Optimising Energy Use in Water Treatment – Sustainable Solutions

Water for Power and Industry

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VEOLIA WATER
Solutions & Technologies

SCI – 28th October 2010

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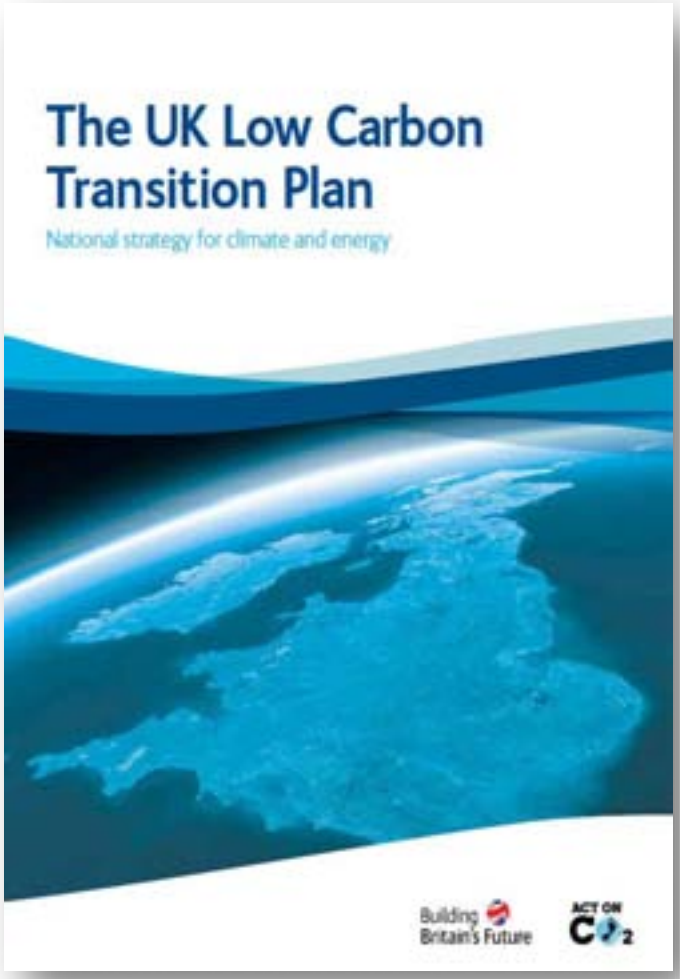
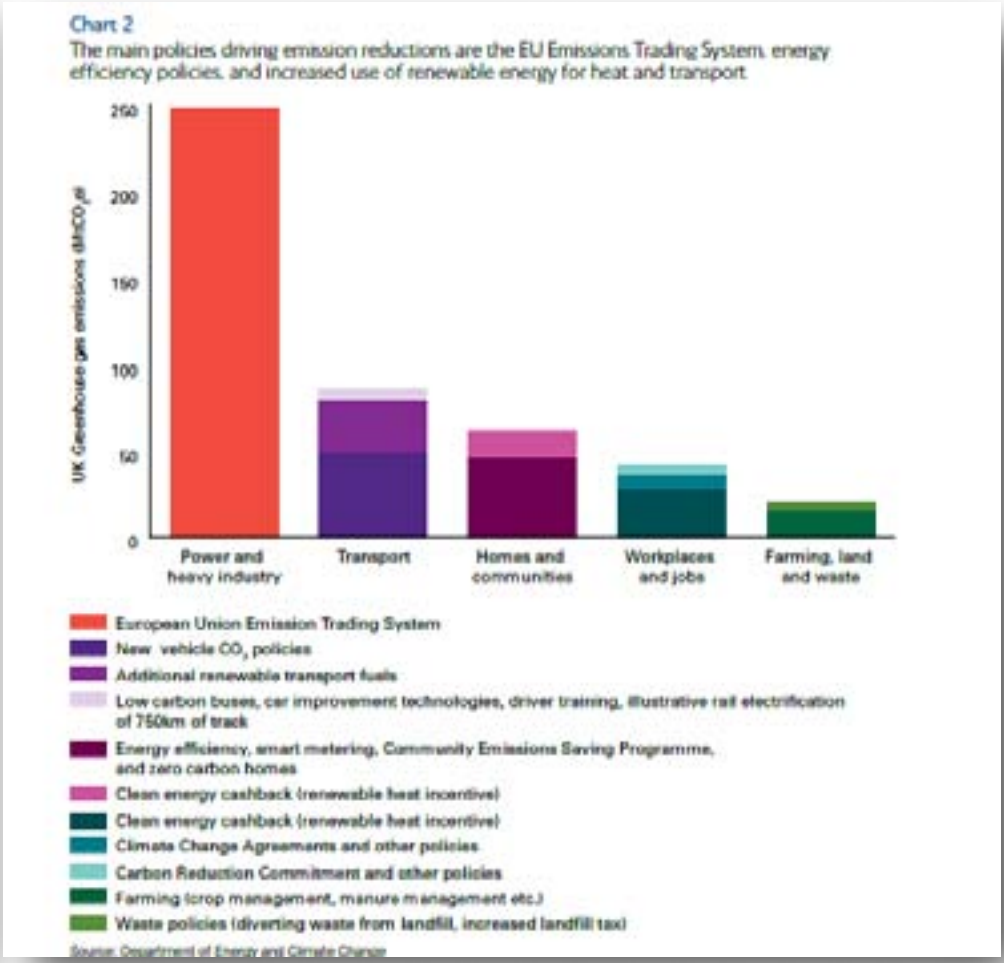
Industry drivers for energy optimisation

Industry drivers…





The water/energy relationship …

Fossil Fuels → Energy Generation → GHG Emissions → Climate Change

Impact on freshwater resources

Changing precipitation patterns

Water Scarcity

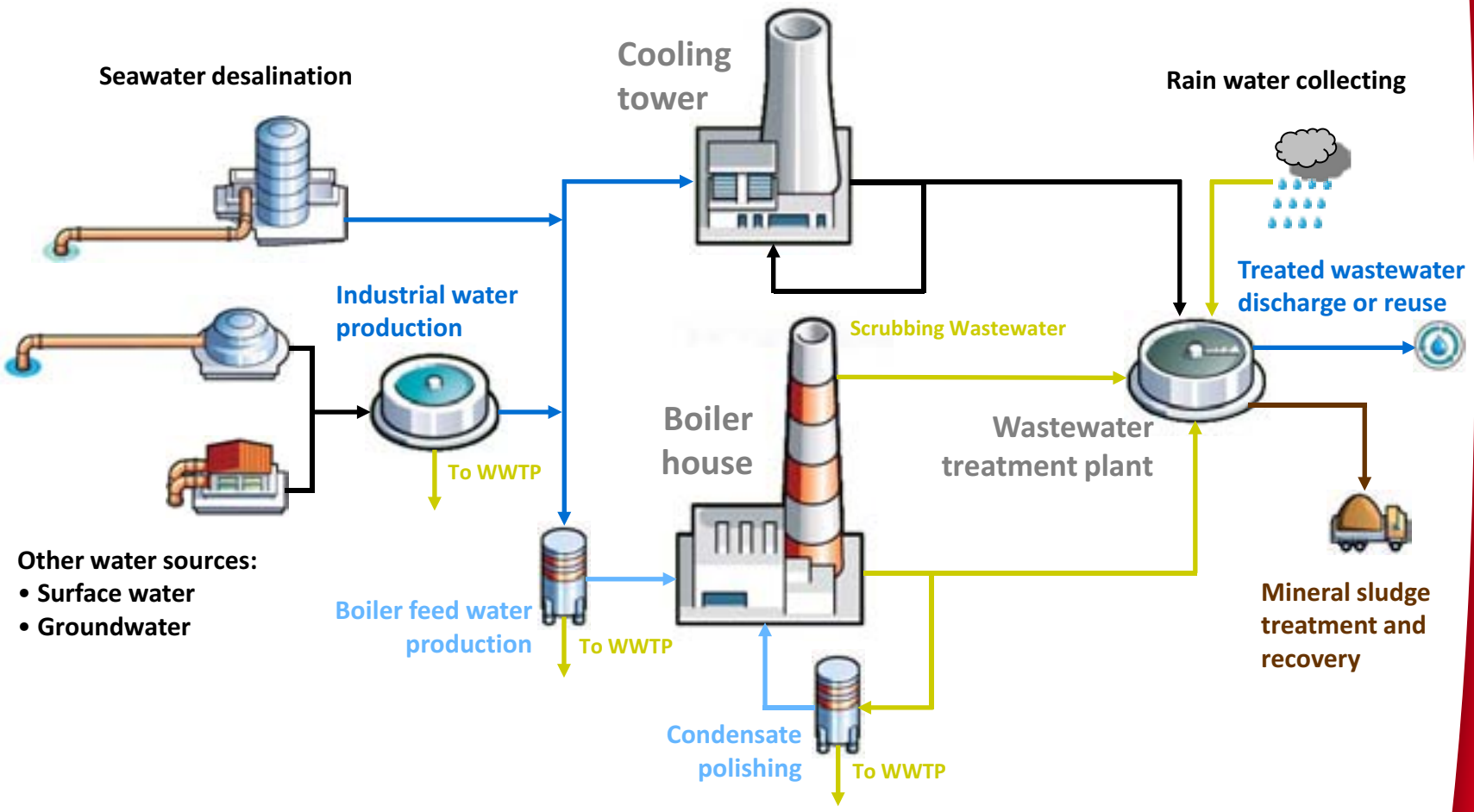
Water Quality

Increased water demand

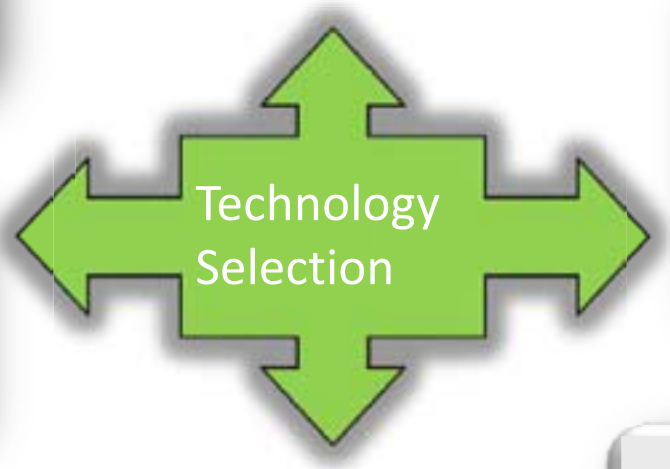
2

Sustainable solutions – how to assess

Water Use in Power Generation …



Technology selection water treatment & reuse …



Water Scarcity & Safety
Competition over abstraction
Climate threats
Irregular quality
Salinity
Exhaustion of water resources
Accidental contamination

Compliance with Regulation
Limitations of water intake
Discharge limits
No discharge possible

Economic Implications
Water consumption costs
Discharge fees
Capex & Opex
Power cost inflation
Future GHG emissions costs

Production needs
Increases in production
Continuous and safe water supply
Avoid production shutdown

Environmental Implications
GHG emission targets
Carbon trading schemes
Water use impact

Technology preference
Existing equipment
Site restrictions
Raw water quality
Treated water quality
Experience

