Smarter Water Solutions: Saving Water, Energy & Chemistry

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23th of October 2024

GRUNDFOS

Possibility in every drop

AGENDA

- Sustainability Trends at Grundfos and Beyond
- Multistage, CR: The energy efficient smart pump
- Hydro MPC: The smart water distribution solution
- Smart Digital: Chemical Dosing


One of the world's leading pump and water solutions companies
20,000+
employees
87.9%
owned by the Poul Due Jensen Foundation
1945
when it all started
DKK 33.3bn
net turnover in 2022
17,000,000
units produced per year
5%
of revenue reinvested

Sustainability is at the heart of everything we do.

Climate action

Decarbonizing the flow of water through energy-efficient pump and water solutions.

Water action

Reducing our footprint and enabling efficient water management and water reuse.

Circular business

Embedding circularity throughout the product life cycle, from design to next-life offering.

Water access

Providing access to safe water for people in need through water solutions and partnerships.

We are the first water solutions company with a validated science-based net-zero target

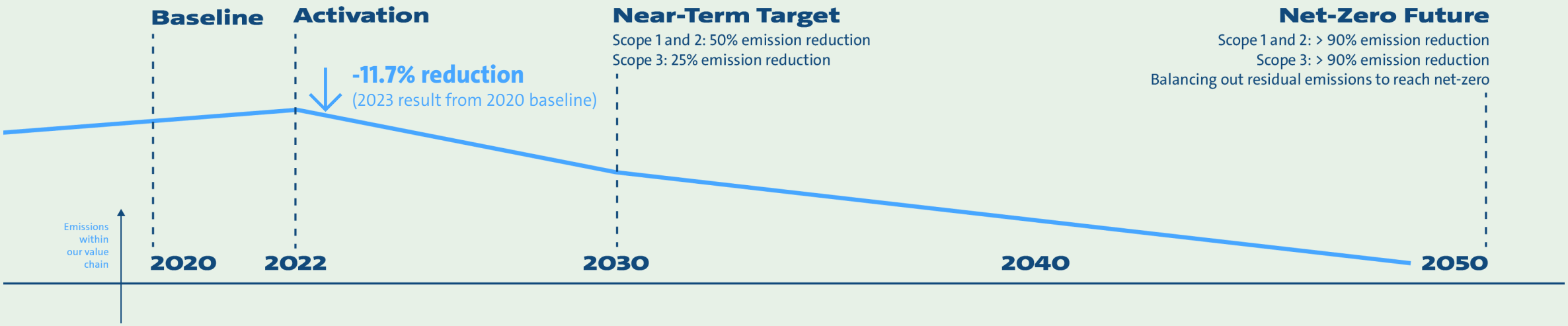
Validated by:

SCIENCE BASED TARGETS

By 2030
-50%
reduction in absolute **Scope 1 & 2** GHG emissions

By 2030
-25%
reduction in absolute **Scope 3** GHG emissions

By 2050
Net Zero
Across **Scope 1, 2, 3**



Energy consumption in the food and beverage industry **has risen 40%** in the past 10 years.

With a global population of 8 billion expected to grow to 9.7 billion by 2050, the demand for food and beverage production is increasing.

In industrialized nations, industries consume more than half the water available for human use...

Source: IWA

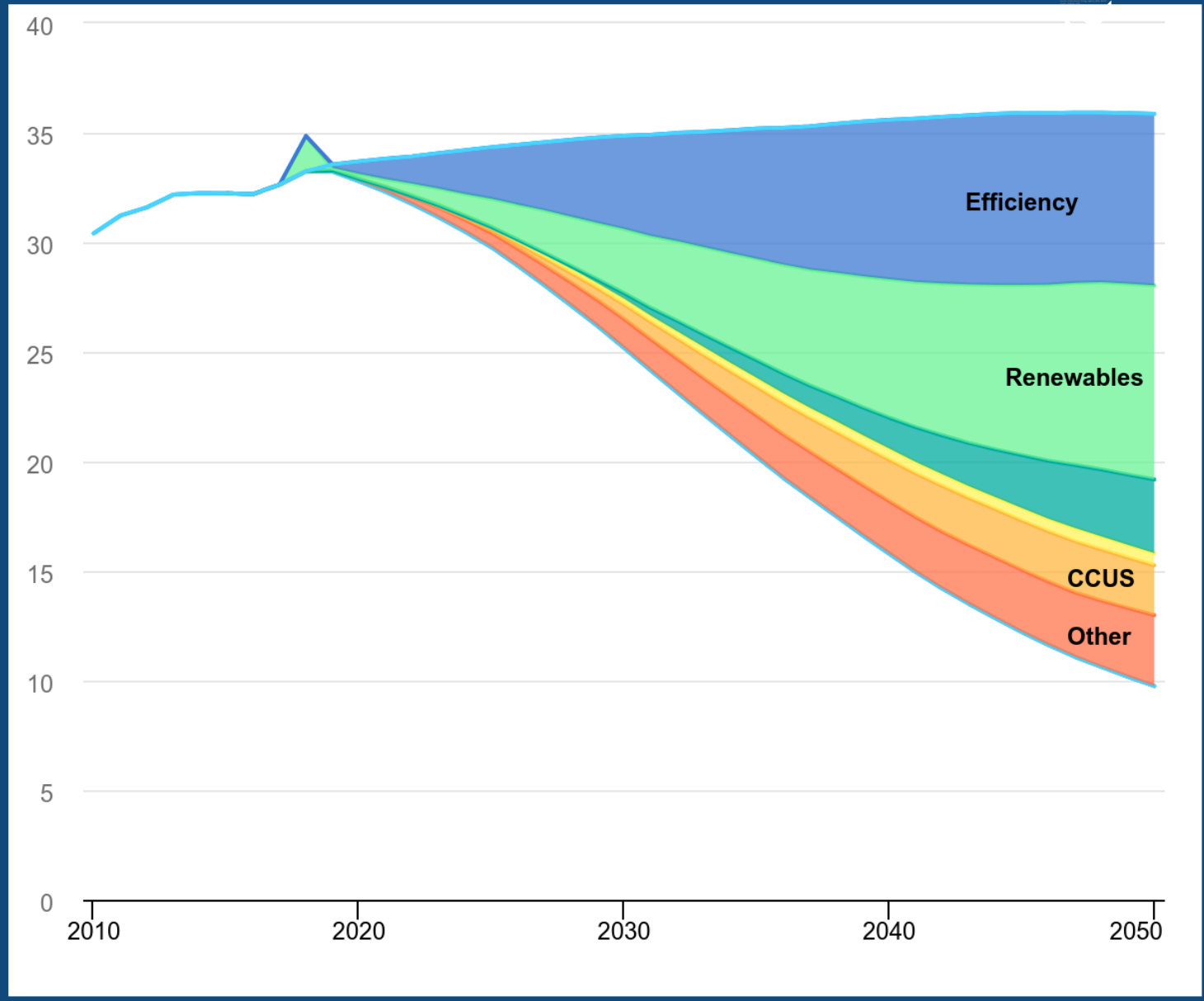
Changes in consumer behavior and consumption patterns are expected to increase water and energy demand by 50% and 40% respectively by 2030.

Source: UNESCO, 2017, UN World Water Development Report

The Importance of Efficiency

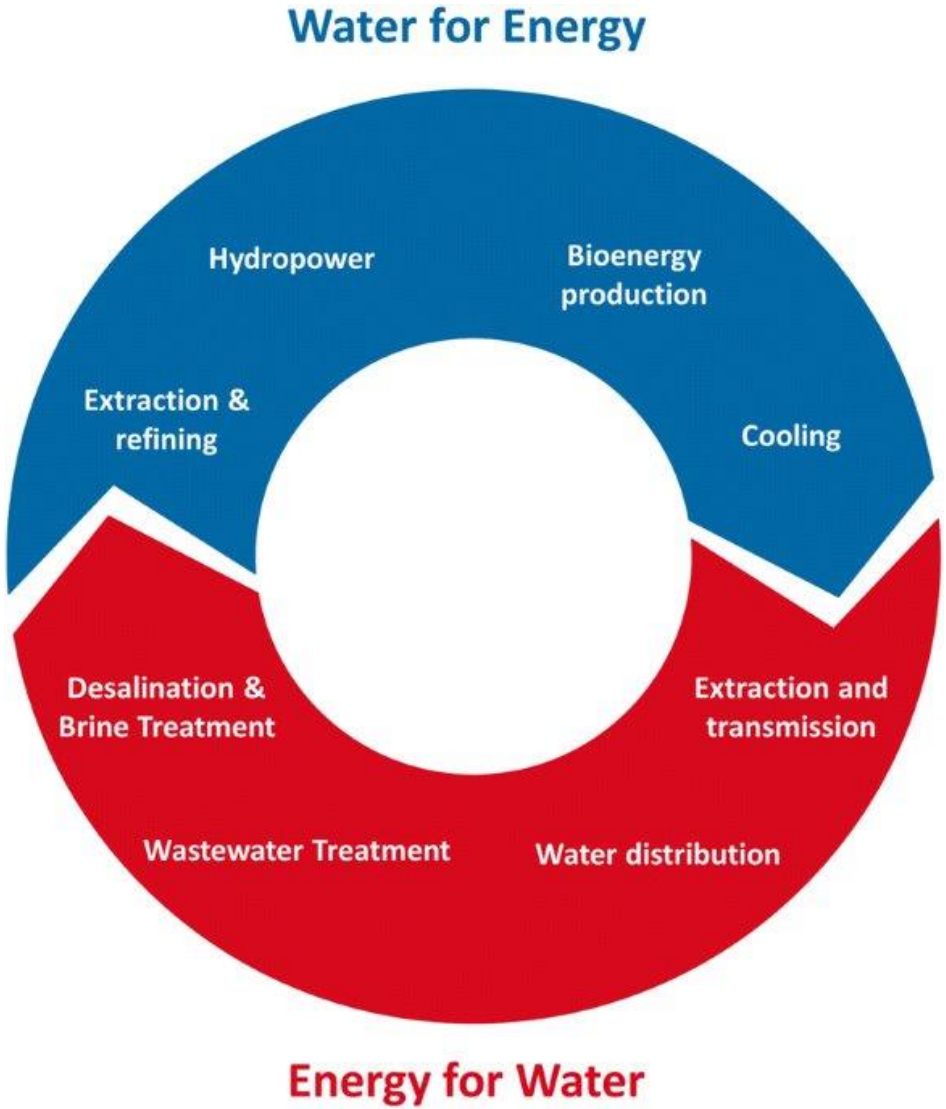
Energy efficiency-related actions account for 1/3 of the emissions reductions needed for Net Zero and the UN SDGs:

- Almost half of these energy efficiency savings come from industry.
- A sharp pick up in efficiency improvements is the single most important element.



