AMMONIA AND CO2

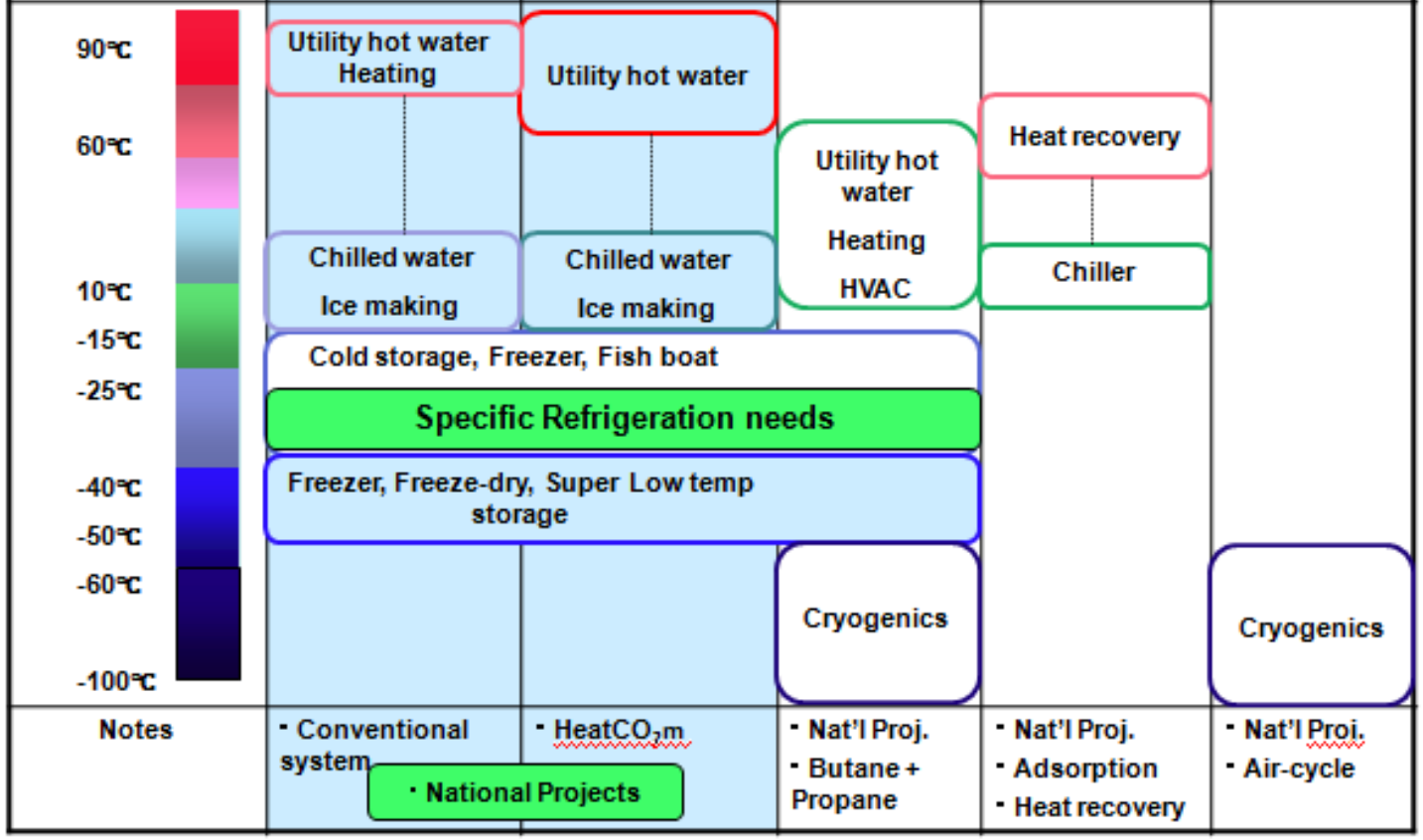
APPLICATIONS

IN

INDUSTRIAL REFRIGERATION PLANTS

DOC.2015-705

"Natural Five" Refrigerants and Product Solutions



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FIELD CASE

SLAUGHTERHOUSE AMMONIA/CO2 SYSTEM

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Ammonia/CO2 plant

Reason for building AMMONIA/CO2 system

1. Increase capacity
2. Phase out existing R22 system
3. Phase out R507 system (F-gas) in near future
4. Reduction of energy consumption & energy costs

