

Life cycle energy analysis of water use system in Ara river watershed

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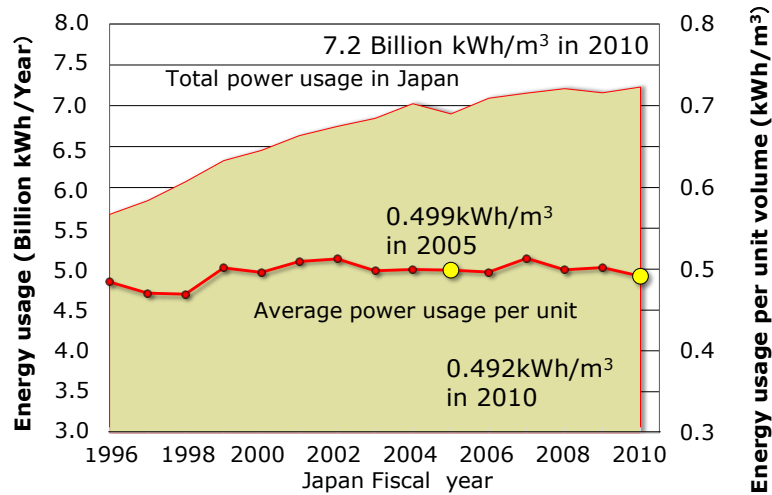
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Content

- ▣ Energy usage by water sectors in Japan
 - Water supply and Sewerage systems
- ▣ Water resource and water supply in Tokyo
 - Water intake from Ara-river
- ▣ Life cycle assessment for water use system
 - Inventory analysis
 - Life cycle energy consumption

Energy usage in sewerage system in Japan

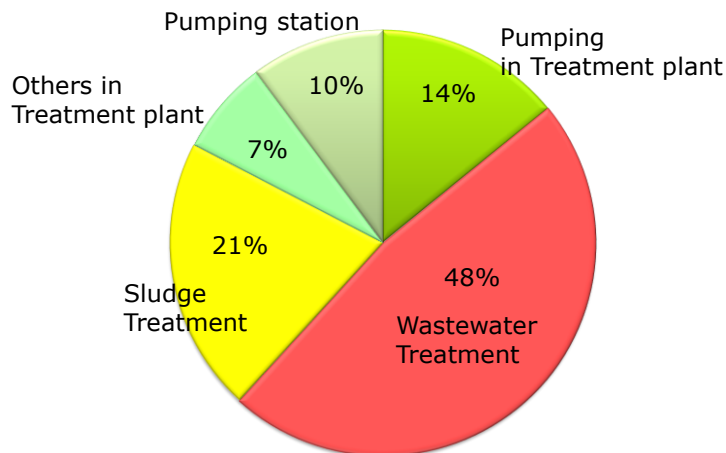
Sewerage works statistics
下水道統計



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Items of energy usage in sewerage system in Japan



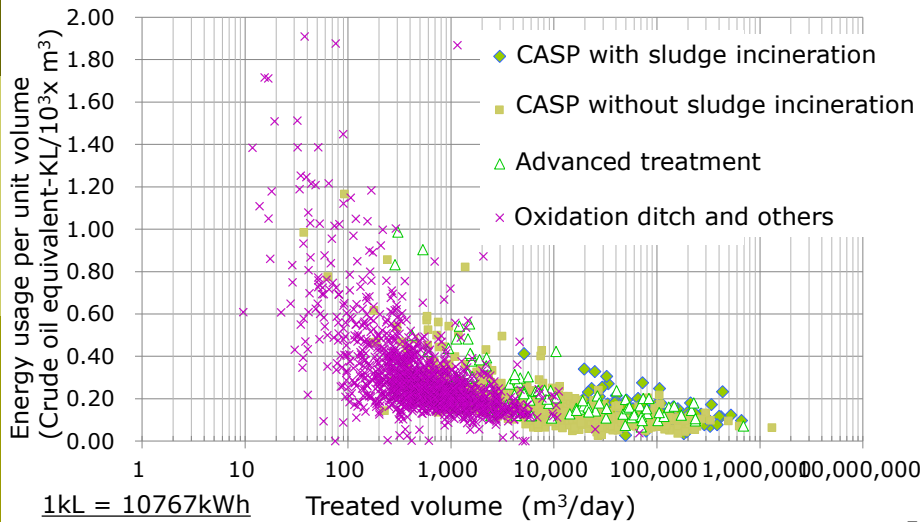
Sewerage works statistics
下水道統計

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Energy usage by different treatment processes

