Economic Level of Leakage

BIWWEC

July 2026

WYETH WATER

Bringing water businesses and technologies to life

Agenda

1. What is NRW

Definition of NRW

Non Revenue Water is defined as water produced by treatment plants, but which is not billed to customers.

NRW = System Input Volume – Billed Volume

The IWA WLSG has undertaken a global KPI initiative, which looks at NRW levels in both % and in liters/capita/day

If we look at both NRW KPIs, we can see that they don’t correlate. This is because of the Billed Authorised Consumption in liters/capita/day. So when looking at NRW targets and specifically Economic Levels of Leakage, it is important to consider the volume of NRW.

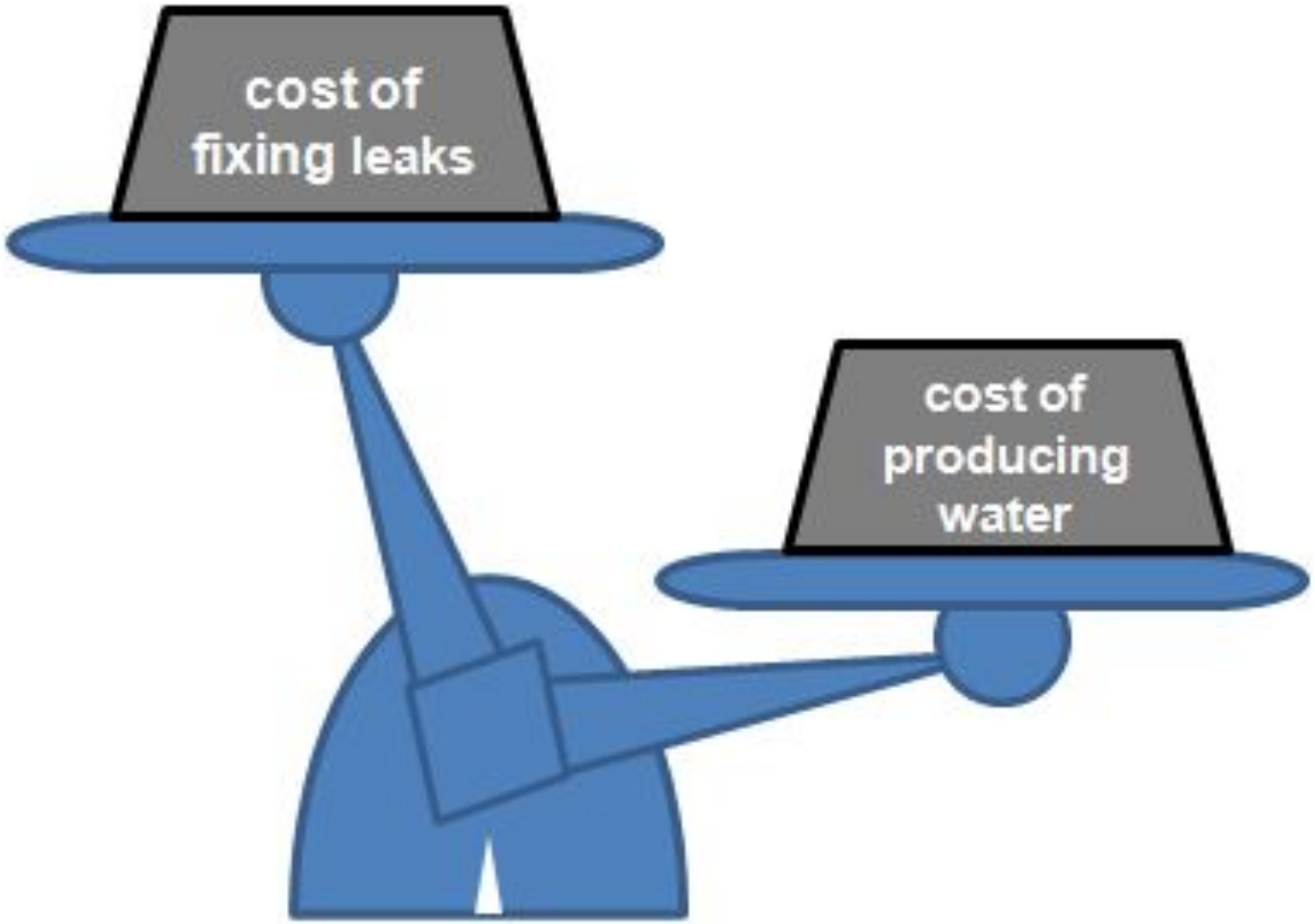
If we look at Malaysia specifically, we can see that the average NRW as a % is 34.3% in 2024, but when we look at NRW as a volume, it comes out at 205 liters/capita/day. One of the highest globally.

So setting targets, and developing ELLs, should not be done as a %, but volumetrically.

