

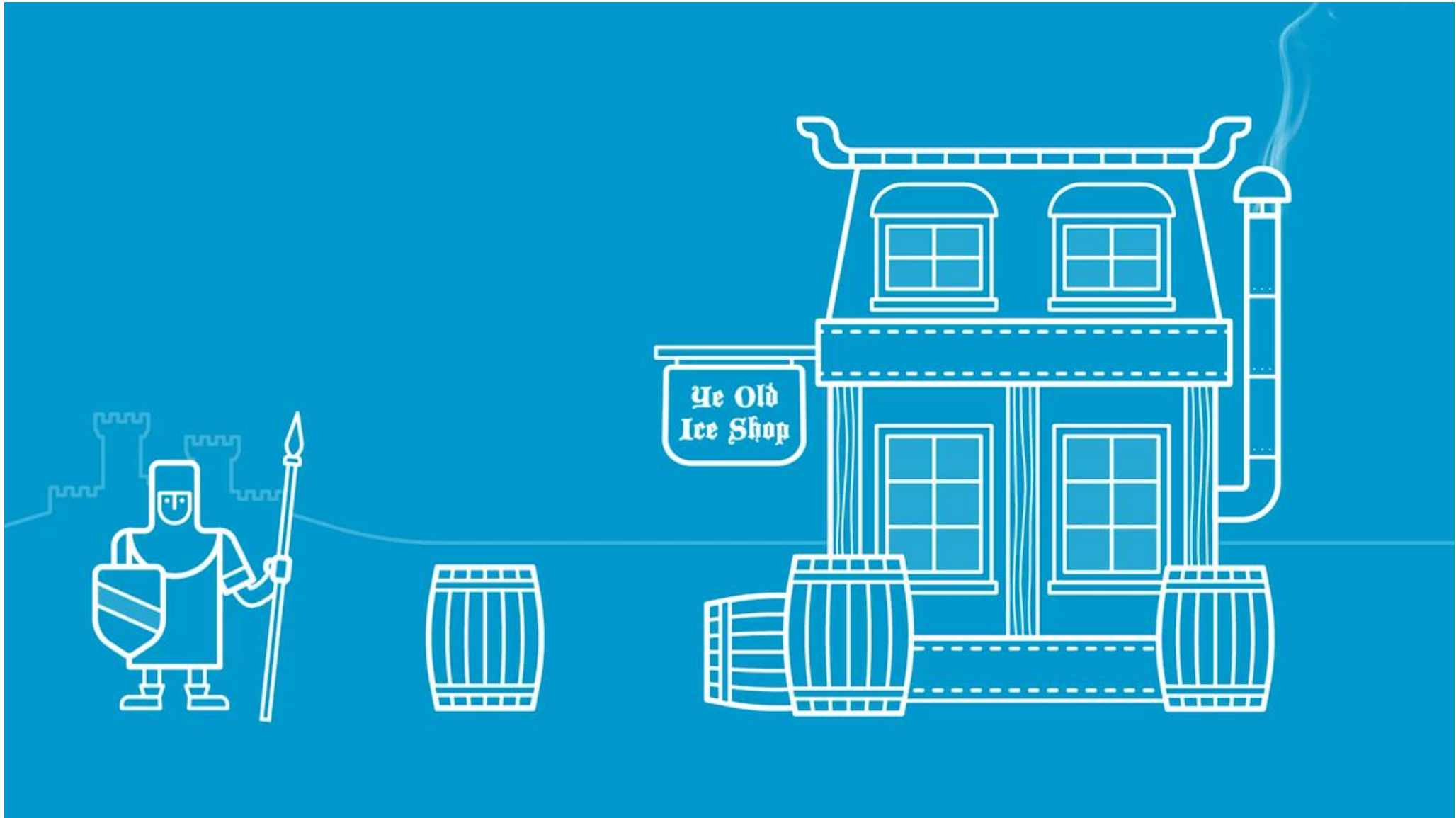


Atlas Copco



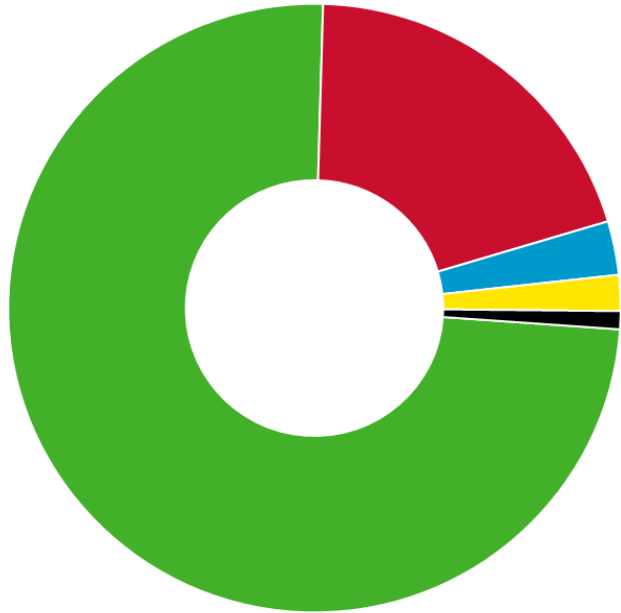
Industrial Gases

Customer Day



Introduction

Air by percentage of volume



78.08% Nitrogen (N₂)

20.95% Oxygen (O₂)

0.93% Argon (Ar)

0.03% Carbon dioxide (CO₂)

0.01% Other gases

What is Nitrogen?

- It forms 78% of the earth atmosphere
- It is a colorless, tasteless and odorless gas
- Lighter than oxygen
- Mostly Inert gas, meaning it hardly reacts with other elements
- It does not support life ⚠
- Essential constituent of proteins and other biological products

What is Oxygen

Properties

Colorless, odorless, tasteless

- Oxygen enrichment can not be detected by the human senses!

Supports life of every form



Highly reactive

Oxygen is heavier than air (ref. 0°C / 1013 mbar)

- Density O₂: 1.429 g/L

- Density Air: 1.292 g/L



Thus, oxygen tends to accumulate in low lying areas!



Introduction

Applications

Nitrogen

Food packaging



Laser cutting



Blanketing



Electronics soldering



Tire inflation



Oxygen

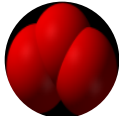
Medical: oxygen therapy



Water treatment:
bacteriological survival



Ozone production



Metal and glass industry

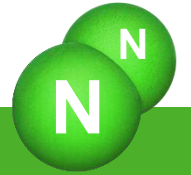
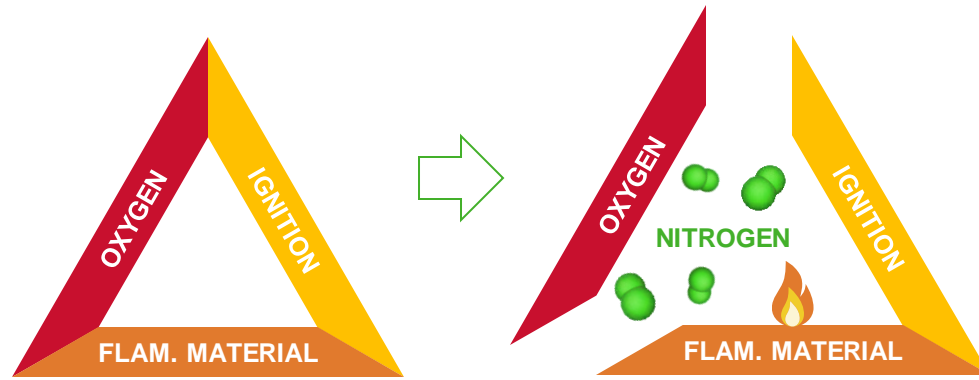


Fish farming



Introduction

Nitrogen - Applications



PREVENT OXIDATION



FAST OXIDATION



Oil tanker



Explosion



Fire



SLOW OXIDATION



Vegetable trans.



