ECO-SMART & INNOVATIVE WASTEWATER MANAGEMENT

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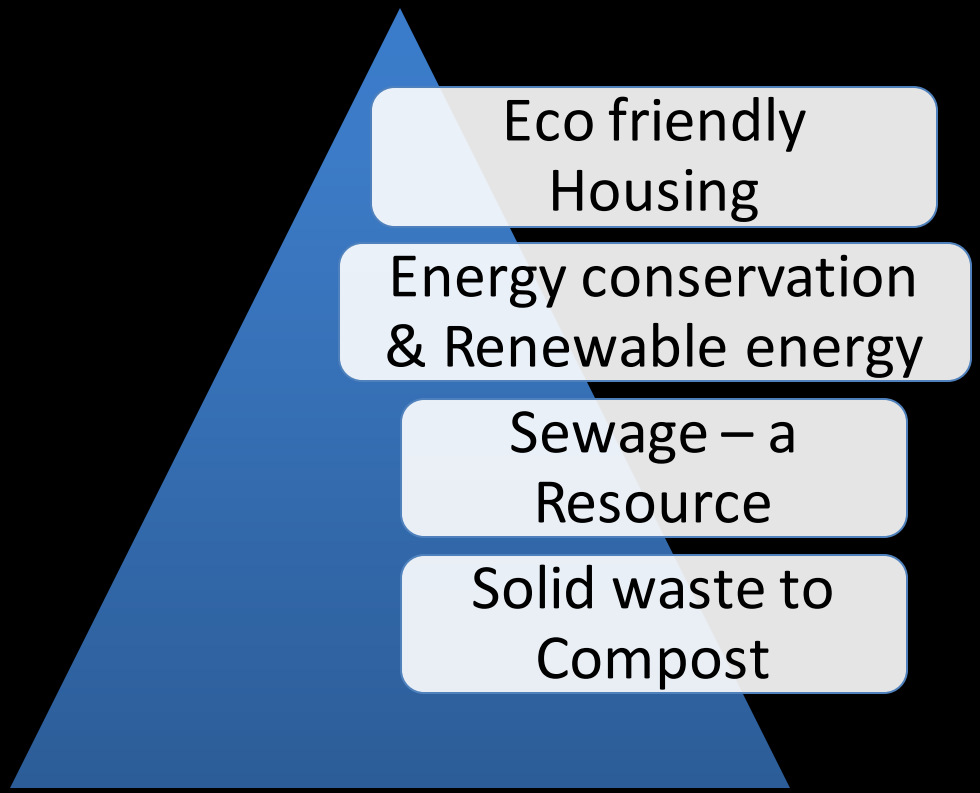
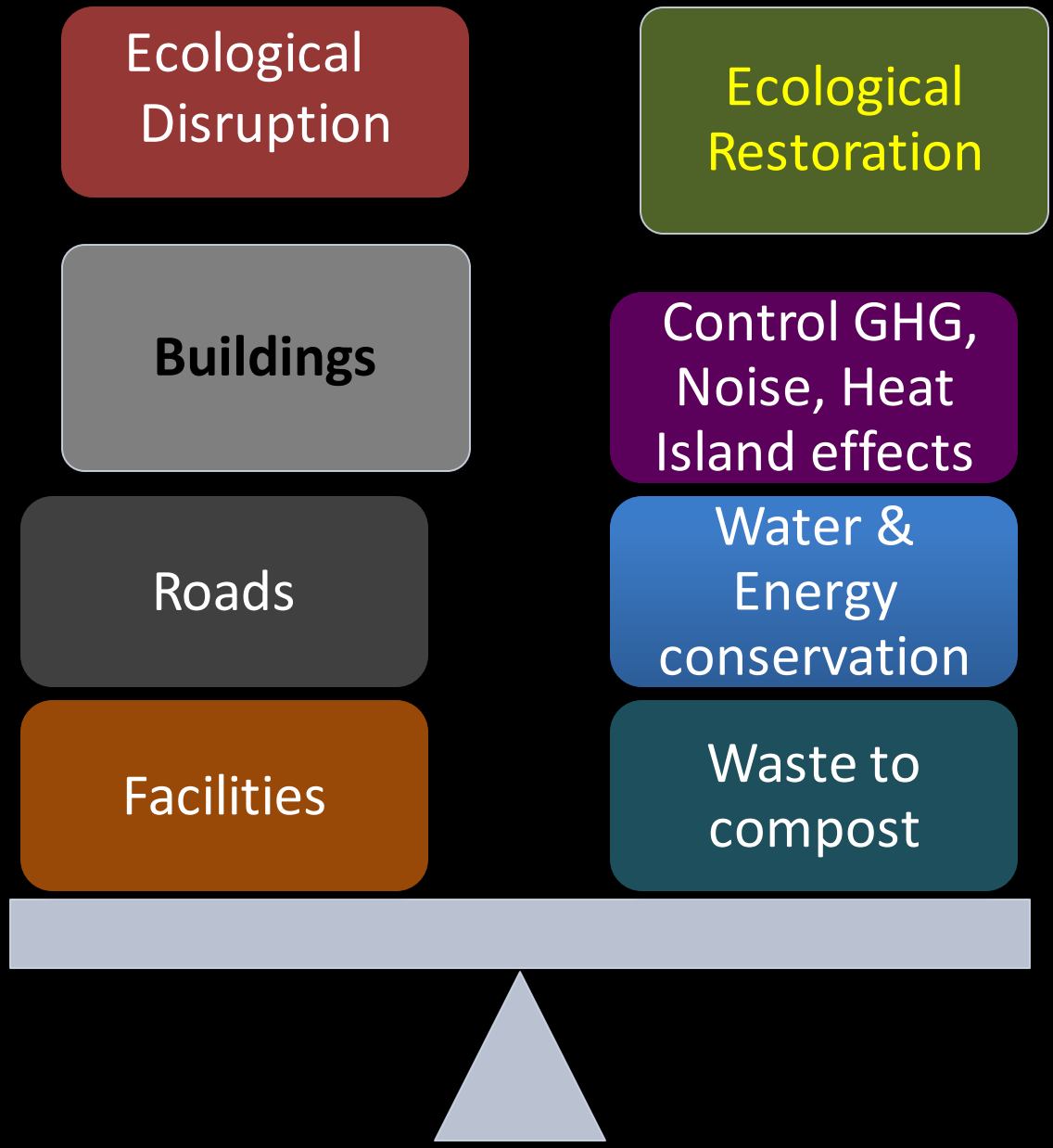
Engineer-Environment Friendship –creation of a Role Model



ECO FRIENDLY HOUSING


Ecological Disruption
Ecological Restoration
Buildings
Control GHG, Noise, Heat Island effects
Roads
Water & Energy conservation
Facilities
Waste to compost

Ecological Footprint

A **tree** can **absorb** an avg of 48 pounds of **carbon dioxide** per year

the impact of a person or community on the environment, expressed as the amount of land required to sustain their use of natural resources. *For calculation methods refer https://www.witpress.com/Secure/elibrary/papers/SC06/SC06033FU1.pdf*

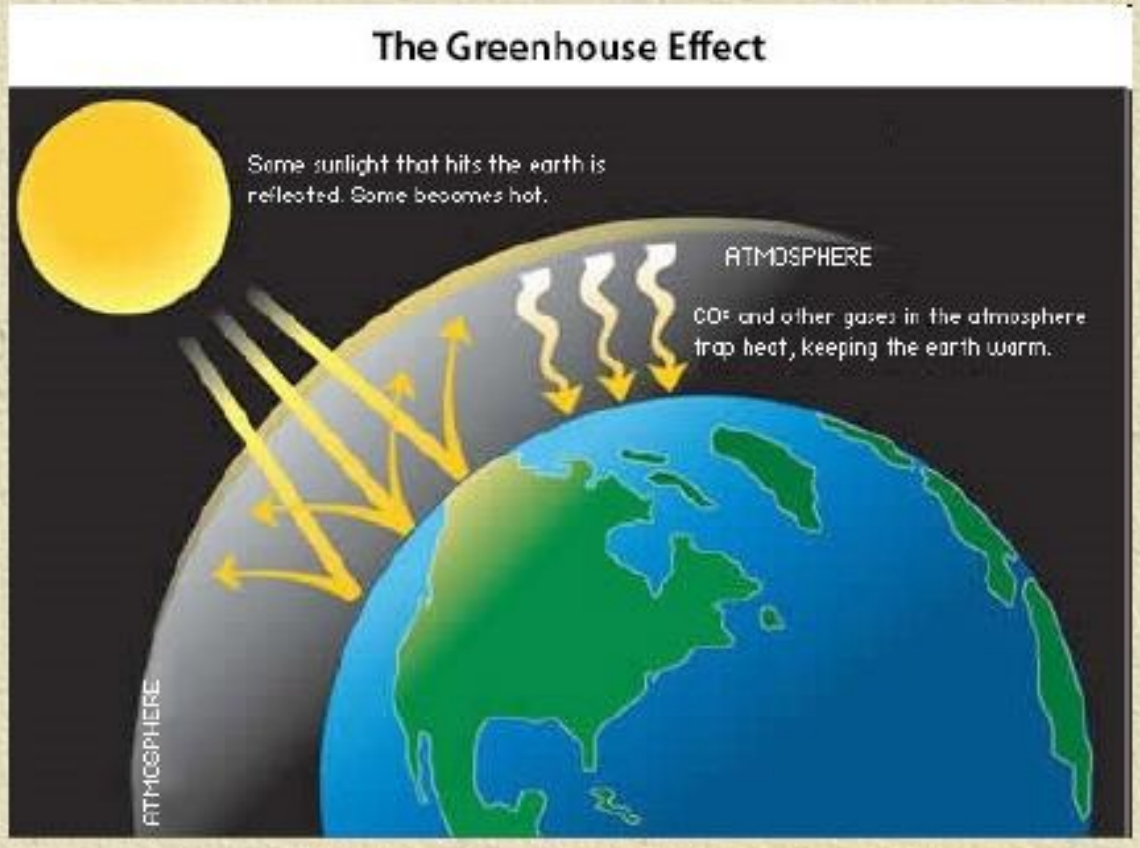
LEED Rating of Buildings

Leadership in Energy and Environmental Design

Certified: 40–49 points
Silver: 50–59 points
Gold: 60–79 points
Platinum: 80 points and above

Composting helps slow Climate Change

Climate Change (or Global Warming) is caused by greenhouse gases in our atmosphere.

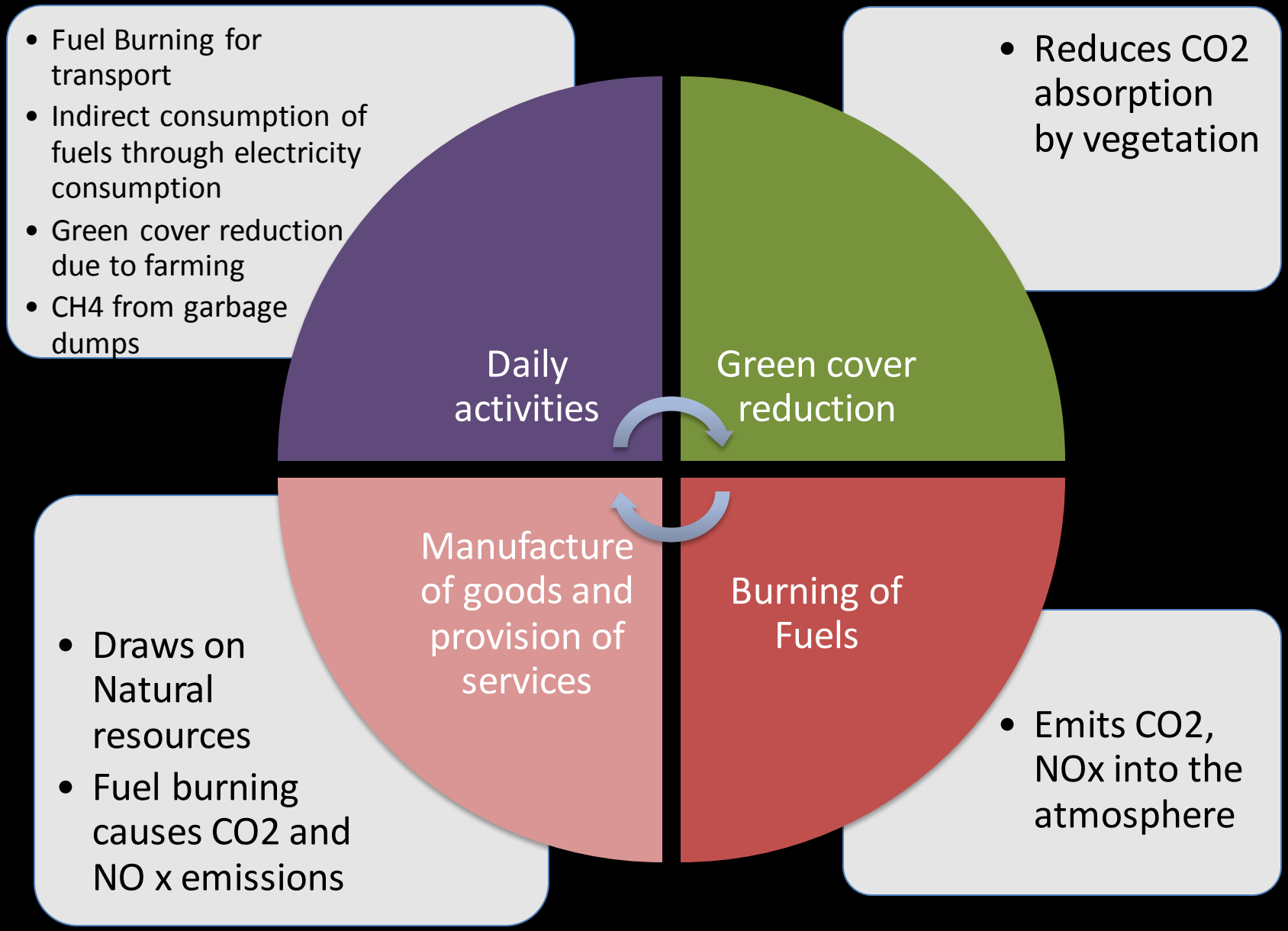


Greenhouse Gases:

Carbon Dioxide

Methane

Nitrous Oxide


• Fuel Burning for transport
• Indirect consumption of fuels through electricity consumption
• Green cover reduction due to farming
• CH4 from garbage dumps
• Reduces CO2 absorption by vegetation
Daily activities
Green cover reduction
Manufacture of goods and provision of services
Burning of Fuels
• Draws on Natural resources
• Fuel burning causes CO2 and NO x emissions
• Emits CO2, NOx into the atmosphere

Controlling GHG emissions

$CH_4 + CO_2$

Septic tank

Sewage Recycling Plant

Controlling GHG emissions

Composting bins

CH4+ CO2

Garbage Landfills

Compost Plant

Controlling GHG emissions

Composting bins

Reduce load on Centralized Plant

Knock odour out of the equation

Reduce cost of haulage

Encourage community participation

Conserve fuel

Controlling GHG emissions

Preferred option

Electric water heaters

Solar water heaters

Controlling GHG emissions

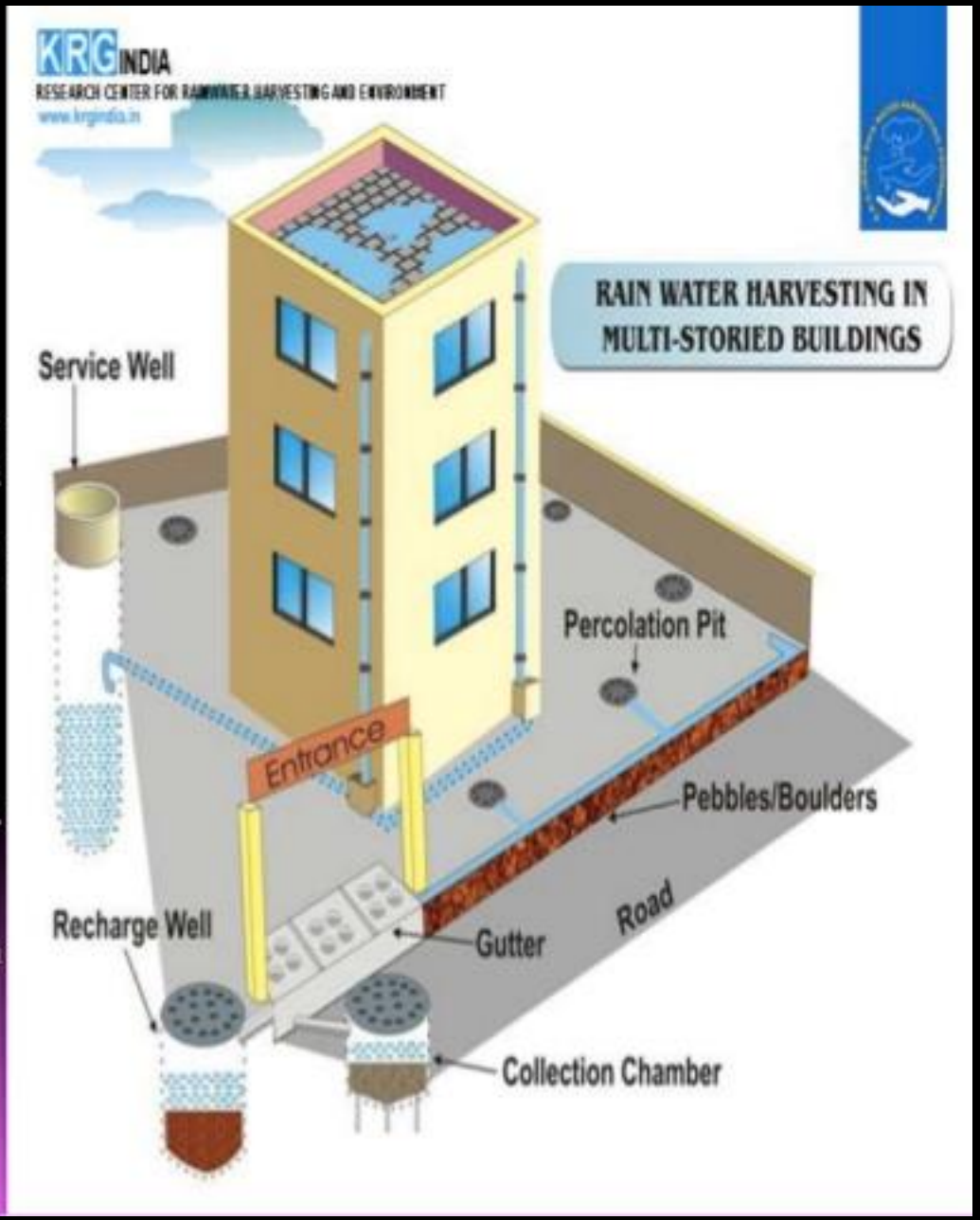
Preferred option

Concrete jungle

Green Housing

Rainwater harvesting systems installed in Multistoried buildings can suffice for daily water usage by the building residents :

- Rainwater collected in the roof flows down the pipes running down the length of building, into **Service Wells** or **Percolation Pits**
- Water trickles down the layer of Pebbles and Boulders designed for underground filtration
- Filtered water flows into either **Recharge Well** or the **Collection Chambers**
- With this setup, the building can draw water readily from its water table in the basement, without any shortage in supply



ROADSIDE WASTE RAINWATER

- Rainy Seasons often result in torrential precipitation
- Water clogging can be seen in **URBAN** as well as **RURAL** areas
- Be it the asphalted **ROADS** or **MUDSCAPES**, rainwater percolates from these surfaces and runs downs the high drains, ultimately adding to the sewage bulk.
- It's a considerable amount of precipitate that gets wasted from the ROADSIDE – A system for **ROADSIDE RAINWATER HARVESTING** is mandatory.

HOW ROADSIDE RAINWATER HARVESTING

- If implemented & practiced regularly, **ROADSIDE RAINWATER HARVESTING** is the most convenient and effective way of conserving the precipitation
- Considering the volume of water raining on 1 square foot area of the road per year, gallons of water can be saved by the process.
- Baffle walls constructed intermittently along the length of the roadside drains force flowing rainwater to trickle down the pit-holes
- An inbuilt De-silting cum Filtration chamber purifies the inflow and directs it towards **Recharge Well**

