



Confederation of Indian Industry



New and cutting-edge Technology for Wastewater Management

-Vijay Bhaskar



Water is a crucial parameter in achieving sustainability



Has a direct impact on 9 areas.



- Ion Exchange –Brief Introduction
- **Waste Water**-The Problem Definition
- Impact on Treatment **Process design**
- **New technologies** for Wastewater Treatment /recycle
- Conclusion

Overview of Ion Exchange India Ltd.

www.ionexchangeglobal.com

Over 55 years of PAN India presence.

Manufacturer of Specialty chemicals & Ion Exchange Resins in ISO 9001,14001 & OHSAS 18001 certified facilities.
MEMBRANES

Comprehensive 24/7 support ensures continuity.

Design, Engineering and Supply of water, waste water treatment and recycle plants on turnkey and EPC basis

Largest one stop shop water solution's provider in Asia

Global footprint with exports to several African , European and Middle East countries as well as to UK and USA.

AV

Research & Development



Well established in-house R&D department since 1965



Recognized by Department of Scientific and Industrial Research (DSIR), New Delhi



R&D Centers

- For Chemicals at Patancheru, Telangana
- For Engineered Products & System at Vashi, Maharashtra



Product application and testing centers with numerous patents to their credit

- Over **10 patents**
- Over **100 products launched**



Domestic Footprint

ANKLESHWAR, GUJARAT



Ion Exchange Resin

WADA, MAHARASHTRA



Fabrication Facility

RABALE, MAHARASHTRA



EOU & Engineering Design Facility

PATANCHERU, TELANGANA



Chemicals Facility

