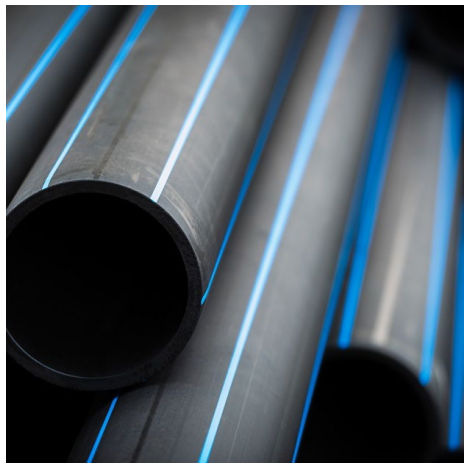

BUILDING SUSTAINABLE WATER NETWORK WITH ADVANCED POLYTHEYLENE (PE) PIPING SOLUTIONS

By Mr Amos Tay
Senior Engineer, Application Development
Borouge Pte Ltd

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ABOUT BOROUGE

WHO WE ARE

Borouge is a **leading petrochemical company** that provides innovative and differentiated polyolefin solutions.

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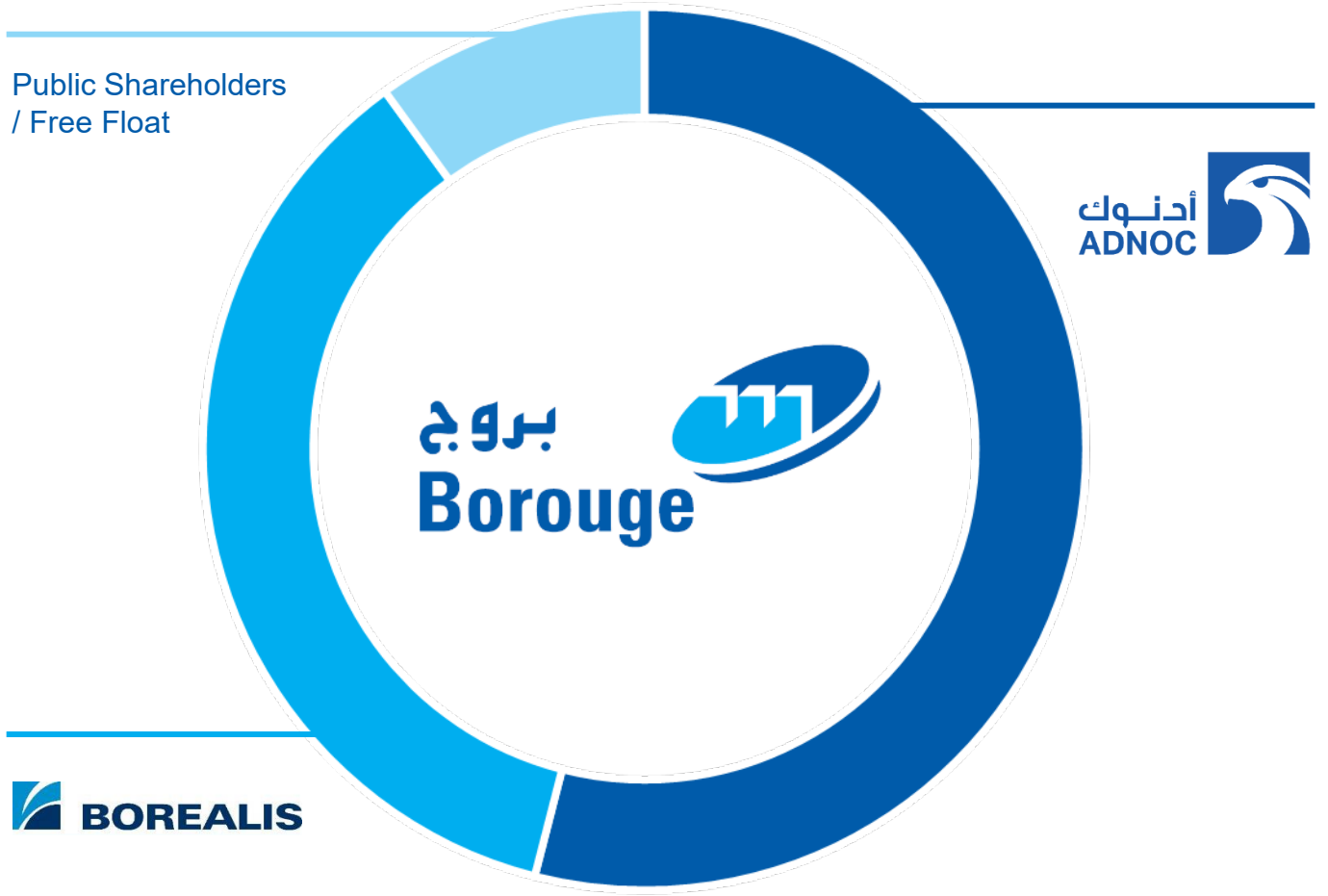
BOROUGE – PART OF A GLOBAL POLYOLEFINS FAMILY