SEWAGE– A RESOURCE

STP

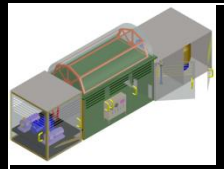
INNOVATIVE DESIGN

WATER SAVED

An Ideal Sewage Treatment Technology

Excellent track Record

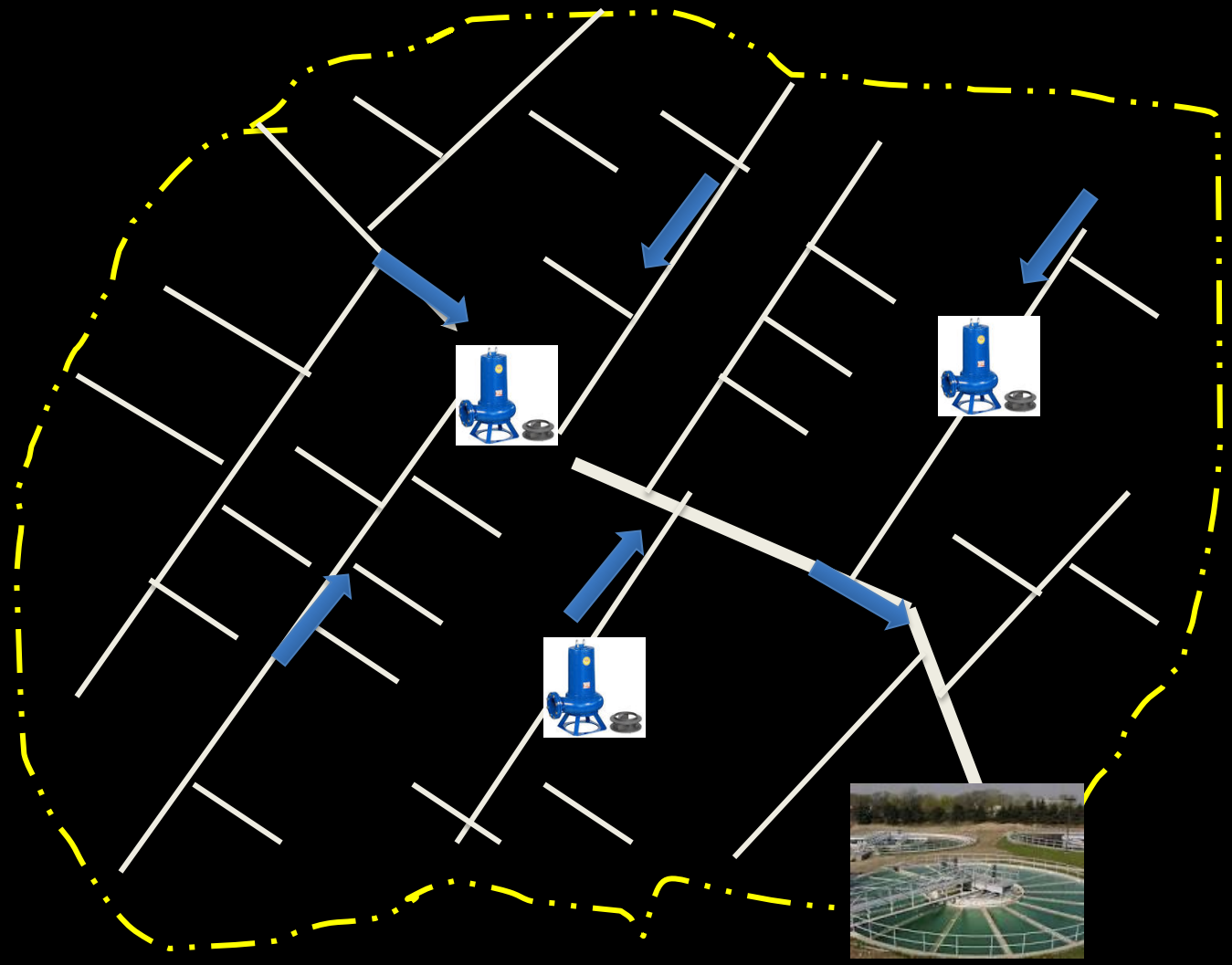
SMALLER TANKS TO BUILD



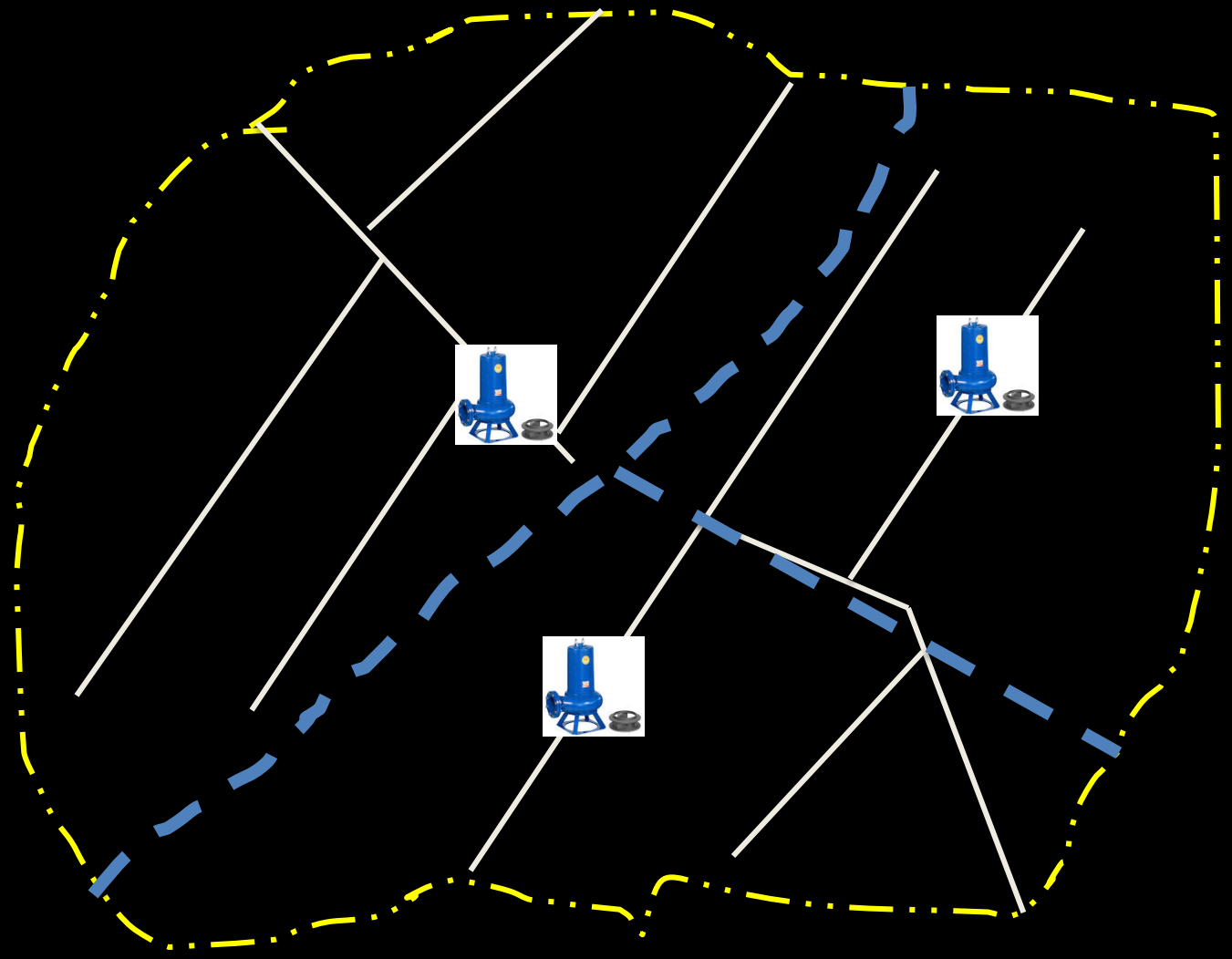
SPACE SAVED

GOOD QUALITY COMPOST FROM SLUDGE

One or Multiple ??

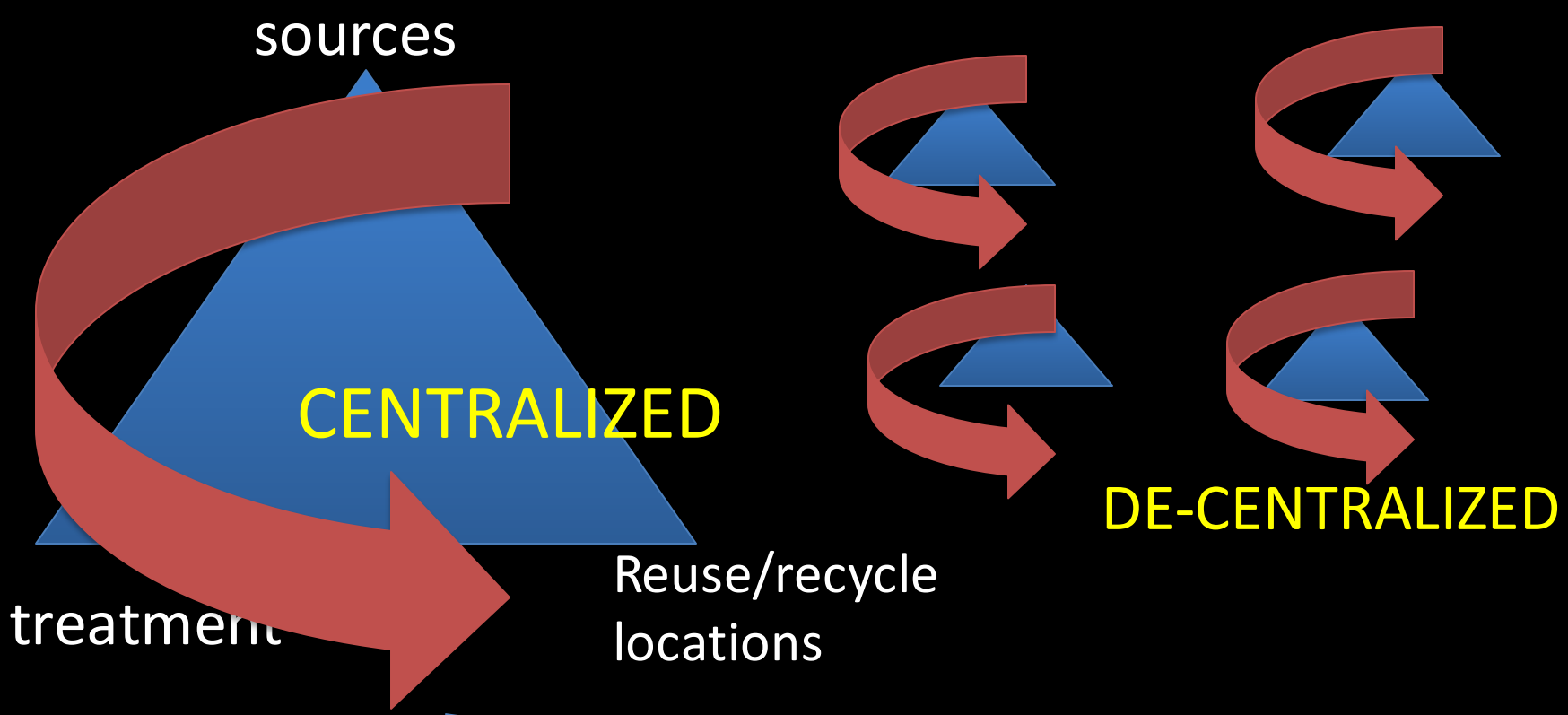


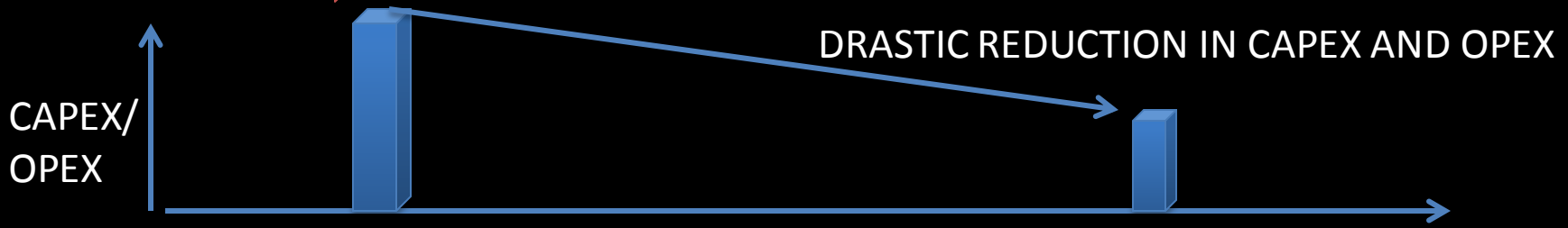
Centralized Sewage Management system

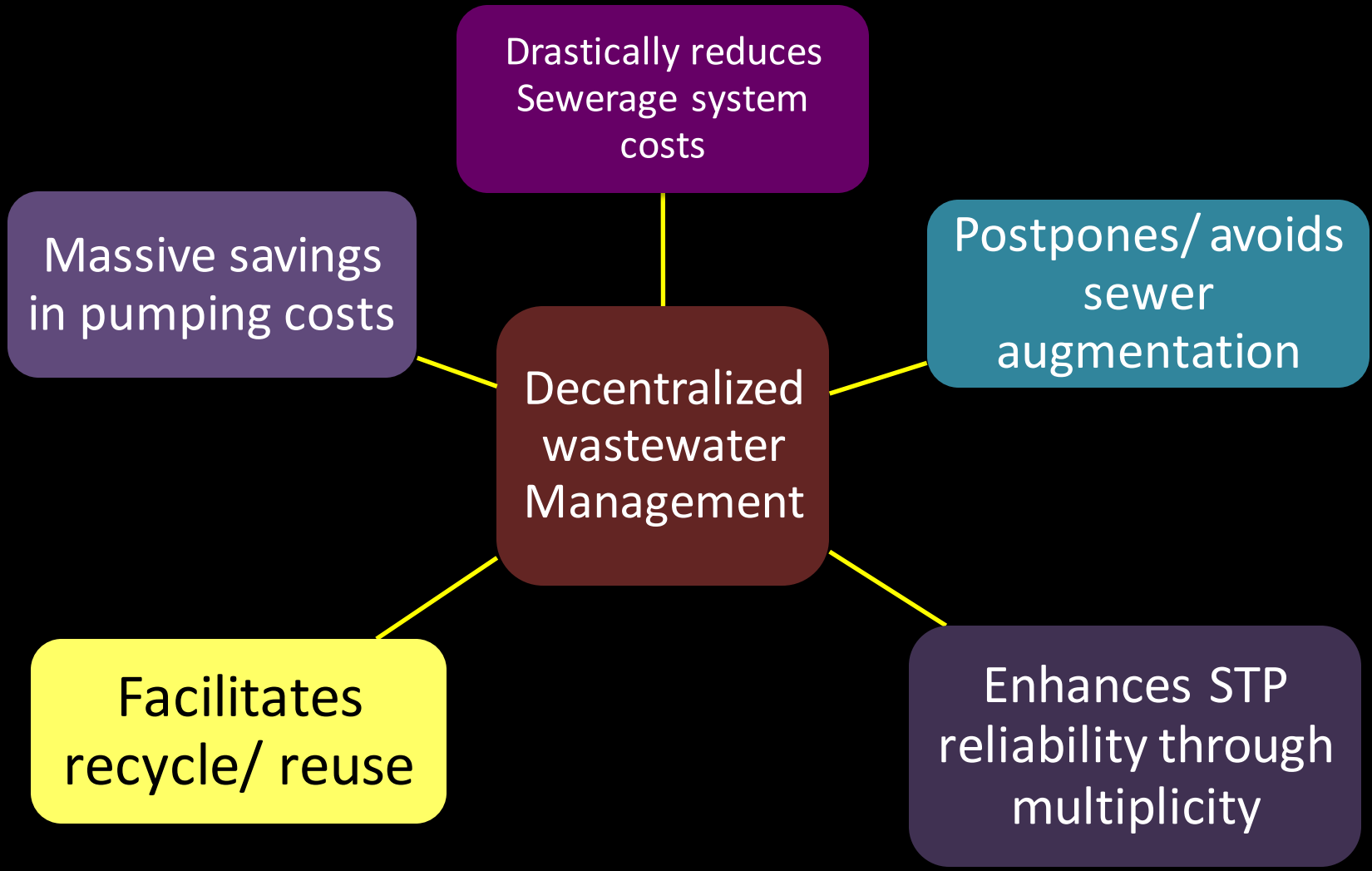


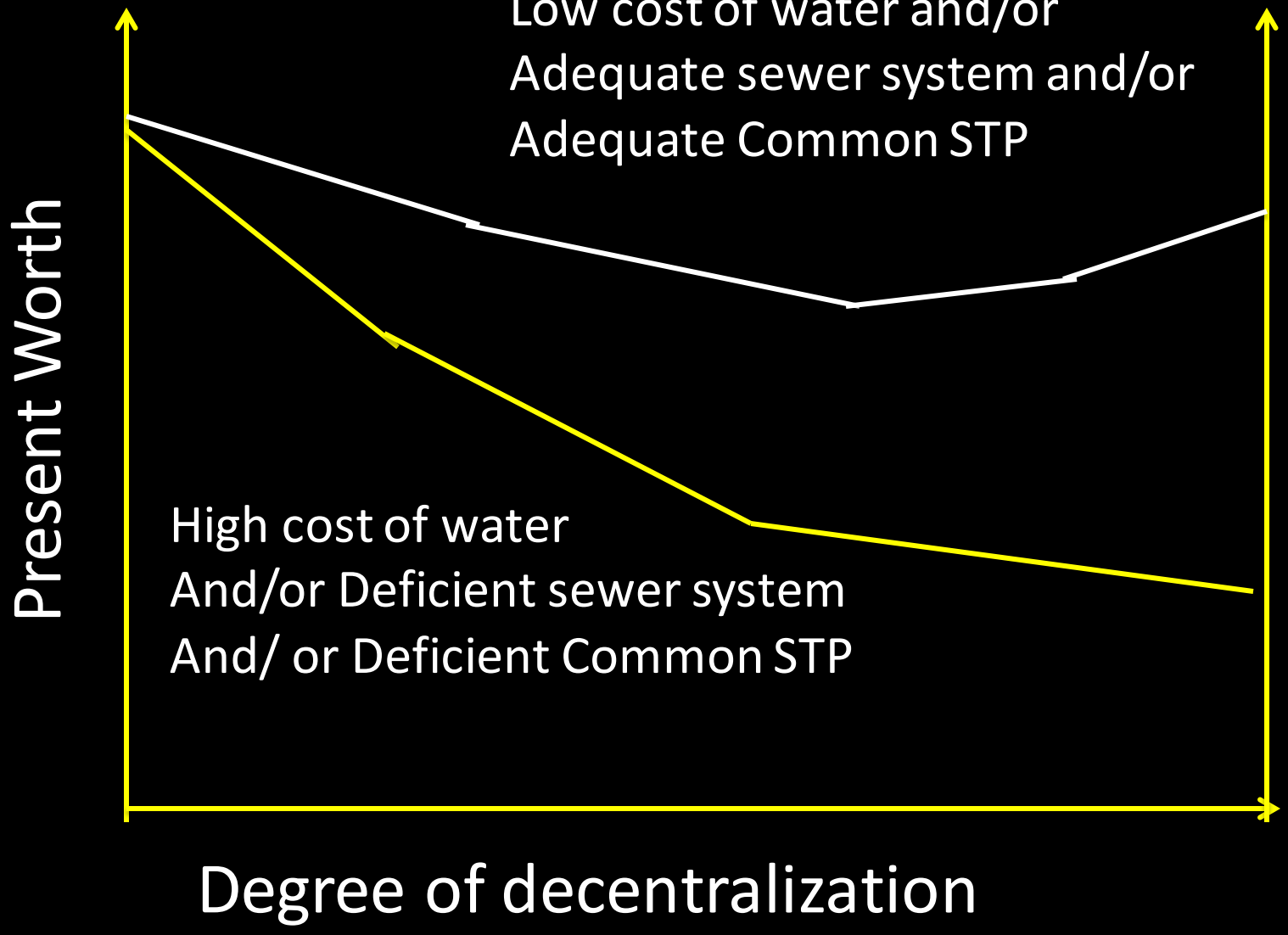
Decentralized Sewage Management system

A MODERN APPROACH
– Decentralized configurations

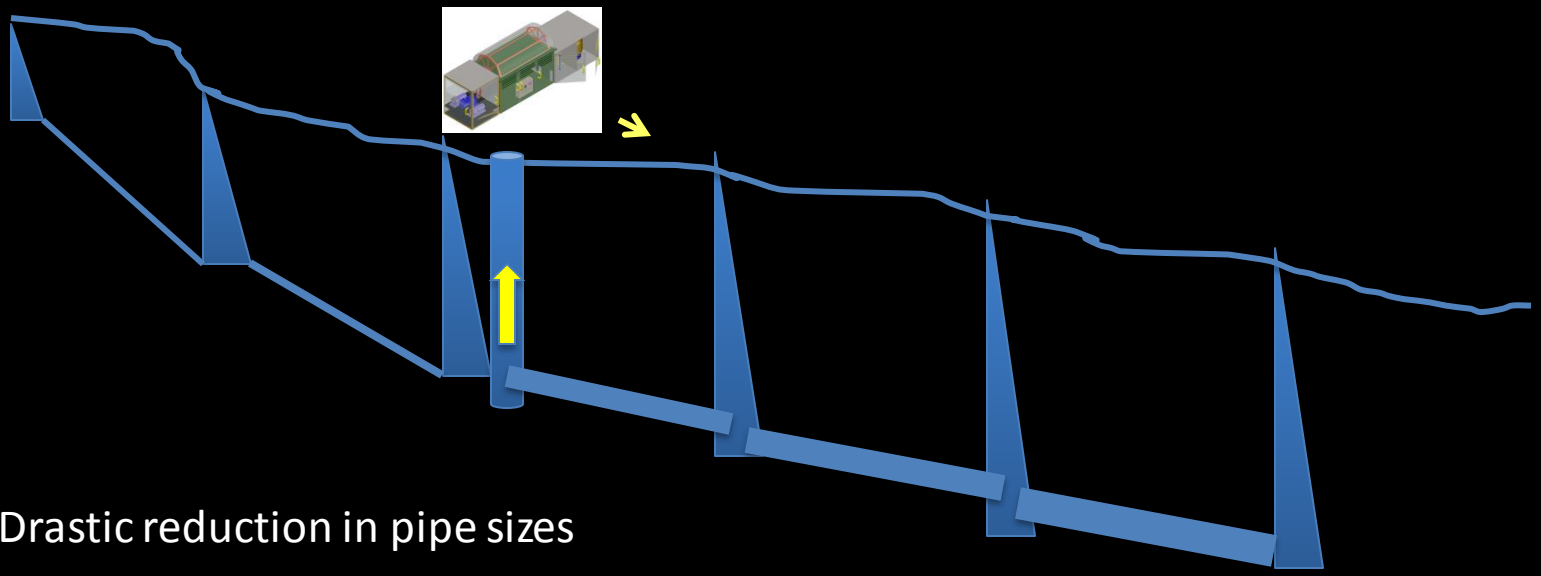





Drastically reduces Sewerage system costs
Massive savings in pumping costs
Postpones/ avoids sewer augmentation
Decentralized wastewater Management
Facilitates recycle/ reuse
Enhances STP reliability through multiplicity


Low cost of water and/or
Adequate sewer system and/or
Adequate Common STP
High cost of water
And/or Deficient sewer system
And/ or Deficient Common STP
Present Worth
Degree of decentralization

