WHITEPAPER

ENERGY REDUCTION & RECOVERY

Excess heat generated in the primary production process is pure potential. However, with clever engineering, this potential can be harnessed to reduce a facility's carbon footprint and energy consumption. With a typical Return On Investment (ROI) of 2 to 4 years, JOA energy recovery systems are possibly the best step you can take towards a more environmentally-friendly and economical production process.

WE INNOVATE AIR

THE IMPORTANCE OF ENERGY REDUCTION

WHERE PRODUCTION HAPPENS, ENERGY IS SPENT AND COSTS ARE MADE. THE AMOUNT OF ENERGY SPENT WILL VARY FROM SIDE TO SIDE, BUT SPENDING LESS ENERGY WILL ALWAYS LEAD TO COST REDUCTIONS.

Cost reduction is not the only benefit of reduced energy usage. Efficient energy management can also drastically reduce the size of a facility's carbon footprint and volume of its emissions. So the benefits are both financially as environmentally related.

A JOA Energy Reduction & Recovery solution typically has an ROI of just two to four years, and has a lifecycle far beyond that. In this whitepaper we look in detail at how you can benefit from intelligent energy reduction and recovery.

DESIGN CONSIDERATIONS

The design and realization of any JOA Solution is heavily data driven. Thorough data collection at the beginning of the design phase leads to extremely efficient systems upon delivery.

When designing specifically for energy reduction and collection, the focus of the data collection step is heavily on any point in the system where heat may be available, or effciency improvements can be made.

OUR DATA COLLECTION PROCESS TYPICALLY FOCUSSES ON THE FOLLOWING POINTS:

1. Temperature
2. Relative humidity
3. Absolute humidity
4. Dew point
5. Extraction velocity and capacity
6. Static pressure

DESIGN CONSIDERATIONS

Any point where sensible heat is emitted from the process is, by definition, an ideal candidate for recovery. It is also important not to overlook latent heat that can be won where phase changes occur. Quite sizable amounts of heat can be won from, for example, condensation. And in many cases the amount of collected heat can even be increased by mitigating any fouling on heat exchange points.

In practice, **Velocity, Pressure, Temperature and Humidity** will be measured during several timeslots to determine the energy potential of the actual operations. We advise taking air technical measurements in several different ducts and at various fan speeds. If applicable and possible, measurements will also be taken during cleaning processes. This ensures a wide range of circumstances for data collection.

Occasionally we also advise performing **smoke tests** in order to determine the possible effectiveness of the existing hood of the exhaust system at various fan speeds.

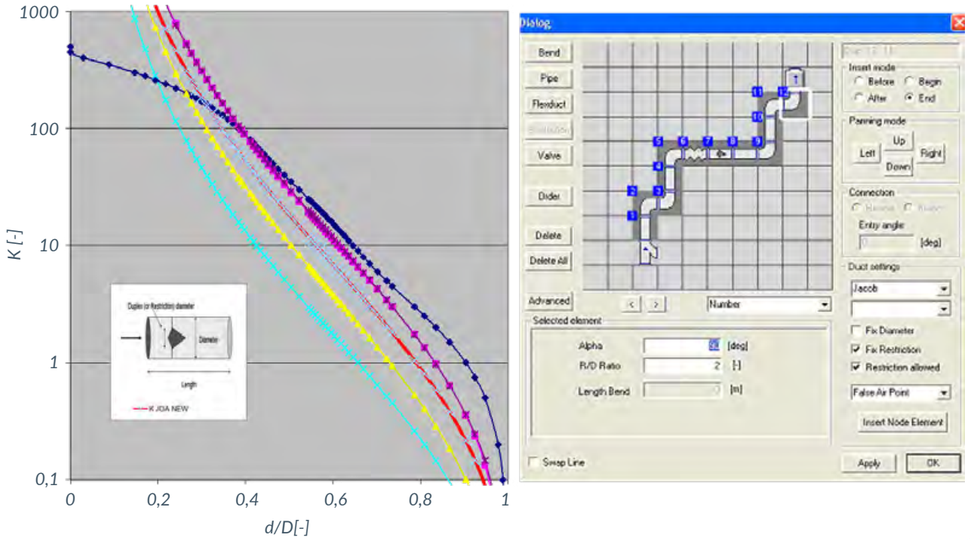
During the data collection phase, potential circuits to return the energy are identified. Ideally, the energy is rerouted to closed loop circuits with heat-producing equipment. Energy reuse is most efficient when a direct producer-consumer connection can be made.

