AIM/Water Model

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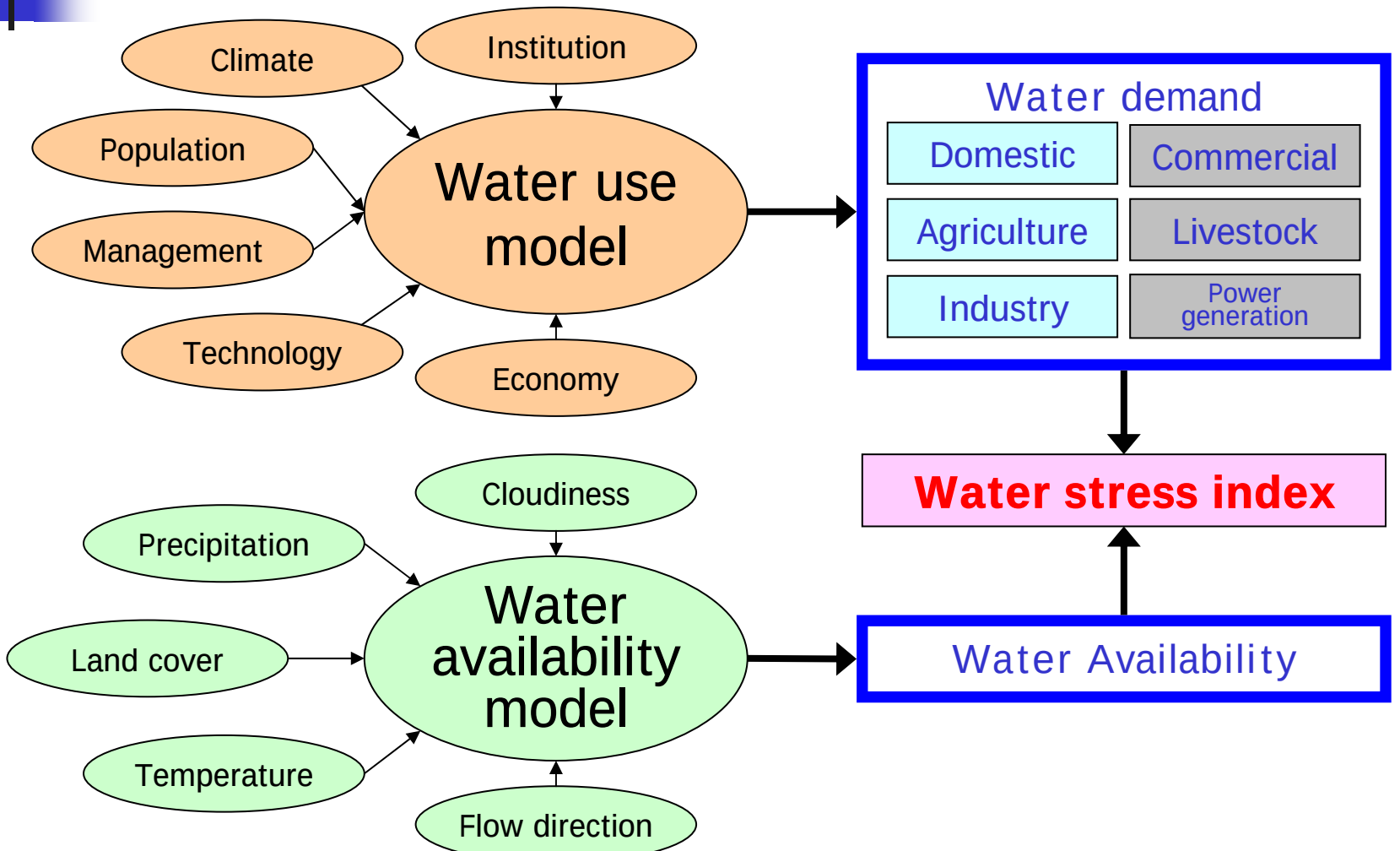
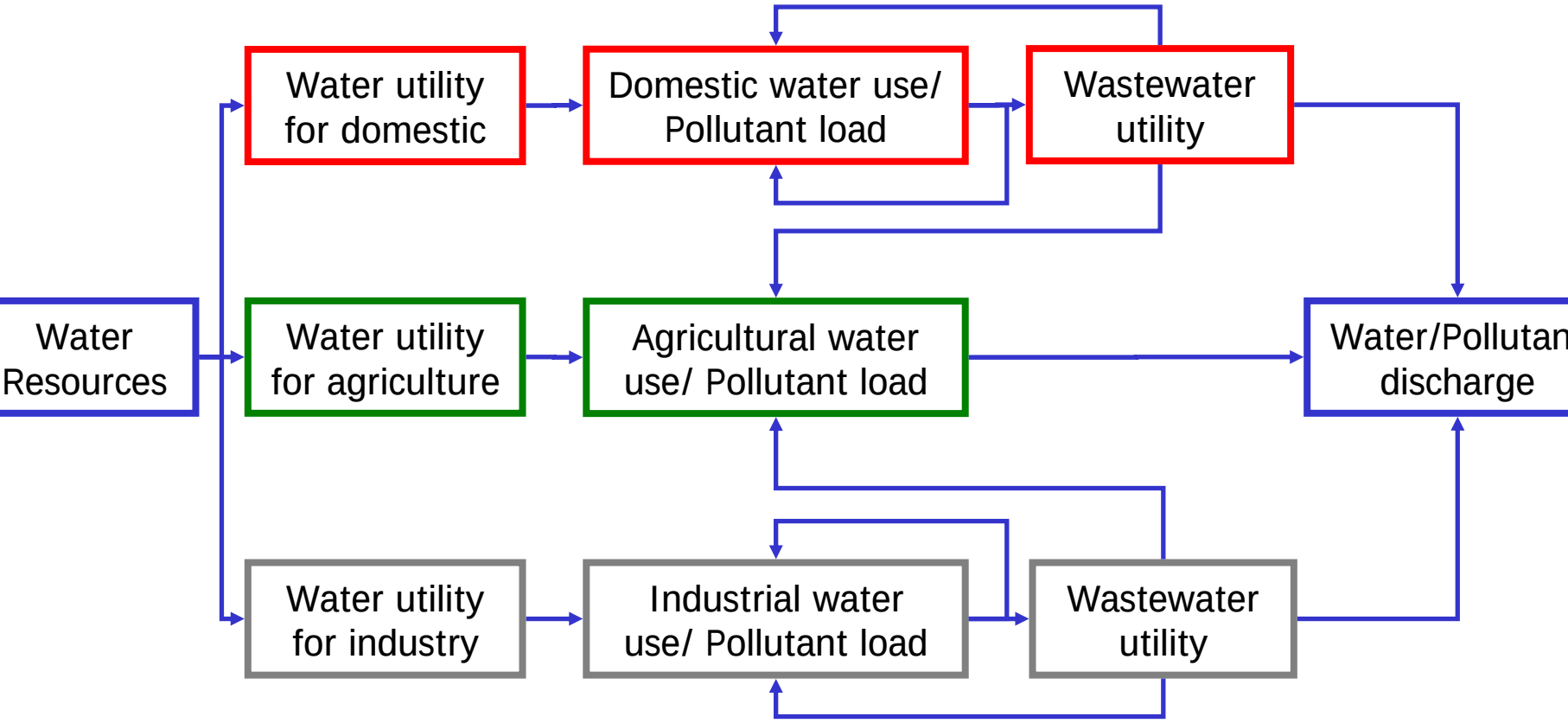
Outline of AIM/Water