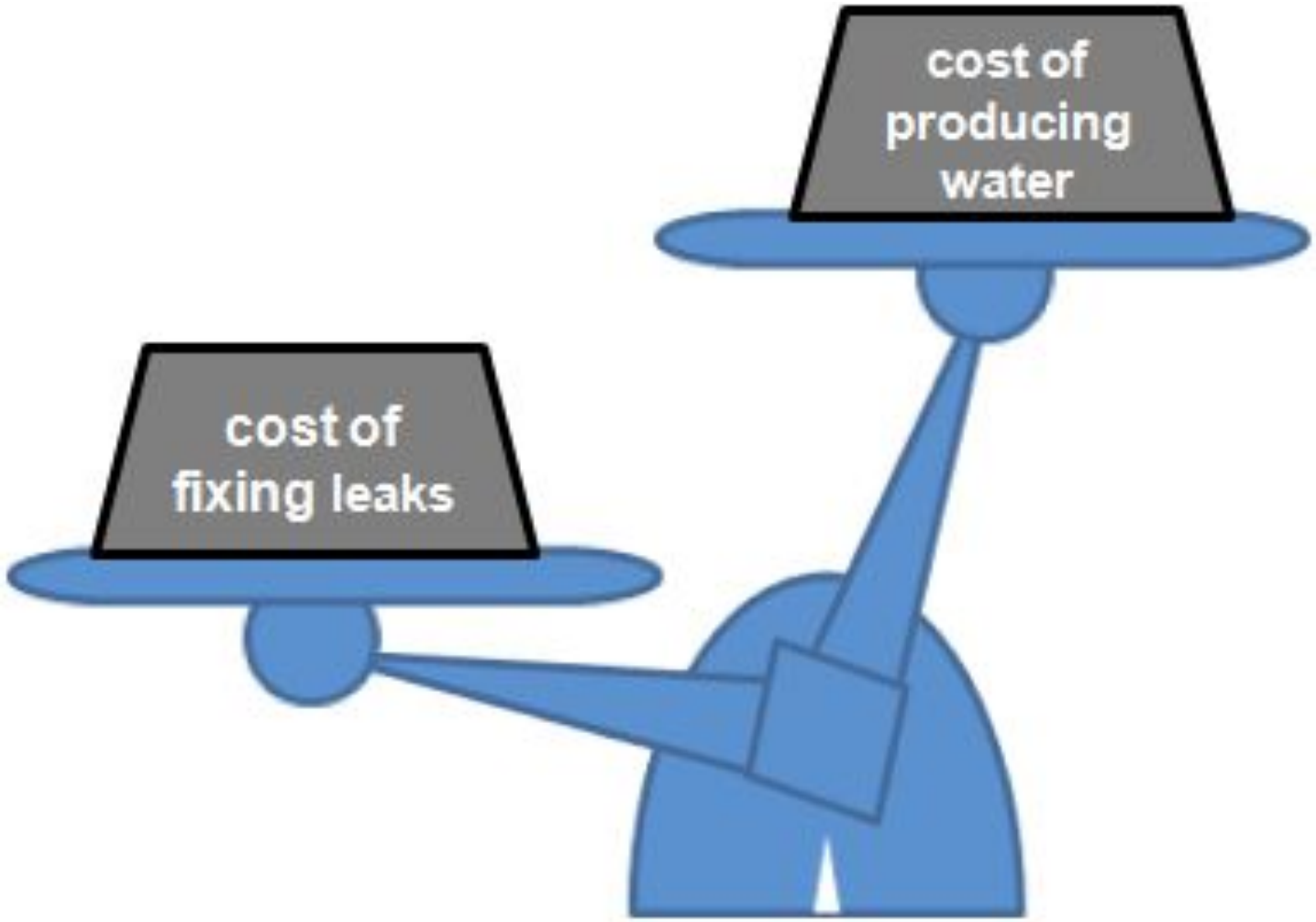
2. Short Run - ELL

- For any water distribution system there is a level of leakage below which it is not cost-effective to make further investment or use additional resources to drive leakage down further.

- In other words, the *value* of the water saved is less than the cost of making the further reduction. This point is known as the economic level of leakage (ELL).