Rotting



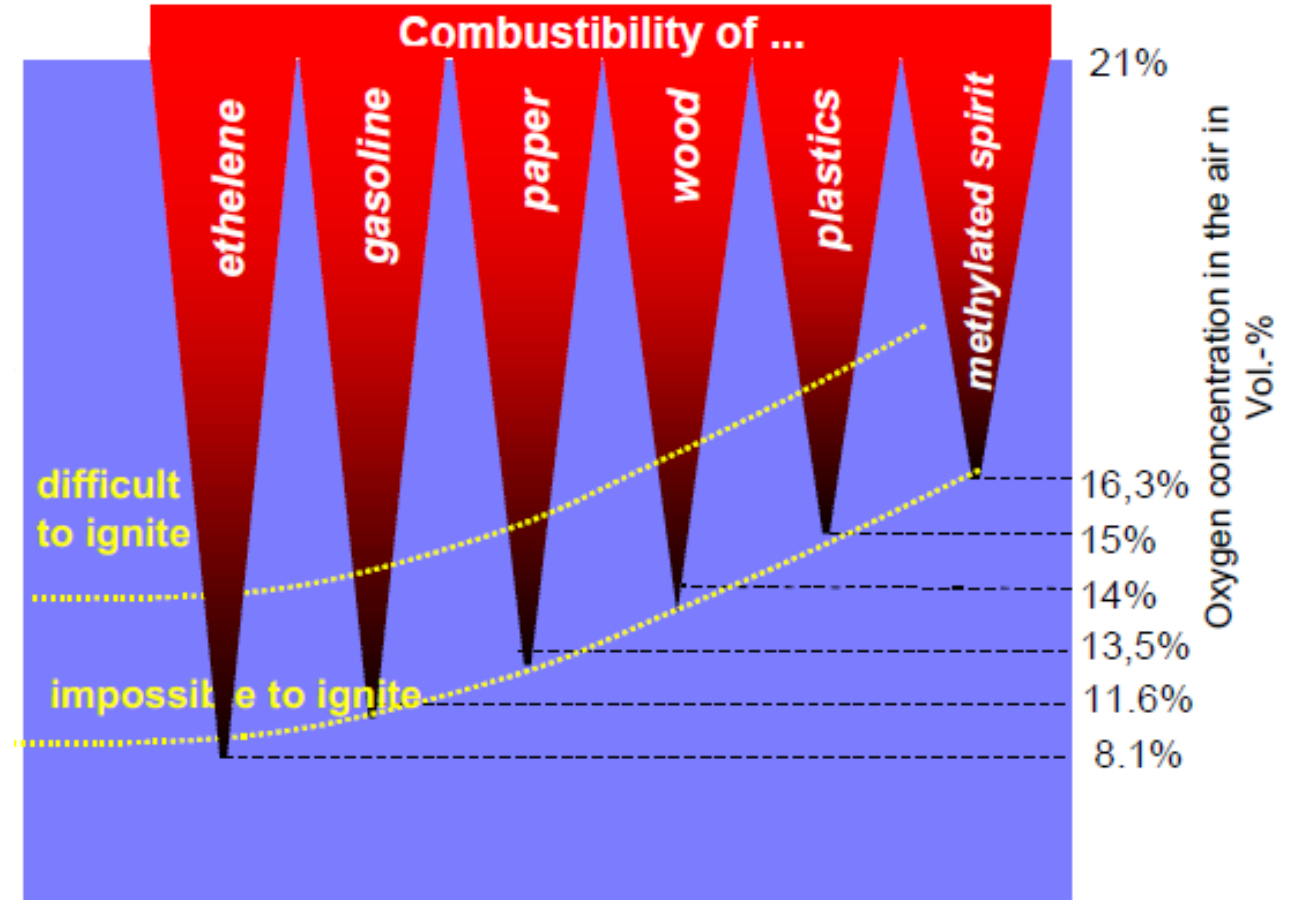
Corrosion



Introduction

Nitrogen - Applications

- MOC* is defined as the limiting concentration of oxygen below which combustion is not possible, independent of the concentration of fuel
- Reducing the O₂ concentration below MOC prevents explosion and fire
- MOC level depends on substance



*MOC = minimum oxygen concentration

Industrial Gas generation

Production technologies

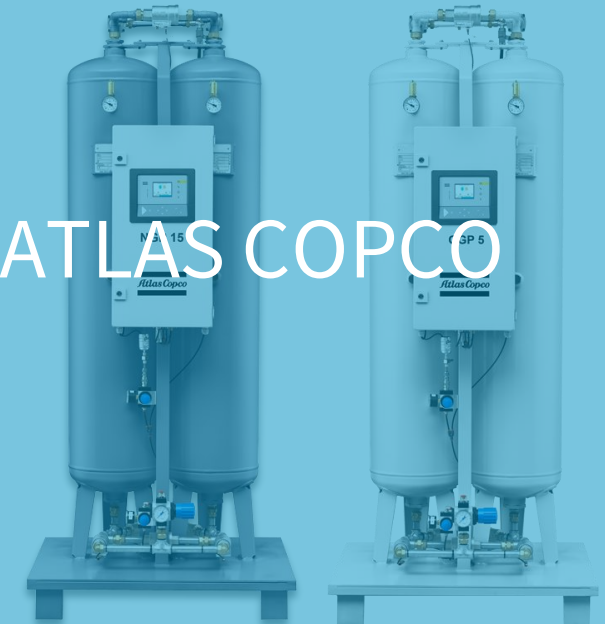
CRYOGENIC SEPARATION



MEMBRANE SEPARATION



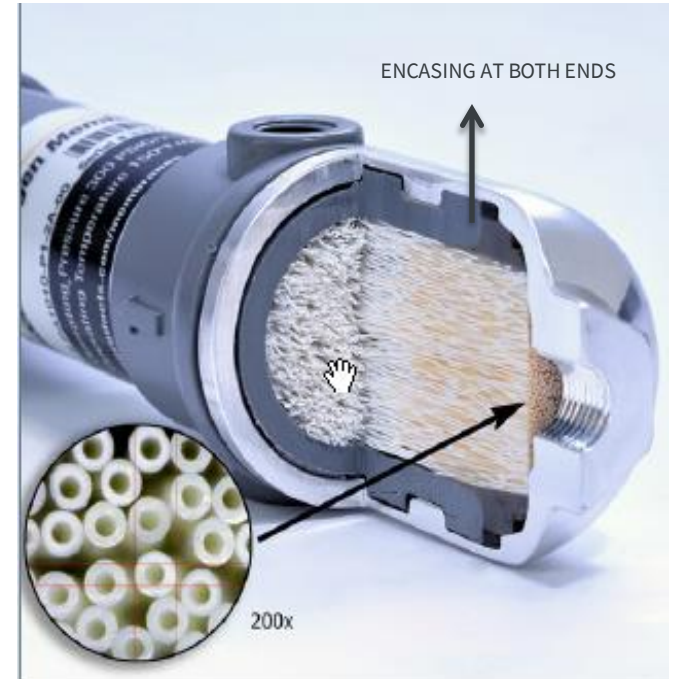
PSA / VSA SEPARATION



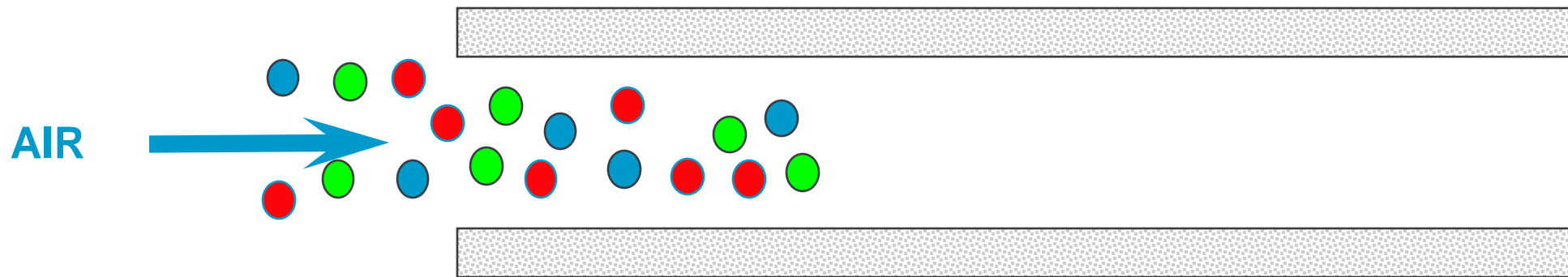
SOLUTION FROM ATLAS COPCO

Membrane TECHNOLOGY at a glance

- A simple technology - no moving parts
- Asymmetric hollow fiber membrane technology.
- Thousands of fibers are bundled and encased at both ends in epoxy resin.
- Fiber bundle is placed in a (marine grade aluminum) housing to protect and route the gas stream properly.
- Gas separation is based on the difference in permeability
- Each gas has a characteristic permeation rate.
 - Oxygen is “fast” gas and selectively diffused through the membrane wall.
 - Nitrogen is “slower” gas and travels along the inside of the fiber.