Source: International Energy Agency (IEA), World Energy Outlook 2019

Understanding the Water-Energy Nexus is Key



Addressing the Nexus

Enabling end-users to save water through water reuse and water efficiency

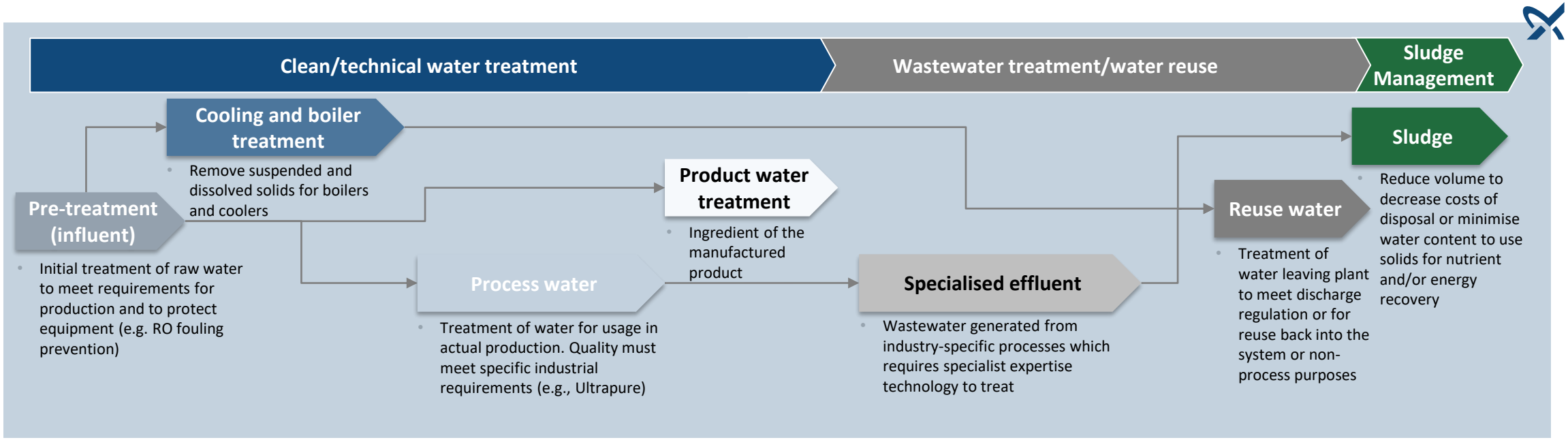
- *Improve chemical accuracy*
- *Water reuse through water treatment*
- *New business models*

Enabling end-users to save energy by innovating and delivering smart pumps and new solutions

- *Best in class energy efficiency solutions*
- *Digital solution for energy optimisation*
- *New business models*

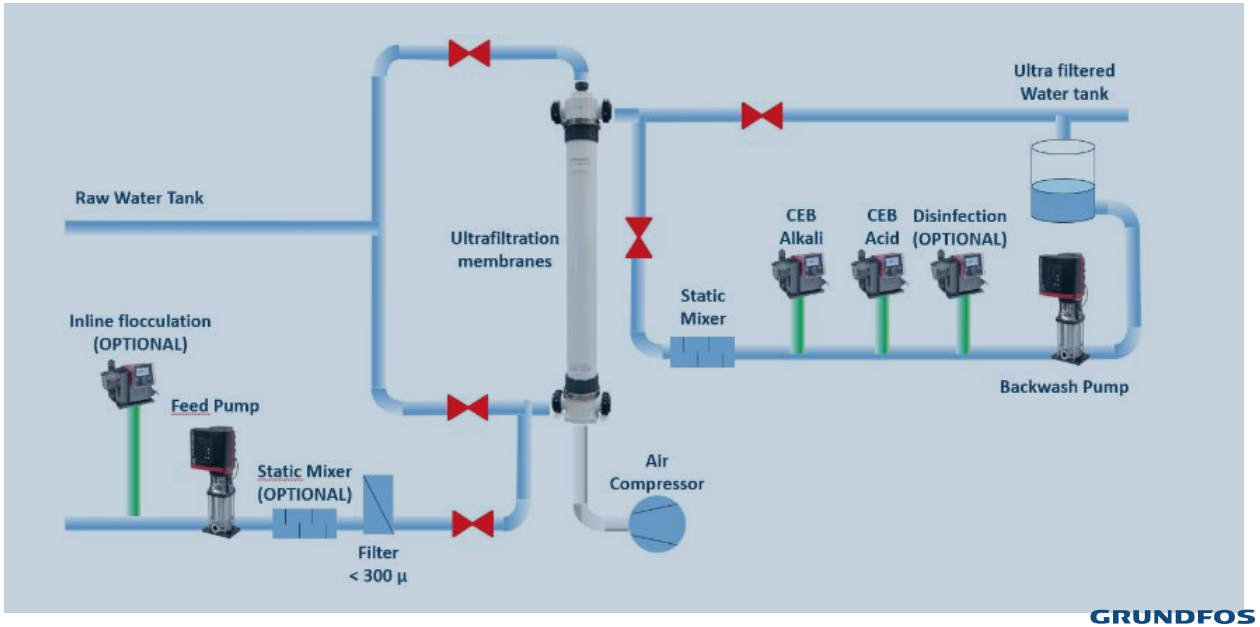
Each day we help our customers reach their sustainable goals.
With Grundfos Industrial solutions industrials can save water and energy while optimizing output.

The theme for the rest of the presentation: Smart Pump Solutions



Water treatment rely on pumps to pressurize, distribute and dose chemistry into the various processes.

Pumps have evolved into highly efficient hydraulics with highly efficient motors. Now pump solutions from Grundfos also include integrated VFDs with demand driven regulation and controllers with SMART analytics to improve the WT process with less energy and chemistry consumption



Grundfos CR Pumps

Highly efficient vertical modular multistage pumps for pressurisation and water distribution.

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Possibility in every drop

Grundfos CR – Invented by Grundfos. Refined, Expanded and Smart

First CR	CRN	CRN Connections	CR(N)E	New LA range	CRT	New Sm & Me range	CR120 & 150	CR95, 125 & 155	CR185, 215 & 255
									
1971	1988	1992	1997	1998	1999	2004	2007	2018	2020-23

Roughly 3.5 million CR pumps serve our customers every day – all over the world.

Grundfos CR – The heart of the Hydro MPC (pressure boosting)

- Multi-stage, centrifugal, In-line, Vertical
- 16 different sizes:
- Small: 1s, 1, 3, 5
- Medium: 10, 15, 20
- Large: 32, 45, 64
- Extra Large: 95, 125, 155, 185, 215, 255

Current CR Range

Motor range from 1/3 HP to 300HP

Standard Temperature range -4 to 248 °F
Optional Temperature range -40 to 356 °F

CR

- **Water supply**
- **Boiler**
- **Cooling**
- **Cleaning/washing**

CRI

- **Water supply**
- **Boiler**
- **Cooling**
- **Cleaning/washing**

CRN

- **Acids**
- **Brackish water**

All CR's available with:

- **E-motor (CRE)**

CRE (CR with an MLE motor)
Intelligent and Efficient Solutions

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What is an MLE?

The MLE Motor is an integrated variable speed developed by Grundfos with optimum electronic control in mind. Grundfos "E" products feature a pump and motor with an integrated variable frequency drive, PI controller and sensor. They offer a plug-and-play pump solution.

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Approvals

The cURus approval is based on the American and Canadian motor standards UL1004-1 and CSA C22.2 No. 100-04. (Rotating Electrical Machines – General Requirements)

Ambient Temperature		
½ to 2Hp	1/60/200-240	122F
1.5 to 7.5Hp	3/60/200-240	104F
1 to 15Hp	3/60/440-480	122F
20 to 30Hp	3/60/460-480	104F

NSF61 Annex G; NSF372

Safe Drinking Water Act – CRE and CME pumps

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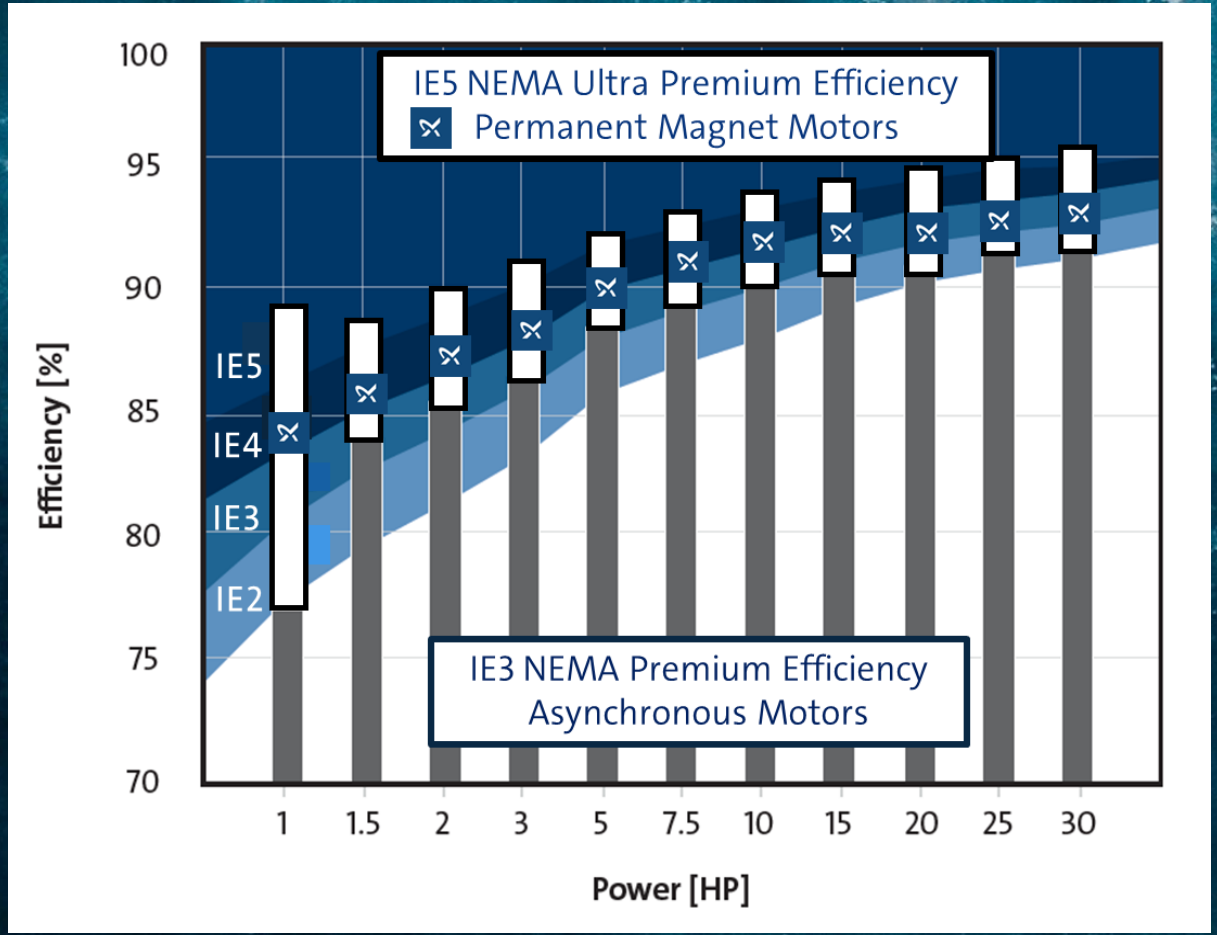
RAISING THE BAR
ABOVE NEMA PREMIUM

