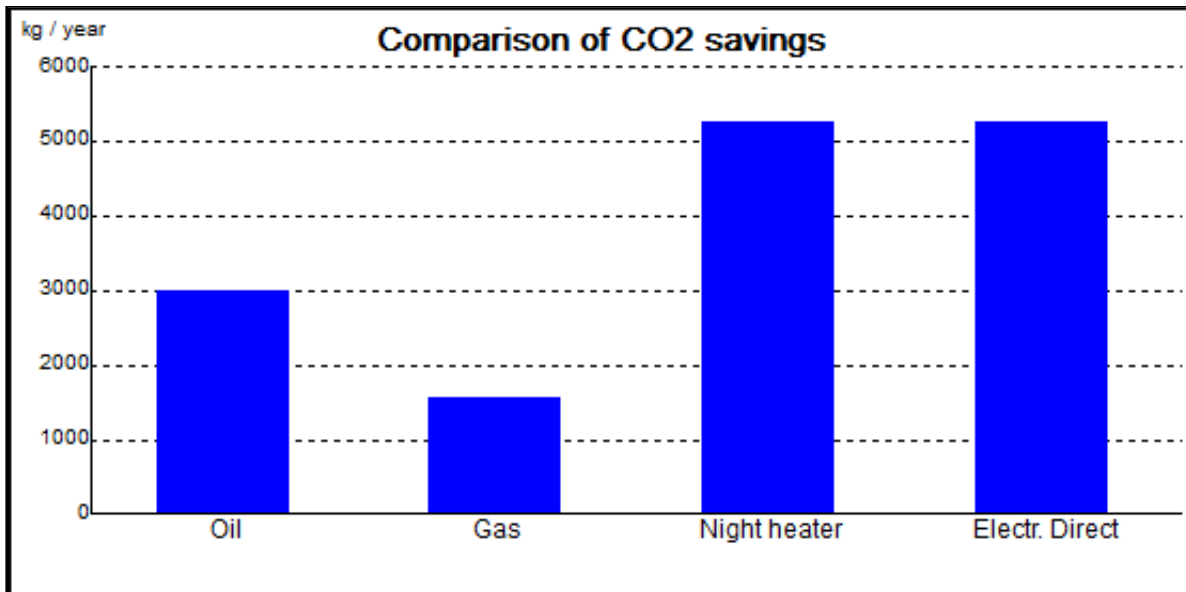


## Energy coverage



## Comparison of CO<sub>2</sub>-Emissions





This calculation is based on user values and valid for normal meteorological conditions. The correct adjustment of the heat pump heating system is assumed. This calculation cannot guarantee that the calculated values are fulfilled in practical operation.