



Efficient Electricification of Ethanol Recovery in Pharmaceutical Production

How WSE Heat Pump Technology Transformed Energy Use in Pharma



Overview- Case study

Material Usage for 2025 – Sales Materials Only

All information is WSE Turbo without third-party validation. The information is provided as an indicative basis and may be different in final installations depending on application specific parameters.

About WSE Turbo



Since our formation in 2019 through the strategic partnership of WSE Turbo and Ecergy, WSE Turbo has been synonymous with cutting-edge energy solutions and turbo machinery innovation. Today, we continue that legacy from our headquarters in Denmark, supported by a network of engineers.

WSE Turbo develops and manufactures high-performance turbochargers, steam compressors, and industrial heat pump systems. All designed to maximize efficiency and drive decarbonization. Our solutions harness advanced thermal process optimization and waste heat recovery, helping industries reduce emissions while improving operational performance.

Backed by decades of engineering expertise, we combine precision turbo machinery with intelligent energy systems, supported by dynamic simulation and process modeling. More than a technology provider, we are a strategic partner. Delivering end-to-end support from concept to integration, ensuring solutions are tailored to each client's sustainability goals.

At WSE Turbo, we don't just decarbonize industrial heat. We redefine industrial energy systems for a cleaner, more efficient future.

The Energy Dilemma in Pharmaceutical Manufacturing

In pharmaceutical manufacturing, where precision and efficiency are non-negotiable, ethanol distillation plays a vital role. Especially in recovering alcohol used during production. But this process is also one of the biggest energy drains in the industry.

Steam boilers work year after year to power distillation columns, consuming massive amounts of energy, inflating operating costs, and leaving behind a significant carbon footprint.

That's where WSE Turbo comes in. We specialize in industrial energy optimization, we offer more than just incremental improvements. Our advanced heat pump system is designed to fundamentally rethink how distillation processes are powered, cutting energy use, lowering emissions, and helping the industry move toward a more sustainable future.

The Heat Pump Breakthrough



The Challenge:

- 1400 kW continuous heat demand in primary reboilers
- High-temperature operations at 134°C
- Unsustainable energy costs from traditional steam heating
- Growing pressure from government to reduce carbon footprint

