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International Sales Manager ASEAN

Manila, May 7, 2019

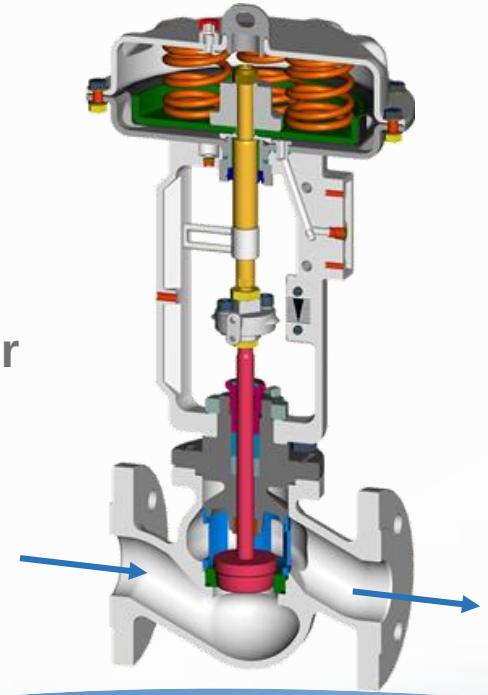
Control Valve Design & Sizing – an efficient tool to reduce energy consumption

ARCA Facts

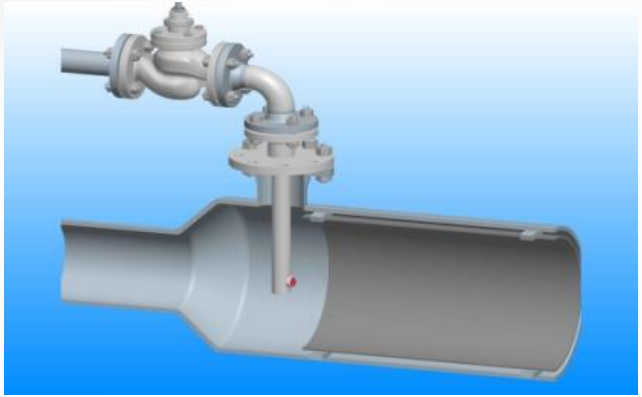
- Internationally operating manufacturer of control valves
- 100% family owned
- Two factories in Germany, with more than 200 employees
- Products are 100% “Made in Germany”

Control valves

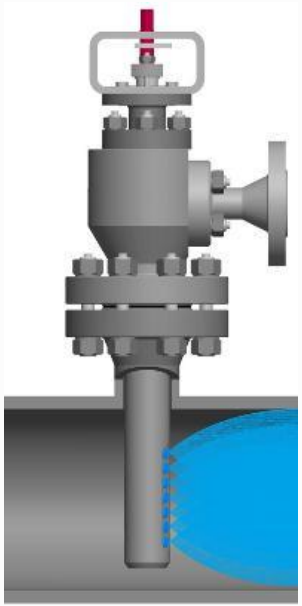
Control valve with actuator and digital positioner



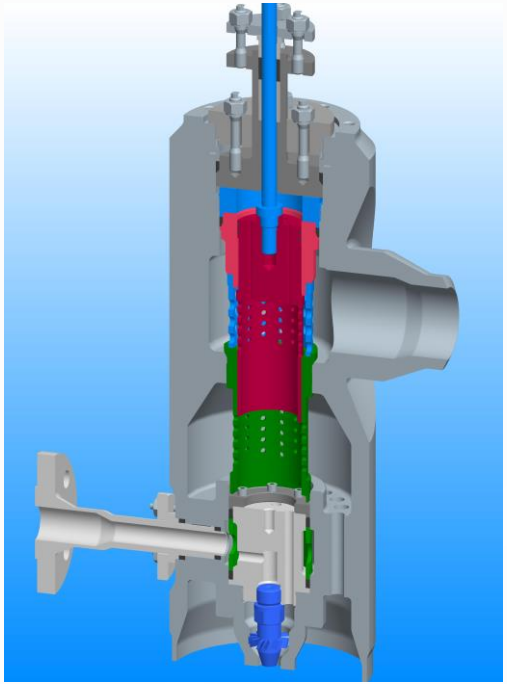
Steam Conditioning valves & solutions



Single-nozzle desuperheater



Multi-nozzle desuperheater



PRDS

Applications





- Thermal power plants:
  coal, gas, biomass, geothermal, solar-thermal, waste incineration
- Oil and gas industry
- Food and beverage industry
- Chemical, pharmaceutical industry
- Steel plants
- Marine business

References

- Energy
- Oil and gas
- Chemical, pharma, biotech
- Food, beverage, sugar
- Steel, paper
- Marine & Offshore

Power Station Jänschwalde / Germany

Jänschwalde is the biggest Power Station in Germany and one of many examples in which ARCA Valves have been installed

BASF Ludwigshafen / Germany

ARCA is Main Valve Vendor of BASF in EUROPE

PEMEX Refinery Cadereyta / Mexiko

Delivery of 1.200 ECOTROL®-Valves

Our Mission...