- Established in **1998**
- Focus on Infrastructure, Energy, Agriculture, Healthcare, Mobility and Advanced Packaging markets in **over 50 countries** across the Middle East, Asia Pacific, and Africa
- **10-fold increase** in production capacity since 2001
- More than **3,100 employees** globally



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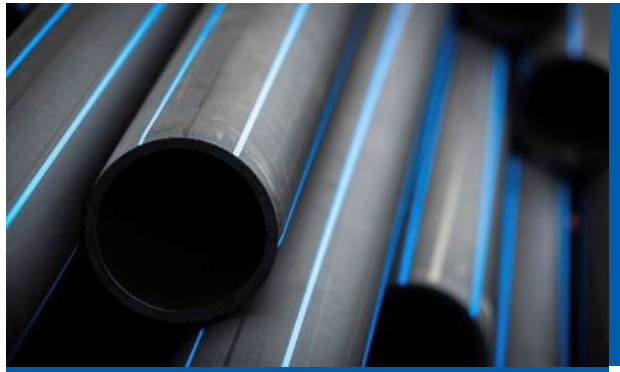
BOROUGE – ENABLING EVERYDAY LIFE



INFRASTRUCTURE

Our water and gas pipe solutions provide vital function to society and enable modern living

HEALTHCARE

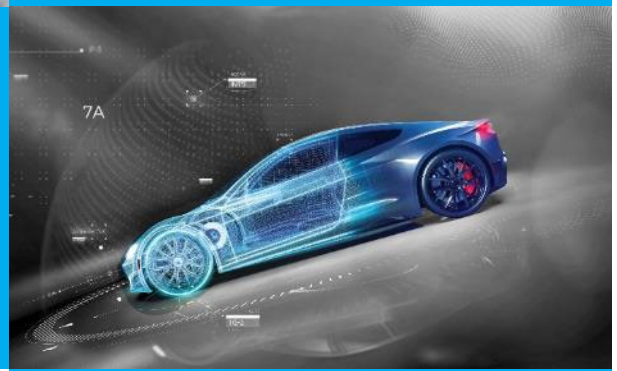
Our healthcare solutions meet the strictest global regulations

ENERGY

Our energy solutions enhance energy efficiency to deliver safe and reliable energy to our homes

MOBILITY

Our mobility solutions make cars lighter and more efficient.