The new MLE motor offers 10% energy savings and up to 25% reduction in payback time compared to the NEMA premium efficient solution



1-30 HP have attained IE5 status

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Control Panels & Modules

Standard – FM200

- 2 analog input
- 1 Digital input
- 1 Digital in/out
- 2 Relay outputs
- Digital sensor in
- +24V supply
- +5V supply
- GENIbus

Advanced – FM300

- 3 analog input
- 2 Digital input
- 2 Digital in/out
- 2 Relay outputs
- Digital sensor in
- 2 PT100/1000 in
- 1 Liqtec input
- +24V supply
- +5V supply
- GENIbus

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CRE's come standard with 7 built in control functions

- Constant Pressure
- Constant Temperature
- Constant Differential Pressure
- Constant Differential Temperature
- Constant Flow Rate
- Constant Level
- Constant Curve

Almost 90% of MLE's in the field Worldwide are set for Constant PSI!

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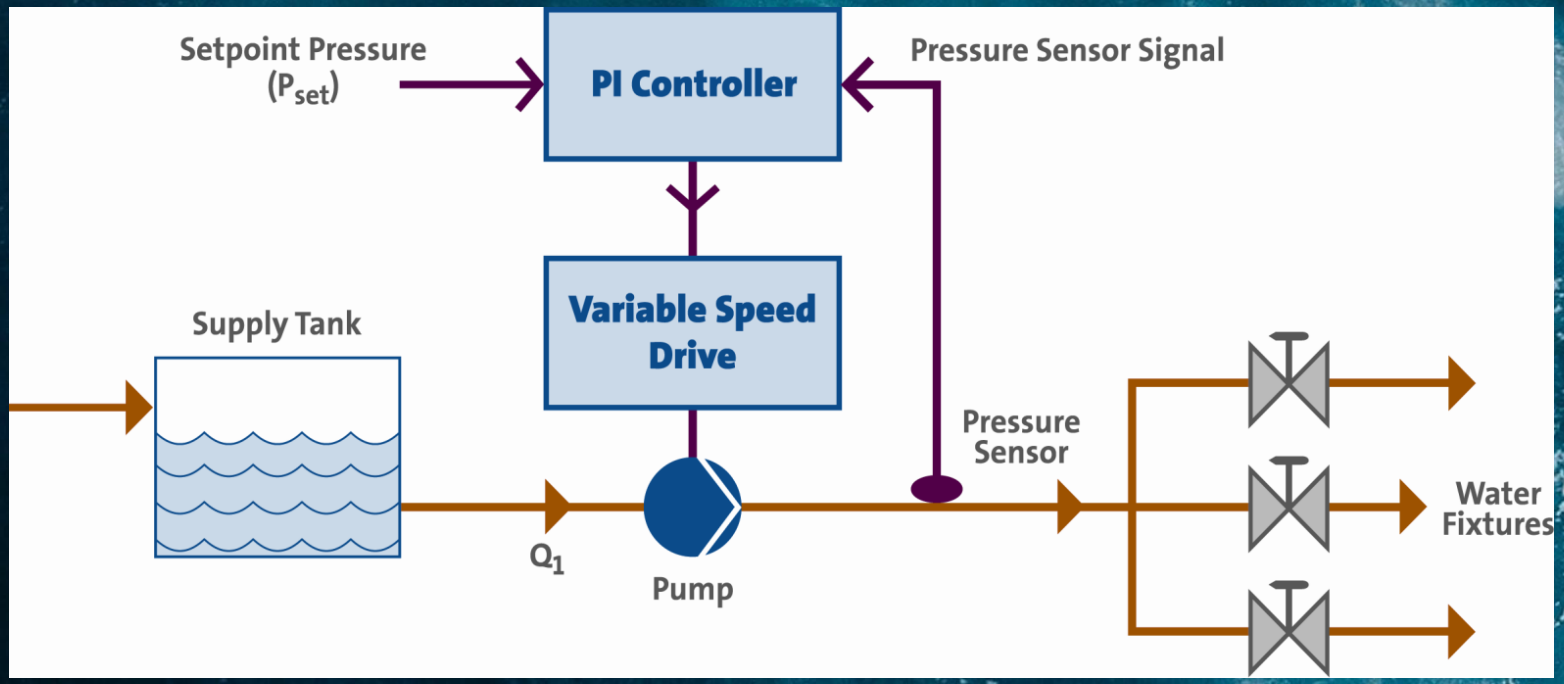
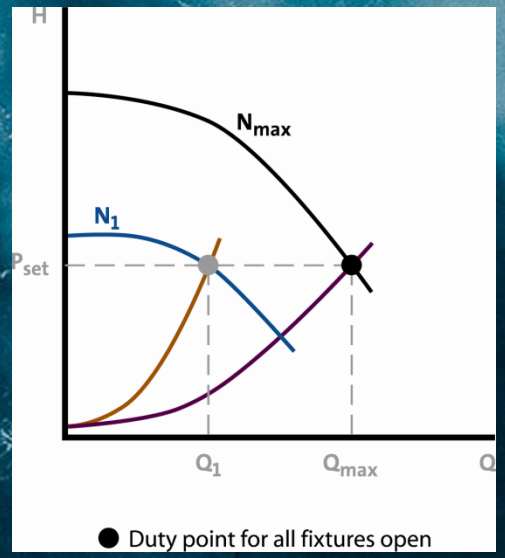
Constant Pressure Control





Pressure boosting of process water

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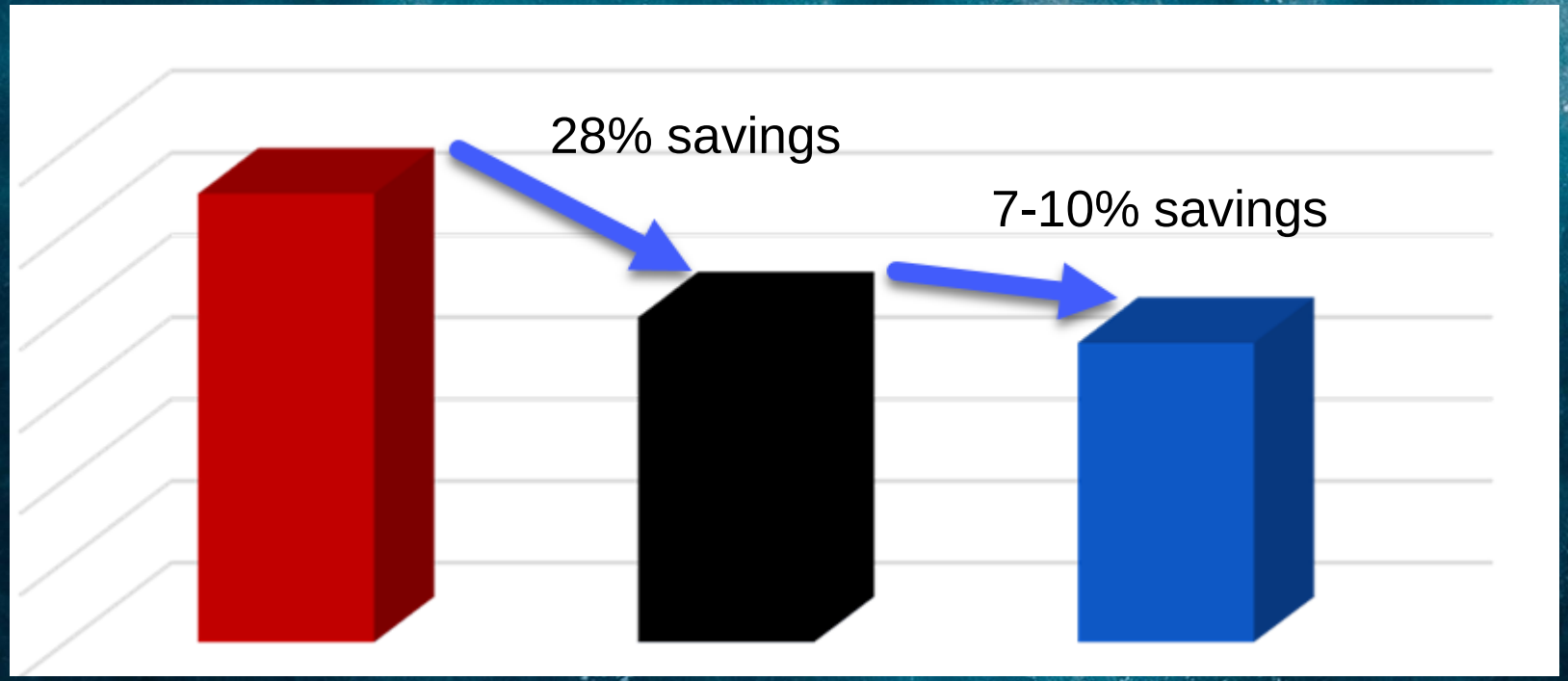
Energy Savings



Fixed Speed - PRV
VFD - Constant Pressure
MLE - Constant Pressure

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Grundfos Hydro MPC

Integrated Intelligent Pressure Boosting Systems

Boost your Pressure & Confidence!