... is to provide the **best and most efficient solution** for your **control application**.

Challenge

Innovative **Solutions** from 100 years experience

Solution

Fast
Reliable
International

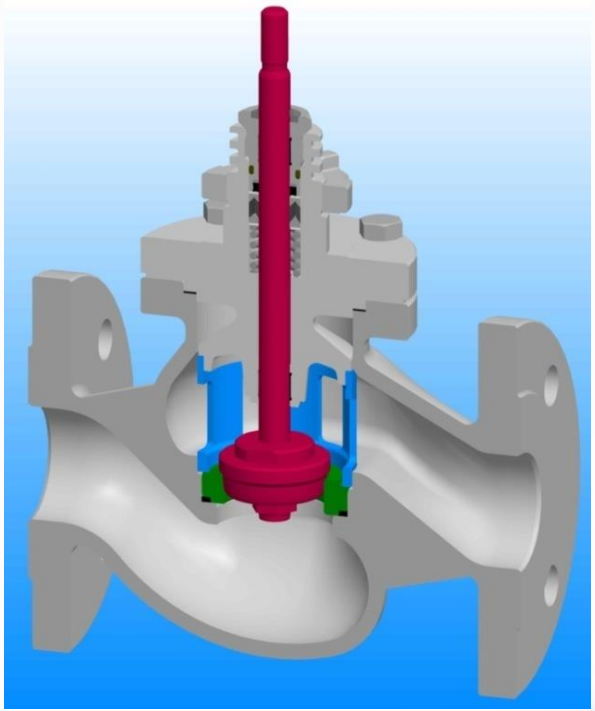
Energy efficiency in industry:

Energy Loss in Control Valves – General Considerations

Energy Loss in Control Valves

In the field of automation, control valves are among the largest energy consumers of a plant.

But, control valves are as essential for a production process as the brakes of a car for safe driving.



Energy efficiency in industry:

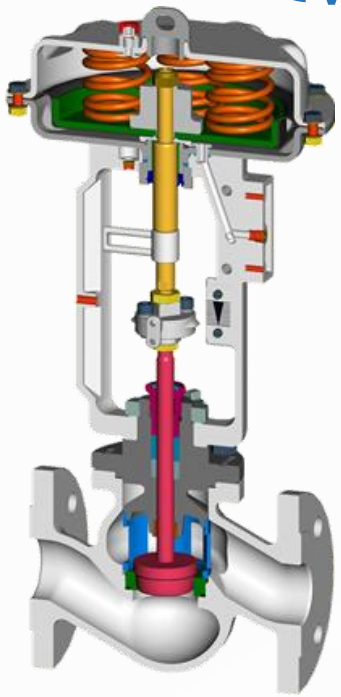
Saving energy when actuating a Control Valve…

Energy Consumption of Valve Actuators

Besides the energy converted by control process itself, the valve actuator needs energy to actuate the control valve.

Often pneumatic actuators are used, which are operated by the plants compressed air supply.

The consumption of compressed air should be reduced to save energy.



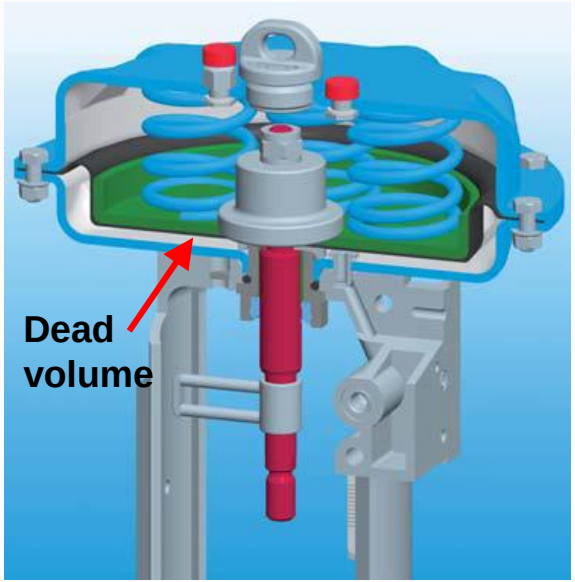
Control valve with pneumatic actuator

Air consumption of pneumatic actuators

ARCA actuators safe energy!