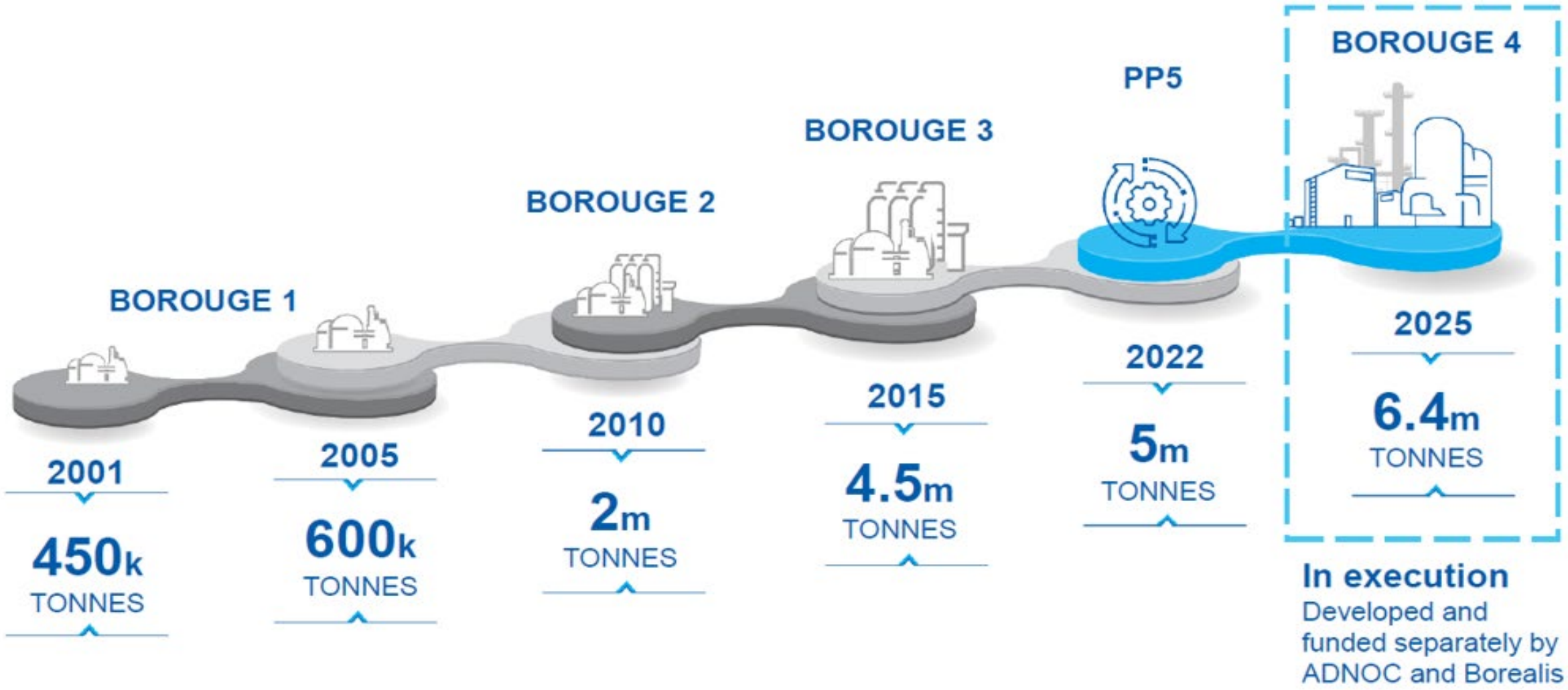
AGRICULTURE

Our agriculture solutions increase crop yield and save water consumption

ADVANCED PACKAGING

Our advanced packaging solutions help preserve food freshness for longer and reduce waste

BOROUGE'S GROWTH JOURNEY



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BOROUGE – FROM UAE TO THE WORLD

+50

logistics service providers globally

+1,000

routes shipping 400-600 containers daily

14

offices across the Middle East Asia Pacific and Africa

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BENEFITS OF PE PIPE SYSTEM

PE100 features	Advantages
PE pipes are corrosion resistant	▪ For long service and low operation cost ▪ Reduced maintenance and repair cost
PE pipes are light-weight	▪ Easier to install; shorter installation time ▪ Lower installation cost
PE pipes are water neutral	▪ Does not affect the taste and odour of the water ▪ Does not change the quality of the water
PE pipes are adapted to modern installation techniques	▪ Relining, ploughing-in, horizontal directional drilling (HDD), are possible due to unique properties of PE
PE is an environmentally sound solution for sustainable piping networks	▪ Has a much lower CO_2 footprint than traditional material ▪ Long service life and leak-tight to protect water resource

WHY POLYETHYLENE FOR WATER SUPPLY NETWORK?