The final step in the data collection phase is to determine the best way to spend the won energy elsewhere on the site.

ENERGY MODELING

When all data in the plant has been collected, we use our in-house developed Air Technical Modeling software (GCM). Often there is more than one point at which heat can be collected and recovered. Though it is easier to imagine efficient re-use from high-heat sources, it is important not to overlook points where lower temperatures are measured. Low heat at high volumes can be very effective in an energy recollection system.

In the Air Technical Scenario Model, all sensible and latent heat content is mapped and possible consumers are identified.



In-house developed Air Technical Modeling software.

"AT JOA, WE BELIEVE THE BEST DESIGNED SYSTEMS CAN ONLY BE CREATED AFTER THOROUGH DATA COLLECTION AND MODELING."

- Tony Roepman, Chief Mechanical Engineer

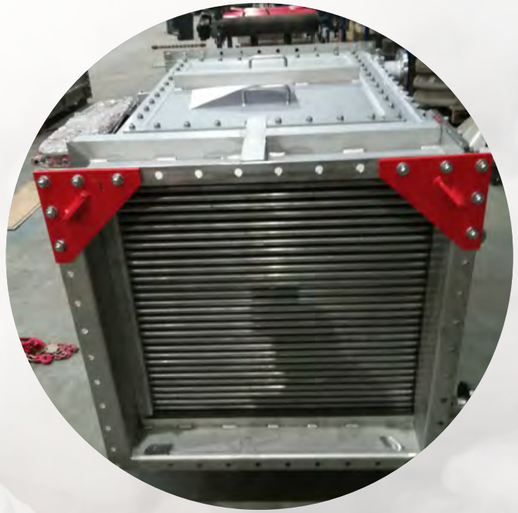
ENGINEERING

The data from our Air technical model serves as input for the energy recovery selection matrix. Possible consumption methods are written out and quantified.

Excess heat can be reused in various ways. In any scenario (air-to-air, air-to-water or air-to-steam), a closed loop solution is preferable to any other solutions. The selection matrix answers the following questions in respect of each of the possible reuse scenarios:

1. How much heat can be reused?
2. What kind of investment is needed to efficiently collect and reuse this heat?
3. What is the ROI?
4. Is the heat source easily accessible, or are there physical obstructions that make access difficult?
5. Is it feasible to split a stream of heat and reuse it in two or more secondary processes?

STREAMS OF HEAT CAN BE RECOVERED IN SEVERAL WAYS:



CLOSED LOOP AIR-TO-AIR

In this solution, the heat carrying agent is the same in both the source and consumer. Closed loop air-to-air solutions are very easy to implement. Heat is recovered from the source and transferred to a different heat exchange point, where air for the secondary process is preheated and used.

CLOSED LOOP AIR-TO-STEAM

Sources with a high heat content can be used to create steam. When heat at 300 °C is recovered, it's feasible to create high pressure steam. Even an exhaust temperature of 100 °C can be used to create low pressure steam up to 3 bar. In regular processes this may not seem like much, but in our experience 2 or 3 bar is often sufficient in a closed loop solution.

AIR-TO-WATER

Often heat can be recovered in inline wet scrubbing systems like the JOA inline venturi scrubber. We have successfully recovered exhaust air from driers and flash towers for direct steam or hot water. Energy recovery using this method ranges from 70% to 85%.

TYPICAL APPLICATIONS:

DEPENDING ON THE HEAT RECOVERED AND METHOD OF RECOVERING USED, THE ENERGY CAN BE CONSUMED BY SEVERAL SECONDARY PROCESSES:

- **Dryers / ovens:** Hot air can easily be recirculated into secondary processes where it can be put to good use. Dryers and ovens can often either be powered completely or preheated substantially with excess heat recovered from elsewhere in the facility.
- **Furnaces:** By their very nature, furnaces require high temperatures. Their energy consumption can be reduced significantly when heat from elsewhere in the plant is reused in the preliminary heating process.
- **Stand-alone steam or hot water production:** In some situations, the consumer of excess production heat is unrelated to the production process itself. Heat can be rerouted to tertiary processes in or around the facility. For example, to heat adjacent office units.

