A stylized botanical illustration featuring several different types of plants and crops. On the left, there is a tall, thin stem with a large, dark, textured seed head at the top. In the center, there are several green stems with various leaf shapes, including some with serrated edges. To the right, there is a stem with a cluster of yellow, elongated seed heads. The background is a light yellow color, and the plants are rendered in shades of green and black outlines. A dark grey rectangular box is overlaid in the center, containing white text.

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:

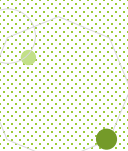
- Production of steam or hot process water from waste heat or district heating


Applicable industry segments:

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

Experiences :

- More than 60.000 operational hours from pilot installations



A botanical illustration featuring several different plant species. On the left, a tall, slender stem rises to a dark, textured, spherical seed head. Next to it is a plant with a thin stem and several pinnate leaves. In the center, a plant has a stem with a small, feathery inflorescence. To its right is a plant with a single, large, yellow, spike-like flower head. Further right is a plant with a stem and several large, lanceolate leaves. On the far right, a plant has a stem with several pinnate leaves. A dark grey horizontal bar is overlaid across the middle of the image, containing the text 'Supplier 2 (Germany)'.

Supplier 2 (Germany)

How could an Industrial heatpump look like?

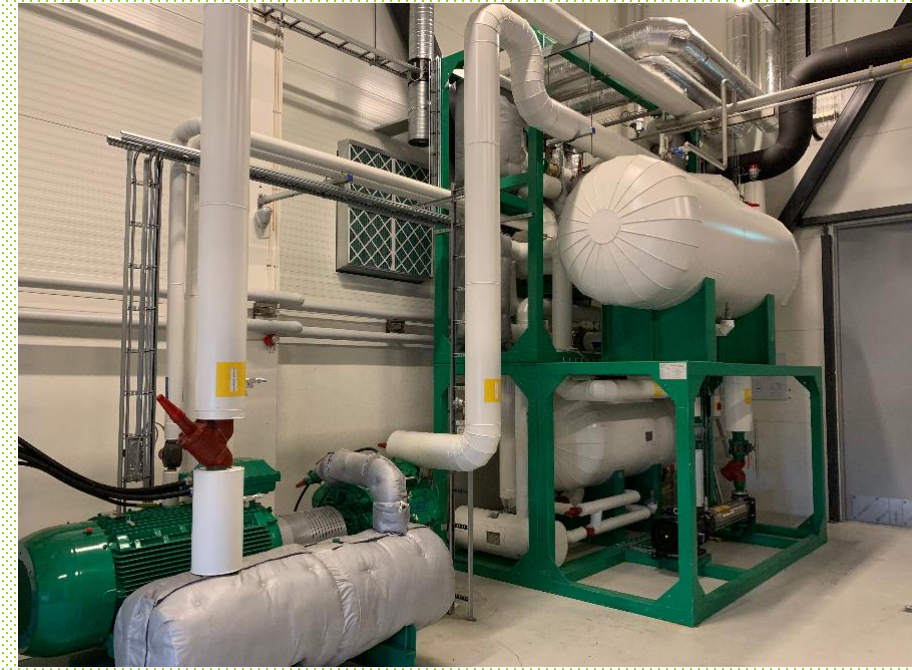
On the next slide we see a few pictures how an Industrial heatpump could look like.

These are 3 different heatpumps from 3 different supplies

Cascade setup



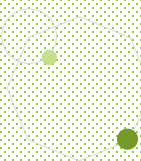
In house installed



Plug and play Heatpump in Container



Haverkamp Consultancy
Borgenweg 5
9502 VB Stadskanaal
0652458028
Info@biochp.nl





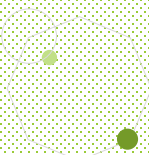
Best matching product

- **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

Haverkamp Consultancy
 Borgenweg 5
 9502 VB Stadskanaal
 0652458028
 Info@biochp.nl