1. Membrane TECHNOLOGY at a glance

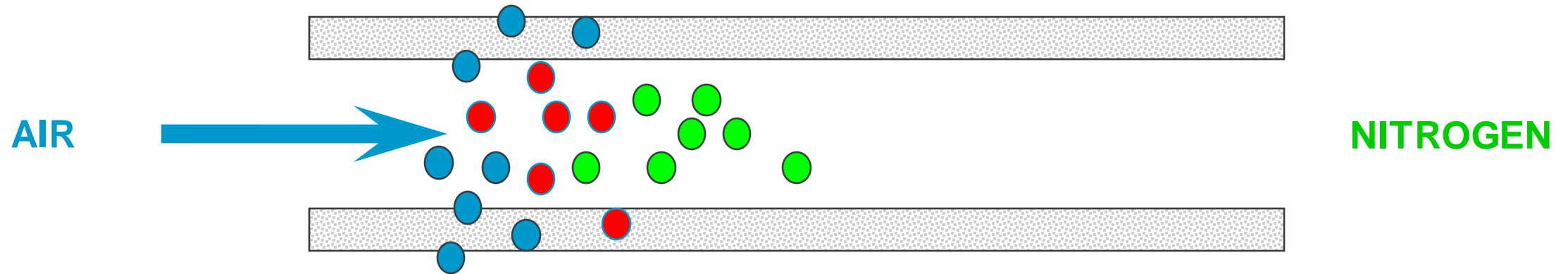


● = H₂O

● = O₂

● = N₂

1. MEMBRANE TECHNOLOGY AT A GLANCE

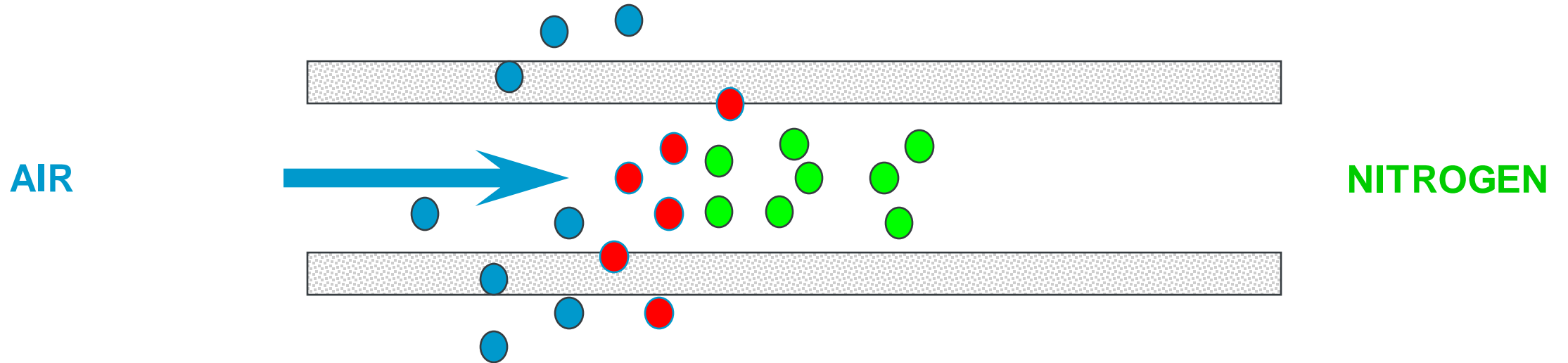


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1. MEMBRANE TECHNOLOGY AT A GLANCE

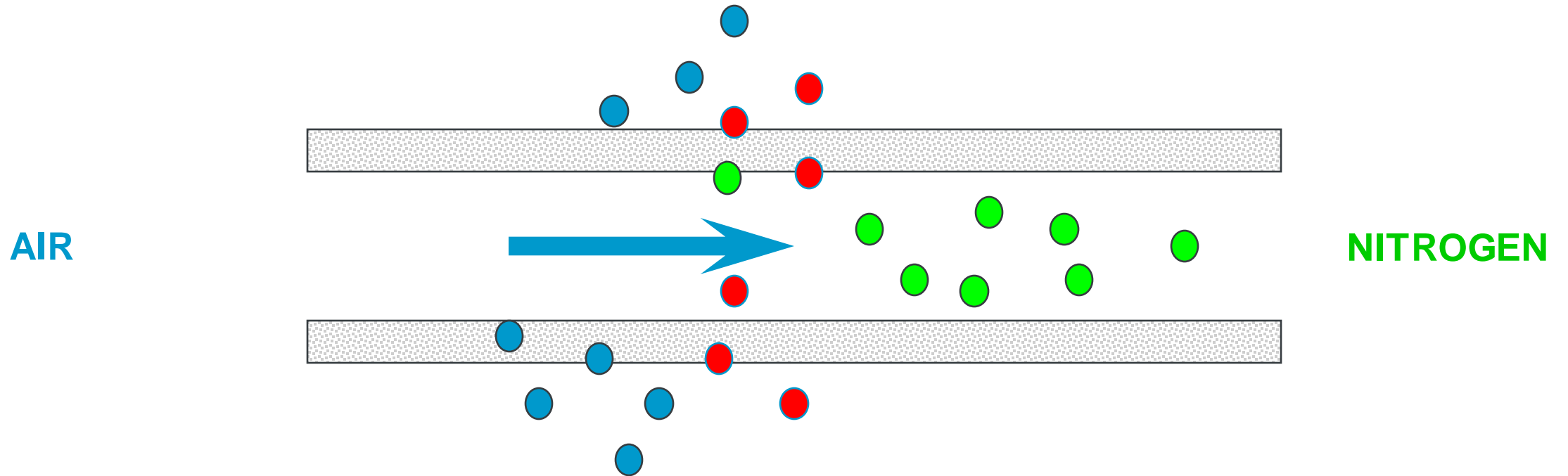


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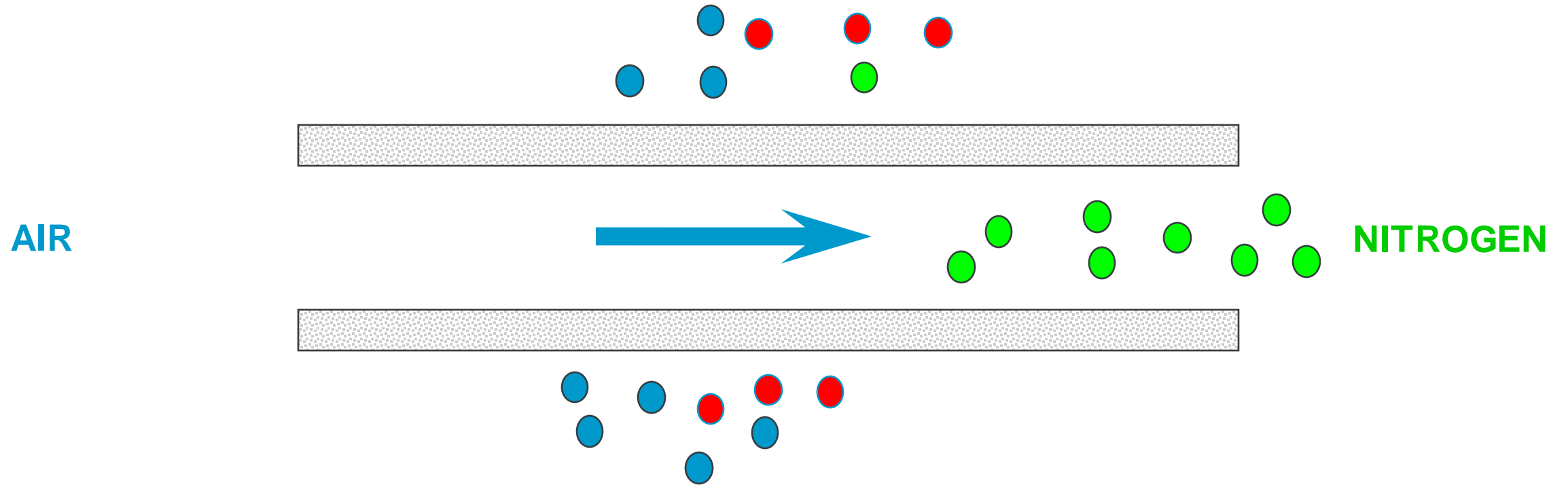
1. MEMBRANE TECHNOLOGY AT A GLANCE