- Integrated analysis on water resource considering political and socio-economic aspects
  - Water balance between availability and use under global warming, population growth and lifestyle change
  - Shortage of water supply and sanitation cause water borne disease
  - Water degradation caused by shortage of wastewater treatment
- Target area: Watershed ~ Country ~ Global
- Modules:
  - Water use, Pollutant load, Water/Wastewater utility

Global water availability/use model



Water/Wastewater utility and water use modeling



Water utility module for domestic

- Projections of water supply by various water utilities
  - ✓ Linkage between water utility module and water use module
    - ▸▸▸ Correlation between water utility and water use

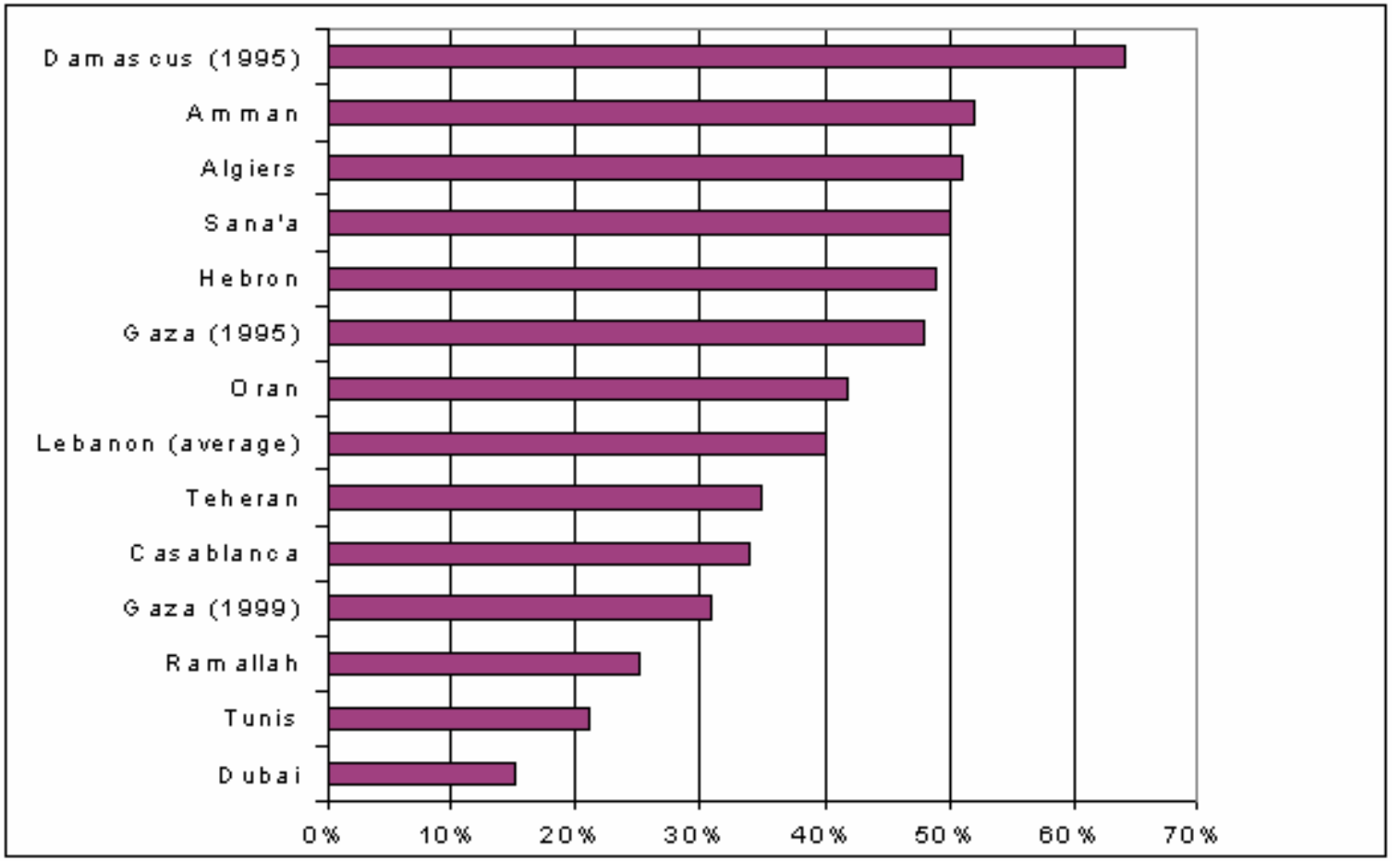
Domestic water use by distance to source by P. H. Gleick (1996)	
Source of water	**Water use (L/p/d)**
Public Standpipe, farther than 1 km	Less than 10
Public Standpipe, closer than 1 km	20
House connection, simple plumbing, pour, flush toilet	60 to 100
House connection, urban, with gardens	150 to 400