Decentralized Configurations for Cost effectiveness

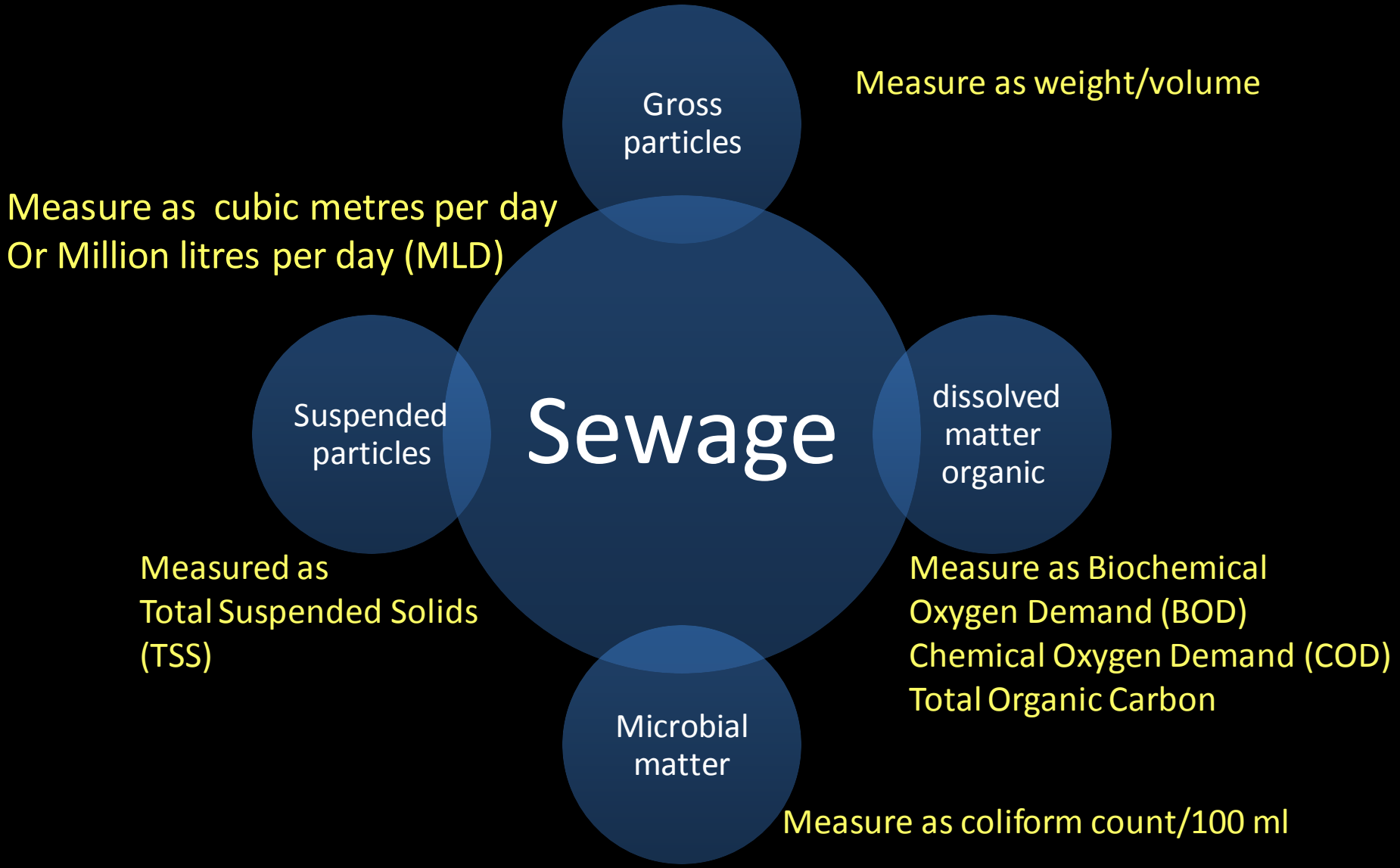


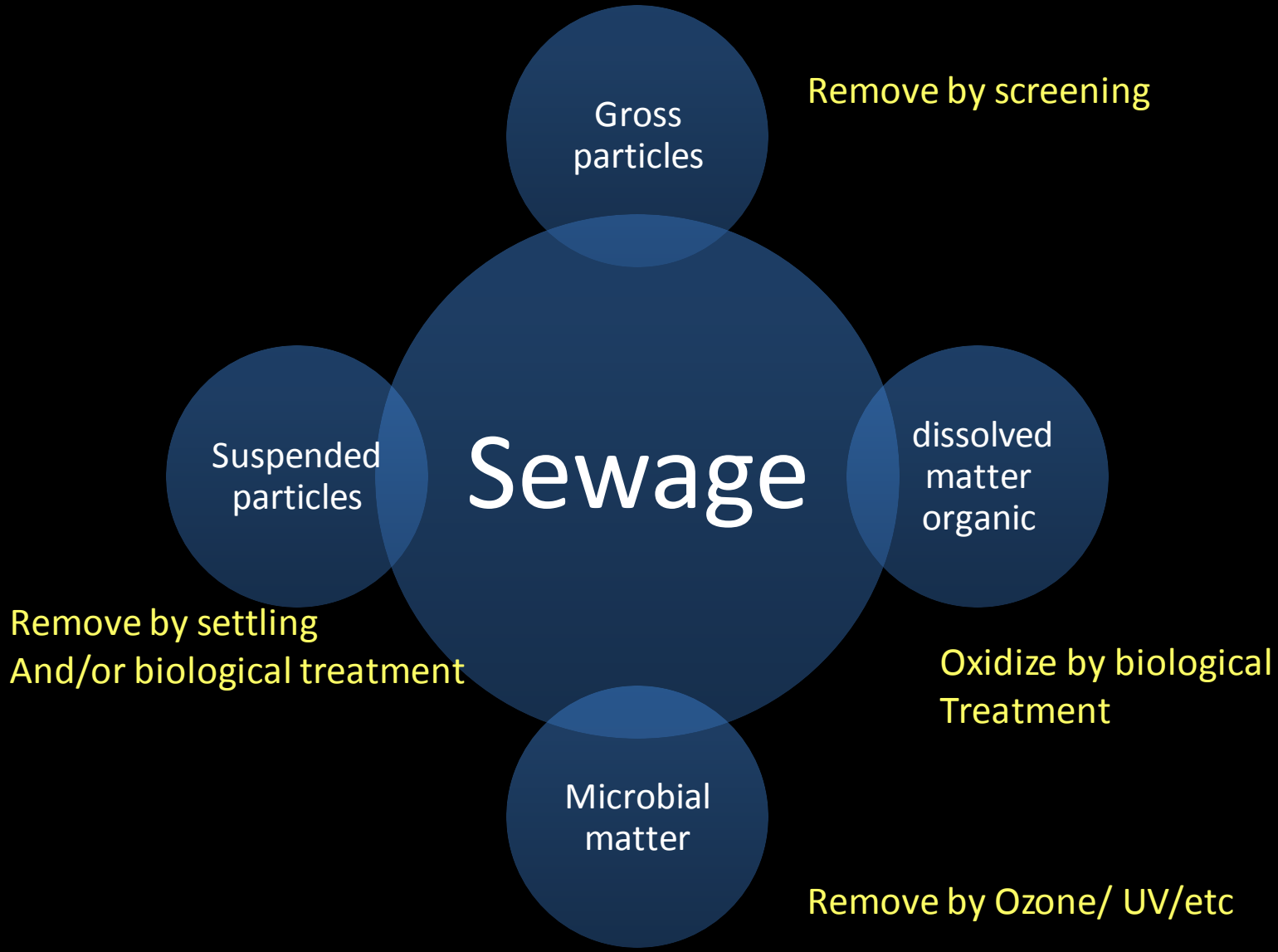
Drastic reduction in pipe sizes

Reduction in depths and excavations

Reduction in manhole depths

UNDERLYING PRINCIPLES IN SEWAGE TREATMENT TECHNOLOGIES


Gross particles
Measure as weight/volume
Measure as cubic metres per day
Or Million litres per day (MLD)
Suspended particles
Sewage
dissolved matter organic
Measured as
Total Suspended Solids
(TSS)
Measure as Biochemical
Oxygen Demand (BOD)
Chemical Oxygen Demand (COD)
Total Organic Carbon
Microbial matter
Measure as coliform count/100 ml


Gross particles
Remove by screening
Suspended particles
Sewage
dissolved matter organic
Remove by settling
And/or biological treatment
Oxidize by biological
Treatment
Microbial matter
Remove by Ozone/ UV/etc

Chemical Bond Energy

Organic matter

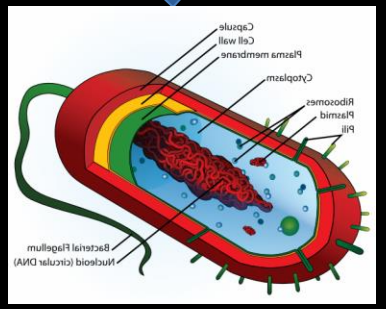
- Micro & Macro
- Nutrients

Pyruvic acid

- Common
- intermediate

CO_2+ Methane

CO_2+H_2O



- Absence of O_2
- ANAEROBIC

Presence of O_2
AEROBIC

- Nitrogen
- Phosphorus
- Organic matter
- Oxygen

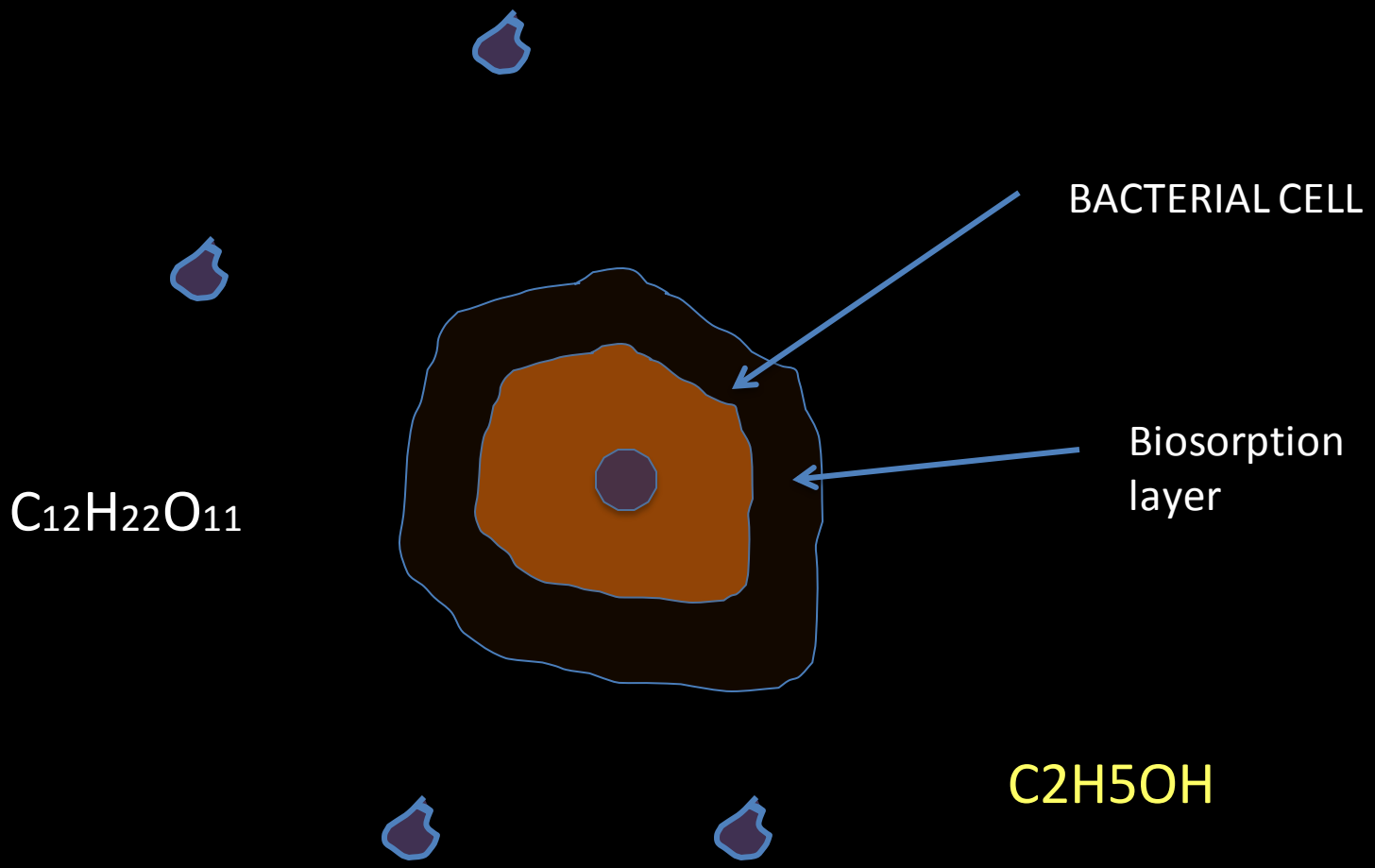
Whichever of these
Is in deficient amounts

G O V E R N S

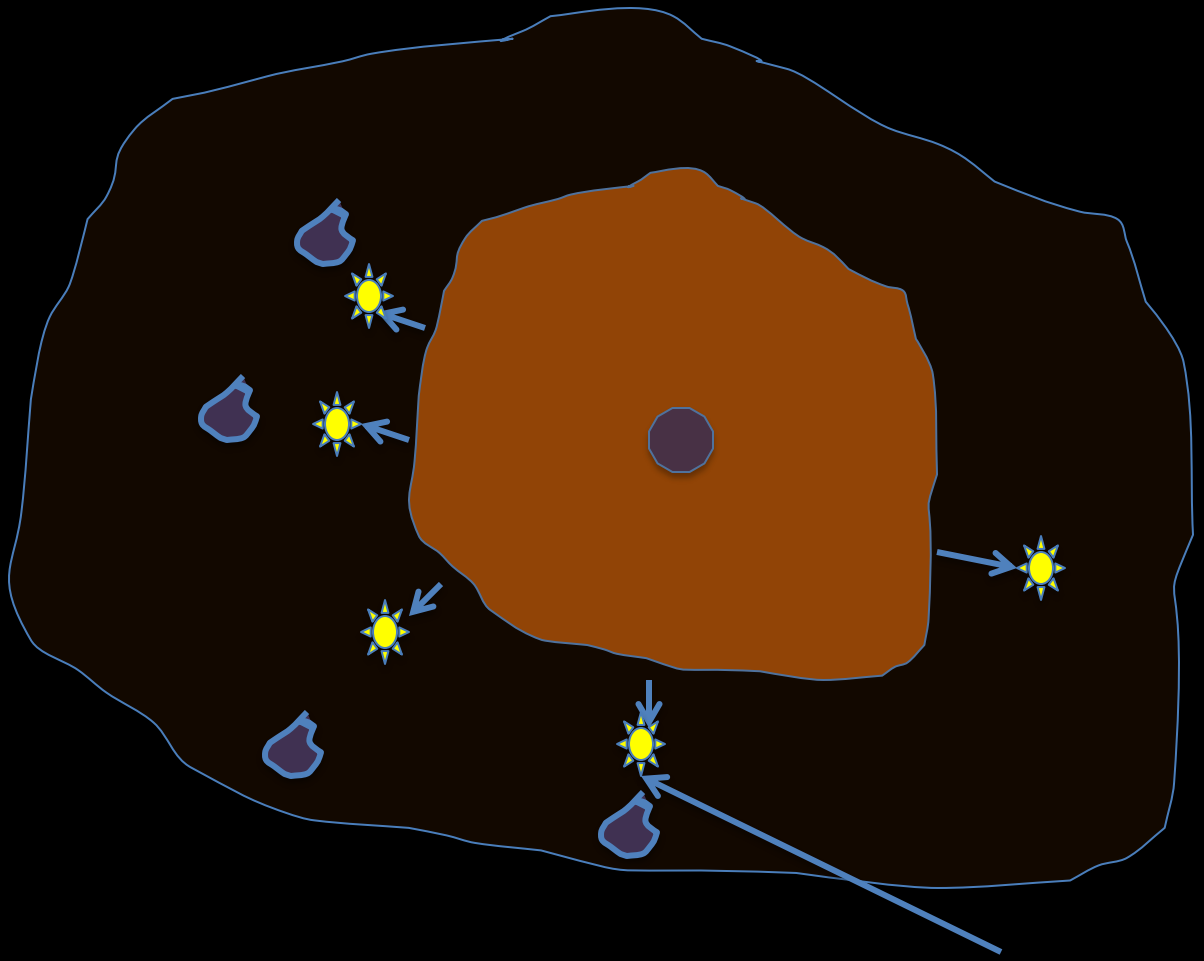
THE RATE OF REACTION

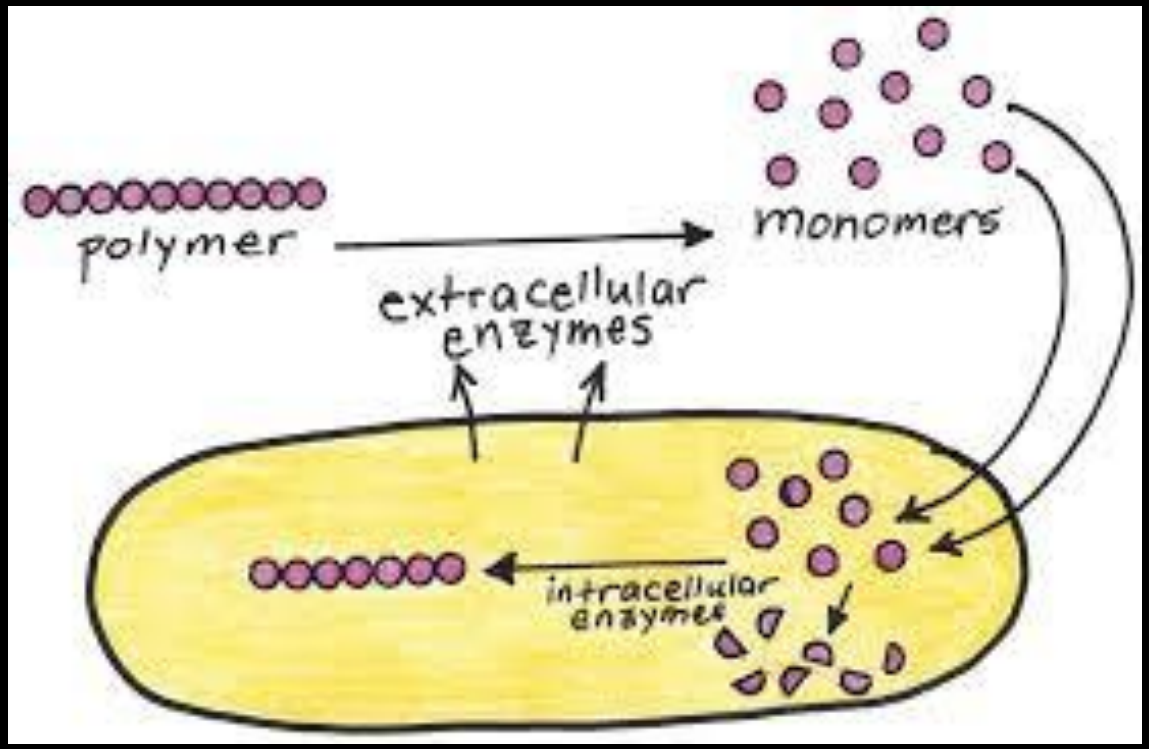
LEIBIG'S LAW OF MINIMUM

Substrate transport



Substrate hydrolysis and solubilization




polymer
monomers
extracellular enzymes
intracellular enzymes

Many hours

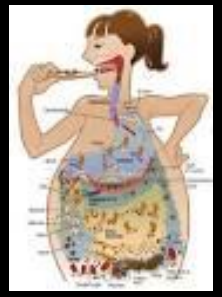
15-30 minutes

Bulk Transport

Diffusion into biosorption zone

Diffusion into cell

Metabolism



Microbes need :

A HABITAT --- Physical “dwelling place”

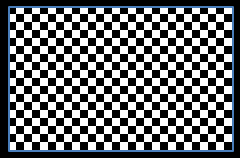
A NICHE --- Conducive environmental conditions

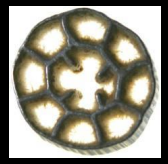
Nutrients– Nitrogen, Phosphorus, Trace elements

Oxygen / No Oxygen

pH, etc

BIOLOGICAL TREATMENT TECHNOLOGIES

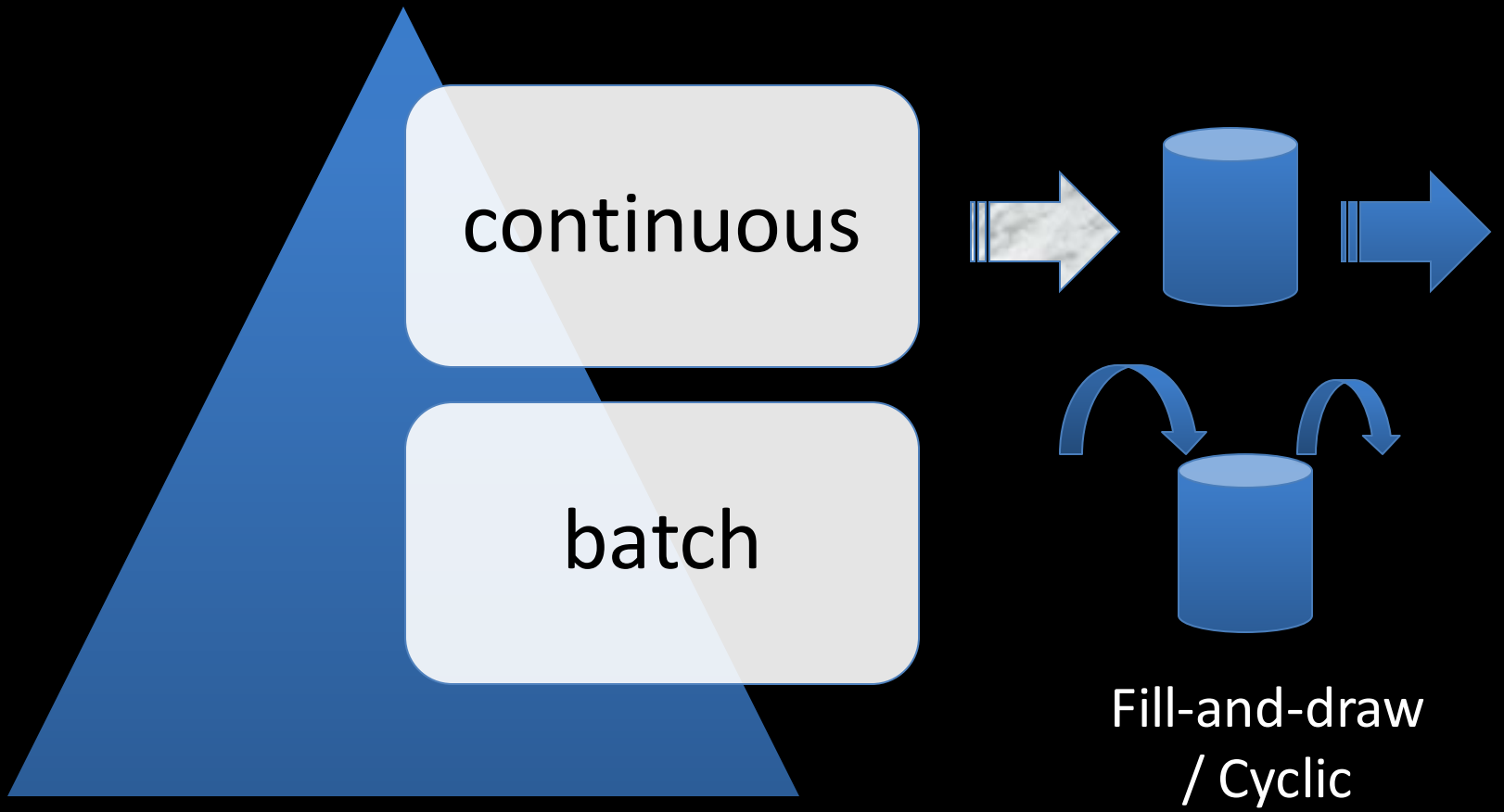




- ATTACHED GROWTH
- SUSPENDED GROWTH
- HYBRID
- CARRIER

PERMUTATIONS AND COMBINATIONS

- AEROBIC
- FACULTATIVE
- ANAEROBIC


continuous
batch
Fill-and-draw
/ Cyclic

	ANAEROBIC	FACULTATIVE	AEROBIC-ANOXIC HYBRID	AEROBIC
SUSPENDED	COMPLETE MIX ANAEROBIC SYSTEMS	AEROBIC-ANAEROBIC LAGOONS	ASP WITH ANOXIC ZONES/REACTORS	ASP GROUP SBRs
ATTACHED	ANAEROBIC ATTACHED GROWTH	NIL	NIL	1. BIOFILTERS, 2. STATIONARY AEROBIC FIXED FILM; 3. RBCS & RMBRS
HYBRID	UPFLOW ANAEROBIC SLUDGE BLANKET (UASBR) WITH OR WITHOUT ATTACHED GROWTH ZONE	NIL	NIL	ACTIVATED BIOFILTER (BIOFILTER+ ASP)

Innovations for space and power savings

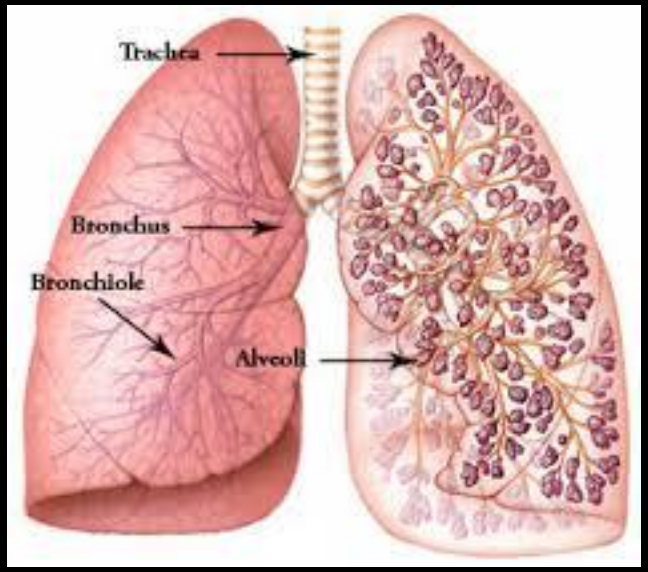
Getting “ECO SMART”

