Technology in the High Entropy World

Professor TAMBO,Norihito Dr.Eng.

President of the University of the Air,Japan

Professor Emeritus of Hokkaido University

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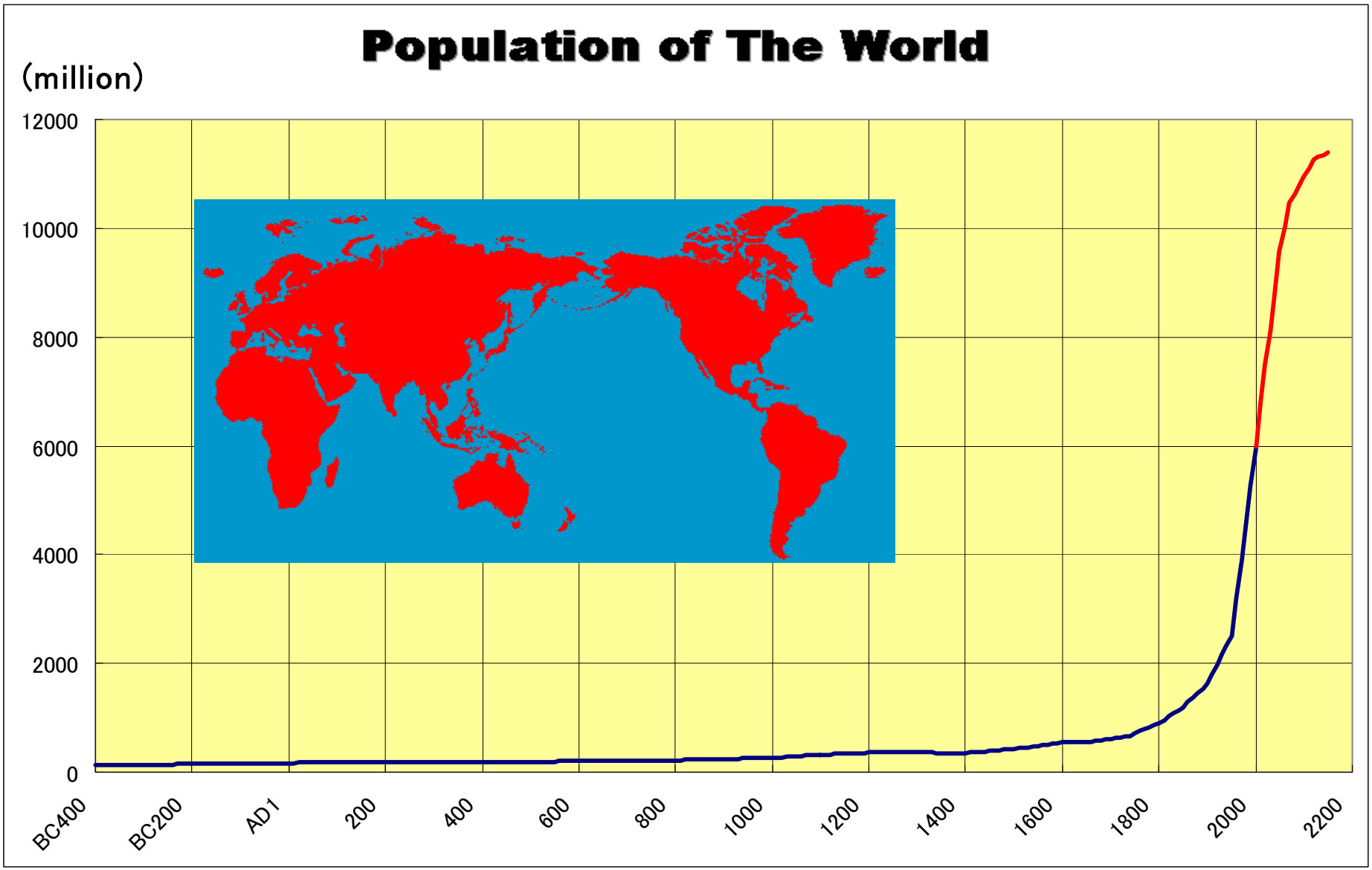
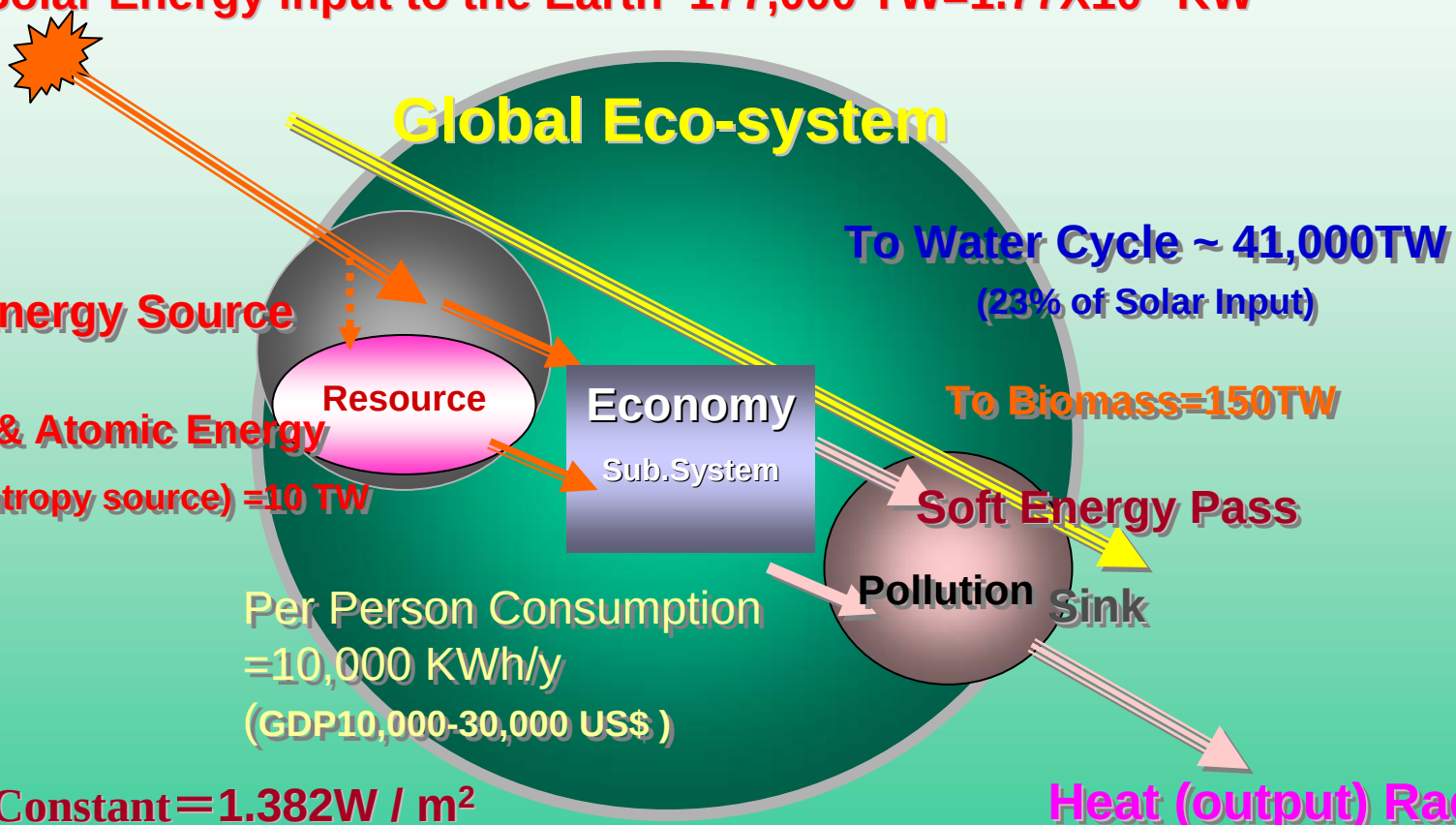
Population of The World