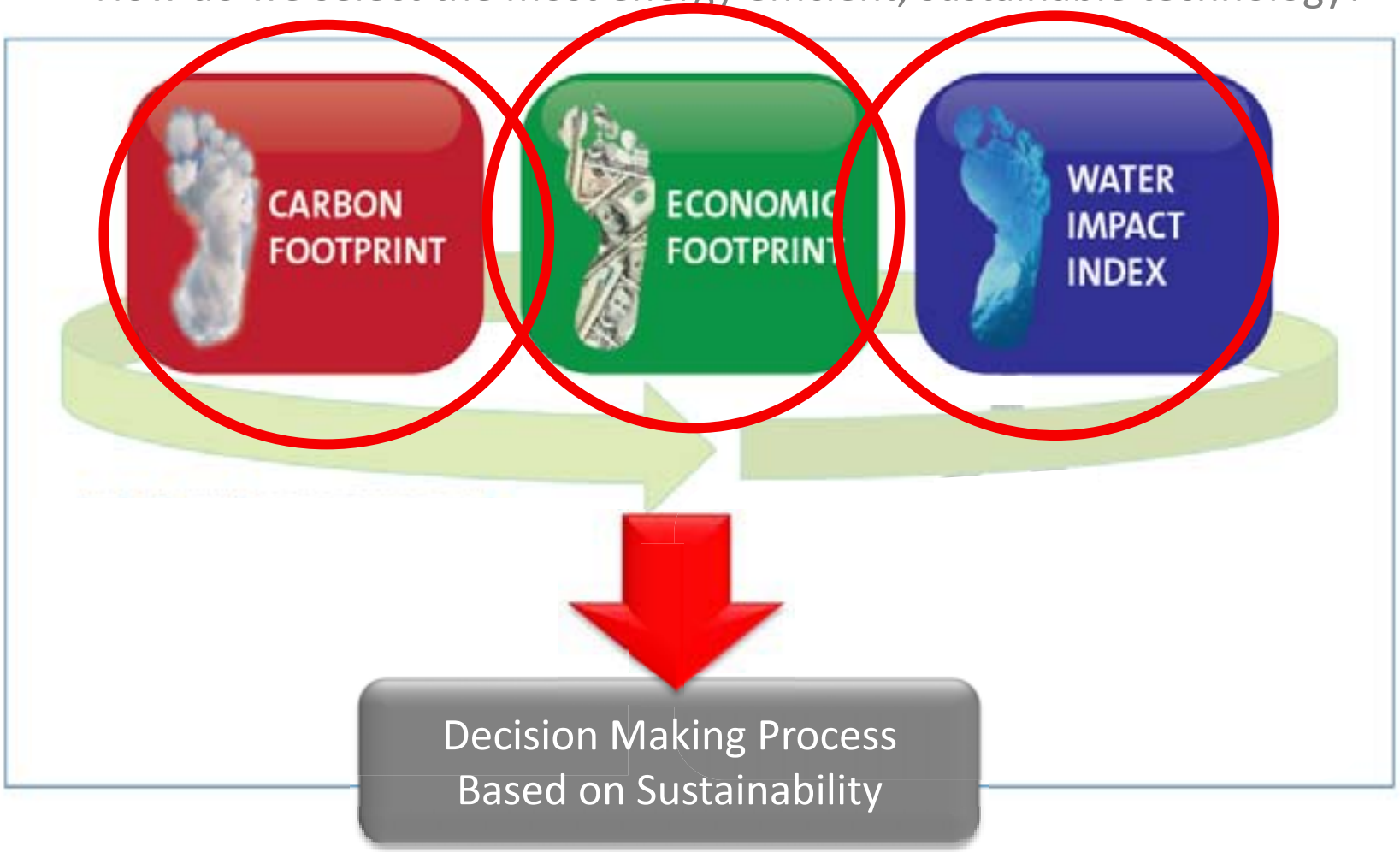
Corporate Image
Environmental guidelines
Shareholder expectations
Public opinion
Corporate image

Key technologies for water reuse

- Clarification: *Actiflo®*
- Filtration: *Filtraflo®* Large/Concrete Filters, *Multiflo®,* Multimedia Filters, *Recyclo®*
- Biological treatment: *Biosep®* / *Biosep Pack®, Biostyr ®*, MBBR
- Membrane filtration systems: Microfiltration / Ultrafiltration / Nanofiltration / RO, Uflex
- Ion exchange systems: *Duo Eclipse™, Rapide™ Strata*
- ZLD concepts: *Crystallizer, Evaled, Ceramem*
- Disinfection: *UVStar®,* ClO_2, ozone
- Metal recovery systems: *Recon® Compact, Hardtac®, Metclean®, Auroclaim®*
- OPUS, CEDI-LXTechnologies
- GAC filtration or biofiltration for color, organic and micro-pollutants removal
- Low-pH or High-pH RO for acidic or basic baths recycling

Sustainable solutions …

How do we select the most energy efficient, sustainable technology?



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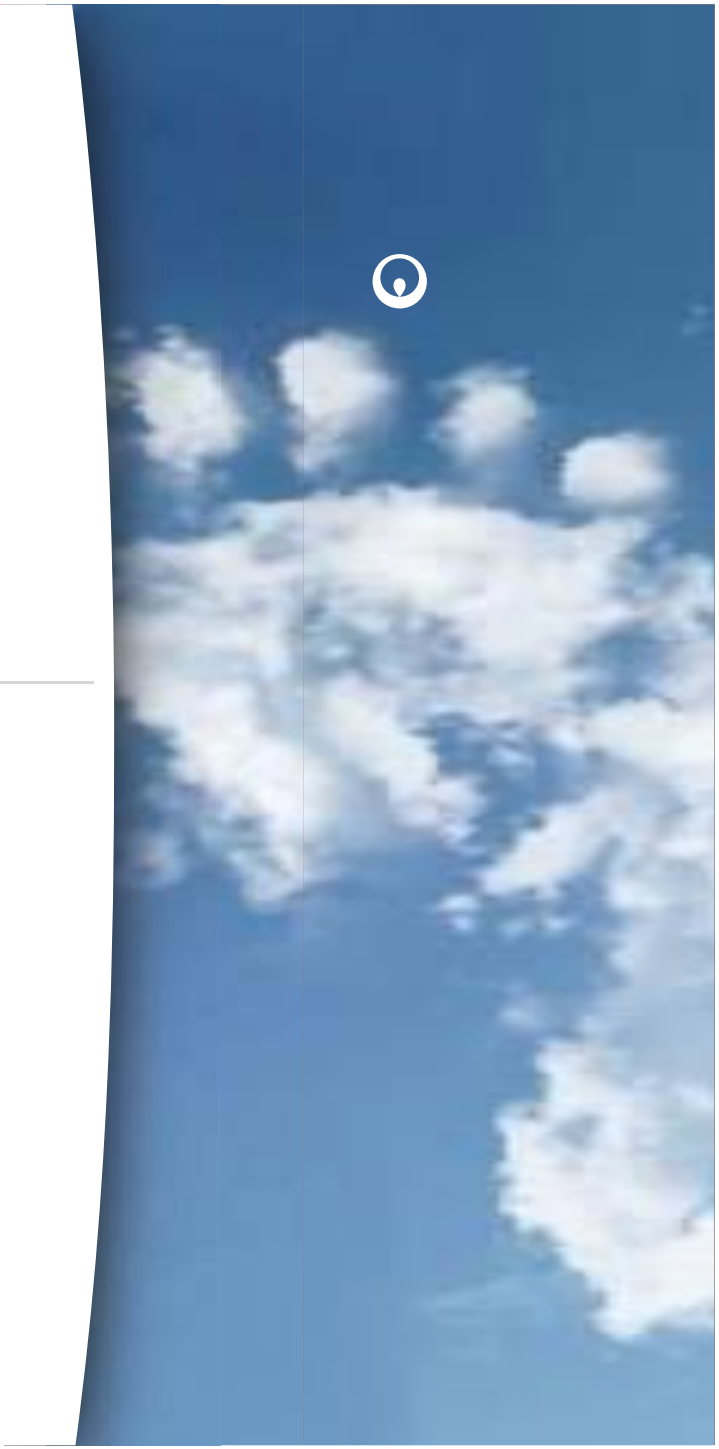
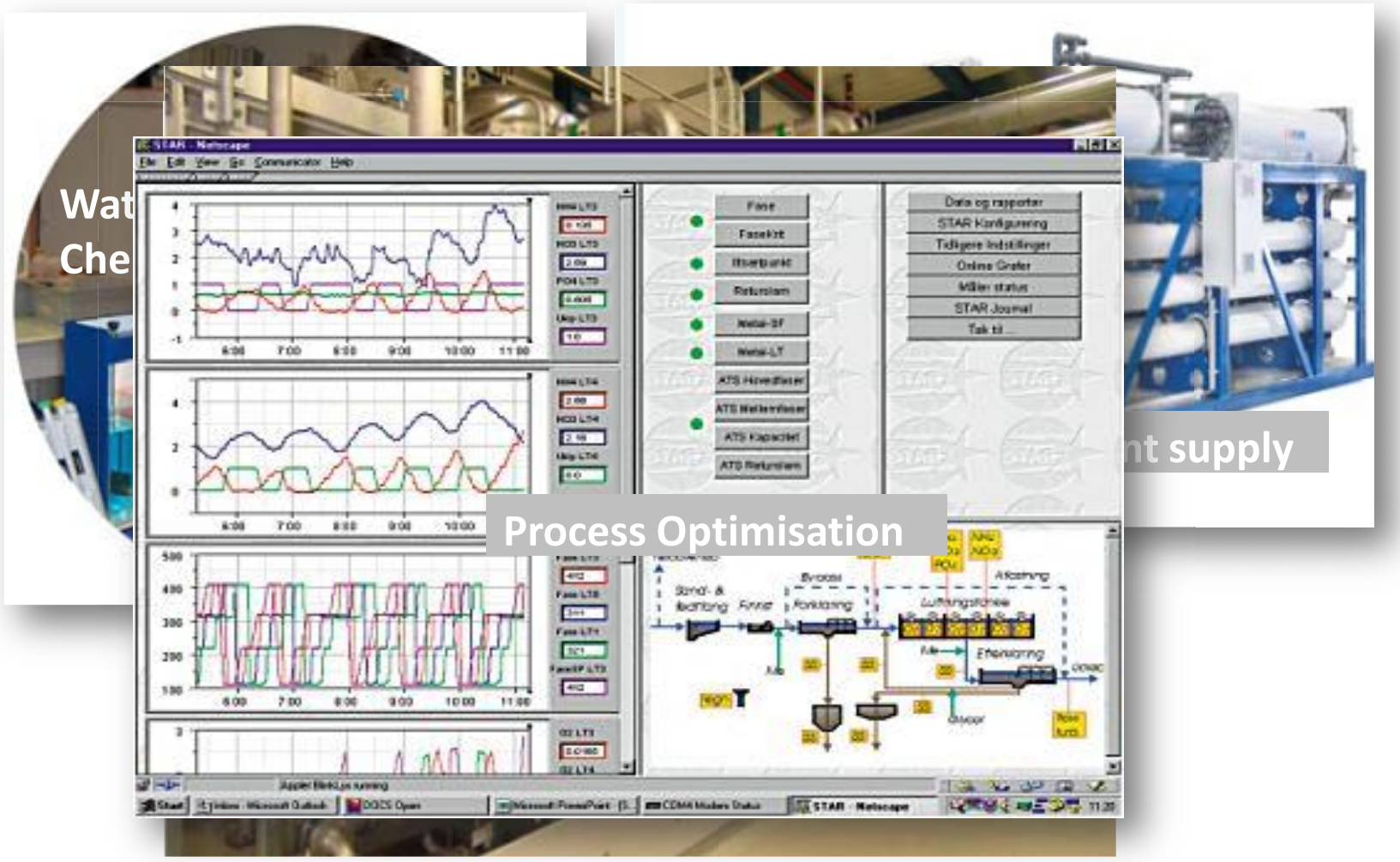
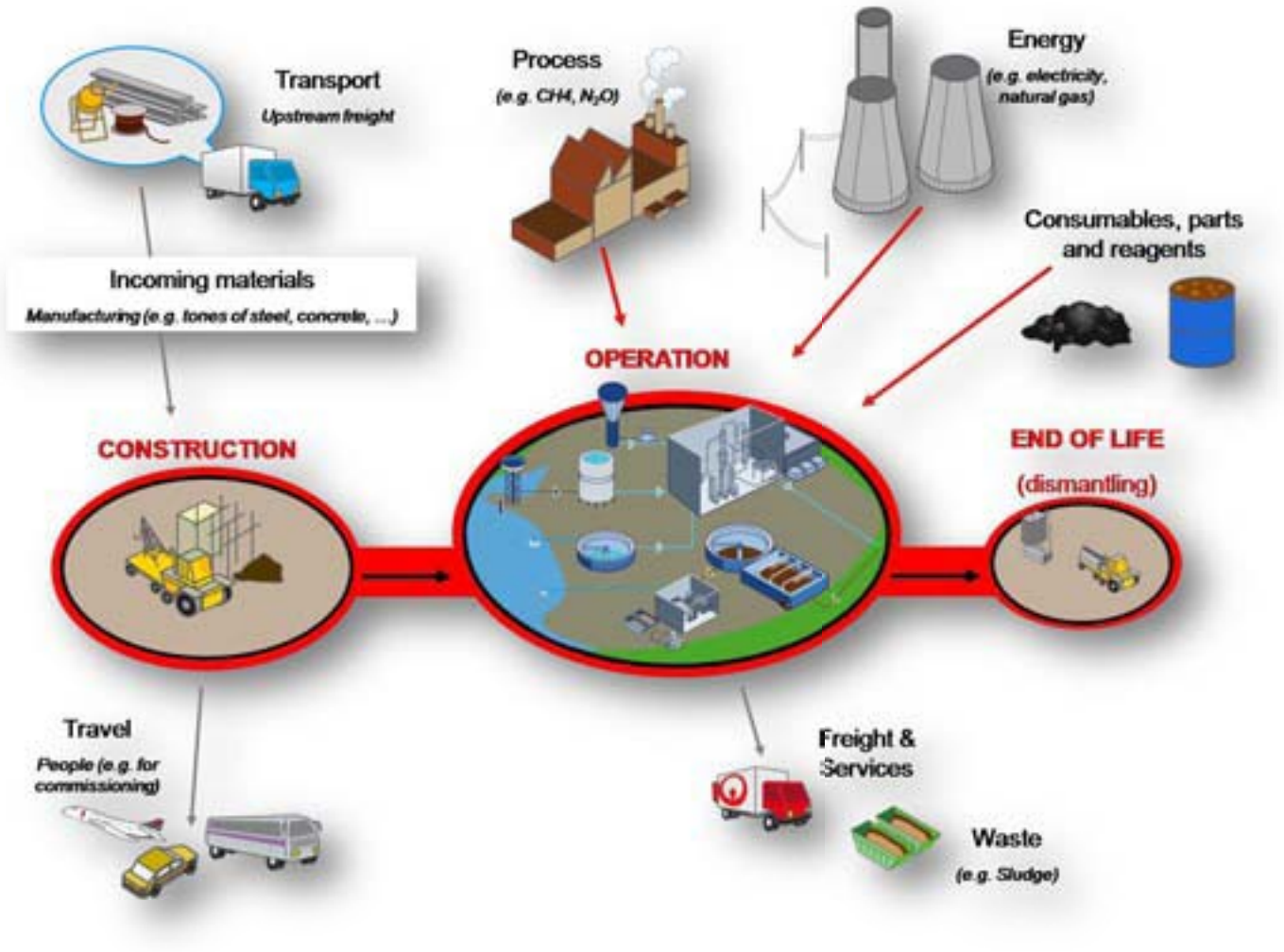
Carbon footprint