Improved/Not improved water utility for domestic

Global Water Supply and Sanitation Assessment Report 2000	
Improved water supply	**Not improved water supply**
Household connection	Unprotected well
Public standpipe	Unprotected spring
Borehole	Vendor-provided water
Protected dug well	Bottled water* * Considered as "not improved" because of concerns about the quantity of supplied water, not because of concerns over the water quality
Protected spring	
Rainwater collection	Tanker truck-provided water

- Necessary data
  - ✓ Coverage [%], Water supply capacity[m^3/d]
  - ✓ Initial cost, Operational and Maintenance cost
  - ✓ Managerial efficiency, Water quality

Unaccounted for Water (UFW)



Domestic water use/Pollutant load module

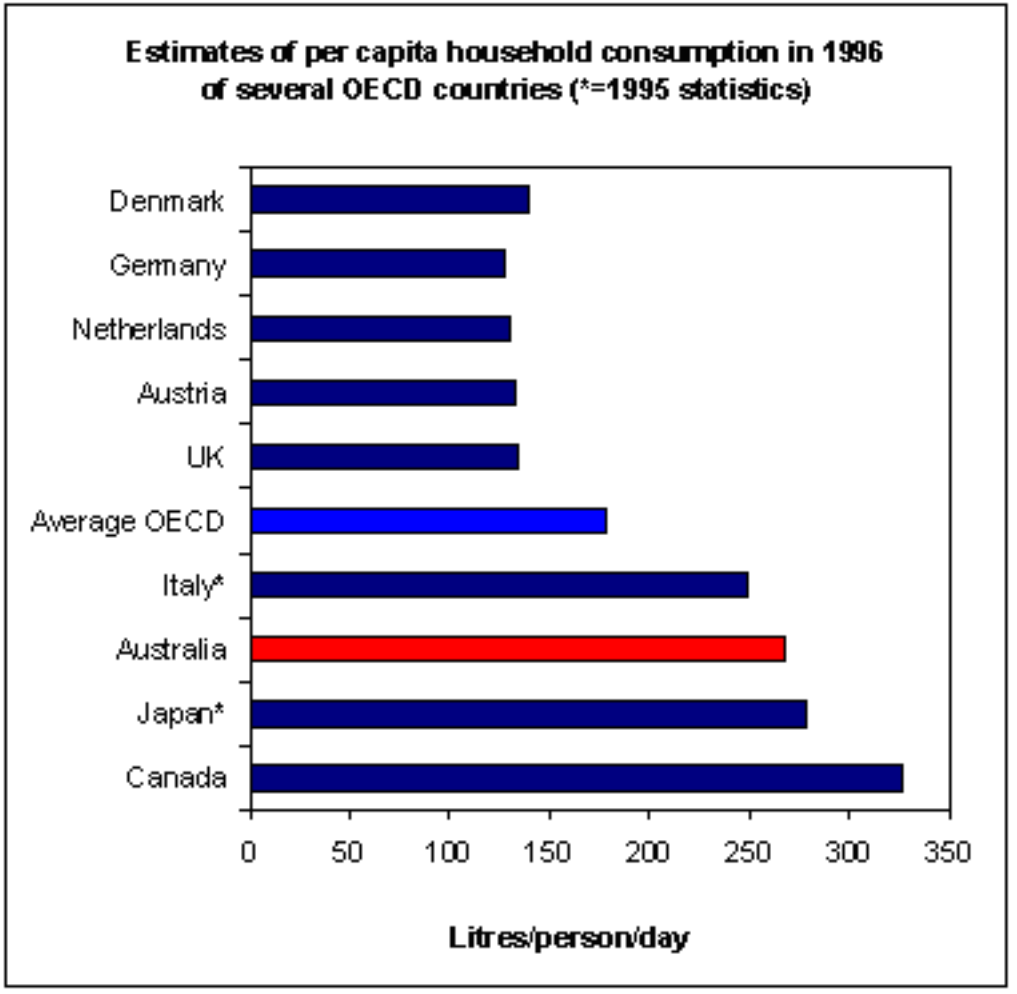
- Water use category
  - ✓ Drinking, Cooking, Toilet, Bath, Shower, Cloth washing, Dish washing, Irrigation for garden, Car washing, etc.
- Necessary data
  - ✓ Population served by water utility
  - ✓ Per capita water use by water utility
  - ✓ Percentage of water use per person
  - ✓ Installation of water savings
  - ✓ Pollutant load per water use
  - ✓ Water quality
- Water savings
  - ✓ Water saving devices. Water saving behaviors