Global Eco-system & Economical Subsystem

Solar Energy input to the Earth 177,000 TW=1.77X10^{14}KW



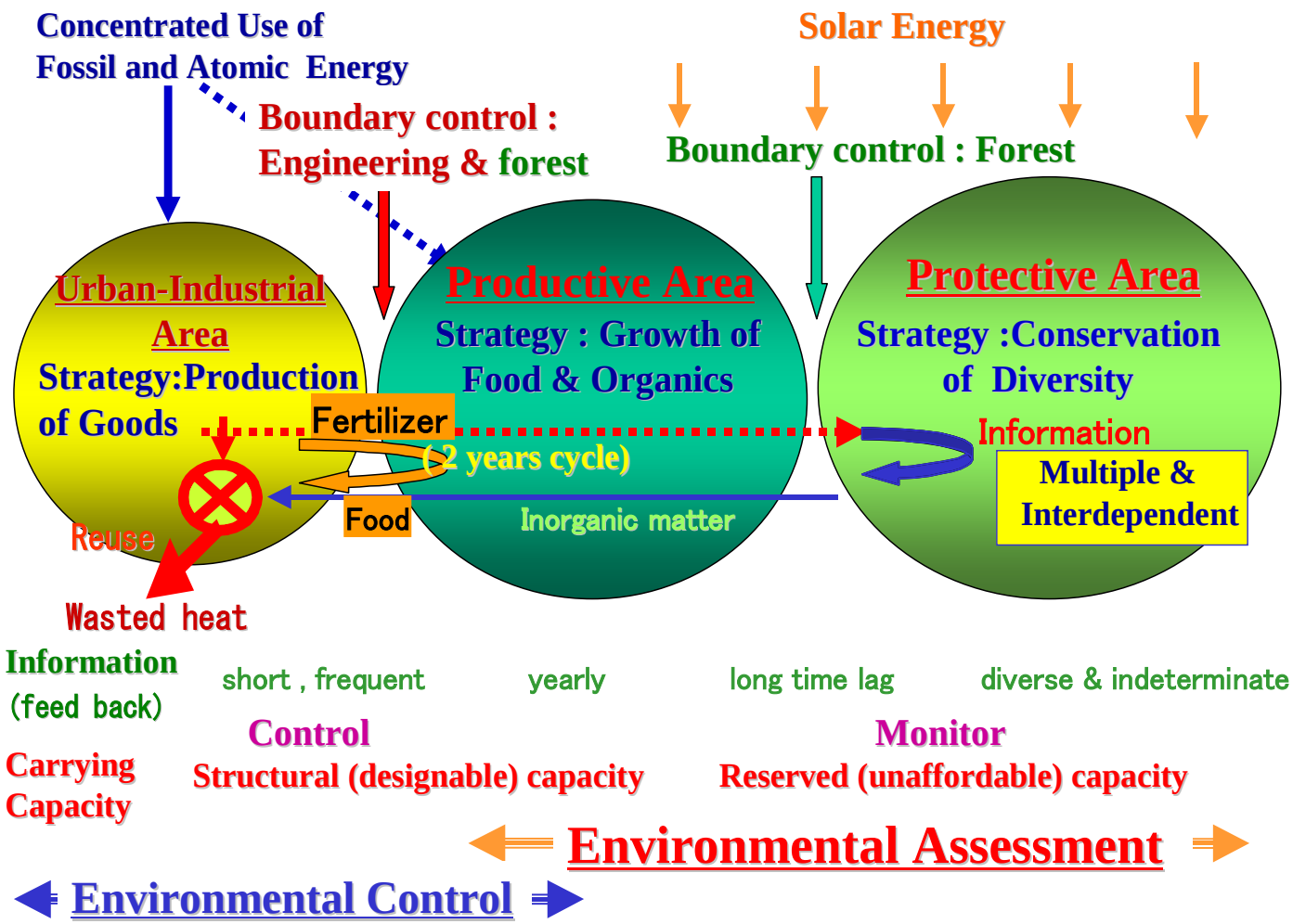
Solar Constant＝1.382W / m^2

Heat (output) Radiation

Shiny grand surface at Tokyo＝ 1.1-0.8W / m^2(Heat and Light)

Yearly input of surface at Tokyo＝38 KWh / m^2

Tambo 2005


Concentrated Use of
Fossil and Atomic Energy
Boundary control :
Engineering & forest
Solar Energy
Boundary control : Forest
Urban-Industrial Area
Strategy:Production of Goods
Productive Area
Strategy : Growth of Food & Organics
Protective Area
Strategy :Conservation of Diversity
Fertilizer
(2 years cycle)
Food
Inorganic matter
Information
Multiple & Interdependent
Reuse
Wasted heat
Information
(feed back)
short , frequent
yearly
long time lag
diverse & indeterminate
Control
Monitor
Carrying Capacity
Structural (designable) capacity
Reserved (unaffordable) capacity
Environmental Assessment
Environmental Control
Tambo 2002

