COMPANY PROFILE

Clear thinking. Clean life. Pure technologies

ecos GROUP

INDEX

COMPANY PROFILE

For over 25 years, our Company has been a Leader in the treatment and recycling of municipal and industrial wastewater.

Our treatment plants operate in all climate zones and, over the years, have treated more than 1 billion cubic meters of wastewater.

We are professionals and customer care is a priority of our work and development.

We are an innovative company. We look to the future and our competitive advantage lies in the search for new technologies and methods of water recovery.

Our research and development help in implementing the unique process solutions and providing not only low-cost manufacturing and construction, but also the lowest operating costs in the sector, which compare us favourably with our competitors.

ECOS Group provides the complete range of services in the field of wastewater treatment. We are ready to perform individual projects related to engineering inspection, design, manufacture or construction of water treatment facilities and integrated projects of any complexity and scope.

It makes no difference to us whether the plant you need is for a capacity of 100 or 100 000 m^3/day. Working with our company, you will get a full range of engineering services and our main distinction is that we are ready to operate each of our projects during any period of time, clearly confirming the high stand ard of our technology and equipment

ECOS Group Founder
Dr. Michael Zubov

Today, more than two billion people in the world are short of water, more than a billion of them living under conditions of the most severe water shortage. The problem is particularly acute in arid countries, where renewable water reserves are very limited.

Over the years, uncontrolled discharge of industrial and municipal wastewater into water basins is increasing, thereby reducing freshwater sources. Lack of fresh water contributes to food shortages, which are becoming a serious restriction on social and economic development, often threatening national security.

We believe that, given proper treatment, the wastewater from the tremendous international problem is capable of being turned into a resource of untapped potential that brings, additional benefits in an era of transition to what may be called eco-economics.

We see development of this idea in the wide spread and cheapening of technologies that allow waste and wastewater to be processed into: electric and thermal energy, organics and clean water.

Our first step in this direction consists in energy-saving plants that allow wastewater to be recycled for industrial or irrigation purposes. We have developed and are now implementing. Megapolis® Plants with zero emissions, which are capable of deeply purifying wastewater without harming the environment.

We have made signicant strides in developing technologies for treating wastewater with a high nitrogen content, thanks to research into anammox bacteria and developments based on the results of these studies.

We have developed SRP® and WRP® units for treatment of waste water sludge, as well as other organic waste. The treatment process is based on gasification of organic materials under supercritical water conditions. At the present time ECOS is performing test run of SRP® unit in accordance with SRP-300 Pilot Plant Project for Manfouha WWTP in Riyadh, KSA.

The list could grow, as we are not satisfied with what has already been achieved and are continuing to set ourselves ambitious plans.

We do not claim to be able to resolve all the world's water problems, yet our developments and technologies are already bringing humanity one step closer to taking care of water resources, which are vital for every living organism

ABOUT

ECOS Group Manufacturing Plant in Russia for Container (package type) WWTP's

Upgrading of Manfouha WWTP, 500 000 m^3/day, Riyadh, Kingdom of Saudi Arabia

HISTORY

1990

Establishment of the Company.

1991

Development of the ERSH® package type wastewater treatment plants based on the method of immobilisation of microorganisms with a synthetic ERSH® filling.

Registration of patents for technologies and equipment for wastewater treatment.

2005

Launch of our own production of package type treatment plants.

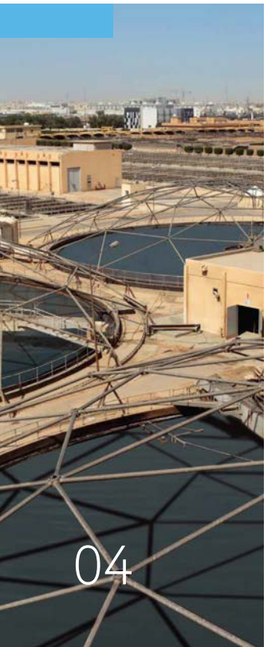
2006

Launch of Projects in Saudi Arabia.

ISO 9001 Standard certication of the Company.

Design of 30 000 m³/day Megapolis® WWTP at Odintsovo, Russia

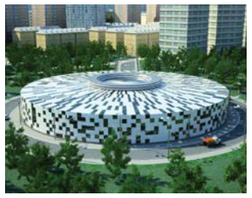
Upgrading of Manfouha WWTP, 500 000 m³/day, Riyadh, Kingdom of Saudi Arabia



2010

Start of new innovative Megapolis® Project — zero emission biological treatment plants.

Establishment of an ECOS Branch in Saudi Arabia (Riyadh).



2011

Establishment of our own design institute (South Design Institute).

Establishment of a GRP vessel factory.