The cost of producing water is greater than the cost of ALC activities



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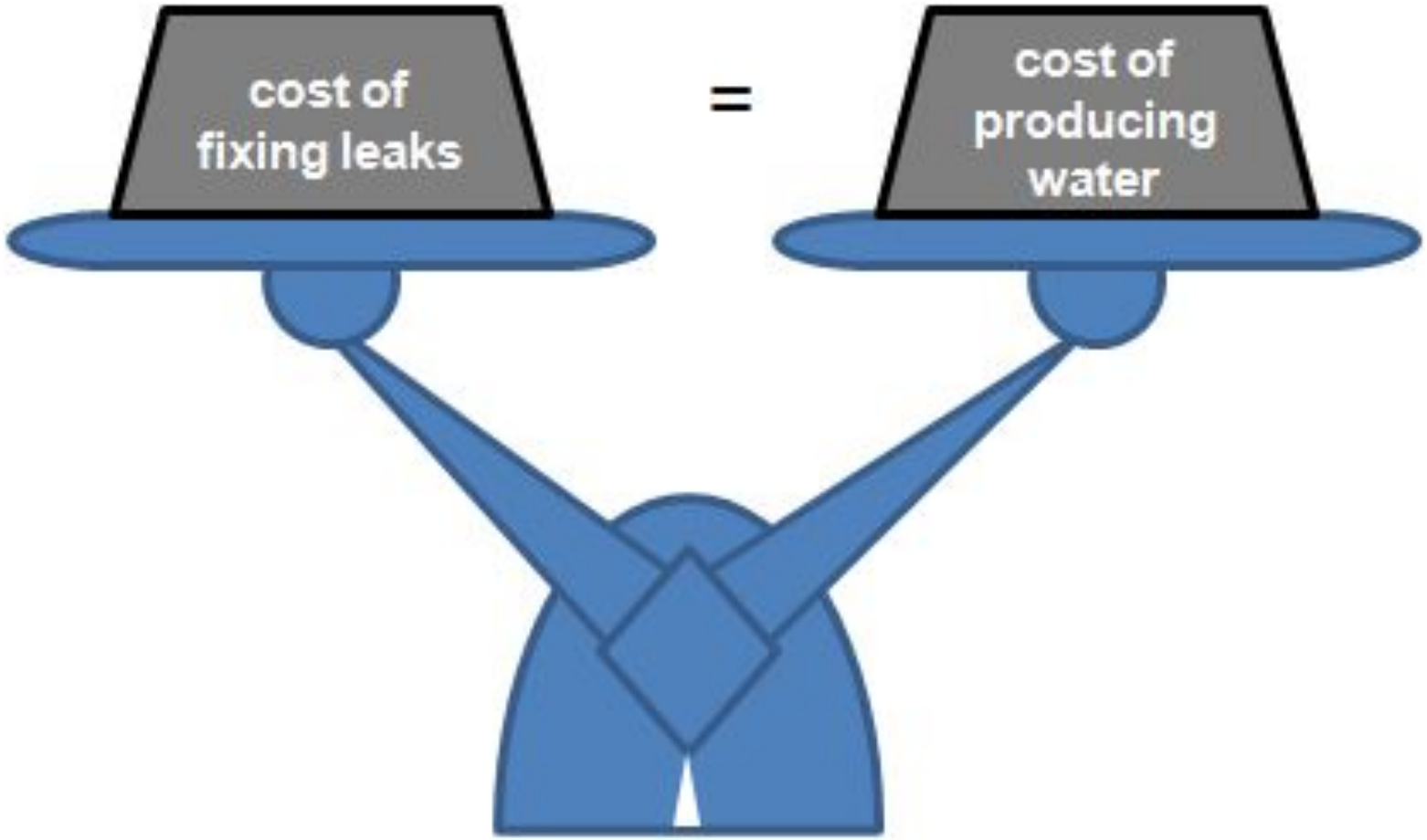