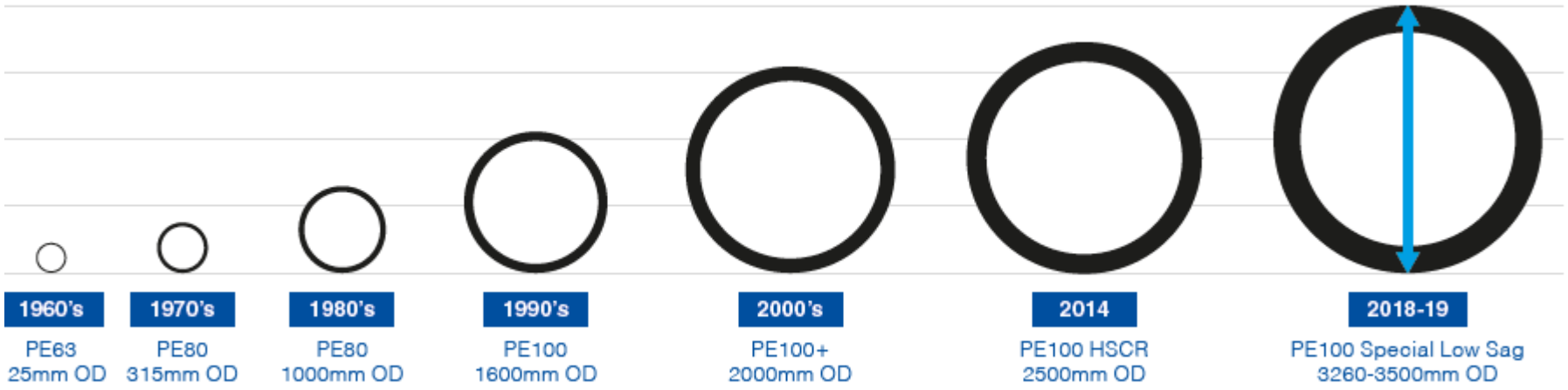
- Polyethylene (PE) pipes are the preferred solution for water service and distribution networks owing to their corrosion resistance and durability
- The most cost-effective option for water applications up to 355mm in diameter
- The industrial sector has long recognised the robustness of PE pipe, using it in applications beyond 2000mm in diameter, such as seawater intake systems for desalination plants
- The reduced carbon footprint, resilience to environmental conditions, and favourable whole life cost of PE pipes address climate-related risks in water asset investment considerations.

Success stories of large diameter PE pipes in water transmission are presented here to encourage a broader adoption of this robust system beyond its present size limitations in water supply systems

ADVANCED PE100 FOR LARGE DIAMETER AND HIGH PRESSURE APPLICATIONS

Borouge

The latest generation of PE100 materials enables larger, tougher pipes to meet higher safety standards for modern water supply and industrial piping systems



Increase in PE pipe size enabled by continuous material advancement in sagging resistance and pipe extrusion machinery

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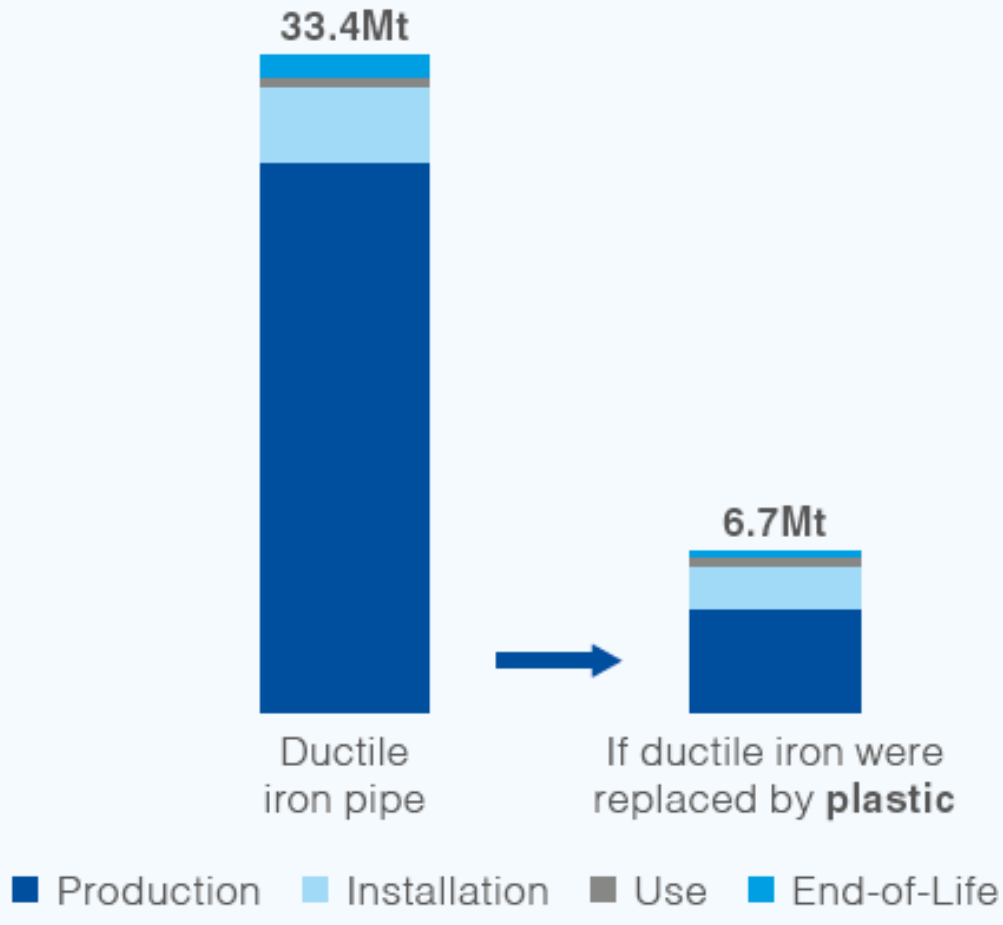
CARBON FOOTPRINT COMPARISON