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What is a Hydro MPC system?

- A complete **M**ulti **P**ump **C**ontrol package.
- Complete system built in Fresno, CA
- All systems manufactured undergoes a functional and hydrostatic testing
- All Systems are uL/cUL listed as package pump system.
- All standard systems are NSF 61 Annex G and NSF 372 approved for safe drinking water.

c UL us LISTED
PACKAGED PUMPING SYSTEM 38PK

CLASSIFIED c UL us WATER QUALITY

Single & Multi-Pump Systems
NSF / ANSI 61
MH26400
NSF / ANSI 372

Why Should You Choose Packaged Systems?

- Pre-engineered for easier and faster design and specification
- Pre-piped, wired, and tested for hassle-free installation
- Pre-programmed intelligent controls for easier commissioning
- Higher efficiency and energy savings
- Low maintenance with Ease of Service
- Pre-tested at the factory
- Less risk/liability

Save Time With Simpler Specifications

Save Money With Easier Installation

Save Energy With Smarter Controls

Hydro MPC System Types

Hydro MPC-E

MLE Motors on Pumps

Type code example

Hydro MPC-E 3CR**E**95-1

Hydro MPC-E (CUE)

CUE Drives in control enclosure

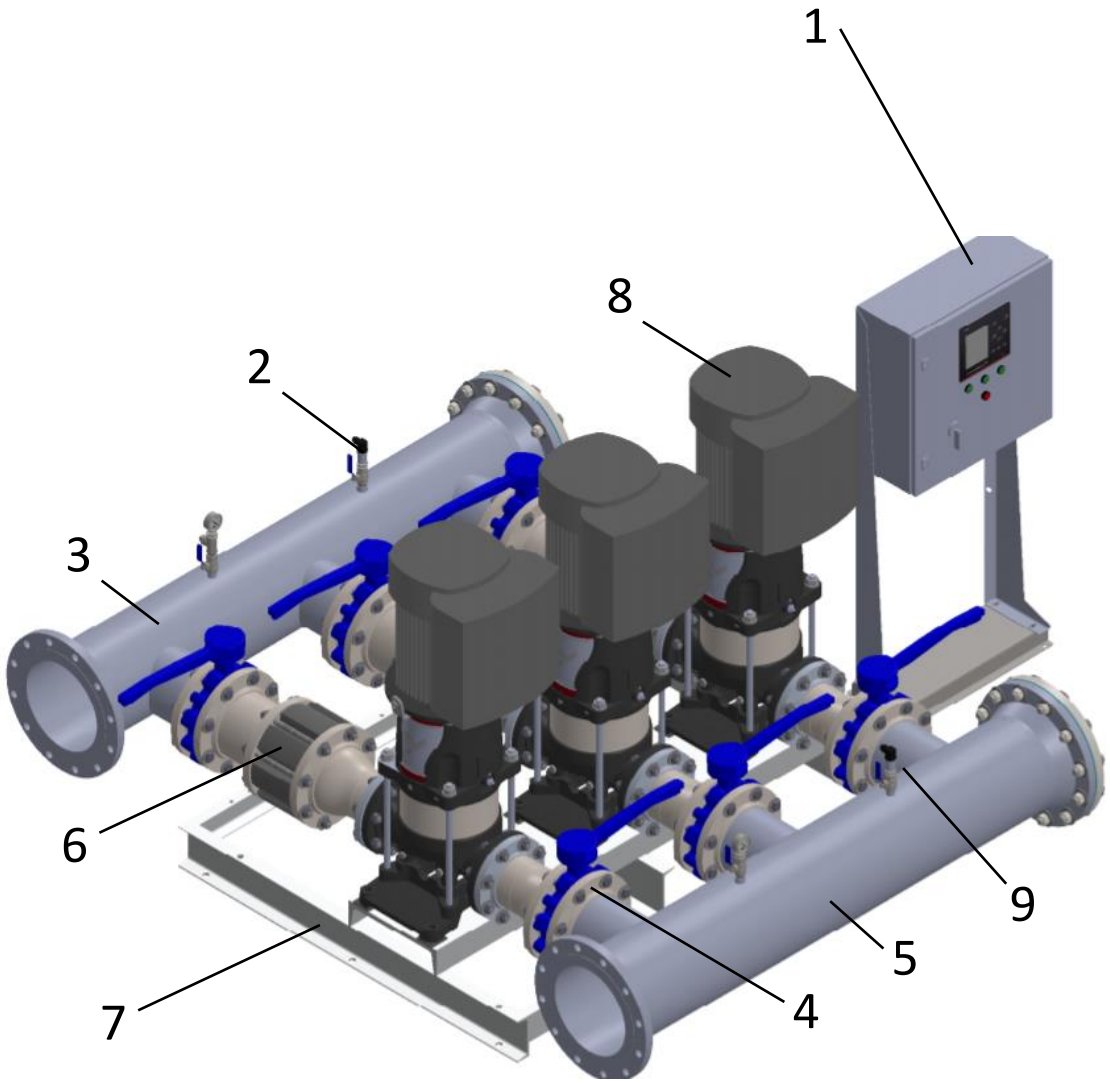
Type code example

Hydro MPC-E 3CR95-1

Hydro MPC Design.
Pre-engineered with shared components across the product range.

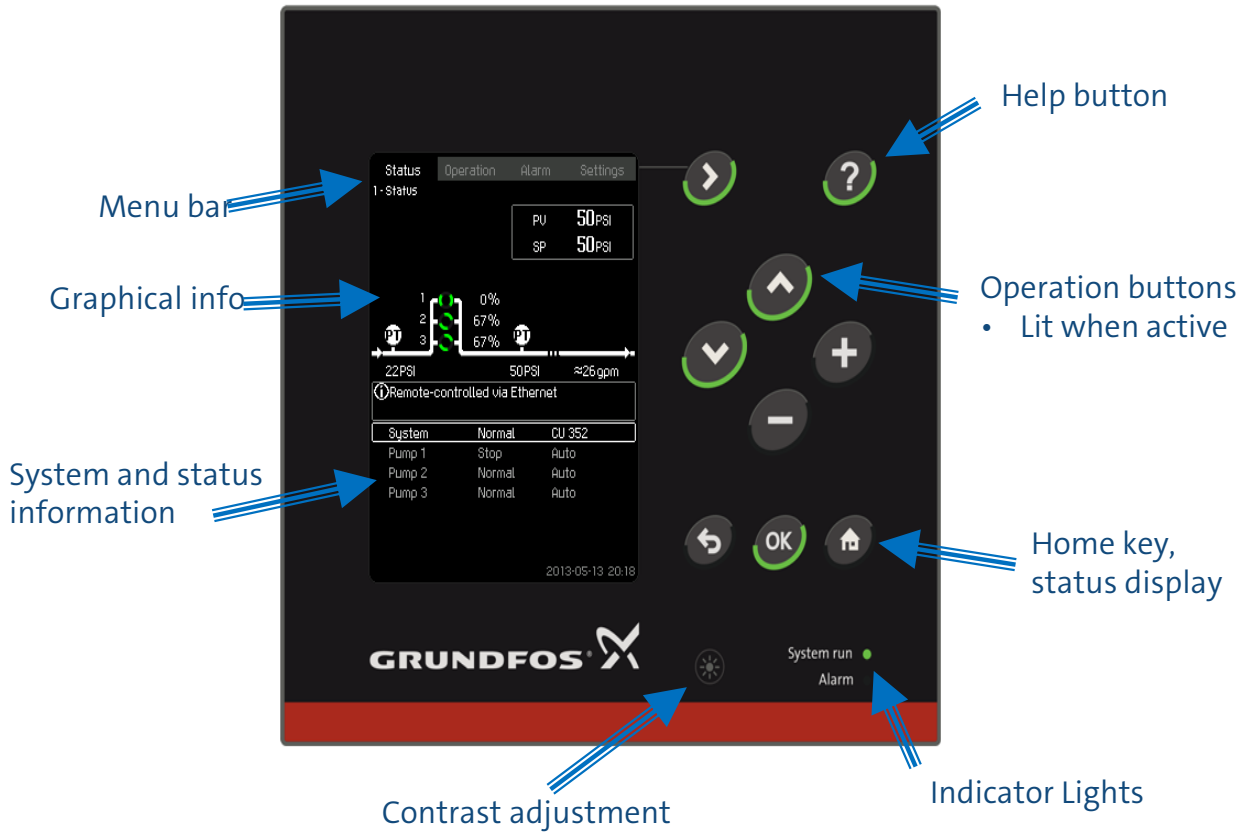
Hydro MPC design elements

1. **Control MPC Panel (CU 352) – UL Type 3R or 12**
2. **Pressure Transducer**
3. Suction/Discharge. Manifolds
4. Isolation Valve (2 per pump)
5. Suction/Discharge. Manifolds
6. Check Valve (1 per pump)
7. Base frame
8. **CR/CRE Pump**
9. Nameplate (UL/cUL Mark)