- = H₂O
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1. MEMBRANE TECHNOLOGY AT A GLANCE



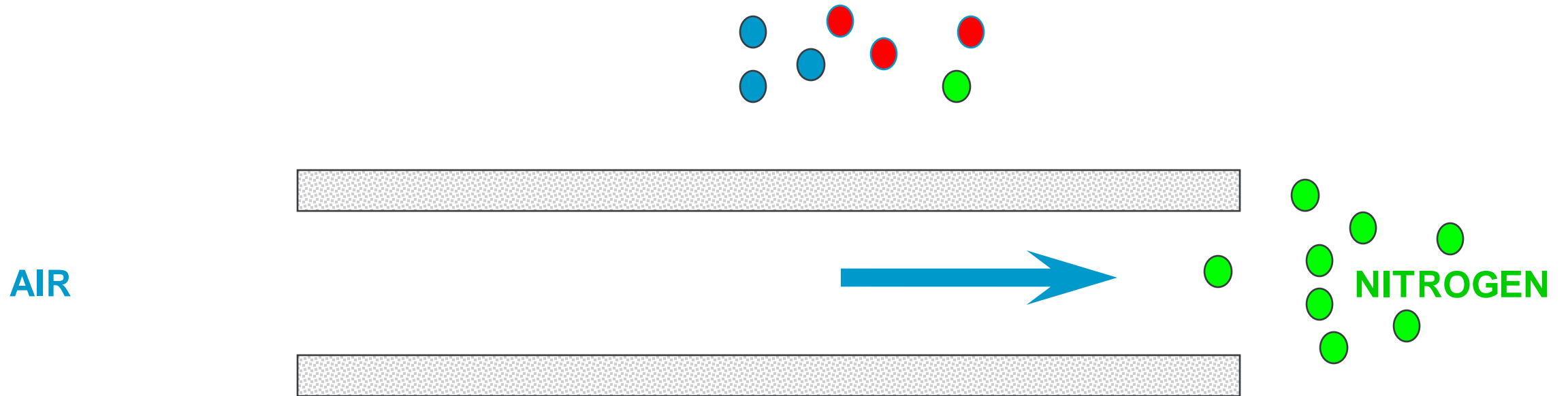
● = H₂O

● = O₂

● = N₂



1. MEMBRANE TECHNOLOGY AT A GLANCE



● = H₂O

● = O₂

● = N₂

ON-SITE GAS GENERATOR PLANT

NGM+ Typical Configuration



Compressor



Dryer



Filters



NGM+



N2 Storage



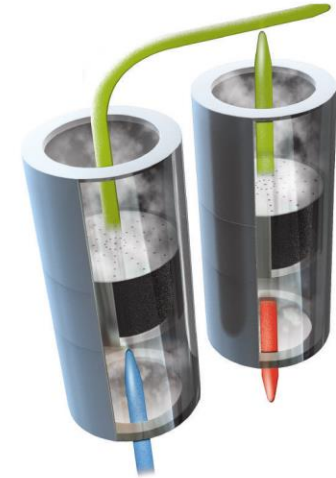
Introduction

Production technologies - PSA

- Separate nitrogen from air using Carbon Molecular Sieve (CMS) that adsorbs oxygen and not nitrogen
- The small oxygen molecules will penetrate the pores while the big nitrogen molecules will pass by the CMS
- Through this high adsorption selectivity, CMS allows us to separate nitrogen from air
- In a PSA unit, two connected tanks work together to produce a near-continuous flow of nitrogen gas



