

IoT and Power Microturbines

Become Carbon Neutral and Grid Independent



Emanuele Guglielmino PhD
CEO

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Company Timeline

Spin-off IIT

First pilot
Milan, Italy



New products development
international sales

2012

2013

2015

2016

2017

2019



Italian National Prize
for Innovation
CleanTech category

Silicon
Valley
Business
Training

Horizon 2020
SME Instrument

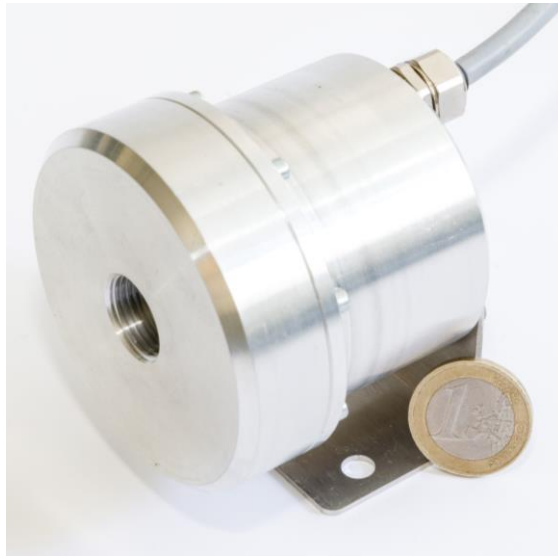
SOLAR IMPULSE

Mission

To make Microturbines the
standard solution for improving the
environmental sustainability of
distributed piping networks



IoT MICROTURBINES



UP TO 200 W
(for gas and water)



POWER MICROTURBINES



UP TO 50 kW
(size can be customised)



9/11/2023

SUBJECT – COP28 UAE SPEAKING INVITATION

Dear Mr. Guglielmino,

I hope this letter finds you well.

The 28th Conference of the Parties to the UN Framework Convention on Climate Change (COP28) on 30 November - 12 December 2023 at EXPO City in Dubai will be a critical moment to unite the world for transformative climate action. COP28 UAE will be one of the largest and most important gatherings in 2023, expected to host 60,000 - 80,000 delegates and over 140 Heads of States.

COP28 is of particular significance as it marks the conclusion of the first Global Stocktake that will measure progress since the Paris Agreement. More fundamental, however, will be our collective response to the stocktake and our resolve to keeping 1.5 °C within reach, while building greater adaptation and resilience to increasing climate shocks – achievements that can only be made possible by an unprecedented scale-up of global climate investments.

The magnitude and urgency of our collective challenges require comprehensive and transformational changes, and an all-of-society mandate. Simply put, we need all hands on deck. Deep commitment and decisive action are essential for the achievement of our global climate goals.

It is our pleasure to invite you to participate at COP28 UAE and to help us advance this ambitious agenda that will enable a more sustainable future for the world. Please find further details below for your consideration:

Energy Transition Changemakers Energy Efficiency Showcase
Tuesday 5th December, 11.30-12.30,
DP World Level 2 Multipurpose room, Green Zone

Energy Transition Changemakers Ceremony
Tuesday 5th December, 17.30-18.30,
DP World Level 2 Multipurpose room, Green Zone

Advanced Microturbines' AquaWatt Project has been recognized as an Energy Efficiency Energy Transition Changemaker. You are invited to showcase the project with a brief presentation in the showcase event and attend the evening award event with COP President Designate Dr. Sultan Al Jaber.

In the meantime, please confirm your participation to Saif Al-Qudahi at salqudahi@cop28.com. In addition, please reach out directly if you have any questions.

Upon receipt of your confirmation, we will share further details pertaining to your participation.

We look forward to welcoming you to the UAE to contribute to this crucial opportunity for action to combat climate change.

P.O. Box 2366, Abu Dhabi,
United Arab Emirates
COP28.com



COP28 UAE

30 Nov-12 Dec

- AMT invited to present its technology
- AMT awarded



IoT Microturbines

W
A
T
E
R



200 W

30 W

150 W



G
A
S



Power Microturbines

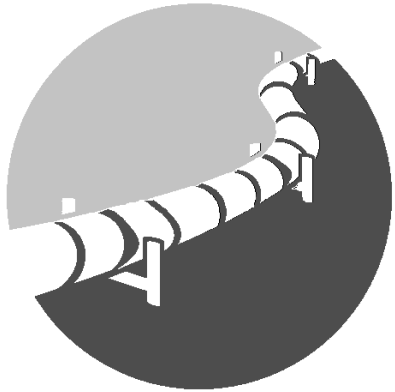
50 kW



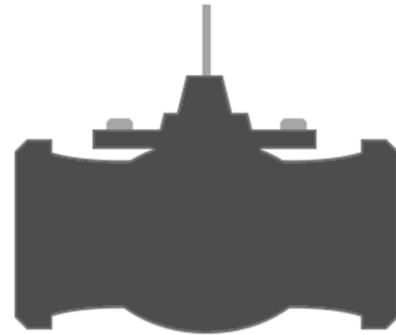
Selected Customers



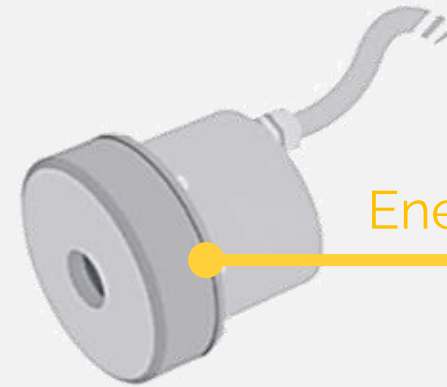
Pipeline



Pressure Drop

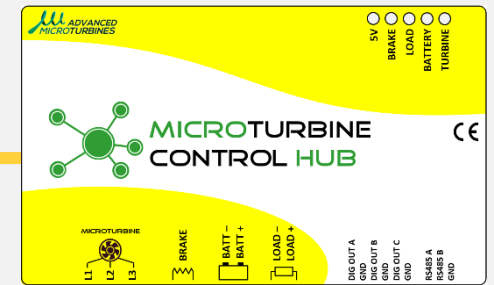


Conversion into Electricity



Microturbine

Energy

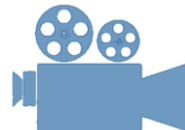


Control Board

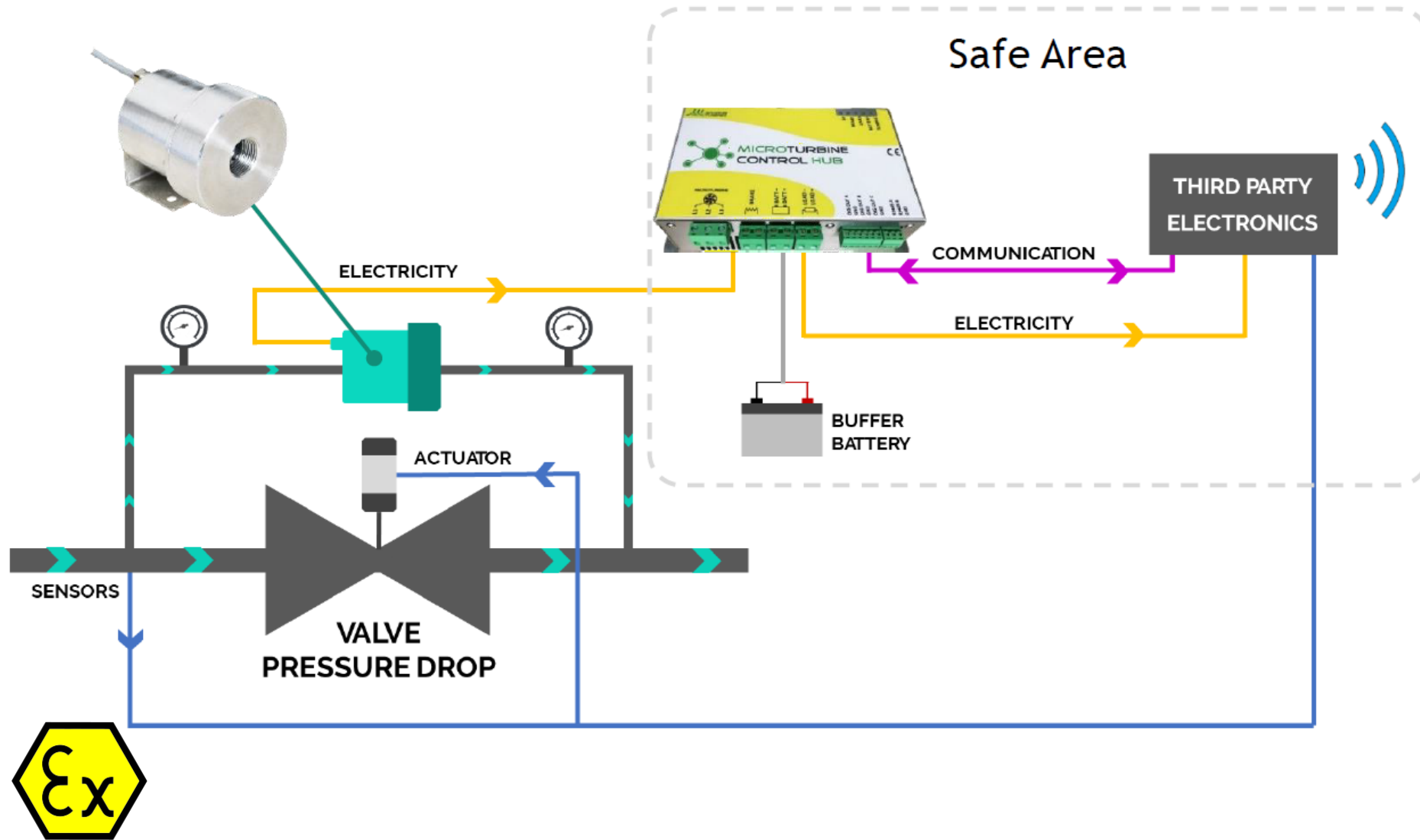
- A device for harvesting energy by
- Locally converting a pressure drop into electricity
- To enable IoT applications off-grid

- Plug & Play Installation
- Real-time Monitoring
- Off-grid IoT Solutions
- Highest Reliability