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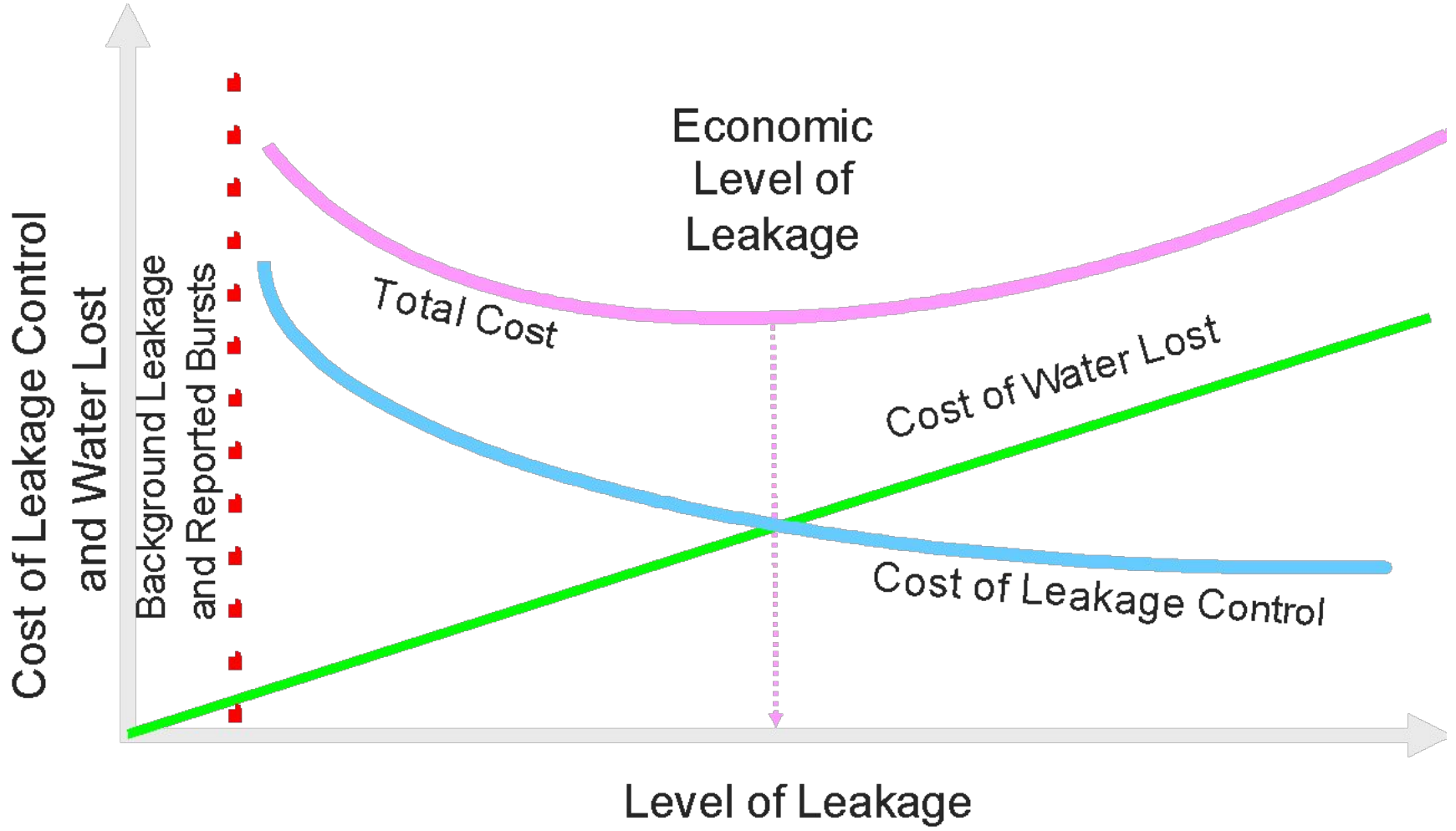
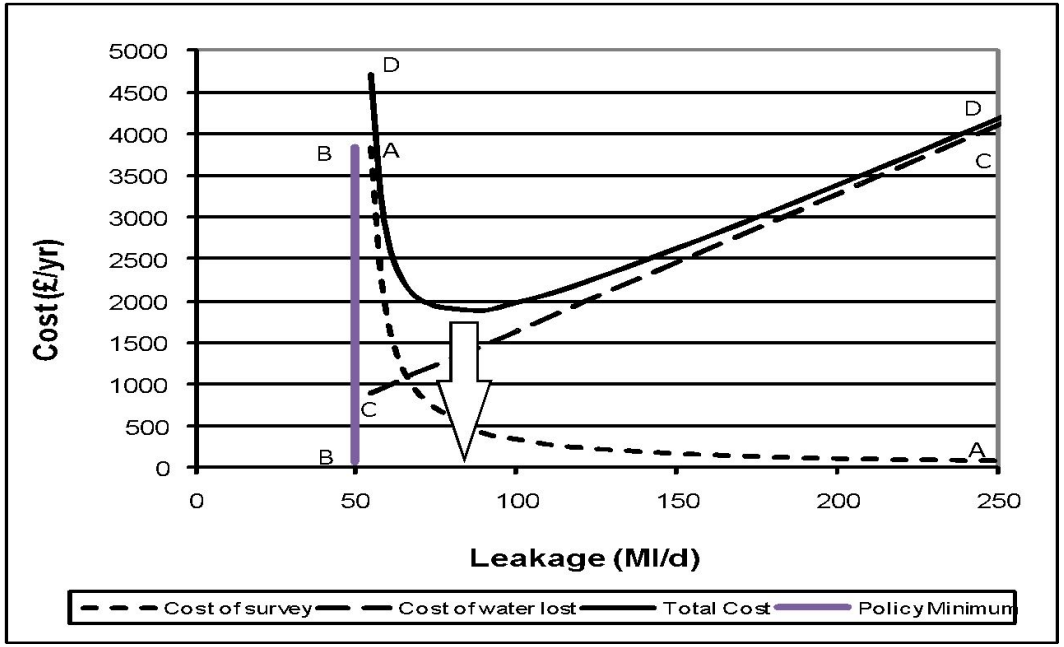


It is important to note that this model is only looking at the Economics of leakage detection and repair, but not NRW as a whole.