Collaborative study, in cooperation with the Vinogradsky Institute of Microbiology, Russian Academy of Sciences, of anammox bacteria application in treatment of low concentration wastewater.

2013

Launch of the Project “Upgrading of Manfouha WWTP” in Riyadh, Kingdom of Saudi Arabia.

2014

Completion of the first Zero Emission WWTP Megapolis® with a capacity of 18 000 m³/day for the Skolkovo Innovation Centre.

The research team under the leadership of Company founder Dr. Michael Zubov is awarded the Russian Government Award in Science and Engineering for developing the scientic basis and implementation of a new biochemical technology of wastewater treatment using anammox bacteria.

2015

Corporate restructurings distinguishing the key specialisations into independent enterprises incorporated by the managing company

2017

In cooperation with the Saudi partner, start of SRP® 300 Pilot Plant Project, which includes testing of SRP® unit in hot climate conditions at Manfouha WWTP, Riyadh.

SRP UNIT

2018

Completion of the main works under the project of Development and Upgrading of Manfouha WWTP in Riyadh.

By request of the Minister of Environment, Water and Agriculture of Saudi Arabia ECOS worked out Master Plan for Development of Waste Water Treatment System in the City of Riyadh Up to the Year 2035 and Proposals for Optimization of Waste Water Treatment System in the City of Jeddah, based on the principle of reuse of the treated waste water.

ecosGROUP

ECOS GROUP STRUCTURE

As of today, the ECOS Group includes several independent enterprises, each of them being responsible for its own task and engaged into project implementation at the right moment.

KB ECOS

development of design documents; certifying and serial production of electromechanical equipment.

SVETEC

the company's main mission is to manage purchases and deliveries of European equipment for the project implemented by ECOS Group.

ECOS NORTH-WEST

sells branded equipment and provides engineering services in the Northwestern Federal District of the Russia.

ECOSERVICE

provides commissioning and operation of treatment plants.

ECOS SAUDI

sells the branded equipment and services, implements integrated projects in the markets of the Gulf and Middle East countries.

PRODUCTION COMPANY LTD.

specialized in design, certification and serial production of package type waste water treatment plants, pump stations and cylindrical vessels from GRP.

ECOS INVEST

at the head of the Group, there is ECOS INVEST Managing Company, which deals with strategic development of the Group, corporate management, investment activities. The Managing Company is the parent company and holds the controlling interest in all subsidiaries.

ECOSPROM

specialized in design, certification and serial production of package and container type waste water treatment plants of LBR® and IBR® series, natural water treatment plants of VOS series, storm water treatment plants of LOS series.

SOUTH DESIGN INSTITUTE

is engaged in development of the design documentation and engineering activities, including supervision at the stage of project implementation.

ECOS

engineering center of ECOS Group, specialized in development of engineering, process and design solutions, as well as research development. Is carrying out marketing of products and services and project management.

Upgrading of Manfouha WWTP

Working meeting with Client in Riyadh, Saudi Arabia

CORE ACTIVITIES

01

DESIGN AND CONSTRUCTION OF NEW TURNKEY TREATMENT FACILITIES

We are ready to work in a responsible partnership with our Clients, from project design to commissioning, with mandatory quality verication in the long term.

During construction of new facilities, ECOS is ready to undertake fund raising and ensure subsequent recoupment of projects such as BOT projects.

02

INSPECTION AND UPGRADING OF EXISTING TREATMENT FACILITIES

We undertake the biggest challenges in upgrading existing facilities. Every project starts with a comprehensive survey and development of terms of reference for step-by-step upgrading without interruption of the treatment process.

Today, we can guarantee that the capacity of almost any treatment plant can be increased merely by means of more efficient process solutions.

03

SERVICE AND MAINTENANCE OF TREATMENT FACILITIES, PERSONNEL TRAINING

We are ready to operate any treatment facilities ourselves, offering guaranteed cost savings and sustained treatment quality. Even so, the Client may choose to operate any of our plants. For this purpose, ECOS Group will conduct the necessary training and provide engineering support at any time.

04

DELIVERY AND INSTALLATION OF CONTAINER PLANTS FOR INDUSTRIAL WATER TREATMENT

Since 2005 we have been producing waste water treatment plants at our own factory in Russia.

Modular and compact plants are 95% factory ready for commissioning to keep the costs low. It can be used effectively anywhere in the world.

