Best Heatlift solutions fore Ducor petrochemicals selected by Haverkamp Consultancy

Supplier 1 (Norway)

Olvondotech.no

Een unieke techniek

Waar de warmtepomp eindigt

Biedt Olvondo de oplossing

- Stirling motor voor liften van (rest)warmte
- Mogelijke bronwarmte tussen 0° en 100°C graden
- Max. temperatuur-afgifte tussen 100° en 200°C graden t/m stoom 180°C
- Vermogen 750kw per stuk. (uitbreidbaar in cascade)
- Helium als “working fluid”
- Dus i.c.m. duurzame stroom een 100% fossielvrije oplossing!

Typical applications:

- Production of steam or hot process water from waste heat or district heating

Applicable industry segments:

- Pulp & paper
- Food and beverage
- Process and chemical
- Pharmaceutical
- District heating

Experiences :

- More than 60.000 operational hours from pilot installations

Supplier 2 (Germany)

How could an Industrial heatpump look like?

On the next slide we see a few pictures how an Industrial heatpump could look like.

These are 3 different heatpumps from 3 different supplies

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Cascade setup

In house installed

Plug and play
Heatpump in Container

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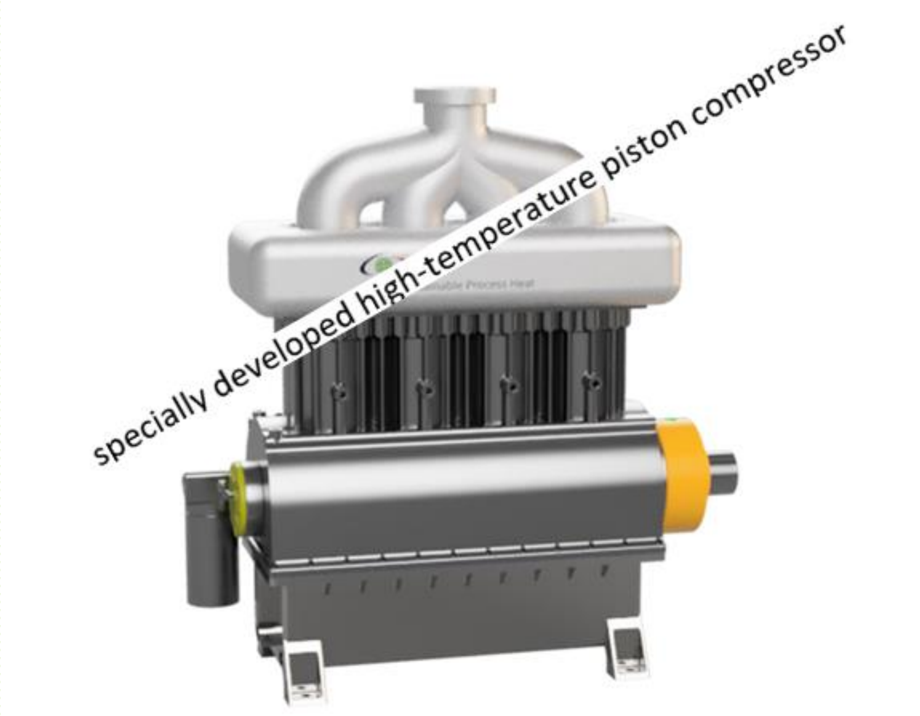
Best matching product

- **Sustainable Process Heat**
- Most flexibel concept,
- meets HT demands incl. WH2Steam
- Startup but ready to market
- Next project 2022 1.4 MW



medium heat source	water, water-glycol, thermal oil, steam
temperature heat source	20°C – 150°C
medium heat sink	water, thermal oil, steam
temperature heat sink	80°C – 200°C
Heating capacity per installed compressor	400 kW – 1000 kW depending on operating point
temperature stroke per step	> 100 K, in practice mostly <80 K
structure	1-stage, 2-stage, parallel, serial
power control	stepless 30%-100%
working media	HFOs with GWP < 10 or natural hydrocarbons