Example of per capita water use for specific uses in piped and unpiped households

Per capita water use for specific uses of water in urban area of Uganda		
	Piped Households	Unpiped Households
Drinking and Cooking	4.08	4.1
Bathing	17.66	10.2
Cleaning and Washing	16.44	7.3
Toilet flushing	24.42	0.0*
Garden	0.84	0.1
* Flush toilet are not commonly used by unpiped households		

Per capita water use in piped water

- ✓ Climate
- ✓ Economic
- ✓ Lifestyle
- ✓ Policy
- ✓ Cost



Example of water savings

- Toilet
  - **Low-Flush Toilets.** Conventional toilets use 3.5 to 5 gallons or more of water per flush, but low-flush toilets use only 1.6 gallons of water or less
  - **Toilet Displacement Devices.** By plastic containers filled with water or pebbles in a toilet tank, more than I gallon of water can be saved per flush.
- Kitchen
  - 10 to 20 gallons of water a day can be saved by running the dishwasher only when it is full.
  - When dishes are washed by hand, water can be saved by filling the sink or a dishpan with water rather than running the water continuously.

Water reuse system for domestic

- **Individual reuse system**: Wastewater discharged from the individual buildings in reused in the building
- **Area reuse system**: Wastewater discharged from communities such as district dwelling housed in reused in the area
- **Wide area reuse system**: Wastewater discharged from public sewage is reused in the wide area on a large scale