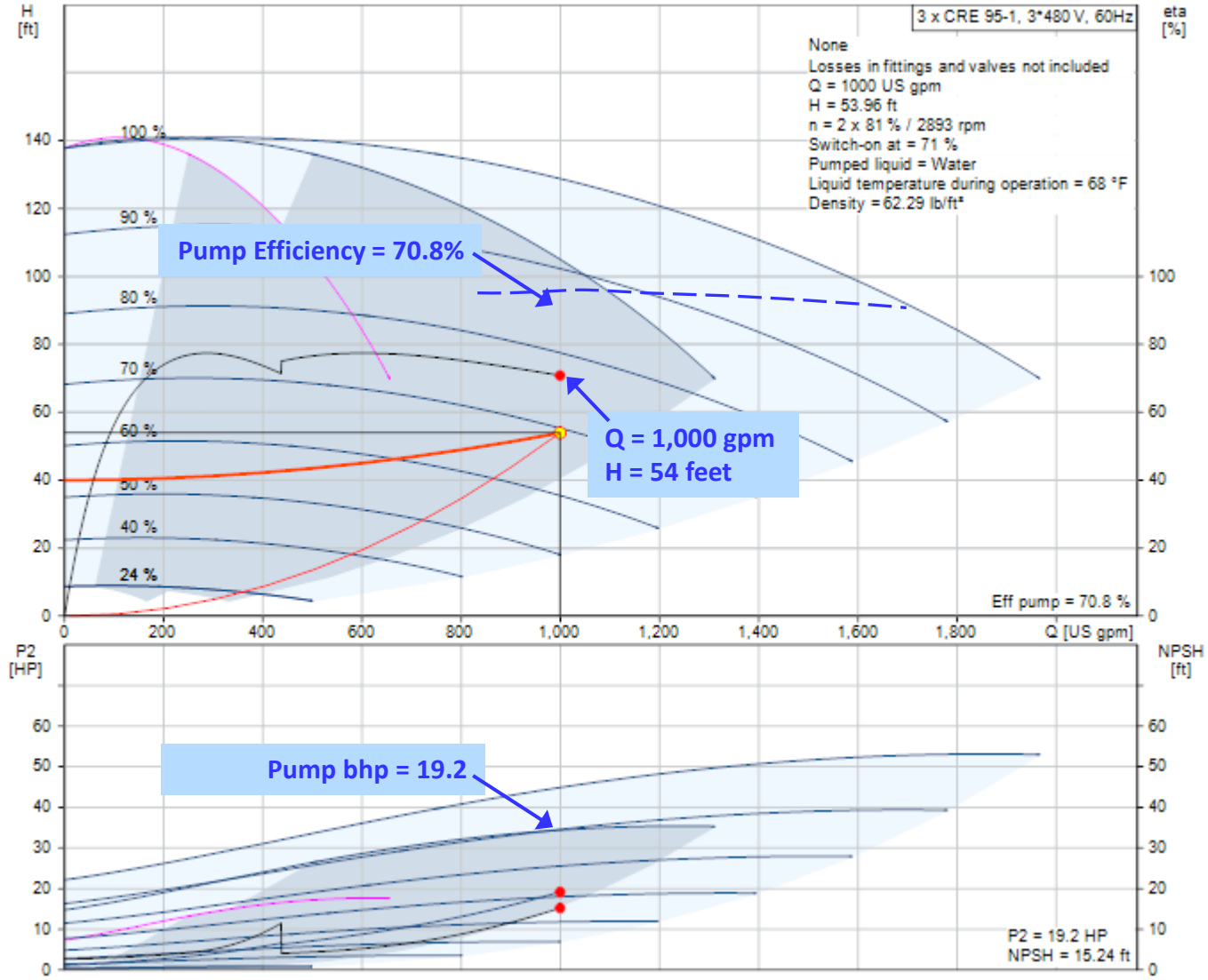
CU 352 Pump Controller

- Highly advanced pump control and user interface
- Especially developed and designed for:
  - Control of up to SIX parallel coupled pumps
  - Optimum comfort through advanced control algorithms
  - Can control Grundfos E-pumps directly
- Start-up Wizard for trouble free installation
- Power Supply: 100-240V 50/60Hz



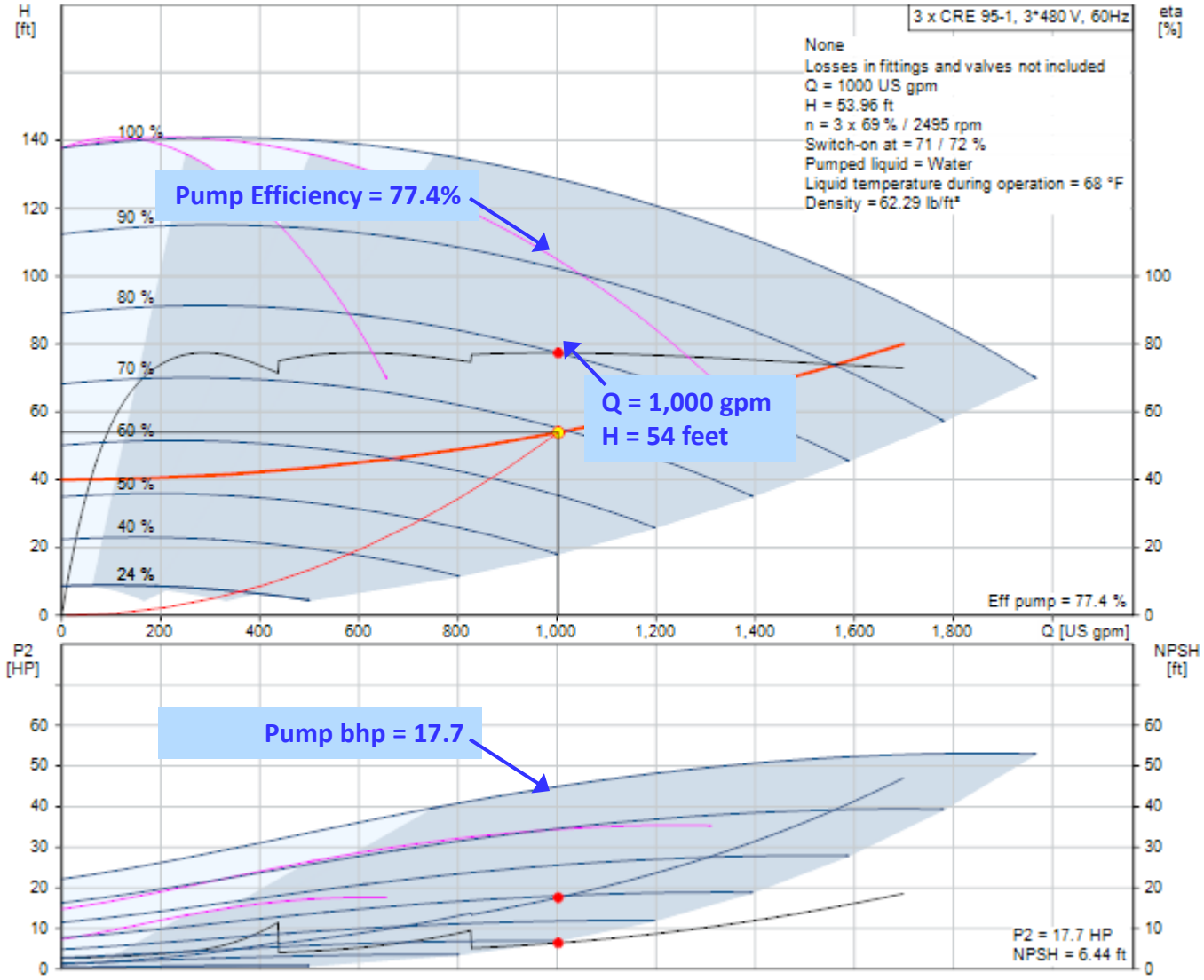
Parallel Pump Control – Efficiency Based Sequencing

2 Pumps at 81% speed



Parallel Pump Control – Efficiency Based Sequencing

3 Pumps at 69% speed



Parallel Pump Control – Power Optimal Sequencing

POWER OPTIMAL PUMP SEQUENCING

UNMATCHED **ENERGY PERFORMANCE** WITH GRUNDFOS CONTROLS

GRUNDFOS iSOLUTIONS | A SMART SOLUTION FOR YOU

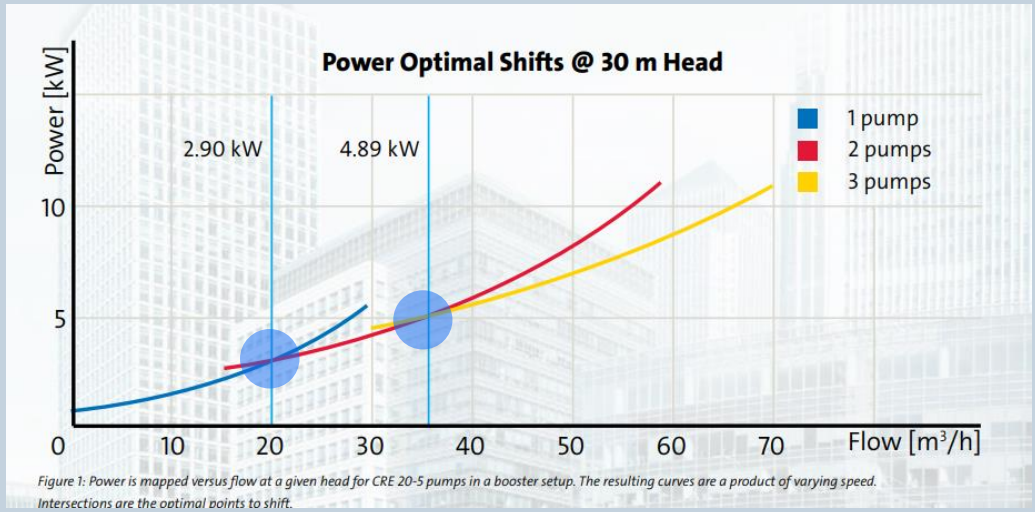


Figure 1: Power is mapped versus flow at a given head for CRE 20-5 pumps in a booster setup. The resulting curves are a product of varying speed. Intersections are the optimal points to shift.

Finding the intersections requires knowledge of pump characteristics.

The POPS (Power Optimal Pump Sequencing) algorithm will determine pump characteristics QH and QP without prior knowledge of the pump characteristics - allowing the algorithm to work with any type, model and brand of centrifugal pump.