Carbon footprint levels …

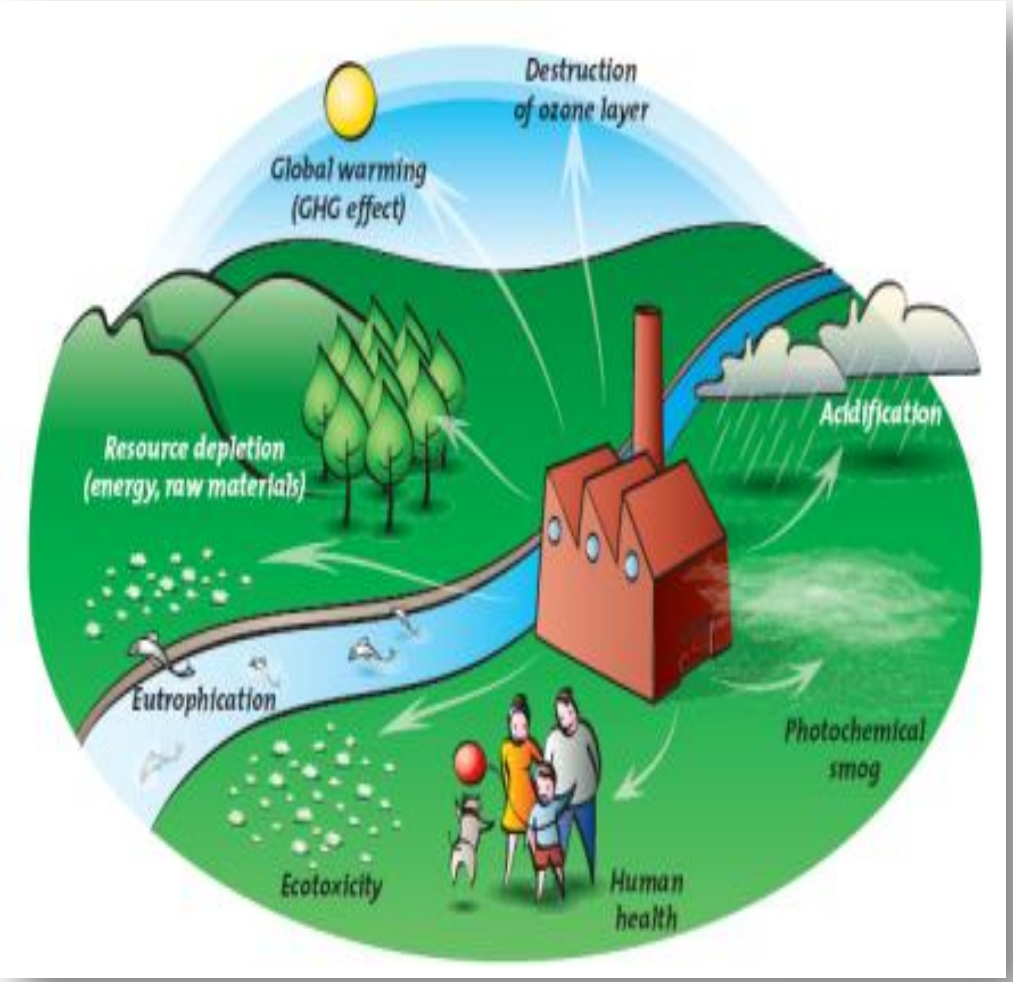


Life cycle assessment …

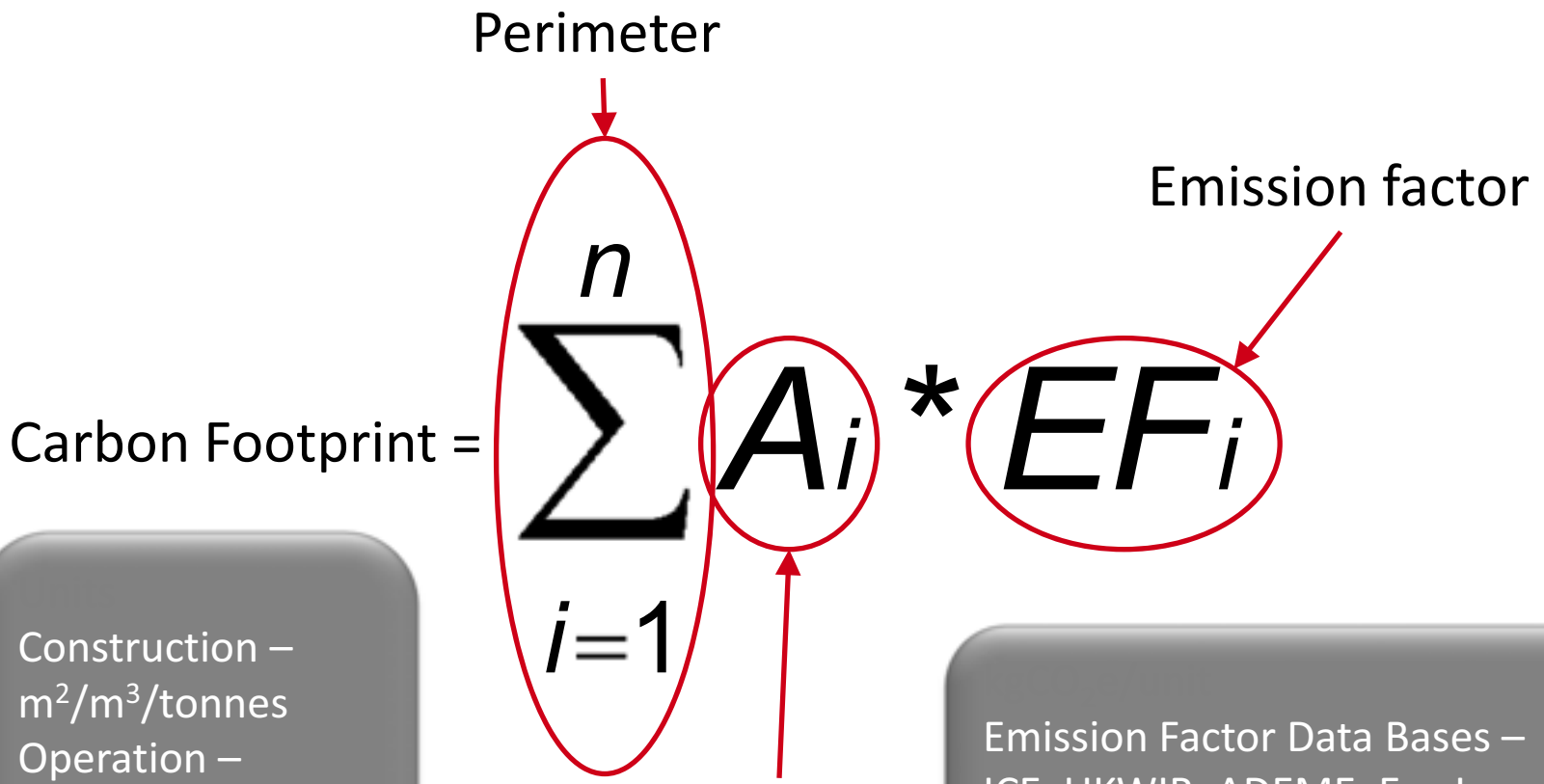


LCA environmental impacts

- Global warming
- Fossil fuels depletion
- Acidification
- Smog
- Ozone layer depletion
- Eutrophication
- Toxicological pollutants
- Habitat destruction
- Desertification
- Land use
- Minerals depletion
- Etc.