POLYETHYLENE PIPE VS CONVENTIONAL PIPE



Material Greenhouse Gas Emission (Mt CO_2 equivalent) from various stages in the pipe life cycle

The European Plastic Pipes and Fittings Association (TEPPFA) Life Cycle Assessment shows that[1,2]:

- 70% of the carbon footprint comes from the production stage of the pipe life cycle
- The choice of raw material used in pipe production significantly affects the carbon footprint
- PE pipes have a much lower carbon footprint than materials such as ductile iron

1. https://www.teppfa.eu/sustainability/environmental-footprint/lca/
2. Ludo D, Peter S, A holistic environmental footprint assessment of the European plastic pipe business, 21st Plastic Pipes Conference PPXXI 2023

ROBUST SYSTEM AGAINST CLIMATE CHALLENGES

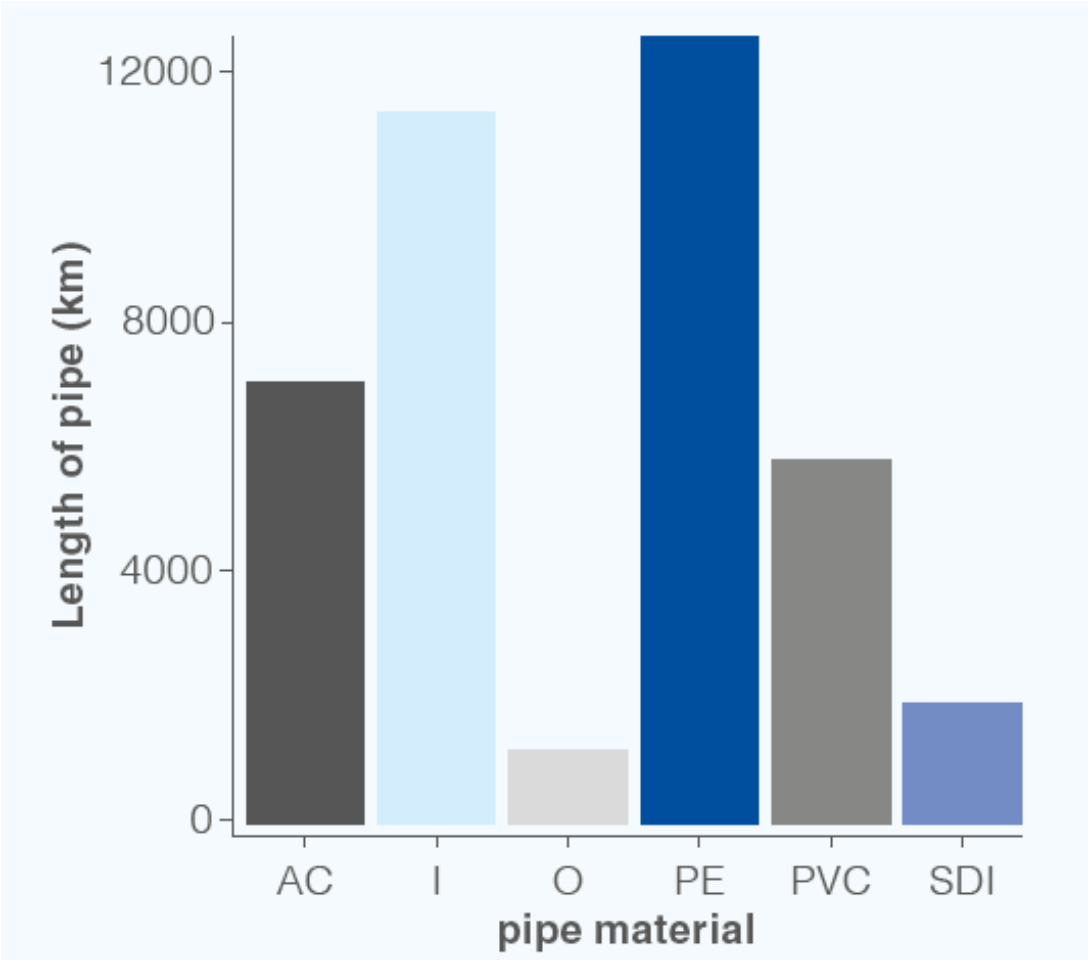


Figure 1: Lengths of pipe materials in the Anglian Water Network.