Before POPS the average power, consumption is 2,74kWh and with POPS activated it is 2,45kWh, which is a saving of 10,5%

Before

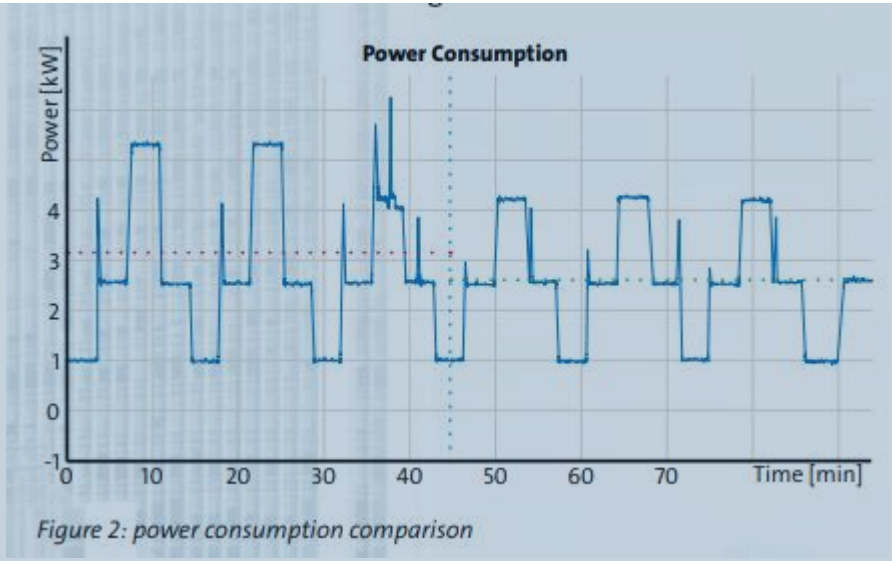
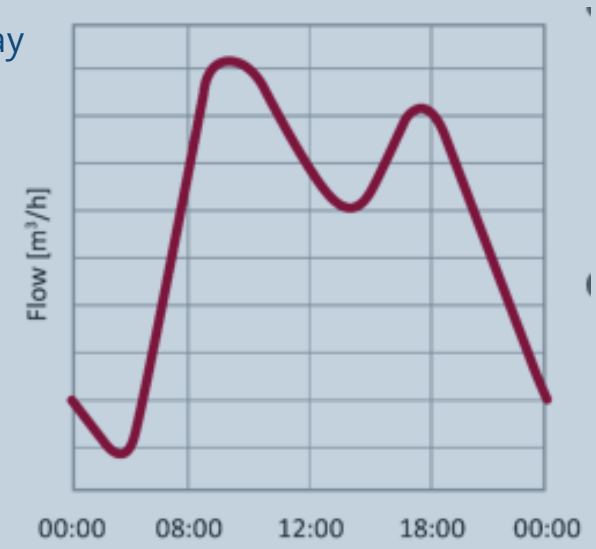


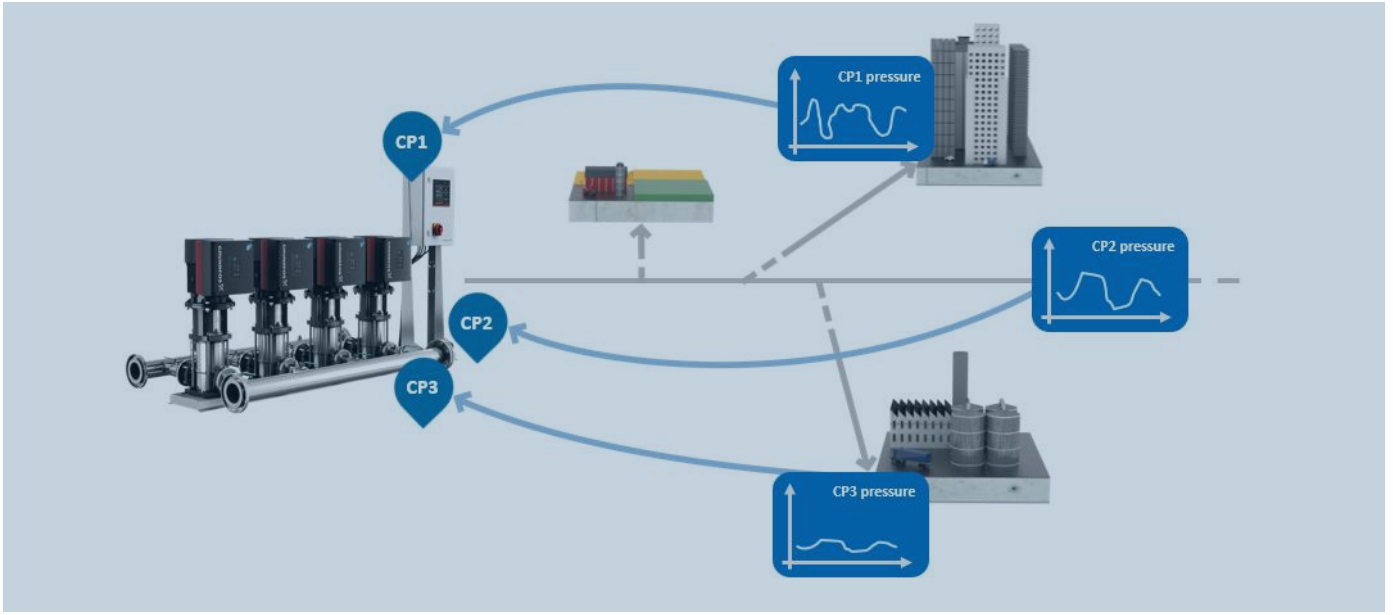
Figure 2: power consumption comparison

After

Parallel Pump Control – Demand Driven Distribution

Water profile
for a typical day



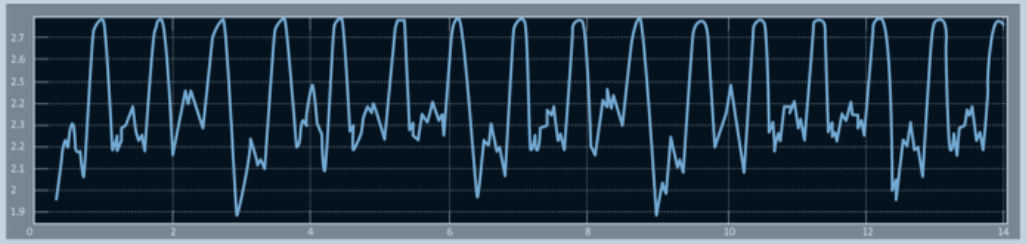


Remote pressure sensors (data loggers) are installed at critical delivery points (CP). The DDD algorithm creates a model of the distribution network system. The booster system optimizes the pump control.

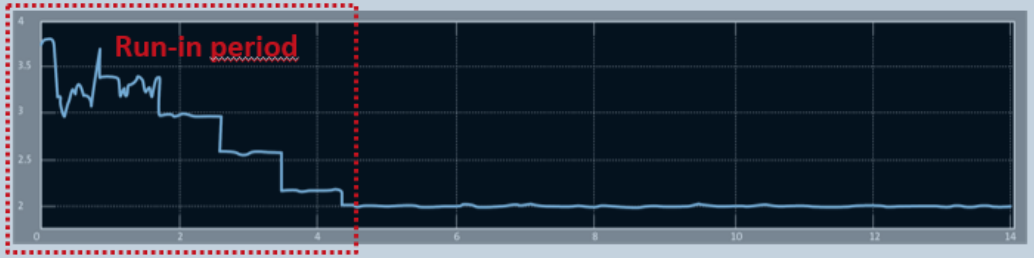
Data from +100 installations:

- **25% energy saving**
- **15% in leakage savings**
- **35% reduction in pipe burst**

Remote sensor
pressure without DDD



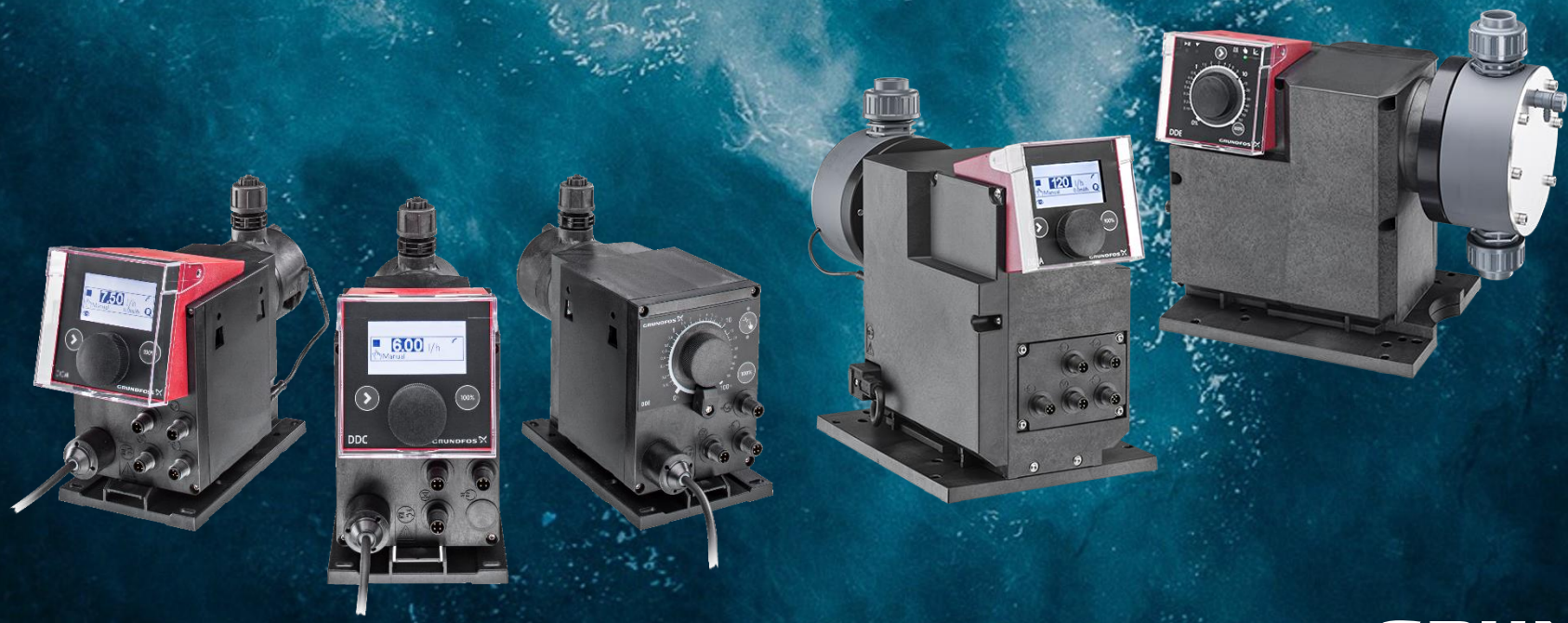
Remote sensor
pressure with DDD



Grundfos Smart Digital

Integrated Intelligent Pressure Monitoring

Secure, precise, versatile and easy to use!