ARCA minimizes the “dead volume”, due to different shelves for the air and the spring chamber.

The use of ARCA actuators permanently safes energy and money!



Energy consumption of positioners

All pneumatic systems have a loss of instrument air, even when the valve is not moving, dependent on the pneumatic amplifier inside the positioner.

With the unique binary-triggered I/P output, the ARCAPRO® 827 positioner provides the lowest "steady state" air consumption in the market with only 26 std l/h.

Compared with 110 std l/h (typical other brand), every single ARCAPRO® 827 saves around 650 m³ of compressed air per year, which is more than 40 US$ of energy cost!

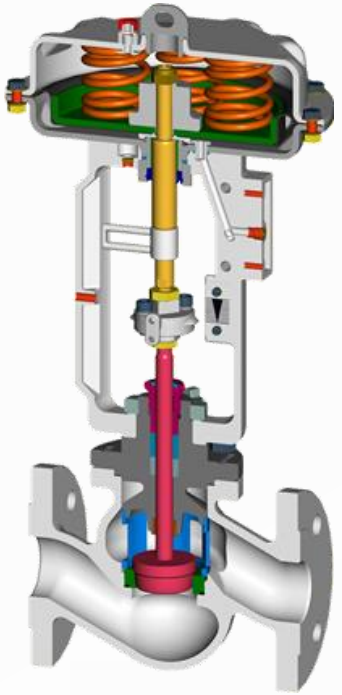
Energy required to actuate the Control Valve

The energy required for one full stroke is:

$$W = F \cdot s = A \cdot \Delta p \cdot s$$

The energy to close a valve with 200 mm seat diameter and 100 mm stroke against 60 bar pressure is:

$$W = 0.0314\, m^2 \cdot 6 \cdot 10^6\, {}^{N}/_{m^2} \cdot 0.1m = \mathbf{18.84\ kWs}$$



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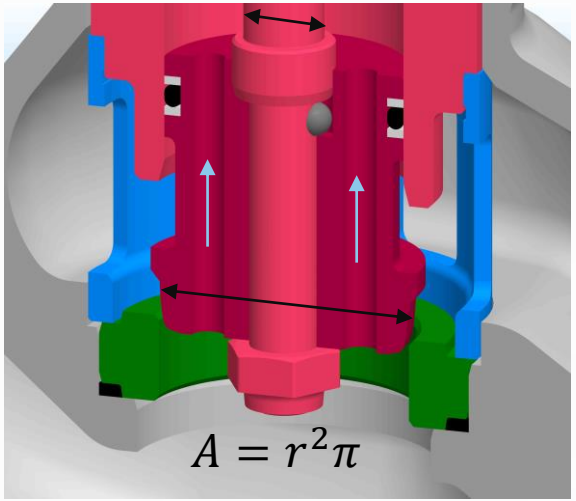
With pressure balancing, it is only:

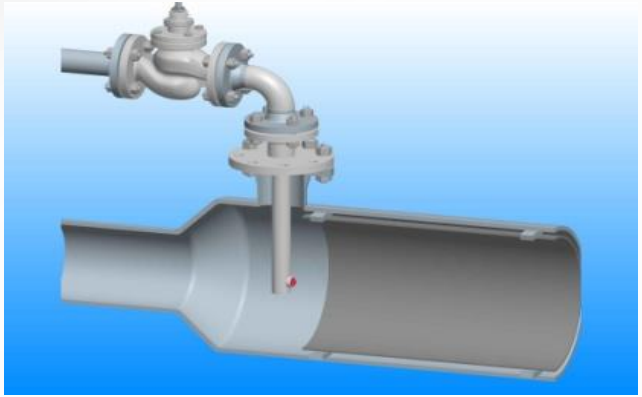
$$W = 0.000707\, m^2 \cdot 6 \cdot 10^6\, {}^{N}/_{m^2} \cdot 0.1m = \mathbf{0.424\ kWs}$$