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Ammonia/CO2 plant

Hot water needs at 68°C

1. Decrease gas consumption

2. Heat recovery from the NH3 refrigeration system :
   from hot gasses and oil coolers.
   Water is heated from 12°C to 26°C at condensation temperature of 25°C

3. In order to get water at a temperature of 68°C in an energy efficient way,
   we used an ammonia heat pump (ODP & GWP = 0)
   with condensing temperature of 70°C (32,1 barg)

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Ammonia heat pump

HEAT PUMP :
using NH3 refrigeration system condensor heat as heat source

1. Positive impact on condensor load
   using ‘waste’ heat
   decreasing condensor load

2. Recovery of residual heat for hot water production
   -> hot water for cleaning : 65°C

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Ammonia heat pump

DEMANDS

1. WATER TEMPERATURE 65°C
   heat demand : 425 KW (hot water 70 m3/day)

2. WATER TEMPERATURE 25°C
   heat demand : 150 KW (10 m3/hr)

3. COOLING DEMAND : 1000 kW

-> CO2 pump circulation refrigeration system (CO2 at -7°C)

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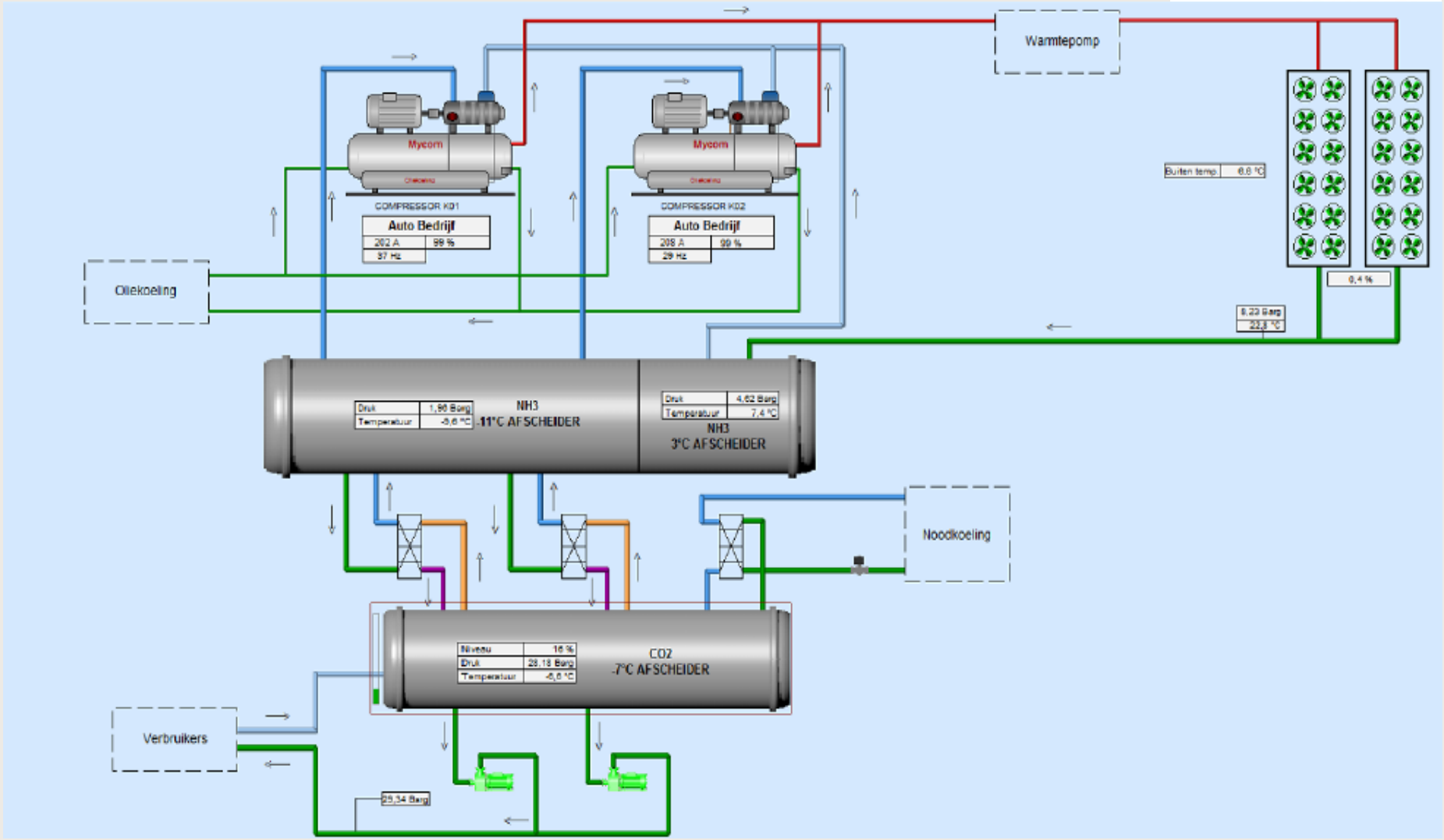
PRINCIPLE SCHEME