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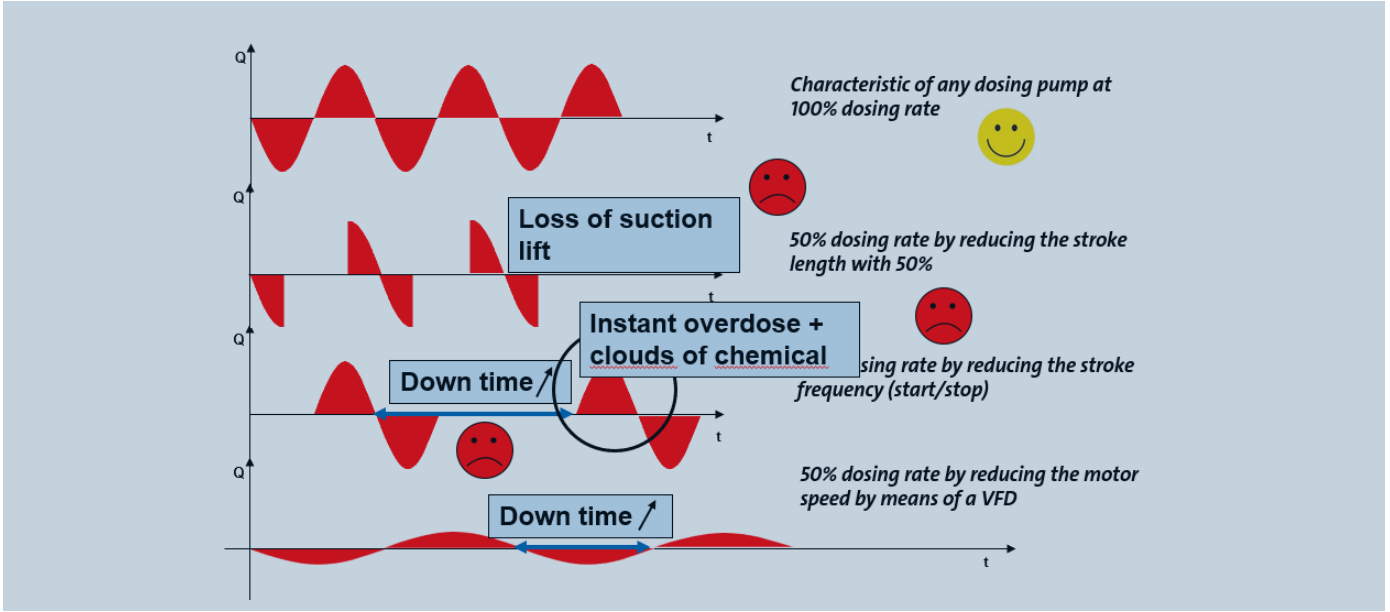
Smart Digital Dosing – The pump.

A **typical (mechanical) dosing pump** have the following characteristic.

The capacity is either controlled by reducing the stroke length or the frequency of the motor.

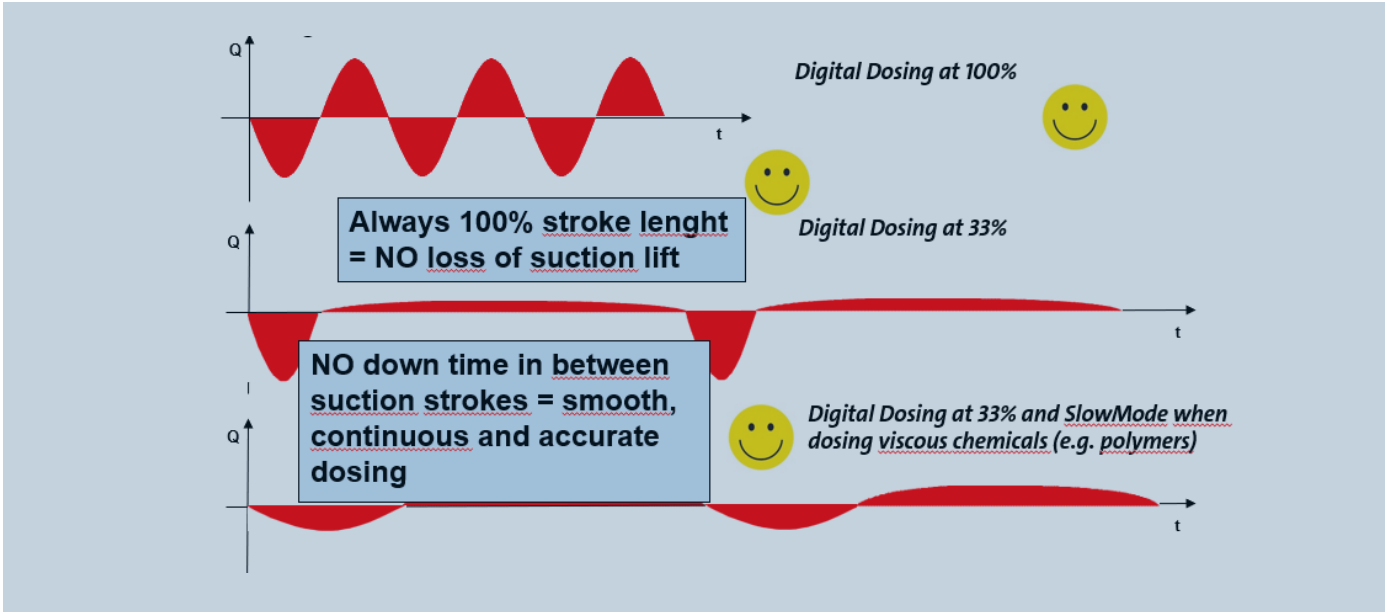
- Works fine in maximum condition
- Looses suction lift when stroke is reduced
- It overdoses in period and no dose in other periods
- It has down time that result in plug flows
- It inherently un-precise with increased setpoint consequently



The **Smart Digital** pump works a highly efficient permanent magnet DC motor and a sophisticated motor controller.

The capacity is adjusted by controlling the membrane movement in 1:3000 or 1:1000.

- Works very accurate in all settings
- Minimum down time and plug flow
- No loss of suction lift – resulting in virtual no vapor lock
- Less variants to cover a wide range of capacities



Demonstration of the stepper motor principle

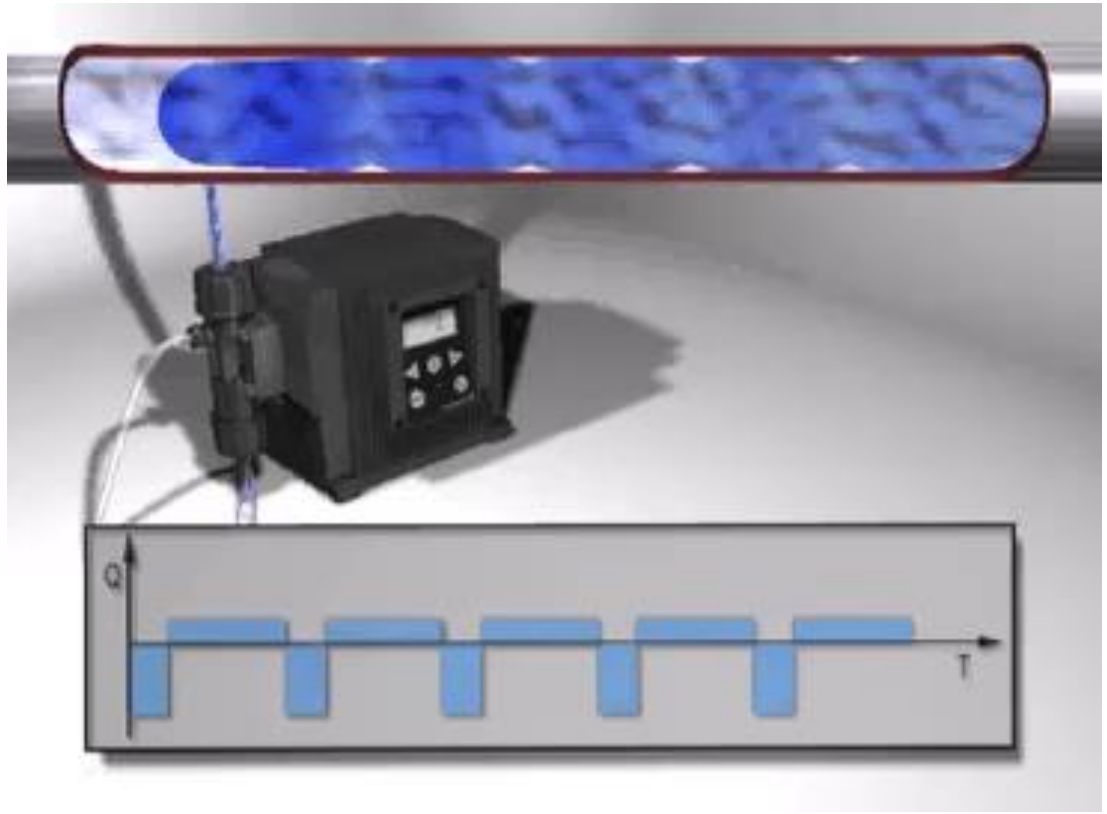
The motor control turn the stepper motor. The stepper motor actuates the membrane crank

The suction stroke is done as quickly as the process allows. There is a special mode for viscous flow.

The chemical is injected over (almost) the full running period – no overdose and underdose

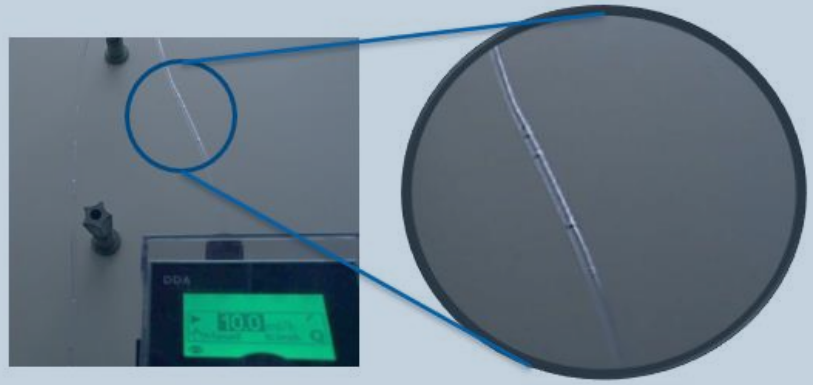
The pressure stroke is controlled by the acceleration of the membrane (Joukowski, dV/dt). So very reduced pressure surges.