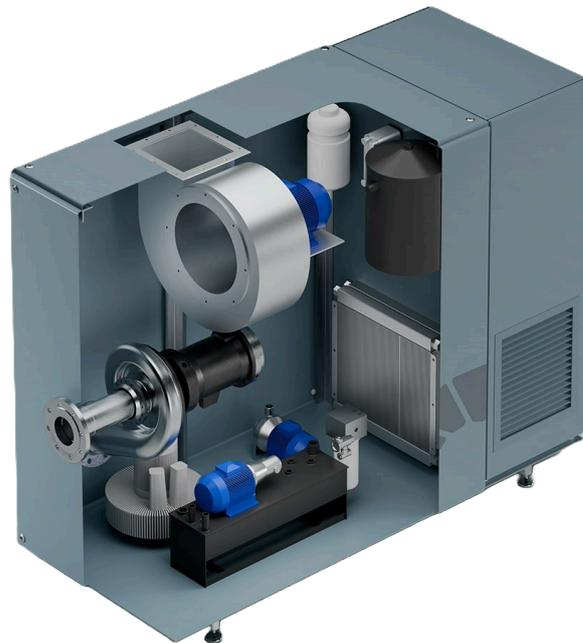


Figure 1: High Speed Heat Pump showing Compressor

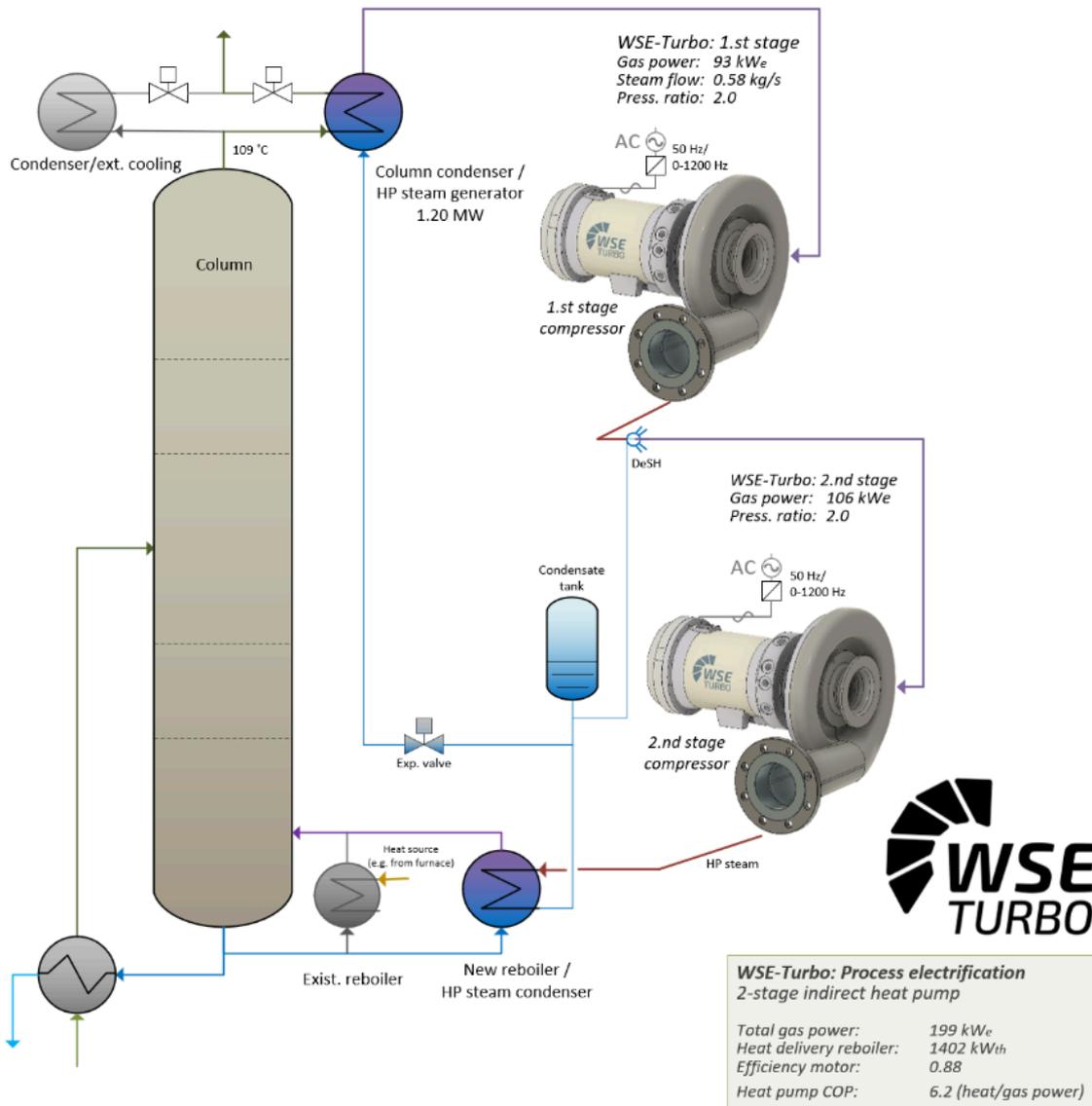
Core Innovations:

1. **High-Temperature Capability** - Specially engineered to handle 134°C process temperatures, a previous barrier for heat pump technology
2. **Exceptional Efficiency** - Achieved a high COP exceeding 5
3. **Precision Integration** - Seamlessly matched the plant's existing 1400 kW thermal demand
4. **Smart Heat Recovery** - Captured and repurposed waste heat that was previously lost

Transformational Results:

1. **Energy Cost Reduction:** Slashed thermal energy expenses by over 60%
2. **Carbon Footprint:** Cut CO₂ emissions by approximately
3. **Operational Flexibility:** Maintained full production capacity while reducing energy intensity
4. **Future-Proofing:** Created a scalable model for additional production lines

The Technial Implimentation



Figuer 2: Simulation with Heat Pump integration on column C1.