Carbon footprint assessment



Construction – m^2/m^3/tonnes
Operation – kWhr/d
Maintenance- 5/10/20 years

Emission Factor Data Bases – ICE, UKWIR, ADEME, Eco Invent, AUDCC, VWS Specific Factors

Bottom up concept …

Embodied Carbon

Operational Carbon

Maintenance Carbon

Cumulative Carbon

Life cycle
Non – Traded price of carbon
Discount rate
Damage rate increase

Whole Life Carbon Cost

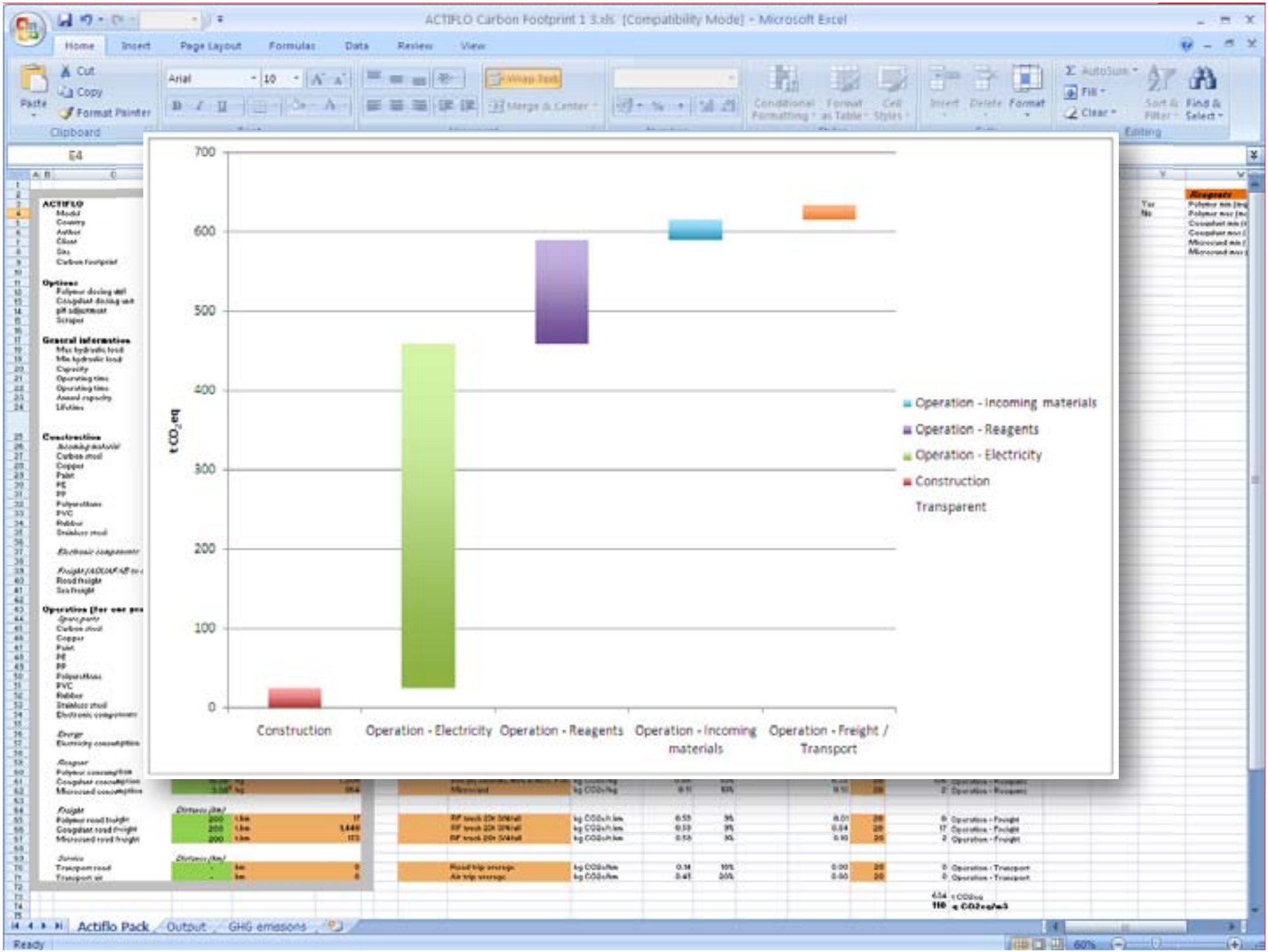
Life Cycle Costs (Capex + Opex)

+

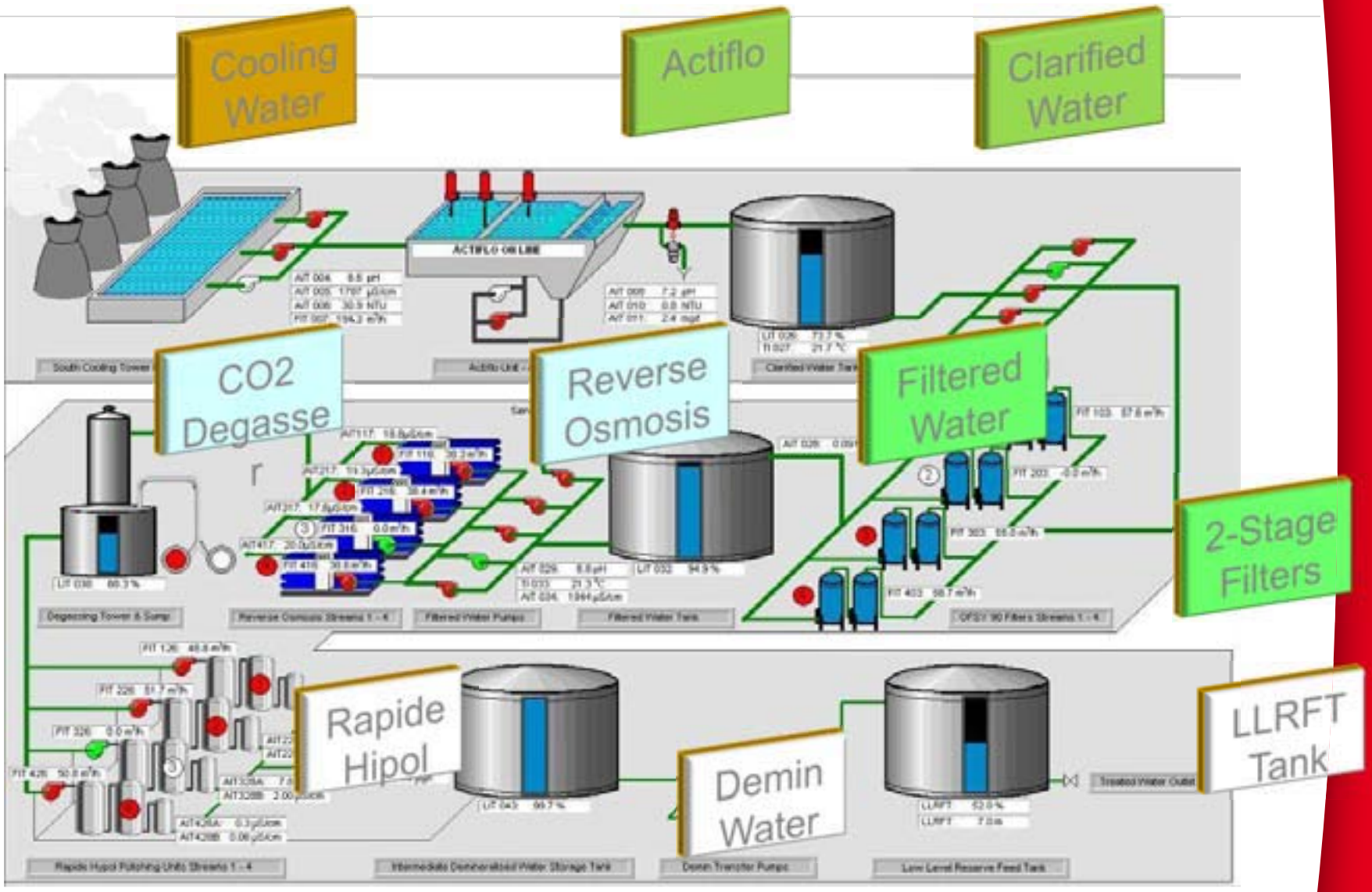
Whole Life Carbon Cost

=

Total Cost for Cost Benefit Analysis


ACTIFLO Carbon Footprint 1 3.xls [Compatibility Mode] - Microsoft Excel
700
600
500
400
300
200
100
0
t CO2eq
Construction
Operation - Electricity
Operation - Reagents
Operation - Incoming materials
Operation - Freight / Transport
Operation - Incoming materials
Operation - Reagents
Operation - Electricity
Construction
Transparent
Actiflo Pack
Output
GHG emissions
Ready