VERNA, GOA PLANT 1



Standard Systems

GOA PLANT 2

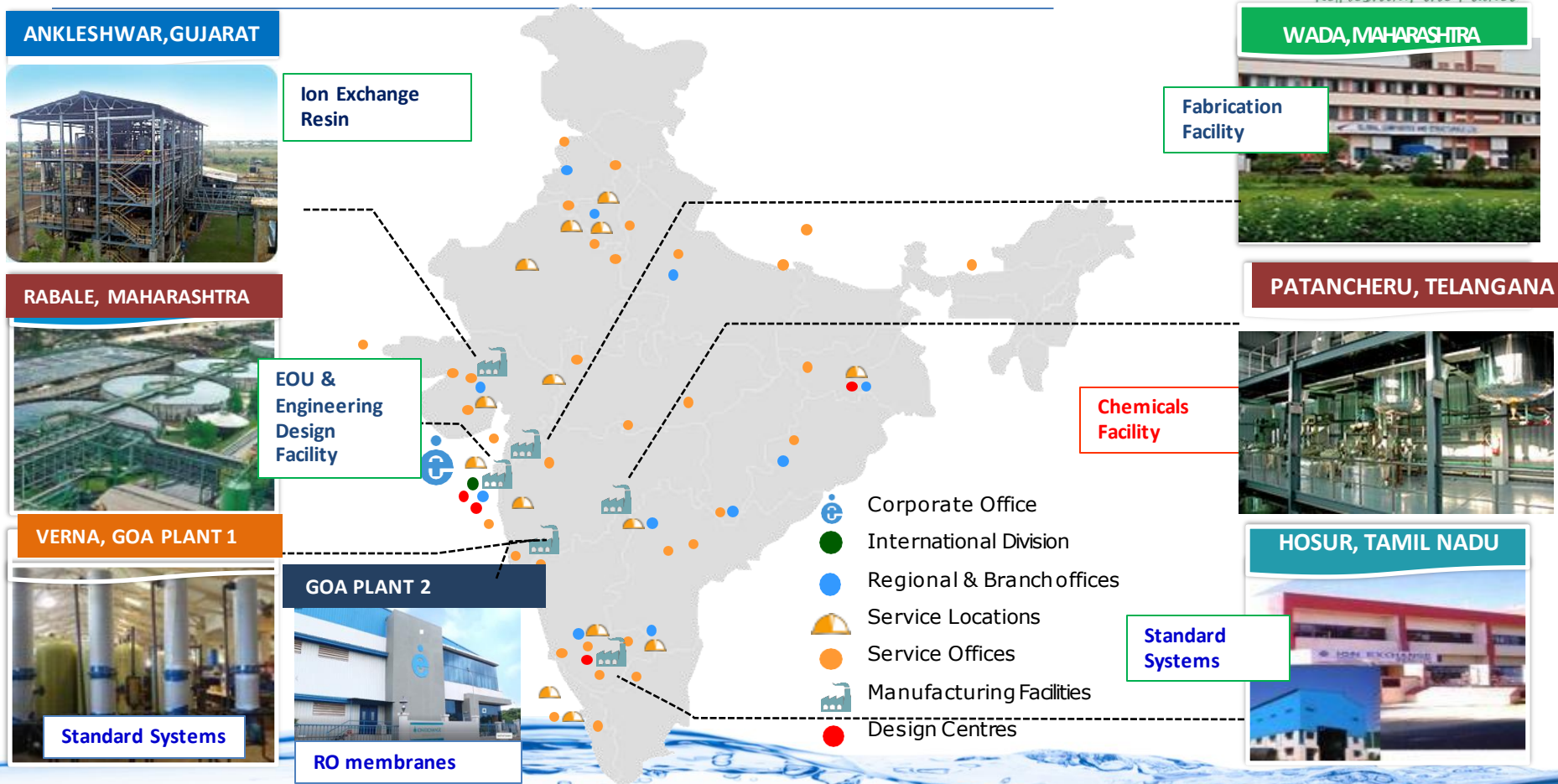


RO membranes

HOSUR, TAMIL NADU



Standard Systems



Membrane Manufacturing-HYDRAMEM

 ION EXCHANGE
Refreshing the Planet

 **HYDRAMEM**[®]
HIGH PERFORMANCE MEMBRANES



Goa, India

- ✓ Fully Integrated RO Membrane Facility In Asia - RO Sheet Casting & Rolling of 8, 4 & 1.8 Inch
- ✓ World Class Testing Facility - Raw material & finished Product with In-House R&D
- ✓ Manufacture-Low Energy membrane, Brackish High Rejection (HR), Fouling Resistant, Sea Water & Nano Filtration

Casting & Coating section

www.hydradem.com

Drivers

- Intensified fresh water scarcity-Uneven supply & Climate Change
- Stricter regulation for waste water disposal
- Corporate Social Responsibility (CSR)/Public Environmental Awareness
- Raw water costs getting expensive
- Rapid Population growth & Urbanization
- ISO 14001/50001
- High costs of waste water disposal
- Deteriorating Water Quality-Pollution & over exploitation of Aquifers



Benefits

- Product Recovery
- Compliance to Environmental regulation
- Augment water supply
- Savings on fresh water
- Protect the Environment



- Raw water scarcity
- Raw water costs are high (Rs.25 -150 / m³)
- Strict discharge regulations

Resulting to think in terms of :

- I. Water audits (for Usage Optimization)
- II. Emerging alternate sources- Waste Water Recycle, (Industrial & domestic), Zero liquid discharge (ZLD) & Desalination



Common Platform for the Problem Definition

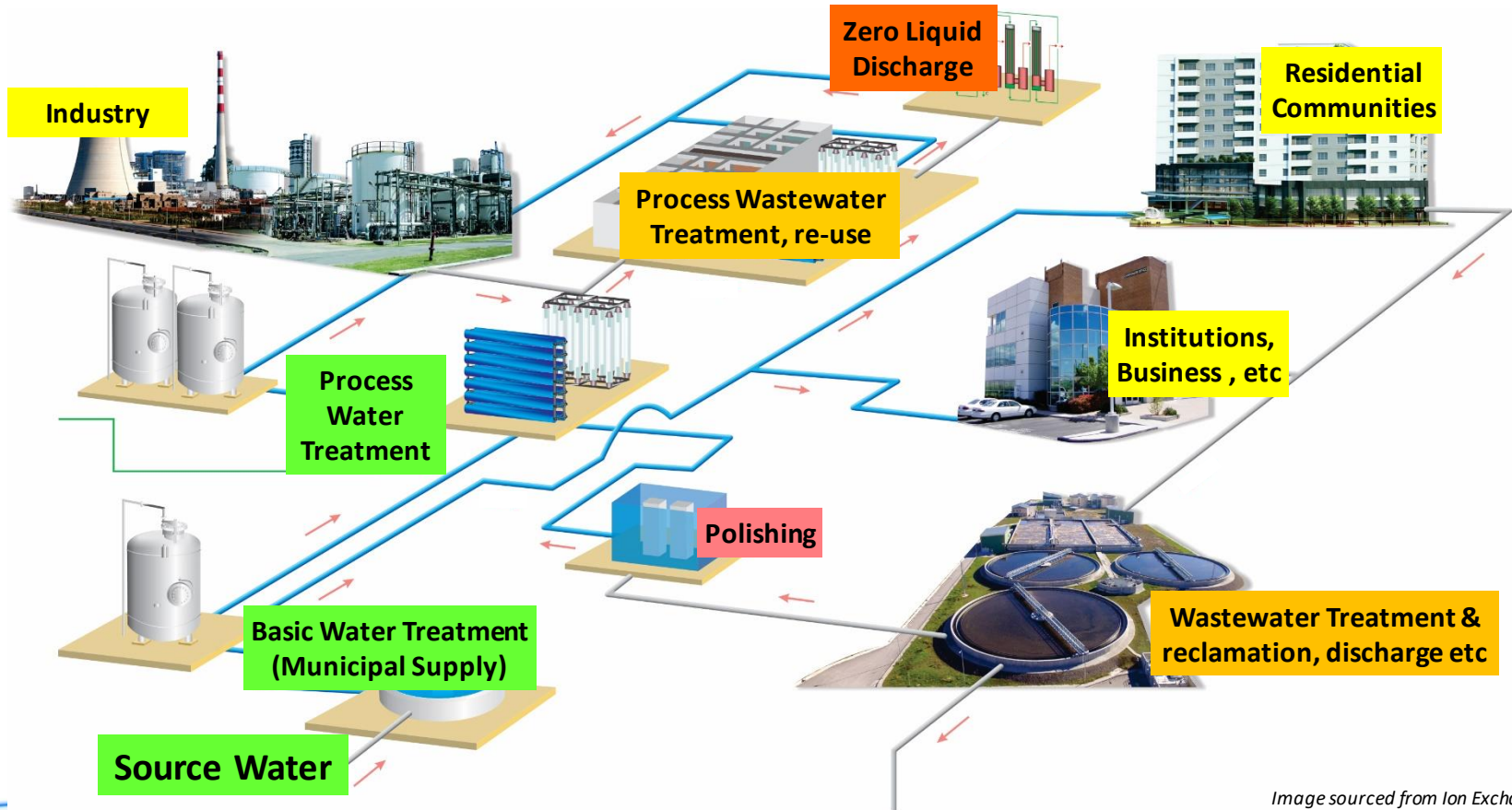


Image sourced from Ion Exchange India Ltd.