- Oxygen
- Nitrogen

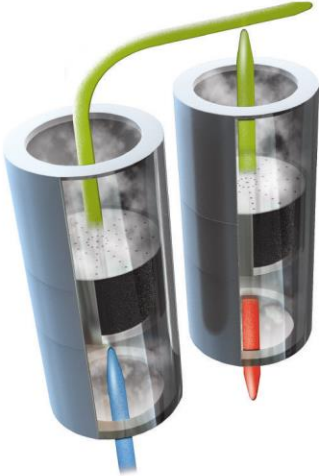


- Clean compressed air
- Nitrogen gas
- Oxygen exhaust
- Carbon Molecular Sieve



Introduction

Production technologies - PSA



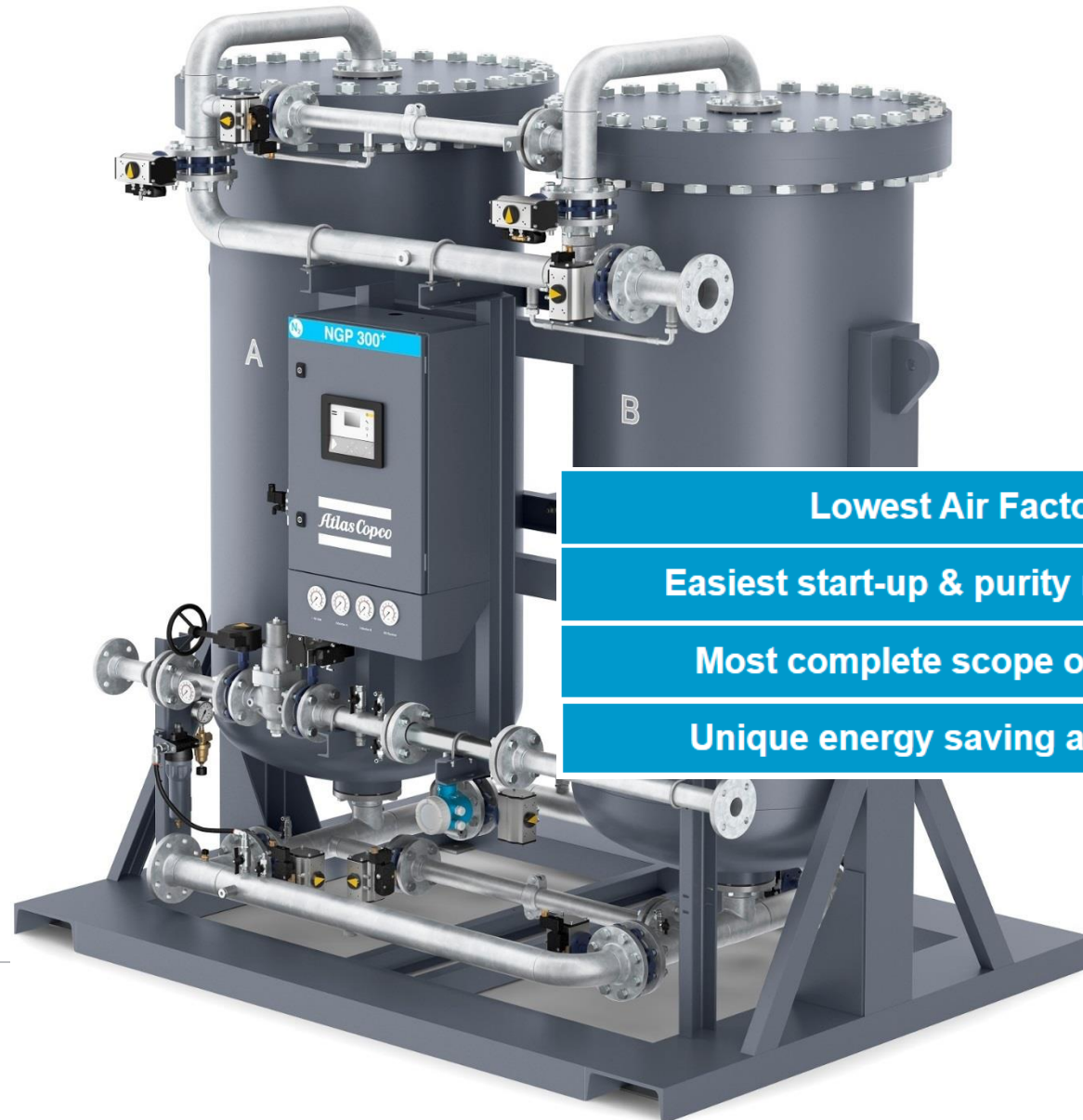
- Oxygen
- Nitrogen

- Clean compressed air
- Nitrogen gas
- Oxygen exhaust
- Carbon Molecular Sieve



The all new NGP+ 160-360

**Our NGP+
has grown BIG!**



Lowest Air Factor

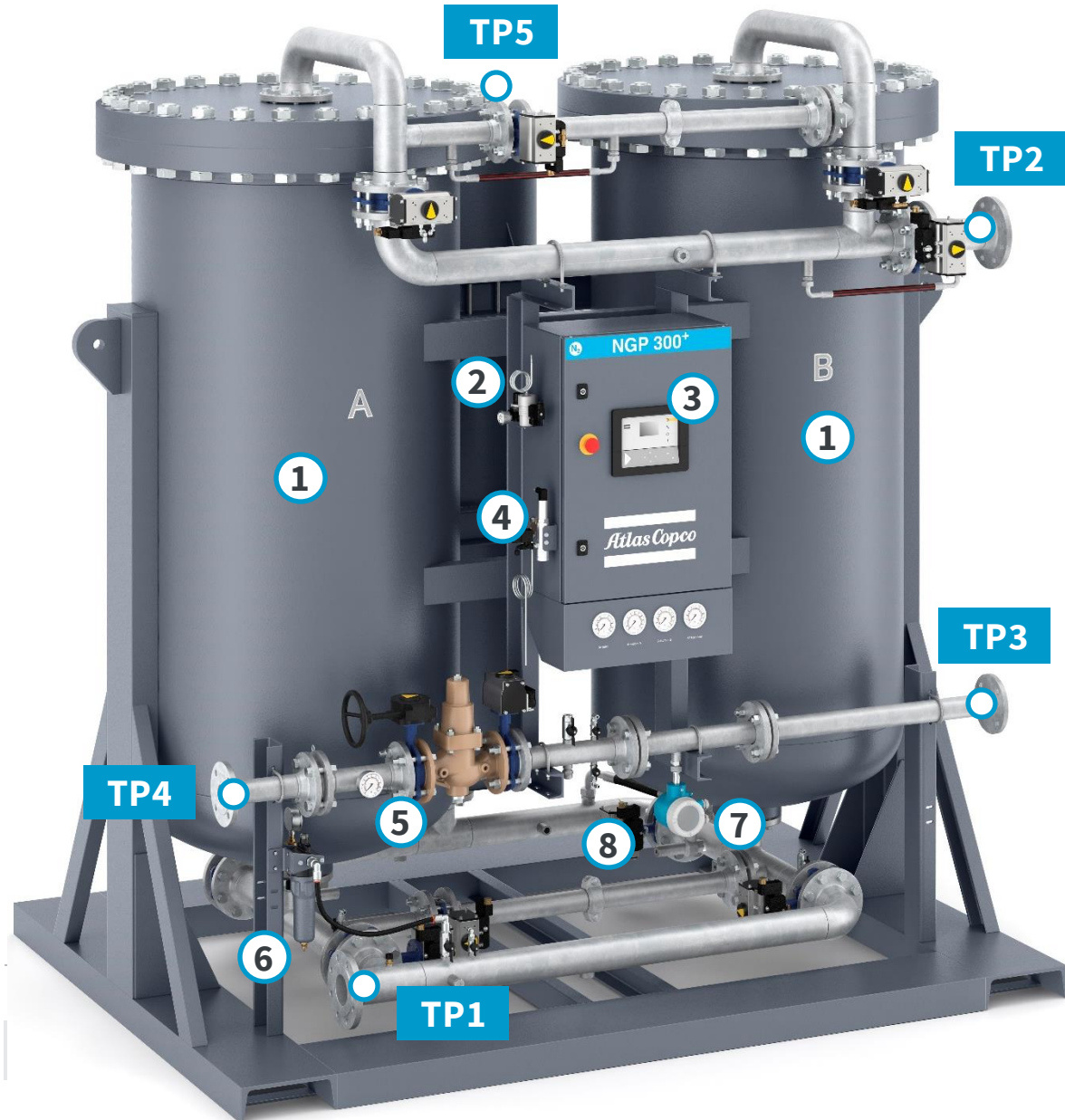
Easiest start-up & purity regulation

Most complete scope of supply

Unique energy saving algorithm

The NGP+ concept!