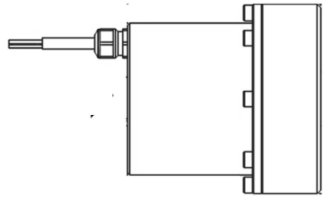
<https://youtu.be/J3UcbotIVZ8>



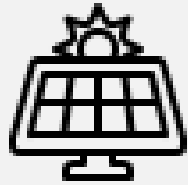
Working Principle



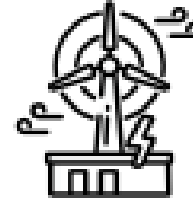
Technologies Comparison



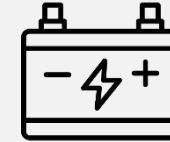
MICROTURBINE



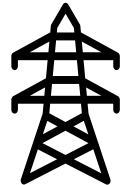
SOLAR PANEL



MICRO-WIND



BATTERY



GRID

ENVIRONMENT



RELIABILITY



COST



MAINTENANCE



ACCESSIBILITY



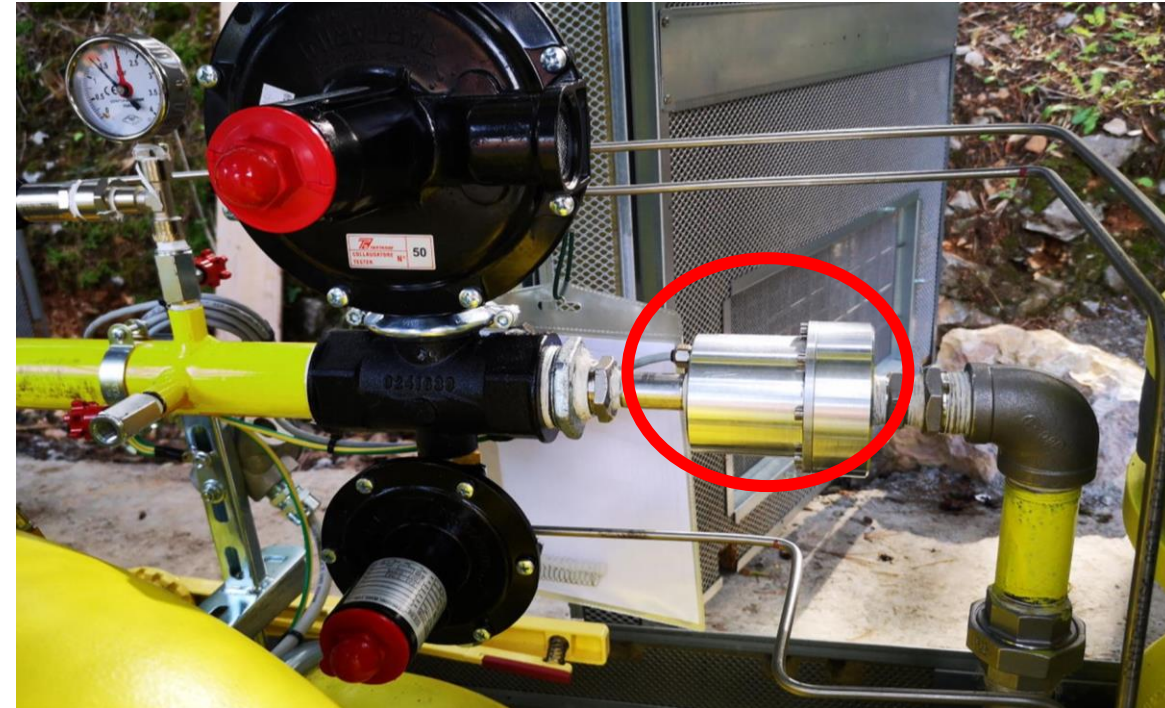
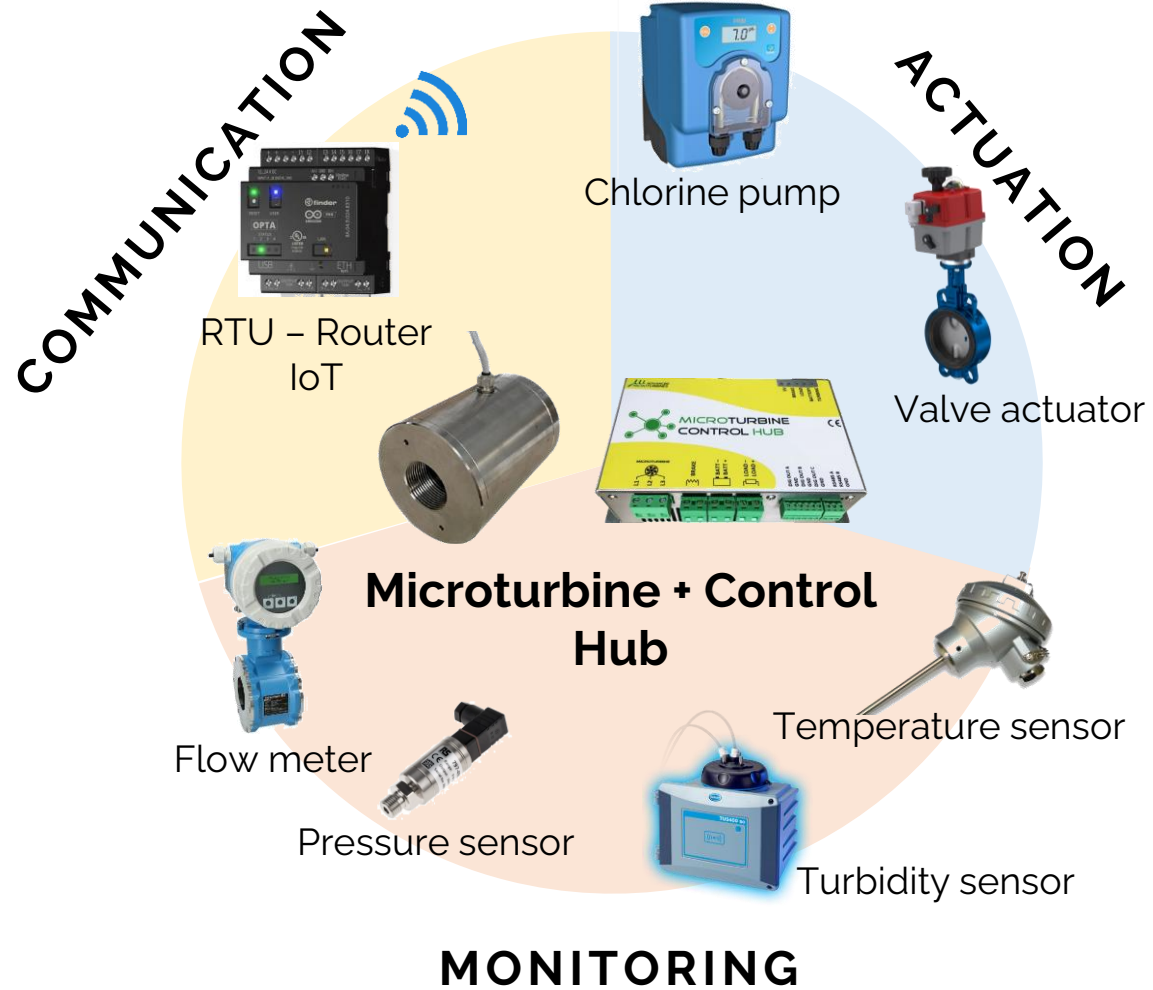
● ○ ○ ○ ○ Very Poor

● ● ● ● ● Very Good

Powering IoT with

GAS MICROTURBINES





30 Watt Model



- ✓ Up to **30W** power
- ✓ 12V or 24V output
- ✓ Controlled battery charging
- ✓ Microturbine speed control
- ✓ Modbus RTU – RS485

150 Watt Model



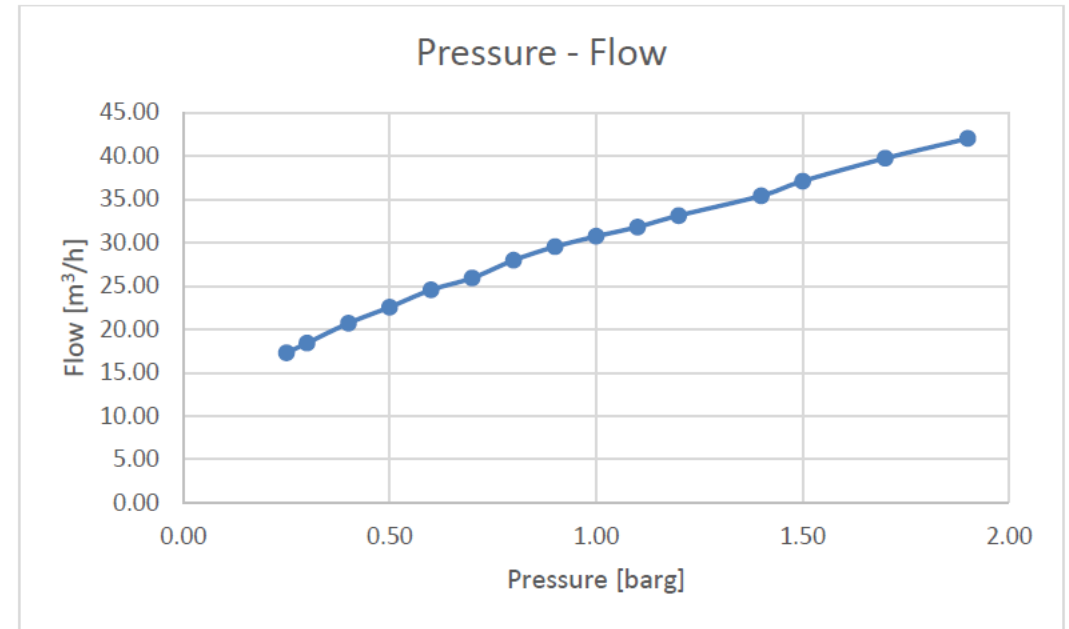
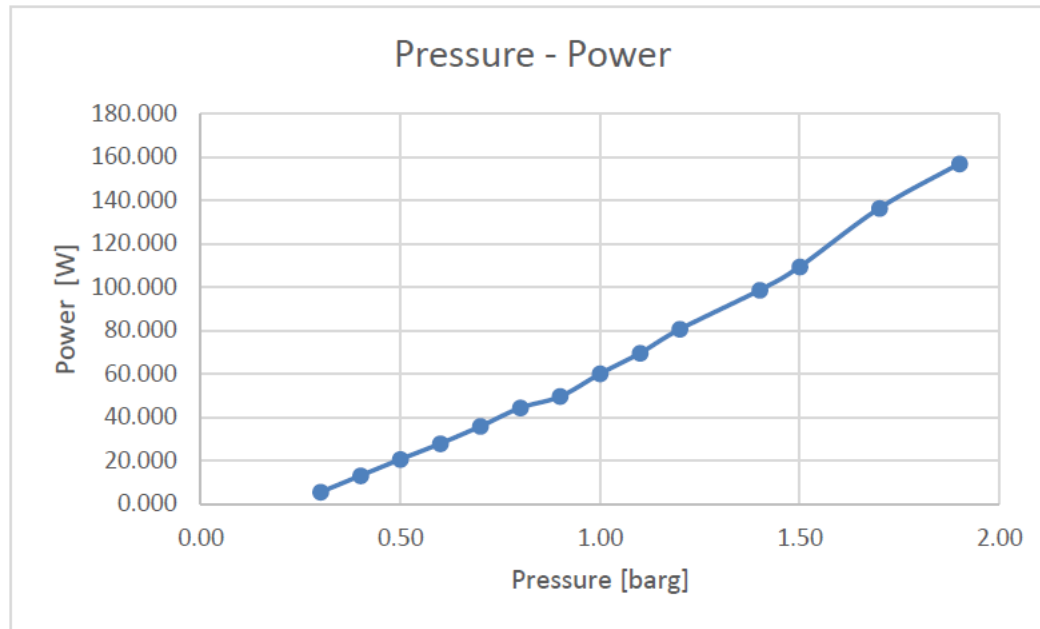
- ✓ Up to **150W** power
- ✓ 12V or 24V output
- ✓ Controlled battery charging
- ✓ Microturbine speed control
- ✓ Modbus RTU – RS485