PROCESS INTENSIFICATION

More microbes per unit volume

Means more compact reactors

And smaller footprints

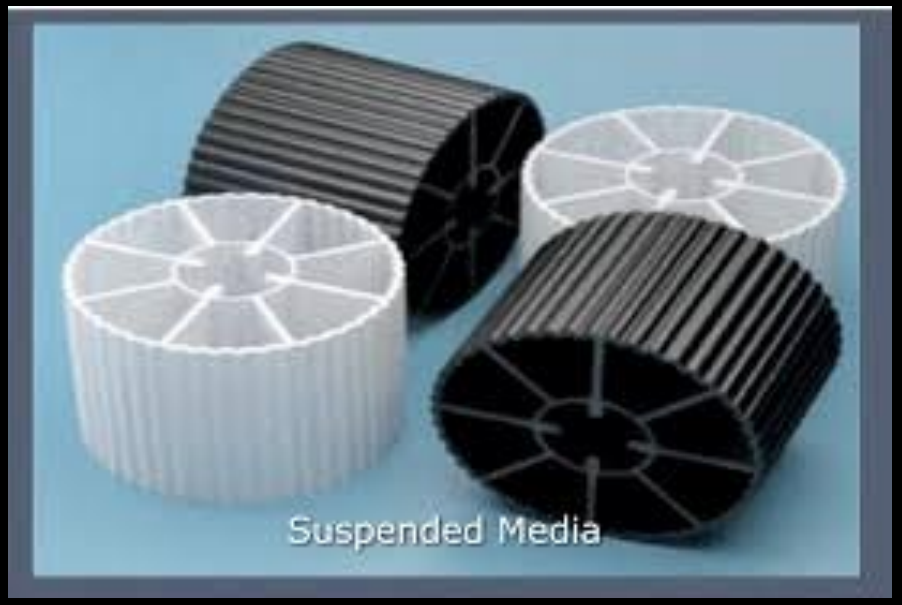


Alveoli (air sacs)
In Lungs

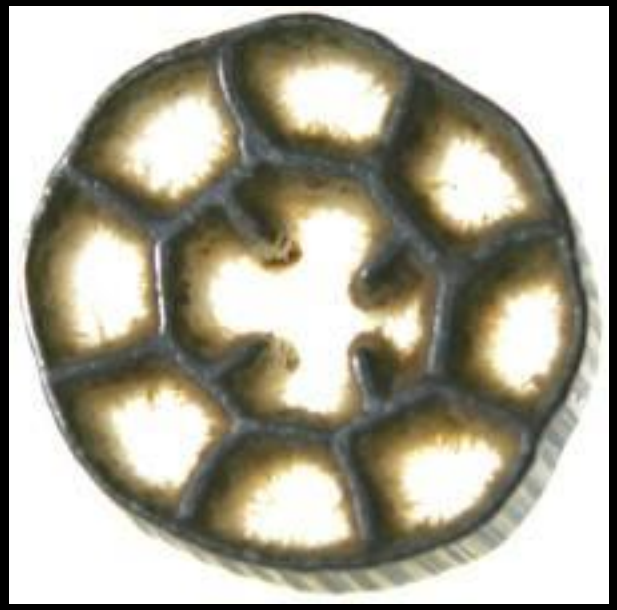
More surface area
Hence more O2 transfer

High specific surface Media
In Bio Reactors

More surface area
Hence more O2 transfer



AFTER BIOFILM DEVELOPMENT



High specific surface media

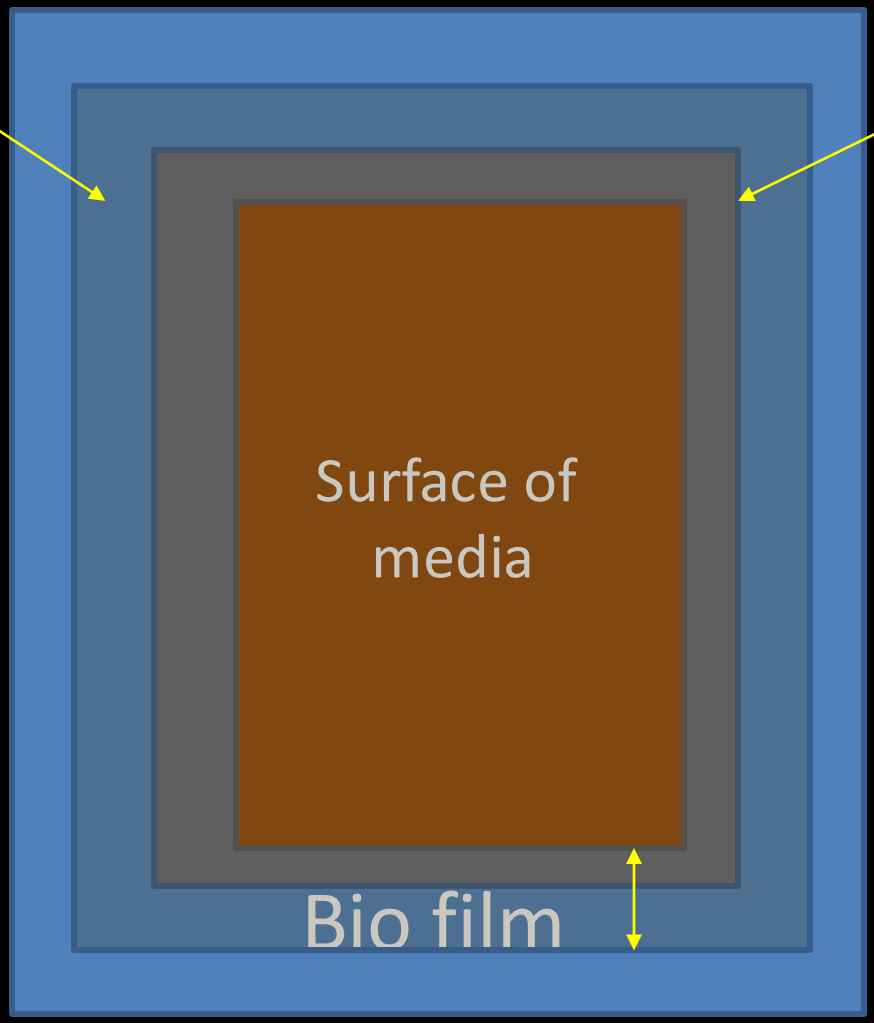
→ Denser bio film

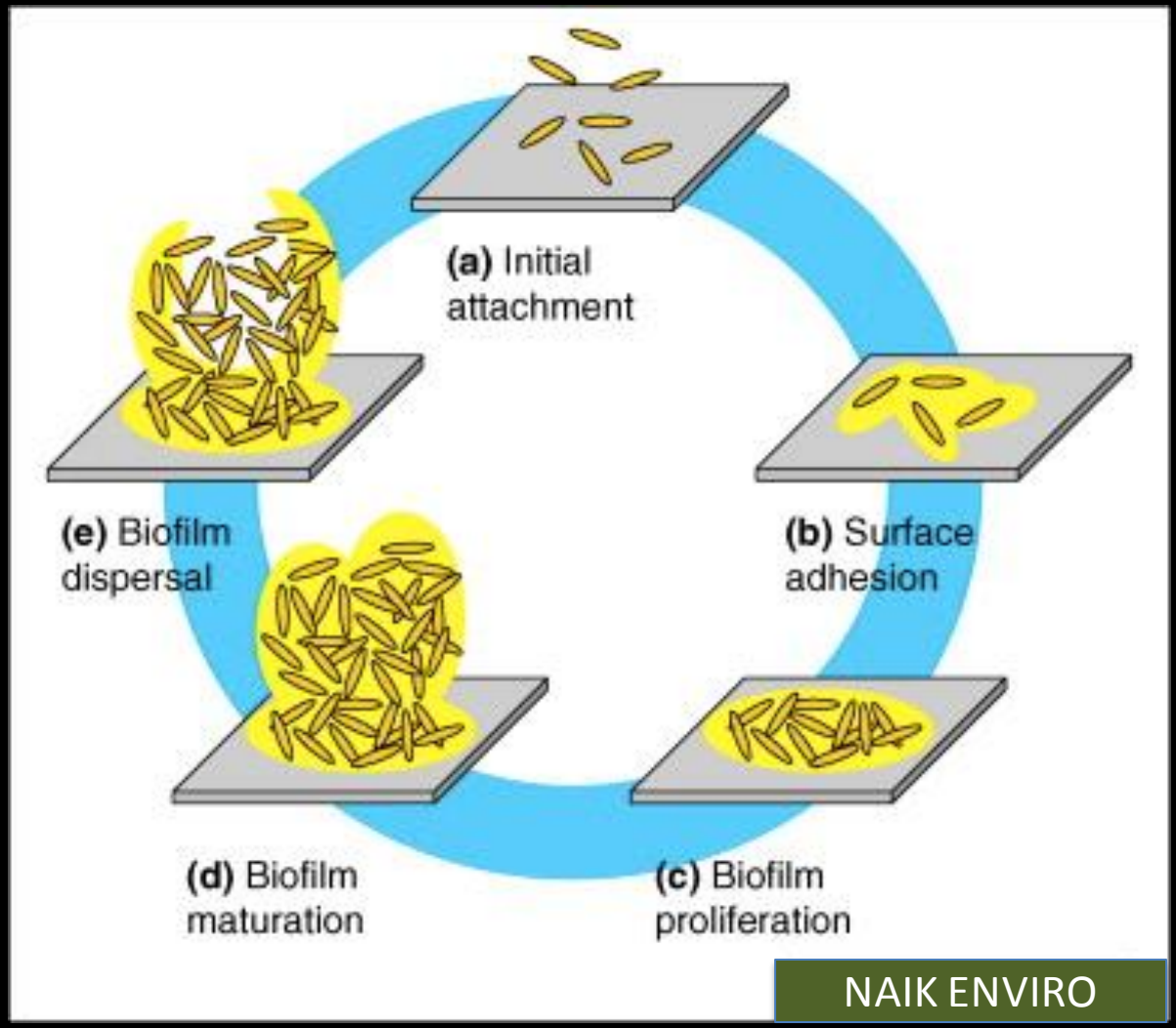
→ More intense biochemistry

Abundant food

Food in Short supply

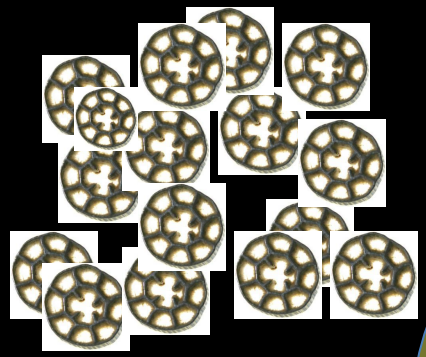
Sewage film Containing Food And O2

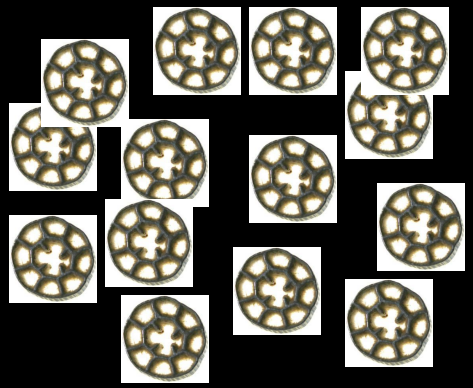



(a) Initial attachment
(b) Surface adhesion
(c) Biofilm proliferation
(d) Biofilm maturation
(e) Biofilm dispersal

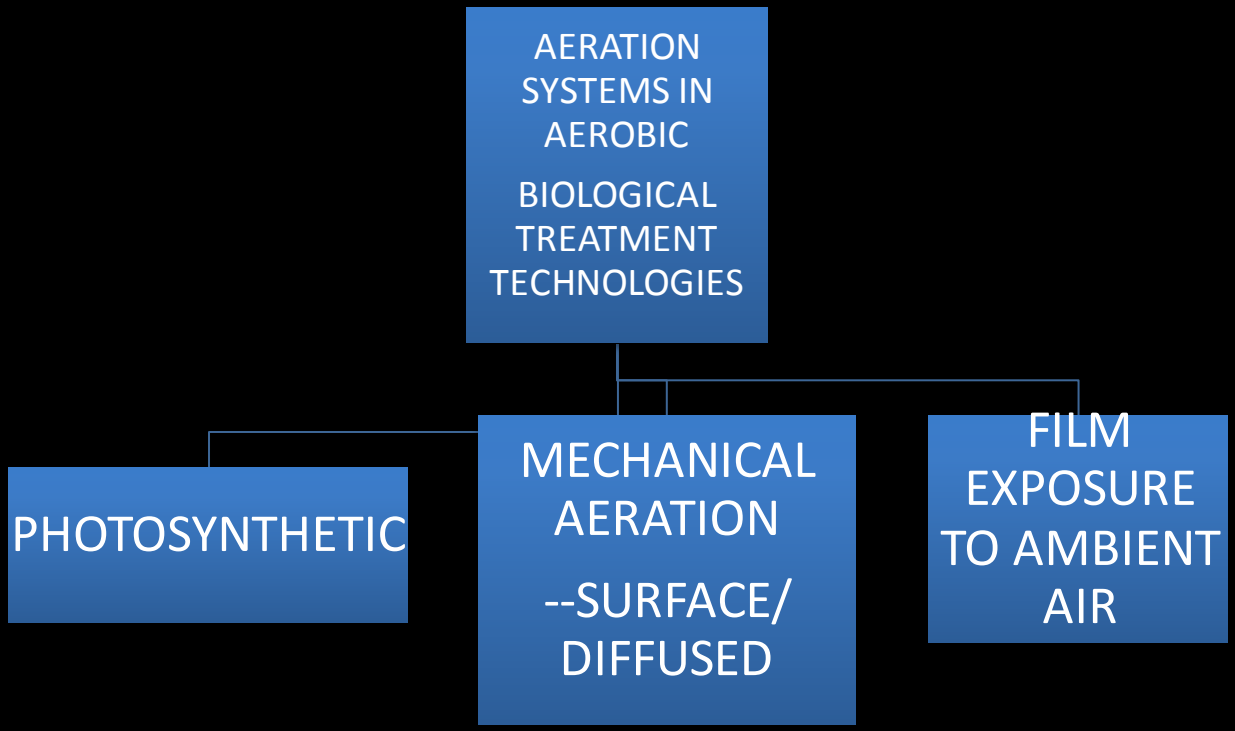
NAIK ENVIRO

Rotating Media Bio Reactor—Biofilm Growth cycle





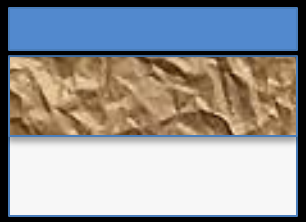
NAIKENVIRO The Heart-N-Science of Environmental Engineering

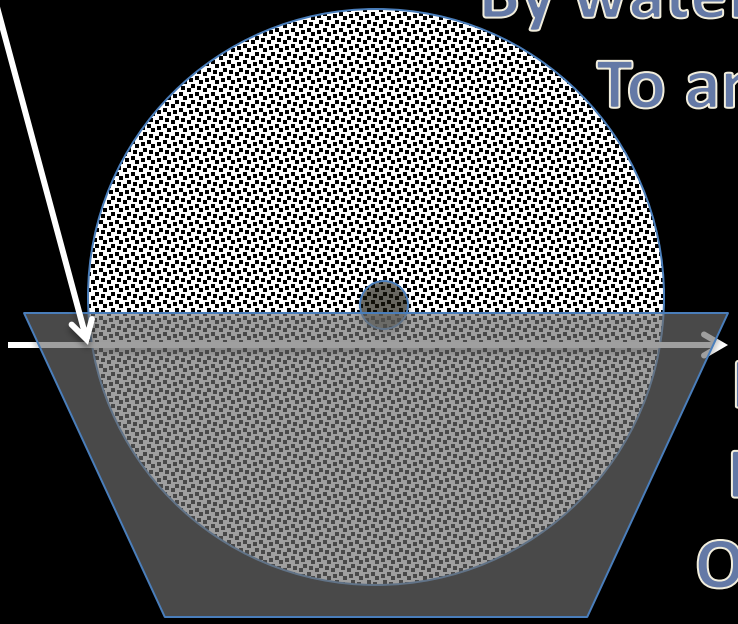

AERATION SYSTEMS IN AEROBIC
BIOLOGICAL TREATMENT TECHNOLOGIES
PHOTOSYNTHETIC
MECHANICAL AERATION
--SURFACE/ DIFFUSED
FILM EXPOSURE TO AMBIENT AIR