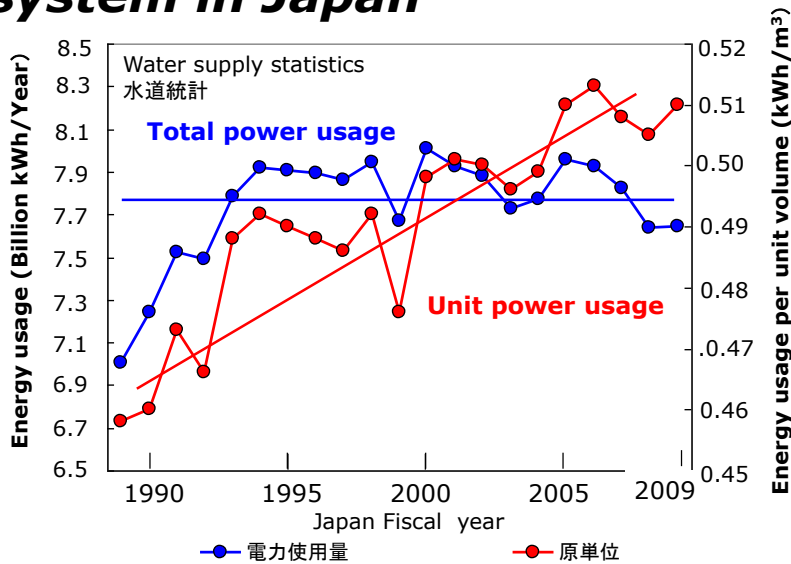
Sewerage works statistics
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Energy usage in water supply system in Japan

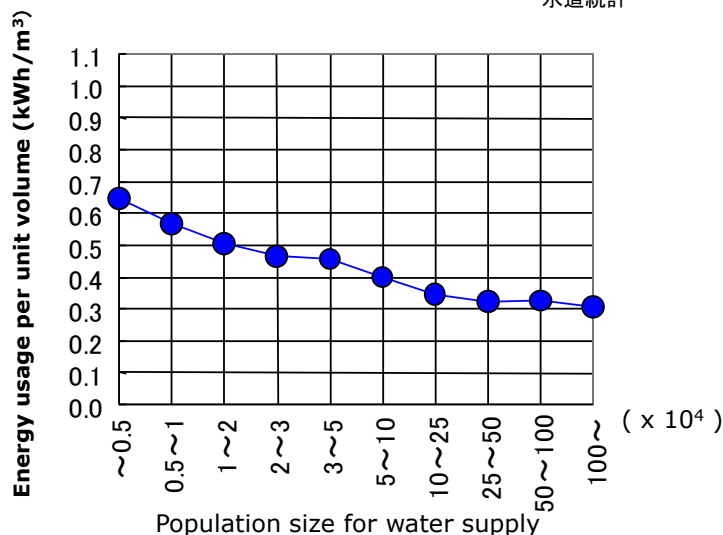


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Energy usage by different population size utilities

Water supply statistics
水道統計

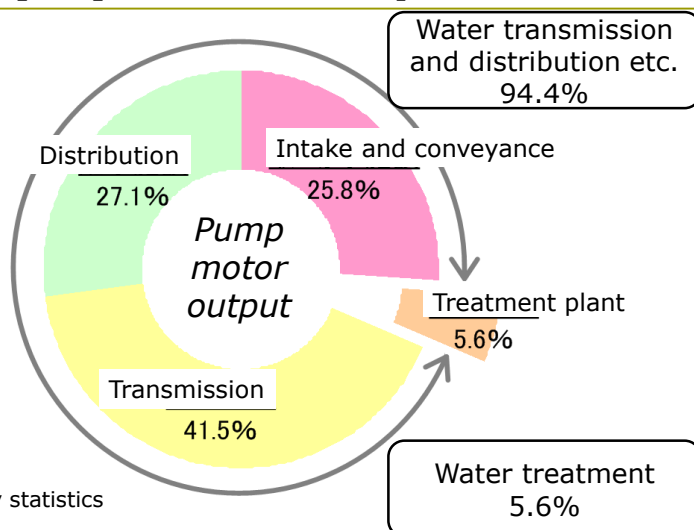


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Items of energy usage in water supply system in Japan