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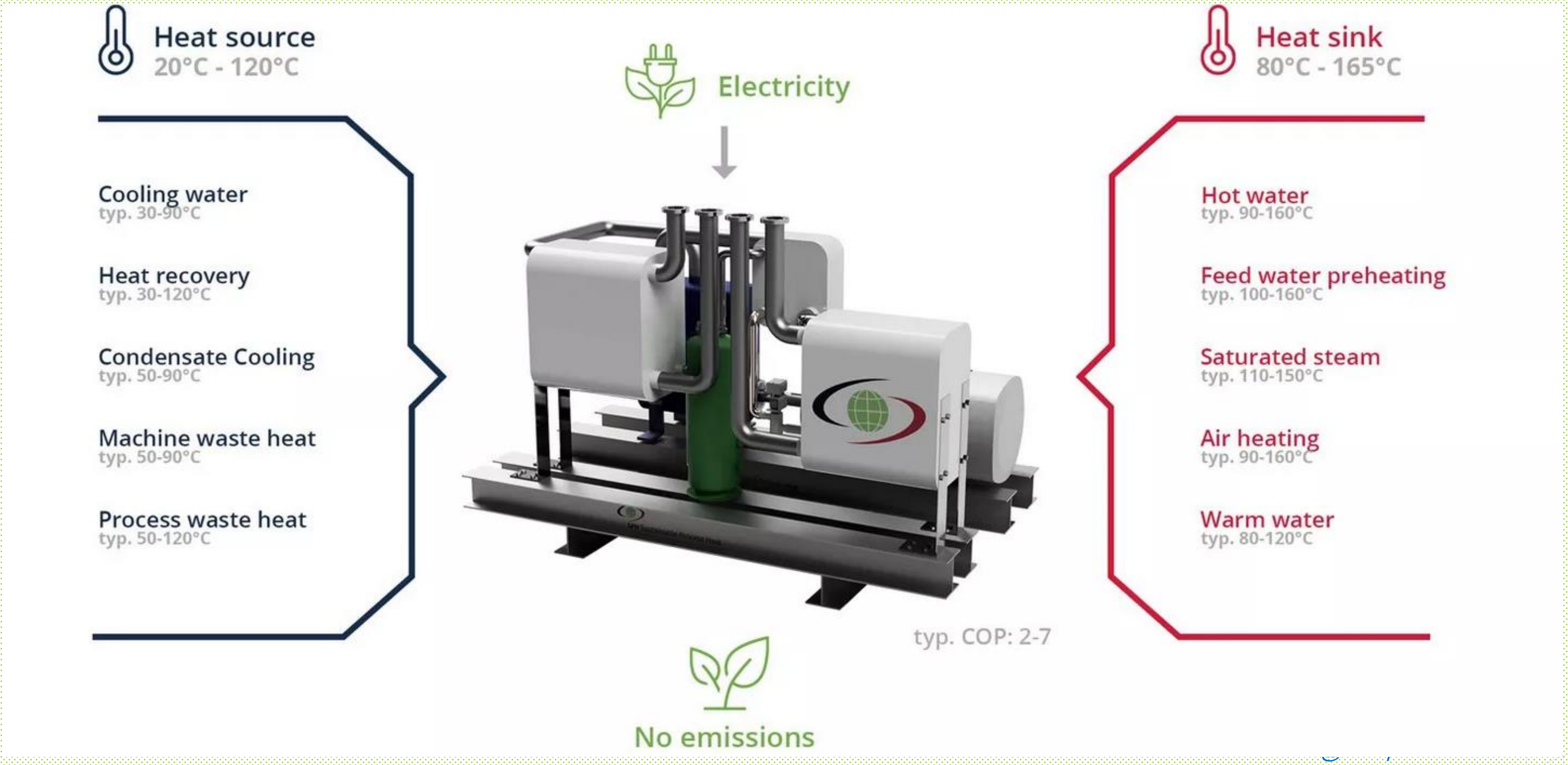
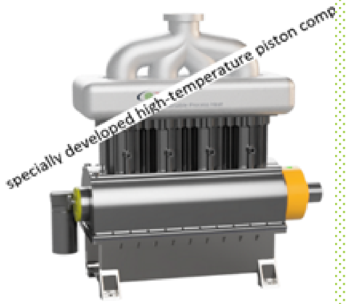

Heat source
20°C - 120°C
Cooling water
typ. 30-90°C
Heat recovery
typ. 30-120°C
Condensate Cooling
typ. 50-90°C
Machine waste heat
typ. 50-90°C
Process waste heat
typ. 50-120°C
Electricity
typ. COP: 2-7
No emissions
Heat sink
80°C - 165°C
Hot water
typ. 90-160°C
Feed water preheating
typ. 100-160°C
Saturated steam
typ. 110-150°C
Air heating
typ. 90-160°C
Warm water
typ. 80-120°C