Constant water level

AERATION
By water film exposure
To ambient air

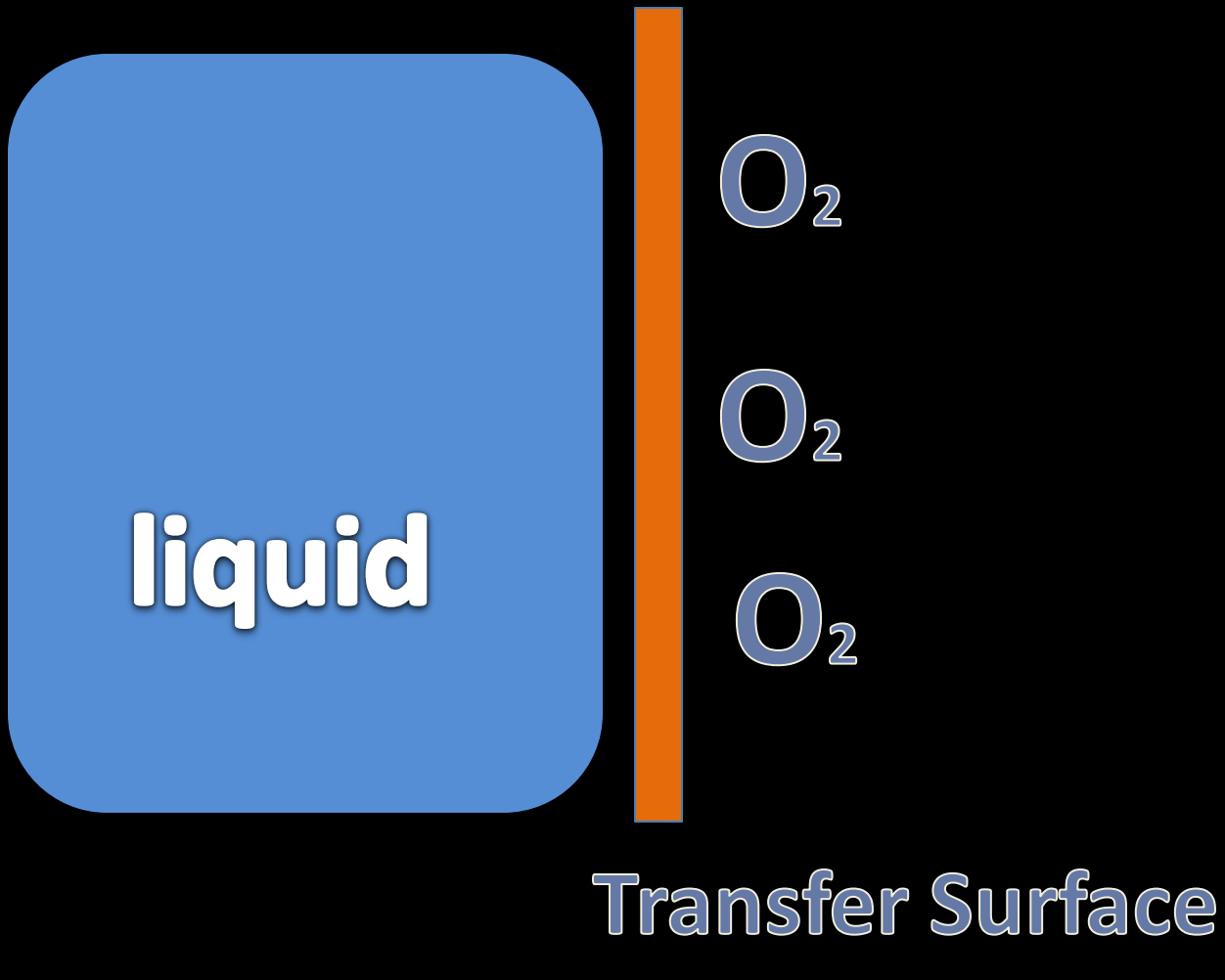
O_2



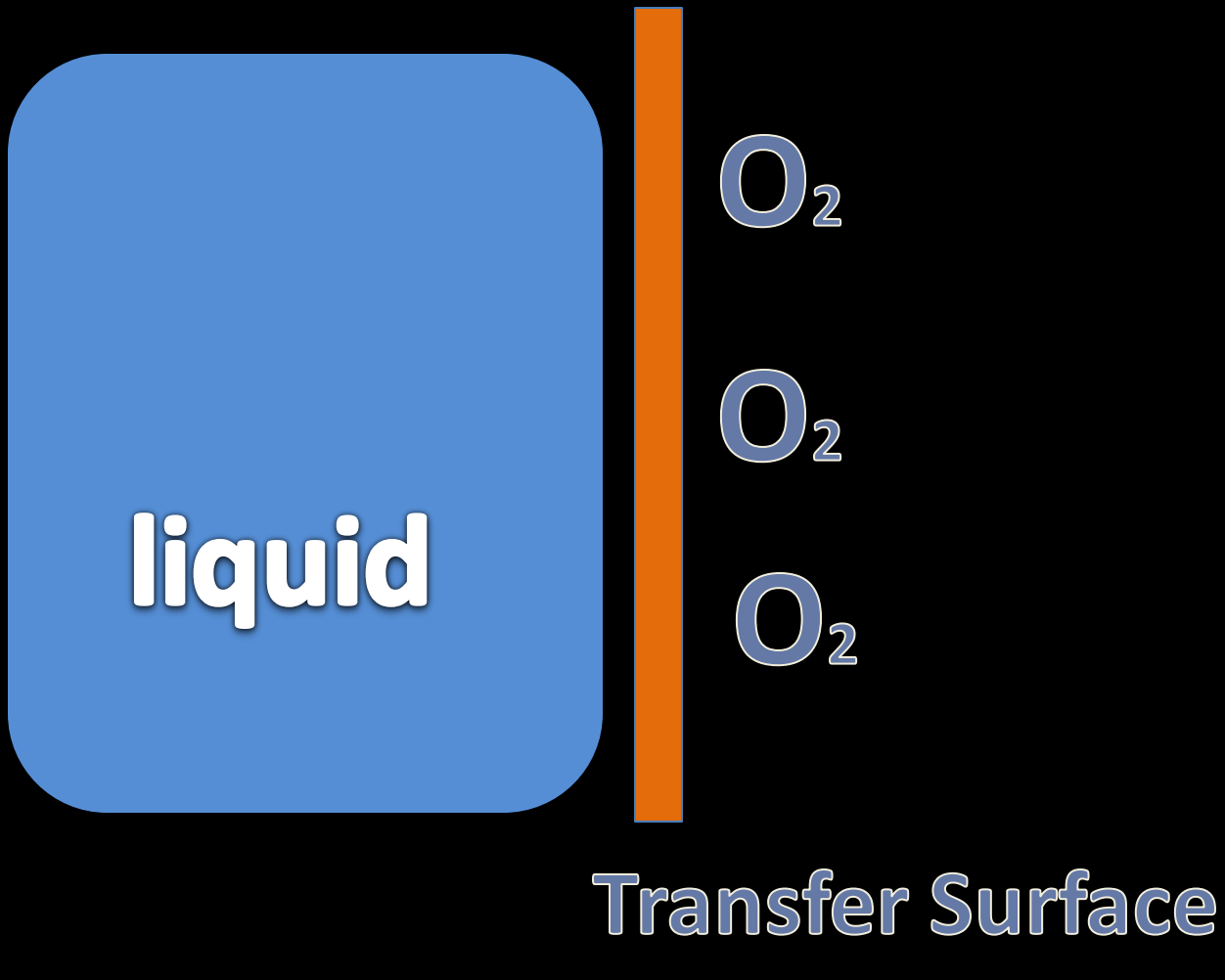


FOOD PICK UP
By Biosorption
On bacterial film
Adhering to
Plastic media

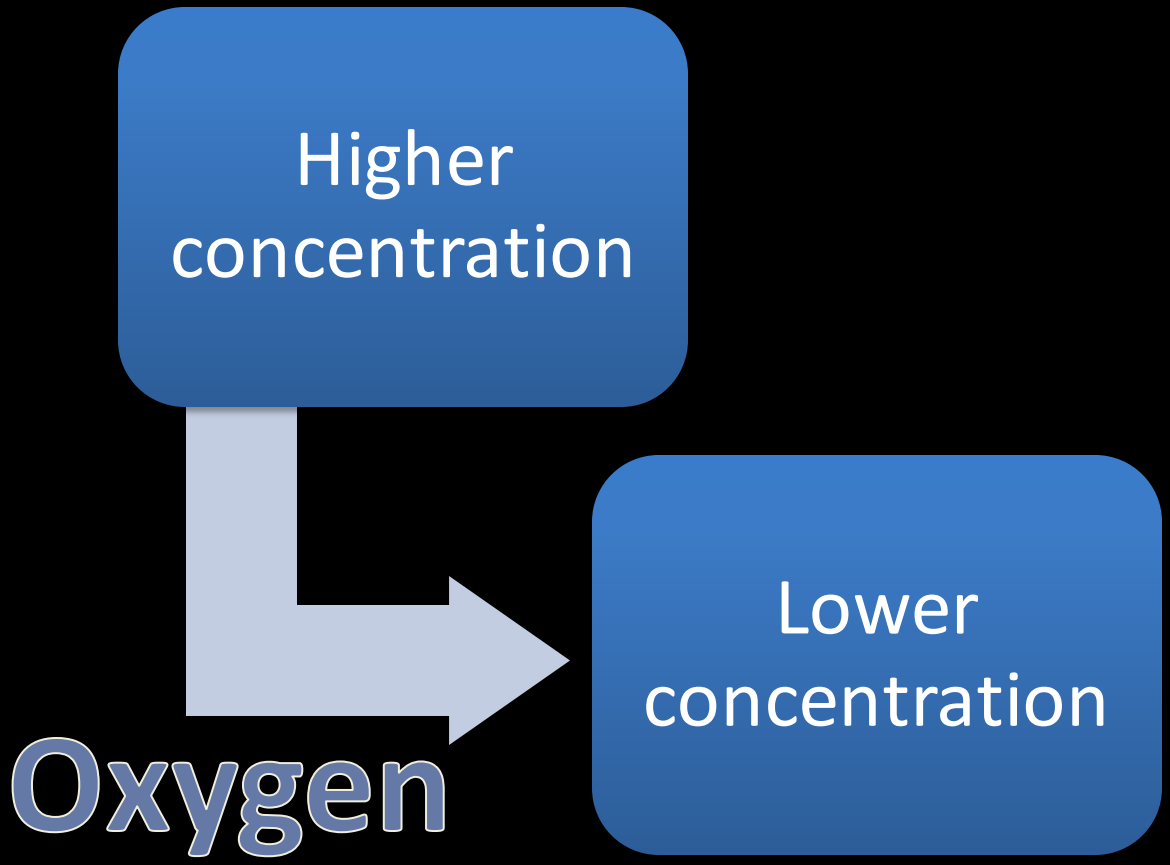
Mechanics of Aeration



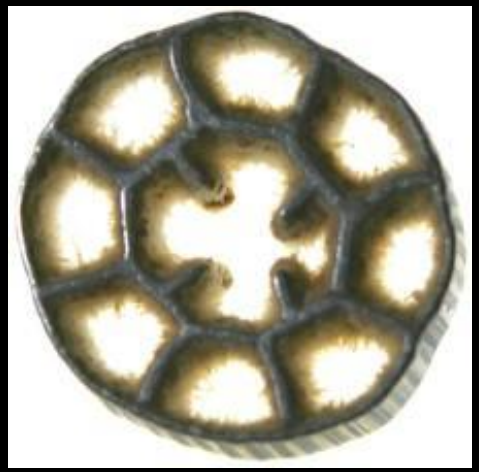
Mechanics of Aeration

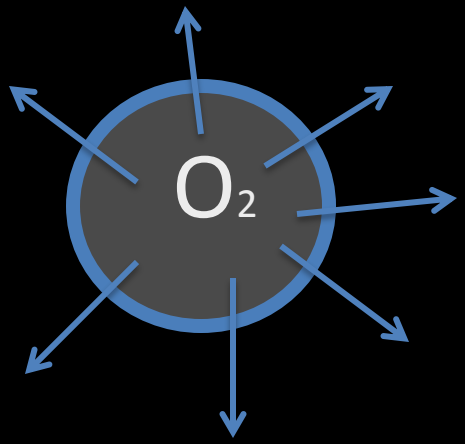


Mechanics of Aeration

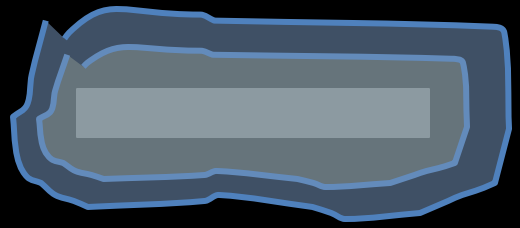


Transfer Surfaces for O_2 Transfer





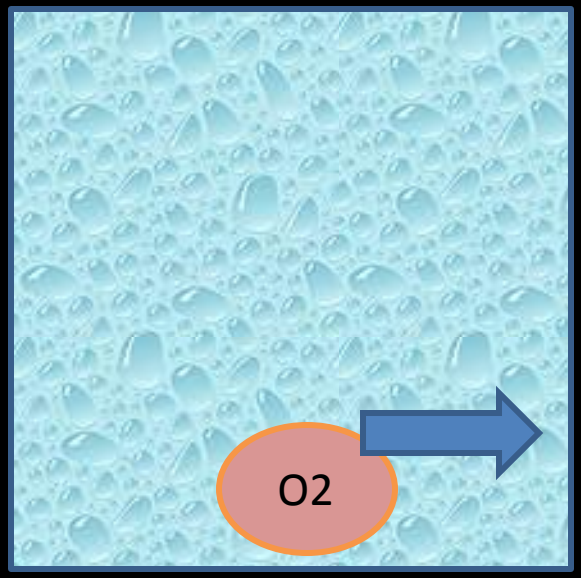
Ambient air



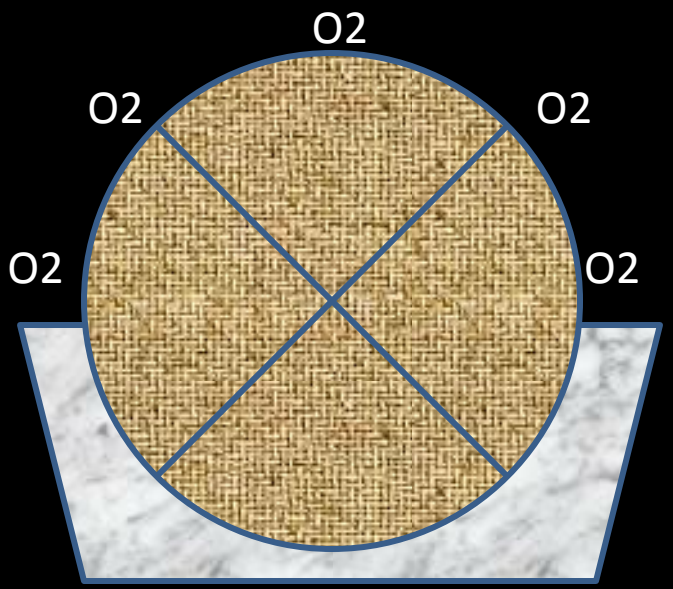
Ambient air

RMBR aeration is far more efficient than Bubbled aeration systems

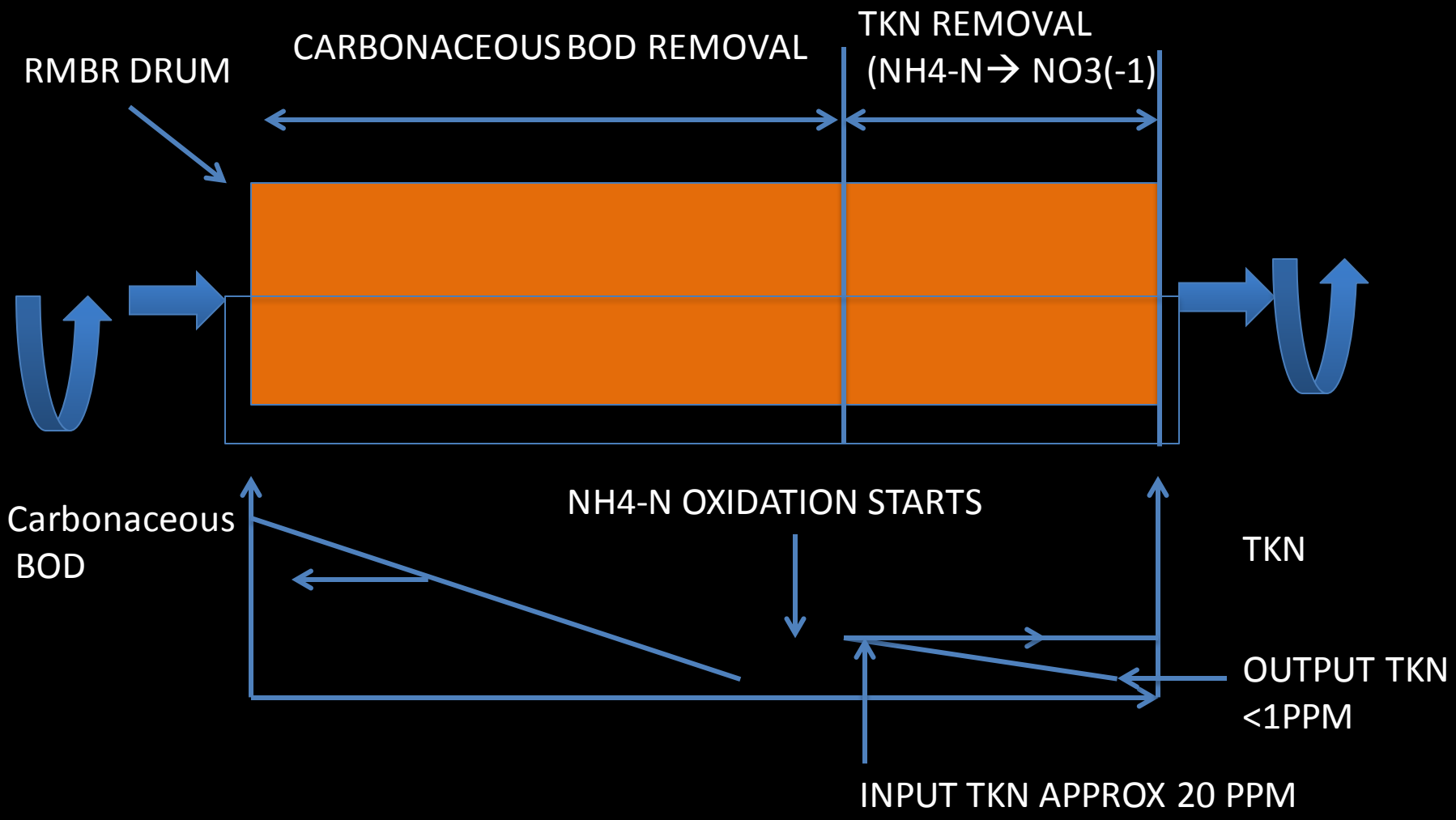
Reducing
O2 gradient
Makes
Bubbled aeration
inefficient



Biofilm in contact
with atmospheric
O2– hence constant
O2 gradient–
hence energy efficient



Premature sloughing of biofilm from support media in bubbled Aeration systems
HIGHLY UNDESIRABLE

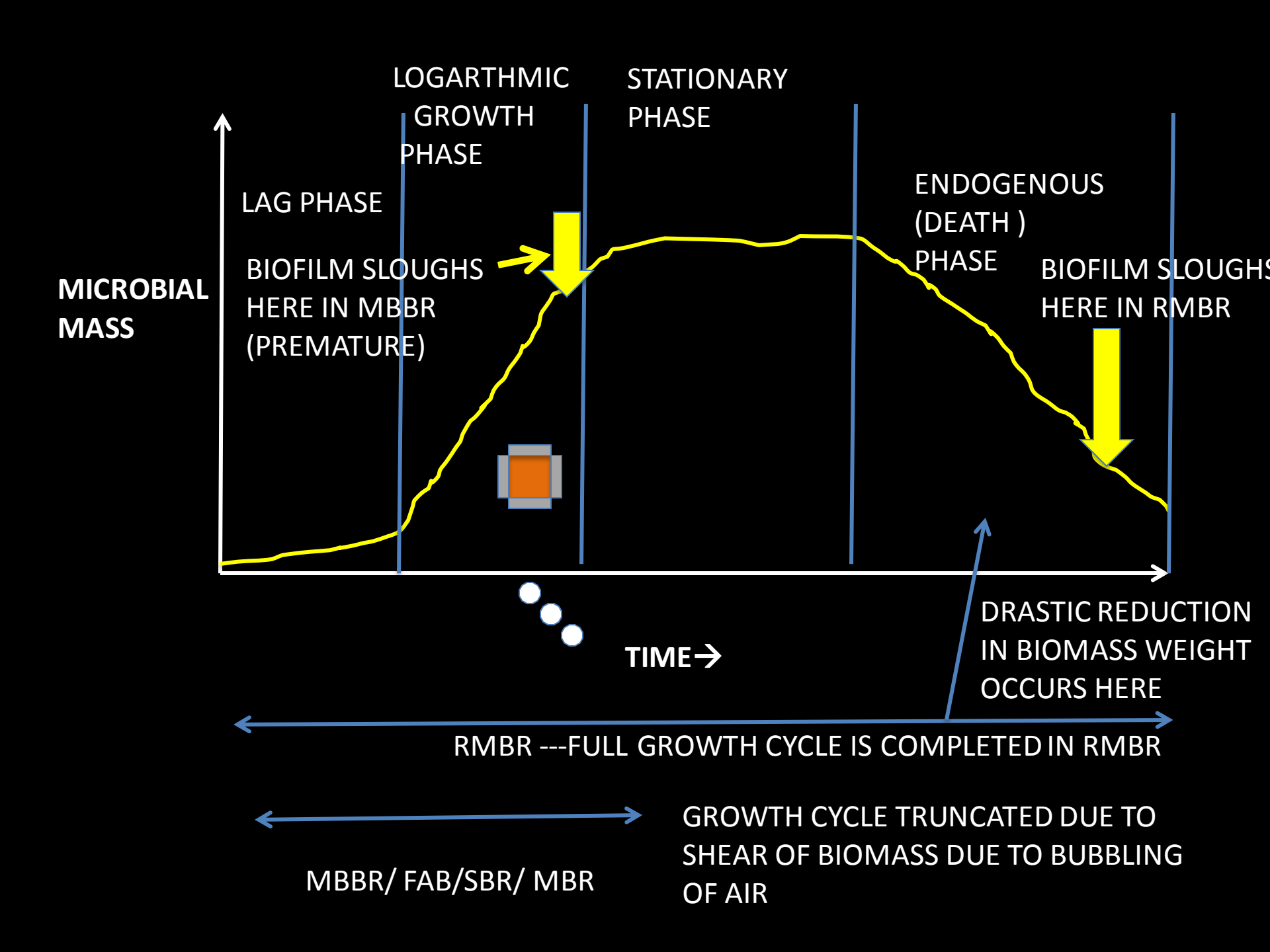


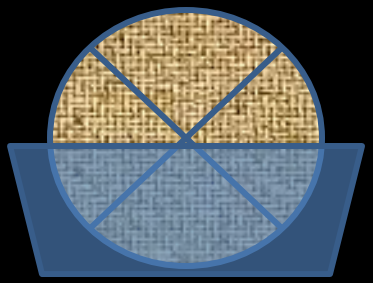
TKN (TOTAL KJELDAHL NITROGEN)
= ORGANIC (ALBUMOID NITROGEN) + AMMONIACAL NITROGEN

TKN REMOVAL

Stability of a society lies in a good blend of youth and experience

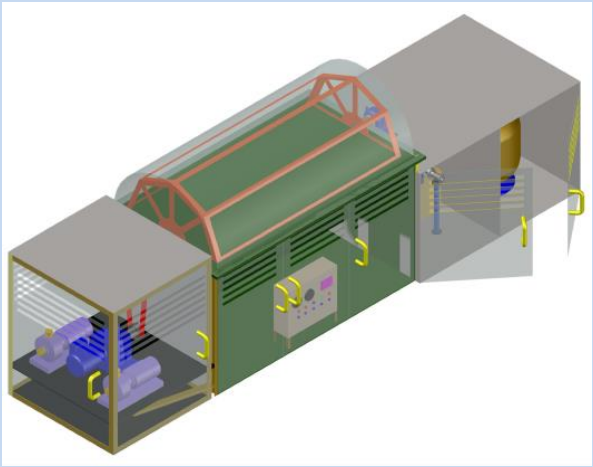
TIME→


LOGARTHMIC GROWTH PHASE
STATIONARY PHASE
LAG PHASE
ENDOGENOUS (DEATH) PHASE
BIOFILM SLOUGHS HERE IN MBBR (PREMATURE)
BIOFILM SLOUGHS HERE IN RMBR
MICROBIAL MASS
TIME→
DRASTIC REDUCTION IN BIOMASS WEIGHT OCCURS HERE
RMBR ---FULL GROWTH CYCLE IS COMPLETED IN RMBR
MBBR/ FAB/SBR/ MBR
GROWTH CYCLE TRUNCATED DUE TO SHEAR OF BIOMASS DUE TO BUBBLING OF AIR