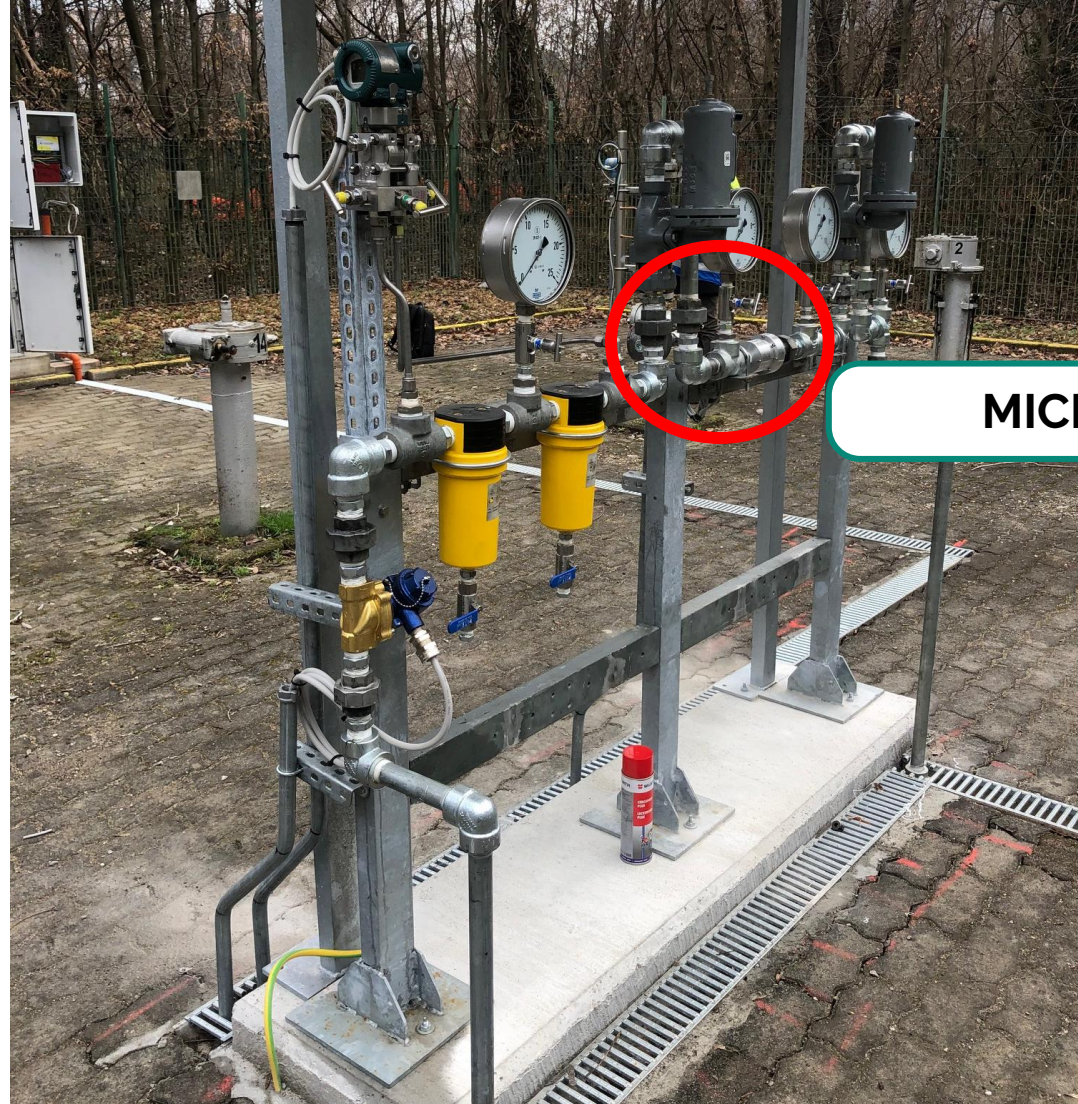
ATEX ZONE 1



Performance Curves



Installation Site Example

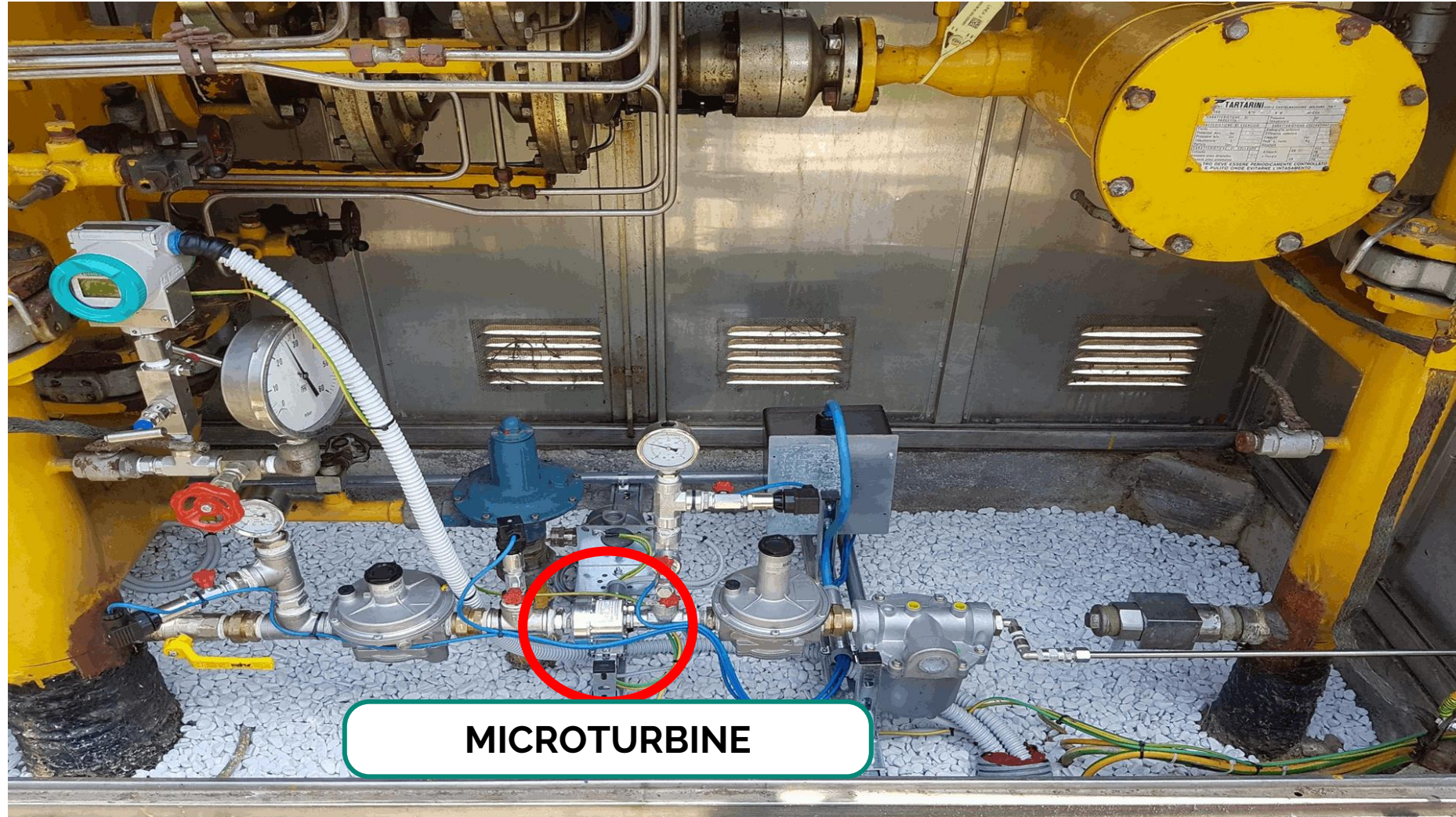


MICROTURBINE

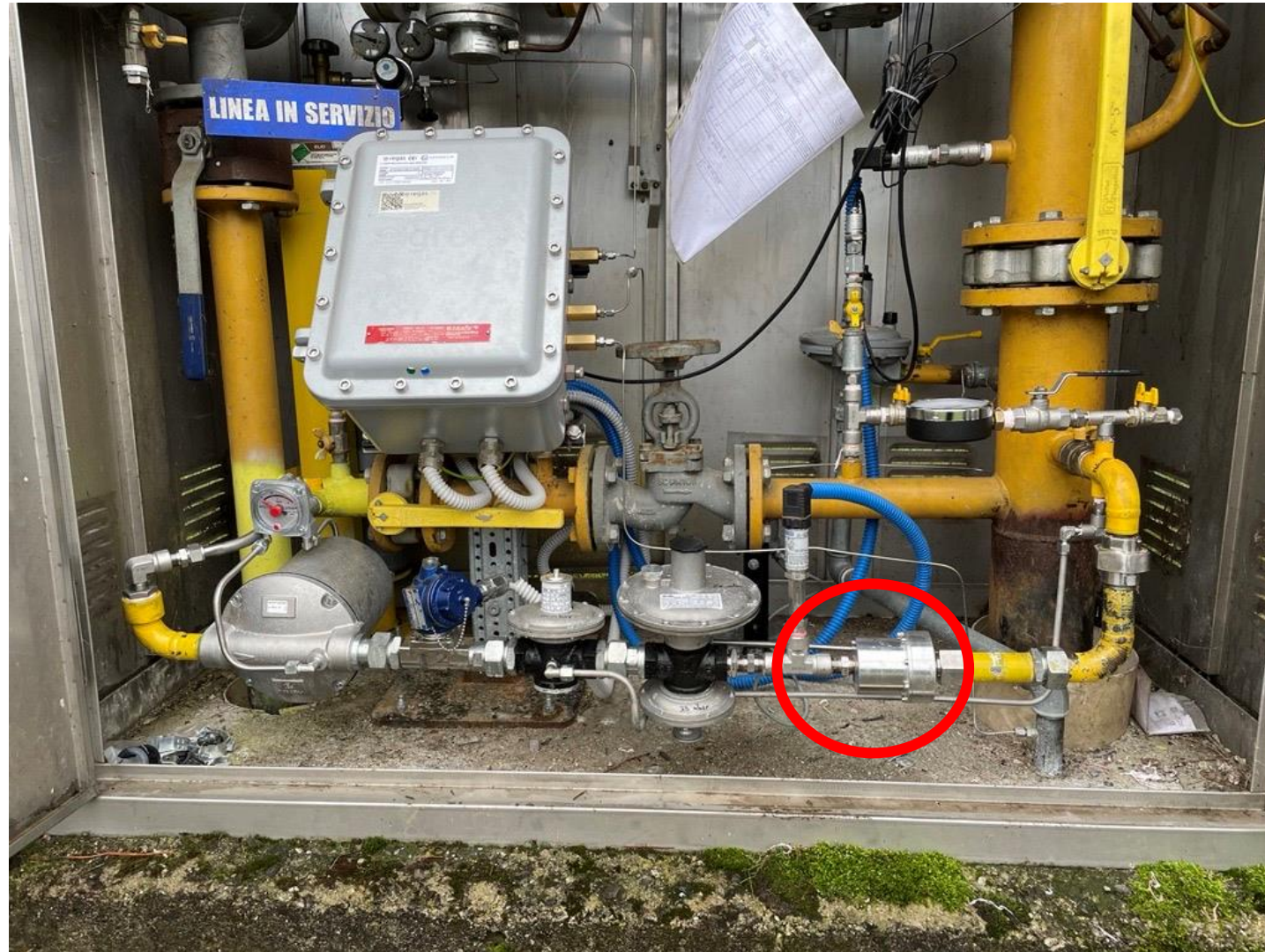
Installation Site Example

SITE EXAMPLE 2 (MA1)

