



Water Supply and Distribution Systems - Solving vs Mending: Following the Trail of Money



 #WATEFCON 2018

Rui Silva Santos / Miguel Zilhão

RSS PORTUGAL

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wat**f**
Water Efficiency Network

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“We do not inherit the Earth from our ancestors; we borrow it from our children.”
Native American Proverb

Money is
becoming
more
expensive
...

€

€

... and
scarcer

Water
Resources



“You can’t build a long term future on short term thinking” Billy Cox

“It is necessary to aim for an increasing efficiency and effectiveness, opting for economically balanced, well thought out, sustainable and long-term solutions - we must not forget that, at least for now, there is no alternative Plan B for living on Planet Earth...”

Rui Silva Santos and Miguel Zilhão, Part-time Philosophers



Mending

Leakage Control

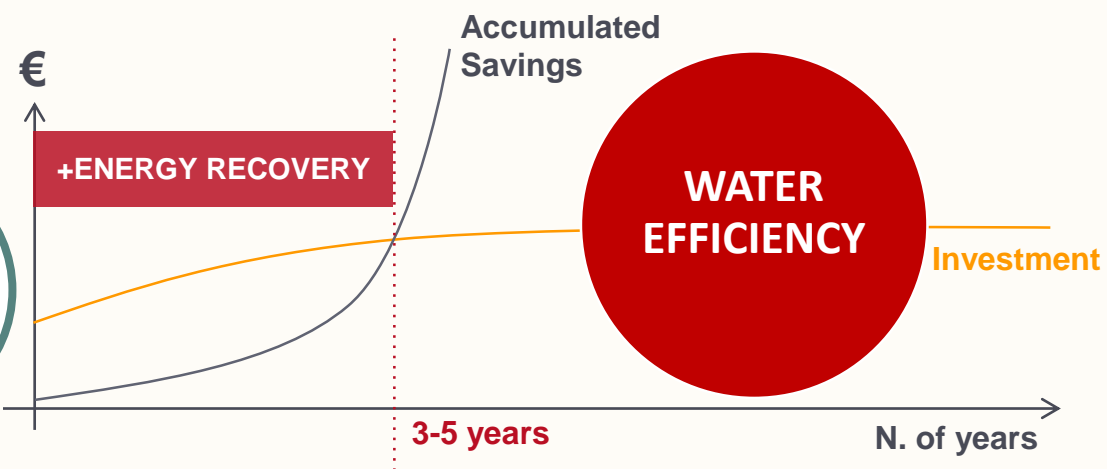
System Control and Management

Global Management

Energy Efficiency and Recovery

...

Solving

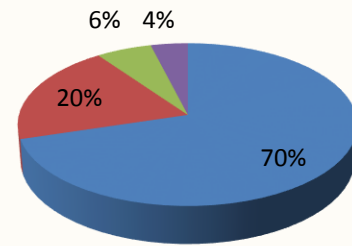
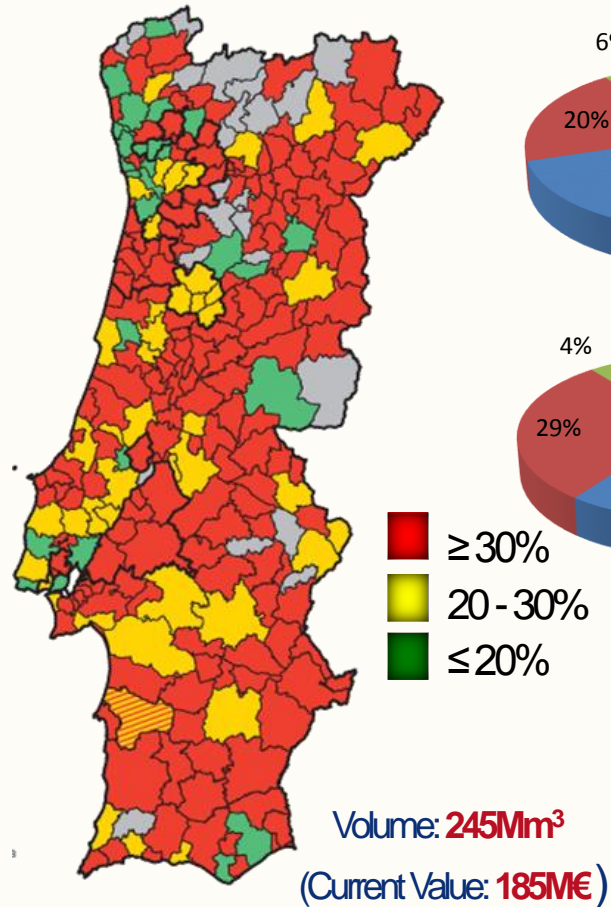