- ALC Find and Fix only
- Some simple pressure management
- Steady state – repair costs not included
- Annual Operating costs balanced
- Current infrastructure
- Current Pressure
- No supply demand balance constraints

Factors affecting SR-ELL:

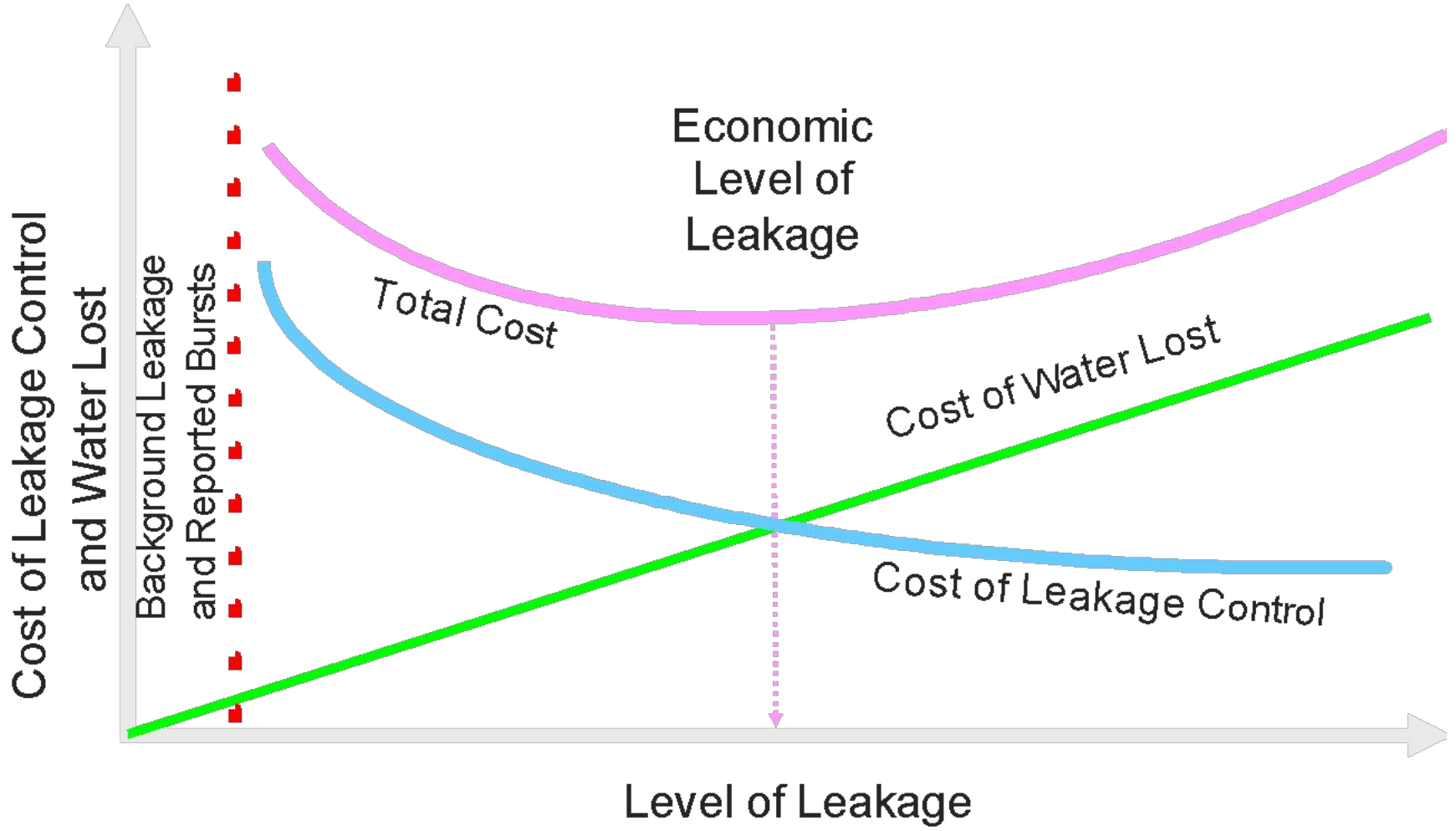
- Background leakage
- NRR (Natural Rate of Rise)
- Cost of water
- Cost of ALC
- Pressure and pressure management

Distribution system

- Power costs for boosting and pumping.

Source and treatment works

- Power and Chemicals
- Sludge disposal
- Other demand-related charges: e.g. business rates and government taxes
- Abstraction charges