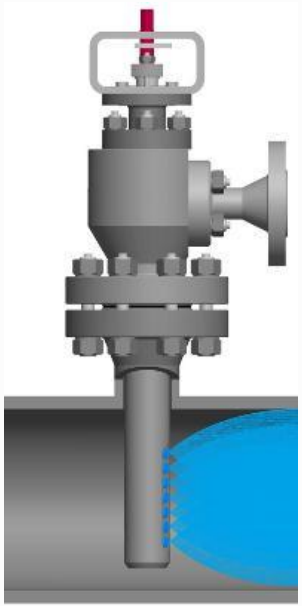
pressure balanced plug

Case Study: Optimising Steam Conditioning in Power Generation

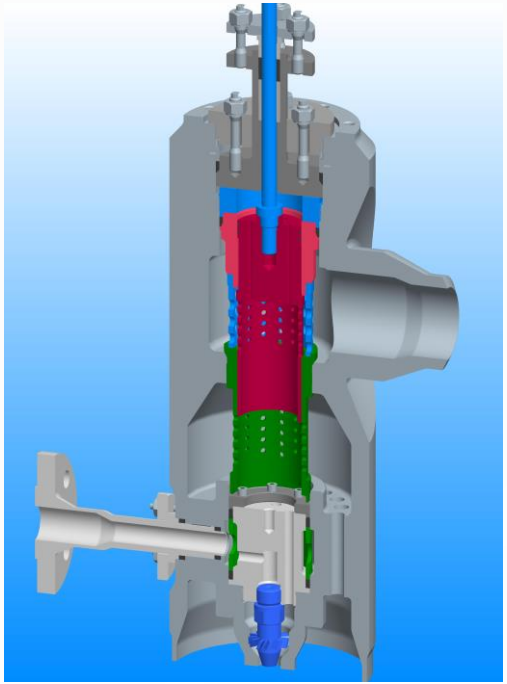
Steam Conditioning valves & solutions



Single-nozzle desuperheater



Multi-nozzle desuperheater



PRDS

Energy Saving Potential in Steam Conditioning

Multi-nozzle desuperheaters save energy:

ARCA uses quarter-turn/one-piece-design technology of Borsig, which was one of the best and most famous German steam technology companies.

By management-buy-out, it is now ARCA-Group technology.

The ARCA design is extremely reliable especially in installations with frequent start-ups, e.g. in gas power plants

ARCA ARTES multi-nozzle desuperheater

Energy Saving Potential in Steam Conditioning

Multi-nozzle desuperheaters save energy:

For a static nozzle, the water pressure must be **30 bar higher** than the steam pressure, to get a rangeability of 3:1. For a multi-nozzle desuper-heater, it only has to be **10 bar higher** than the steam pressure. For a steam pressure of 22 bar and a water flow of 40 t/h, the power required for the cooling water pump is

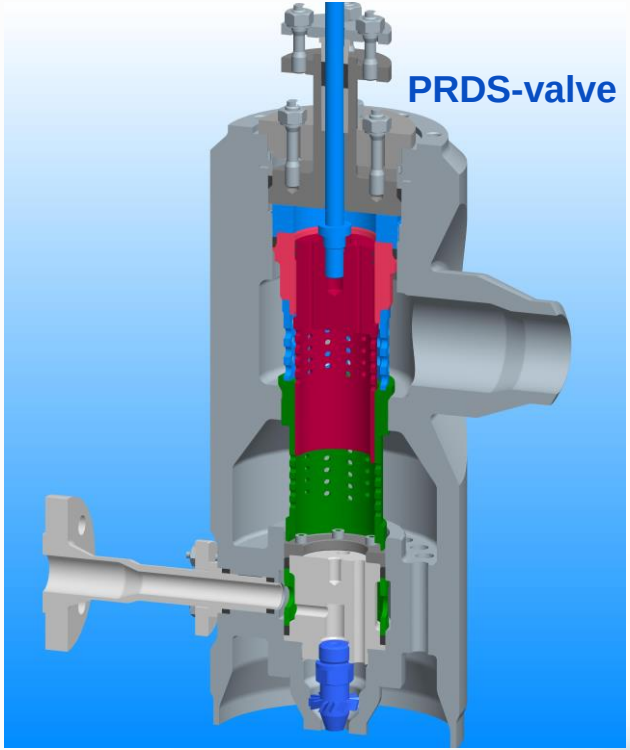
- for static injection nozzles: **82 kW**
- for a multi-nozzle desuperheater: **45 kW**
- for a PRDS with Venturi nozzle: **28 kW**