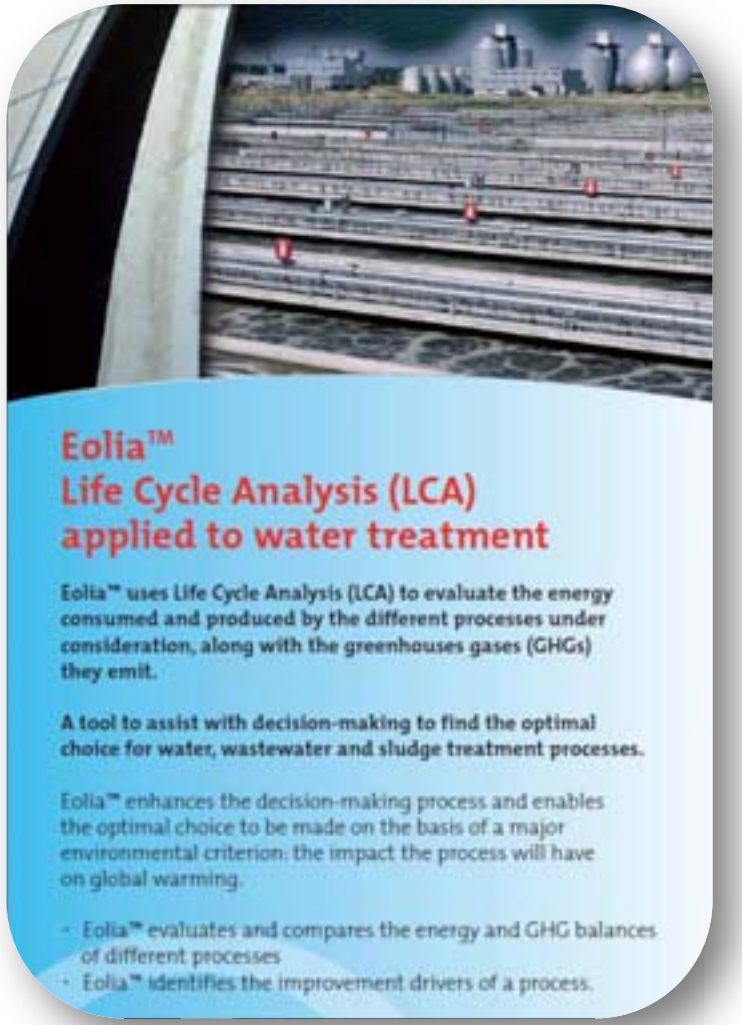
Solutions evaluation…



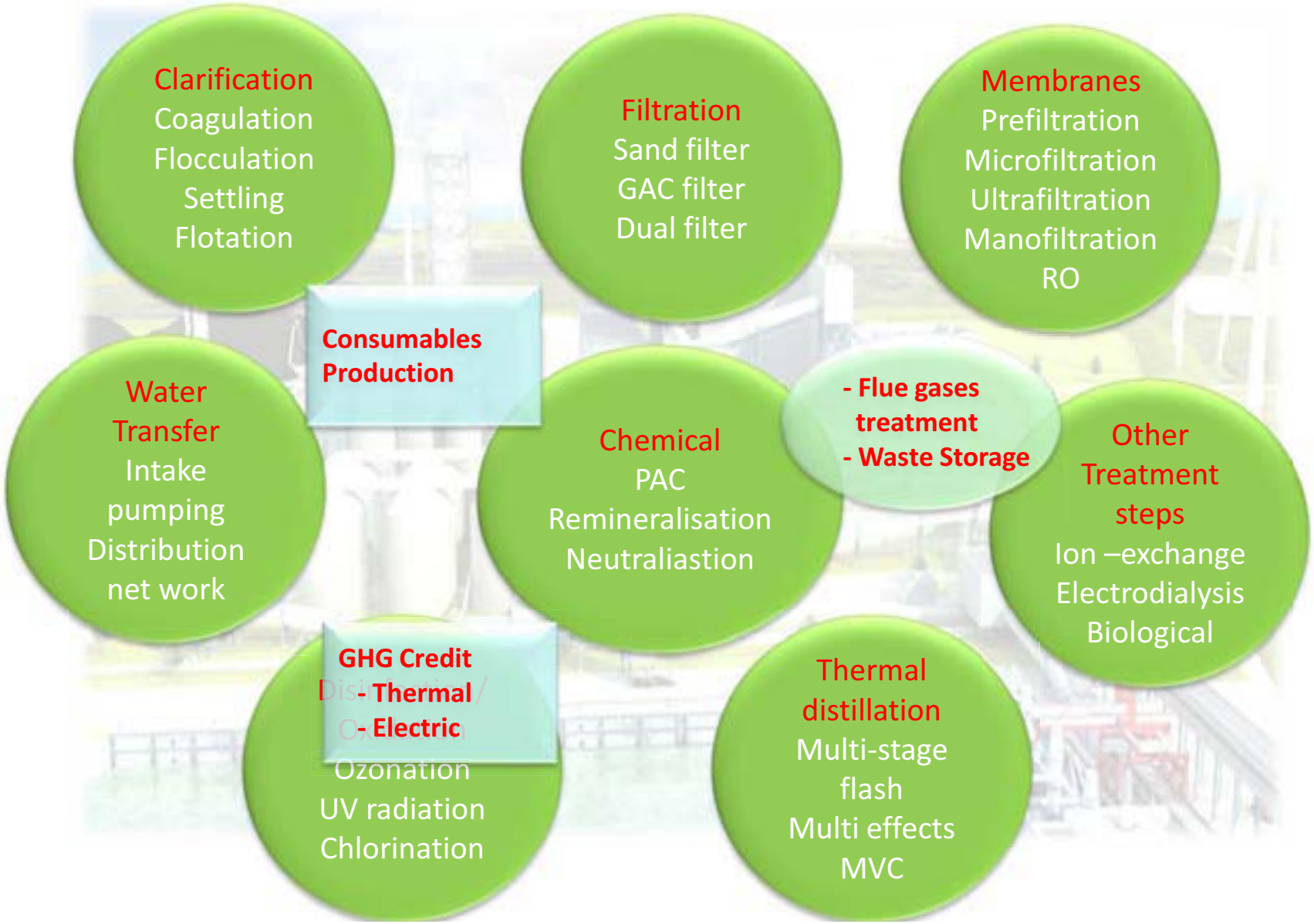
EOLIA™ – decision support tool

Top down concept …

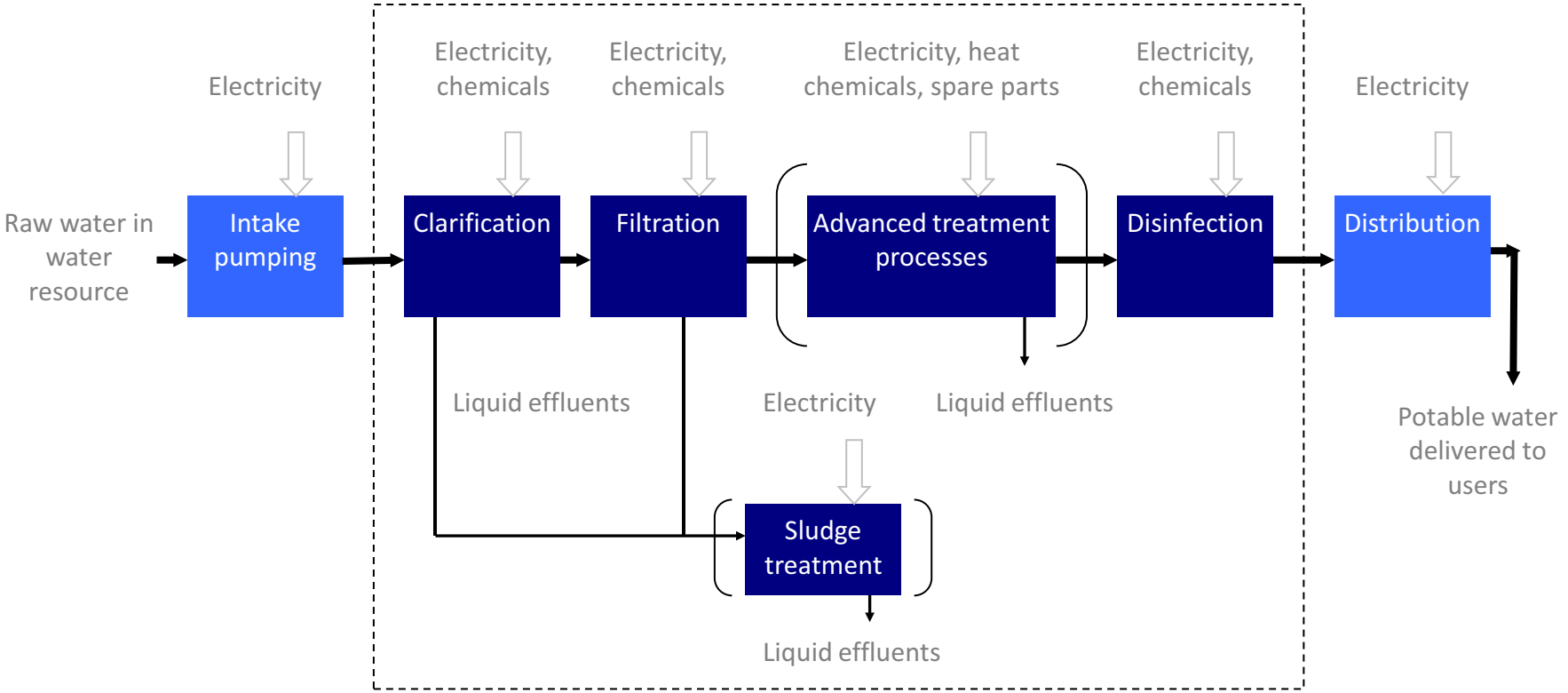
- Enables treatment configurations to be evaluated in terms of energy and GHG emissions
- Identification of process hot spots
- Effect of integration of new technology
- Can be used to as an optimisation tool for existing operations
- Quick evaluation of numerous treatment options based on local conditions