The all new NGP+ 160-360



1 ADSORBER VESSELS

2 O₂ SENSOR

3 MKV GRAPHIC

4 INLET (AIR) PDP SENSOR
OUTLET (N₂) PDP SENSOR (OPTION)

5 NON RETURN VALVE
MANUAL FLOW CONTROL VALVE

6 BUILT IN PDP⁺ FILTER

7 FLOW TRANSMITTER

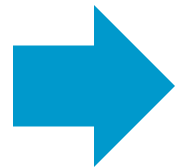
8 OFFSPEC AIR/N₂ FLUSHING LINES

Lowest Air factor

$$\text{AIR FACTOR} = \frac{\text{AIR IN}}{\text{N}_2 \text{ OUT}}$$

105
Nm³/h

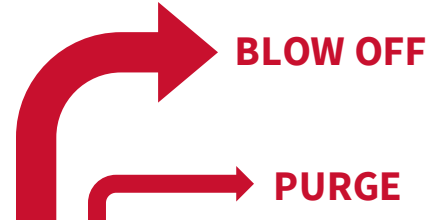
AIR IN



35
Nm³/h

N₂ OUT

3
AIR FACTOR



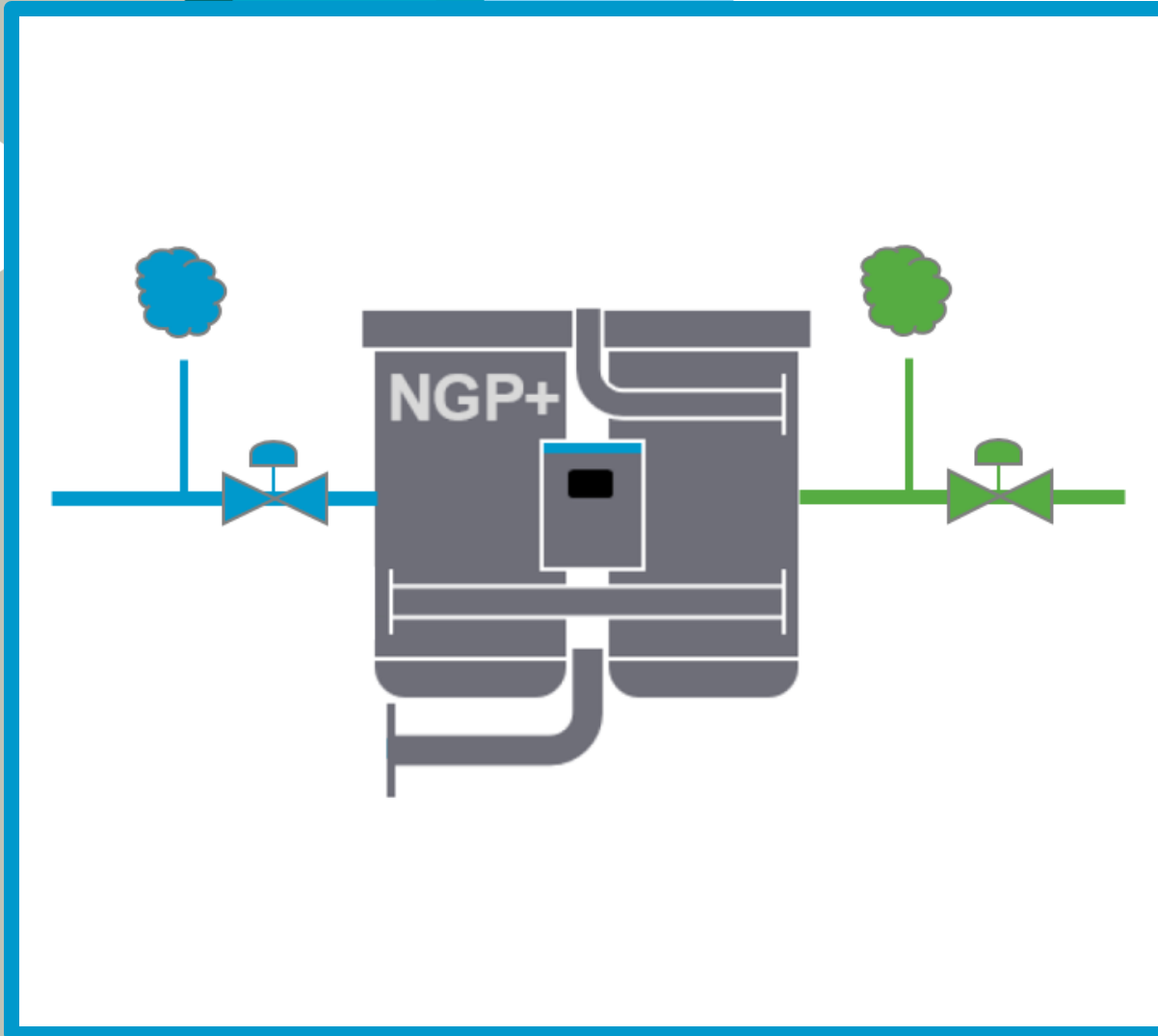
AIR FACTOR

3



Zoom in

OFFSPEC GAS BLOWOFF

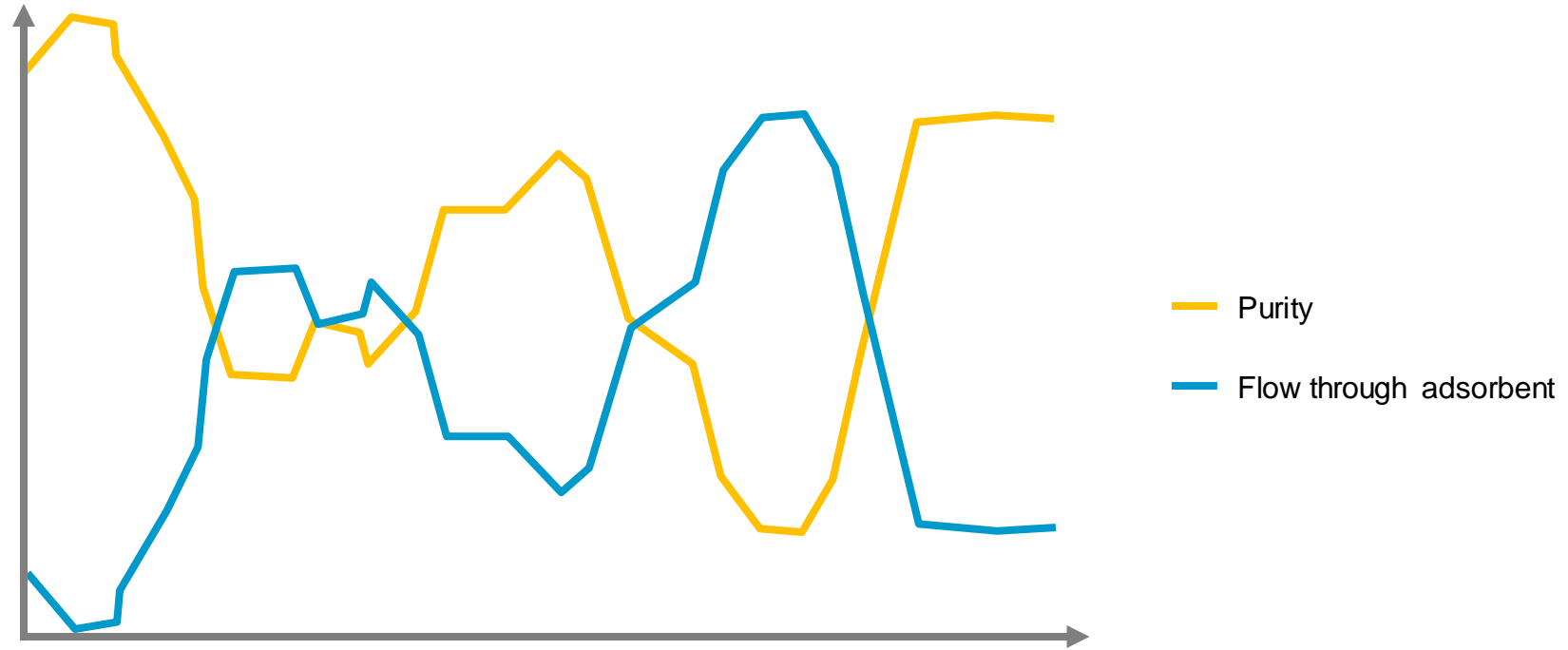


- Protecting the application
 - Low purity N₂ never reaches the process
 - Automatic blow-off via silencer
- Protecting the investment
 - Compressed inlet air with high PDP never reaches the adsorption material