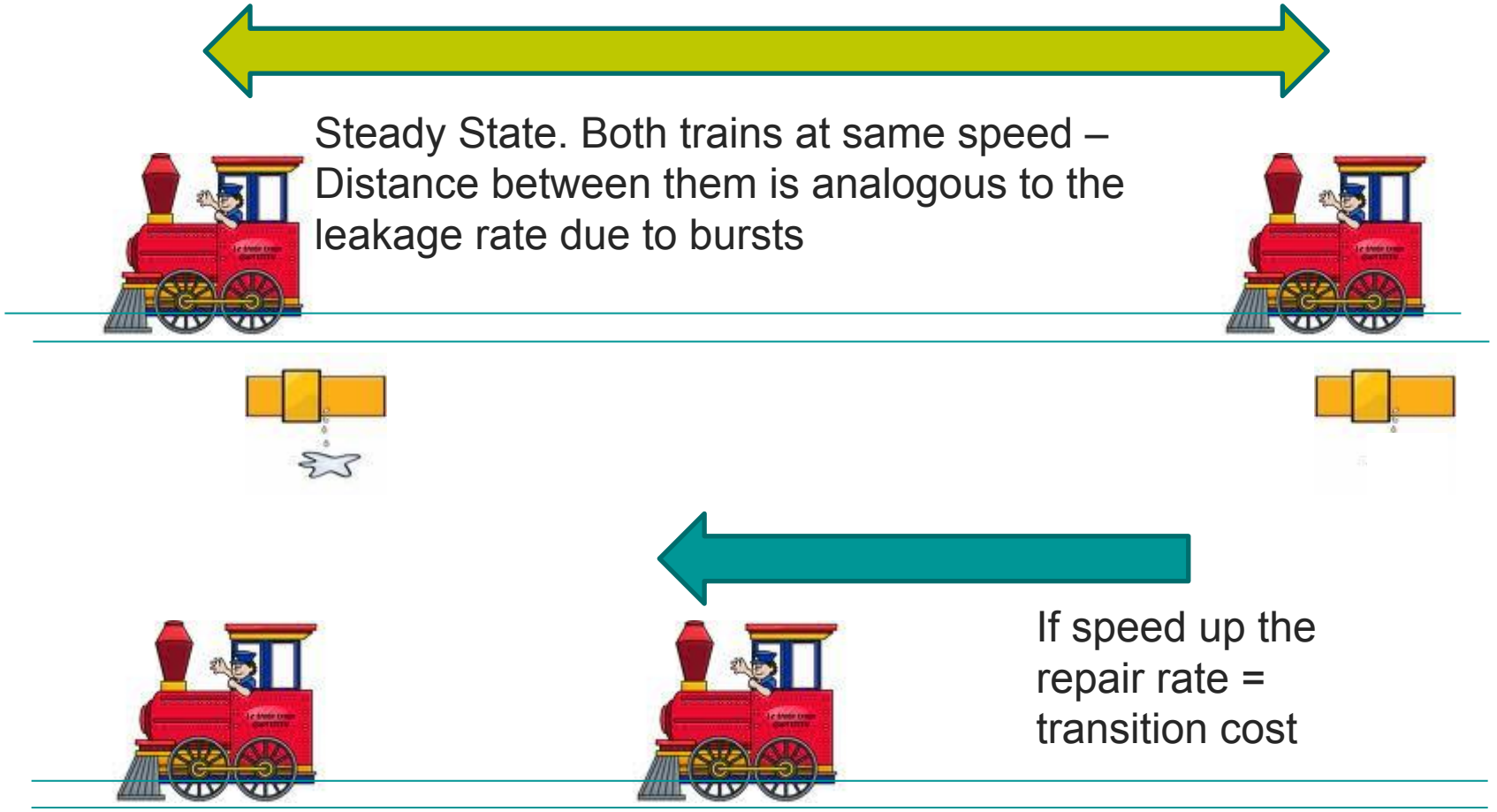


Background leakage can be estimated using the Unavoidable Annual Real Loss (UARL) calculations.

The total natural rate of rise (NRR) in leakage may be thought of as the continuing increase in leakage that would occur in the absence of any leak repairs. It is made up of two components – the breakout of new leaks in the network, plus the growth (increase in volume) of existing leaks. Of this total NRR, a proportion will comprise visible (customer reported) leaks, which will be duly repaired. It is the remaining portion that is normally used in leakage economic studies and defines the leakage, which must be overcome through active leakage control (or other means) before any observable reduction in leakage over a period (normally a year) is observed.