- PE pipes are weather resistant
- PE pipes have the lowest leakage rates in varying environmental conditions[3]
- PE pipes are the least sensitive to soil conditions, such as acidity and thermal contraction. They possess the capability to effectively manage ground instability
- The robustness of their joints is attributed to their fully fused end load resistant joints and resistance to corrosion

AC: asbestos cement;
I: Iron;
O: other/unknown;
PE: polyethylene;
PVC: polyvinylchloride;
SDI: steel and ductile iron

3. Dr Timothy S. Farewell, The impact of environmental factors on leakage in the Anglian Water region", Oct 2020

ROBUST SYSTEM AGAINST CLIMATE CHALLENGES

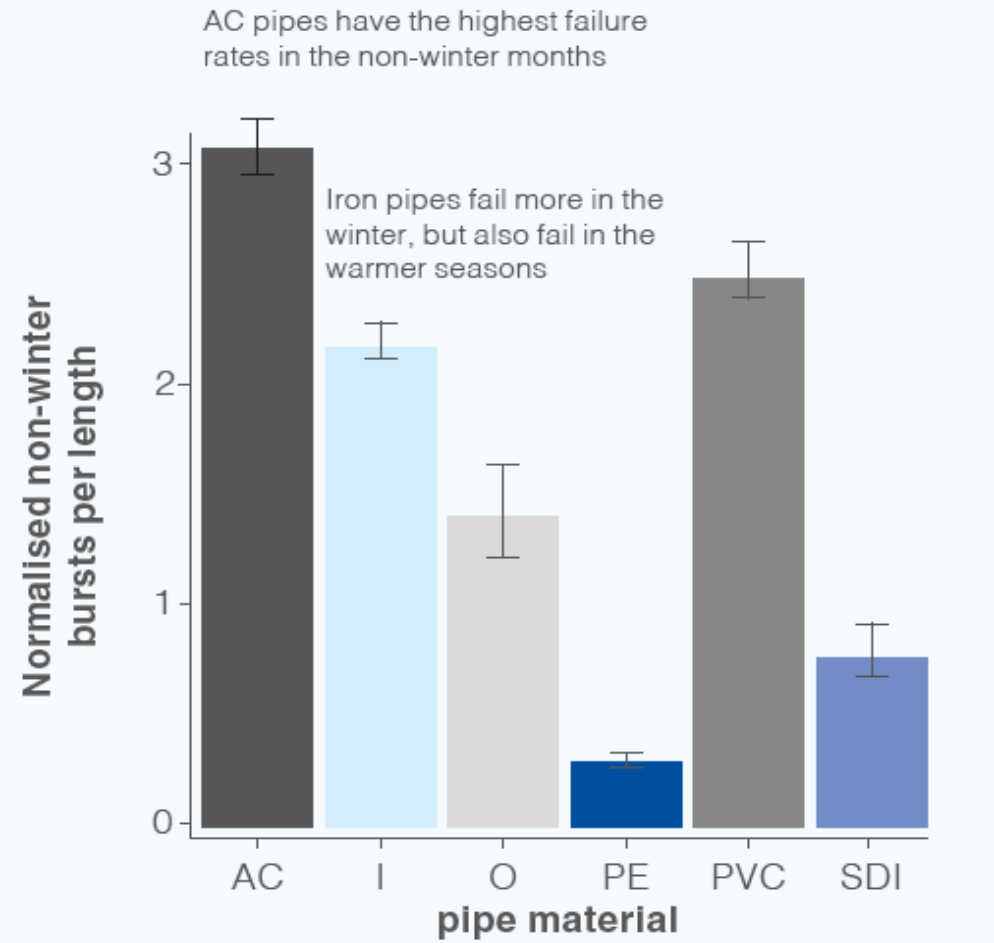


Figure 2: Normalised rate of non-winter failures per 10km pipe for recent years (May-October of 2017-2019)