Installation year	2019
Upstream pressure	2 bar
Downstream pressure	20 mbar
Voltage	24 V
Load	RTU, Modem, Transmitters + IS barriers



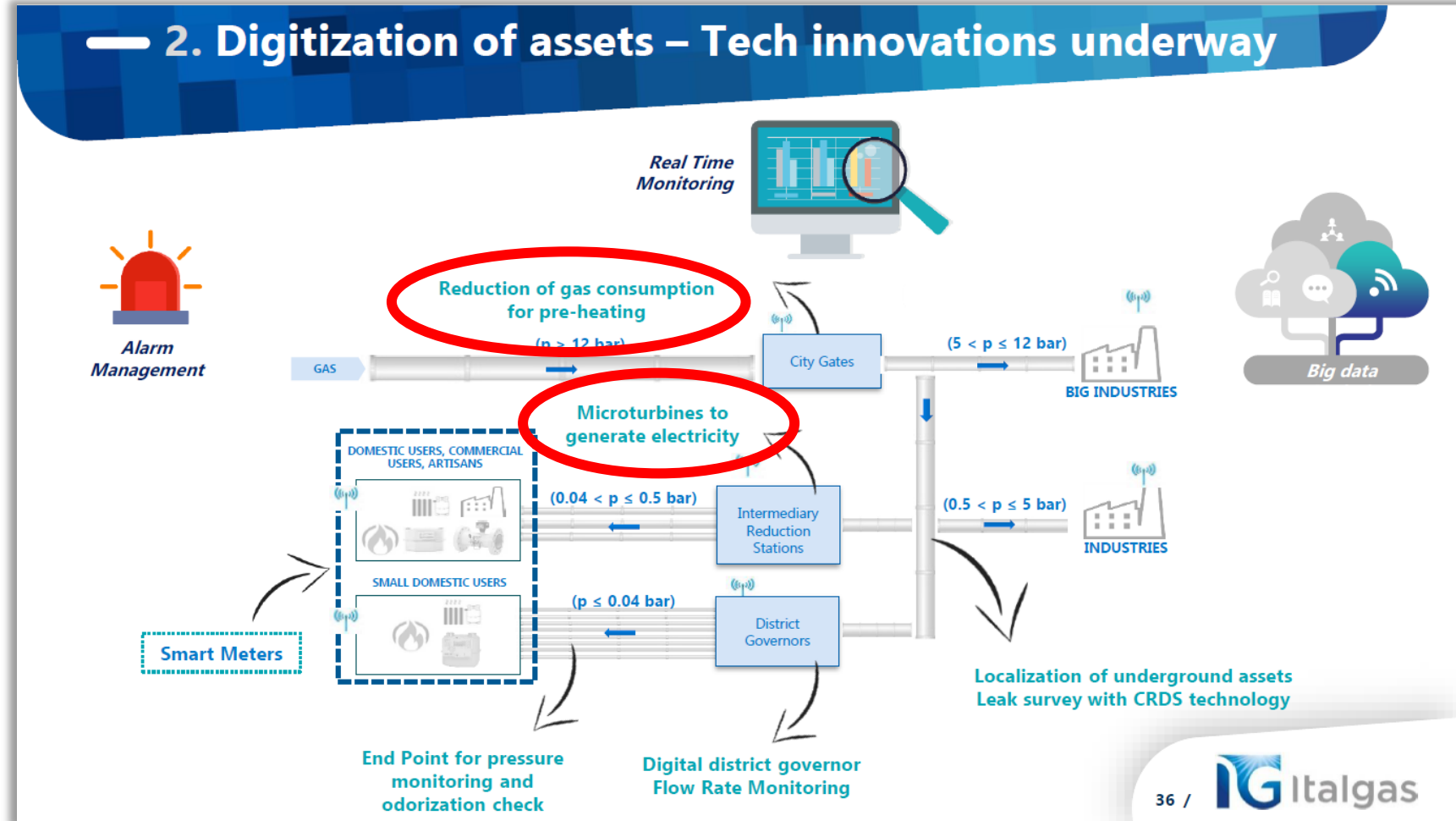
Installation Site Example with Gas Chromatograph





Italgas Strategic Plan 2019 - 2025

2. Digitization of assets – Tech innovations underway





INITIAL INVESTMENT : 9650 €



SAVING. : 18600 €

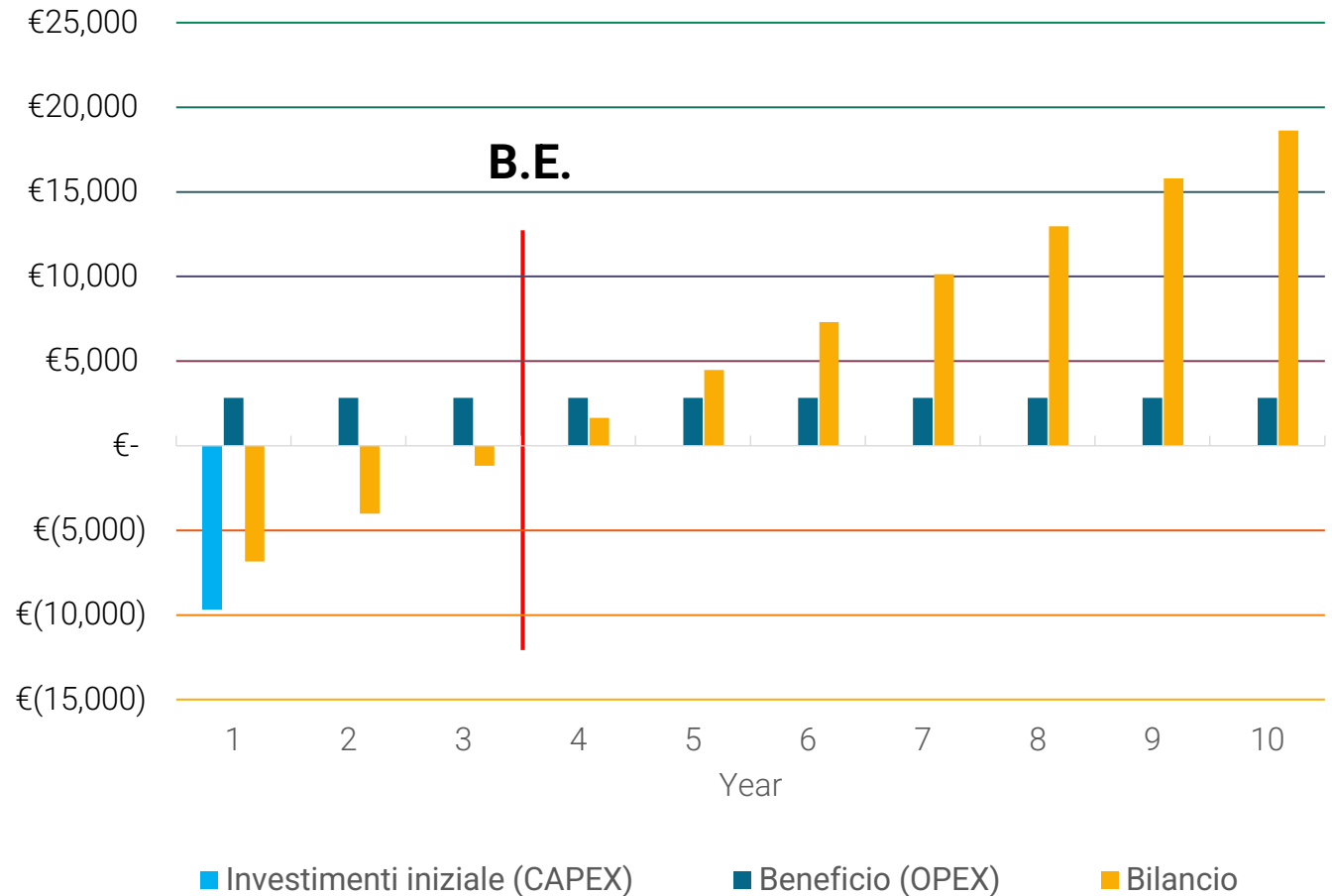


BE : 3.5 YEARS



IRR : 27,2 %

BE : Break-even point
T.R.I. : Internal Rate of Return



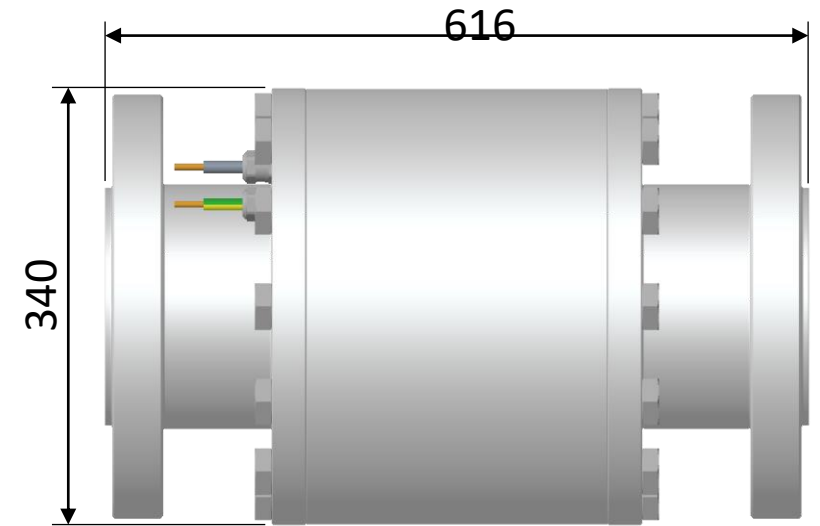
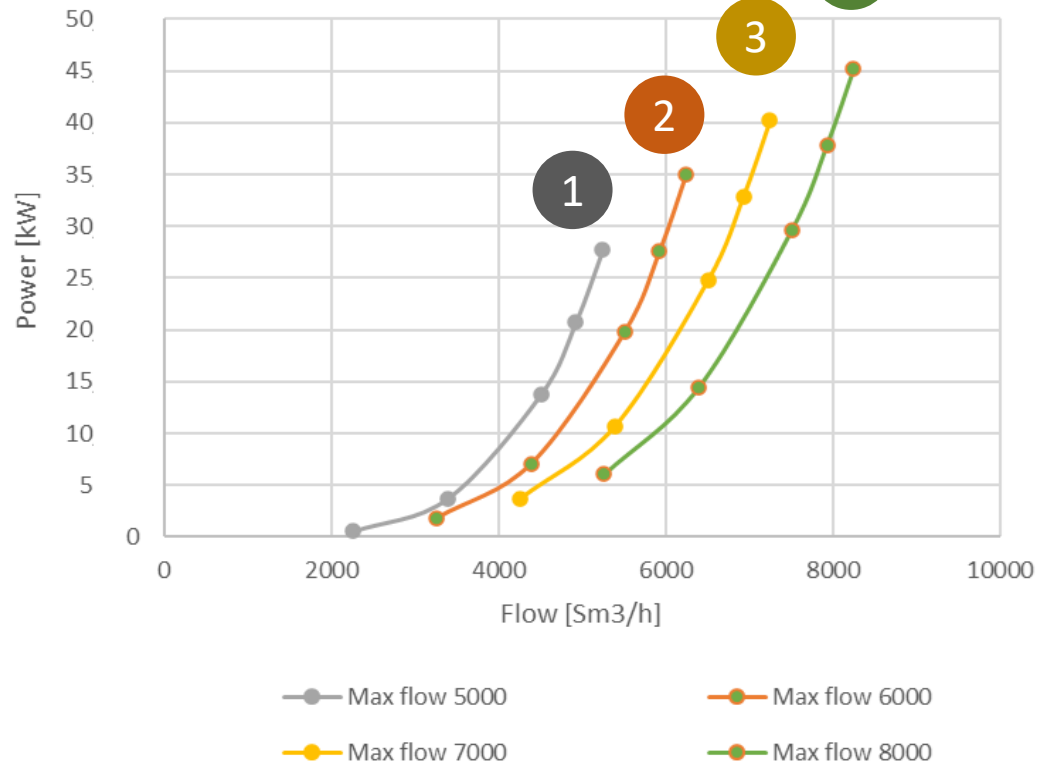
Recovering Energy with

GAS TURBOEXPANDERS



Turboexpander – Up to 50 kW

Power vs Flow



The power you generate goes ...