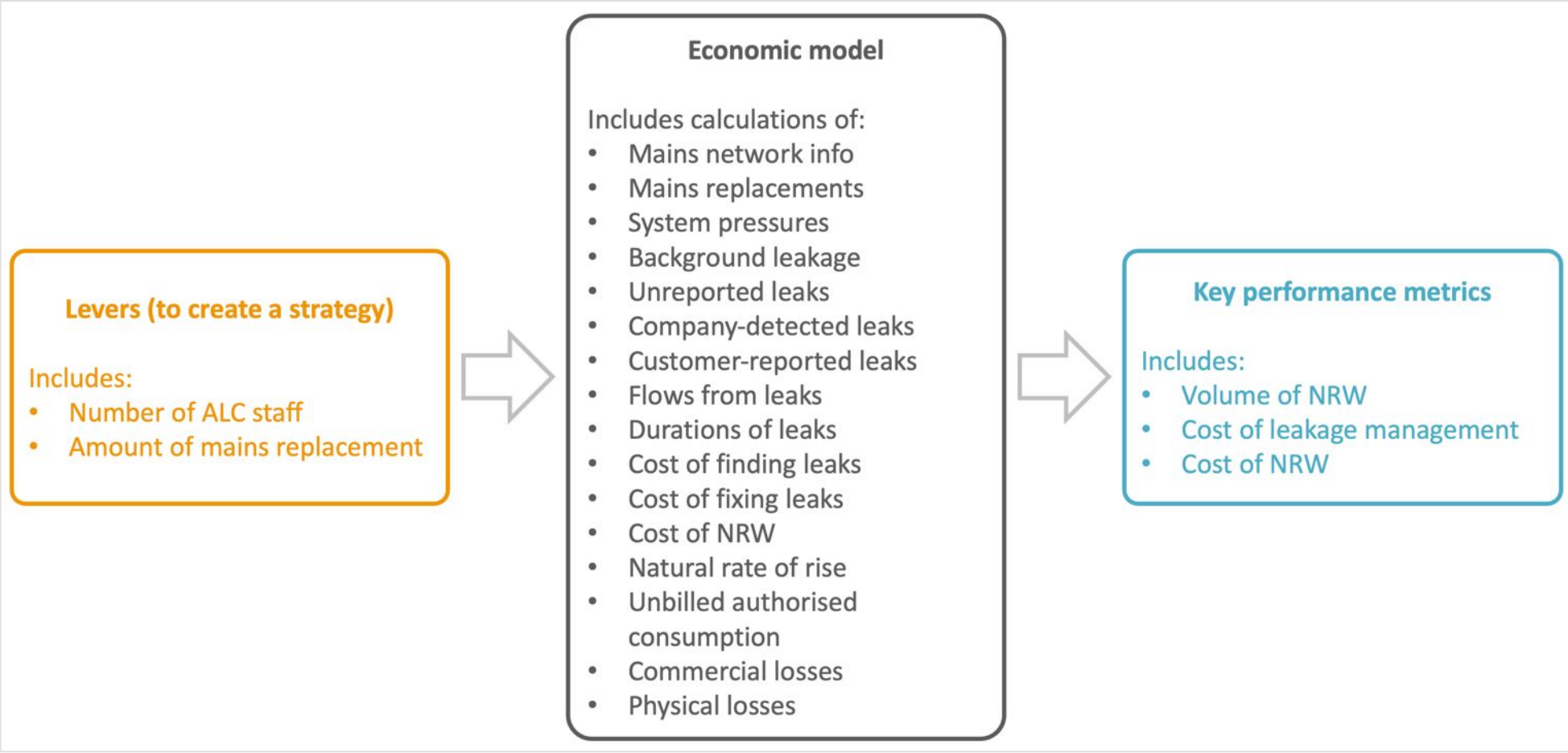
It is therefore used to define the effort/expenditure levels that would be needed to hold leakage at a given level. Generally two standard methods can be employed for estimating NRR:

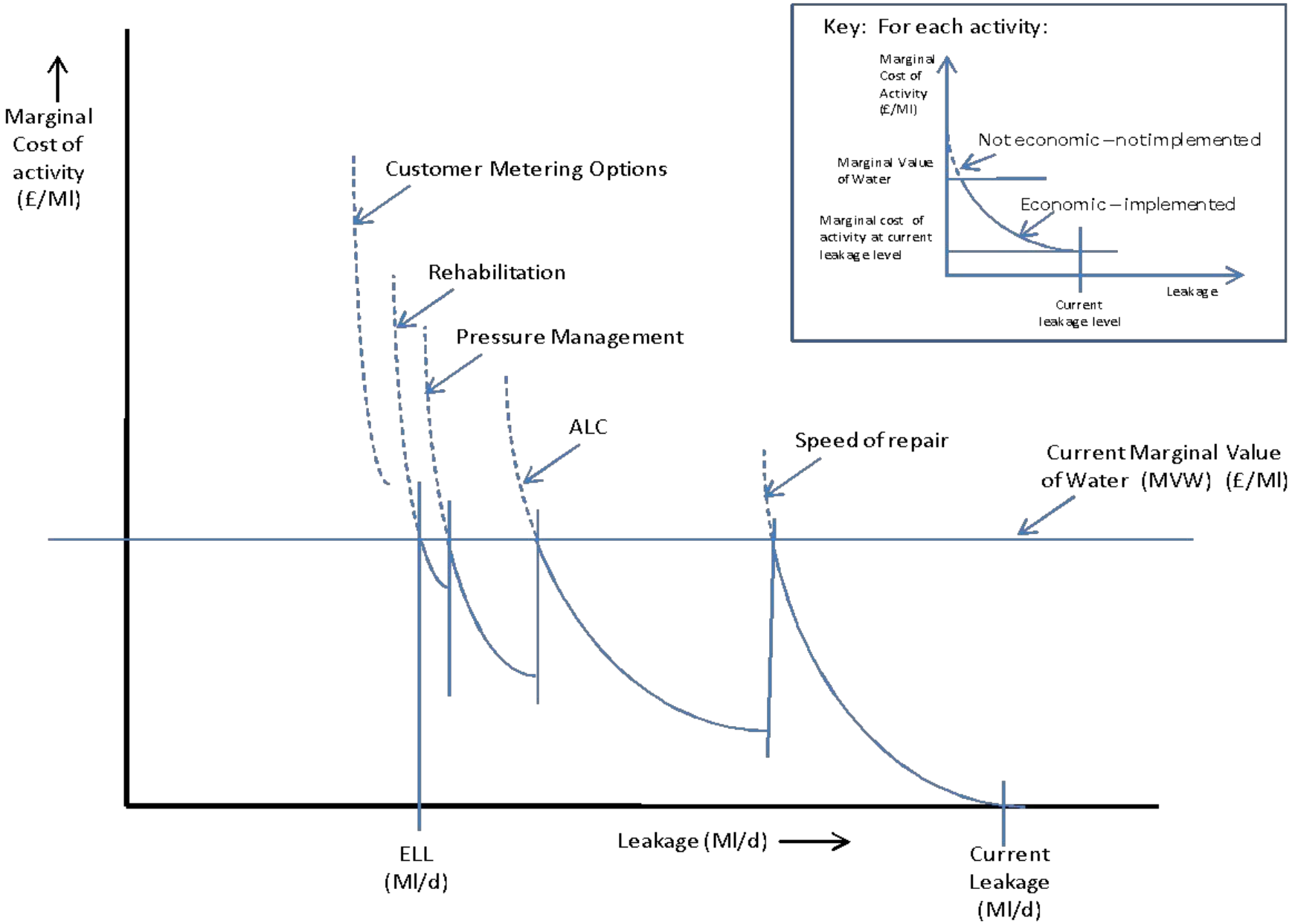
- a ‘bottom up’ approach based on the increases in DMA night flow data between leakage intervention periods,
- a ‘top down’ approach based on area or zone leakage levels taken over a year, burst numbers and average leak flow rates.