Understanding the Problem - Quality &

Further made even more challenging by :

- Extreme Events (Winter Chill, Climate Change)
- Extra-ordinary Rain fall
- Industrial Leaks/Discharges
- Urbanisation, Mega Cities: (sheer pop. density)
- Massive social changes !

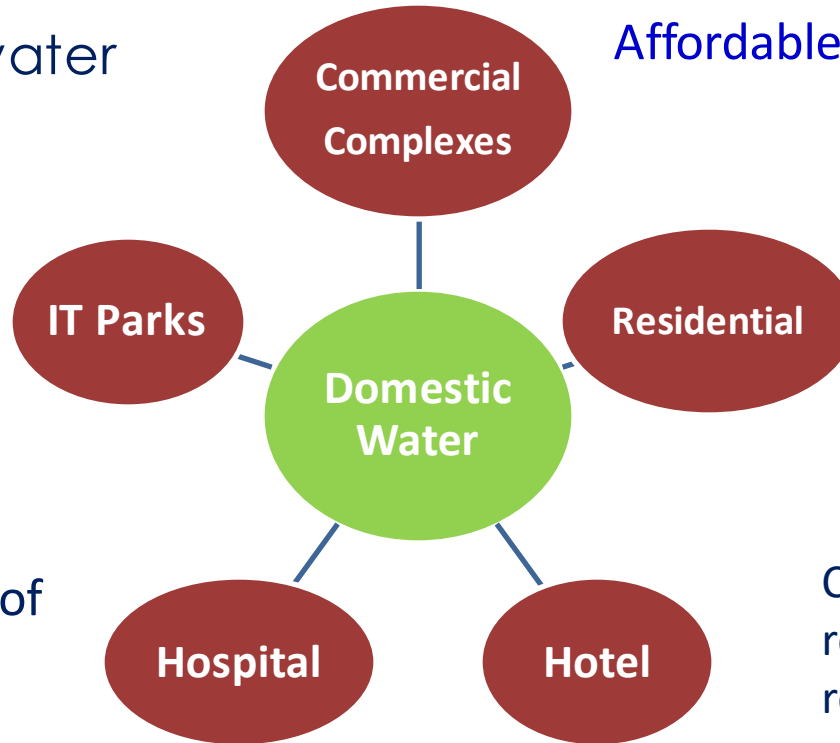


Image sourced from Ion Exchange India Ltd.