••• For internal consumption

- Heat pump
- H₂ electrolyzer



EMISSION REDUCTION

••• Sell to the grid

50 kW = 10,000 m² solar panel surface (1.3 times the size of a football pitch)

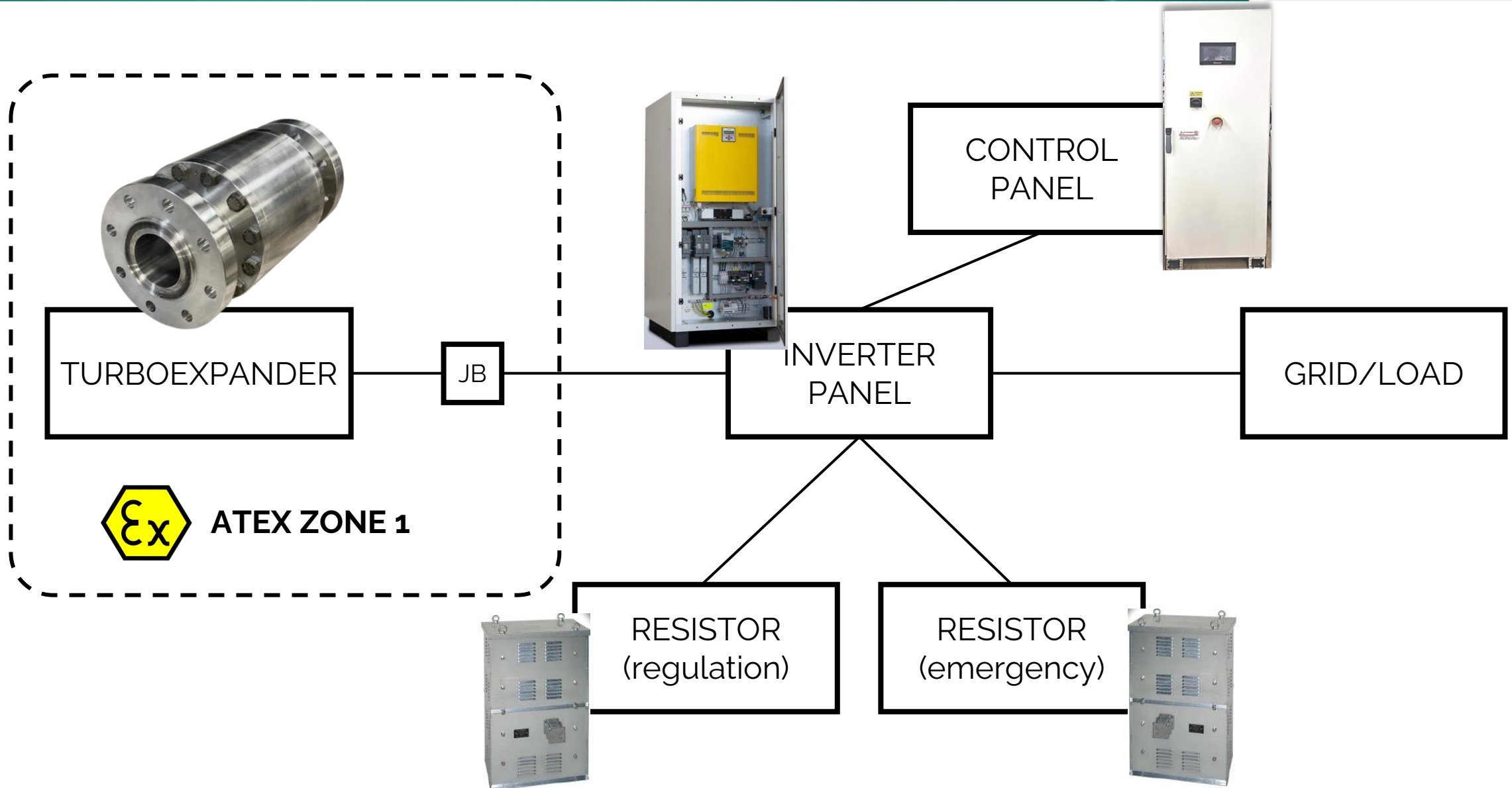


ENERGY ON-DEMAND



RANDOM ENERGY (sun dependent)

Turboexpander Architecture



INVERTER PANEL
control board



TURBOEXPANDER

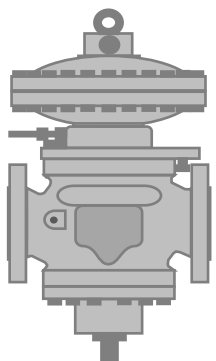


BRAKING RESISTORS
regulation and safety



CURRENT

PRESSURE
REGULATOR



GAS BOILER

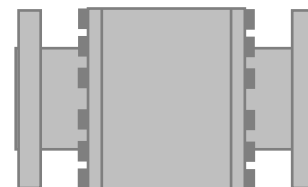


HEAT FROM
GAS BURNT

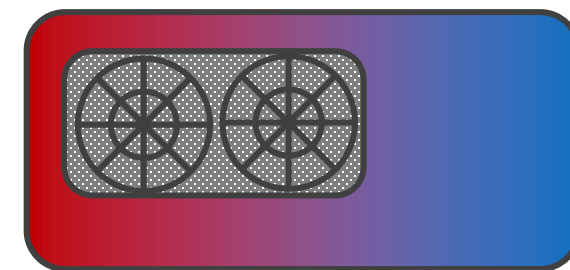
- Gas burnt
- High CO₂ emissions
- Energy wasting