Heat source
20°C - 120°C



Heat sink
80°C - 165°C



Electricity



typ. COP: 2-7



No emissions

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

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

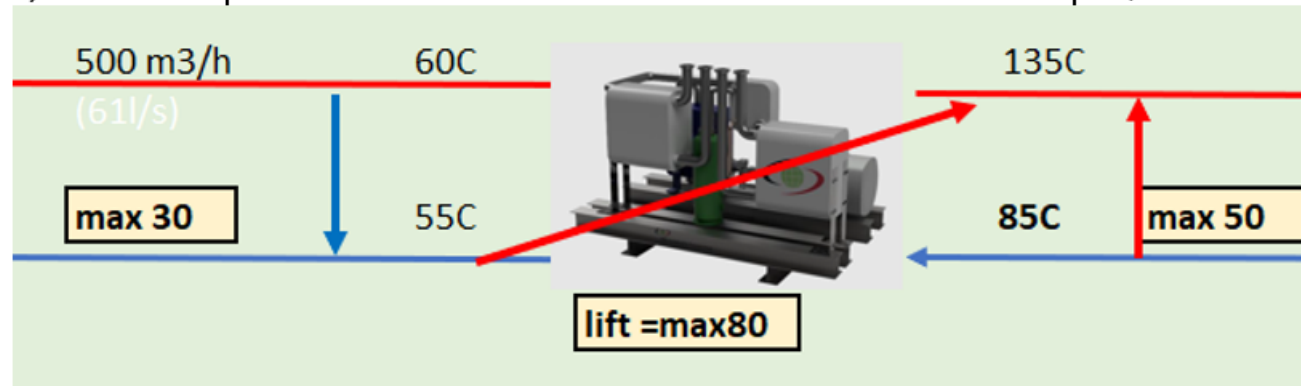
Warm water
typ. 80-120°C

Unique selling point's

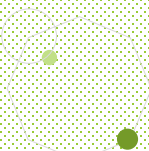
- Fixe machine as 1 fits all applications,
 - New design compressor with new higher max lift (80C) *)
 - So one compressor using different refrigerants
 - Low GWP
-
- Heat source temperature spread 3°C –30°
 - So you can at this point take lot of heat out of a single source.
 - Says Source side input /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,



Haverkamp Consultancy
Borgenweg 5
9502 VB Stadskanaal
0652458028
Info@biochp.nl



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

STEP 1		STEP 2		First Payback calculations	
Calculated investment heatpump 4.2. MW output COP=6 means power needed/h = 700kw 4200 <i>(Available heat + Power = output)</i>		Price of steam is not know Actual prices are expected to be extreme high <i>base on daly prices of nat. Gas</i>		Calculated investment € 3.000.000	
prijs/kw ex works € 600 /kw	2520000	I calculate € 35 /Ton	use of ton/hour 5,5	Yearly cost of steam???	€ 1.540.000
Setup, transport design etc ???	480000	Yearly cost of steam 8000	Total cost of steam € 1.540.000	Yearly cost of heatpump??	€ 750.000
Budgetprice	Capex € 3.000.000			Yearly lower costs	€ 790.000
(EIA available ???)	Check	Price of ton/steam in real life?	Check	Yearly payback time	3,8
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		Check: Cost of steam	€ 1.540.000		
8000 h * 4,2 MW = 33600 MW energy	94%	heatpump	€ 750.000		
So 94% of all steam supplied will be avoid		This makes a yearly gain if	€ 790.000		