Domestic Waste Water Generation-Sustainable Source

Infinite source of water

Affordable & Easily available



Not complex in terms of contaminants

Can be recycled for Industry requirements & domestic requirements

Industrial Waste water-An Alternate of Source

Huge Quantity
Generated



Some are Complex in
Nature but treatable

Only 20% is
recycled for reuse

Can be recycled & use
for high / low end
applications

The General Process Flow – Wastewater treatment

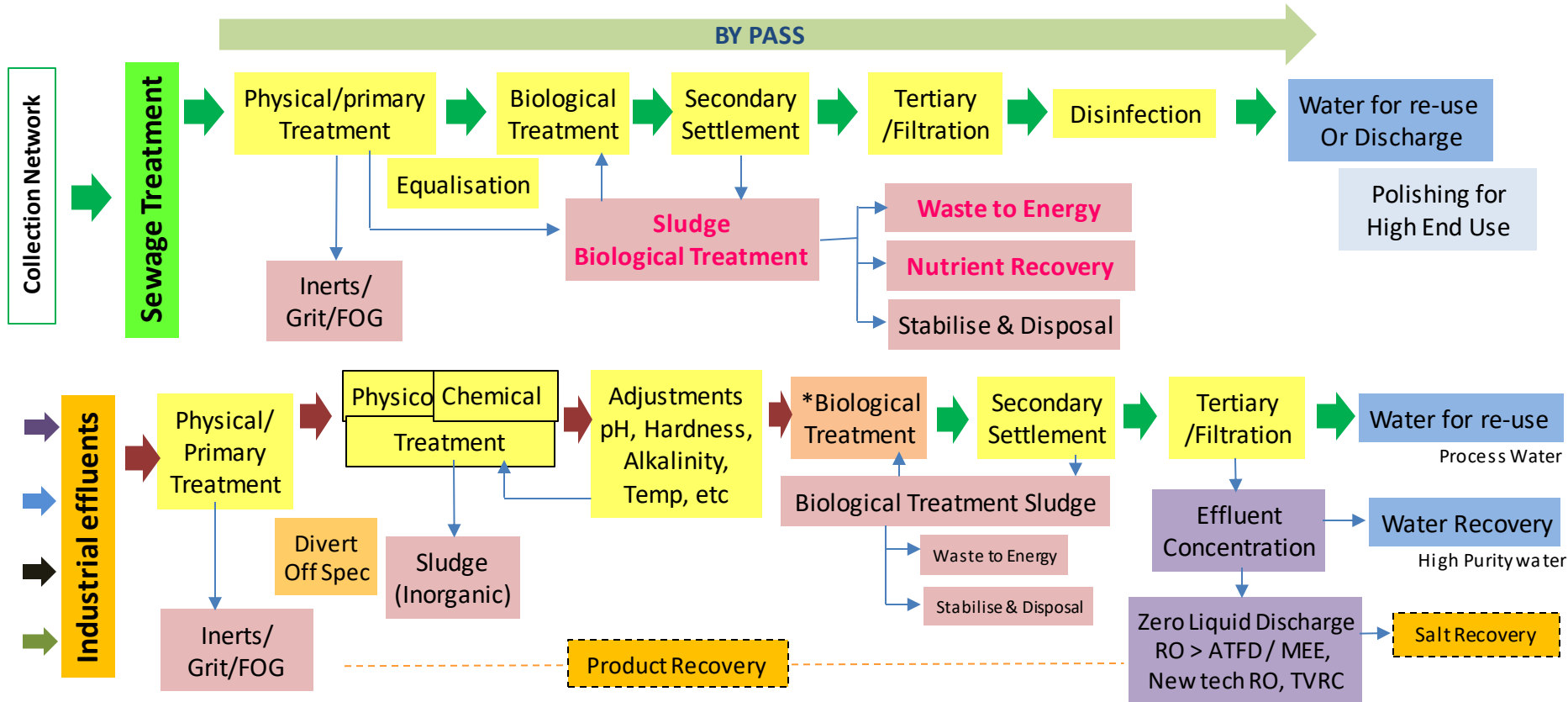


Image sourced from Ion Exchange India Ltd.

The General Process Flow

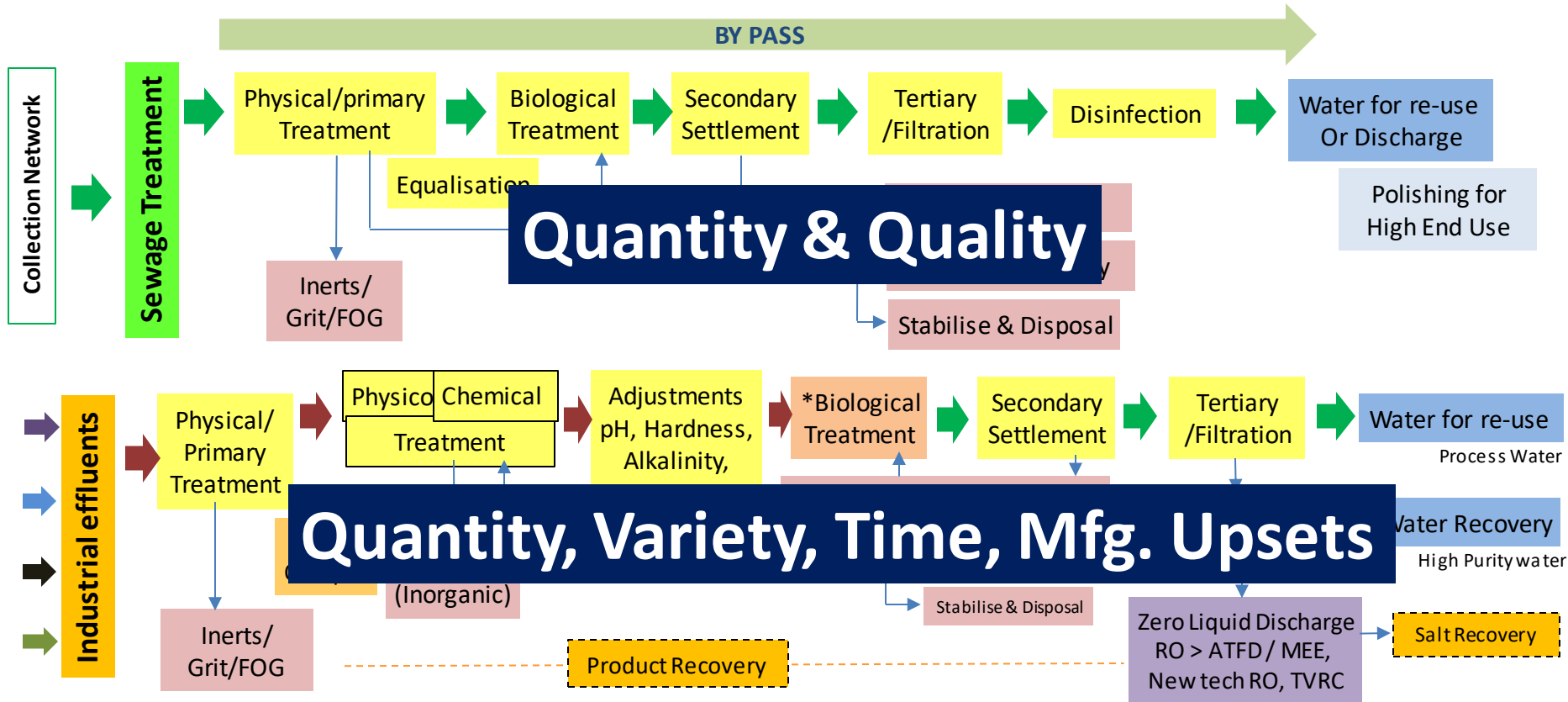


Image sourced from Ion Exchange India Ltd.