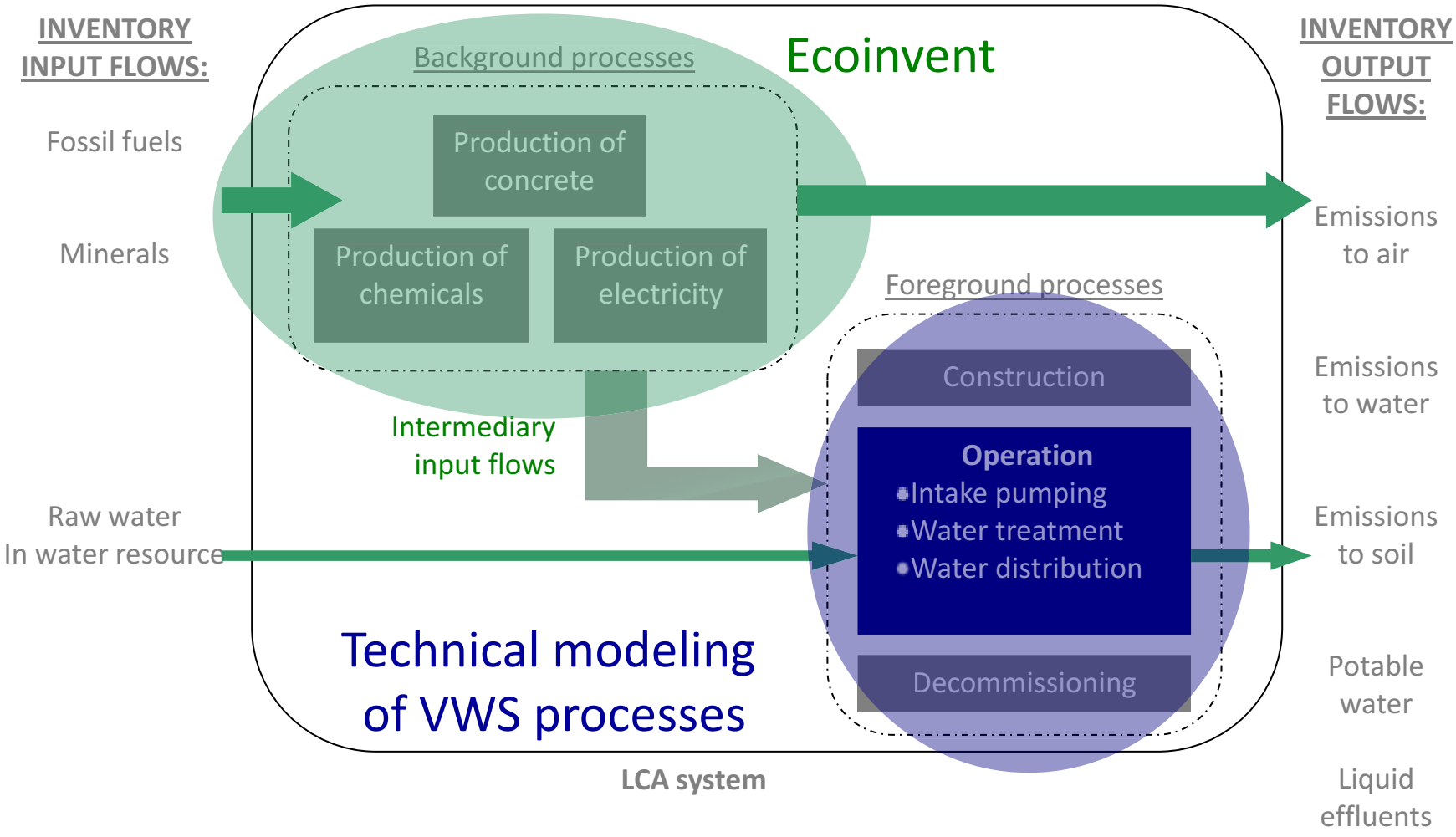
Water treatment modules …



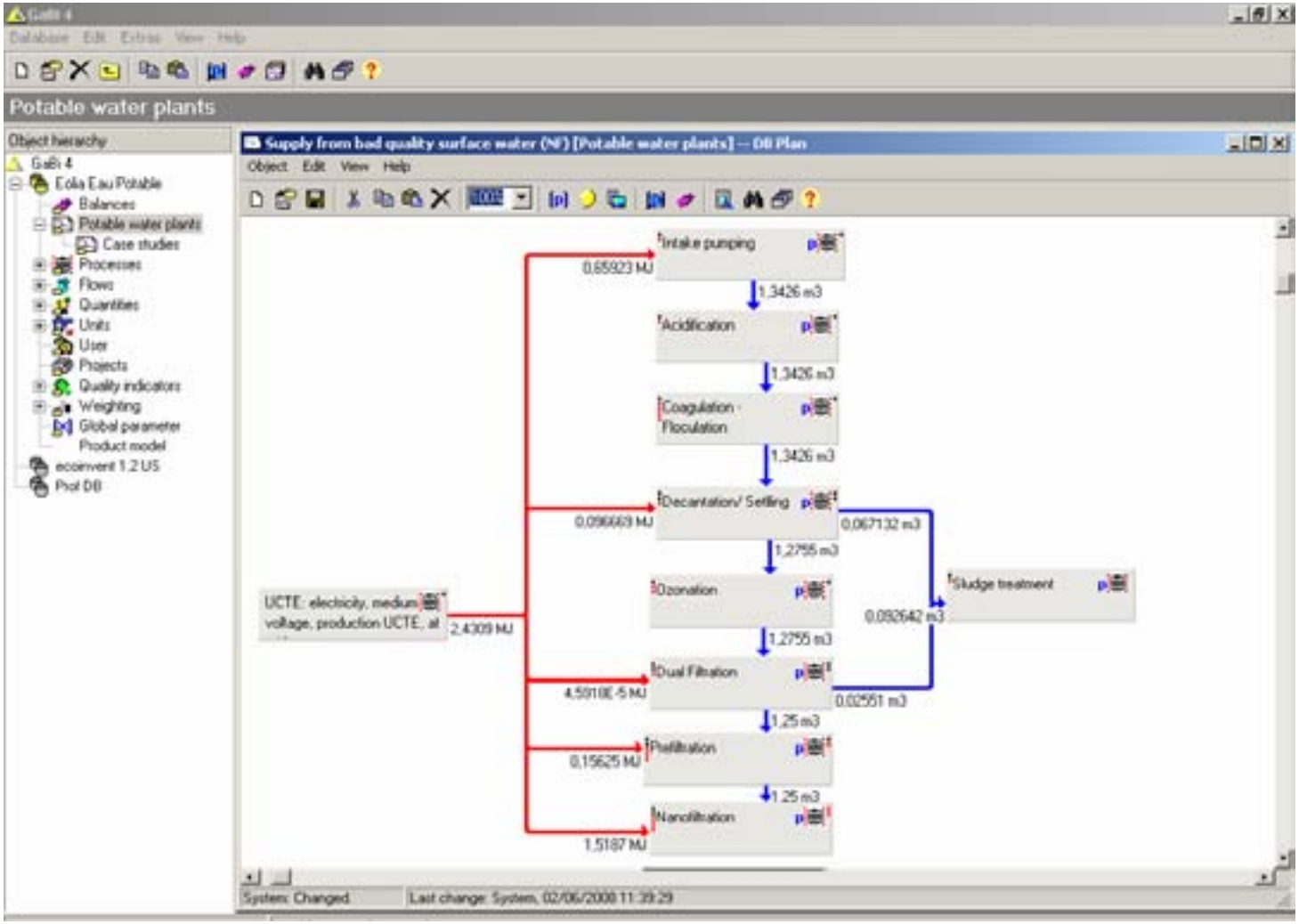
Water treatment system



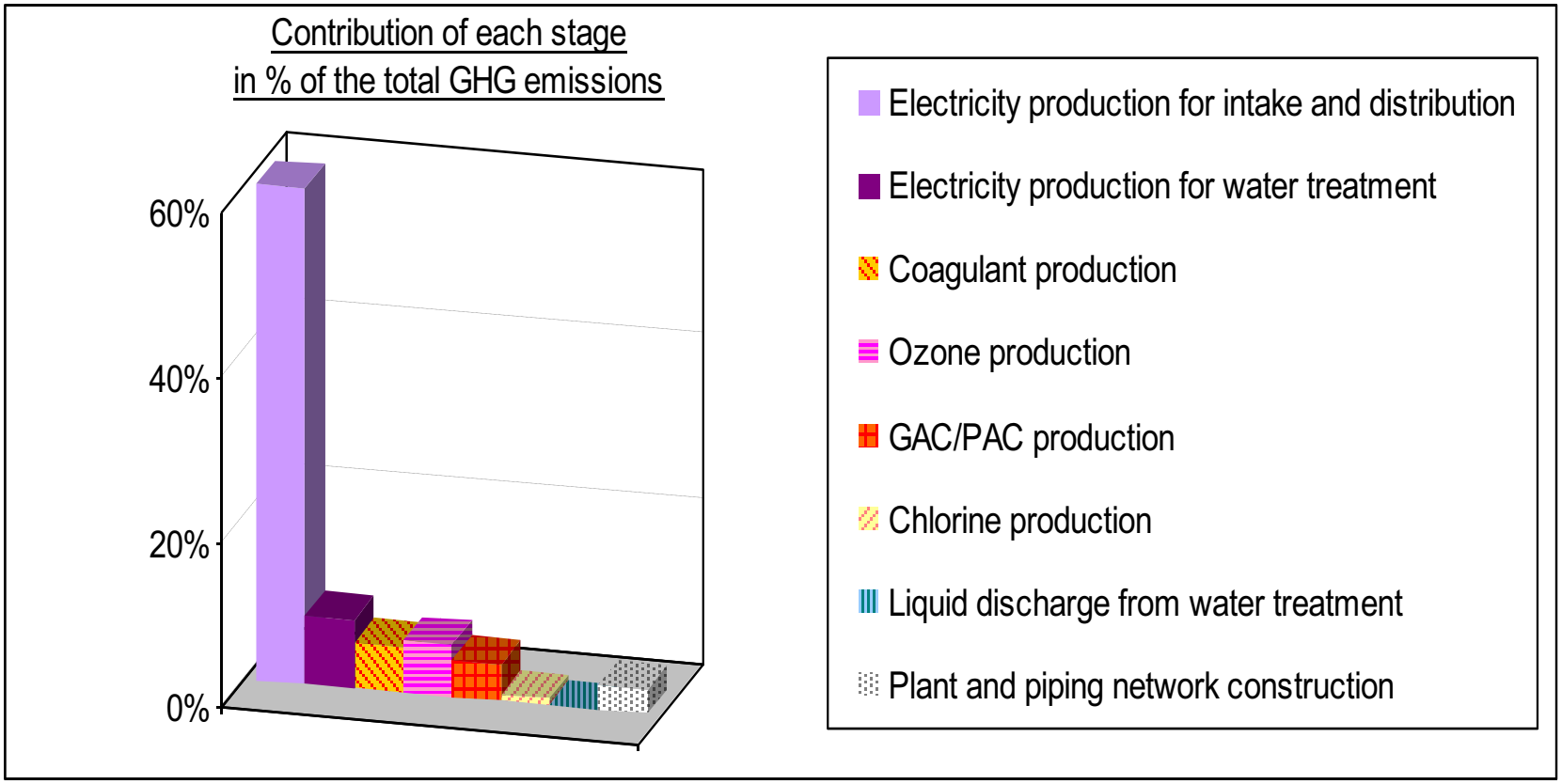
LCA: System studied



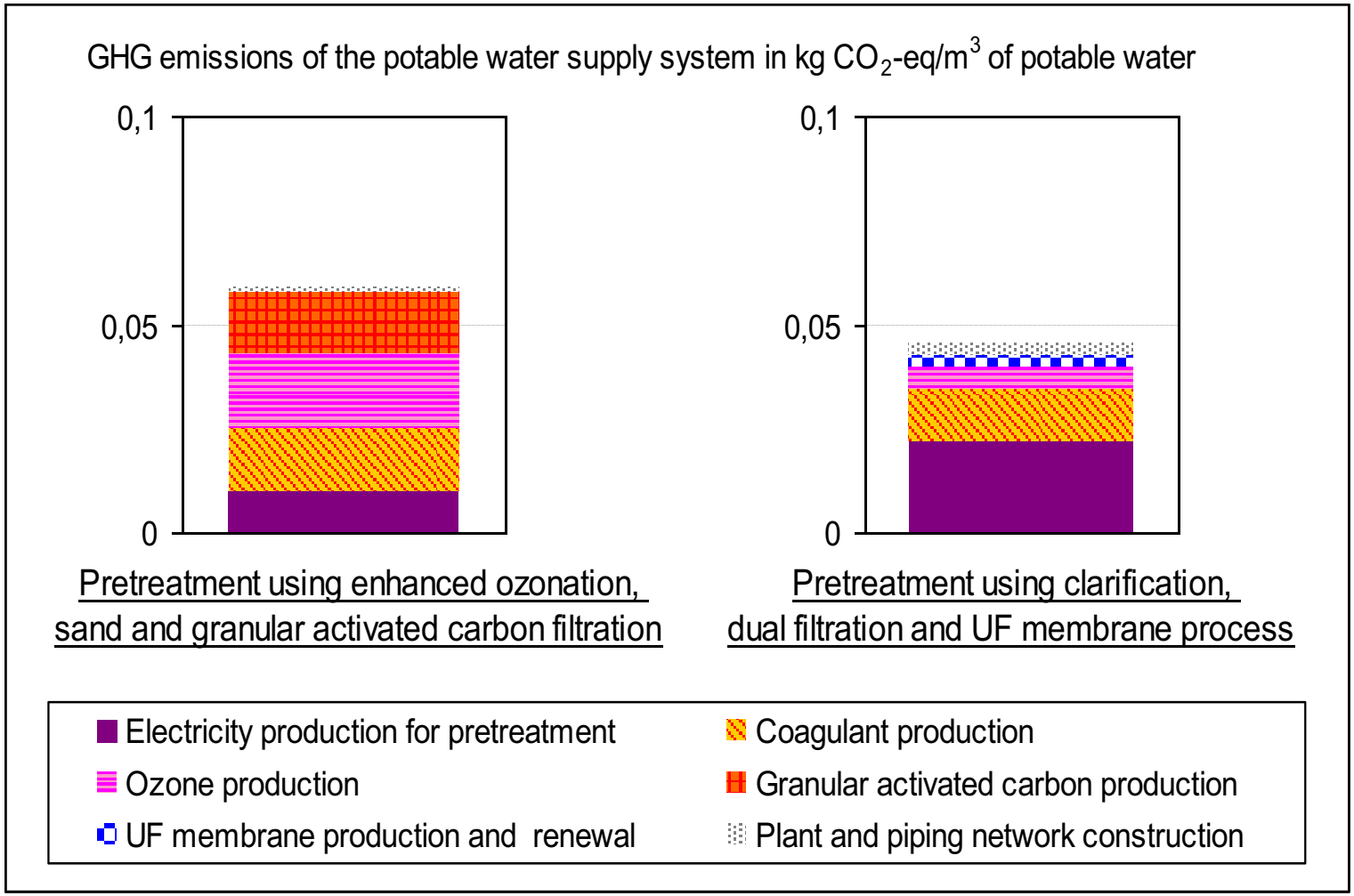
User interface …



GHG emission output …



Solution comparison …



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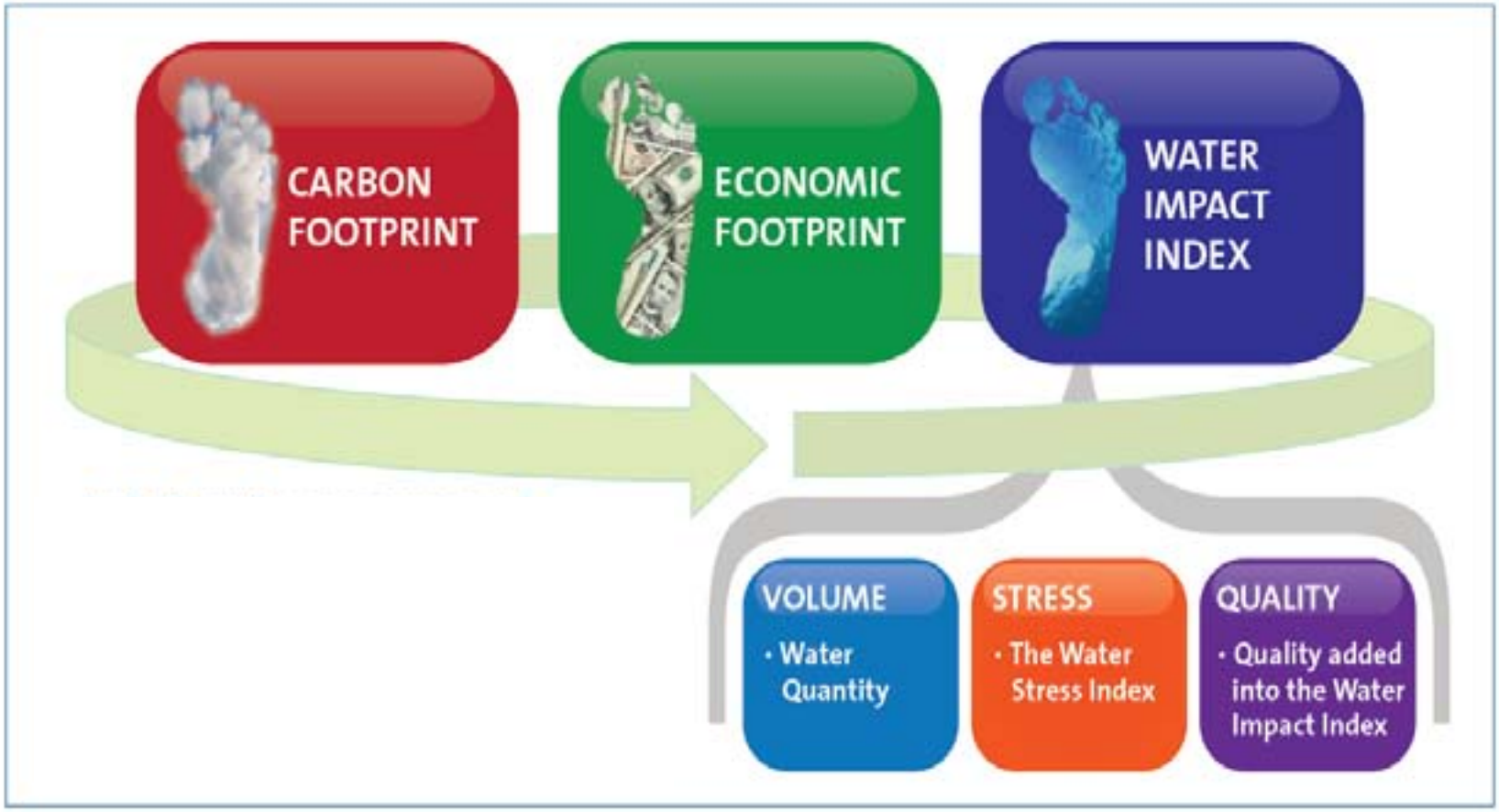
The new Water Impact Index - WII

Water Impact Index …



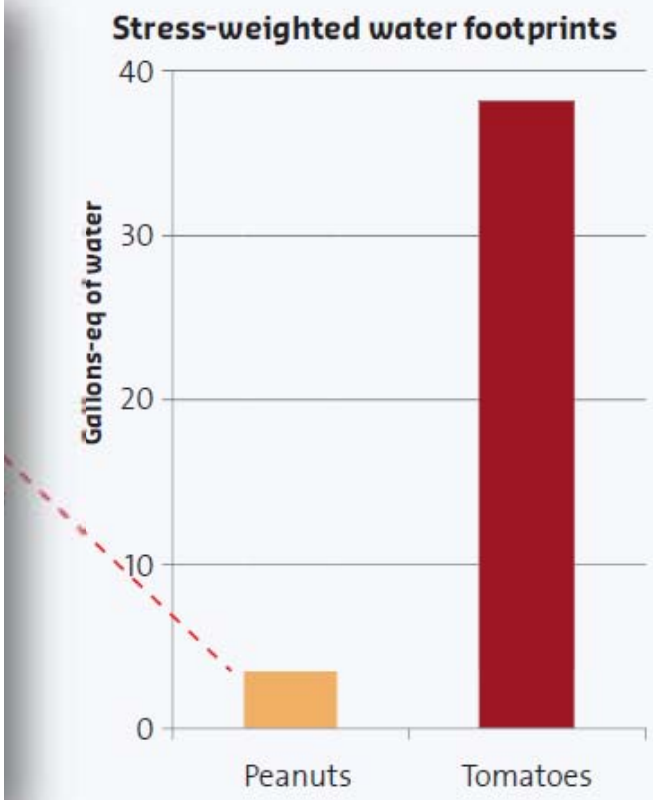
Water Impact Index …

Why go beyond a volumetric approach?

Peanut production: rain fed agriculture

Tomatoes are produced in water stressed areas

Tomatoes require more fertilizers (water pollution)



METHODOLOGY

A new metric for assessing water impacts.

Direct Water Impact Index

$$WII = WSI \times [(V_{extracted} \times Q_{extracted}) - (V_{released} \times Q_{released})]$$

Indirect Water Impact Index

Energy

$$WII = WSI \times [(V_{extracted} \times Q_{extracted}) - (V_{released} \times Q_{released})]$$