ARCA ARTES multi-nozzle desuperheater

Energy Saving Potential in Steam Conditioning

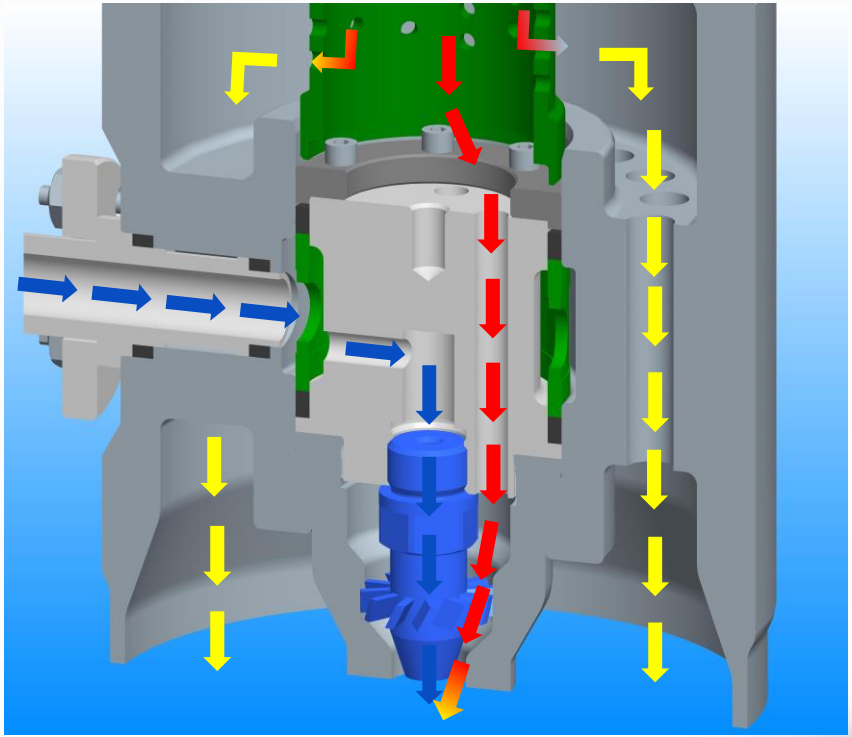
In a combined **P**ressure **R**educing and **D**e-superheating **S**tation (**PRDS**), a fraction of the high pressure steam can be used to atomize the cooling water in a 2-phase nozzle, using the Venturi effect.

Then, the water pressure can be equal or even less the downstream steam pressure, reducing the power required for the water pump to only **28 kW**.



Steam and water flow in a PRDS Valve

1. The main steam flow passes the reducing stages and leaves the valve
2. The cooling water goes into the 2-phase nozzle.
3. A fraction of the steam is separated upstream and led to the swirling chamber of the 2-phase nozzle. The Venturi-effect maintains a high velocity and a very low pressure at this point, providing perfect atomizing of the water.