Importance of Waste Characterisation / Stream

S. No.	PARAMETER	Rice washing 4am	Dal wash 4am	Starch 8am	Floor washing 11am	Vessel washing 11am	Vegetable washing 11am	Vessel wash 4pm	Sewage
1	Flow Volume CuM	3	3	30	55	60	5	25	55
2	pH	7.00	6.59	5.85	7.13	5.58	6.42	5.83	6.5-8.0
3	Conductivity (ms)	1,753	2,900	1,053	926	1,524	1,035	1,004	
4	TSS (ppm)	8,618	5,622	19,420	6,734	918	1,948	2,004	
5	TDS (ppm)	3,340	5,580	13,790	620	1,240	800	660	400
6	Without filter COD	7,360	13,120	32,800	592	1,200	512	2,688	
7	Filtered COD (ppm)	4,720	6,400	27,200	336	560	244	496	
8	Without filter BOD	900	2,933	17,667	259	500	210	633	250
9	Filtered BOD (ppm)	650	2,267	6,167	94	222	95	265	
10	Oil & Grease (ppm)	>10	>10	>10	265	330	>10	738	

Focus areas of New Technologies

Applications

- Energy & Treatment efficiency
- Ability to handle varying demands (both Hydraulic & other Loads)
- Stable Treatment Quality & Process Flexibility
- Data Analysis > Process Value Predictions > Model Predictive Controls
- Waste Minimisation – Sludge Volumes, Back wash Volumes, Chemical consumption
- Cost - CAPEX & OPEX
- Lesser reliance on Manual intervention, self learning

Technologies

- Membrane Technologies- UF, RO, NF, **AMBC/FO, EDR, Membrane distillation**
- De-salination – New membranes (FO, Brine mining), new thermal processes
- **Speciality Chemicals, for improving performance** of Membranes, dis-infection
- Enzymes, Micro-biology, Engineered Eco-systems > Improved Wastewater treatment
- Cloud based optimisation, **AI & Data analytics platforms** – KPI tracking
- **Waste to Energy, product recovery from waste.**

Waste Water treatment -Innovative technologies

Physico Chemical

- ❖ Ultra High Rate Solid Contact Clarifier (UHRSCC)
- ❖ Multimedia filters (MMF)
- ❖ Continous Sand filter (Disc Filters)/Self Cleaning Bio-filters
- ❖ **Advanced Oxidation-Electro Coagulations system**
- ❖ **Ceramic Filters**

Biological Treatment

Aerobic Process

- ❖ Extended Aeration
- ❖ **NGP STP**
- ❖ High Rate FMR/ MBBR
- ❖ Sequential Batch reactor
- ❖ **MBR IPC**