Better Economy

Better Environment

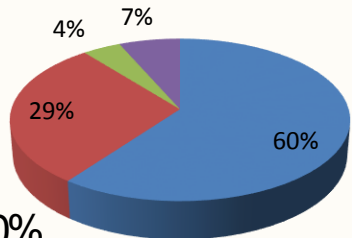
Better Public Service

“Statistics are like bikinis – they show a lot but not everything”
Lou Piniella

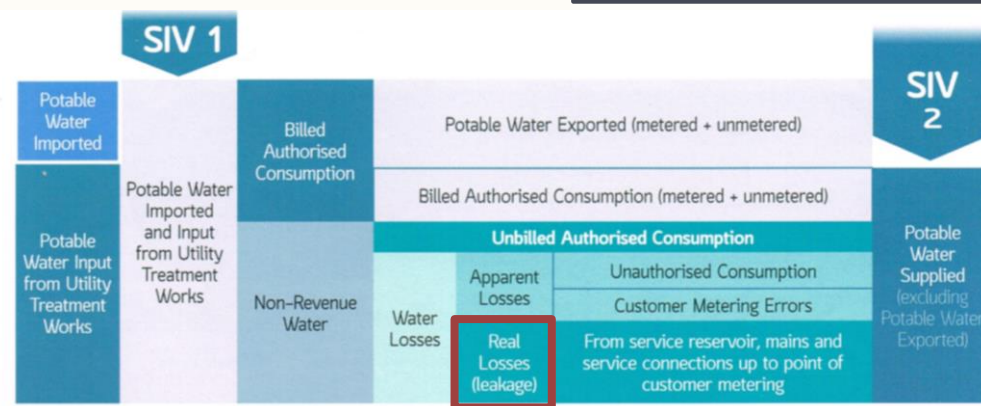
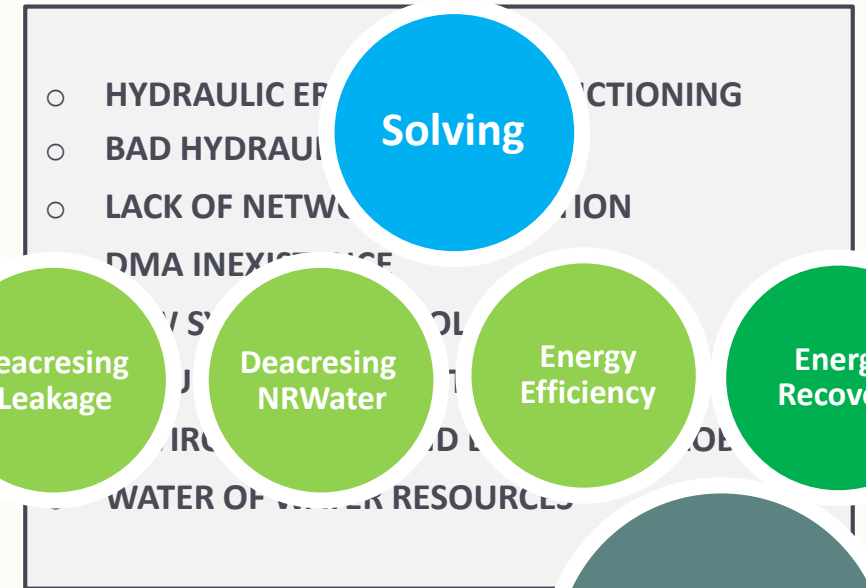


Volume

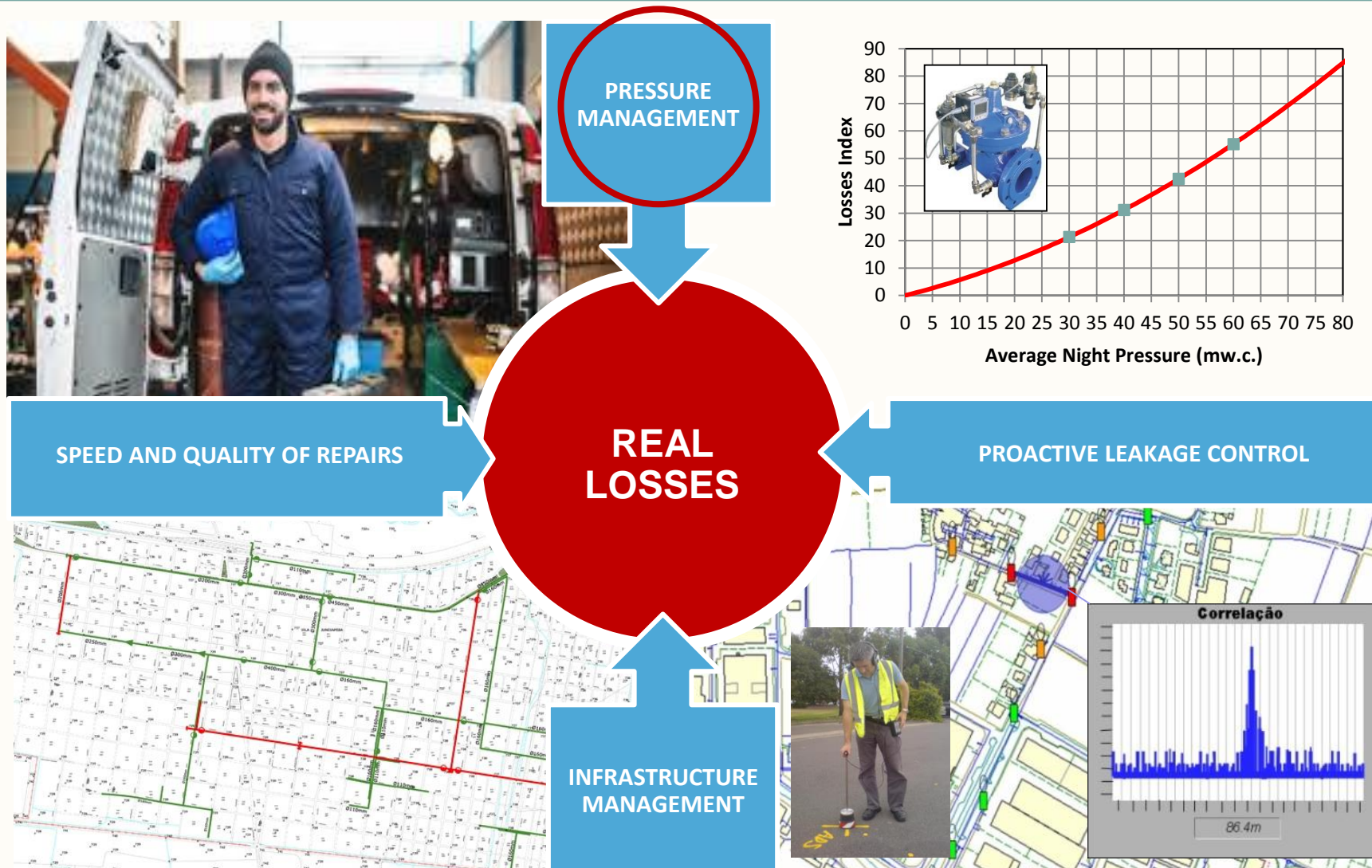
- Billed Authorized Consumption
- Real Losses (Leakage)
- Apparent Losses
- Unbilled Authorized Consumption