Wastewater utility module for domestic

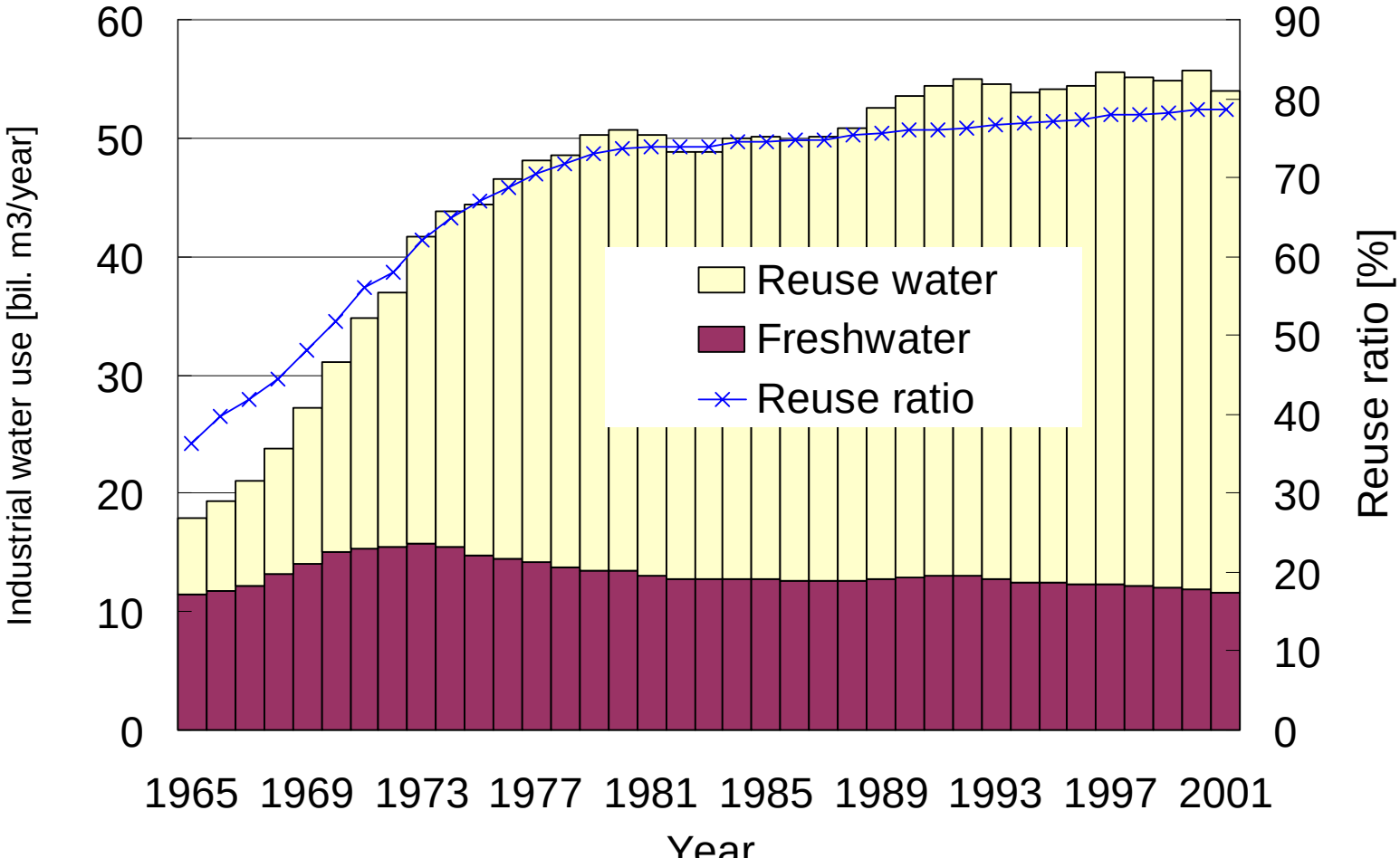
- Treated water volume and pollutant discharge by wastewater utility
  - ✓ Coverage [%], Capacity of wastewater treatment [m^3/d]
  - ✓ Pollutant removal efficiency, Managerial efficiency
  - ✓ Initial cost, Operations and maintenance cost

Global Water Supply and Sanitation Assessment Report 2000	
Improved water sanitation	**Not improved sanitation**
Connection to a public sewer	Service or bucket latrines (where excreta are manually removed)
Connection to septic system	
Pour-flush latrine	
Simple pit latrine	Public latrines
Ventilated improved pit latrine	Latrines with an open pit

Industry

- Water/Wastewater utility module for industry = for domestic
- Water use module for industry
  - ✓ Water use by industrial category
    - Link to economic model
    - Σ (Industrial product by category)*(per product water use by industrial category)
- Pollutant load module for industry
  - ✓ Pollutant load by industrial category
    - Link to economic model
    - Σ (Industrial product by category)*(per product pollutant load by industrial category)

Industrial water reuse (Japan)