AGING PEOPLE #1
Download from
Dreamstime.com


AGING PEOPLE #1
Download from
Dreamstime.com



Eco Smart STP

TRADITIONAL STP

SPACE OCCUPIED BY CONVENTIONAL SYSTEM = 2-4 TIMES AN ECO-SMART STP

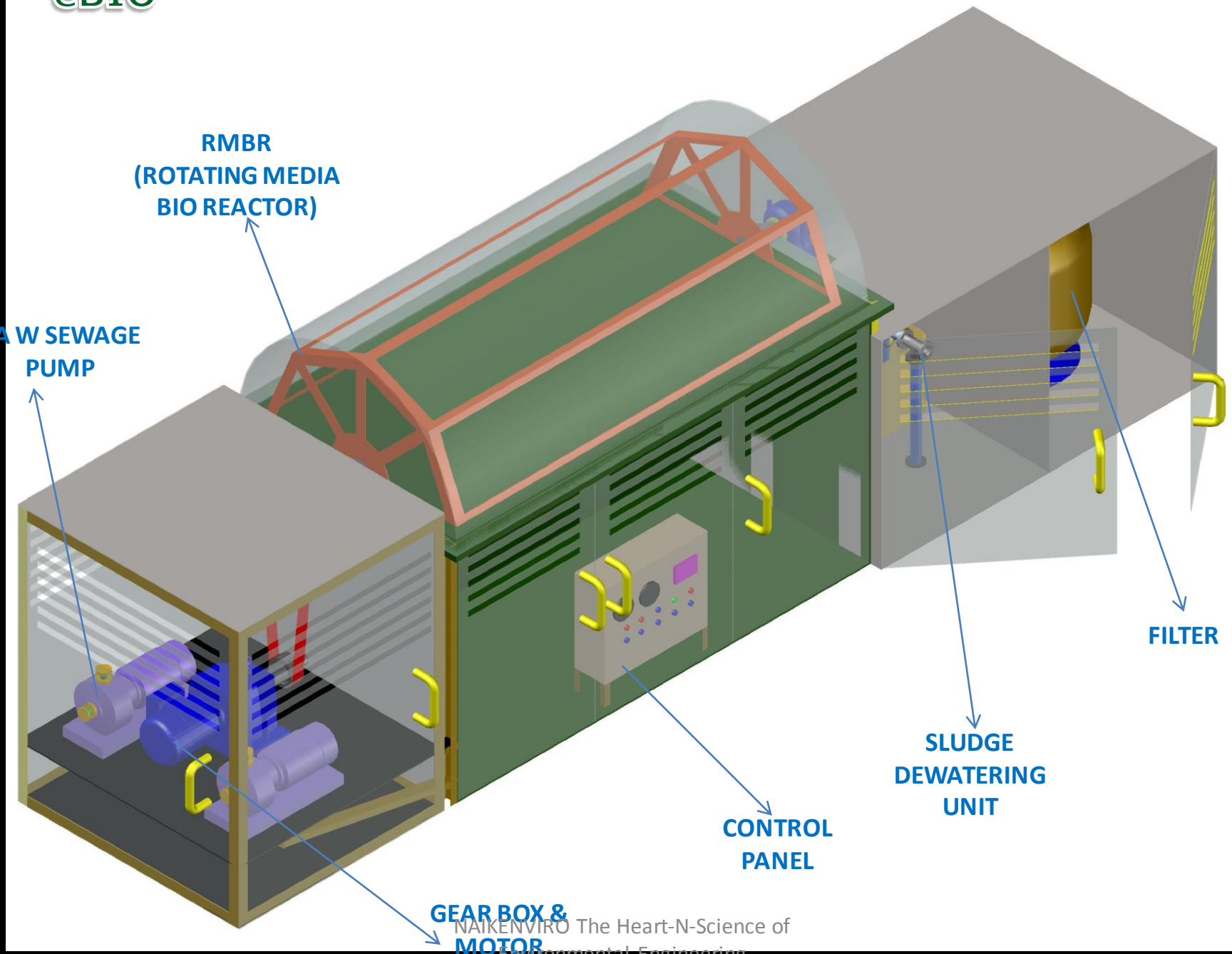
ECO-SMART STP CONFERS HUGE BENEFITS TO THE USER

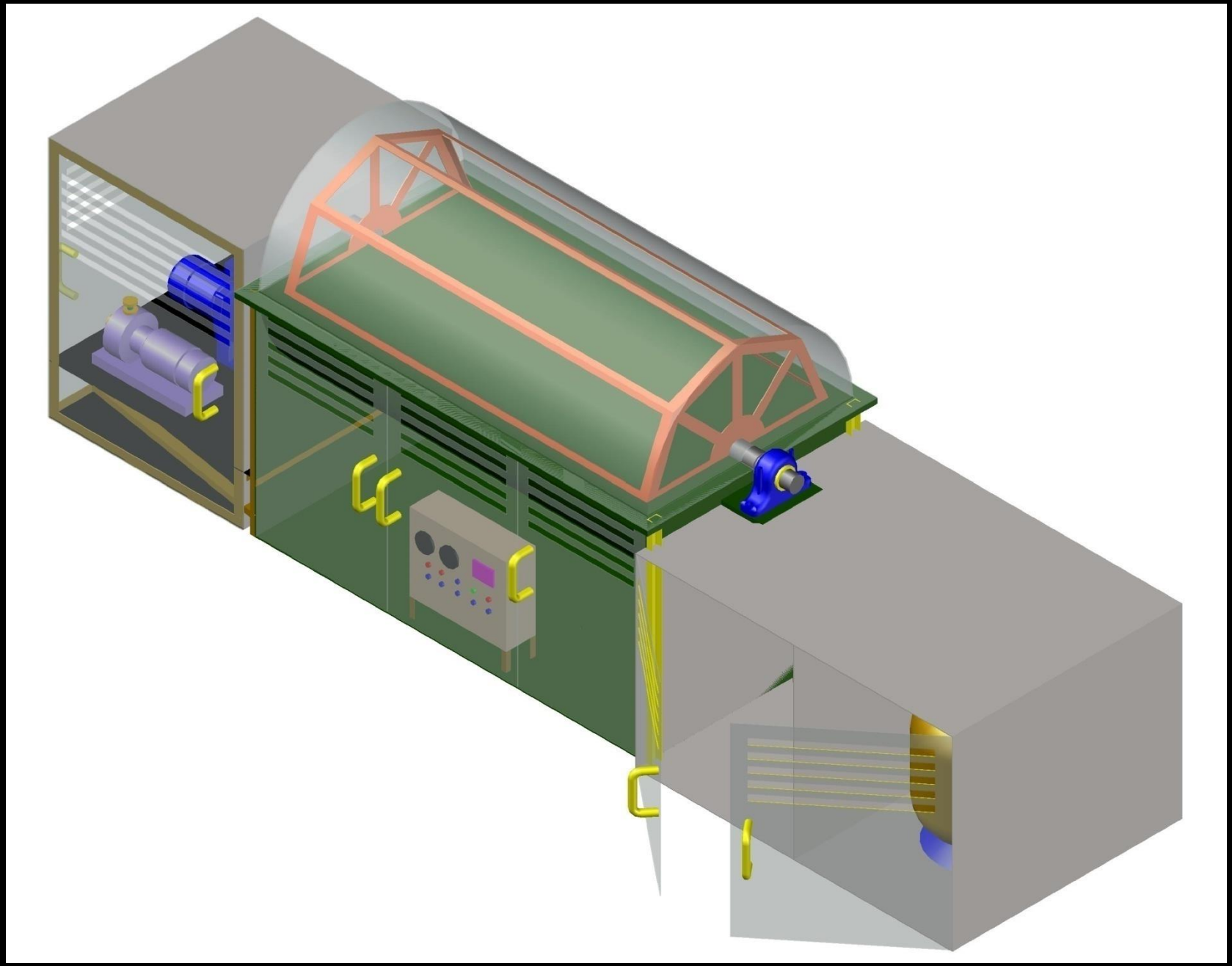
SMALL FOOTPRINT OF ECOBIOPACK RELEASES VALUABLE SPACE FOR BENEFICAL USE

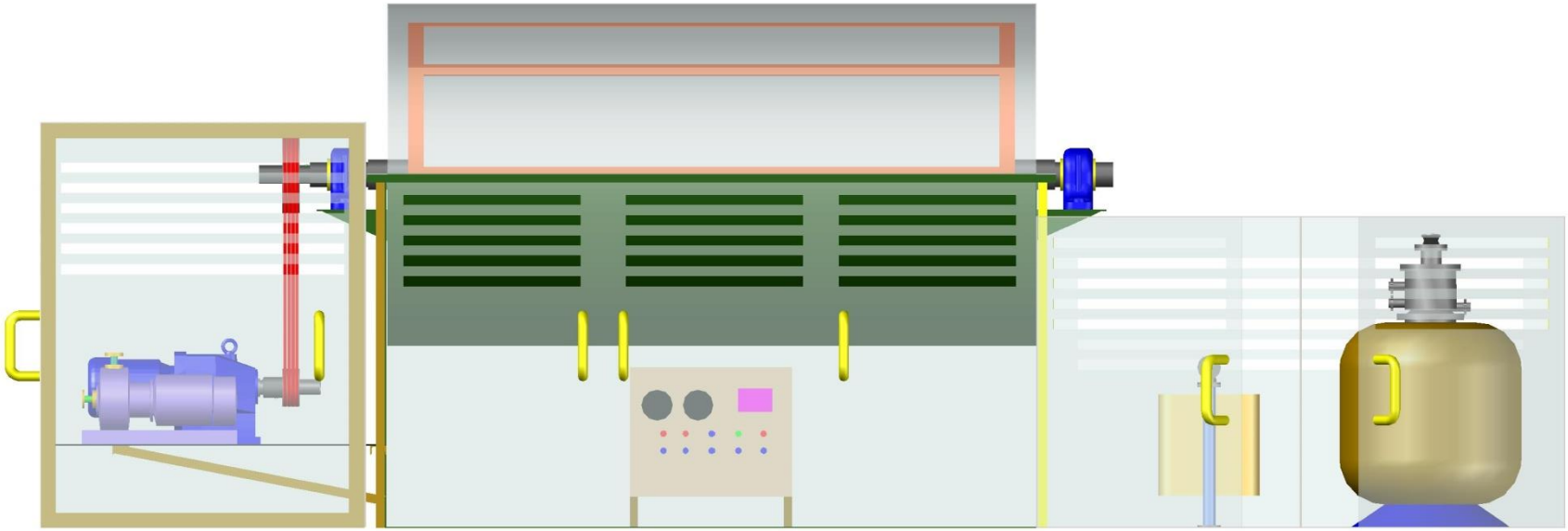
IMPROVES LEED RATINGS FOR GREEN BUILDINGS THROUGH:

A) SUBSTANTIAL ENERGY SAVINGS
B) SOUNDLESS OPERATION
C) CLEAN AMBIENT AIR
D) 100% WASTEWATER RECYCLE FOR TOILET FLUSHING, COOLING AND GARDENING

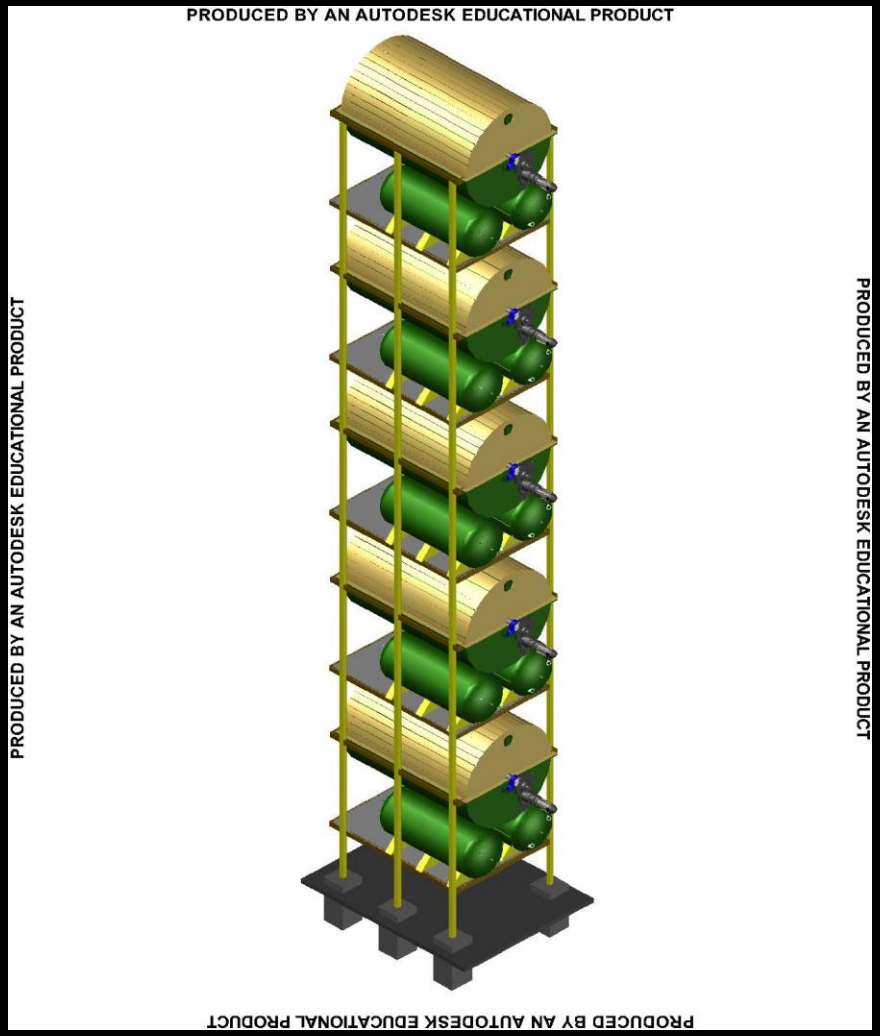
eBIO


RMBR
(ROTATING MEDIA
BIO REACTOR)
RA W SEWAGE
PUMP
FILTER
SLUDGE
DEWATERING
UNIT
CONTROL
PANEL
GEAR BOX &
MOTOR

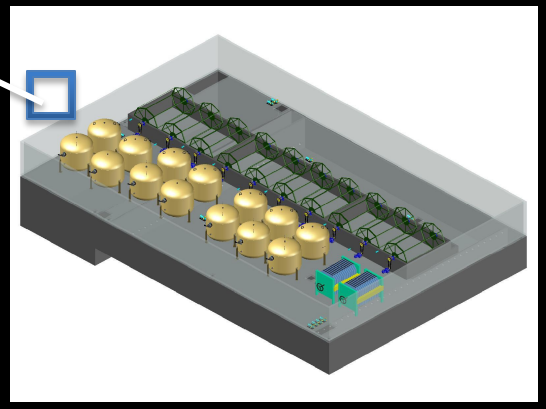


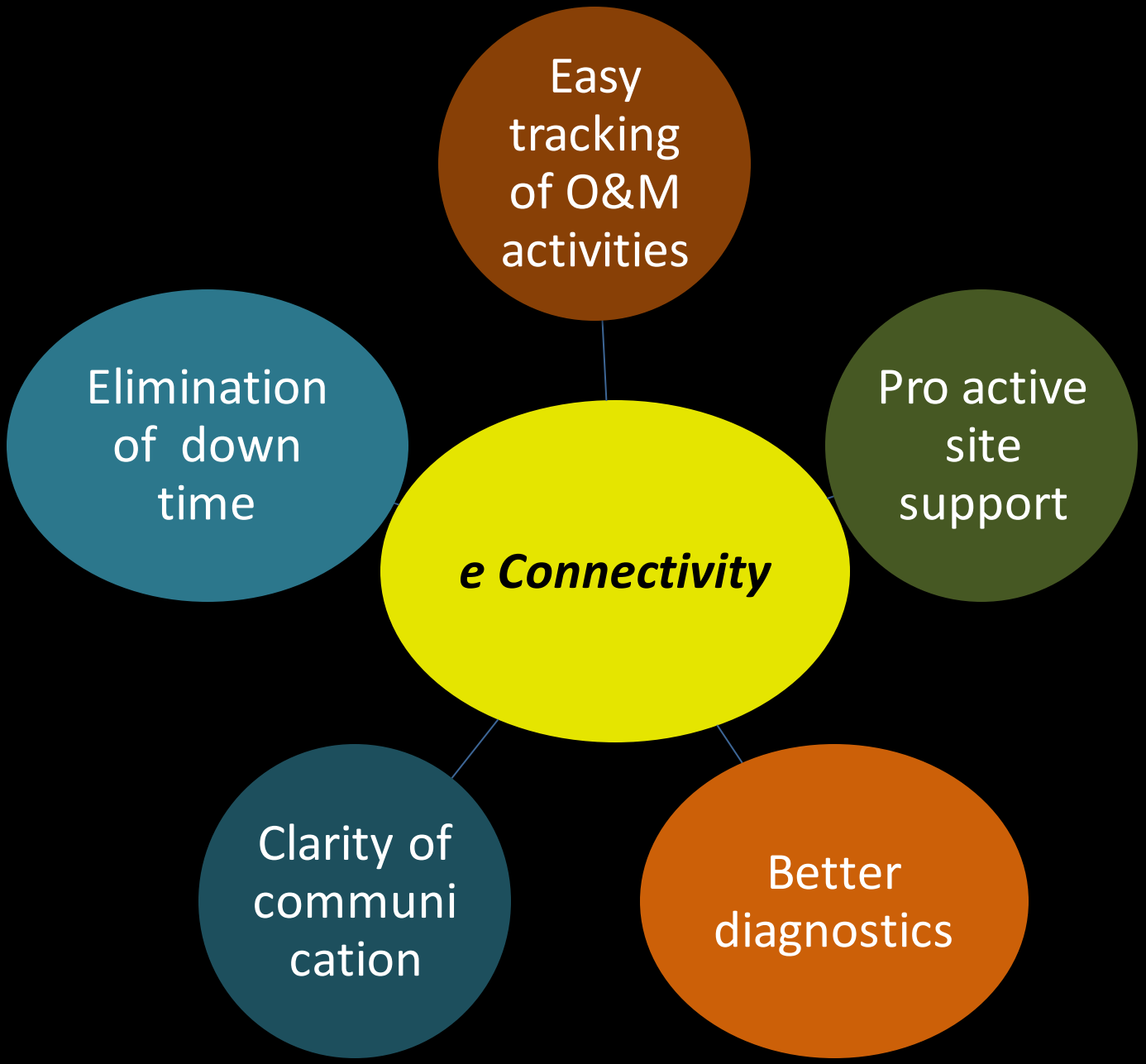


STP TOWERS


PRODUCED BY AN AUTODESK EDUCATIONAL PRODUCT
PRODUCED BY AN AUTODESK EDUCATIONAL PRODUCT
PRODUCED BY AN AUTODESK EDUCATIONAL PRODUCT
PRODUCED BY AN AUTODESK EDUCATIONAL PRODUCT

e-Connectivity--- ECO SMART STPS




Easy tracking of O&M activities
Elimination of down time
Pro active site support
e Connectivity
Clarity of communi cation
Better diagnostics

INNOVATIONS

- Introduced wet sump & pumps before equalisation tank to reduce excavation and RCC costs drastically
- Used multi tier design to reduce footprint
- EcoSmart technology to further save power and space for biological treatment
- Used non mechanical sludge dewatering system to simplify operation and save power

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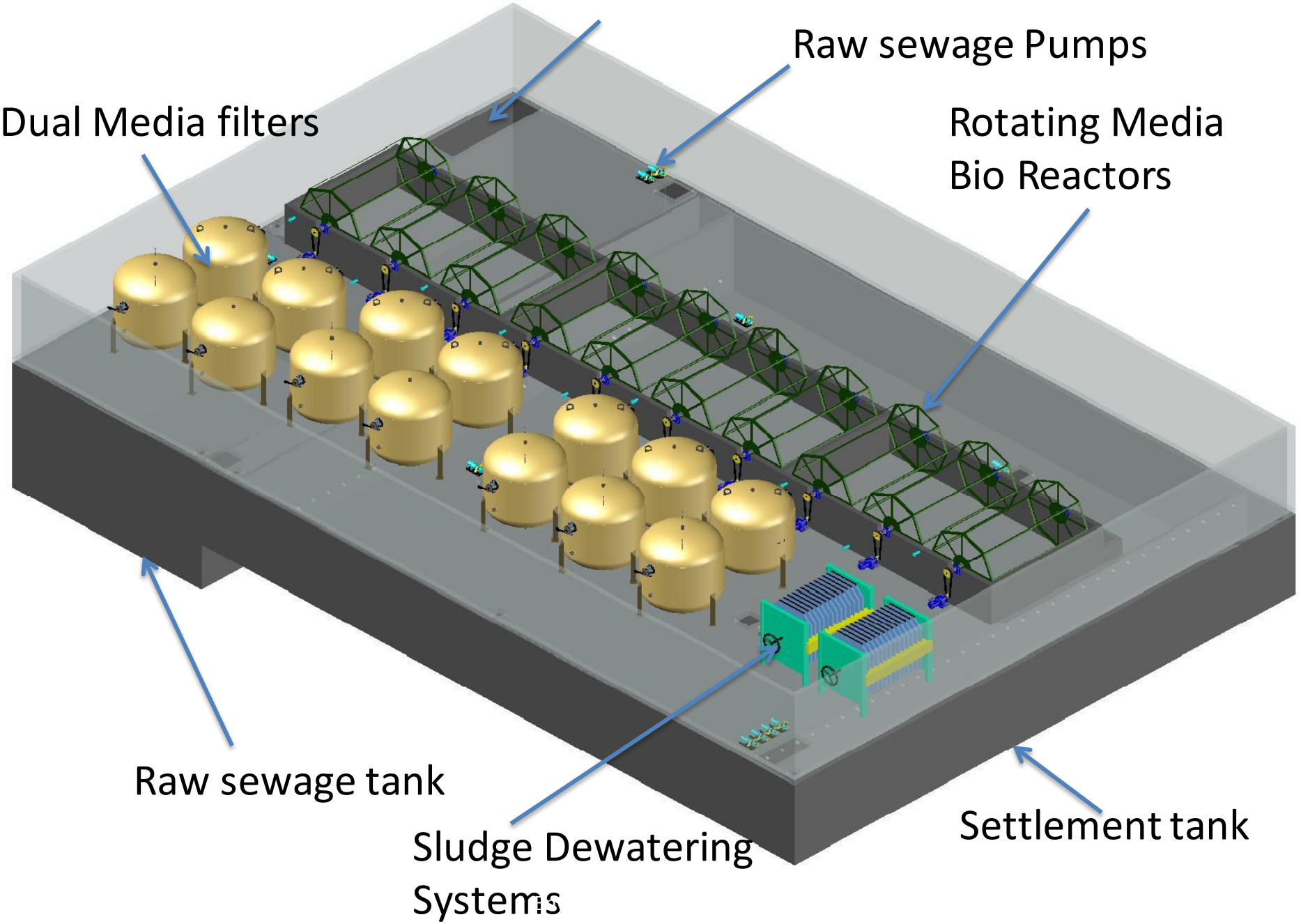
Environmental Engineering

Use of recycled sewage for Municipal Garden at Dadar

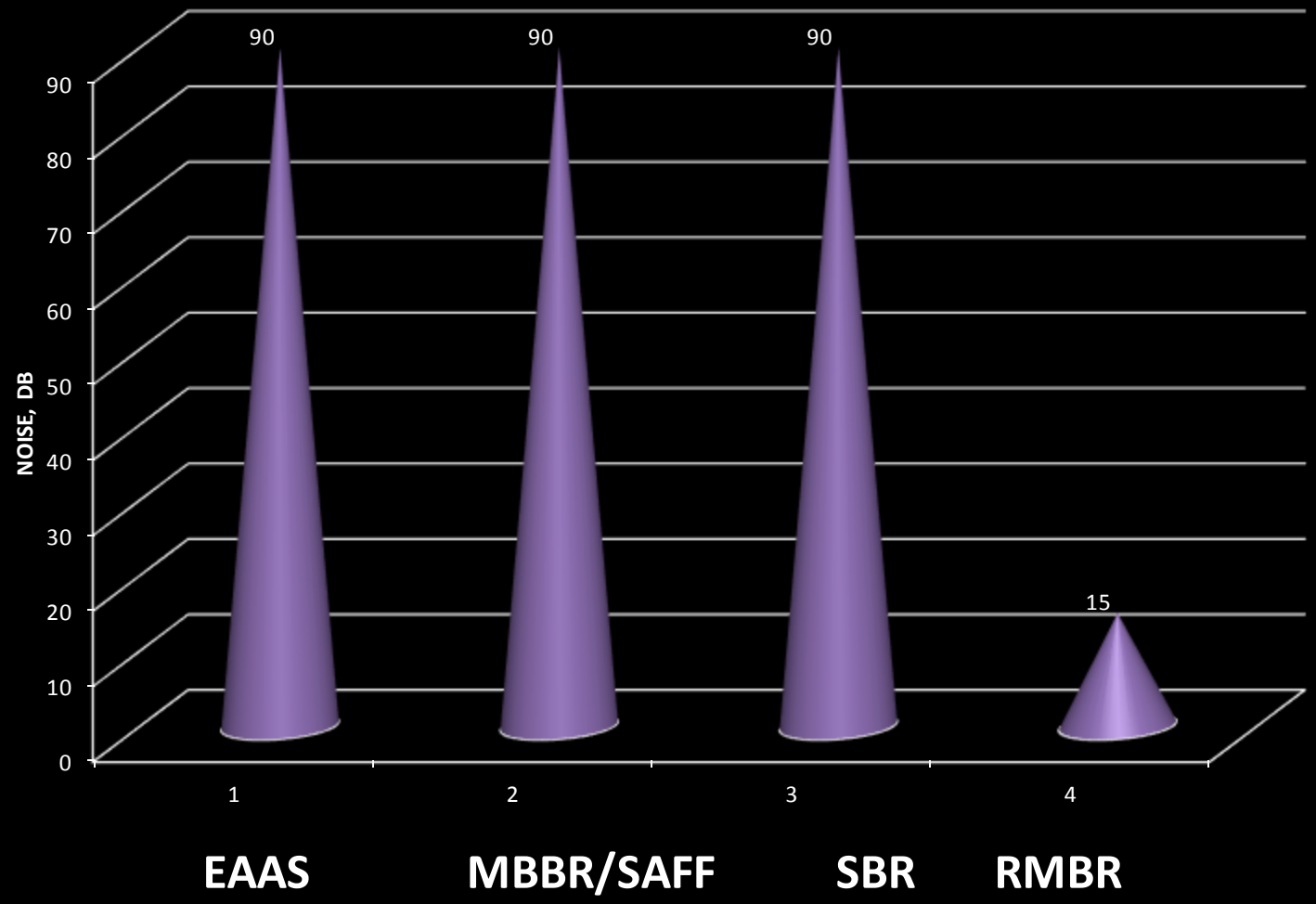
--an emerging trend


NAIK ENVIRONMENTAL ENGINEERS PVT.LTD.
THE NAIK ENVIRO ECOBIOPACK Patent No. [234990]