Man. Entity

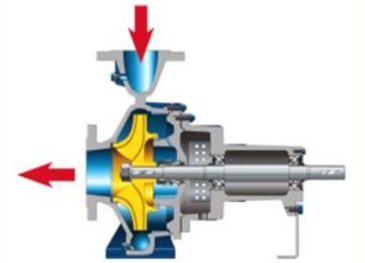


“Irrational barriers and ancient prejudices fall quickly when the question of survival itself is at stake” - John F. Kennedy

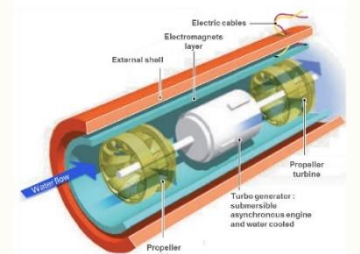


ENERGY RECOVERY

PAT (KSB...)

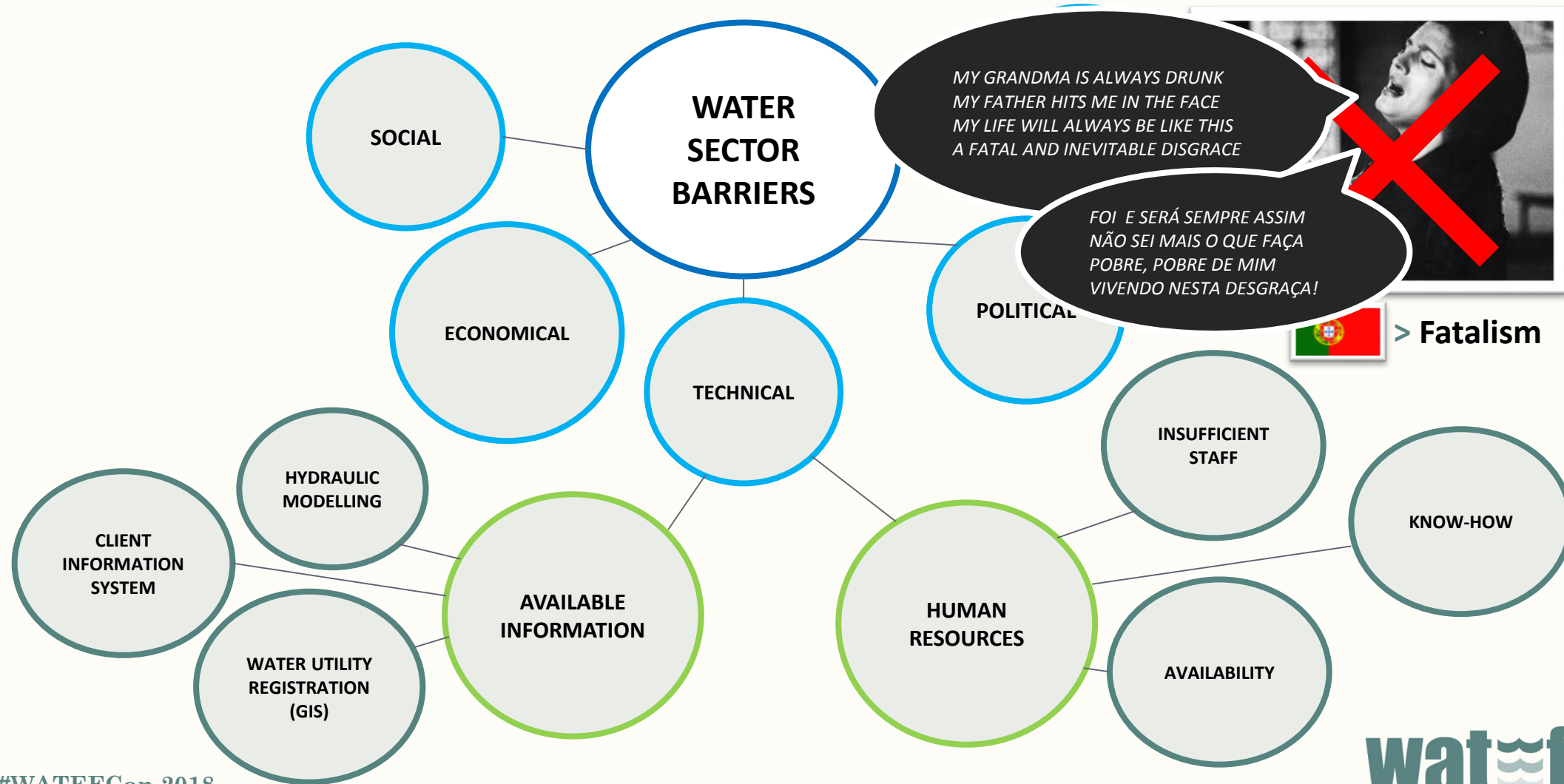


Micro-Turbines (PAM...)