FUTURE

TURBOEXPANDER



HEAT PUMP

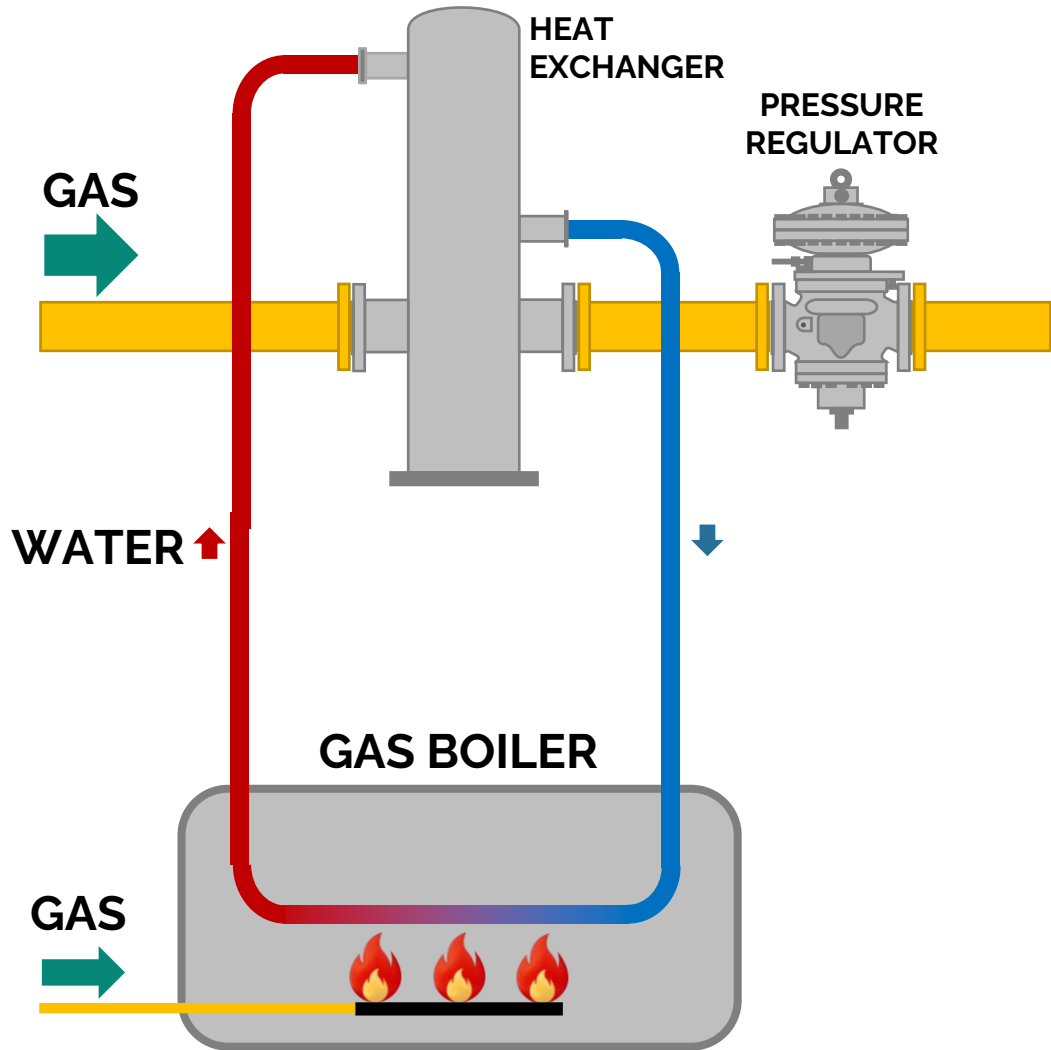


HEAT FROM
ENVIRONMENT

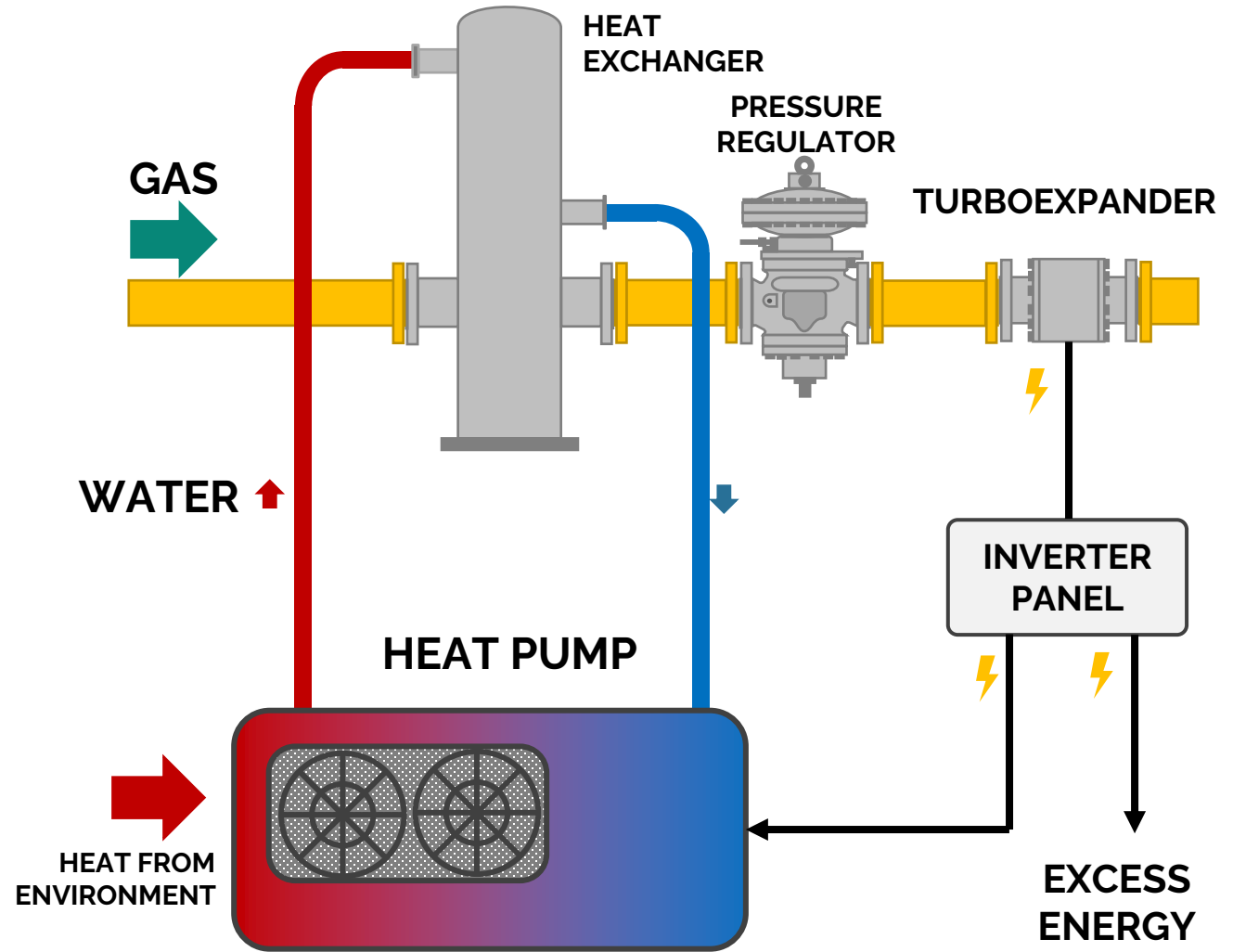
- NO gas burnt
- CO₂ emissions reduction
- Energy harvesting

Feeding Heat Pump – Case Study

CURRENT



FUTURE

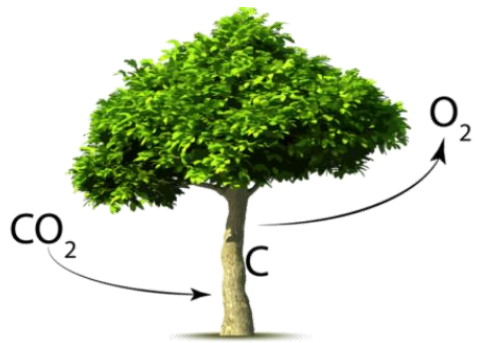
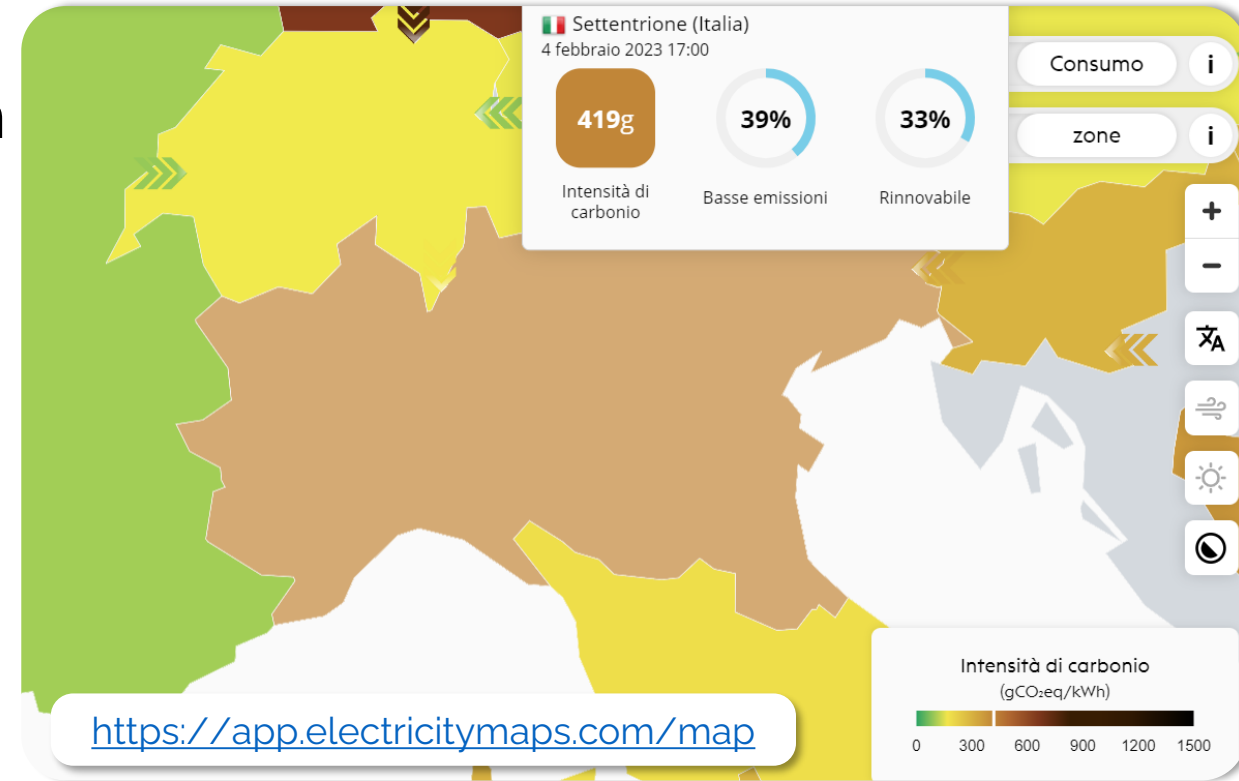