9MLD COMPACT STP AT WADALA TRUCK TERMINUS



sound level comparison at 5-10m from STP



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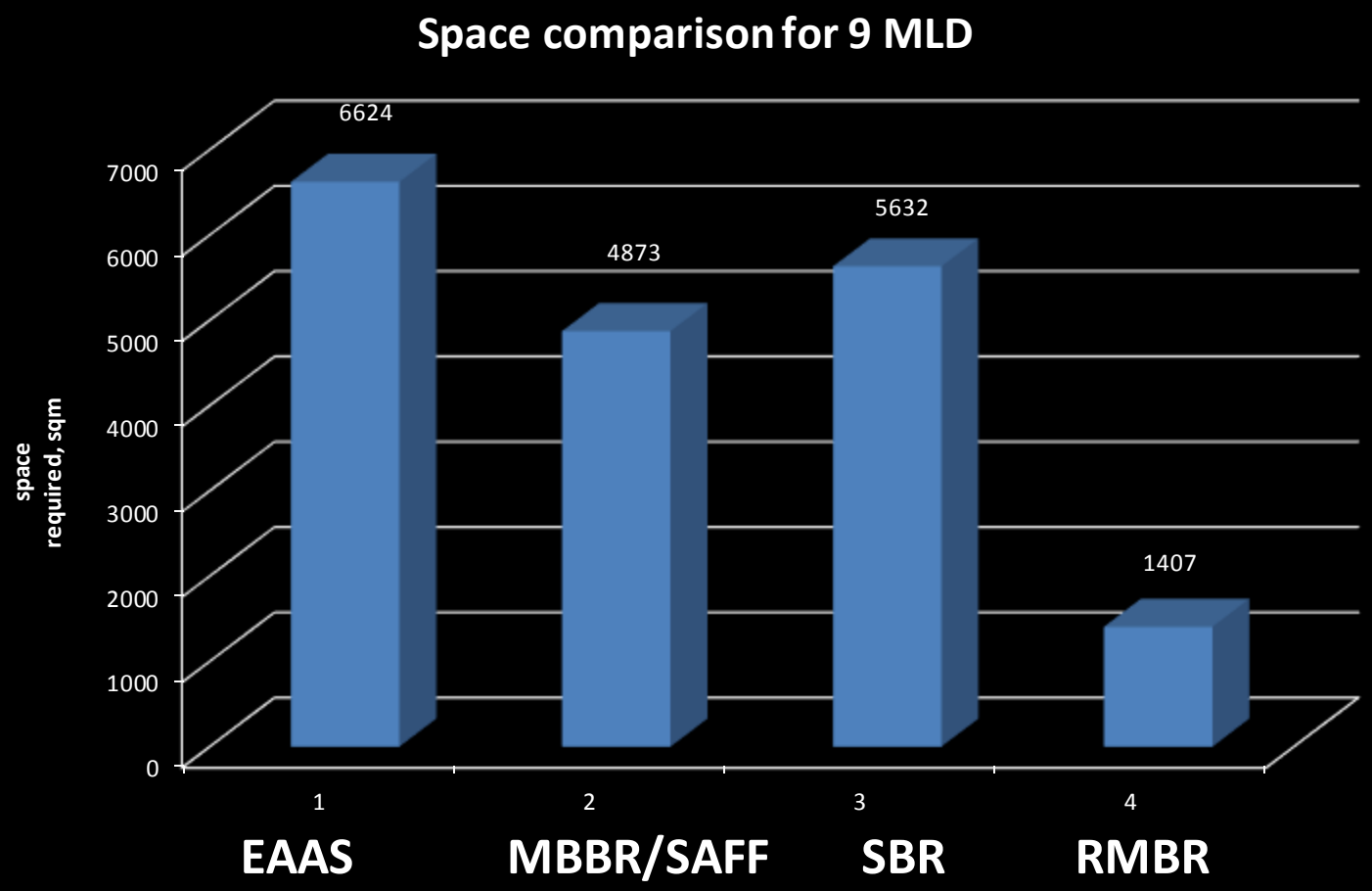
9MLD COMPACT STP AT WADALA TRUCK TERMINUS



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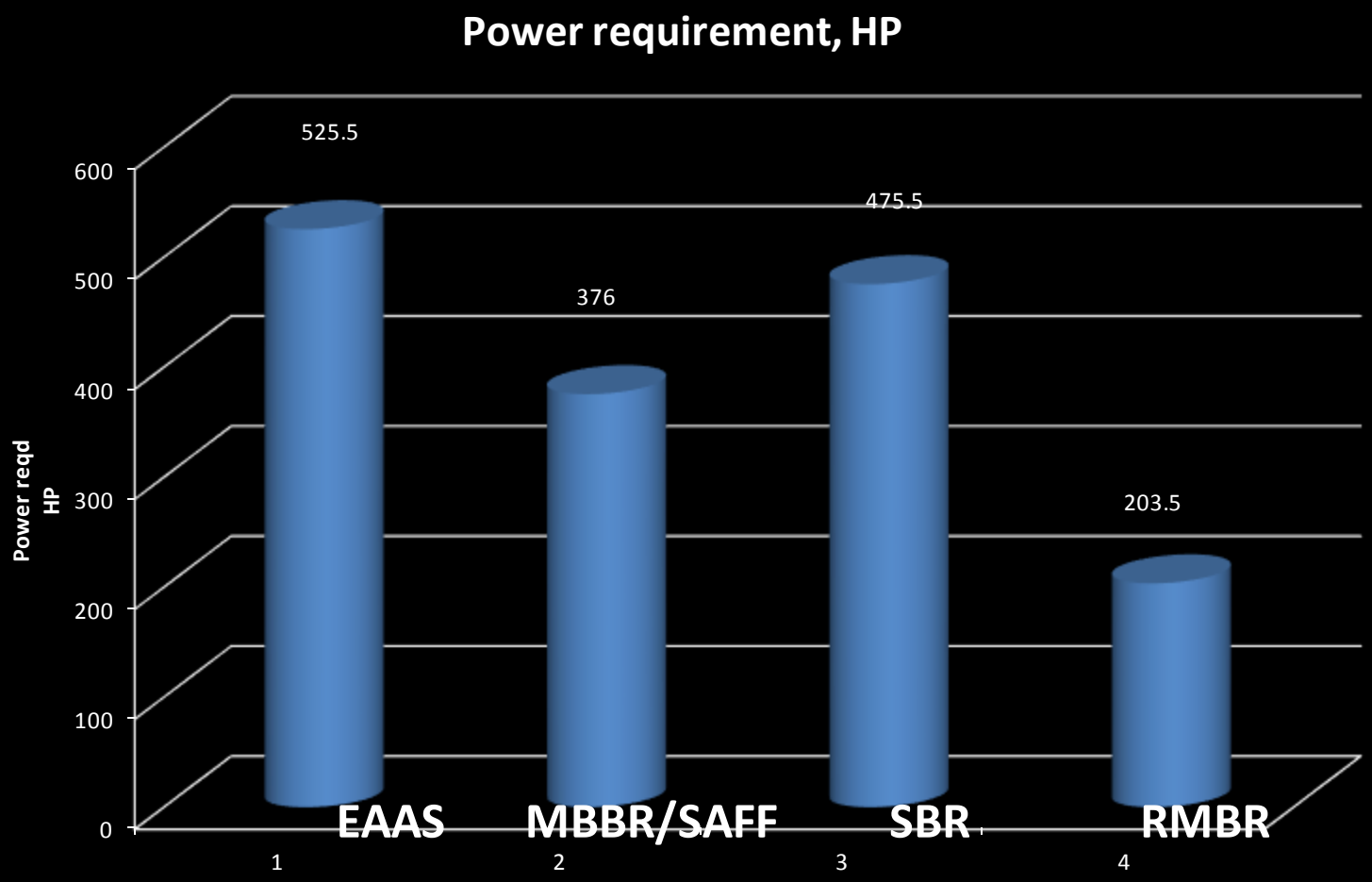
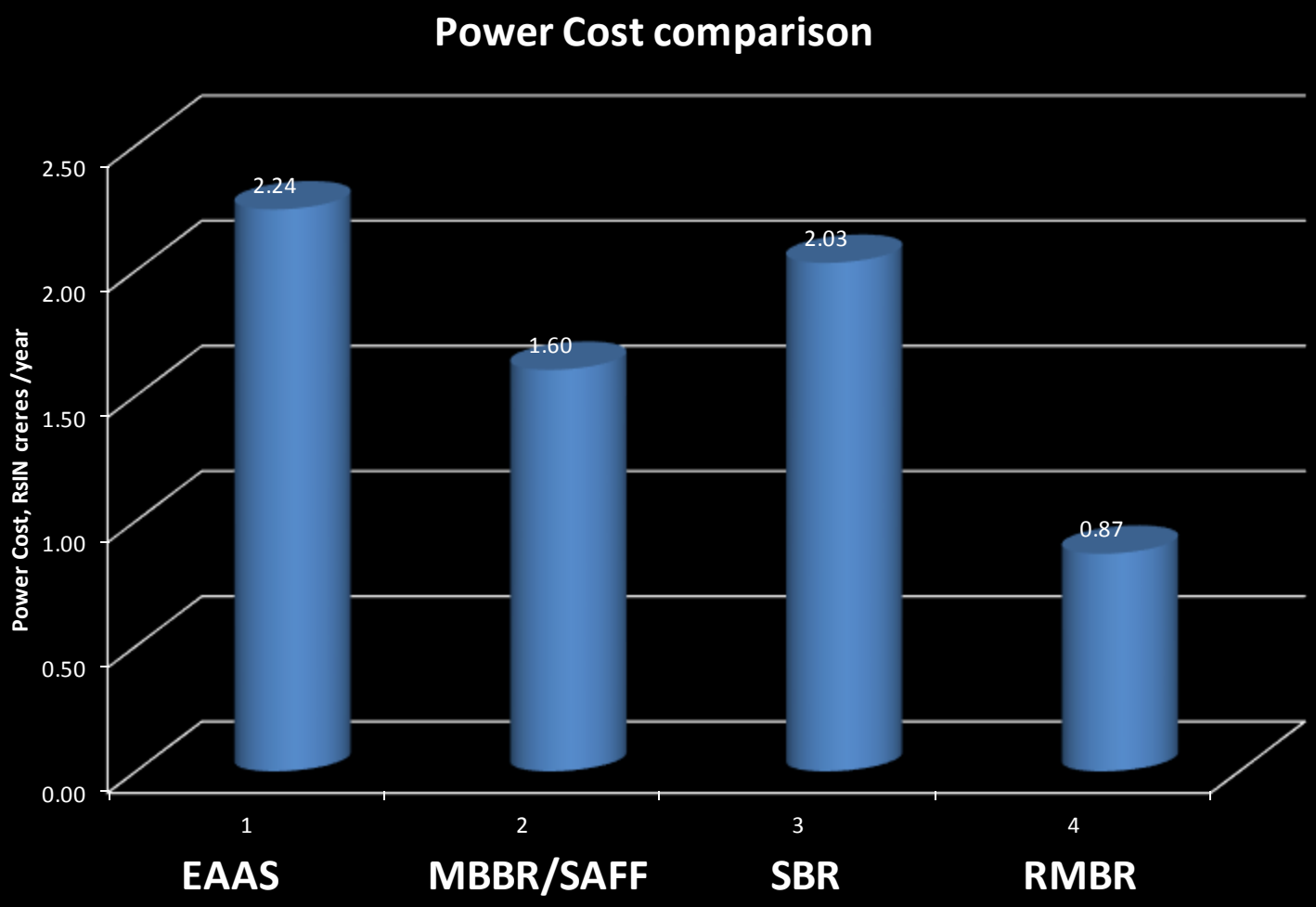
9MLD COMPACT STP AT WADALA TRUCK TERMINUS



9MLD COMPACT STP AT WADALA TRUCK TERMINUS



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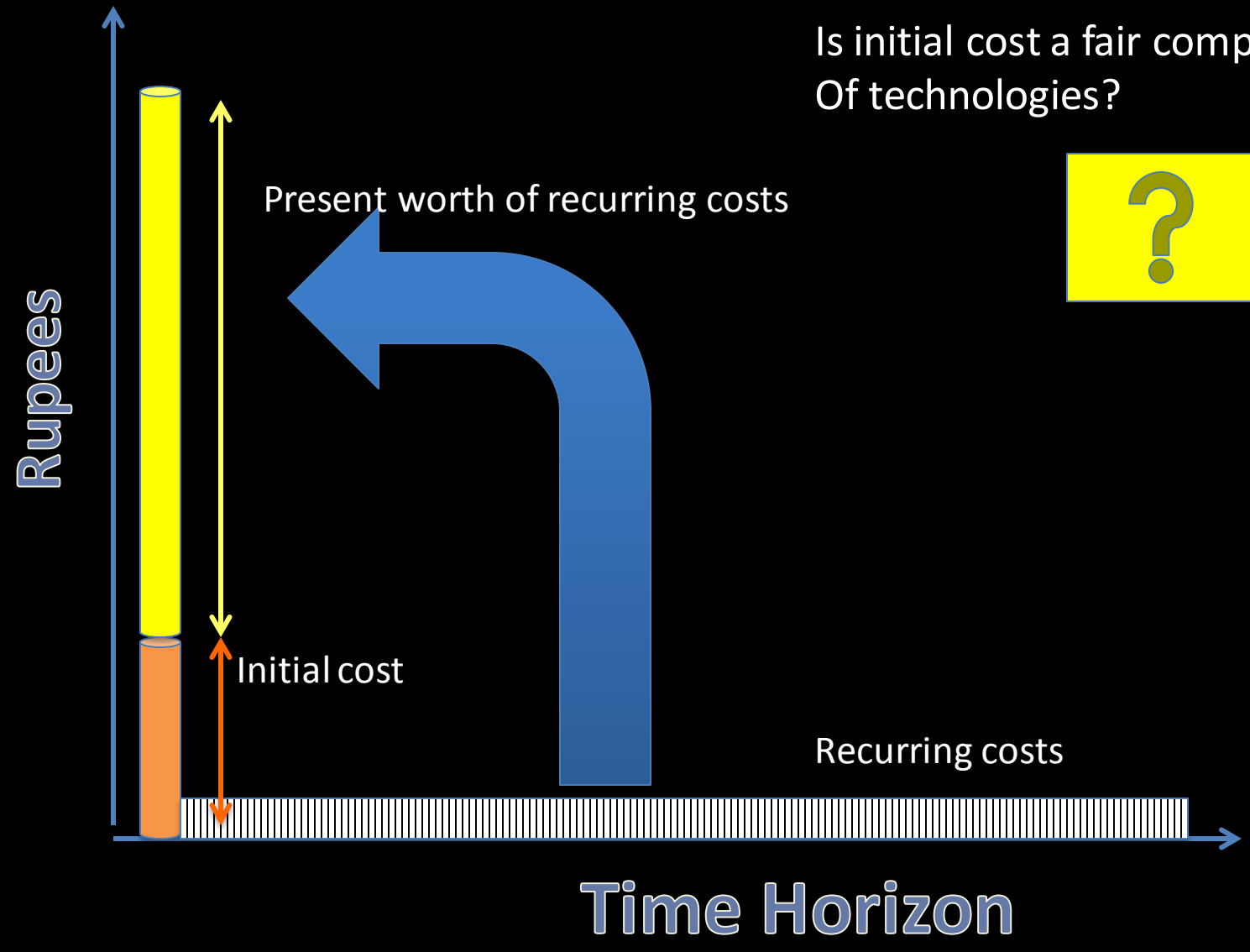
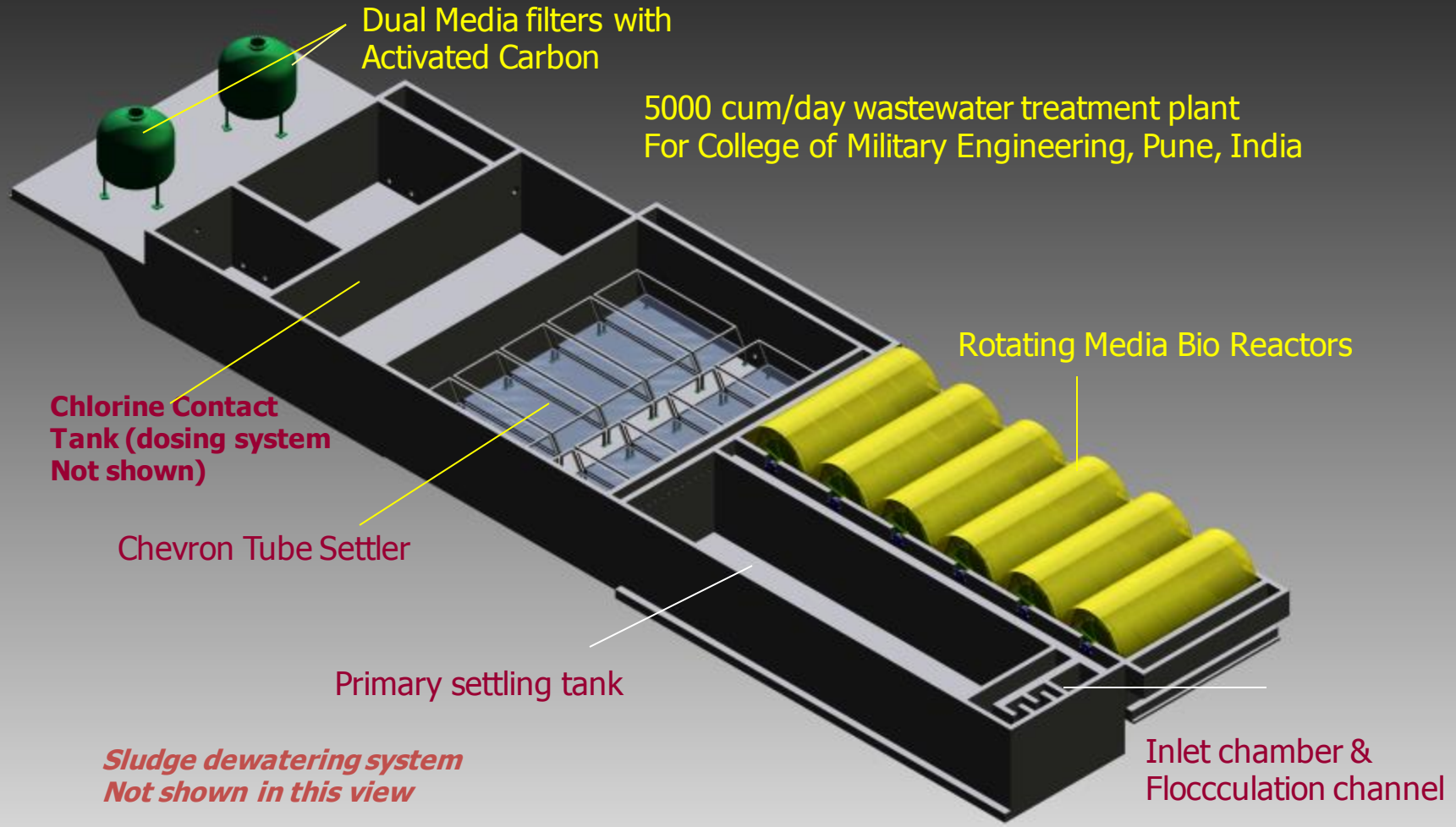

Is initial cost a fair comparison
Of technologies?
?
Present worth of recurring costs
Rupees
Initial cost
Recurring costs
Time Horizon

INTERNATIONAL ROWING CHANNEL 2KMX 0.5 KM DEVELOPED FROM RECYCLED SEWAGE

5 MLD COMPACT, ENERGY EFFICIENT SEWAGE TREATMENT PLANT AT COLLEGE OF MILITARY ENGINEERING , KIRKEE, PUNE, INDIA
A 3 D VIEW



MCGM 1.5MLDX 2
AT MCGM's BANGANGA PUMPING STATION

- Treated water to be supplied for gardening to

  – Raj Bhavan

  --- Minister's Bungalows

  --- Kamala Nehru Park

  And for toilet flushing to contiguous residential areas

BEFORE

AFTER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NAIK ENVIRO

SCADA

•The operating system at site is SCADA, which stands for supervisory control and data acquisition. It is an industrial control system where a computer system monitors and controls the ongoing operation/process.

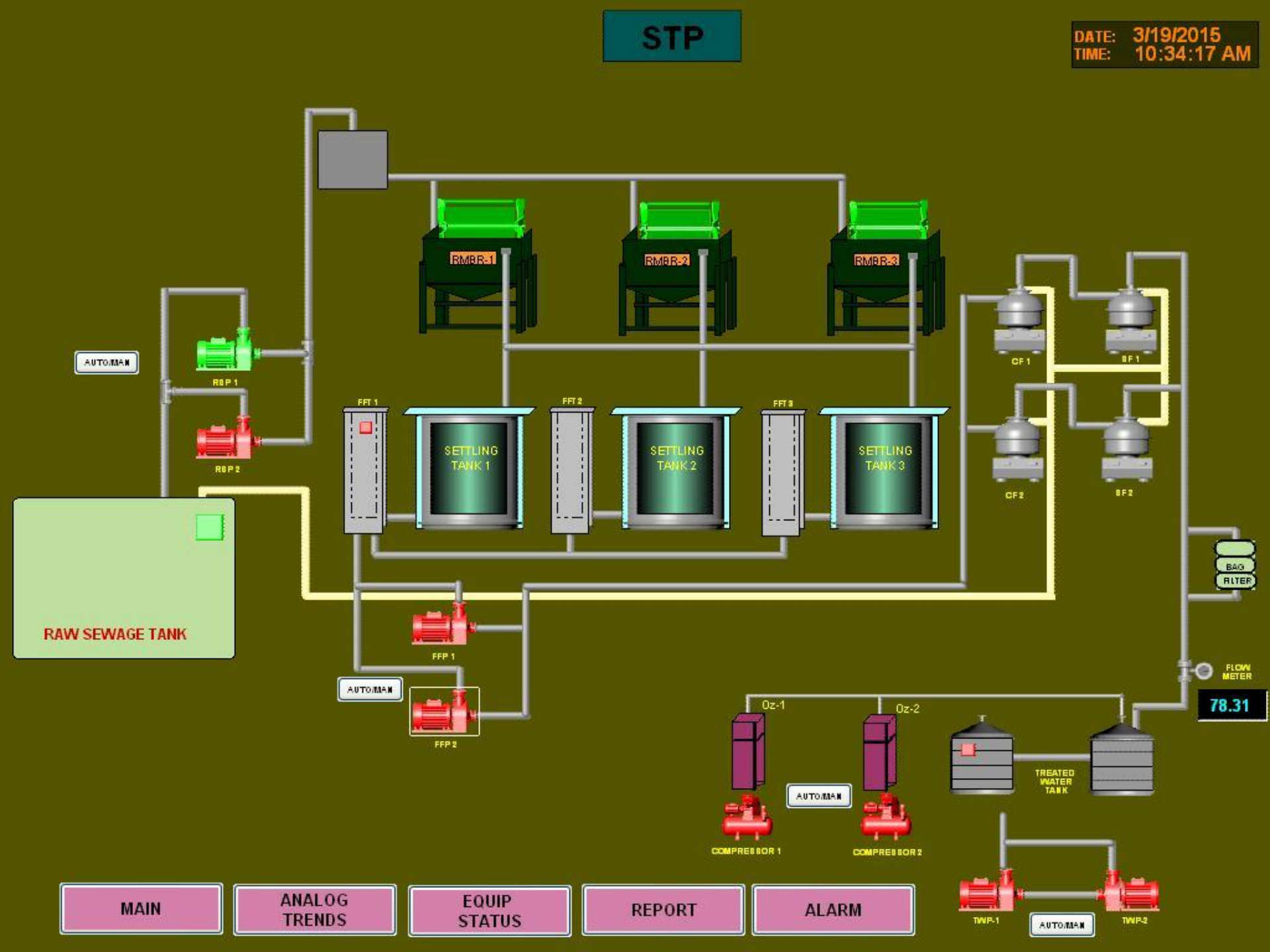
•The software gives various information's like details of pump operation, breakdown details, energy consumption, treated water quality parameters, historical trends etc.