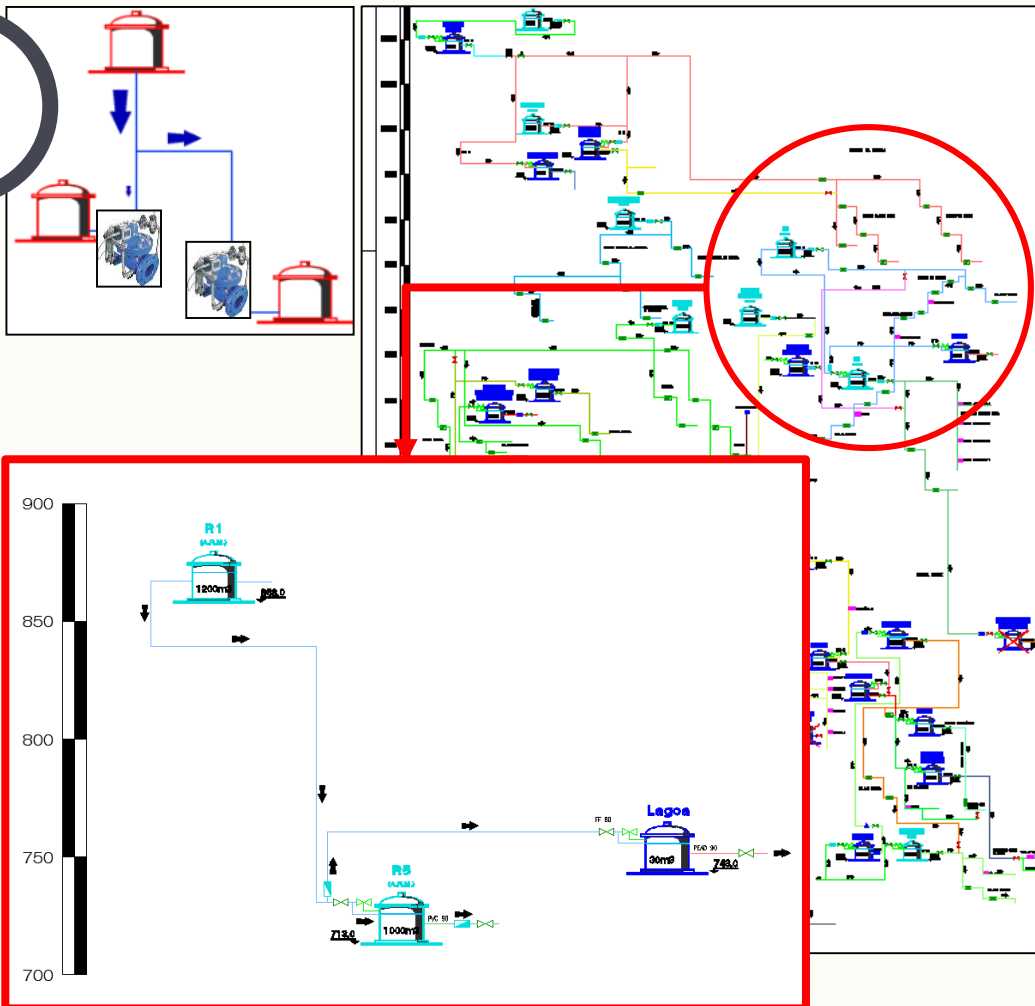
OR...

“In this world nothing can be said to be certain, except death and taxes”
Benjamin Franklin

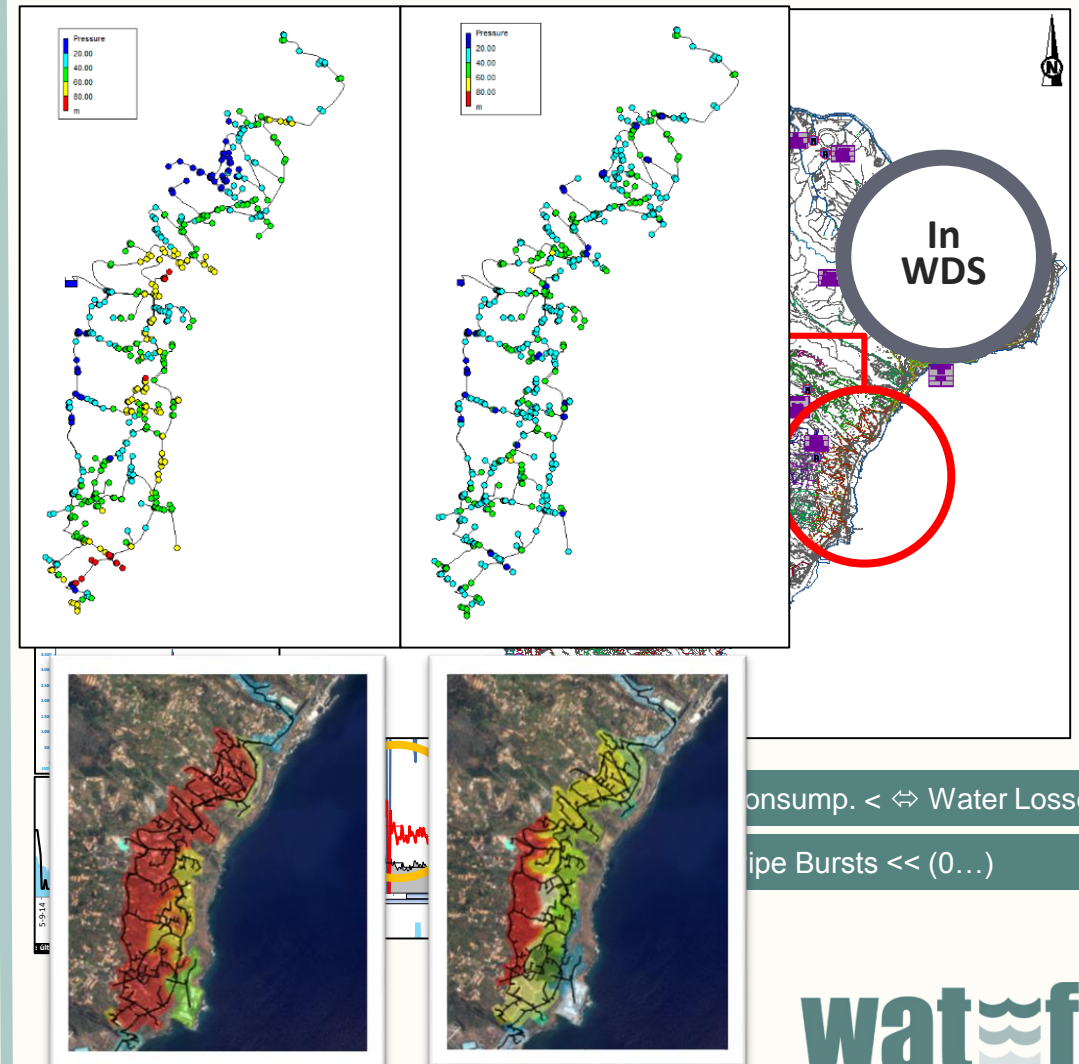


“A pessimist sees the difficulty in every opportunity; an optimist sees the opportunity in every difficulty” – Winston Churchill