Low Entropy and High Entropy World

$$\triangle E = Q/T_{out} - Q/T_{in}$$

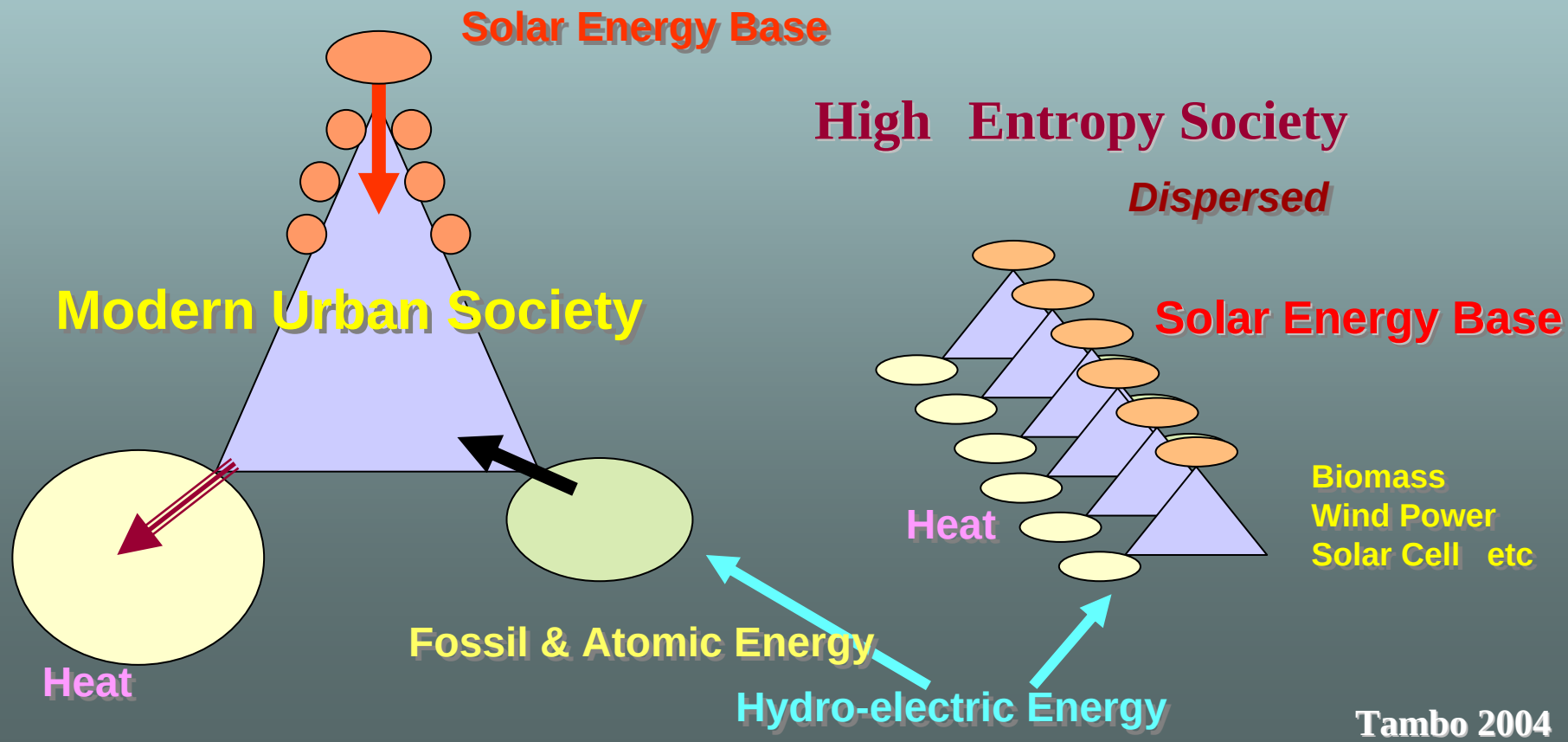
Low Entropy Society

Centralized

Solar Constant

$Q=8.142J/cm^2min^1=2.0cal/cm^2min=1,382W//m^2$

$T_{in}=6000K$, $T_{out}=300K$ $\triangle E=0.0062cal/cm^{-2}min^{-1}$ **K**

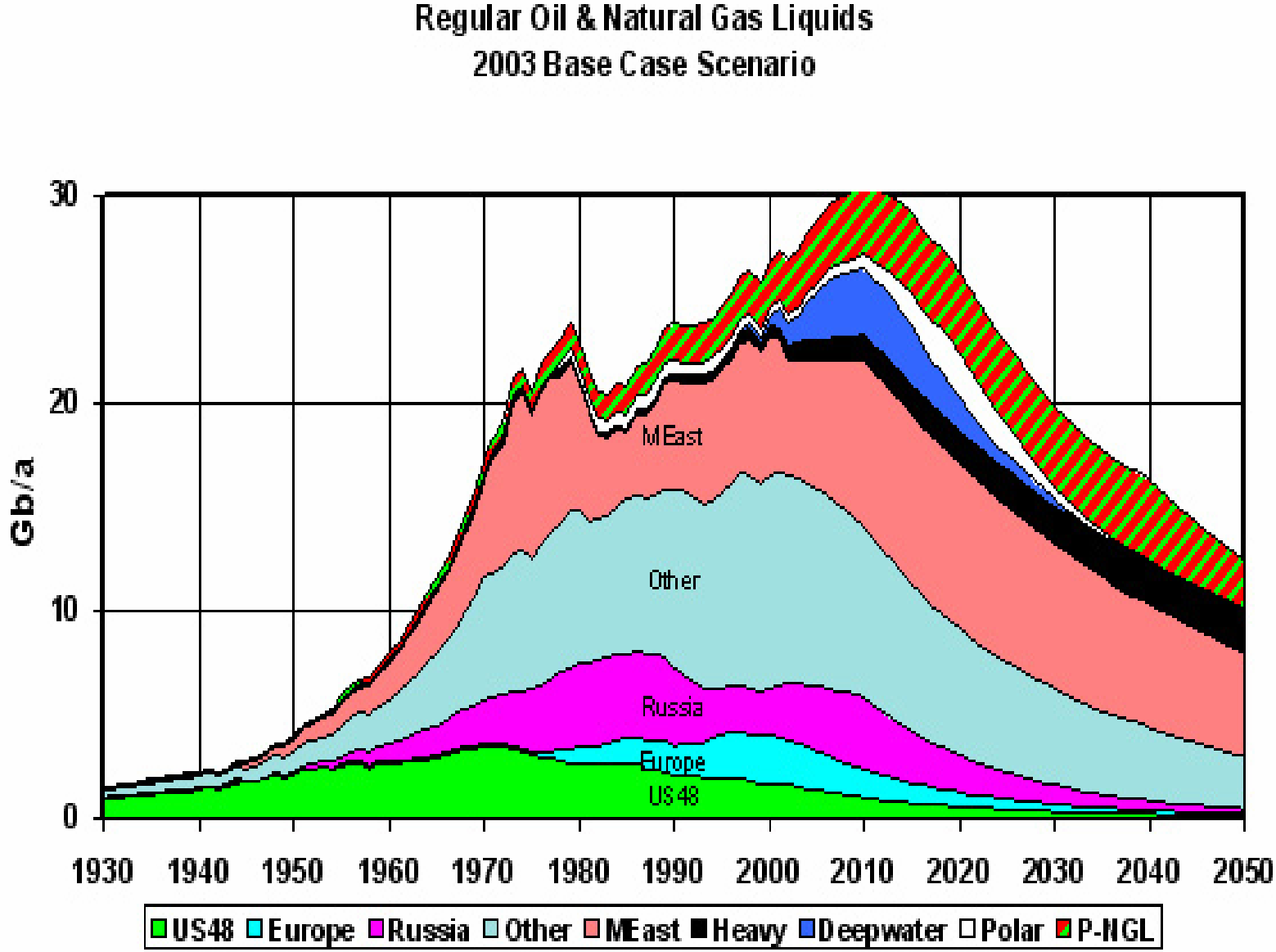


Tambo 2004

Energy Density of Various Energy Resources

