WEDC

Developing
knowledge and capacity
in water and sanitation

Energy Audits and Leakage Management

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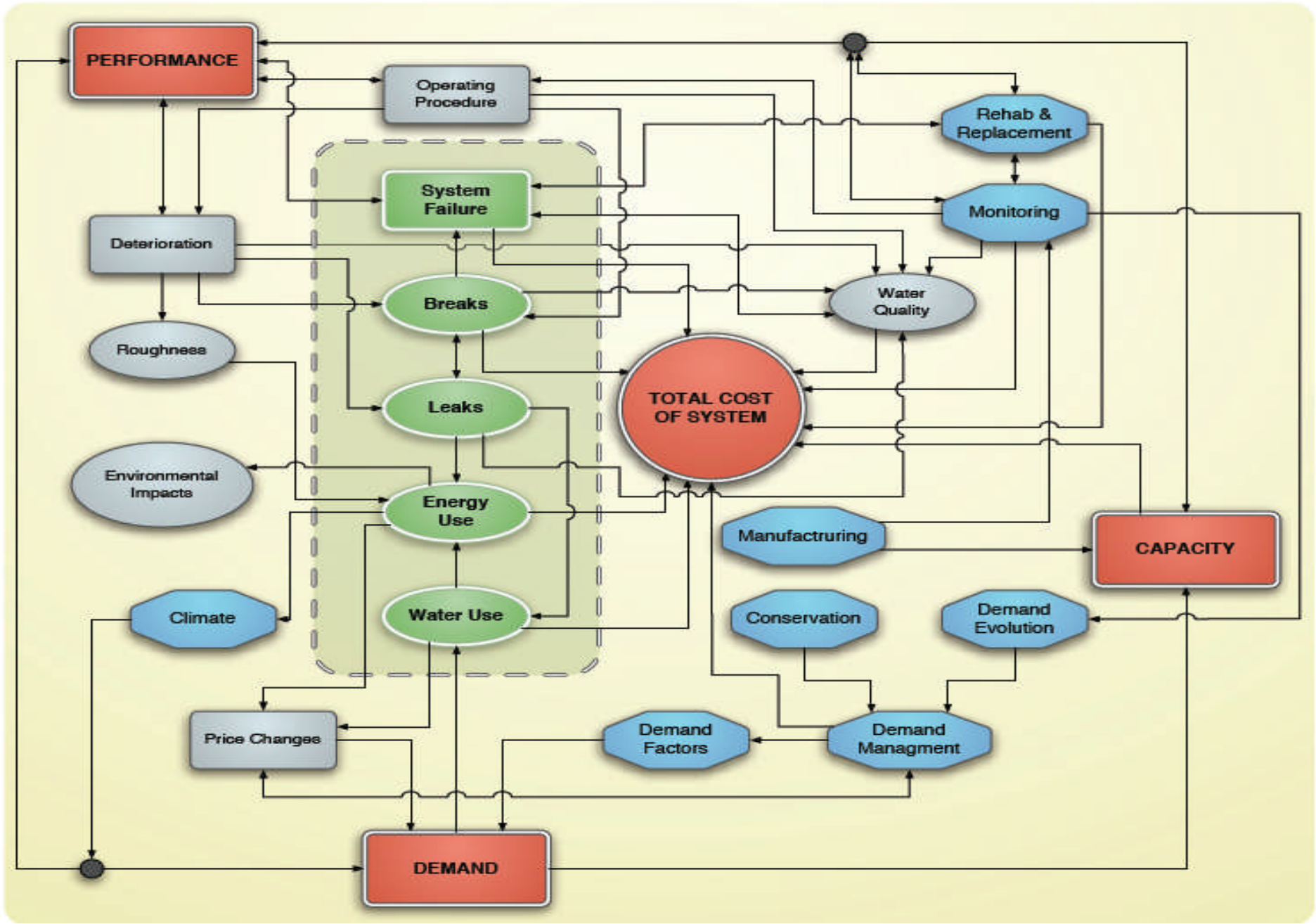
Overview

- Water utility energy use 0.05 – 0.8 KWh per m3 in developed economies (AWWA, 2003)
  - consumes ~ 7% of global electricity;
  - ~2-3% of global energy
- Varies depending on several factors, e.g.
  - Topology
  - Treatment processes
  - Efficiency of plant/equipment
  - Hydraulic factors
- E.g. 3% for all USA, but 19% for California (American Water, 2009)

Why Energy Audits (EA) for leakage mgmt?