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EQUIPMENT

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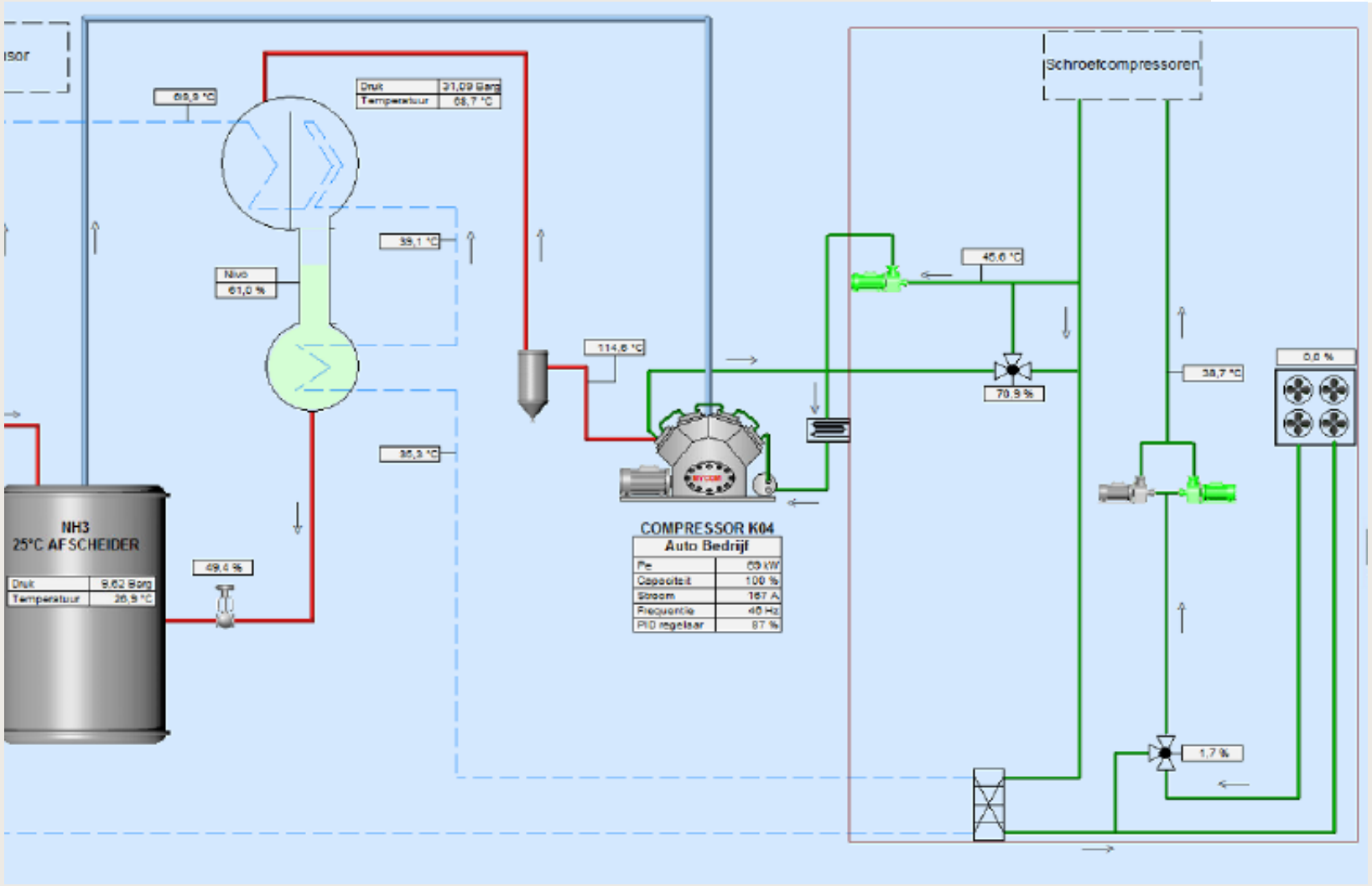
PRINCIPLE SCHEME