	KWh / m^2 / Y	KWh / m^2
Home Consumption	35	0.024
Office Consumption	400	0.045
Solar Cell 15%operation	24	0.082
Windmill 20%operation	21	0.012
Bio-mass Aspen,@6years	2	0.00032
Thermal Power 75% op.	9,560	1.6
Atomic Power 75% ope.	12,400	2.0

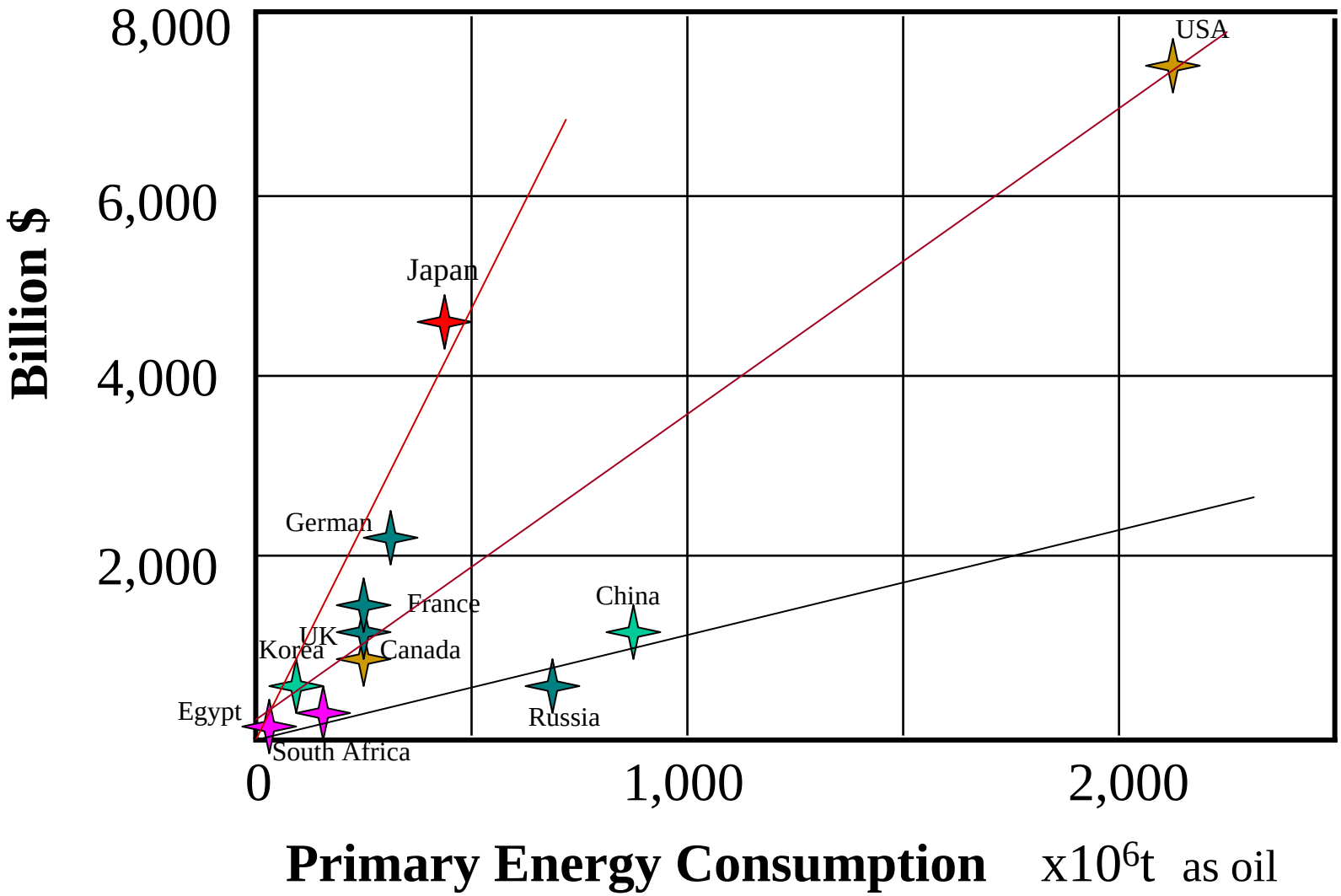
Denryoku-chuukenn: Concept of Future Energy (Japan electric research center) 1998