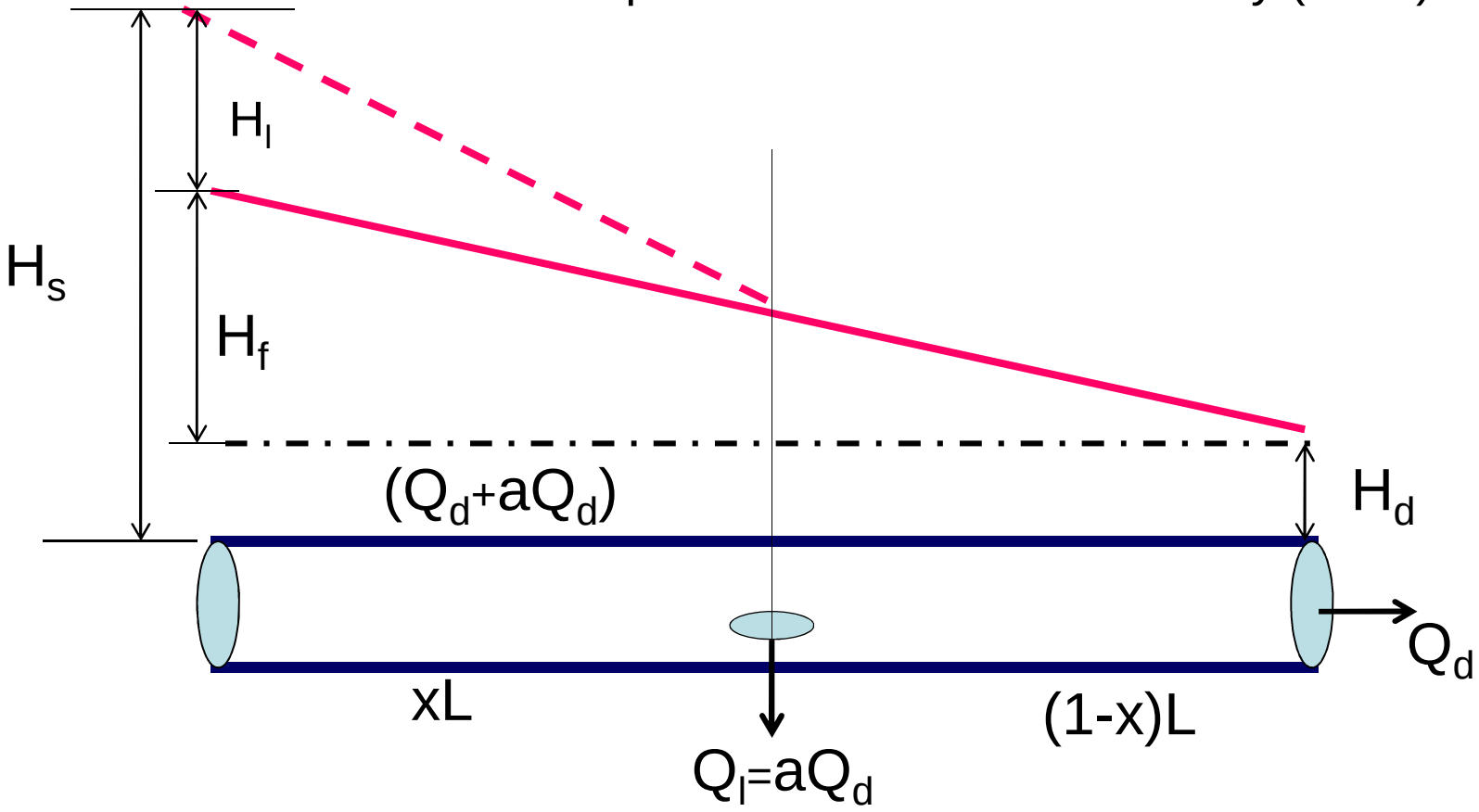
- EA is an inspection, survey and analysis of energy flows in a system
  - So as to understand the energy dynamics
  - Explore how to reduce energy loads with minimal effect on the outputs
- Active leakage management could save up to 14% of electrical power consumption for large-scale water networks in a developed economy (Bounds & Kahler, 2006), >>> for poor networks

Energy Use in the Water Distribution Labyrinth (Source: Colombo & Karney ,2003)



Leakage & Energy Gradient Line

Adapted from Colombo & Karney (2003)



Leakage & Energy relationships

- Energy losses disproportionately greater than leakage losses
  - Ratio of ~ 1.5:1 for pipelines in generally good condition
  - Ratio increases as systems age and/or as demand increases, ratios of 2.5:1 have been reported in the literature

  (Colombo & Karney, 2003; El-Diraby et al, 2009)

NRW FOR SELECTED AFRICAN CITIES

Figures for 2006 (Source: WOP Africa, 2009)

CITY	%NRW
Kano	63
Maputo	58
Dar Es Salaam	55
Khartoum	51
Lusaka	50
Nairobi	49
Accra	49
Eldoret	48

CITY	%NRW
Mwanza	42
Mombasa	41
Lagos	40
Kampala	39
Addis Ababa	35
Chipata	35
E Thikweni	32
Jo'burg	31

Water Loss Management Strategies

(Source: : Liemberger and Farley, 2004)

Energy vs Speed & Quality of Repairs

- Bursts or breaks => water escapes with pressure and velocity => extra energy burden on pumping system
- Reduced location & repair times => reduced time for elevated power loads
- Quality of repairs => frequency of bursts
- Less fuel/energy use for
  - Transportation, tools and equipment
  - Diversion and disruption of traffic
  - Coping strategies for alternative water services

Energy vs Active Leakage Management

- Active leak detection will reduce
  - awareness time
  - the natural rate of rise in leakage, hence less bursts
- Net savings in energy & fuel costs in
  - Transportation, tools and equipment
  - Diversion and disruption of traffic
- Avoided costs in terms of coping strategies for alternative water services

Energy vs Pressure Management

- Pressure management
  - Reduces pressure surges => less occurrence of leaks & bursts => less energy load
  - minimises unnecessarily high residual pressures => less leaks => less energy load
- Net energy savings compared to ALM
- Avoided energy costs associated with bursts & coping strategies

Energy vs Pipeline & Asset Renewal

- Deterioration of water pipes leads to
  - Higher incidences of leaks and bursts
  - Higher frictional losses => higher energy loads
  - Diminished network performance => higher energy loads
- WDS with deteriorated pipes use 2-3 times more energy than those with newer pipes (El-Diraby et al, 2009)

Conclusion

- There are substantial direct benefits from water loss management strategies for WDS, e.g.
  - Reduced operational costs
  - Postponed infrastructural investments
  - Better service levels – pressure, reliability etc.
- There are disproportionately higher energy savings => less carbon emissions
- Water utilities in African cities could make huge financial savings & reduce carbon emissions