Water supply statistics
水道統計

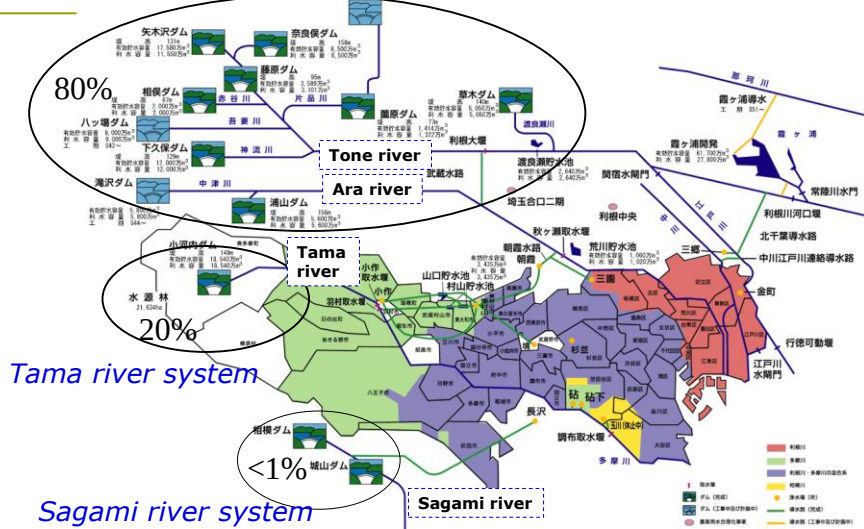


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Water resource and water supply in Tokyo

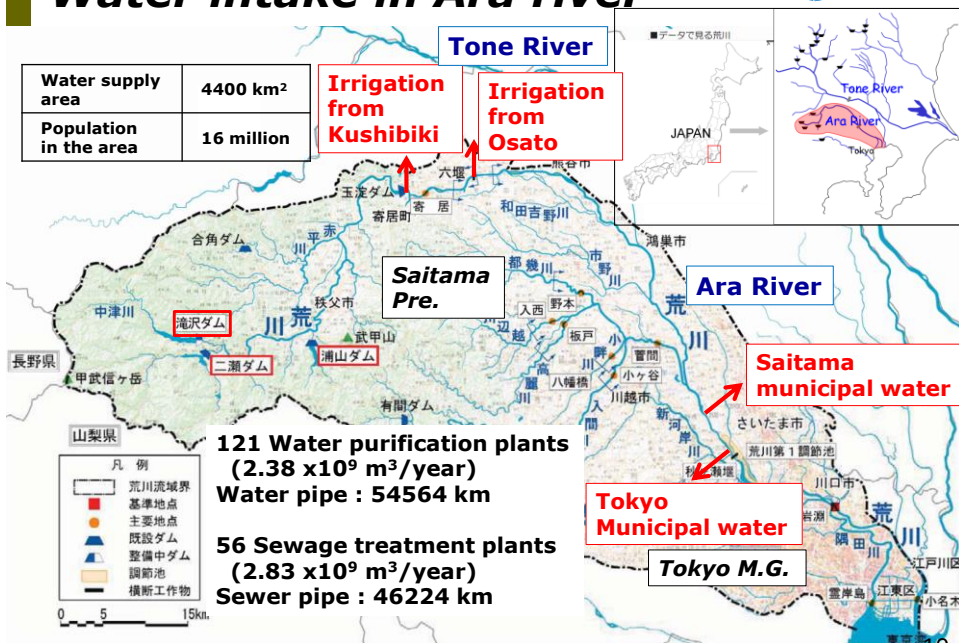
Tone-Ara river system



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Water intake in Ara river



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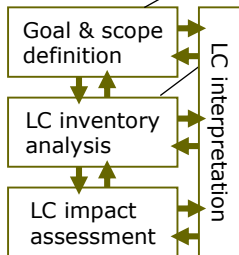
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Raw material extraction

Landfilling

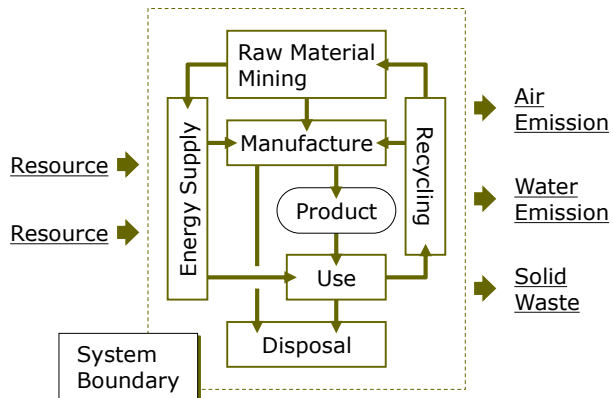
Life Cycle Assessment

LCA consists of 4 phases:



Goal & Scope Definition: Define the functional unit and system boundaries

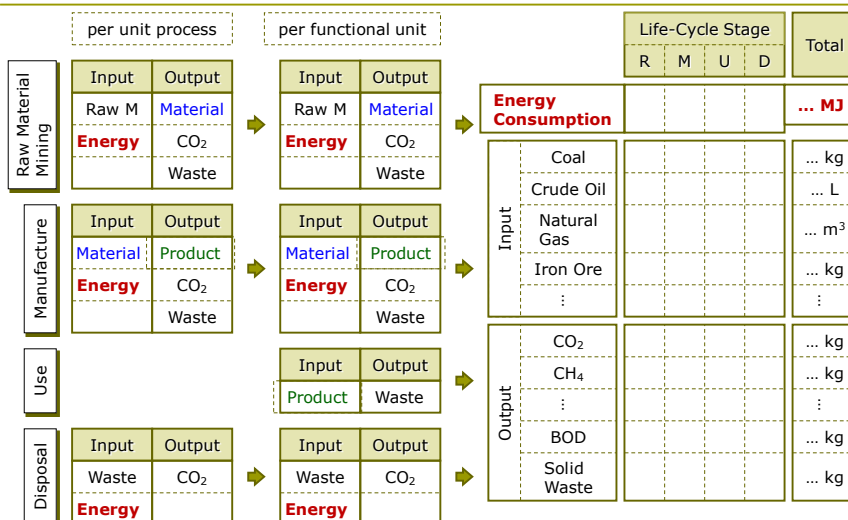
LCI Analysis: Account for all materials and energy of the product/service system over the whole life-cycle.



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Life Cycle Assessment: Inventory Analysis



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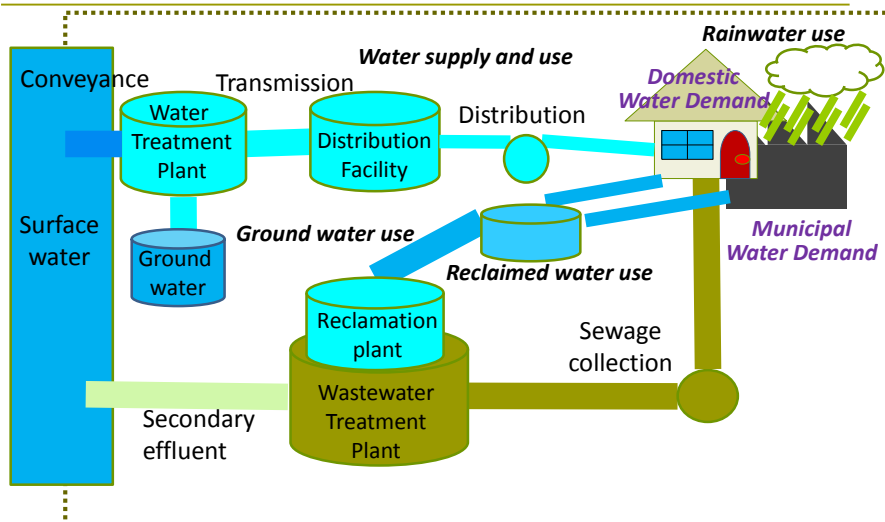
Life Cycle Assessment: Inventory Analysis Example

Input	Output	Energy
Naphtha 0.940 kg		$\times 51.3 \text{ MJ/kg} = 48.2 \text{ MJ}$
Electricity 0.159 kWh		$\times 6.31 \text{ MJ/kWh} = 1.0 \text{ MJ}$
Diesel Oil 1.230 MJ		$\times 1.10 \text{ MJ/MJ} = 1.4 \text{ MJ}$
Polypropylene (PP) Resin Production	PP Resin 1.000 kg	
	Solid Waste 0.950 g	$\times \dots \text{ MJ/g} = \dots \text{ MJ}$
	CO ₂ 1.002 kg	
	NO _x 0.913 g	
	SO _x 0.225 g	
	⋮	
		+) Total ... MJ

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System Boundary of Water Use System