In
WSS

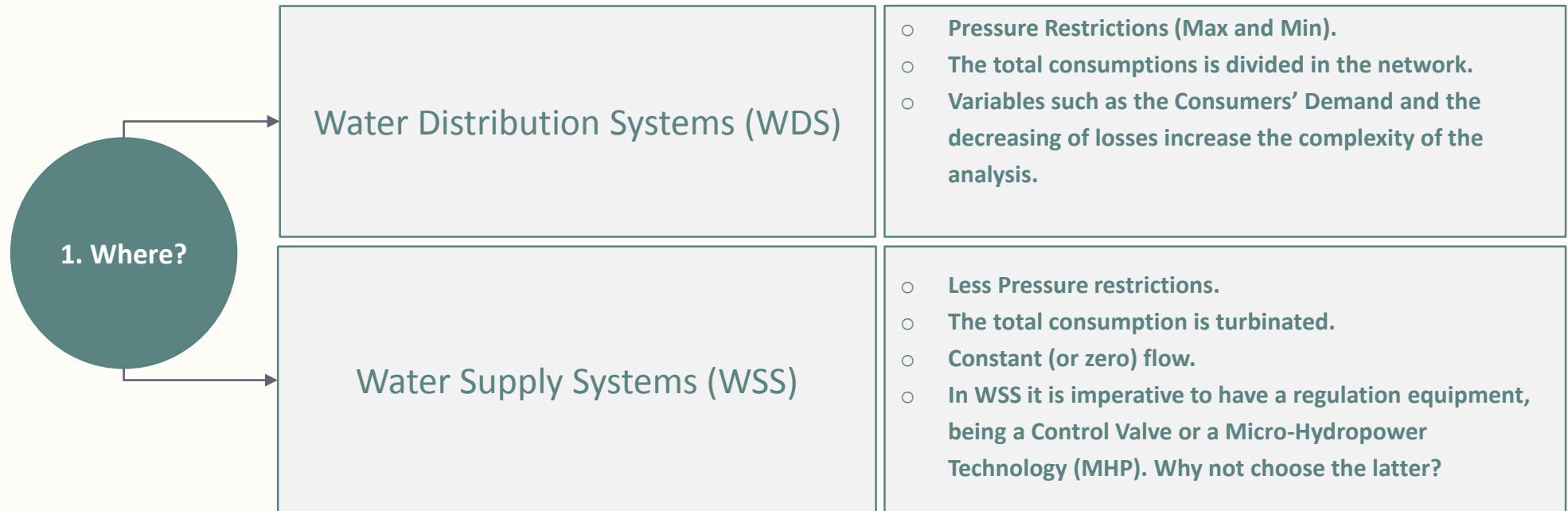
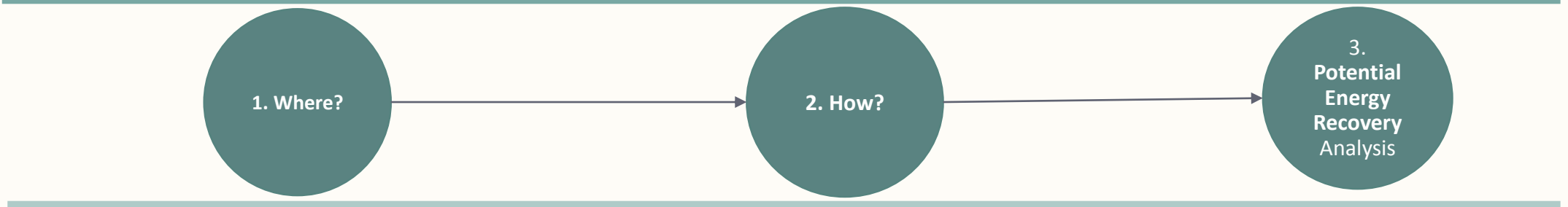


In
WDS



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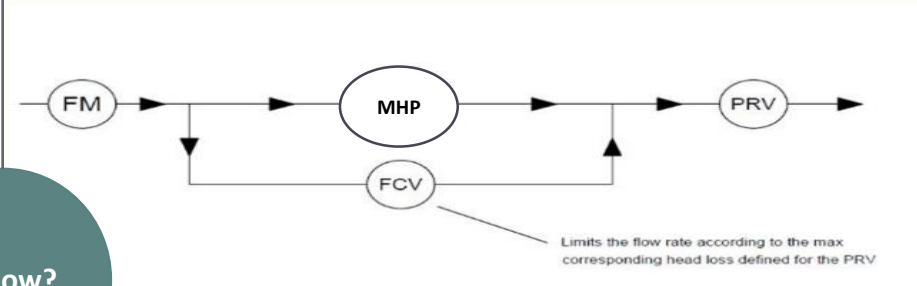
“Setting goals is the first step in turning the invisible into the visible”
Tony Robbins



“At its heart, engineering is about using science to find creative, practical solutions”
Queen Elizabeth II