Anaerobic Process

- ❖ UASB-Tall Reactors

Recycle System

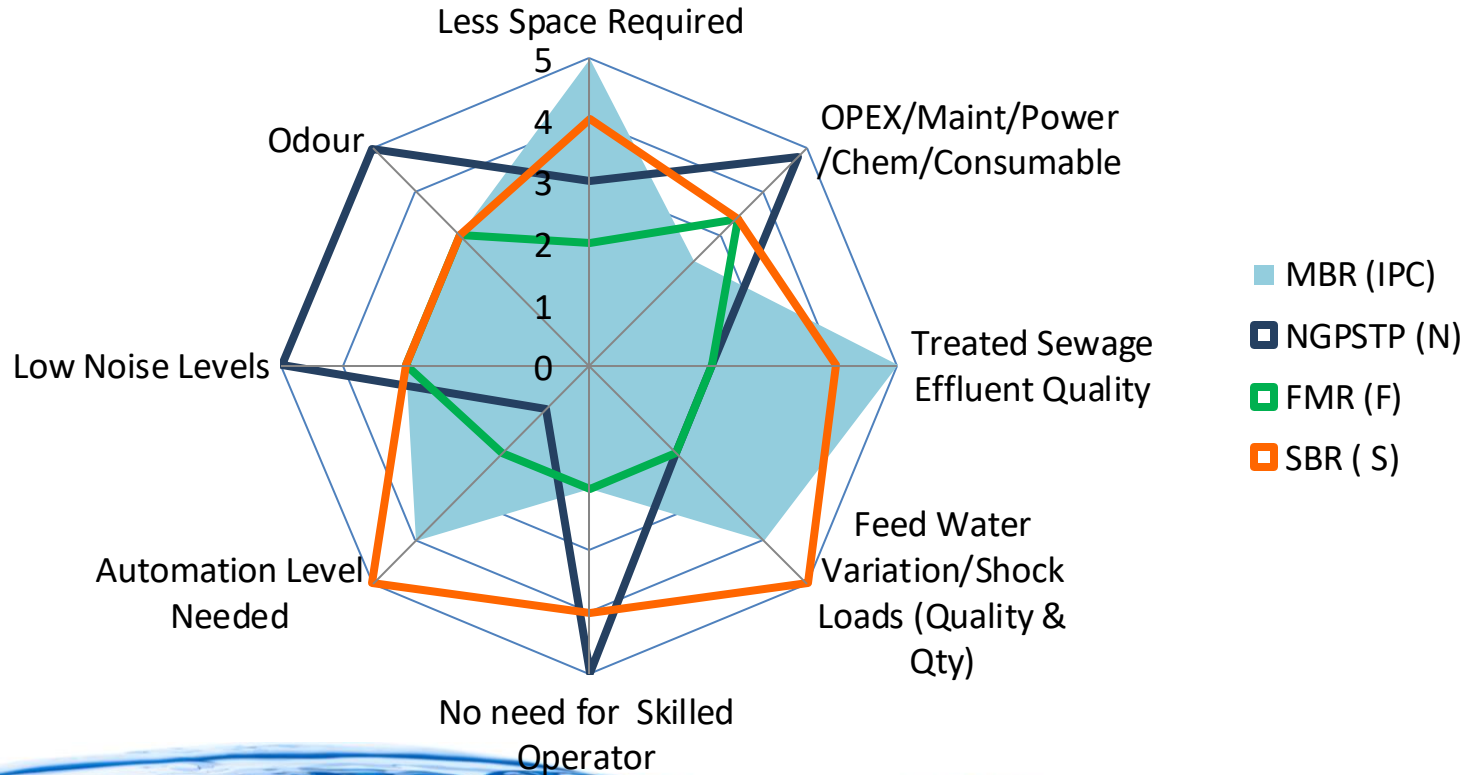
Membrane Processes

- ❖ Micro filtration
- ❖ Ultra filtration
- ❖ **MBR-IPC membrane**
- ❖ Nano Filtration
- ❖ Reverse Osmosis(RO)
- ✓ **Spiral Membrane**
- ✓ **Disc & Tube Membrane**
- ❖ **AMBC/Forward Osmosis (FO)**

ZLD

- ❖ Multiple Effect Evaporators (MEE)
- ❖ Mechanical Vapour Recompression (MVR)
- ❖ Dryers
Agitated Thin Film Dryer (ATFD)
Centrifuge (Pusher)

COMPARISON OF DIFFERENT STP TECHNOLOGIES



NEW GENERATION SEWAGE TREATMENT PLANT (NG PSTP)

- All in one package (Single Tank design)
- Minimal site work (Factory assembled)
- **Low power consumption (0.75kwh/m3)**
- **3- months sludge storage capacity**
- Suitable for 10 – 100 m³/day capacity



NEW GENERATION SEWAGE TREATMENT PLANT (NG PSTP)



FLUIDISED MEDIA REACTOR (FMR)

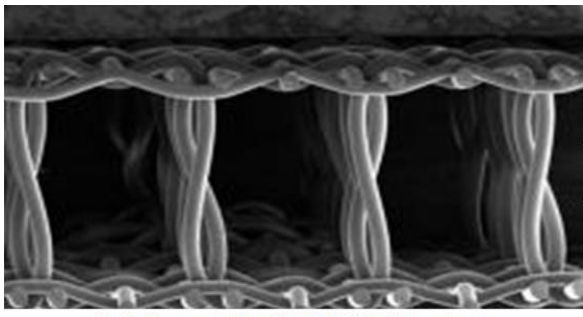
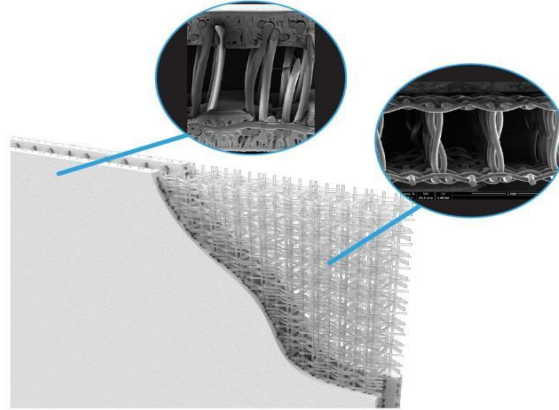


Global Hospitals-FMR 400 KLD
Chennai

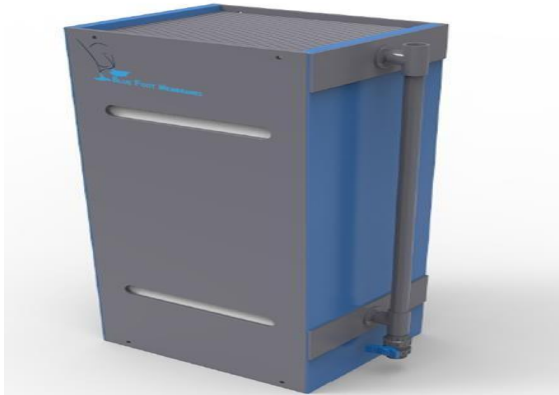






Membrane Bio Reactor-Integrated Permeate Channel (IPC)

- IPC MBR is an innovation in MBR Technology
- It combines the advantages of flat sheet and hollow fiber membrane systems while eliminating the disadvantages of flat sheet MBR
- Back-washable membrane with a delta P > 2 bar -Transpressure



↑
Integrated
Permeate Channel
↓



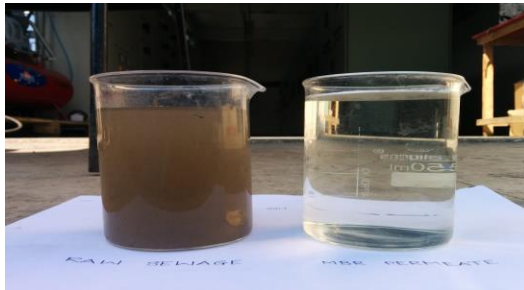
-  Improved fouling control
-  Flux yield + 30-50%
-  Higher packing density + 50%
-  Robust design
-  Low aeration demand
-  Competitive cost