Upgrading of Manfouha WWTP, 500 000 m³/day, Riyadh, Kingdom of Saudi Arabia

05

MEGAPOLIS® DESIGN – ZERO EMISSION TREATMENT PLANTS

Our innovative solution Megapolis® is a new generation plant with zero emissions. It is extremely compact and totally enclosed: all the treatment processes are located in the same building and harmful emissions are recycled. Environmental pollution is thus reduced to zero and the sanitary protection zone to a minimum

06

MONOBLOCK: OPTIMIZATION OF CAPITAL AND OPERATION COSTS

Monoblock design solution for waste water treatment plants has been recently developed by ECOS Group with the purpose of capital and O & M cost optimization. Monoblock design means, that all treatment process stages are arranged in a compact form inside one process block, with minimal length of engineering networks.

Such solution provides sufficient saving of construction cost and also operation expenses, due to minimum water transportation requirements.

Megapolis® WWTP design

RESEARCH & DEVELOPMENT

We believe in the future based on high technology, free from environment pollution. With this purpose we invest in research and development.

ECOS Group R & D Department activities aim at practical implementation of the patented up-to-date technologies and solutions developed by ECOS research team.

SRP UNIT

SRP® (Sludge Recycling Plant) is designated for processing of sludge produced during waste water treatment. The process is based on decomposition of complex organic materials under high temperature and high pressure conditions. The decomposition ratio comes up to more, than 90%, and the resulted gas contains over 70% of methane.

WRP UNIT

WRP® (Waste Recycling Plant) is all purpose unit designated for processing of wide range of complex organic and chemical wastes, including very hazardous ones. Its principle of operation is similar to SRP® process, and the installed peripheral equipment allows to widen remarkably fields of application.

RESEARCHES IN ANAMMOX BACTERIA

Remarkable results have been achieved in the studies related to role of ANAMMOX Bacteria in treatment of waste water with high Nitrogen content, conducted in cooperation with the scientists from Vinogradsky Institute of Microbiology of the Russian Academy of Sciences.

For this, the Government of the Russian Federation granted ECOS Groupe in 2014 special Science And Technology Achievement Award for introduction of new waste water biological treatment process with participation of ANAMMOX Bacteria.

Research in Anammox Bacteria

DEVELOPMENT OF SRP® AND WRP® PROCESS UNITS

SRP® (Sludge Recycling Plant) and WRP® (Waste Recycling Plant) – these are two really break-through developments resulted from the studies in the field of waste water sludge and organic waste processing based on gasification of organic compositions under supercritical water conditions.

At the present time ECOS Group is implementing the pilot investment project SRP® 300 Pilot Plant in the capital of Saudi Arabia with the purpose to test efficiency of SRP® 300 Unit and its advantages during implementation on waste water treatment plants in the Kingdom.

COOPERATION WITH ALFA LAVAL

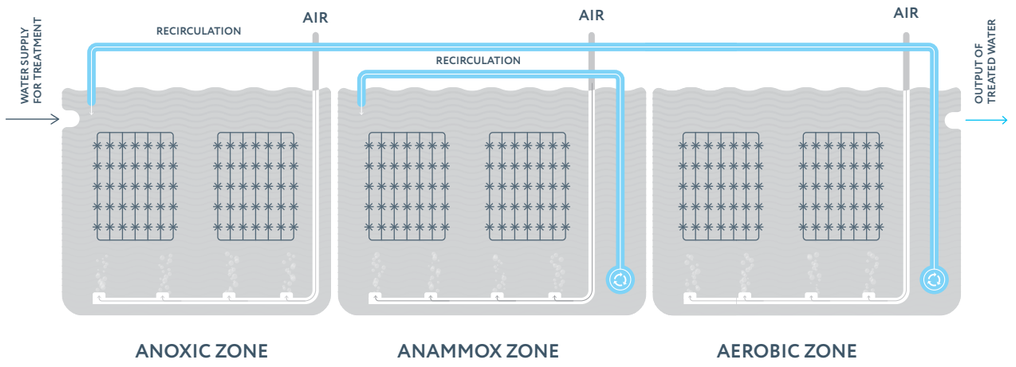
Due to cooperation with Alfa Laval Group new process solutions have been developed for treatment of industrial waste water in sugar, alcohol, vegetable oil industries and breweries. The process enables possibility of reuse of the treated effluent, and is based on application of Alfa Laval selective membranes for concentration of organic materials followed by decomposition of the concentrate in WRP® unit under supercritical conditions.

Another achievement of the cooperation with Alfa Laval is development of new type of MBR package treatment plants with low power consumption for hot climate countries. Special modules of membranes fabricated from Polyvinilidenfluoride carrying out filtration by gravity are applied, which provide increase of membrane permeability with increase of waste water temperature. Application of such type of membranes allows to reduce aeration tank volume 2-3 times, as well as to decrease substantially the total plant footprint.