2. How?

○ Non – Regulation (NR) Mode



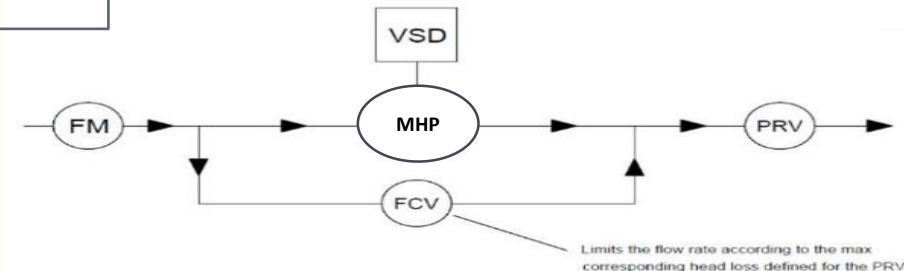
- Use the Micro-Hydropower Technology (MHP) Nominal Speed

OR

- Fixed Optimized Rotational Speed
- Variable Rotational Speed

In
WDS

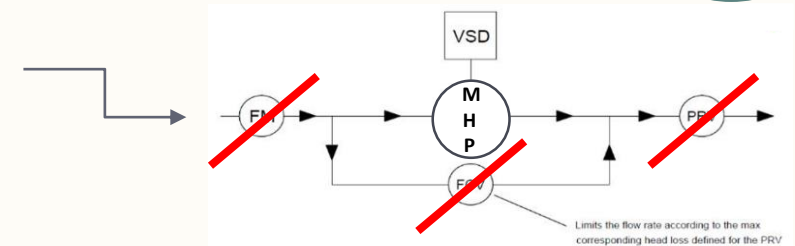
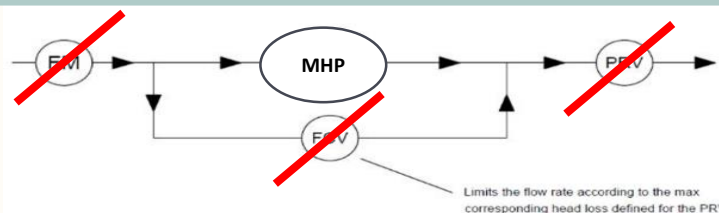
○ Electric – Regulation (ER) Mode



- The ER Mode optimized with a Fixed Rotational Speed since the flow in WSS is constant (or zero).

In
WSS

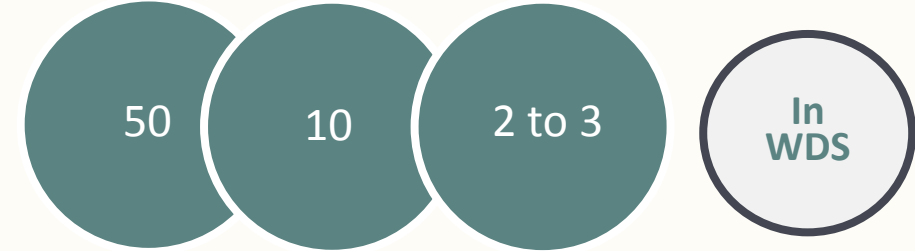
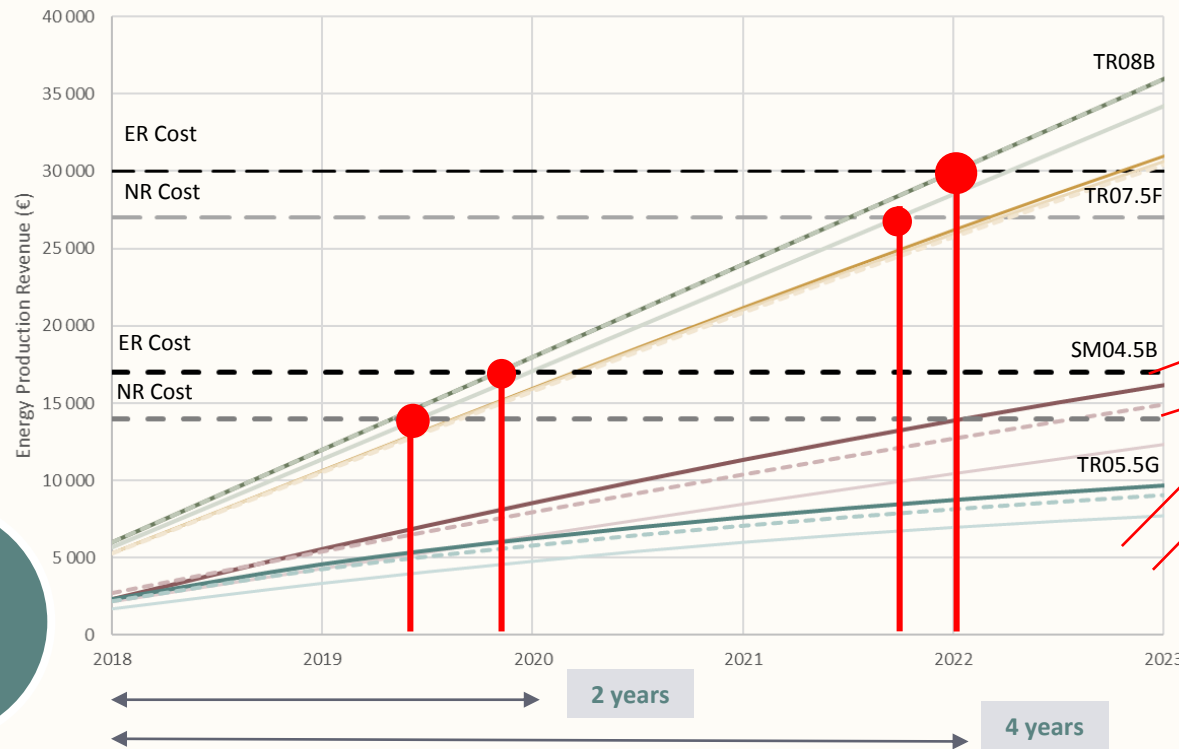
○ NR Mode