➡ Zero risk for the application

➡ Long lifetime for the generator

Industrial Gas generation- Key Point



PURITY CONTROL = FLOW CONTROL



ON-SITE GAS GENERATOR PLANT

NGP+ 160-360 Typical Configuration



Compressor



Dryer



Filters



Feed Air Tank



NGP+



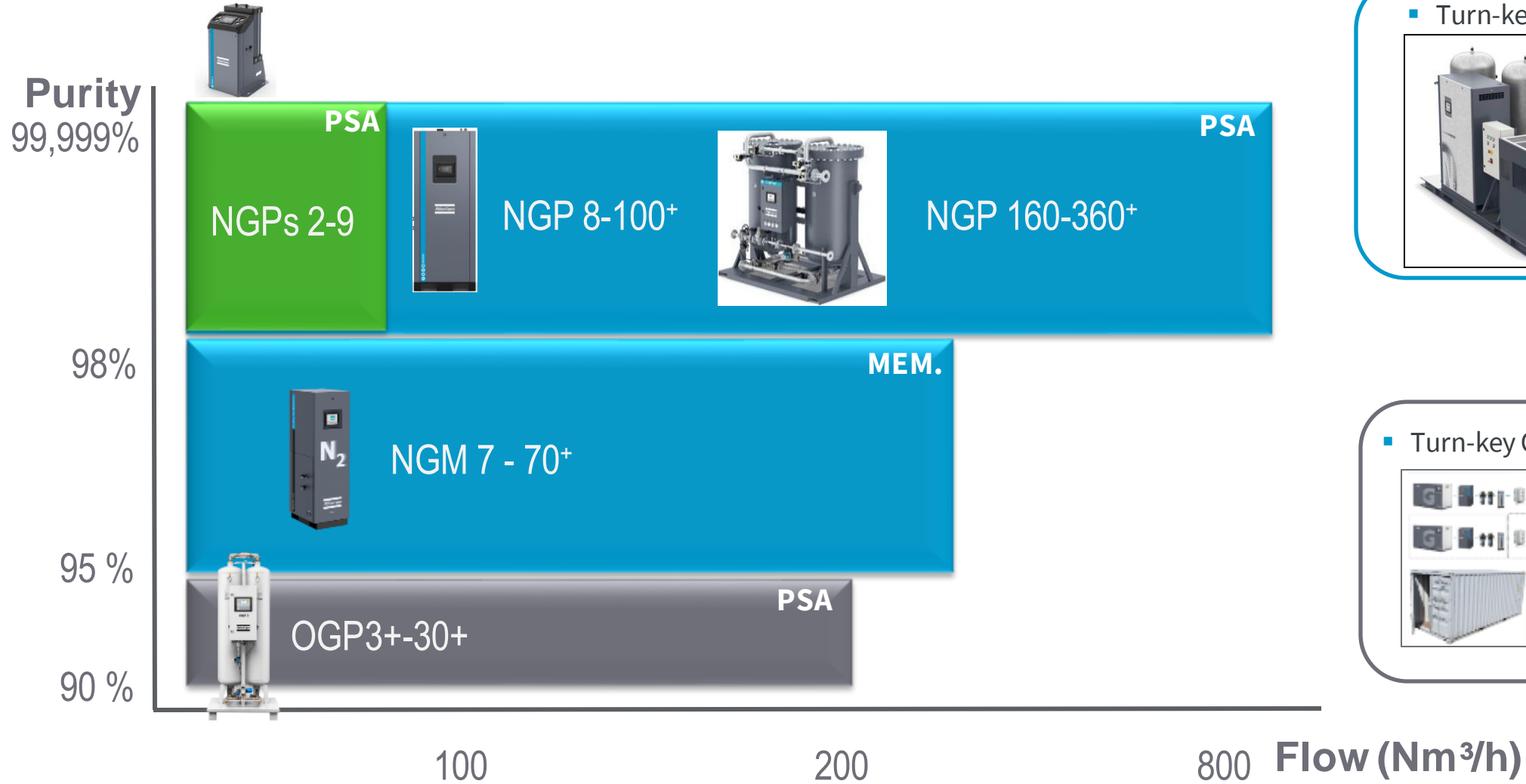
PDp+ Filter



N2 System Tank



Industrial Gas portfolio in Airpower



■ Turn-key N₂ solution



■ Turn-key O₂ solution



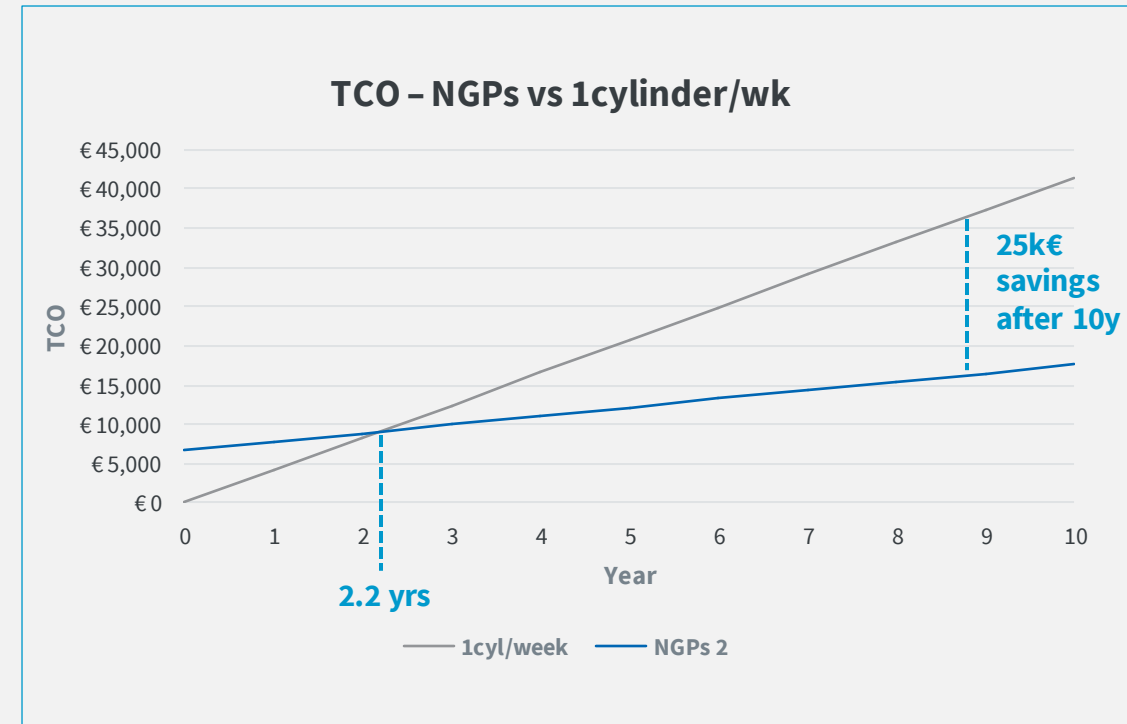
NGPs: the ultimate cylinder replacer

- Application: 3D printing – 2h per day, 5d per week – 1.2 Nm³/h steady N₂ consumption – Purity 99.5%
- Current N₂ supply: **1 cylinder per week** (250bar & 50L): 12.3Nm³

	Cylinder		NGPs 2	
INVESTMENT				
	0		6000	NGPs 2
	0		700	Tank+filter +piping
OPERATIONAL				
	2468	gas cost	0	
	1440	delivery	0	
	240	rental	0	
	(0)	admin/ handling	0	
	0		103	Electricity
	0		1005	maintenance
OPERATIONAL (sum)	4148		1108	

Data cylinder: €4/Nm³ N₂ – €120/delivery – €20 rental/month
 Data NGPs: air/N₂ ratio 3.8 – 0.15kWh/Nm³ air – €0.30/kWh – 500hrs/y