Improvement of Manfouha WWTP: upgrading without shutdown

IBR® TECHNOLOGY

IBR® (Immobilized Biofilm Reactor) Technology relates to methods of wastewater purification by biofilm microflora attached to an inert immobile carrier placed in a vessel (reactor).



IBR® Process Chart

The ERSH® patented synthetic filling is used as the biofilm carrier. Cubic cartridges with ERSH® filling are fixed inside the bioreactor, which is also equipped with a fine-bubble aeration system and recirculating pumps.

The ERSH® filling has a welldeveloped surface, providing for a high density of attached microorganisms and, consequently, a high rate of biodegradation of organic impurities in the system.

The attached microorganisms have a higher concentration of biomass and a higher activity than the activated sludge and MBBR systems (Moving Bed Biofilm Reactor) and IFAS (Integrated Fixed-Film Activated Sludge).

By controlling the intensity of the aeration inside the bioreactor, it is possible to create areas with different oxygen regimes: aerobic, anoxic, anaerobic. Periodic flushing and continuous aeration prevent clogging of the filling.

Wastewater treatment in the reactor can be carried out with or without physical-and-chemical treatment.

SPHERE OF APPLICATION

IBR® technology can be used for treating municipal and industrial wastewater, which are characterised by:

- high daily and seasonal inflow fluctuations;
- fluctuations in the pollution load over a wide range;
- low concentration wastewater;
- low BOD : N ratio in incoming wastewater, 3-4:1 or less.

As well as for treatment of wastewater from factories of certain specific branches of industry, where the waste has a high content of nitrogen impurities, e.g.:

- food processing industry;
- gas-processing industry;
- fertiliser plants.

Container WWTP type E-150 IBR

ADVANTAGES OF THE IBR® TECHNOLOGY

- Stable and reliable wastewater treatment.
- Less space required.
- No risk of washout, since biofilm is fixed on the carrier.
- Suitability for load fluctuations. The flow of treated water and pollution load can be increased and decreased without damaging the treatment process.
- Automatic adjustment for load fluctuations.
- Rapid resumption of reactor operation after shutdown.
- Minimum maintenance.
- High quality treated effluent with possibility of reuse.
- Rapid adaptation of microorganisms attached to impurities of industrial wastewater.

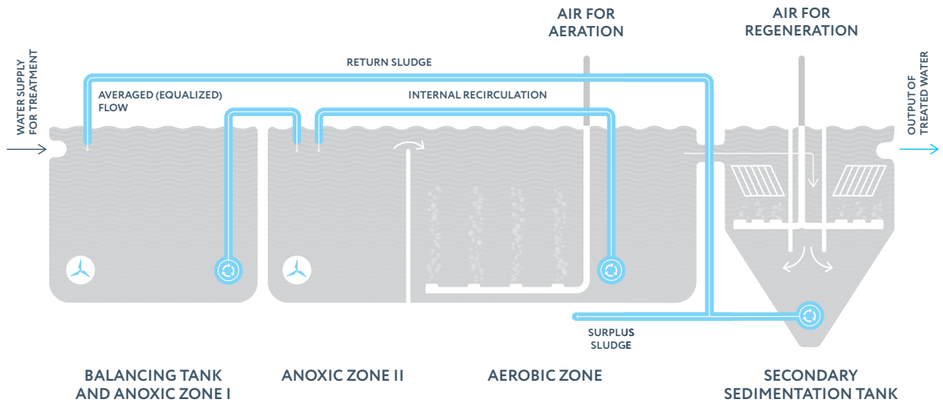
IBR® technology can also be used to implement the process of anaerobic ammonia oxidation (Anammox), which effectively removes nitrogen by means of specific anammox bacteria that oxidise the ammonia by nitrite under anoxic conditions.

Areas of anammox process application are: treatment of wastewater with high concentrations of nitrogen impurities, local treatment of return flows from the dewatering of digested sludge

IBR TECH

LBR® TECHNOLOGY

LBR® (Laminar Biological Reactor) Technology relates to methods of biological wastewater treatment by free activated sludge, whereby quality treatment is achieved through formation of a uniformly distributed (laminar) processing load throughout the day to all facilities.



LBR® Process Chart

The following factors are the basis of the LBR® Tech nology:

1. equalisation of wastewater flow and concentrations of impurities with the concomitant process of denitrification and phosphorus removal;
2. biological wastewater treatment by means of denitrification and nitrification processes;
3. separation of the sludge mixture in vertical settling tanks with tubular settler (lamella) modules.

Prior to biological treatment, the wastewater passes through the equalisation stage to provide a uniform load as of the flow and impurities.

Owing to the supply of return sludge, the process of denitrification and biological phosphorus removal occurs partially or completely (depending on conditions) in the balancing tank. The volume of the balancing tank-bioreactor includes the volume required for adjustment of nonuniform inflow of wastewater and the contact volume to provide the necessary time for the denitrification and phosphorus removal process.