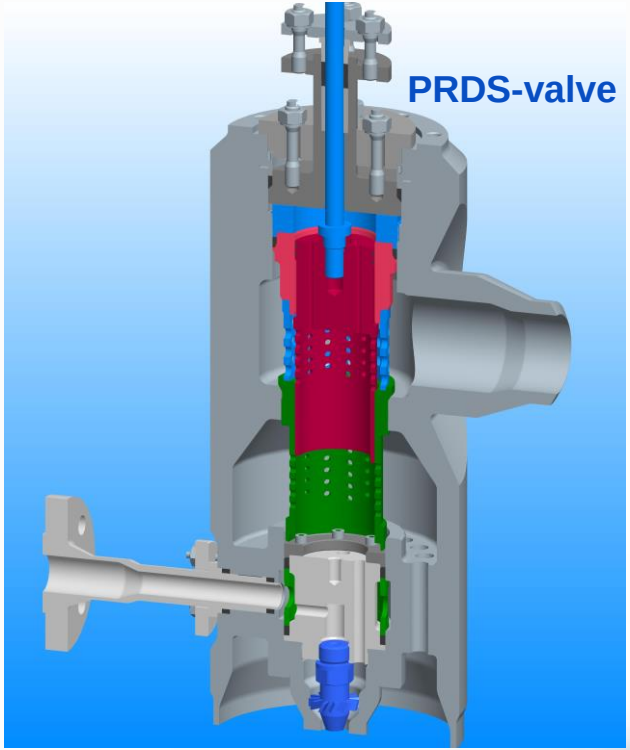


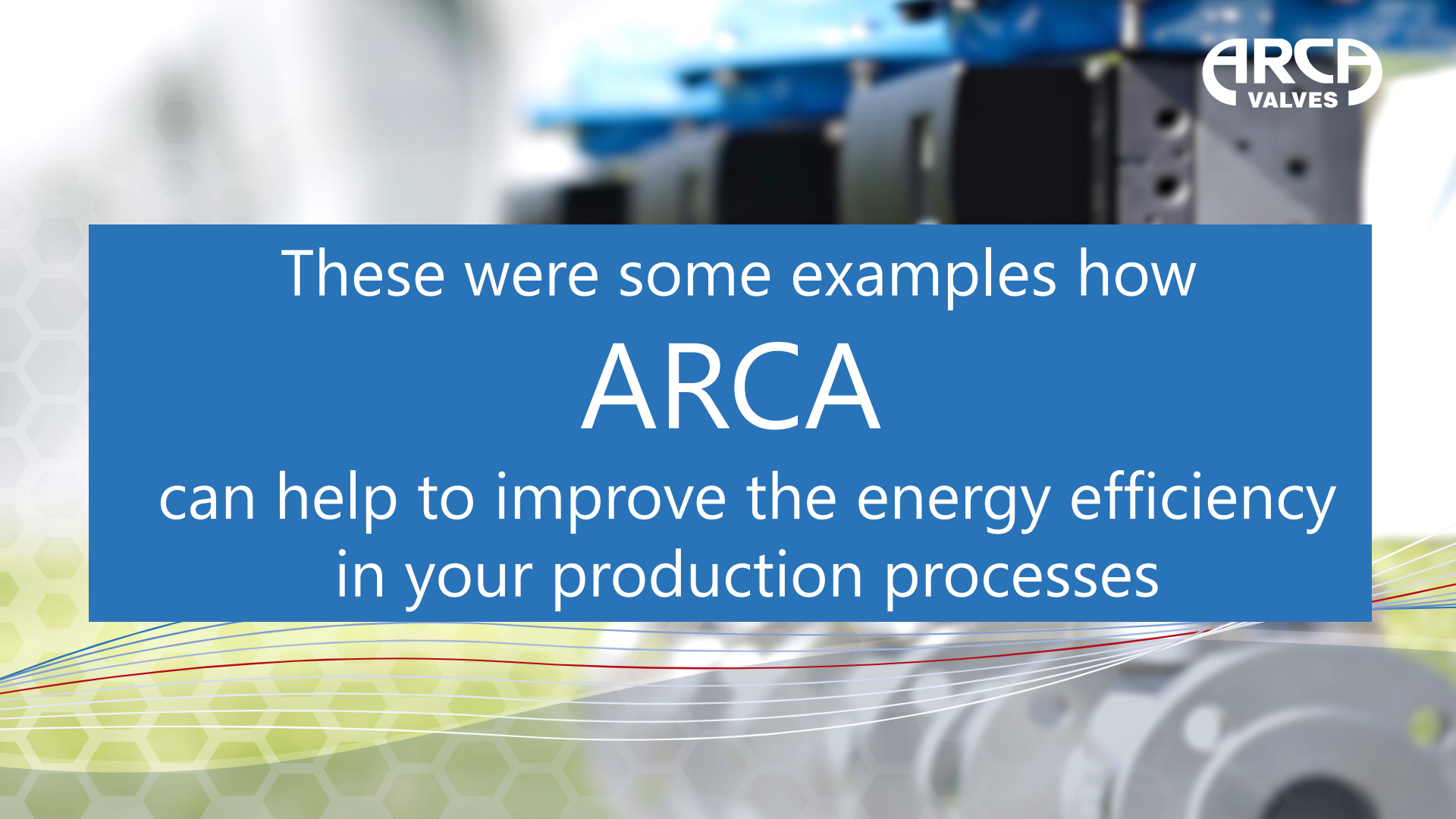
Energy Saving Potential in Steam Conditioning

Energy saving per year, compared to static nozzles, for steam at 22 bar and a water flow of 40 t/h:

- **with multi-nozzle desuperheater: 324 000 kWh**
- **with Venturi 2-phase nozzle: 473 000 kWh**

This is BIG!!!




These were some examples how
ARCA
can help to improve the energy efficiency
in your production processes


ARCA
VALVES
We are open
...for any questions
...and challenges
...and inquires