- The robustness of their joints is attributed to their fully fused end load resistant joints and resistance to corrosion
- PE pipes have the lowest burst rate per length compared to all other types of pipes and have the greatest installation length in the Anglian Water region

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ECONOMIC BENEFITS OF POLYETHYLENE – FAVOURABLE WHOLE LIFE COST

- PE pipes are cost-effective for water applications due to their corrosion resistance and leak-free performance. Their whole life cost encompasses the cost of acquisition, installation, operation, and maintenance of the pipe network
- Low initial cost systems often have higher failure and leakage rates, leading to significant maintenance costs and water loss over the life of the pipe network[4]
- PE networks have significantly lower costs throughout their lifetime, with lower failure and water loss rates. This contributes to long-term cost savings

	Mild Steel Cement Lined ND 813mm pipe	PE100 Polyethylene OD 900mm pipe
Pipe Cost	1.0	1.7
RC Supports	0.8	Not Needed
Trench Installation	Above ground	0.1
Joint Welding	0.1	0.1
Corrosion Protection (every 5 yrs)	0.3	Not Needed
Total Cost (normalised)	2.2*	1.9+

4. Plastic Pipe Institute Position Paper Economic Benefits of HDPE Pipe in Water Infrastructure October 2015
* MSCL - Above-ground pipe in soft ground area; + HDPE - buried

IDEAL SOLUTION FOR WATER TRANSMISSION

SOUTHERN EGYPT

- Food security and sustainable agriculture were made possible with extended PE pipes and an irrigation network (200mm-1400mm OD)
- High performance leakage-free PE100 pipes were used for a 420km pressure pipeline and irrigation networks in Southern Egypt, enhancing food security and promoting sustainable agriculture. This was achieved by expanding agricultural land by nearly 520,000 acres, with a goal to exceed one million acres in the future

Photo courtesy of Gulf Manufacturing Company

PE100 pipe butt welded into long lengths to be laid in trenches, to convey water for the irrigation system in Southern Egypt, turning arid desert to arable land

JAKARTA, INDONESIA

A large diameter (800mm OD) potable water transmission pipeline was installed in an urban area

- Private water company, PT Aetra Air Jakarta, has constructed water mains with a significant diameter in a congested urban area, utilising PE100 pipes with an OD of up to 800mm
- The utilisation of narrow trenching techniques and above-trench welding has minimised disruption while facilitating water utilities

Water utilities in countries such as Indonesia and Vietnam are adopting PE100 pipes into larger water transmission lines, replacing metallic systems for the benefits of corrosion resistance, ease of installation and toughness

UNITED ARAB EMIRATES

The 55km (1200mm OD) water transmission pipeline connects four out of six Emirates of the UAE

- A trans-Emirates project led by UTICO, the largest private utility provider in the UAE, used PE100 pipes to lay a 55km desalinated water transmission pipeline connecting four Emirates – Ras Al Khaimah, Um Al Quwain, Ajman and Sharja
- The smooth bore of these PE pipes helped to reduce pumping costs during operation
- The flexible PE100 pipes made it easier to maneuver the welded 1400mm OD pipe into the trench

Utico
THE UTILITY EXPERTS

Figure 8: The UTICO Ras Al Khaimah to Sharjah 1200 and 1400 mm OD Water Pipeline

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CONCLUSION

- PE100 pipe systems offer **durable**, **sustainable**, and **high-performing solutions** for critical infrastructure and essential services

- They are effective in mitigating climate and environmental challenges posed by temperature fluctuations, ground stability, and salinity and acidity

- PE100 pipes are extensively utilised for water transportation and demanding industrial applications in increasingly larger dimensions

- Water utilities should consider expanding beyond small distribution pipelines their use of PE pipes to take full advantage of a durable, robust, and sustainable water network

THANK YOU

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بروج
Borouge