From the balancing tank-bio- reactor, using pumps with a constant discharge flow rate, the sludge mixture is supplied to aeration tanks for further biological treatment.

Separation of the sludge mixture into clarified water and return sludge occurs in the secondary vertical type settling tanks equipped with tubular settlers with a closed-proprietary system of air regeneration.

Settlers modules divide the operating volume of the settling tank into a number of settling areas with a laminar regime of fluid flow, sedimentation processes being intensified by increasing the contact surface and reducing the suspension sedimentation height.

SPHERE OF APPLICATION

Application of the LBR® Technology in the design and construction/upgrading of treatment facilities is determined by the need to improve the conventional technology for biological wastewater treatment under conditions of nonuniform initial composition and flow.

LBR TECH

ADVANTAGES OF THE LBR® TECHNOLOGY

- Consistent high quality treated water due to the l aminar mode of facility operation.
- Stability of the system in relation to load fluctuations and volumes of sewage.
- Reduced occupied space.
- Reduced power consumption.
- Ease of control and maintenance.
- Optimum adaptation to existing concrete tanks during upgrading of treatment facilities.

BASIC ELEMENTS OF THE LBR® TECHNOLOGY

BALANCING TANK-BIOREACTOR

Inflow of wastewater to the treatment facilities with a steady flow and averaged concentration of impurities creates a variety of advantages. These include more efficient biological treatment facilities and tertiary treatment of wastewater. The economic effect is created by combining the functions of averaging, denitrification and biological phosphorus removal in the same building. In addition, the dimensions, capacity and cost of subsequent facilities and process equipment are reduced, since they are calculated and selected using averaged flow parameters.

SECONDARY VERTICAL SETTLING TANKS WITH TUBULAR SETTLER MODULES

Tubular settler (lamella) clarifiers provide the most favourable conditions for effective separation of the sludge mixture in the laminar mode by creating of identical hydraulic characteristics throughout the volume of the facility.

Lamella allow the utilisation factor of the clarifier to be increased, so that it provides the same performance at smaller dimensions compared to conventional tanks. Reduced settling time prevents unwanted denitrification in the clarifier and washout of suspended solids from the clarified water under high temperature conditions.

Use of a suspended sludge layer in which the flocculation is intensified likewise in the contact medium, produces purified water containing suspended solids at the outlet of less than 10 mg/l, so operating costs are cut by reducing the load on the final filters

Container STP type E-600 LBR

ERSH® SYNTHETIC FILLING

ERSH® consists of "synthetic algae", which are the biofilm carriers during the biological treatment and tertiary treatment or the filtering medium when placed in the tertiary filters. ERSH® is made of synthetic fibers transversally interlaced in the form of bristles into a twisted wire core of stainless steel wire. ERSH® is located in plane (frame) or cubic (cartridge) frame forms with different pitch and density, which are placed in the requisite quantity in bioreactors and final treatment filters. The lifetime of the filling is more than 25 years.

BIOREACTOR WITH AN ERSH® SYNTHETIC FILLING

The bioreactor with fixed (attached) microorganisms on an ERSH® filling is designed for biological treatment and tertiary treatment of wastewater. Owing to the large specific surface of the ERSH® filling, a high concentration of biocenosis is created in the bioreactor. Engineering control over development of the necessary bacteria allows the desired process (aerobic, anaerobic, anoxic) for wastewater treatment to be implemented.

The bioreactor with an ERSH® synthetic filling is used in the IBR Technology.

FILTER WITH AN ERSH® SYNTHETIC FILLING

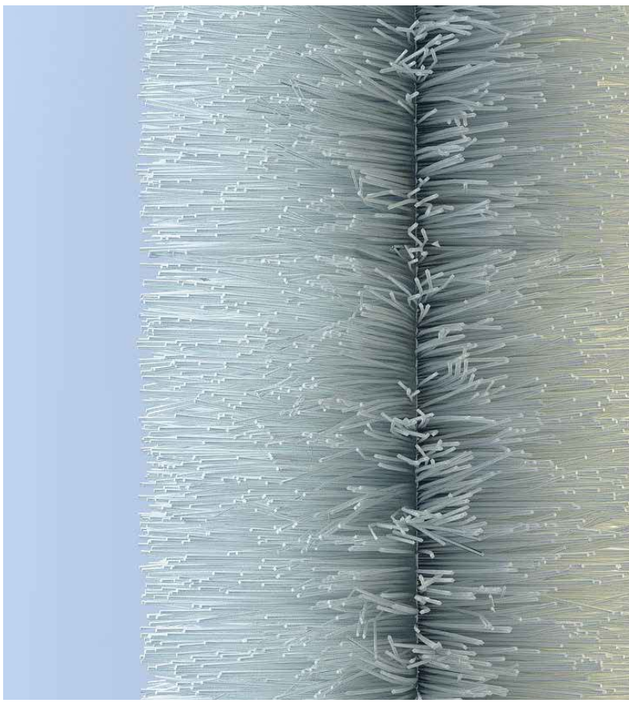
The filter with the ERSH® synthetic filling is designed for tertiary wastewater treatment. Is applied in LBR® and IBR® plants. The filter operates on the principle of gravity volume filtration. Owing to the tighter loading of the cartridges (compared with bioreactor cartridges), an effective filter medium is created for retention of suspended solids. The ERSH® filter filling has a high contaminant-containing capacity owing to the high proportion of the pore space, which is not, however, prone to clogging. After completion of the filter cycle, regeneration (restoration of filter performance) is performed by supplying compressed air, followed by emptying (no water supply from the outside).