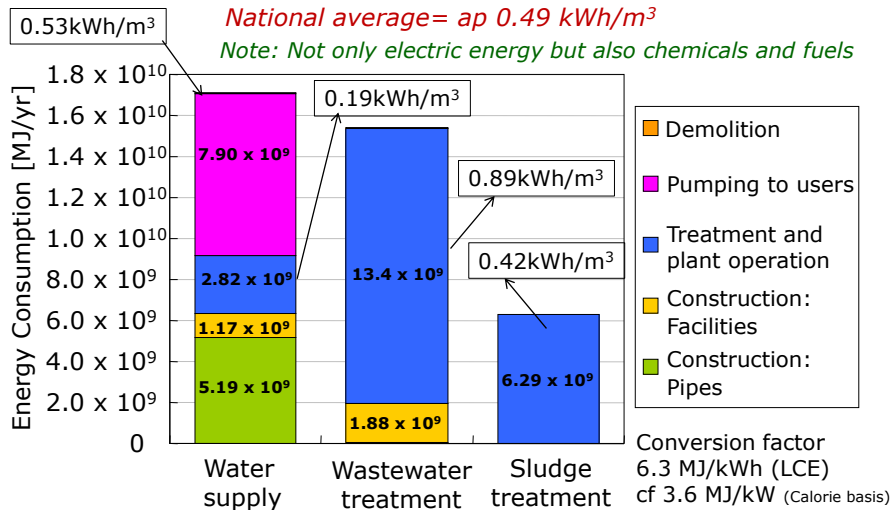
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Water supply: $2.38 \times 10^9 \text{ m}^3/\text{year}$

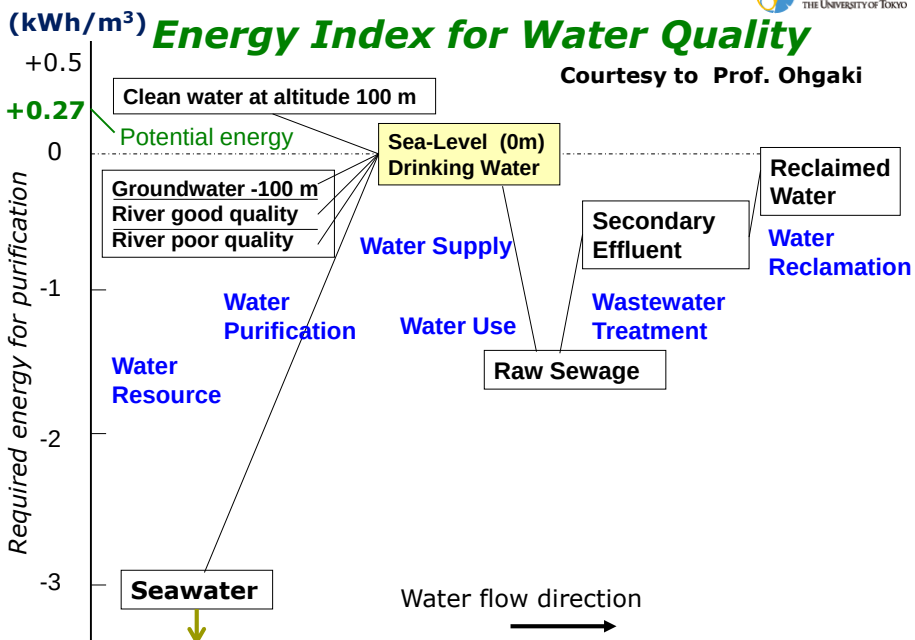


Water Use System in Ara-river watershed: LC Energy Consumption



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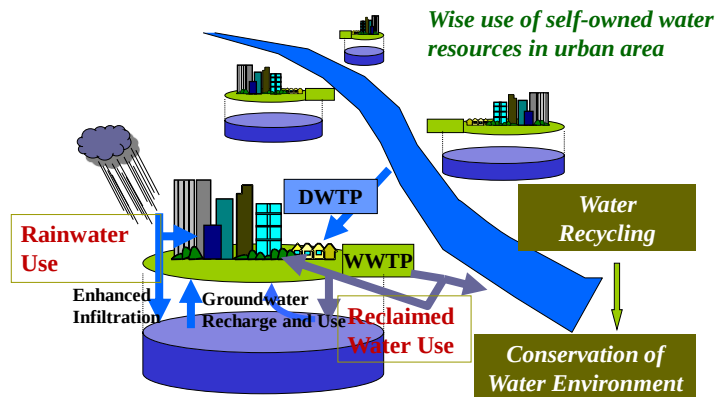
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Thank you for your attention

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Watershed-based Sustainable Urban Water Use



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