MEMBRANE BIO REACTOR-IPC MBR



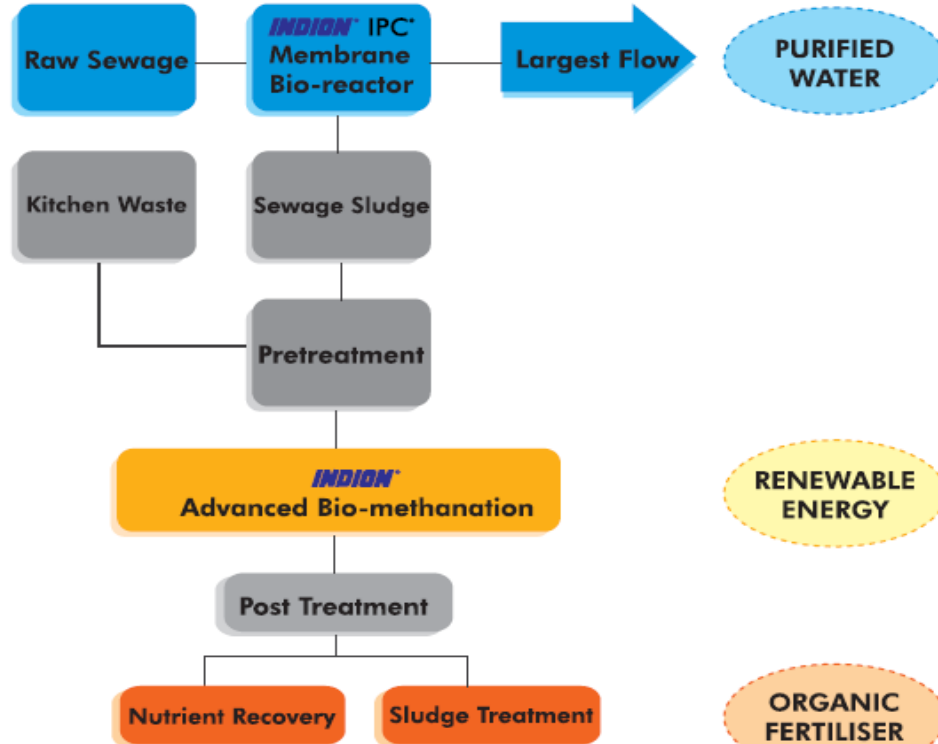
IPC MBR Plant Performance

Parameter	Units	Raw sewage to Pilot plant		Treated Sewage (After Indion MBR)		Reduction %
		Actual	Design	Actual	Design	
pH		6.0 – 8.3	6.5 - 7.5	7	6.5 - 7.5	
TSS	ppm	58 – 918	150 – 200	*BDL	< 1	~ 100%
COD	ppm	121 – 812	400 – 500	18	< 30	> 94 %
BOD	ppm	71 – 415	250 – 300	*BDL	< 10	~ 100%
TKN	ppm	22	40 – 50	1.3 – 4.5	< 5	> 85 %
Turbidity	NTU	240 – 295		3 – 5		
Color		Turbid		Colorless & Odorless		
Total Bacterial Count	Cfu/ml	> Log 9	-	<u>Bacteria -6log</u> <u>Virus -3 log</u>	6 log for Bacteria	



**FEED (RAW) SEWAGE
&
INDION MBR
(TREATED SEWAGE)**





- **Heat Energy** (Commercial Application)
- **Electrical Energy** (Commercial Application)
 - Can work as standalone system (decentralised) or can work along with the Grid taking Net-Metering into account
 - Can be hybridised along with the existing Solar Rooftop Projects of the Client
- **Bio-CNG** (replacing LPG cylinders)
- **Organic Manure** (Agriculture)

Integrated Waste to Energy System-Demonstration Plant



Integrated Waste to Energy System-Demonstration Plant



Akshaya Patra ,Hyderabad

Akshaya Patra ,Hyderabad ,Demonstration plant

Design Basis

- MBR STP sludge : 2000 - 6000 kg/day
- Kitchen waste : 900 kg/day

Biogas & Fertilizer generated from pilot plant shall be:

- Biogas production (65 % methane):
± 10 Nm³/h
- Gross electrical output:
± 20 kW/hr
- Digested sludge -Fertilizer(with 4-5% solids) : ± 493 T/year

All Membrane Brine Concentrator (AMBC)