CO2 avoided- Business Case

306 MWh/y × **0.419 ton CO₂/MWh**



Total: 54.5 ton CO₂/y saved



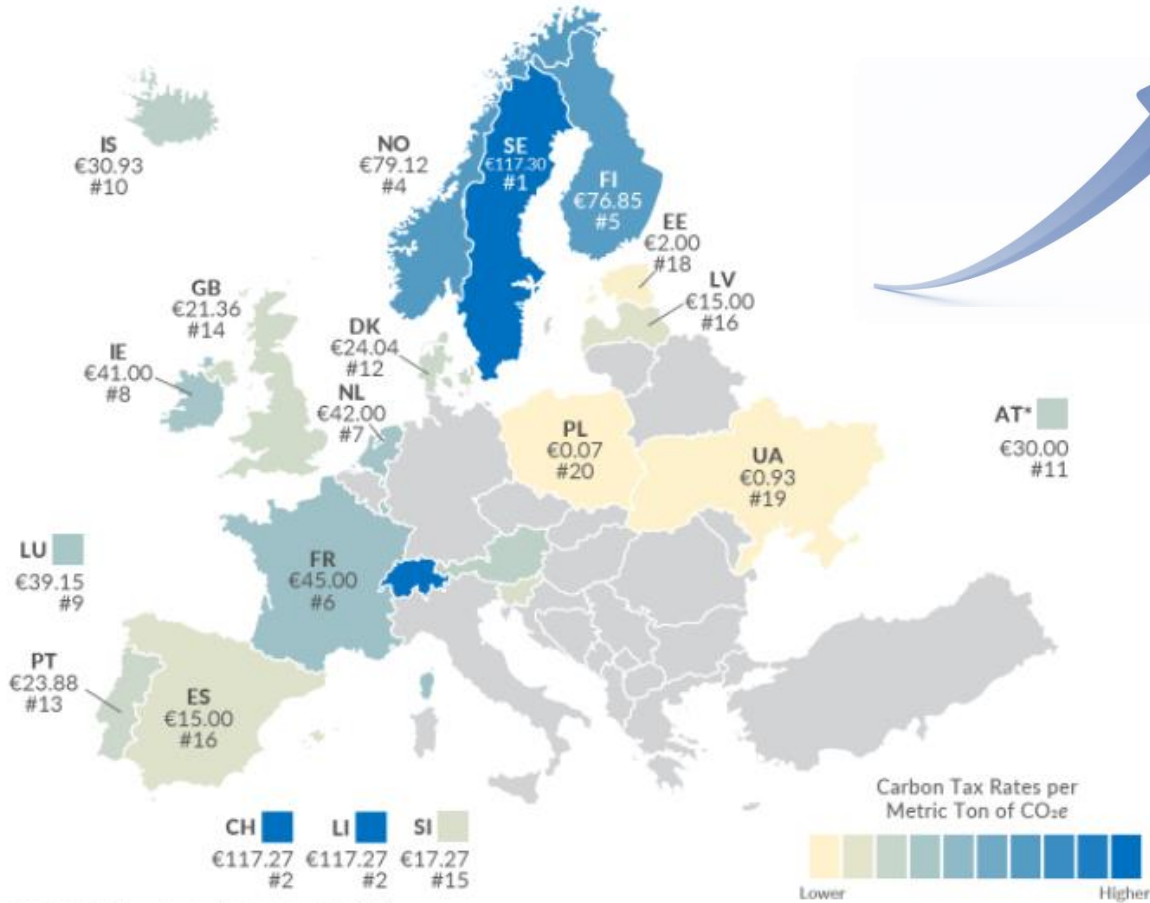
Equivalent to 2,500 trees

1 tree = 25 kg Co2 /year eq

Carbon Tax

Carbon Taxes in Europe

Carbon Tax Rates per Metric Ton of CO₂e, as of April 1, 2022



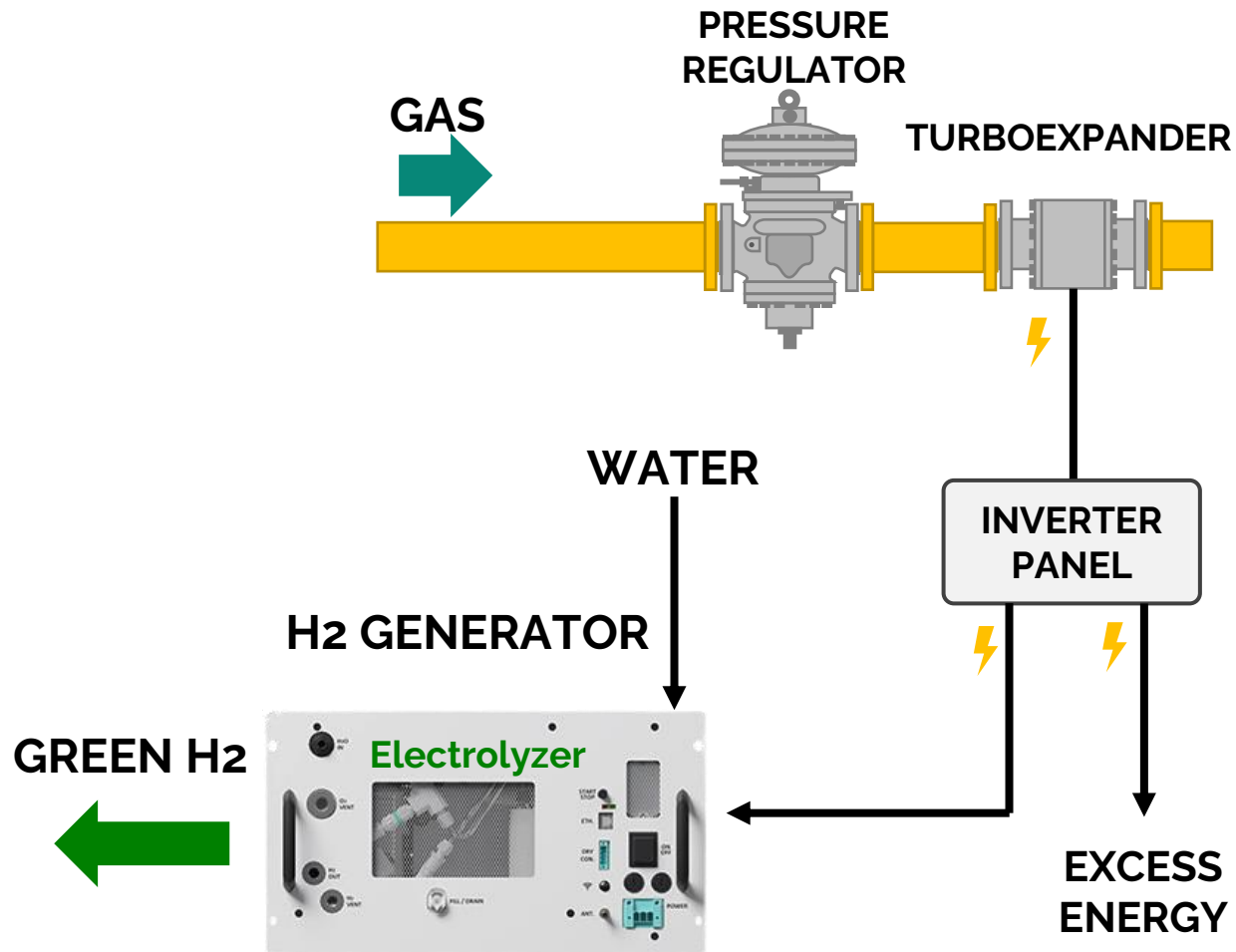
Carbon Tax range 1€ ÷ 120€ ton / year



Future Trends: Carbon Tax
sharp increase in next years



Electricity used to feed a Hydrogen generator (electrolyzer)



Hydrogen can be used for :

- Blending with natural gas
- Storage
- Downstream chemical process
- Hydrogen burning -> Plant Zero CO2 emissions

Based on the analysis carried out, it was assessed that 1000 microturbines save 117 tons of CO2 equivalent per year, more than using solar panels to produce the same amount of energy.

validated in June 2022
validation id:

JKA499

Verifyable at
www.impact-forecast.com

ADVANCED MICROTURBINES

Mitigates climate change with an impact reduction potential of:

-117

tCO₂eq / year

Validity of forecast

■ Valid

Impact compared to baseline

■ Positive

Magnitude of impact

■ Significant

This corresponds to:



5333 trees

OR

15	118	228	49	23	21
times driving a car around the world	passengers flying London-New York	barrels of oil burnt	EU households annual electricity	elephants mass (5t) of CO ₂	hot air balloons (2800 m ³) of CO ₂

Life Cycle Assessment (LCA) externally assessed by



Validated within EU project



<https://impact-forecast.com/>

Turboexpander helps align your company with global directives:

- ✓ United Nation 2030 Agenda for Sustainable Development
- ✓ EU-Green Deal

- Helps boost your **ESG** and **Corporate Social Responsibility**
- Easier access to EU financing / other initiatives



Case study with 6000 m³/hour

	CURRENT STATE (pressure regulators)	FUTURE (turboexpander)	COMPARISON ⁽¹⁾	COMMENT
Pre-heat gas volume burnt [Sm ³ /y]	35,145 Sm ³ /y	0 Sm ³ /y	-35,145 Sm ³ /y	No gas burnt. Increase of gas sales
Electricity produced [MWh/y]	0 MWh/y	306 MWh/y	+306 MWh/y	Production of electricity sufficient to auto-sustain gas pre-heating plus 121 MWh/y electricity available for other applications.
Pre-heat energy used [MWh/y]	259 MWh/y	556 MWh/y ⁽²⁾	+297 MWh/y	
CO ₂ produced [ton/y]	66 ton/y	-128 ton/y ⁽³⁾	-194 ton/y	Total avoidance of CO ₂ emissions

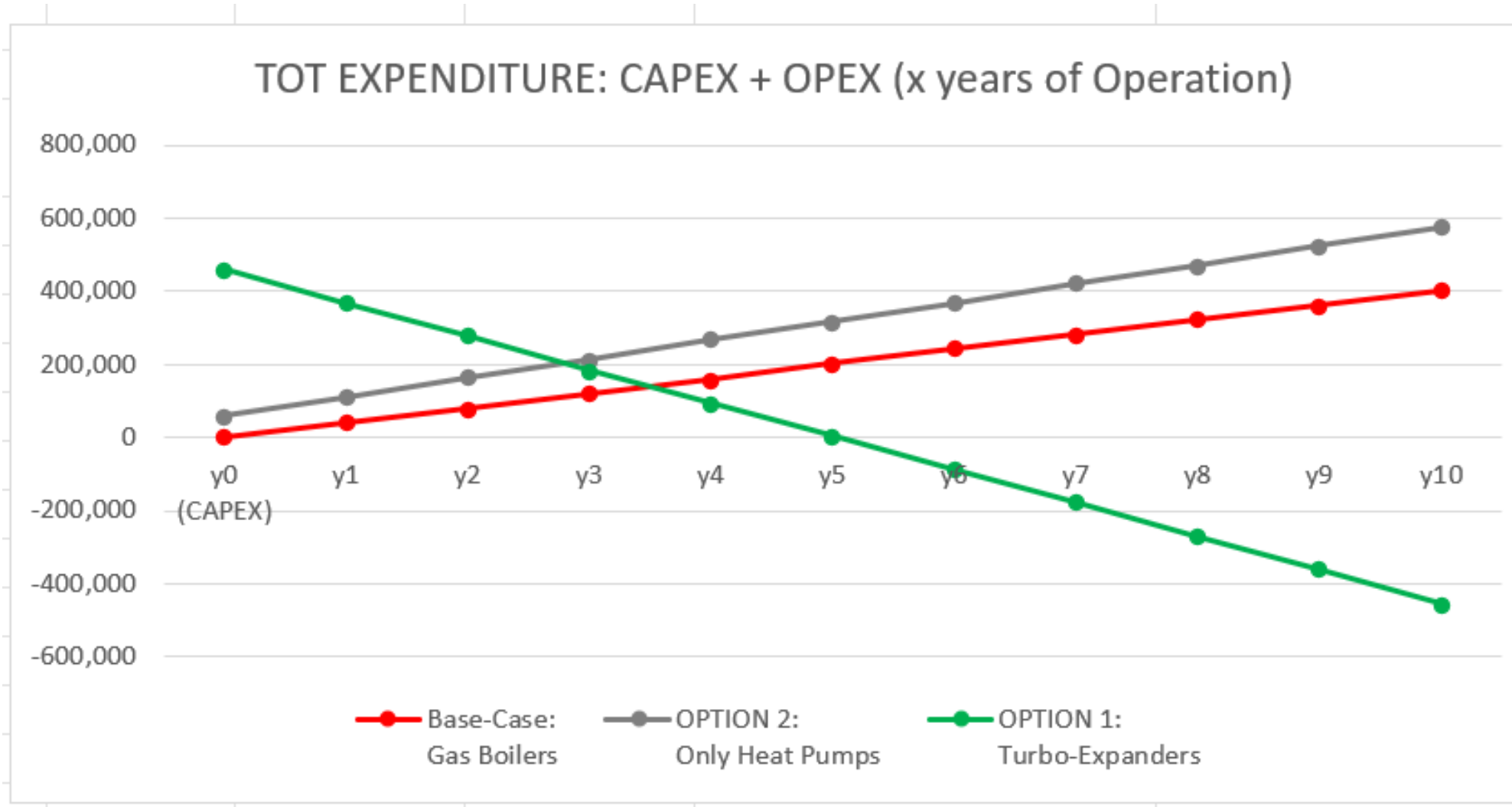
NOTES – General: Data refer to 1 solar year

(1) Future state [minus] current state;