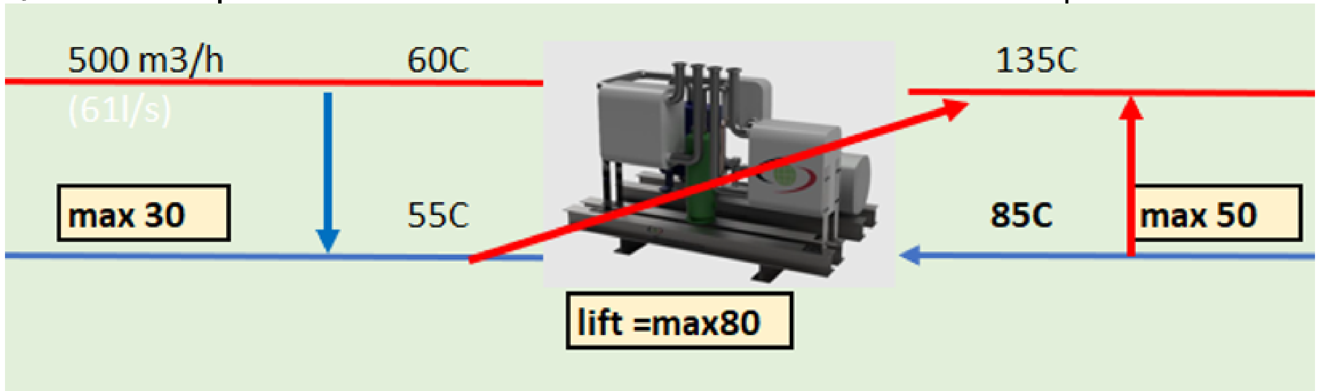
Unique selling point’s

- Fixe machine as 1 fits all applications,
- New design compressor with new higher max lift (80C) *)
- So one compressor using different refrigerants
- Low GWP



- Heat source temperature spread 3°C –30°
- So you can at this point take lot of heat out of a single source.
- Says Source side input /output = 60/30 (as a cooling tower)
- Heat Sink temperature spread 5°C –50°
- Say you could heat from 40/90 or 100/150
- Max. temperature output – 165°C   (**next model 2.0 – max 200°C)**
- No steam needed then use thermal oil fore drying applications for example
- Modulating from 100-30% of max performance.
- Last but not least : Simple but effective so competitive pricing

*) Lift is temperature difference between source and sink output,



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Let see if we could do some calculation and how find some indicated payback time

STEP 1			
Calculated investment heatpump 4.2. MW output			
COP=6 meens power needed/h = 700kw			4200
(Available heat + Power = output)			
prijs/kw ex works	€ 600	/kw	2520000
Setup, transport design etc ???			480000
Budgetprice		**Capex**	**€ 3.000.000**
(EIA available ???)	*Check*		
Power demand/h		KW	700
Yearly running hours			8000
Price / kwh	*Check!*		***€ 0,10***
		Opex	**€ 560.000**
Service & maintenance (SLA)		on reques	**€ 40.000**
Expected lifetime	Year	20	
Simplified calculated yearly			**€ 750.000**
Check:	127, TJ	35000 MW energy	
8000 h * 4,2 MW =		33600 MW energy	94%
So 94% of all steam supplied will be avoid			

STEP 2			
Price of steam is not know			
Actual prices are expected to be extreme high			
base on daly prices of nat. Gas			
I calculate	€ 35	/Ton	
use of ton/hour	5,5		
Yearly cost of steam	8000		
Total cost of steam			**€ 1.540.000**
Price of ton/steam in real life?	*Check*		
Check:	Cost of steam		€ 1.540.000
	heatpump		€ 750.000
	This makes a yearly gain if		**€ 790.000**

First Payback calculations		
Calculated investment		**€ 3.000.000**
Yearly cost of steam???	**€ 1.540.000**	
Yearly cost of heatpump??	**€ 750.000**	
Yearly lower costs	**€ 790.000**	
Yearly payback time		**3,8**

So YES the need of steam will be excluded while using a heatpump
And YES payback time could be lower than 7 years but this is just al lucky shot,
So when all financial data is given then a secure payback time will be available