ADVANTAGES OF THE BIOREACTOR WITH AN ERSH® SYNTHETIC FILLING

- Stable and reliable wastewater treatment.
- Less occupied space than required for activated sludge systems.
- No risk of washout, since the biofilm is fixed on the carrier.
- Automatic response to load fluctuations.
- Suitability for load fluctuations; the flow of treated water and the pollution load can be increased and decreased without damaging the treatment process.
- Rapid resumption of reactor operation after shutdown.
- Low cost control and maintenance.
- Rapid adaptation of microorganisms attached to impurities of industrial wastewater.

Bioreactor with ERSH® synthetic filling

ERSH® synthetic filling

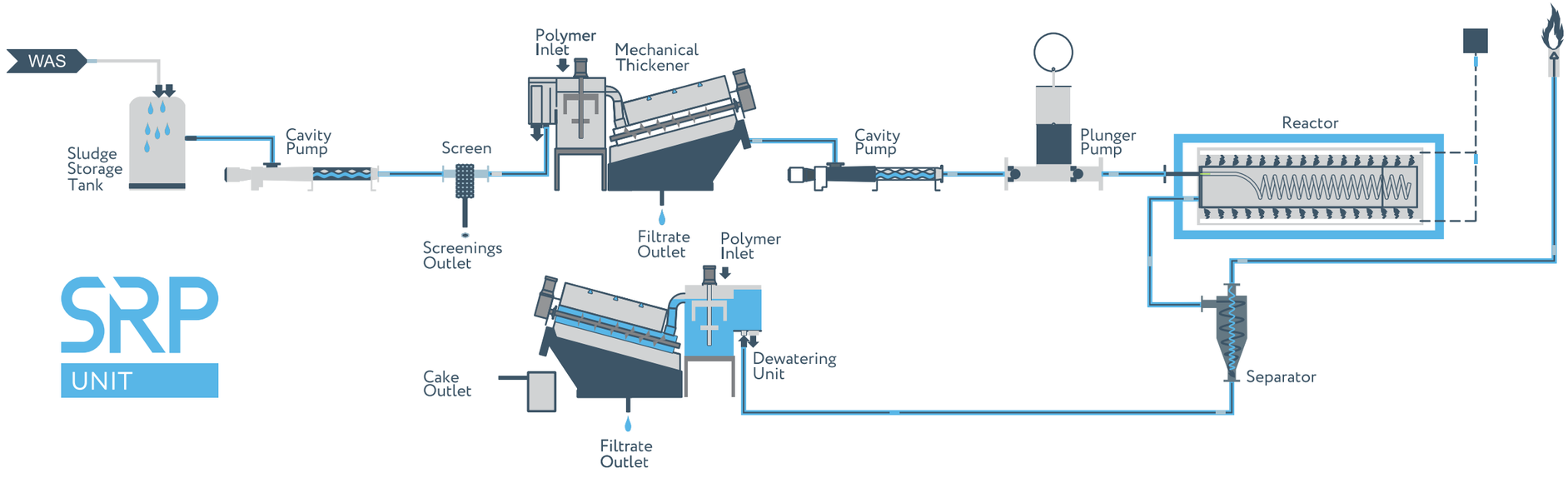


ADVANTAGES OF THE FILTER WITH AN ERSH® SYNTHETIC FILLING

- Principle of gravity filtration — low power consumption.
- Simplified regeneration — no wash water supply from the outside, no additional air blowers for regeneration (air blowers for the aeration system of the aeration tank are used).
- Complete recovery of filter performance after regeneration.
- Water supply to the lower part of the filter provides for a high degree of impurity retention in 1-2 metres of the filling layer.
- Injection of chemicals is possible — phosphorus removal.
- Possibility of treating large water volumes.
- Low cost control and maintenance.
- No moving parts ensures long life of the filling.
- Low hydraulic losses, maximum 20 cm.
- Optimum adaptation to existing concrete tanks in the process of upgrading of treatment facilities.