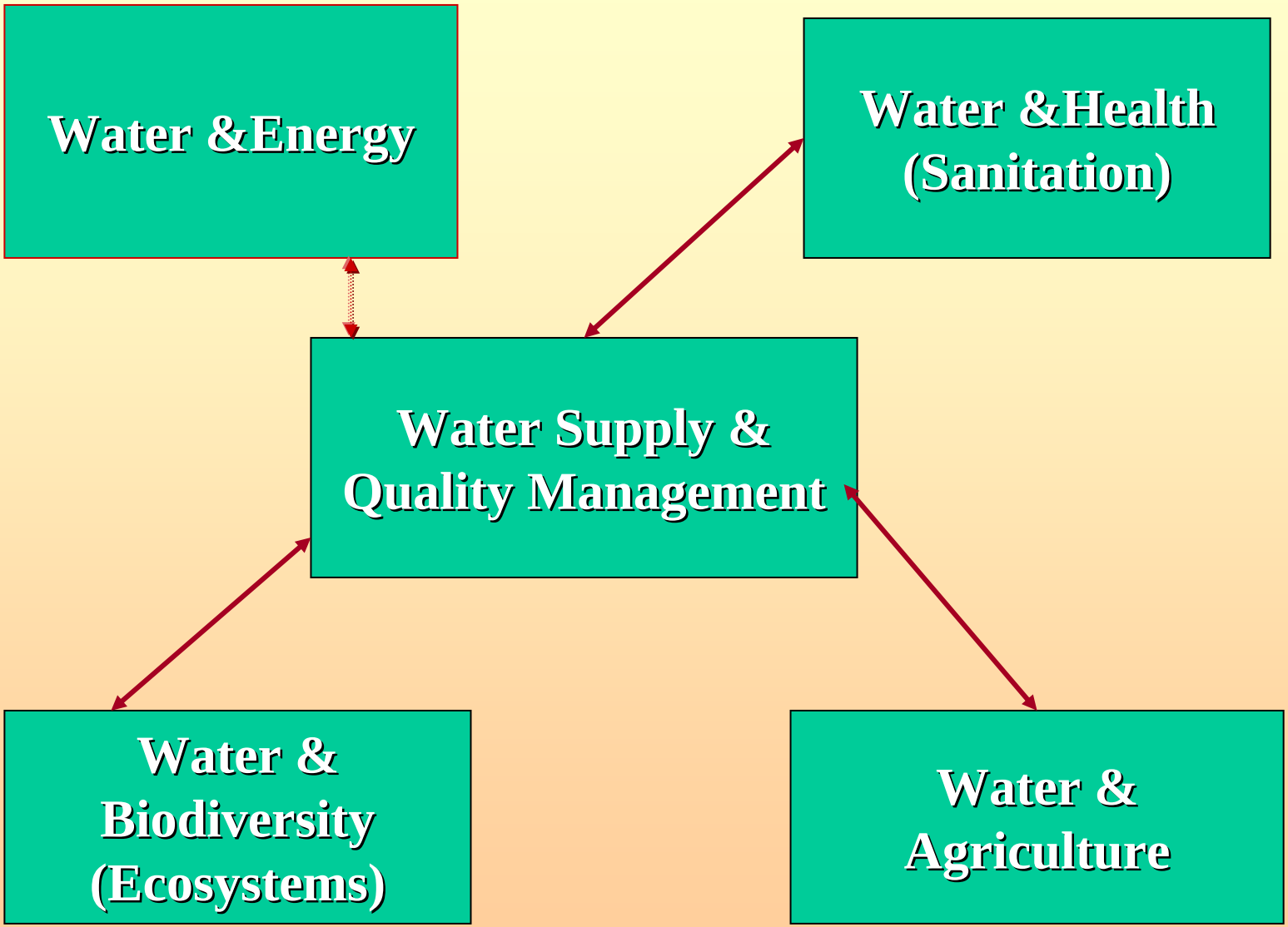
Data from Uppsala Hydrocarbon Depletion Study Group