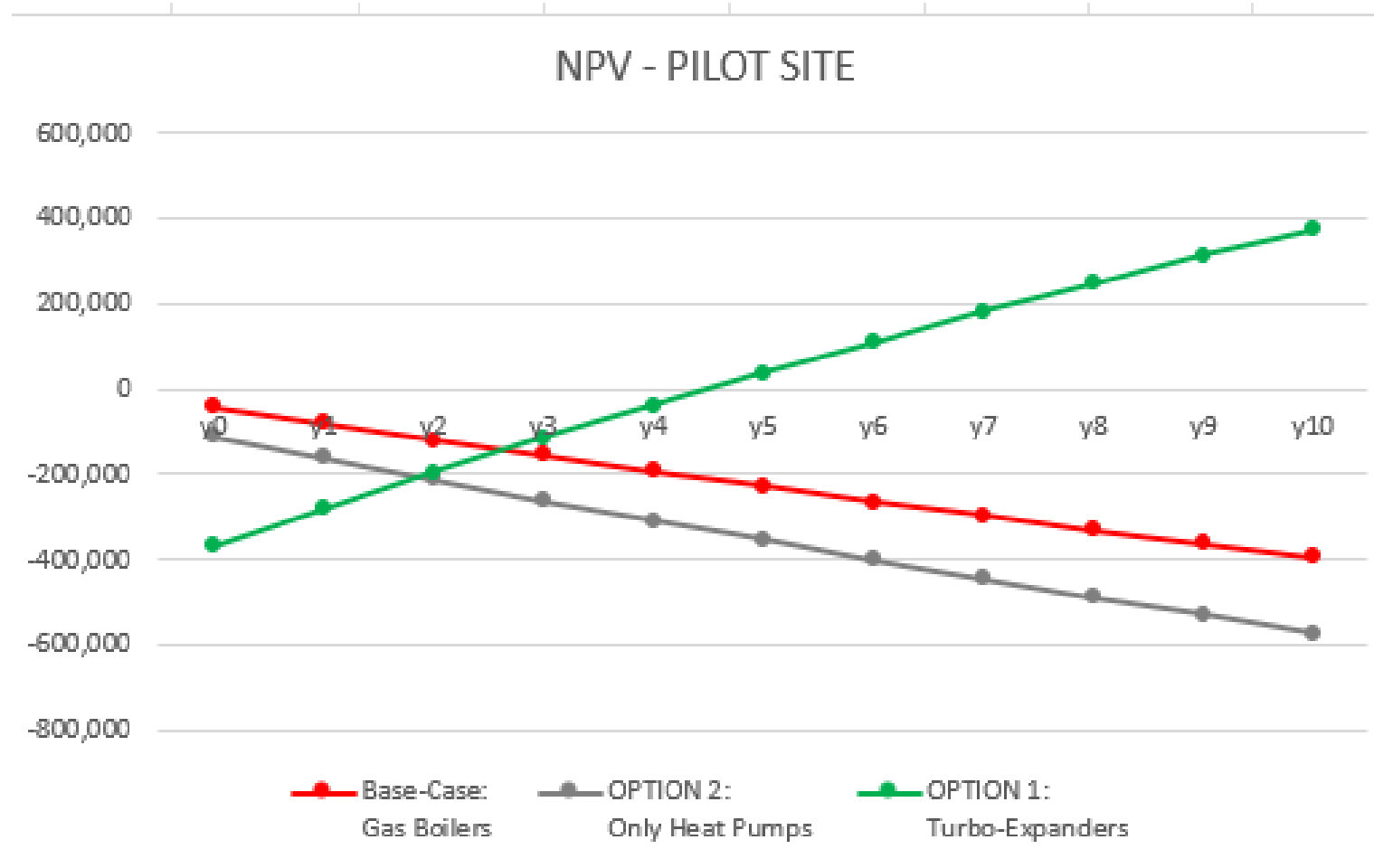
(2) Pre-heating with Heat-Pump requires only 185 MWh/y from external source (i.e. electricity from Turbo-expanders)

(3) CO₂ that would be generated producing the equivalent amount of electricity with national grid energy mix

Return on Investment (ROI)



Net Present Value (NPV)



Powering IoT with

WATER MICROTURBINES



Digitalization is key to overcoming the inefficient management of water resources



World

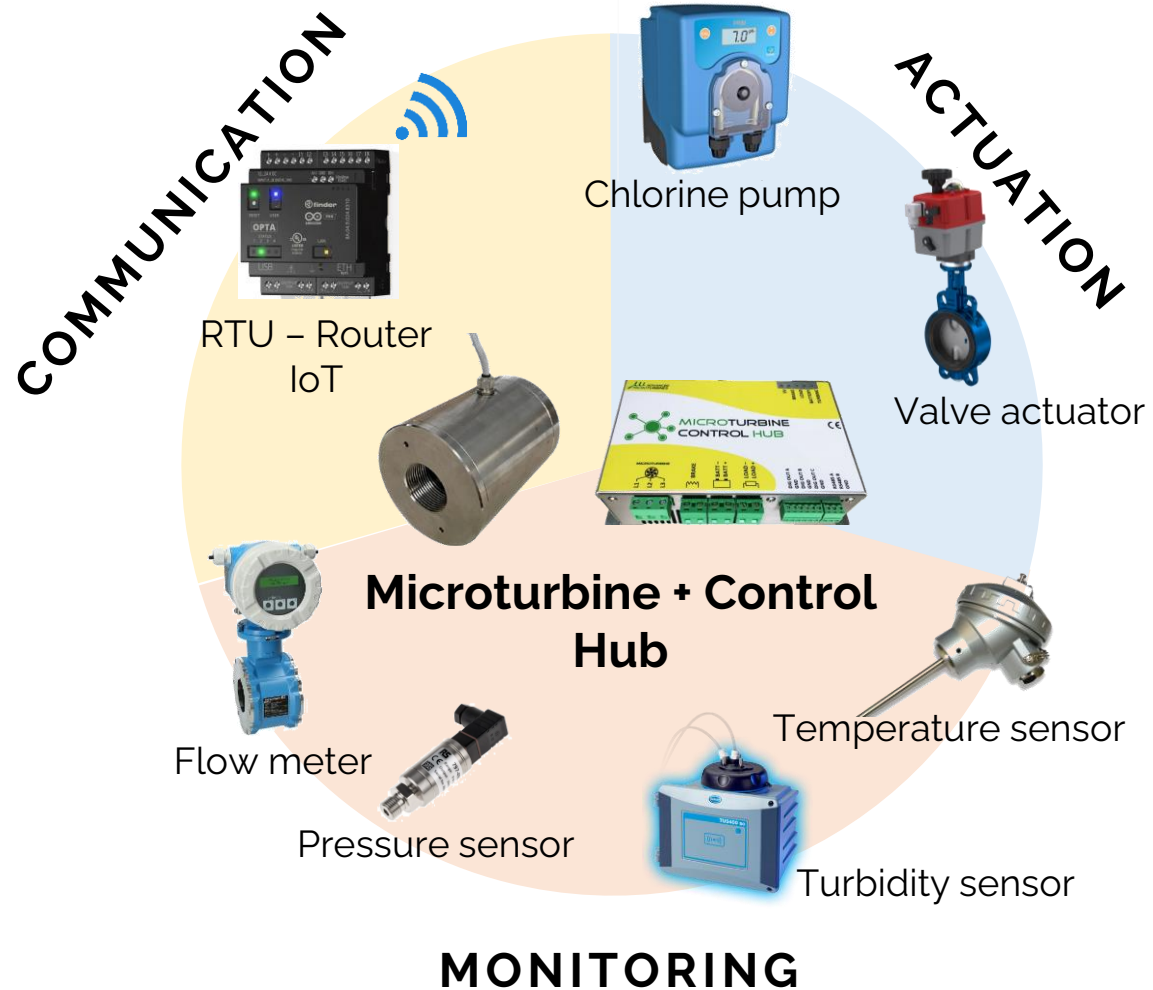


10% Reduction of Water Loss
\$1.4 Bn Potential Savings

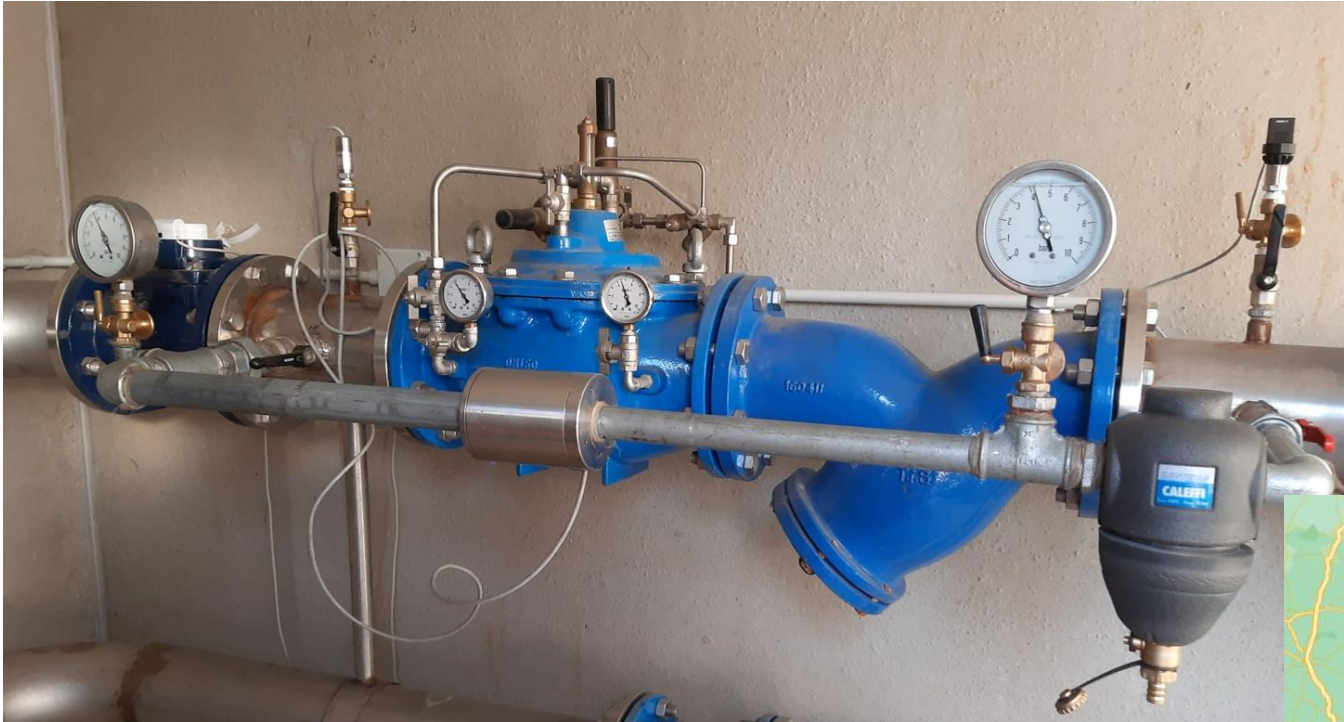
Europe



45% **23%** Water Loss
2,171 m³ per km of Piping



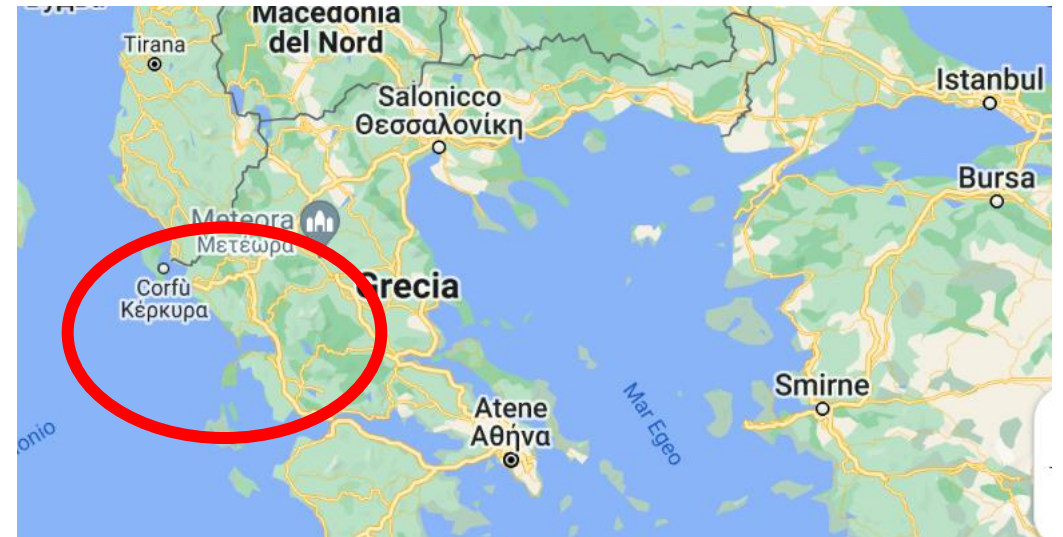
Installation Example - WATER



Installation Example - WATER



Installation Example - WATER





ADVANCED MICROTURBINES



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