SRP® — SLUDGE RECYCLING PLANT

SRP® (Sludge Recycling Plant) is designated for processing of sludge produced during waste water treatment. The process is based on decomposition of complex organic materials under high temperature and high pressure conditions. The decomposition ratio comes up to more, than 90%, and the resulted gas contains over 70% of methane.



SRP UNIT

FIELDS OF APPLICATION

- Liquid wastes in food industries
- Liquid wastes in oil industries
- Chemicals and pesticides
- Filtrate from Landfills with high concentrations of COD, Nitrogen Ammonia and secondary contaminations, containing all periodic table elements
- Waste water sludge

ADVANTAGES

- Conversion of any organic composition to combustible gas
- Conversion of non-organic materials (heavy metals, non-organic acids) to salts and other non-hazardous matters

First SRP® tests were run in 2017 and proved promising results. Decomposition ratio of organic materials was 90-95%, gas output reached 0.85 m3/1 kg of crude material, with methane content over 70%.

PRINCIPLE OF SRP® UNIT OPERATION

SRP® process is based on gasification of organic compositions in liquid waste under supercritical water conditions (t>374°C; P> 22.1 MPa).

Supercritical water is created during heating and increase of pressure of the boiling liquid up to the critical point, where liquid and steam density becomes the same, and water is conversed to intermediate state between gas and liquid. After that, further increase of temperature and pressure brings water to the supercritical condition (fluid).

PROCESS CONTENT

- Water (H2O) in the critical condition becomes split into H and O. Free Oxygen is considered super oxidizer;

  O oxidizes the contaminating materials, causing decomposition and creation of new, more simple not hazardous complexes;

- During decomposition of organic materials escape of gases takes place, like methane (CH5), ethylene (C2H4), hydrogen (H2), nitrogen (N2), carbon oxide (CO) etc. Type and quantity of gases depends on process conditions and initial substrate properties;
- Ash-free organic matter dissociation value is 90-95%
- Gas output value is 0.85 m3/1 kg of ash-free organic matter with methane content exceeding 70%;
- Final ash looks like inert, non-hazardous material (Hazard Class 5)

MANFOUHA

In the Year 2013 the National Water Company and Ministry of Water and Electricity of Saudi Arabia awarded ECOS Group project for Improvement of Manfouha WWTP in Riyadh.

Improvement works implemented without Plant shutdown

Treated water is supplied for irrigation since 2015

+50%
WWTP CAPACITY OF RATED POWER

25%
REDUCTION OF RATED POWER CONSUMPTION PER 1 M3

At the present time negotiations with the National Water Company are going on transfer of Manfouha WWTP operation and maintenance to ECOS Saudi.

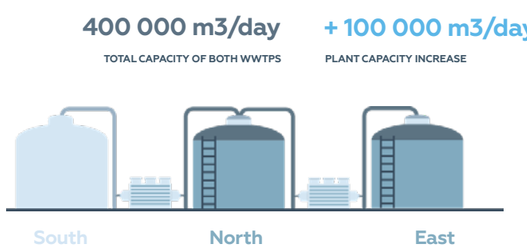
ECOS GROUP SCOPE UNDER THE PROJECT

Development of the basic design and shop drawings, development and approval of the work plan were performed by the South Design Institute Ltd. Fabrication, supply and installation of the equipment were performed by Svetec s.r.o, ECOSPROM Ltd. and Production Company Ltd.

Testing and commissioning works, including sophisticated automation system, as well as service works were carried out by ECOService.

PROJECT GOALS

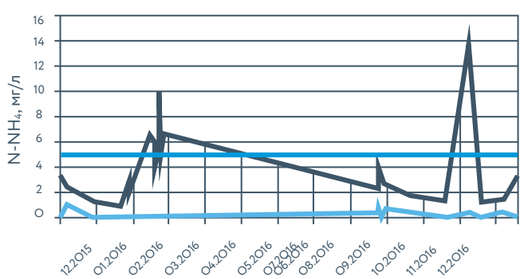
- Increase of the total WWTP capacity by 25%, up to 500'000 m3/day.
- Sufficient improvement of TSE quality, allowing reuse of the treated waste water.
- Implementation of non-standard engineering solutions for WWTP improvement without its shutdown and without construction of any new process tanks.



PROJECT GOAL

Improvement of north and east wastewater treatment plants: upgrade according to modern requirements with increase in total treatment capacity.