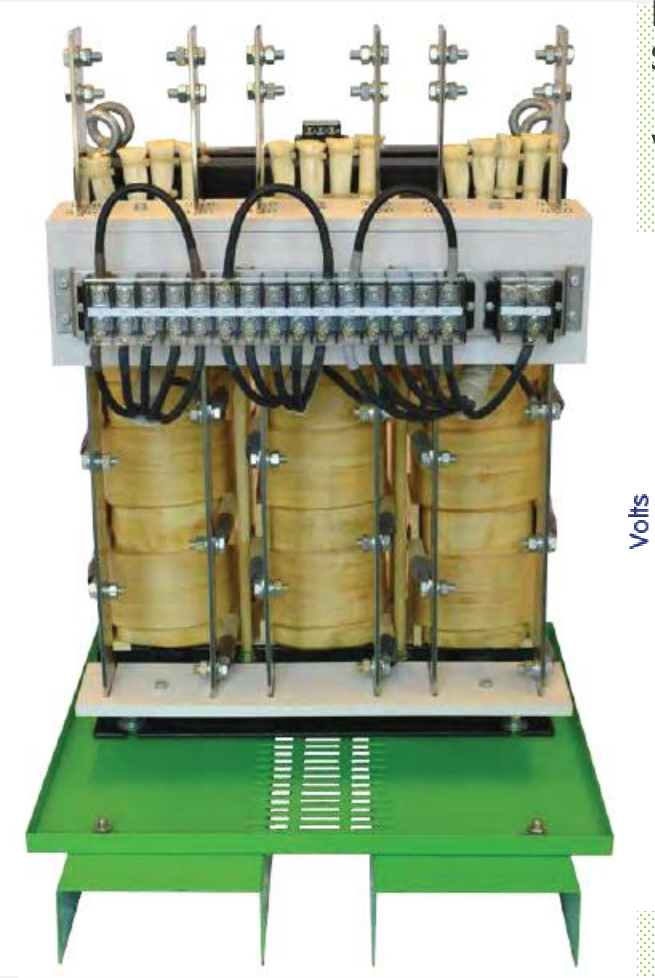
Ducor petrochemicals

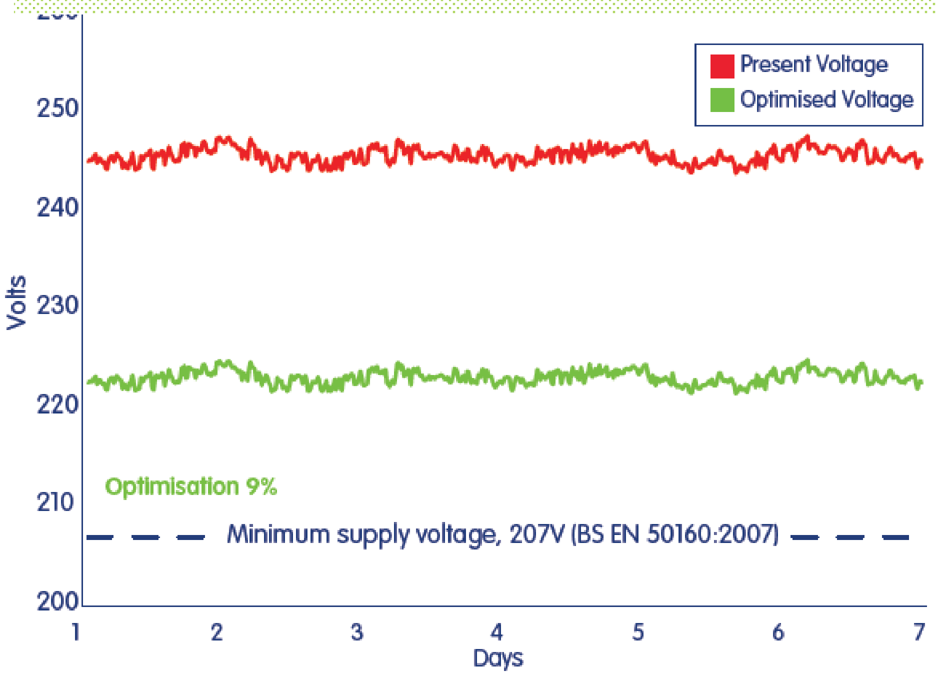
Heatlift + power efficiency (optional)

Extra toevoeging

Stroom optimalisatie technologie voor het besparen van stroom.

Vaak tot wel 8% besparing haalbaar op bestaand stroomgebruik. En dus ook op de kosten van stroom





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Some conclusions and/or ideas to consider.

- Without knowledge of prices of steam and power it is not possible calculating a fair payback time. When this data is kept “secret” then challenge should not be about finding best Payback time !
- Lots of energy is moving around on the plant with lots of difference between temperatures, it seems there a more interesting opportunities re-use of wasted heat. This needs a second check I would say.
- 24 MW energy is lost in cooling towers. Is there any opportunity this could be used once more?
- All quality is as good as clean so this can be directed used in a heatpump or should heat-exchangers should be installed?
- Installing a power optimizing technology could show `higher efficiency of power needs witch will increase all over profits of this case. Could this be an interesting option for the Ducor plant?
- Final challenge will be calculated if all data is available.
- Consider a 1 MW pilot showing proof of performance.
- Consider ESCO solution then no investment and price/uptime.
- Consider cascade concept with lower risk of downtime and easy to maintenance.
- Prefer co-operation with local contractors.

Some conclusions and/or ideas to consider.

- Share data from investigated sustainable study
- Share al data prices of steam and power (past /now and future
- Share data (anonymus) of calculated heatpump.
- Without this data it is hard/impossible calculating a best payback time
- Capex has low effect on PB time
- Cost of steam and power had **high effect** on PB time.
- Include power optimizing technology for decreasing need of power.

Any questions ?

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