Main Screen

OTHER INSTALLATIONS

COMPACT, ENERGY EFFICIENT SEWAGE TREATMENT PLANT

BASED ON THE PATENTED ECOBIOPACK RMBR SYSTEM


STP
DATE: 3/19/2015
TIME: 10:34:17 AM
RMBR-1
RMBR-2
RMBR-3
AUTO/MAN
RSP 1
RSP 2
FFT 1
FFT 2
FFT 3
SETTLING TANK 1
SETTLING TANK 2
SETTLING TANK 3
CF 1
CF 2
SF 1
SF 2
BAG FILTER
RAW SEWAGE TANK
FFP 1
FFP 2
AUTO/MAN
FLOW METER
78.31
Oz-1
Oz-2
AUTO/MAN
COMPRESSOR 1
COMPRESSOR 2
TREATED WATER TANK
TWP-1
TWP-2
AUTO/MAN
MAIN
ANALOG TRENDS
EQUIP STATUS
REPORT
ALARM

ANALOG TREND

DATE: 3/19/2015
TIME: 10:35:02 AM

ENERGY METER READING

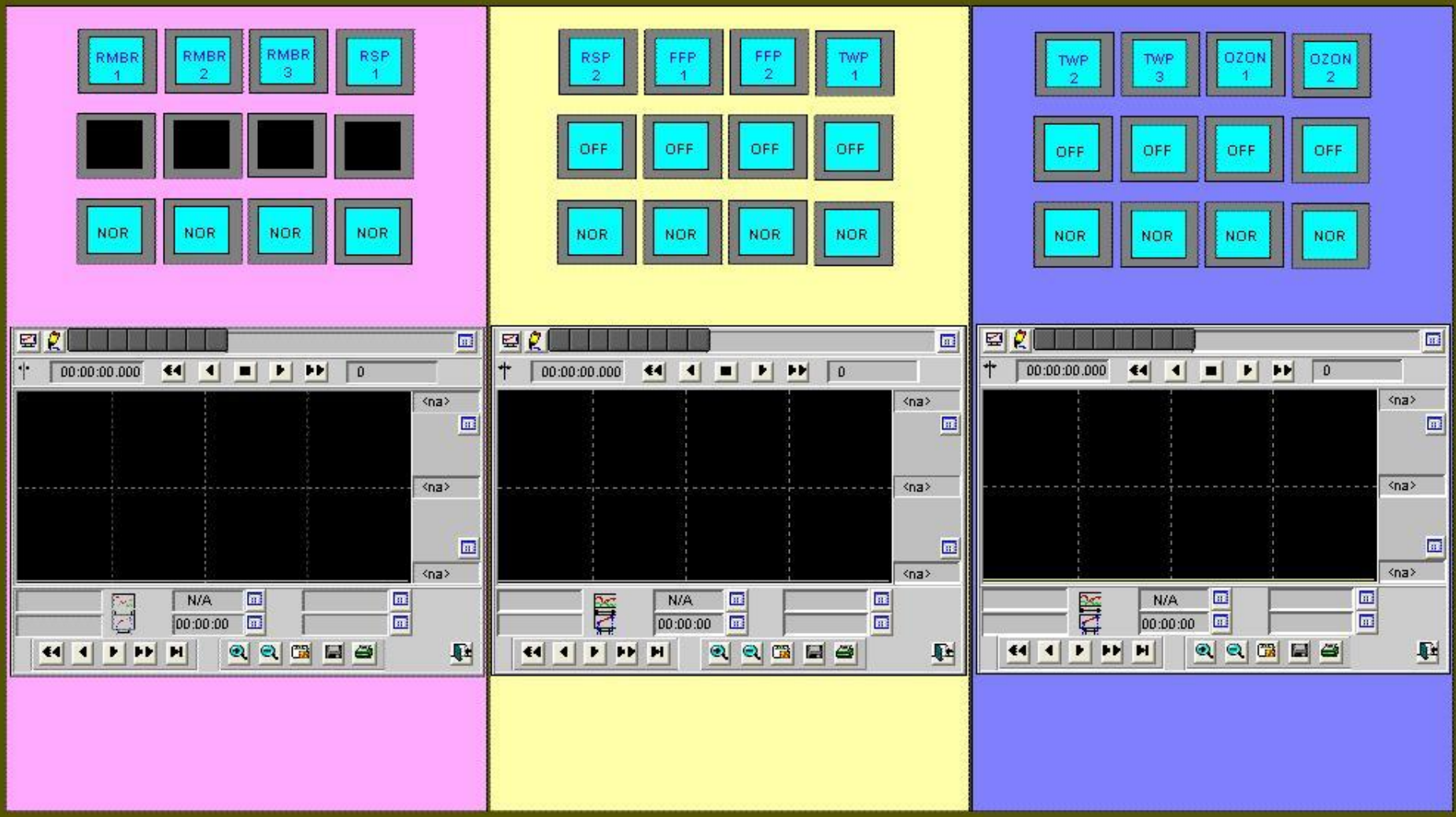
Volts (V)	Amps (A)	PF	WATT
411.97	15.82	0.77	8686.96

PROCESS PARAMETERS

Turbidity (NTU)	Ph	TEMP (°C)	FLOW (m3/Hr)	Do (mg/l)
10.96	7.78	32.43	77.90	10.68

EQUIPMENT STATUS

DATE: 3/19/2015
TIME: 10:37:00 AM



MAIN | STP | ANALOG TRENDS | REPORT | ALARM


RMBR
Control Panel
Gear Box
Raw Sewage Pumps
Softener
Hypo Dosing Pump
Settling tank
Filter Feed Pumps
Activated
Carbon Filter
Pressure
Sand Filter

2008: 100cmd plant for Automobile service station at Bayan, Kuwait

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NAIK ENVIRO

ECO-SMART & INNOVATIVE WASTEWATER MANAGEMENT & Solid Waste to Compost

Dr. Shirish Naik

Solid Waste to Compost

Composting keeps food waste out of landfills

Composting saves space in landfills

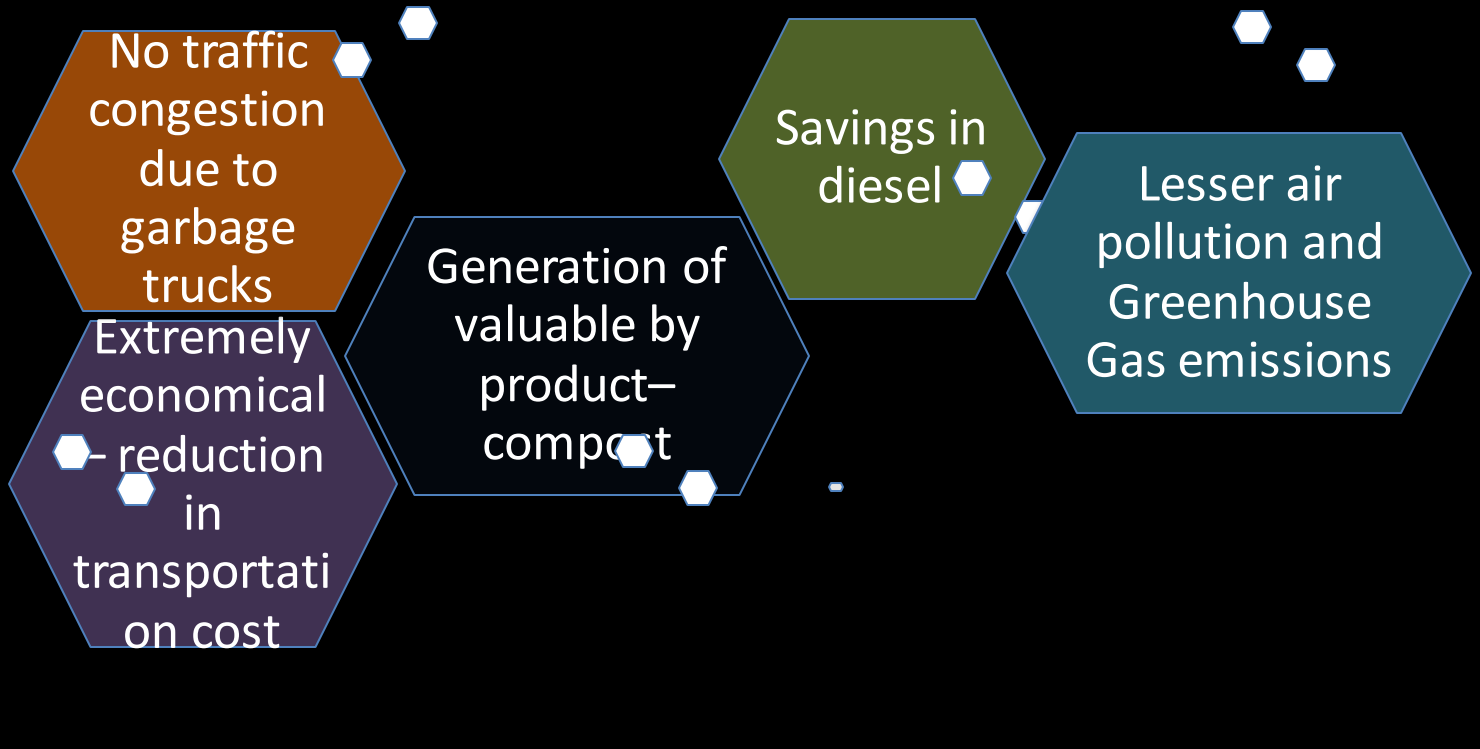
Integrated In vessel Composting

Integrated composting is a unique invention for rapid conversion of :

ECOGOLD OWC

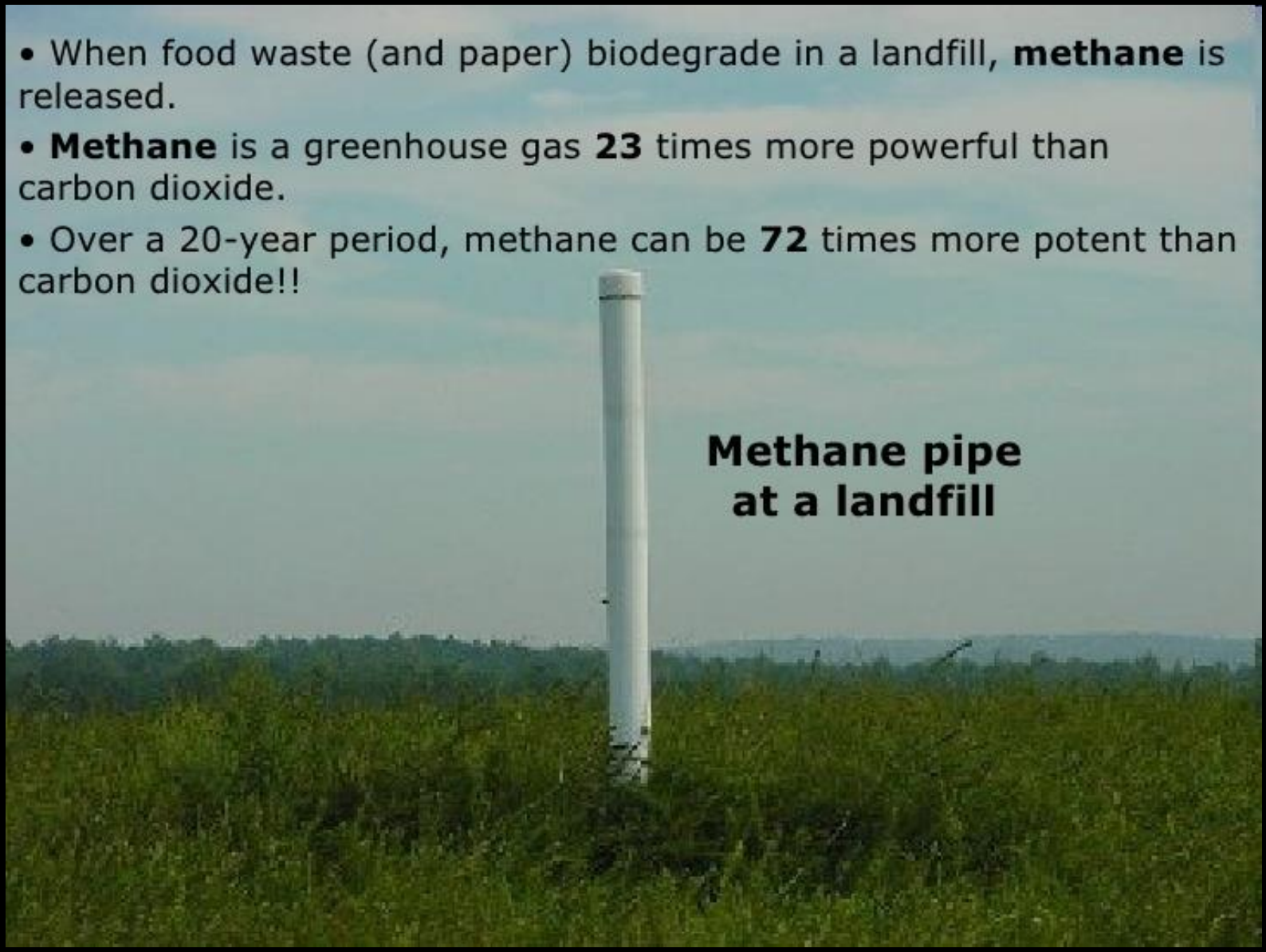
NOTE: BIOGAS NOT GENERATED

Benefits of Decentralized Management of Solid Waste



Mobile Management–Truck mounted Compact ECO-SMART Composters

- When food waste (and paper) biodegrade in a landfill, **methane** is released.
- **Methane** is a greenhouse gas **23** times more powerful than carbon dioxide.
- Over a 20-year period, methane can be **72** times more potent than carbon dioxide!!



Methane pipe at a landfill

How does it work?

- **Water:** material in bin should be as damp as a wrung out sponge. Add water if not, and when building pile. Add sparingly in winter.
- **Air/ Oxygen:** mix/stir occasionally
- **"Green" materials:** (nitrogen) food waste
- **"Brown" materials:** (carbon) leaves, hay, shredded and soaked newspaper, egg cartons
- **Microorganisms:** eat material and heat it up

ALL THE BELOW MATERIAL CAN BE COMPOSTED


Vacuum cleaner sweepings




Paper tissues

Veggies and fish/meat
Waste/waste food

Eggshells

Bones

Hair

Nails

Waste dog food


Waste flowers

NON COMPOSTABLE STUFF
ALL THE BELOW MATERIAL CANNOT BE COMPOSTED

THERMOCOL &
PACKING MATERIAL

PLASTICS

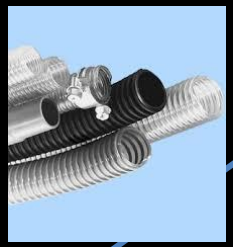
PLASTIC AND METAL
BOTTLES,AND CONTAINERS

CONSTRUCTION DEBRIS

LEATHER, REXINE

BATTERY
CELLS

SANITARY NAPKINS



PVC Etc.

CLOTH

LIQUIDS

STEEL ITEMS

HARDWARES

IN SHORT, ANYTHING THAT IS NOT OF NATURAL ORIGIN CANNOT BE COMPOSTED

RESTRICTED ITEMS
(feed in limited quantity)

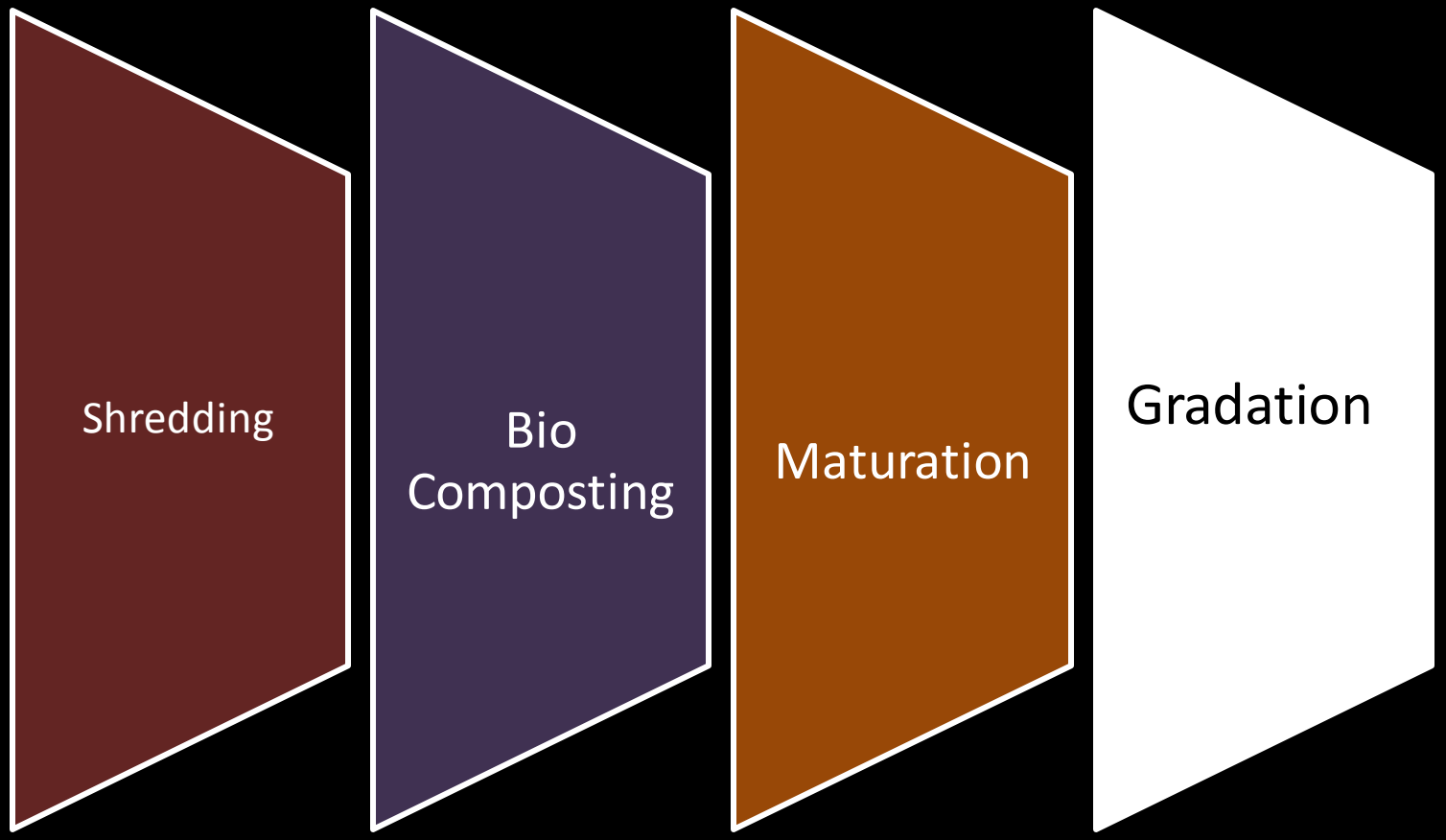
Paper – not to exceed 5% of garbage

Carpentry waste (wood only)-- not to exceed 5% of weight of garbage

Cardboard packaging waste (no plastics)-- not to exceed 5% of weight of garbage

Total of these items -- not to exceed 10 % of weight of garbage
Store and distribute feed over a few days

Integrated Organic Waste Converter



		Traditional OWC	Integrated OWC
1	In vessel composting	No	Yes
2	Integrated composting--shredding, blending, composting, maturation, sieving	No; only shredding and blending is done in the machine; composting and maturation is done on open trays	In an integrated system, once the garbage is shredded and charged at one end, compost is ready for withdrawal from the other end of the machine
3	Odour and pest nuisance	highly susceptible	No odour and pest issues as the system is fully enclosed
4	Technology	Low end	High end
5	Saw dust	may be required	not required
6	Manual intervention	high	minimal
7	Treatment of hard material like bones, coconuts etc	Not possible	Easily done

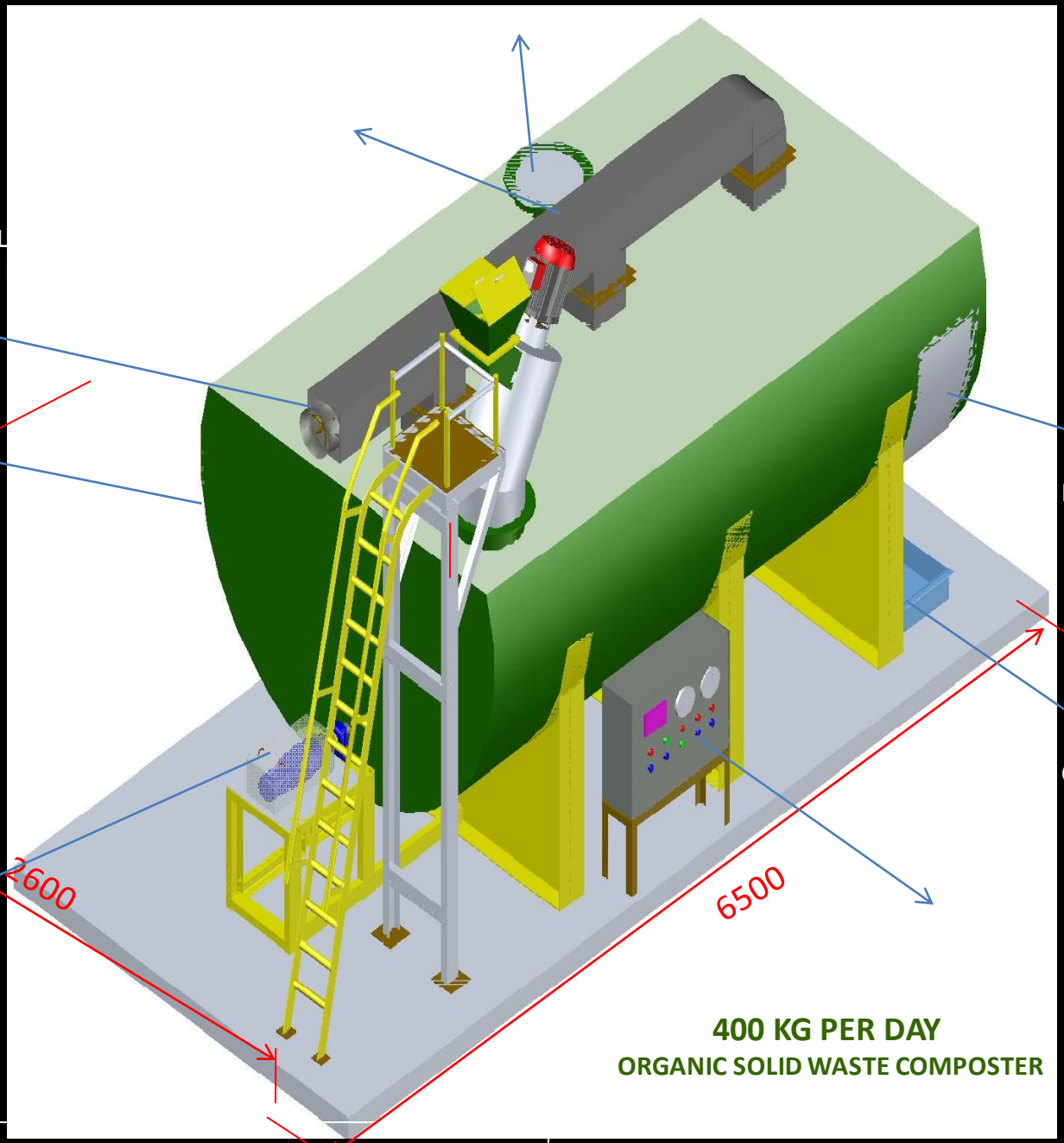
Waste

Shredder

Integrated Composter

Ready Compost


Feed In let
Garbage Bin
Composter Drum
Shredder


EXHAUST FAN
COMPOST DRUM
SIEVES FOR
PRODUCT DISCHARGE
2500
COMPOST TROLLEY
2600
6500
GEARED MOTOR
400 KG PER DAY
ORGANIC SOLID WASTE COMPOSTER

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