The core two-stage heat pump system that could:

- Deliver 1400 kW of heat with just 265 kW of electrical input
- Achieve an astonishing Coefficient of Performance (COP) of 6.2
- Operate reliably at the demanding temperatures pharmaceutical processes require

Configuration

- Primary column (C1) equipped with a robust 210 kW heat pump
- Strategic pressure adjustment to optimize compressor performance

Design

- encapsulated for noise control and safety compliance
- Parallel installation allowing seamless transition between systems
- Intelligent controls that dance with the plant's existing automation

Quantified Operational impacts



Energy Efficiency:

Achieved **81% net energy savings** (1400 kW heat load reduced to 265 kW electrical input)

High COP 5.3: sustained across 5,000 annual operating hours

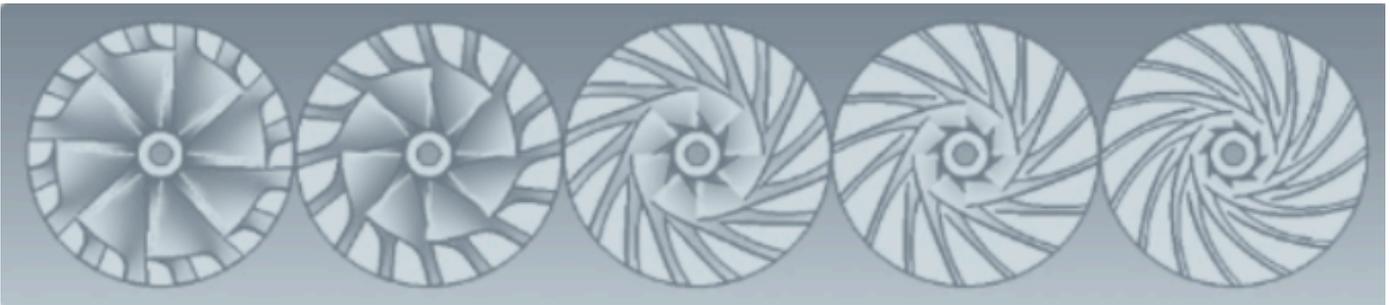
Emissions Reduction:

Eliminated **5,675 MWh/year** of steam-based heat generation

Corresponding reduction in carbon emissions (exact tonnage dependent on energy source)

System Reliability:

Leveraged compressor technology with **48,000+ hours** demonstrated mean time between overhauls Containerized design ensured **ATEX compliance** and reduced maintenance interventions



Implementation Insights

The project followed a structured approach:

Phased Commissioning:

Parallel installation allowed uninterrupted production during transition

Existing steam system remained operational as backup during initial heat pump validation

Clear Scope Delineation:

WSE Turbo scope: Heat pumps, heat exchangers, and PLC controls (up to flange connections)

Client scope: Bypass piping, DCS integration, and civil workers

Performance Optimization:

Adjusted Column C2 pressure to **1.5 bara** to optimize compressor efficiency

Conducted 500-hour surveillance test to verify reliability prior to full operation

ESTABLISHING SUSTAINABLE PROCESSES

With a COP of 5.3, this heat recovery system delivers an outstanding business case—combining high efficiency, rapid payback, and strong financial returns while future-proofing industrial operations.

The success of this recovery cycle demonstrates how industrial separation processes can be transformed into highly efficient heat pump loops, drastically cutting energy costs and emissions. Further compression enables higher-temperature applications, making it even more viable in regions with volatile gas prices or stringent CO₂ reduction targets.



Connect with our international sales teams

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