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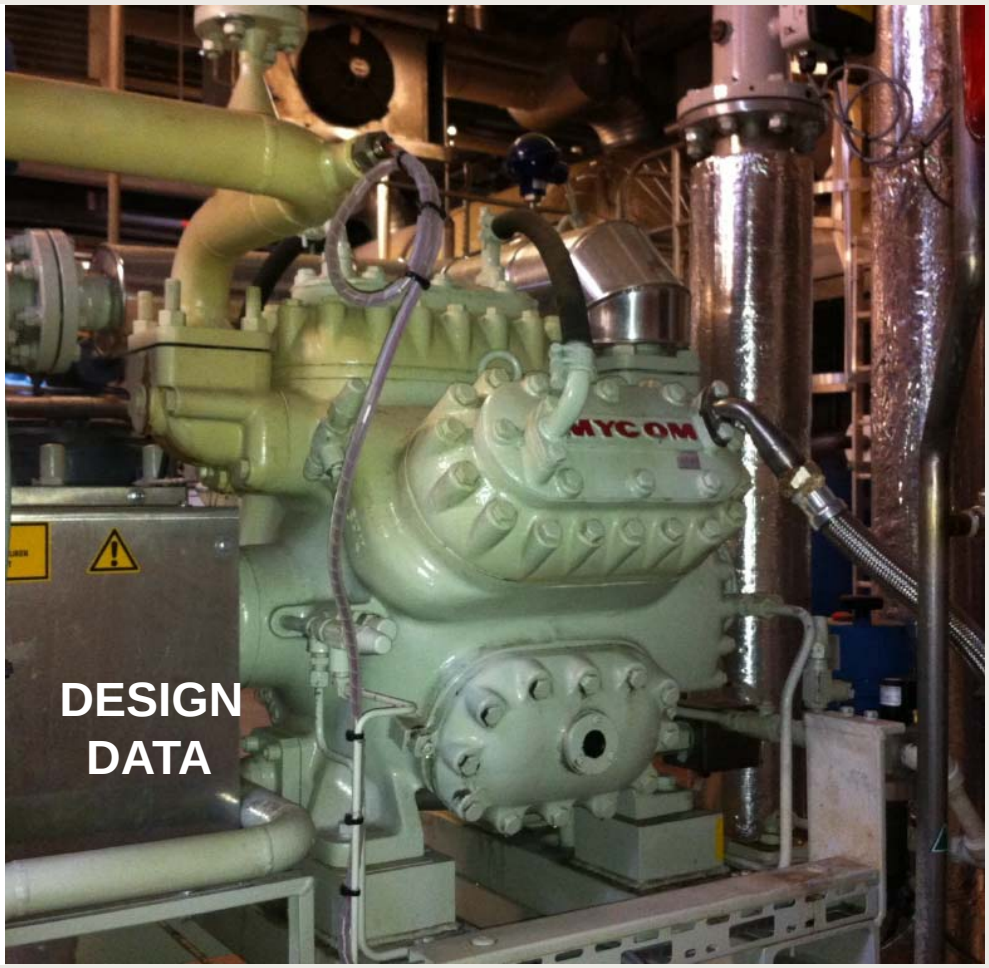
EQUIPMENT

MODEL		N6HK	
QTY		1	
SITE LOCATION COUNTRY TOWN		NEDERLAND	
REFRIGERANT		NH3	
TE	°C	17	25
TC	°C	70	70
PS	barg	6,8	9
PD	barg	32,1	32,1
RPM	rpm	1600	1600
QC	kW	357	468
BKW	kW	80	84
COP-H		**4,5**	**5,6**
OPERATING HOURS			
HP	hrs	4300	