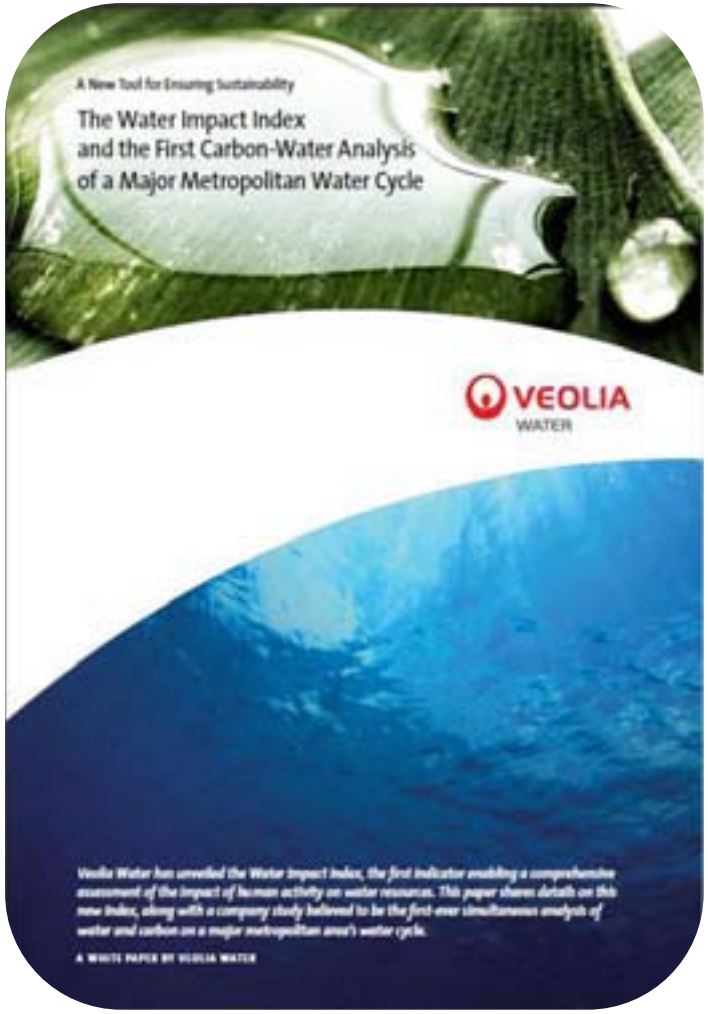
Chemicals

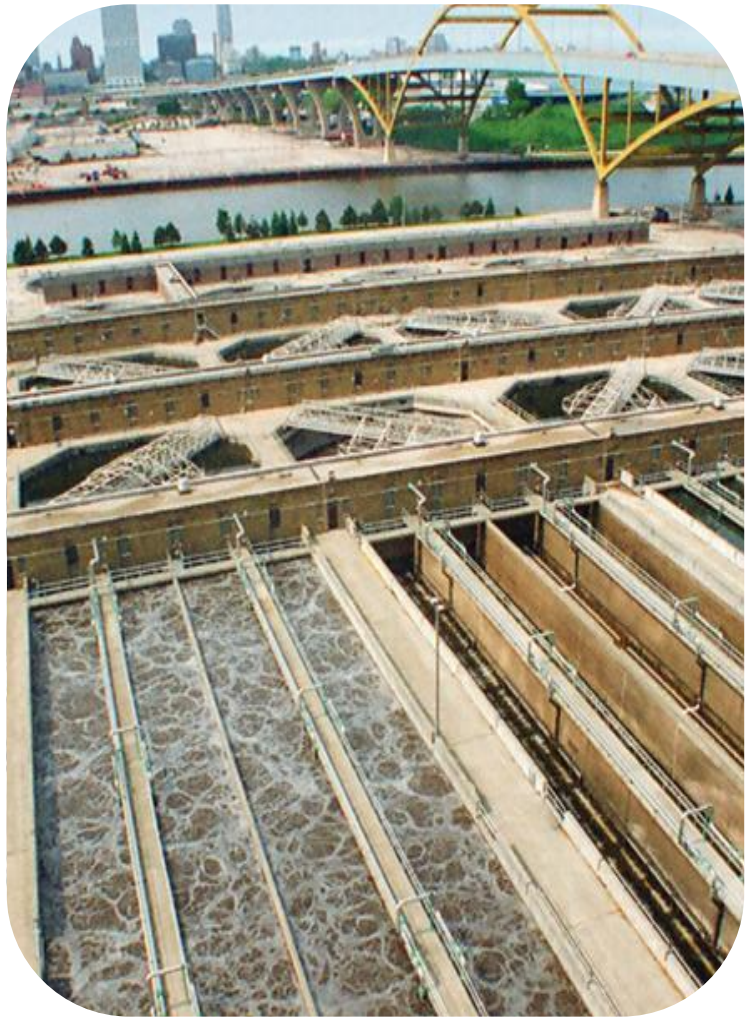
$$WII = WSI \times [(V_{extracted} \times Q_{extracted}) - (V_{released} \times Q_{released})]$$

Waste

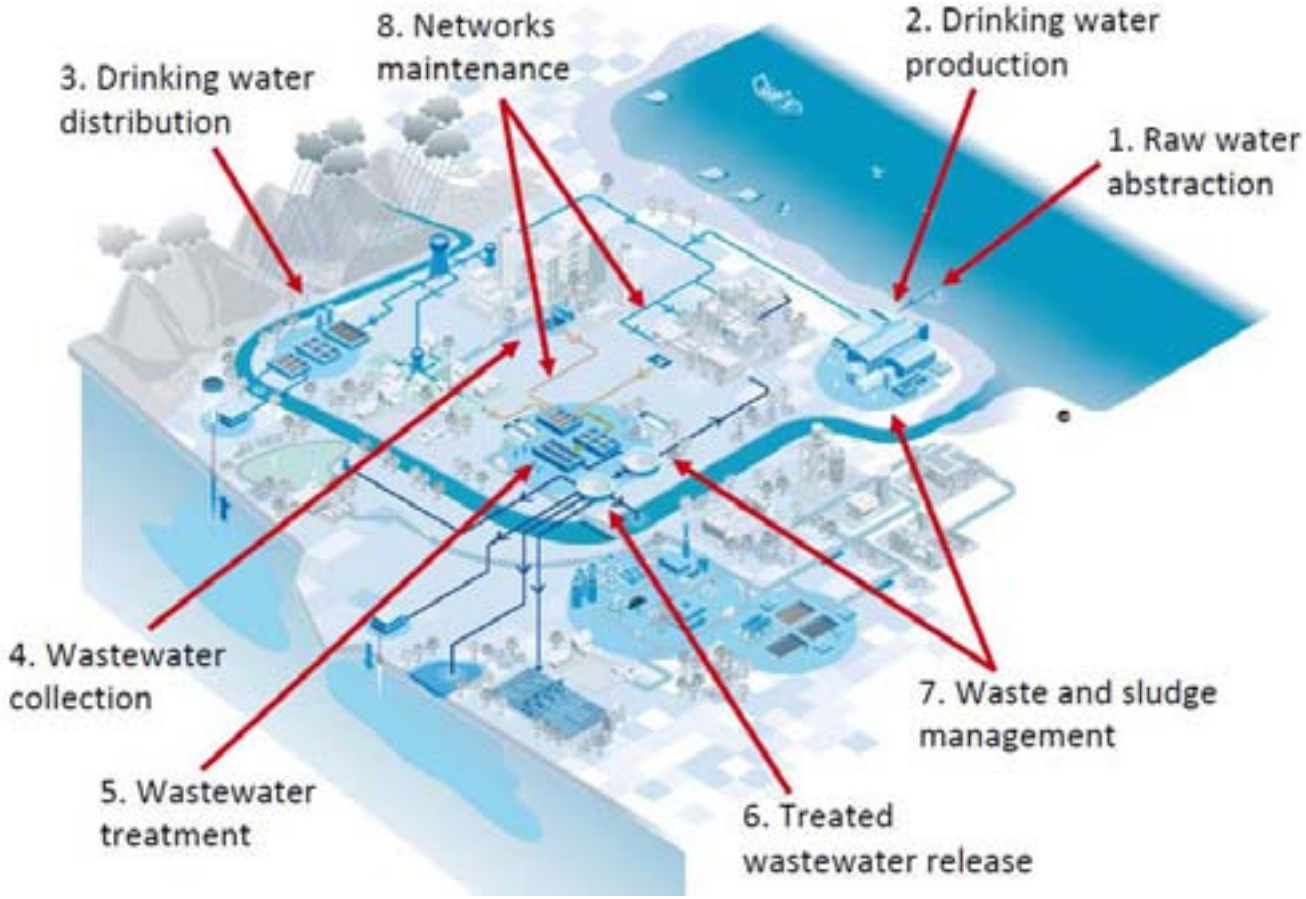
$$WII = WSI \times [(V_{extracted} \times Q_{extracted}) - (V_{released} \times Q_{released})]$$

First carbon – water analysis …

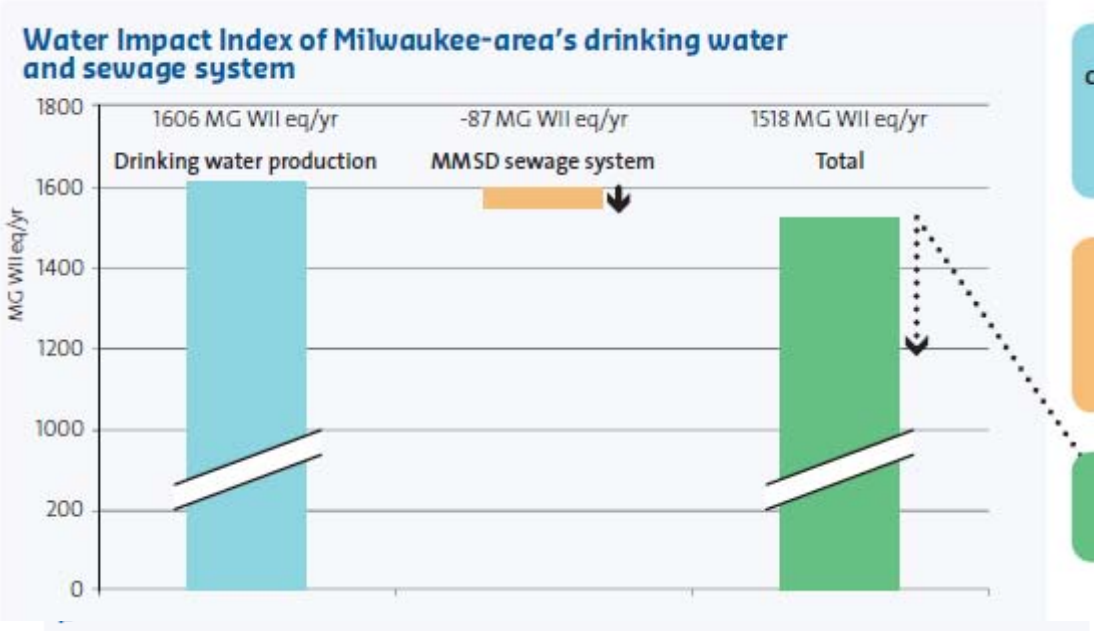




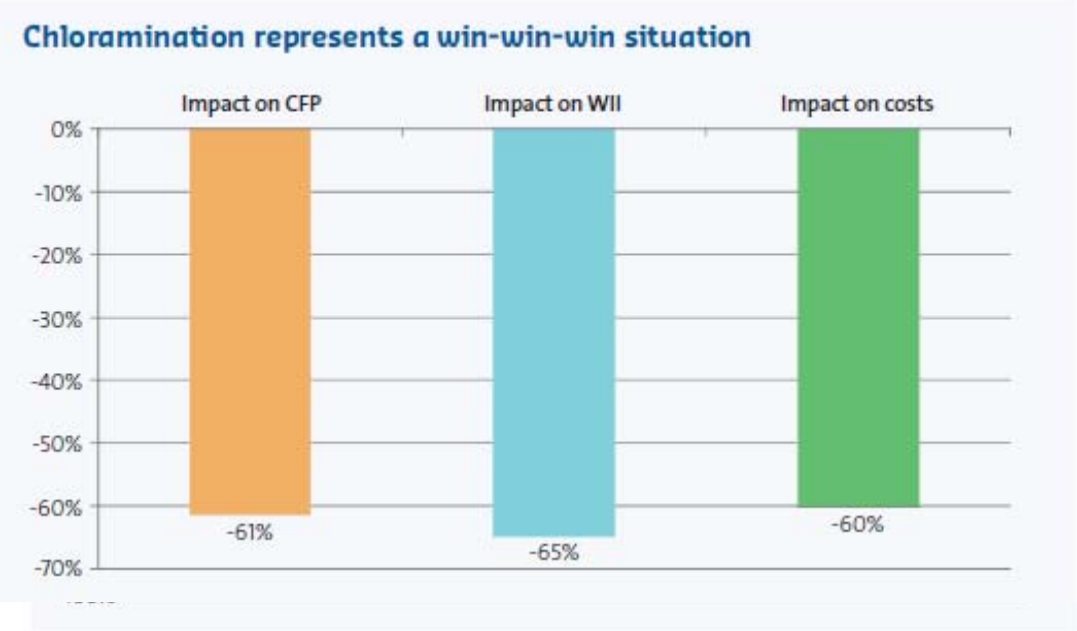
Water system evaluated …



Carbon - Water Impact assessment…



Carbon - Water Impact assessment …



Switching from sodium hypochlorite disinfection to chloramination would reduce the Water Impact Index of chemicals, the carbon footprint and generate savings.

Conclusions…

- Provision of water treatment solutions to the meet the future requirements of Industry will require not only an innovative use of technology, but also an innovative approach to technology selection to ensure a sustainable solution
- Optimisation of energy use and reduction of GHG emissions in water treatment is intertwined with water use
- Veolia Waters combined carbon footprint and water Impact Index tools can be used to determine water treatment solutions that create minimal environmental impact
- Coupled with conventional economoc analysis they provide a multi criteria analysis to achieve a « best in class » decision making process

Thank You for your Attention

Any Questions Please !

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