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



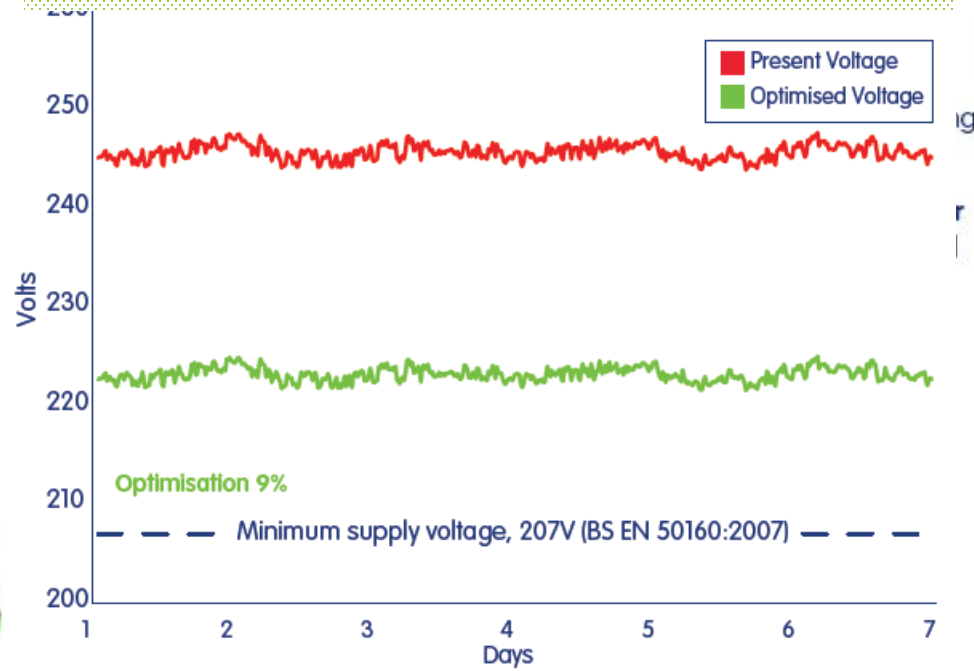
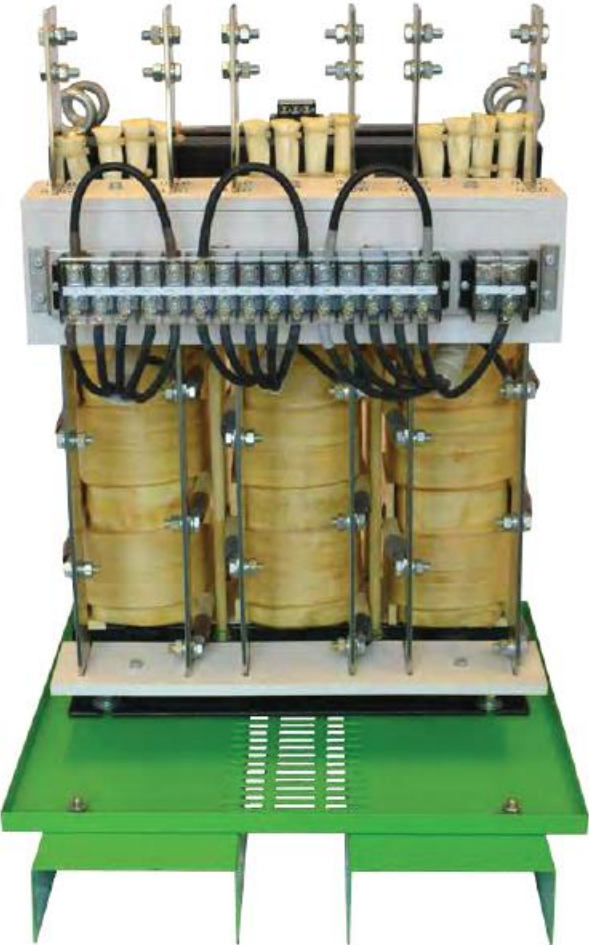
Ducor petrochemicals

Heatlift + power efficiency (optional)

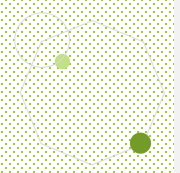
Extra toevoeging

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



Haverkamp Consultancy
Borgenweg 5
9502 VB Stadskanaal
0652458028
Info@biochp.nl



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 all 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 ?

Haverkamp Consultancy
Borgenweg 5
9502 VB Stadskanaal
+31652458028
Info@biochp.nl