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MAYEKAWA MYCOM

UNIT LAYOUT

Installation date :
December 2011

Operating hours per year
±7000 hrs

Calculation detail :
POWER DRIVE
Efficiency =
97~98%

DRIVE MOTOR
WEG 315S/M 75kW
$\cos^{\psi}$ = 0,87/0,75
efficiency =
93,7/93,2
(100%/50% load)

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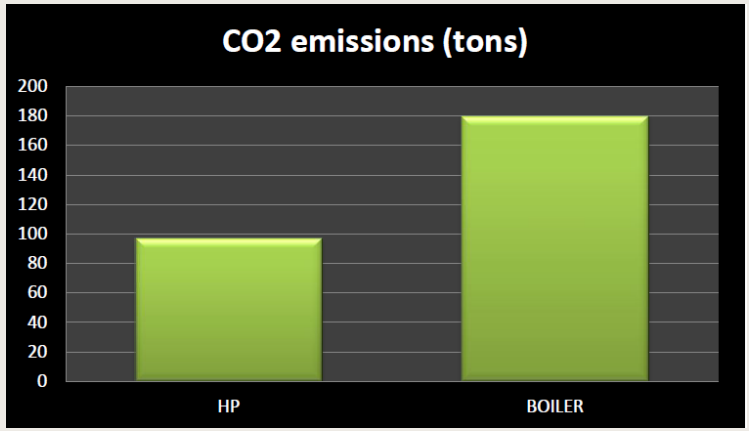
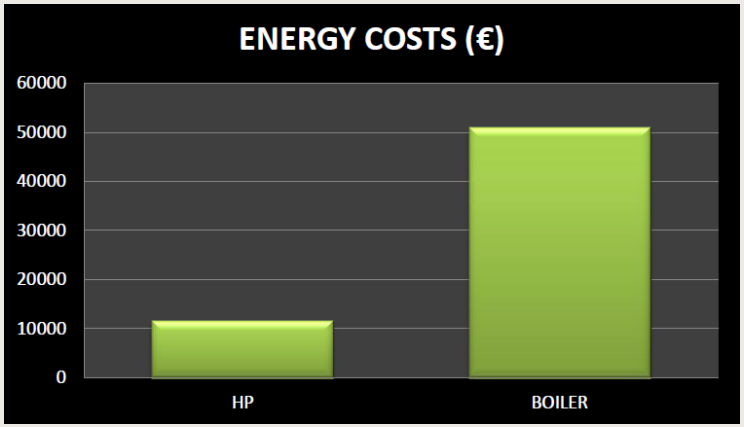
OPERATION SAVINGS

	HEAT PUMP	BOILER
Performance (COP)	4,48(*)	0,85
Hot water(26->68)	425 kW	425 kW
Energy consumption primary (2040 hrs/yr)	193.526 kWh	102.000 m3 natural gas
Energy prices	€ 0,06/kWh	€ 0,50 /m3
Energy costs	€ 11,611,-	€ 51.000,-
CO2 emissions	97 tons	180 tons





(*):incl.losses

OPERATION SAVINGS

	HEAT PUMP	BOILER
Performance (COP)	N.A.	0,85
Hot water(12->26)		142 kW
Energy consumption primary (2040 hrs/yr)		34.080 m3 natural gas
Energy prices		€ 0,50 /m3
Energy costs		€ 17.040,-
CO2 emissions		60 tons
SUMMARY (12->68)		
ENERGY COST	**€ 11,611,-**	**€ 68,040,-**
CO2 EMMISION	**97 tons**	**240 tons**
SAVINGS		
COST	**€ 56,429,-**	
CO2 EMISSION	**143 tons**	