Campbell & others 2001

GDP vs. Energy Consumption (1996) UN



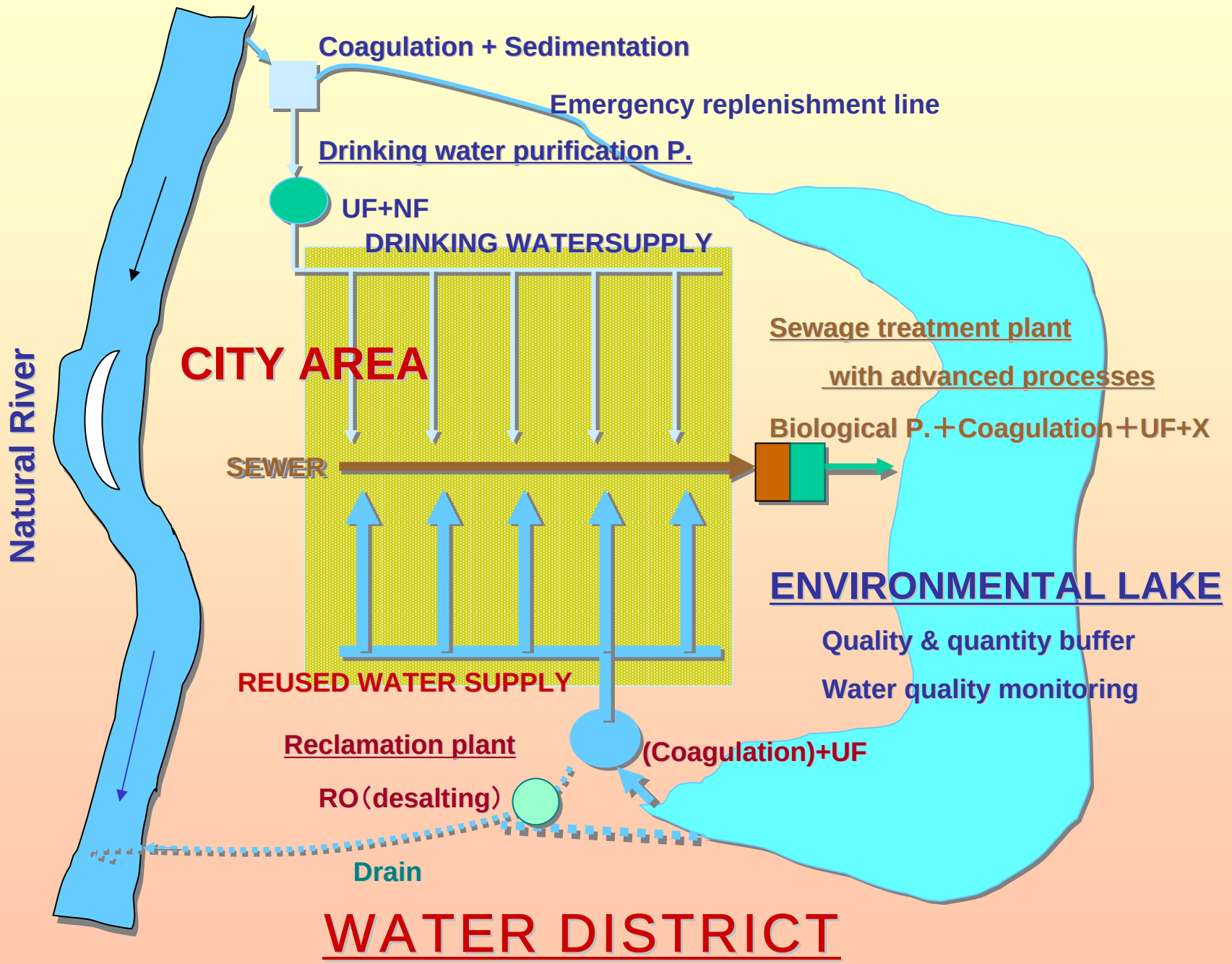
Tambo 2000

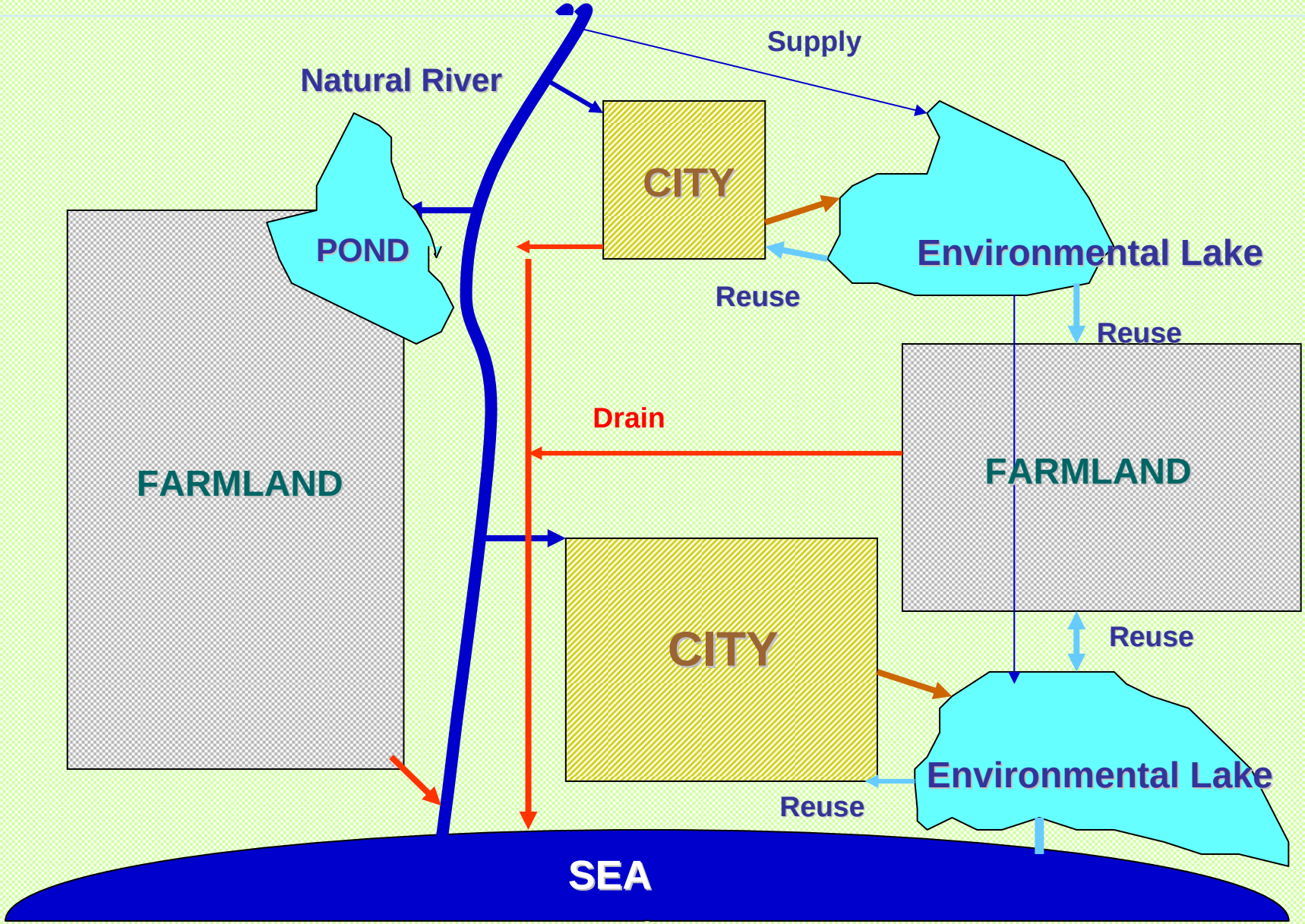


Water Sectors

WATER DISTRICT

- **Establishment of much more closed urban aquatic metabolism for high population density and activity area.**
- **Water district is more ergonomic system than ecological.**
- **Integrated river basin management is improved remarkably by introducing the water district concept.**


Coagulation + Sedimentation
Emergency replenishment line
Drinking water purification P.
UF+NF
DRINKING WATERSUPPLY
Natural River
CITY AREA
Sewage treatment plant
with advanced processes
Biological P.＋Coagulation＋UF+X
SEWER
ENVIRONMENTAL LAKE
Quality & quantity buffer
Water quality monitoring
REUSED WATER SUPPLY
Reclamation plant
(Coagulation)+UF
RO（desalting）
Drain
WATER DISTRICT



WATER DISTRICTS & FARMLAND

Tap v.s. Bottled Water

$ 1-2/m^3	$ 1000/m^3
300 L/p/d	20 L/p/d
mg/L	μ g/L

Energy Consumption

Tokyo Water & Sewage Works（1995） 7 million m^3/d

- Water & sewage works as a whole

  0.82 kWh/m^3

  (Treatment 45%、Transportation 55%)

- Water Supply 0.38 kWh/m^3

  (Treatment 20%、Transportation 80%)

- Sewage Works 0.44 kWh/m^3

  (Water & sludge treatment 67%, Transportation 33%)

- Sea Water Conversion : 3-5 kWh/m^3

WATER DISTRICTS AGRARIAN & RURAL AREAS