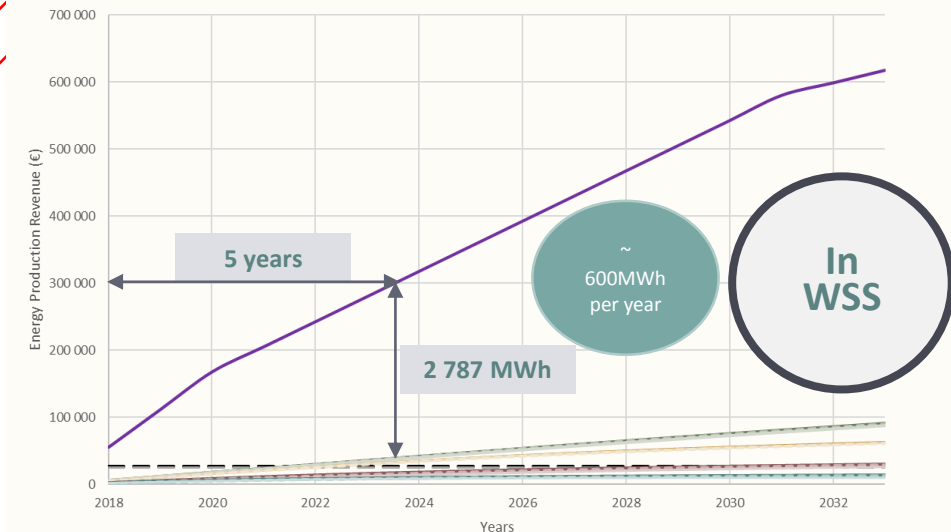
- Important to highlight that the flow is constant through time, what varies is only the operational time

“Nothing is less productive than to make more efficient what should not be done at all” – Peter Drucker

3. Potential Energy Recovery Analysis



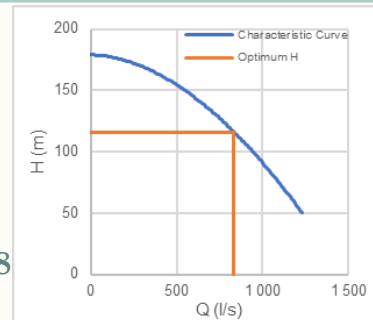
Differential Cost between implementing MHP technology and a pressure reduction equipment with all accessories.



$$Q = aD^b J^c$$

$$\Delta H = J * L$$

$$H = \Delta z - \Delta H$$

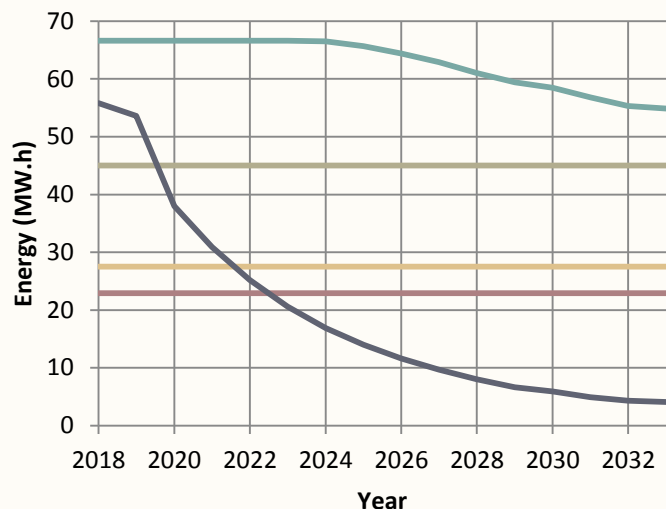
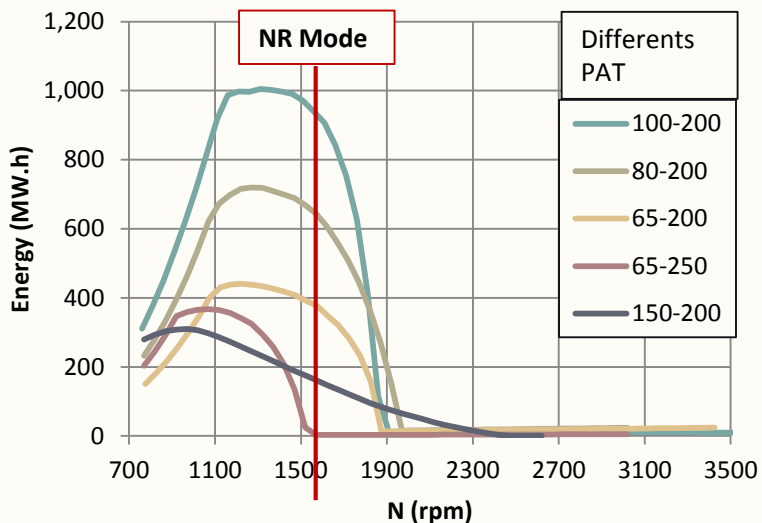


$$H_{opt} = \Delta z - \frac{\Delta z}{1 + \frac{1}{c}} \approx \frac{2}{3} \Delta z \quad (c = 0.54)$$

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“I never guess. It is a shocking habit destructive to the logical faculty”
 Arthur Conan Doyle

MHP (PAT) SELECTION and OPTIMAL ROTATIONAL (FIXED OR VARIABLE) SPEED SOFTWARE (EXAMPLE)