The motor control is very accurate – even at a turn down ration of 1:1000. With FC down to 1:3000



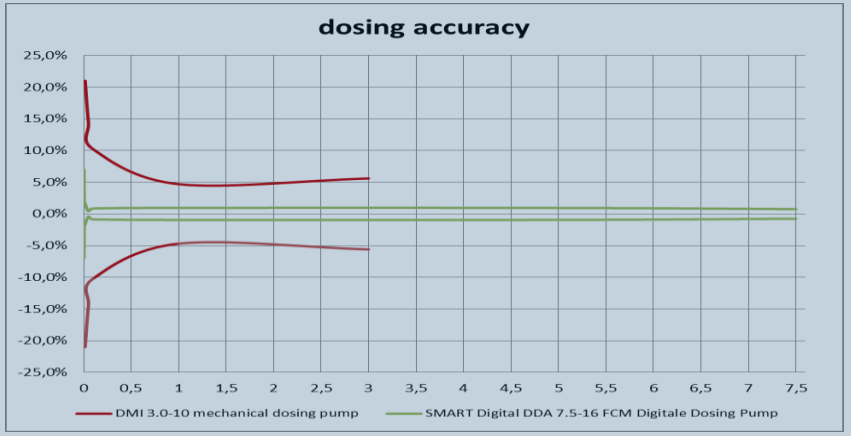
DDA-FCM. Build in pressure measurement and PID controller -> Flow Control Measurement.

Degassing fluids: Dosing accuracy: 1.96% of dosing setpoint.



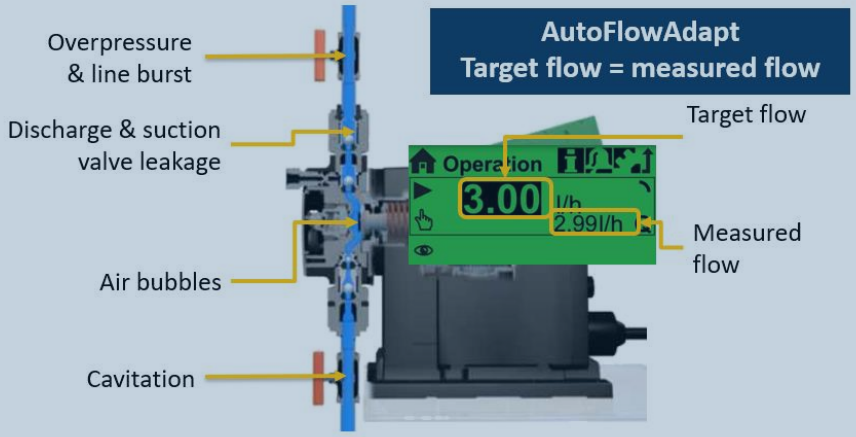
(University Weihenstephan. Mech. Dosing: 7-10%)

Dosing accuracy: 0.4-0.7% of dosing setpoint.

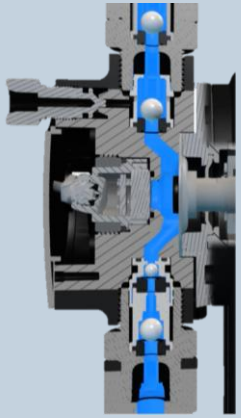


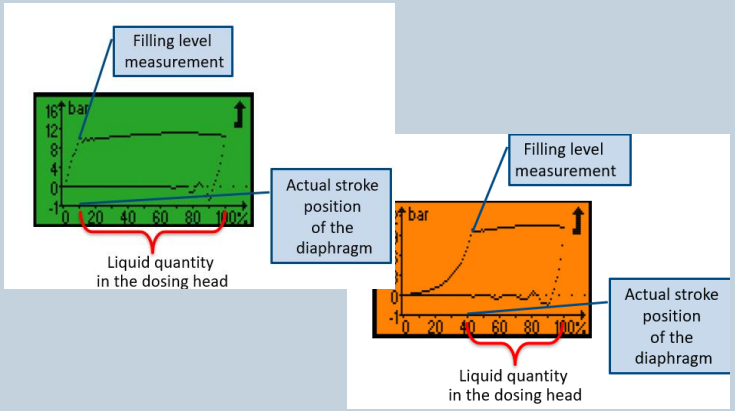
(University Weihenstephan. Mech. Dosing: 5-10%)

Process safety. The pressure characteristic indicates the problem. The PID controller solves the problem.



The pressure characteristic is used to enhance **precision**. Build in **flow meter**, **auto-degassing** and **auto calibration** and much more.





Summary: Benefits with the Smart Digital Dosing Pump

Cost savings

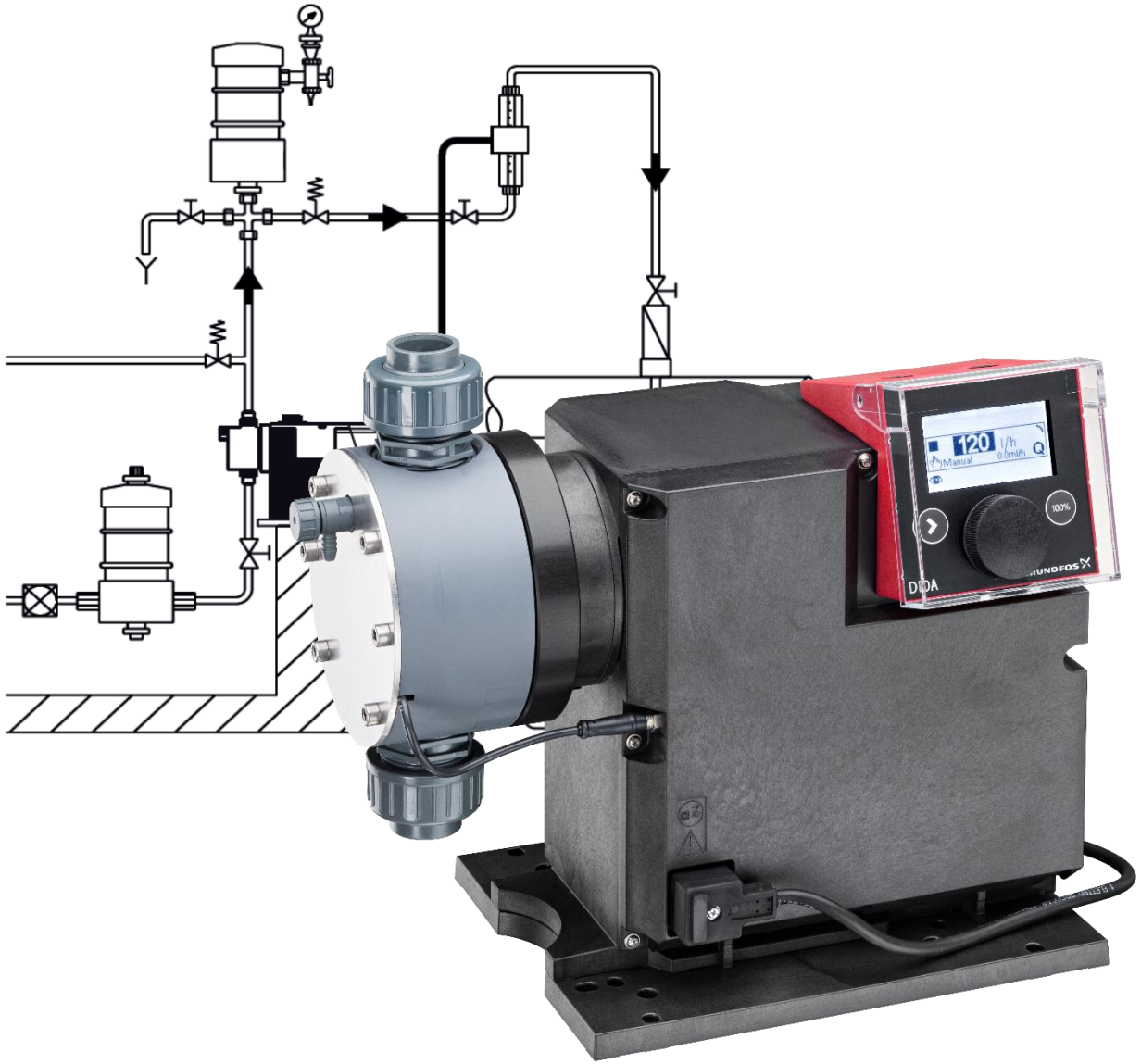
- Dosing with high accuracy (+/- 1% of the set point) – reduces chemical consumption
- Integrated pressure gauge (+/- 0.001 bar)
- Integrated flow meter – no external dosing flow meter required

Easy installation

- No calibration required
- No additional safety components
- No discharge pulsation damper required
- No suction pulsation damper required

Easy process integration

- Dosing of degassing liquids
- Dosing of high viscosity liquids – slow mode



Case stories.

- CR/CRE. CR 95 pumps increase efficiency and reduce downtime for chemical plant | Grundfos. Midwest U.S. chemical processing and distribution company
- HYDRO MPC/Hydro HP. Turkey processing plant increases reliability while cutting energy usage with a Grundfos high-pressure pump solution | Grundfos. Virginia Poultry's and solutions provider Carotek.
- DDD – Demand Driven Distribution. How dynamic pressure management with Grundfos DDD helped achieve significant savings | Grundfos. Przedsiębiorstwo Gospodarki Komunalnej Sp. z o.o. (Communal Services Utility LTD) in Wolsztyn, Poland
- Smart Digital. SMART Digital solves off-gassing problem | Grundfos. Beaufort-Jasper Water and Sewer Authority.
- Smart Digital. Award-Winning Food Sanitation Startup Uses Innovation and SMART Digital Dosing to Fight COVID-19 | Grundfos. Clean Works.

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