Steady State. Both trains at same speed – Distance between them is analogous to the leakage rate due to bursts
If speed up the repair rate = transition cost
New Steady State, with lower leakage level

3. Long Run - ELL

The Long Run – ELL starts to look at activities beyond just ALC, including pressure management and commercial losses. In addition, it also includes long term strategies, such as mains replacement and customer meter replacement.




Marginal Cost of activity (£/Ml)
Customer Metering Options
Rehabilitation
Pressure Management
ALC
Speed of repair
Current Marginal Value of Water (MVW) (£/Ml)
ELL (Ml/d)
Leakage (Ml/d)
Current Leakage (Ml/d)
Key: For each activity:
Marginal Cost of Activity (£/Ml)
Not economic – not implemented
Marginal Value of Water
Economic – implemented
Marginal cost of activity at current leakage level
Leakage
Current leakage level

Manage pressures, even in Zones with low pressure

As leaks are repaired, reduce inlet pressure to maintain original Average Zone Pressure

100% of leak flow rates repaired are saved

Use savings for controlled pressure increase in original Zone, or avoiding intermittent supply in other Zones

This concept was used for a successful multi-million $ contract in Malaysia in the late 1990s, with PRVs installed on all DMAs as they were created

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Analyze your water losses

4. SELL

Economic

- Cost of Water
- Govt Subsidies
- Cost of NRW activities

Social

- Tariffs
- Water Quality
- Customer Service

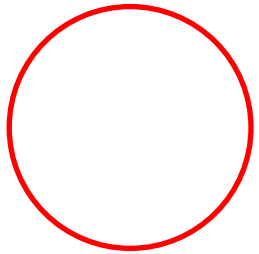
Environmental

- Raw Water Availability
- Climate change
- Carbon Footprint

Political

- Public Image
- Cross border supply
- National Security

Part of the IWA Global KPI assessment was to evaulate Baseline Water Stress.



So countries with high Water Stress are likely to want to manage their NRW levels lower.

On the cost / value of water :

- Environmental concern over low flows
- Environmental damage from over-abstraction
- Environmental drivers, for example European directives such as the Water Framework, Groundwater, Birds and Habitats directives.
- Carbon footprint of water production
- Regulatory water-efficiency targets
- Security of supply requirements
- Risk of supply restrictions in drought conditions
- Impact on social and economic progress
- Risk of additional environmental damage in drought conditions
- Possible political target

External drivers on leakage reduction:

- Social and economic cost of disruption from repairs and capital works
- Carbon footprint of repairs
- Carbon footprint of detection activity.

5. Conclusion

		Sort Run ELL	Long Run ELL	Sustainable ELL
Unconstrained	Interventions	Opex	Opex & Capex	Opex & Capex
	Driver	Economics	Economics	Economics
	Marginal Value of Water	Marginal cost of water production and distribution	Marginal cost of water production and distribution	Marginal cost of water production and distribution + Externalities
Constrained	Interventions	Opex	Opex & Capex	Opex & Capex
	Driver	Headroom	Headroom	Headroom
	Marginal Value of Water	>MCW <= Marginal cost of next source	>MCW <= Marginal cost of next source	>MCW <= Marginal cost of next source + Externalities

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