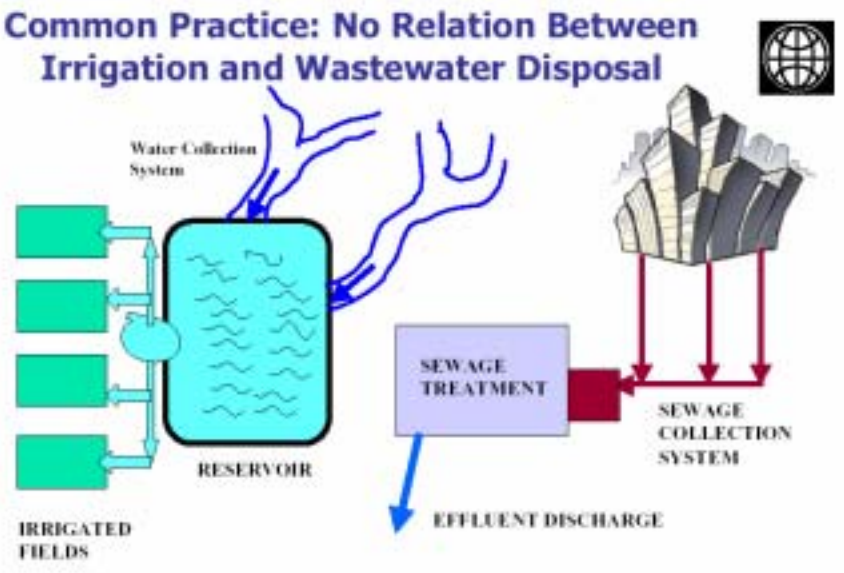


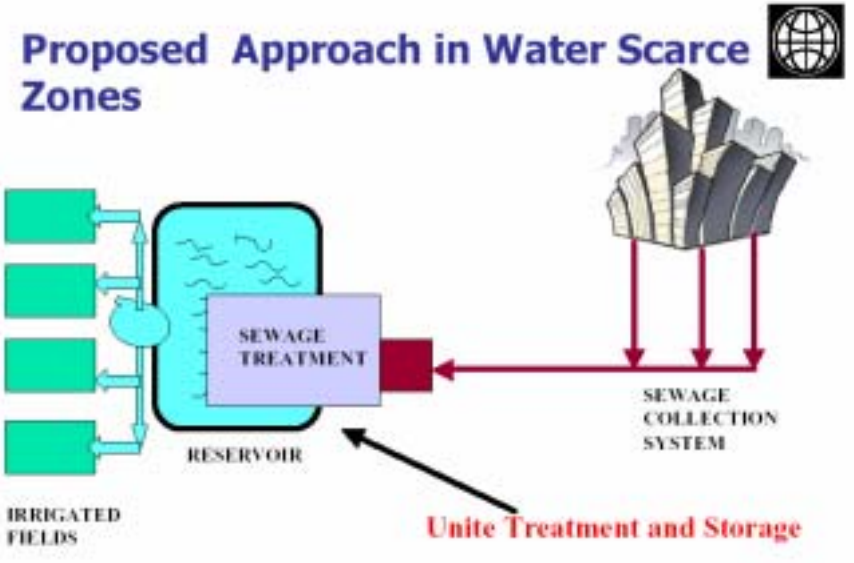
Agriculture

- Water utility module = Irrigation management module
  - ✓ Water supply efficiency by irrigation project
  - ✓ Water intake, conveyance
- Water use module
  - ✓ Simple: Crop product, Per crop product water use, water use efficiency
  - ✓ Complex: Dr. Takahasi developed based on “FAO, Crop evapotranspiration”, temperature, humidity, wind speed, soil data, crop data, irrigation technology, etc
- Pollutant load module
  - ✓ Fertilizer
  - ✓ Pollutant runoff ratio by land management condition

Water savings (Agriculture)

- Irrigation method (ex. Micro drip system)
- Treated water reuse





Future task

- Database development
  - ✓ General data
    - Population, Water/Wastewater utility coverage, Institutional data, Water quality standard
  - ✓ Technological data
    - Quantitative performance, Cost, Managerial efficiency
- Module development

==>Strategic Database (APEIS-IEA project)