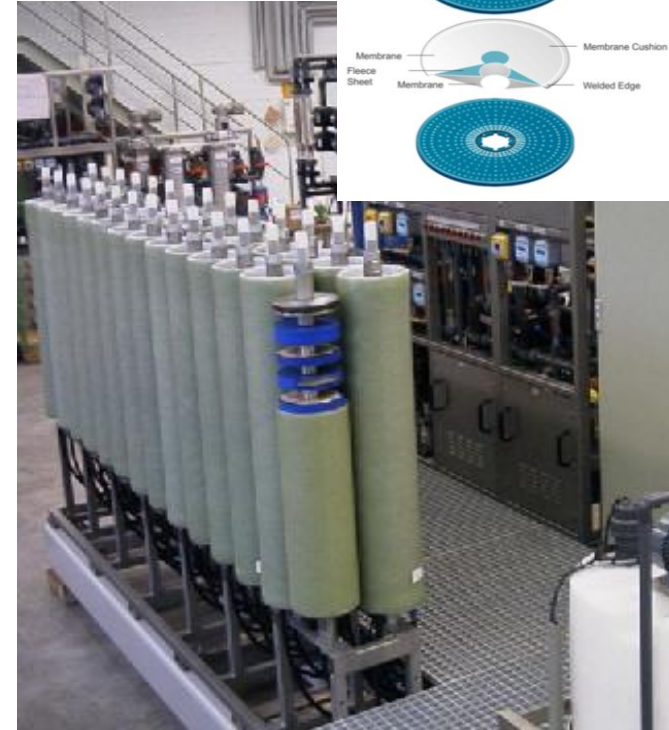
- Overcomes membrane limitations
Higher COD & TDS
- High recoveries
Beyond > 90-95%
- Reduces Capacity of **Multi Effect Evaporator**
- Can be used in existing Sea water RO to **enhance recoveries**
- Can be used for **product recoveries** in specific industries



Advanced recycle system –ZLD System

INDION® Disc & Tube / Plate & Frame RO

- **DTRO is flat-sheet membrane technology**
To treat **complex water** with **minimal pre-treatment and foot print** to produce water with lower TDS ,colloids , Organic matter & Particulate.
- **Handle tough effluent -Distillery, Pharma, Textile and Chemicals Industries**
Higher feed COD (30,000 mg/l) and TDS (24,000 to 50,000 mg/l)
- **Precursor to ZLD**
To reduce the life cycle cost of the system



- **Forward Osmosis (FO) is a 'green' process** which use Semi-permeable membrane to **separate water from dissolved solids.**
- System can handle:
 - **High TDS (70,000 ppm – 2,00,000 ppm)**
 - **High COD/BOD (> 5000 mg/l / > 8000 mg/l)**
- Up to 80% recovery with permeate
TDS < 50 ppm



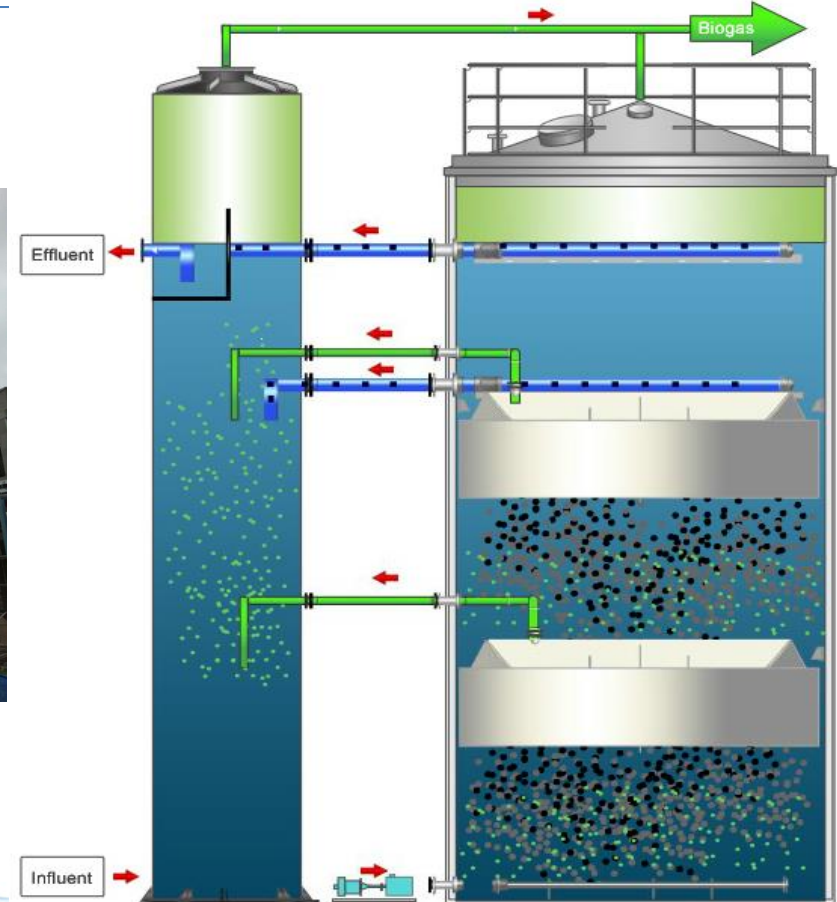
ANAEROBIC Reactors –Advanced Tall Reactor

- **HIGH RATE REACTOR-COD LOADING** is 15 – 35 kg /m³.day

- **UNIQUE Phase separator** for Gas-Liquid

- **Low Maintenance**

No complex internals or rotating equipment inside the reactor



Conclusion

- New technologies are available to meet all sorts of Waste water treatment challenges
- The sustainable way forward starts with basics: Understanding characteristics & efficient wastewater management. *This is a low hanging fruit, to ensure sustainability.*
- *Prior experience & detailed knowledge* of effluent streams is a key factor, for successful implementation of ETPs./STP.
- New technologies provide many excellent options, to *make a remarkable improvement* in quality of life of everyone.



***Water is everybody's business!
Together, we can make a difference.***

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Thank you for your Valuable time!