- **Avoid inefficiency (poor cost performance) of long distance bulk transportation.**
- **Separate excrement and gray water in order to ensure recycle of excrement for fertilizer and to get easy reuse of gray water for irrigation, ground water recharge etc. after developed sanitary quality control.**
- **Dispersed small scale treatment facilities and a new service installations are needed. It could be an appropriate technology for the developing world as well as to reconsider the 20th century commonsense of developed modern world.**

Eco-sanitation

Energy Recovery

Garbage

Fertilizer

Night soil

Urine

Dry toilet

Septic tank
Separator

Kitchen

Aerobic
Wastewater Treatment

Laundry

Irrigation, Recharge

Artificial wet land
(Pond)

Bath
/Shower

Clean Water Supply

Clean River

AGRARIAN & RURAL AREAS' SMALL SCALE FACILITIES

NIGHT SOIL

- Separated toilet
- Vacuum car or tube collection system
- Night soil digestion + aerobic process + good separation process +sludge recovery for fertilizer+conditioning
- Use of local natural energy source
- Local reuse of the recovery

GRAY WATER

- Separated domestic waste collection + aerobic treatment
- Water reuse on site
- Sludge recovery
- Use of local natural energy source

Truly advanced concept and technology such as Biotechnology, Membrane technology, Control technology, Energy technology, Reliable materials etc. are needed.