ER Mode - Fixed Optimized Rotational Speed

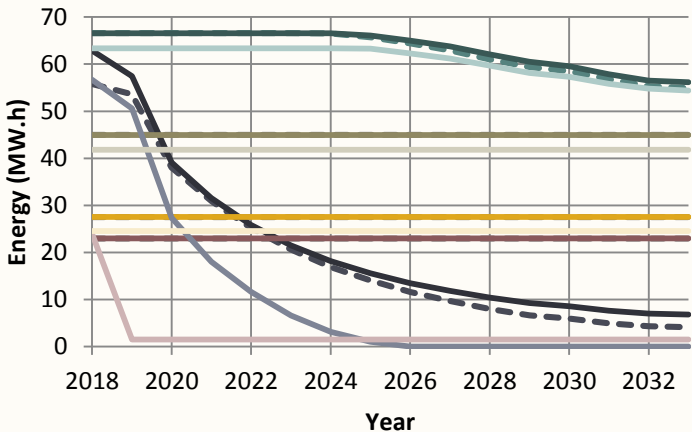
PAT 100-200 for TR08B

#	PAT	N(rpm)	E _{max} (MW.h)
1	100-200	1310	1005,0
2	80-200	1270	719,3
3	65-200	1225	440,7
4	65-250	1070	367,2
5	150-200	970	310,0



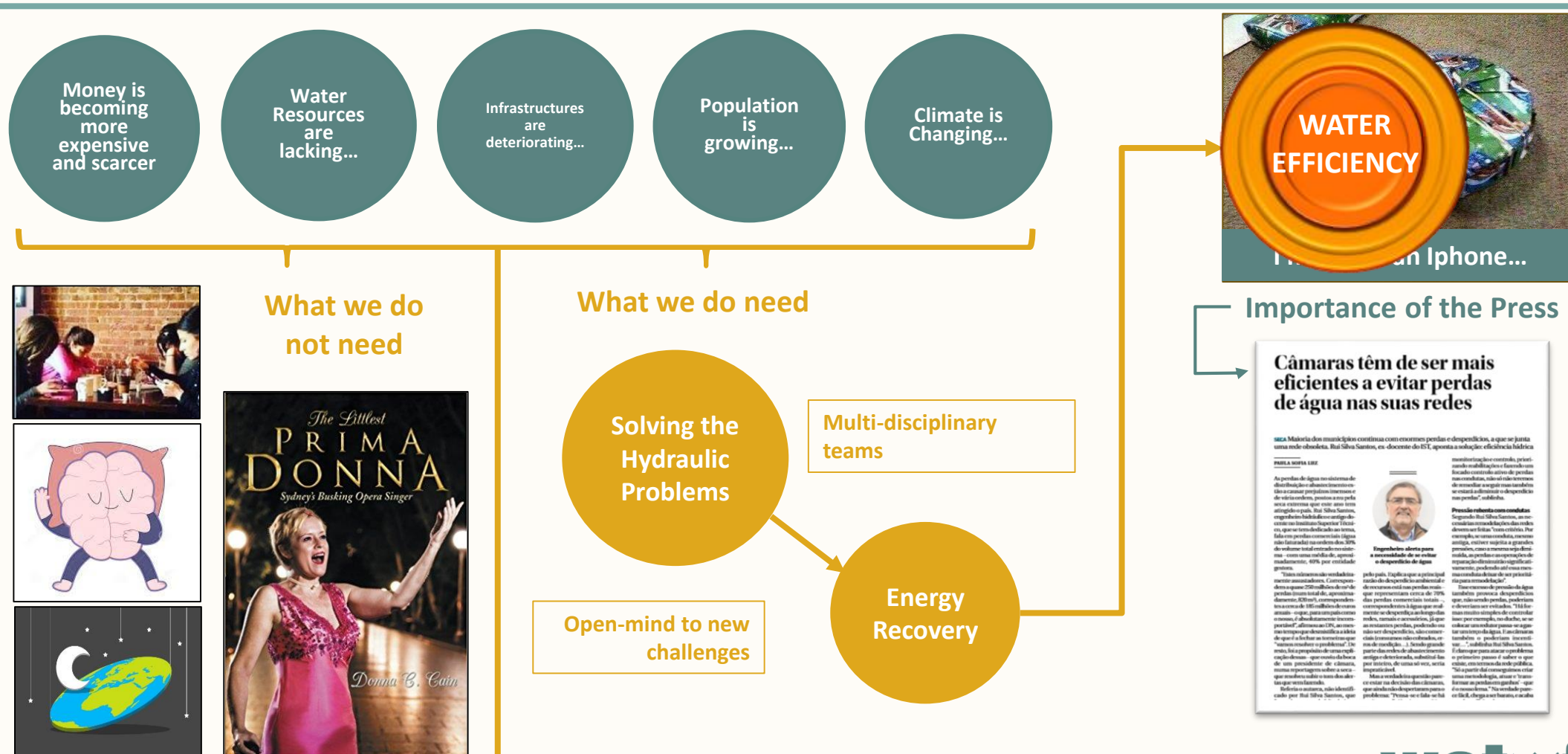
PAT	NR		ER - Fixed Optimized N		ER - Variable N	
	N (rpm)	E _{tot} (MW.h)	N (rpm)	E _{tot} (MW.h)	N (rpm)	E _{tot} (MW.h)
100-200	1510	971,1	1310	1005,0	Variable	1013,7
80-200	1520	668,1	1270	719,3	Variable	742,3
65-200	1525	391,3	1225	440,7	Variable	440,7
65-250	1520	64,0	1070	367,2	Variable	367,2
150-200	1520	175,0	970	310,0	Variable	346,7

Comparison of the Regulation Modes



- ER Mode - Variable Rotational Speed
- ER Mode - Fixed Rotational Speed
- NR Mode

“We cannot solve our problems with the same thinking we used when we created them” – Albert Einstein



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To Know, Analyse, Design, Decide and **Act**

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Water Efficiency Network



Thank you for your attention

Obrigado pela vossa atenção

Rui Silva Santos

Miguel Zilhão

rss@netcabo.pt