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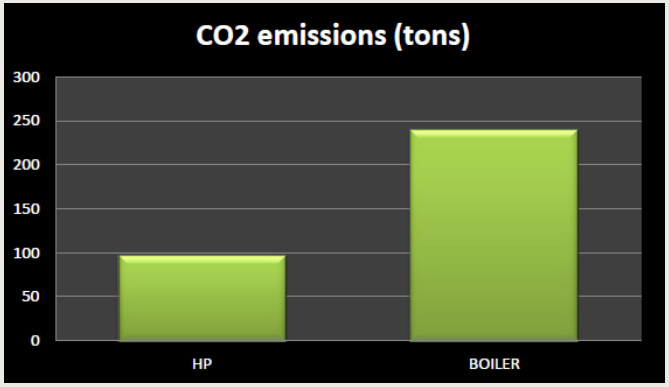
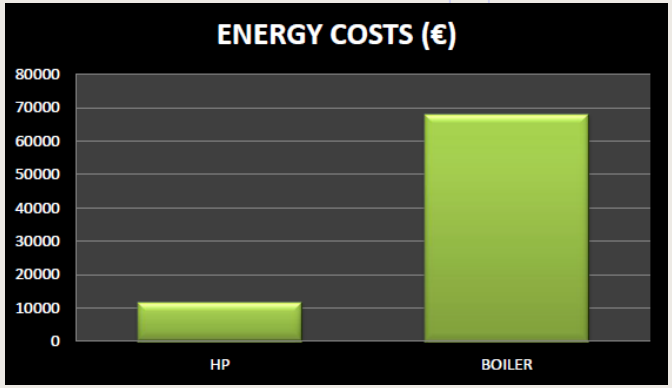
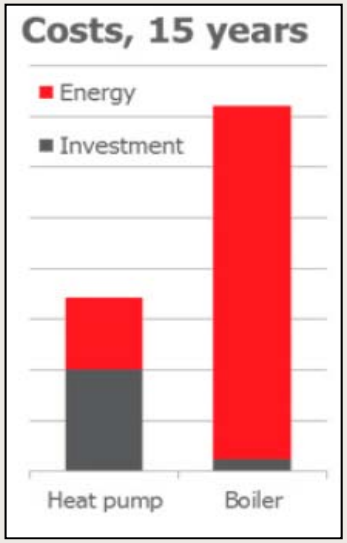
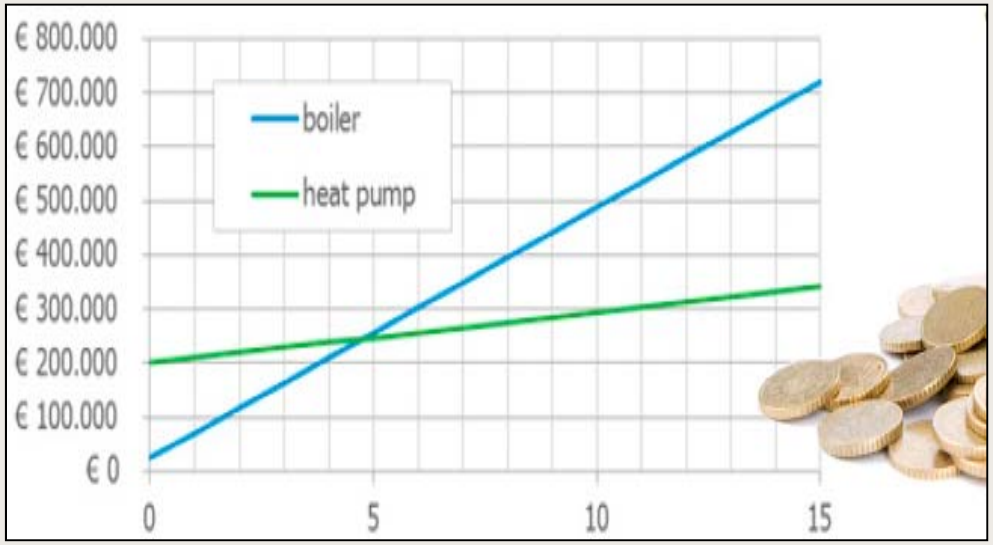
OPERATION SAVINGS









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CONCLUSION :

ANNUAL SAVINGS :

OPERATION 56.429 €
CO2 EMISSION 143 tons
CONDENSOR-WATER (+ treatment)
NATURAL WASTE HEAT
CONDENSOR

INVESTMENT : €200.000 (boiler:€25.000)
RETURN OF INVESTMENT < 5 YRS
In the Netherlands, the investment in a heat pump is eligible for **SUBSIDY** in the form of tax reduction on the investment
HIGHER EFFICIENCY THAN COMPARABLE TECHNOLOGIES

LONG LIFE TIME (>25 YEARS)

MAINTENANCE LOW-COST

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AMMONIA AND CO2 APPLICATIONS IN INDUSTRIAL REFRIGERATION PLANTS

THANKS FOR YOUR ATTENTION !

special thanks to :

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