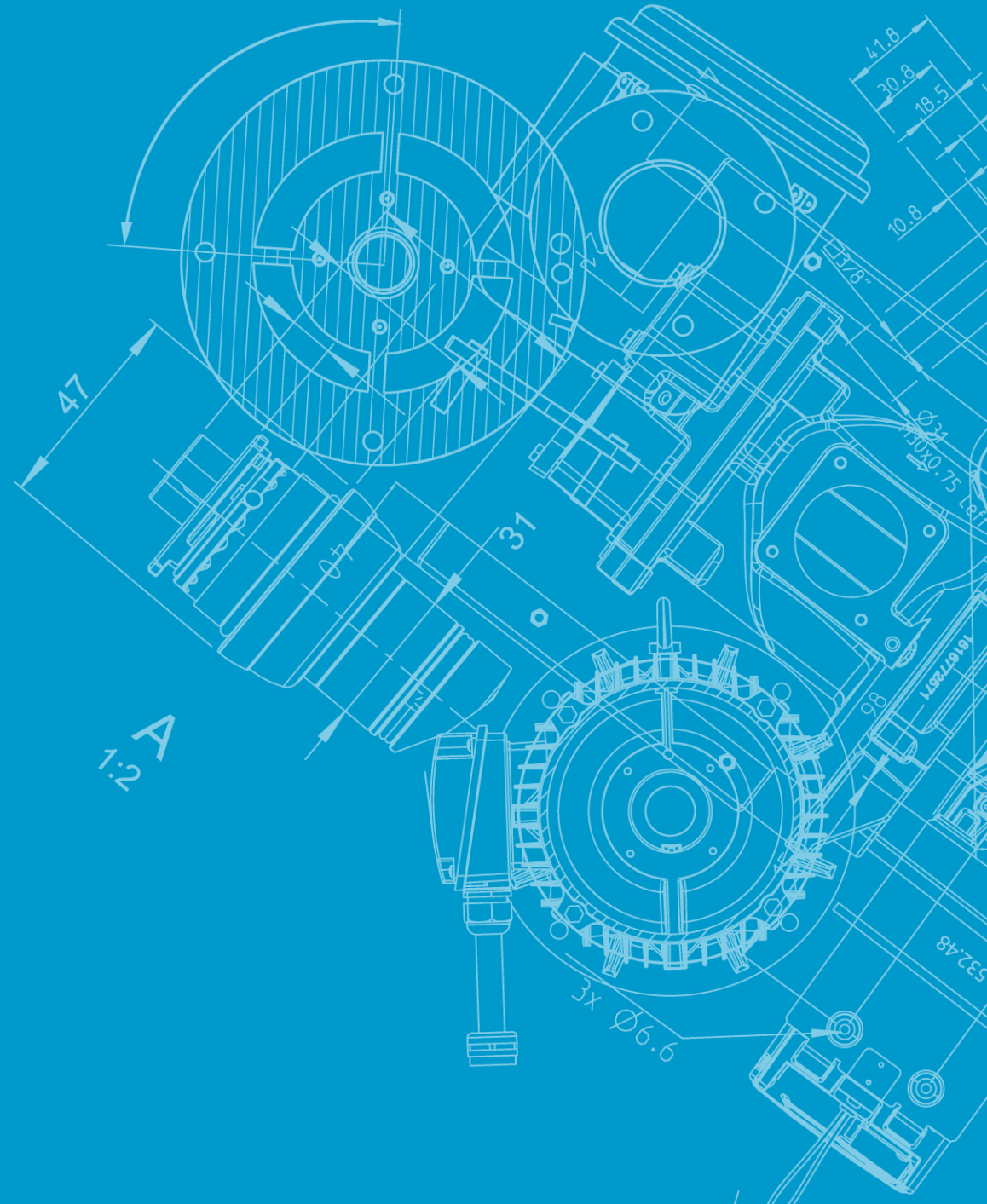
Operational saving of 75%



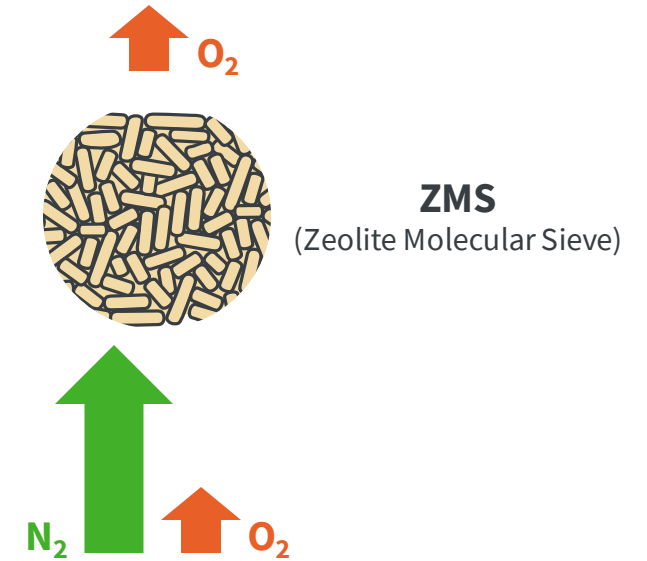
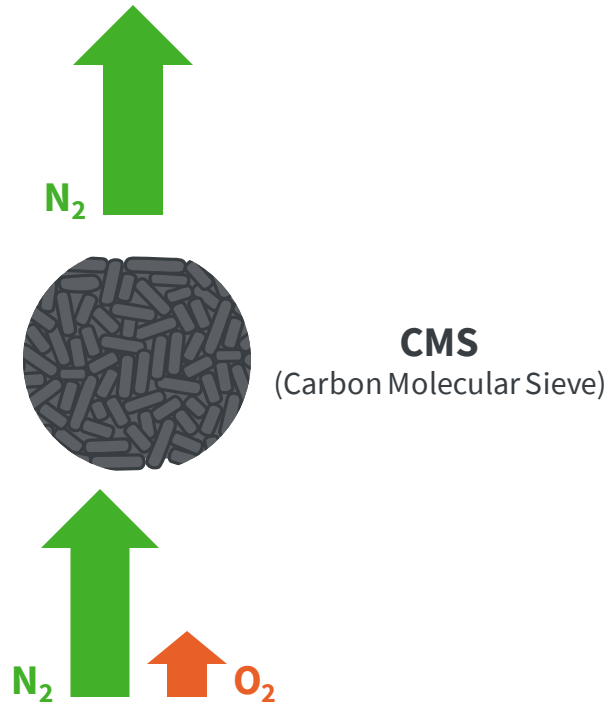
- + CO₂ savings by avoiding road transport of cylinders (iron)
- + no wasted gas
- + stable gas price
- + unlimited supply (e.g. switch to 3h per day)

On-site Gas Generator

Oxygen Generator OGP+



Things you should know when selling O₂



Oxygen installation

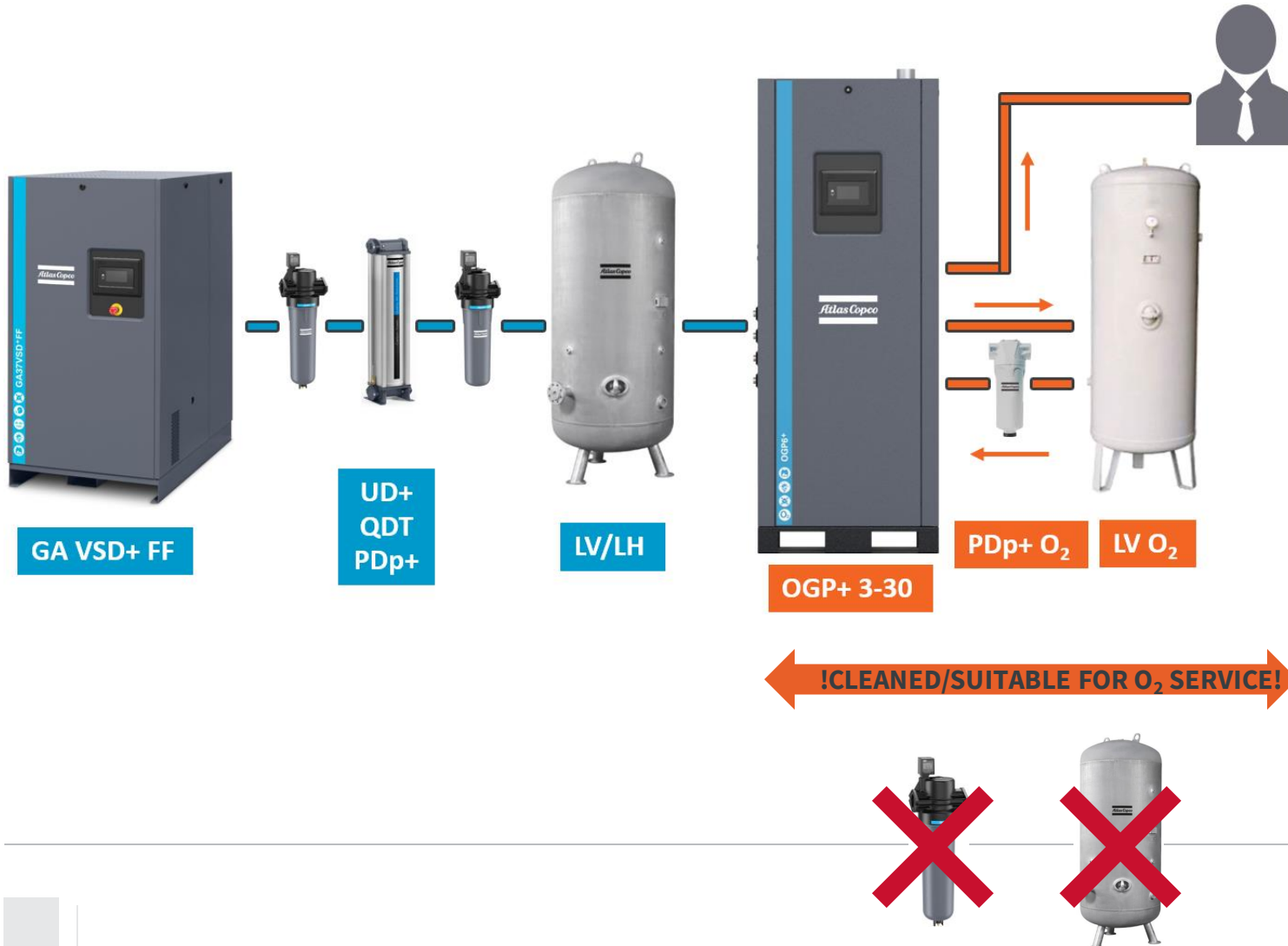
OGP+



Cleanliness



Material Selection



- Introducing pollutants = introducing fuel = fire risk
- Don't use regular compressed air filters/tanks in the orange part!
- Cleanliness requirements & material selection instructions: refer installation proposal

O₂ safety



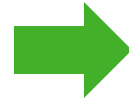
Ambient Monitoring



EXHAUST WASTE:
blow-off and purge
21% - 60% O₂



NGP+



5% - 0.001% O₂



EXHAUST WASTE:
blow-off and purge
8% - 21% O₂



OGP+



90% - 95% O₂



No matter the gas generator type, O₂ safety awareness is always important!



IF YOU NEED MORE INFORMATION, SCAN HERE!



Atlas Copco