TYPICAL SOLUTIONS:

- **ERD Scrubber:** An up to 99% efficient solution for heat recovery is the JOA Energy Recovery Dust Scrubber. this wet scrubbing system is outfitted to collect heat from the scrubbing process for use elsewhere. Depending on the amount of heat available, replacing regular scrubbers with JOA ERD Scrubbers can be worth the investment as the ROI can be as low as 4 years.
- **Heat exchangers:** Though this technology is hardly groundbreaking in the 21st century, clever application of heat exchangers makes all the difference. Using heat to power secondary processes can turn an inefficient and wasteful process into an efficient and environmentally-friendly one.
- **Twin coils:** Twin coils are essentially two interconnected heat exchangers placed in one stream of hot air and one stream of cold air. Heat is extracted from the hot air and transferred to the cooler current.

ADVANTAGES

THOUGH IMPLEMENTING EFFECTIVE AND EFFICIENT ENERGY RECOVERY MAY SEEM LIKE A HASSLE, THE BENEFITS ARE OVERWHELMING:

- **Reduced energy intake:** Any secondary process that doesn't need energy from the grid leads to reduced energy intake and energy costs.
- **Lower carbon footprint:** We all want to do our bit to reduce emissions for a sustainable future. And decreasing your carbon footprint is not only beneficial to the environment. Reduced CO2 emissions often lead directly to tax reductions.
- **Attractive ROI:** A JOA energy recollection system typically pays for itself within two to four years.
- **Contribution to sustainable development goals:** We only have one planet. By harnessing and applying excess heat efficiently and not letting any energy go to waste, you actively take a step towards a greener future.

IMPLEMENTING THE JOA DUST & VAPOR EXTRACTION SYSTEM

Every JOA extraction system is tailor-made and engineered to meet the specific challenges faced at that production facility. That is why the implementation of all JOA systems is done in five phases:

CONSULTANCY

Every case is different and requires a thorough prior analysis. We cooperate with your team of process owners, production specialists and operators, and gather as much information as possible to fully understand your unique system requirements.

ENGINEERING

By interactively engineering solutions based on your specific requirements, we ensure the long-term reliability of the Exhaust Air Treatment installations. We also provide the necessary preventive maintenance advice, and advise on how to handle process and equipment changes effectively.

MODELING

By combining 3D engineering with integrated GCM Modeling we can guarantee efficient project execution for both greenfield projects and upgrades in running plants. This ensures system performance from the start. And we can precisely predict the performance of the new system, which prevents unpleasant surprises and costly ‘learning on the job’.

REALIZATION

Upon customer approval, JOA implements the system as designed. All our projects are carried out by dedicated project managers with multi-disciplinary backgrounds. Their experience will guide your production facility through the implementation and ensure the project is delivered on time. Depending on the location, we can cooperate with local content manufacturers and installation partners, or bring in our own.

SERVICE

After project completion, we will stay in touch and offer you the best possible service. We provide spare parts and tailor-made preventive maintenance advice to realize long-term reliability of your exhaust air treatment installations and feeding systems.

CONTACT US TODAY

At JOA Air Solutions, we have years of experience that we want to share with you.

BAS VAN DEN BOGERD

Business Development Director

Bas.vandenbogerd@joa.nl

+31 (0)652710572

GET IN TOUCH

and make an appointment with one of our specialists to discuss your dust and vapor extraction challenges.

SHARE THIS DOCUMENT WITH YOUR COLLEAGUES

JOA HEAD OFFICE

Delftechpark 25

2628 XJ Delft, The Netherlands

JOA INTERNATIONAL

JOA Moscow, Russia

JOA Shanghai, China

JOA San Luis Potosi, Mexico

ABOUT JOA?

JOA Air Solutions provides tailor-made, turnkey and guaranteed improvements to all your Dust, Vapor and Aerosol challenges. With JOA you will reduce downtime, improve OPEX and become more safe & sustainable. By effectively predicting your required specifications in advance, we implement reliable 1st time right Industrial Filtration Systems.

As Compliance, Safety and Energy Efficient Production is growing in importance every day, you need the peace of mind provided by an expert in air technology with an inhouse multi-disciplinary team of knowledgeable engineers. At JOA, we love to solve complex challenges where we combine smart filtration techniques with environmental and economic benefits.

www.joaairsolutions.com

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