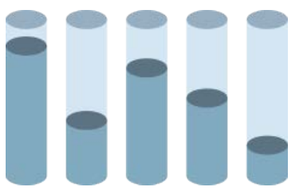
Efficiency of Tertiary ERSH Filters on removal of Ammonia Nitrogen



IBR® PROCESS WITH APPLICATION OF ANAMMOX BACTERIA.

Process design was based on the patented treatment solutions with application of Anammox process.

Anammox Bacteria provides efficient treatment of Ammonia Nitrogen and other contaminants from waste water, in order to ensure treated water storage during long period of time without its secondary contamination.



ANAMMOX PROCESS

Zero values for residual ammonium nitrogen

IMPROVEMENT STAGES

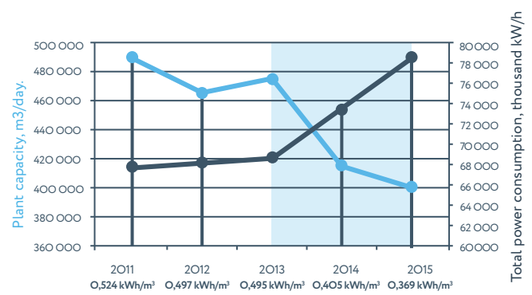
- Improvement of the Mechanical Treatment works
- Improvement of Aerated Grit Traps
- Improvement of 4 Aeration Tanks operating in parallel at North Plant
- Improvement of 4 Carousel Aeration Tanks at East Plant
- Conversion of 52 Tertiary Sand Filters at North Plant into branded ERSH Filters with synthetic filling, where conditions for Anammox process are created.

EFFICIENT SOLUTIONS FOR POWER CONSUMPTION

With upgrading of the Plant capacity by 25% and improvement of TSE quality several times, the rated power consumption was decreased by more, than 25%. In the Year 2015 the total power saving was more, than 11 million kW/h, comparing with 2013.

ECONOMIC EFFICIENCY

Possibility of treated water reuse for irrigation since November 2015 provided remarkable economic effect. Our calculations show, that if all treated water is sold to consumers, it will reimburse all expenses for Manfouha Improvement Project during 1.5 – 2 years.



PROJECTS DELIVERED

650 m³/d
Storm sewage treatment plant.
Severomorsk airfield

10 000 m³/d.
Design of treatment plants.
Syasstroy

18 000 m³/d.
Waste water treatment
plant, Skolkovo, Moscow

30 000 m³/d.
Megapolis® treatment
facilities design. Laykovo,
Moscow region (design only)

150 000 m³/d.
Waste water treatment plant
improvement, Surgut

50 000 m³/d.
Sewage deep-water discharge
treatment facilities, Gelendzhik

125 000 m³/d.
«Yuzhnye» deep-water discharge
treatment facilities, Sevastopol

50 000 m³/d.
Reconstruction of waste water
treatment facilities.
Nefteugansk (design only)

2 600 m³/d.
7 waste water treatment plants
for shift camps «Russian
Railways», Sochi

30 000 m³/d.
Water and wastewater treatment
plant Improvement, Aktau

500 000 m³/d.
Waste water treatment plant
improvement, Manfuha, Riyadh

5 000 m³/d.
Waste water treatment plant
improvement, Al-Jazeera, Riyadh

800 m³/d.
Waste water treatment
facilities. Boguchan aluminum
plant. Krasnoyarsk

1 800 m³/d.
Waste water treatment
facilities. Vladivostok

1 000 m³/d.
Reconstruction of water
supply and disposal
facilities. Kunashir island.

Severomorsk-3
Kaliningrad
Priozersk
Ust-Luga
St. Petersburg
Okulovka
Tver
Yaroslavl
Moscow
Fokino
Tula
Glubokiy
Sevastopol
Yalta
Novocherkassk
Novorossiysk
Gelendzhik
Belorechensk
Apsheronsk
Sochi
Astrakhan
Kamyzyak
Buynaksk
Aktau
Riyadh
Yoshkar Ola
Pervomayskiy
Ufa
Orsk
Karabalyk
Arch
Yugorsk
Khanty-Mansiysk
Tyumen
Varandey
Seyah
Saranpaul
Obskaya
Sosva
Berezovo
New Urengoy
Suzun
Kogalym
Surgut
Nefteyugansk
Severs k
Tomsk
Novosibirsk
Kemerovo
Barnaul
Kyzyl
Manzherok
Almaty
Krasnoyarsk
Irkutsk
Chita
Yakutsk
Tsiolkovsky
Severo-Kurilsk
Vilyuchinsk
Yuzhno-Sakhalinsk
Iturup, Kurilsk
Knevichi
Vladivostok
Russian island

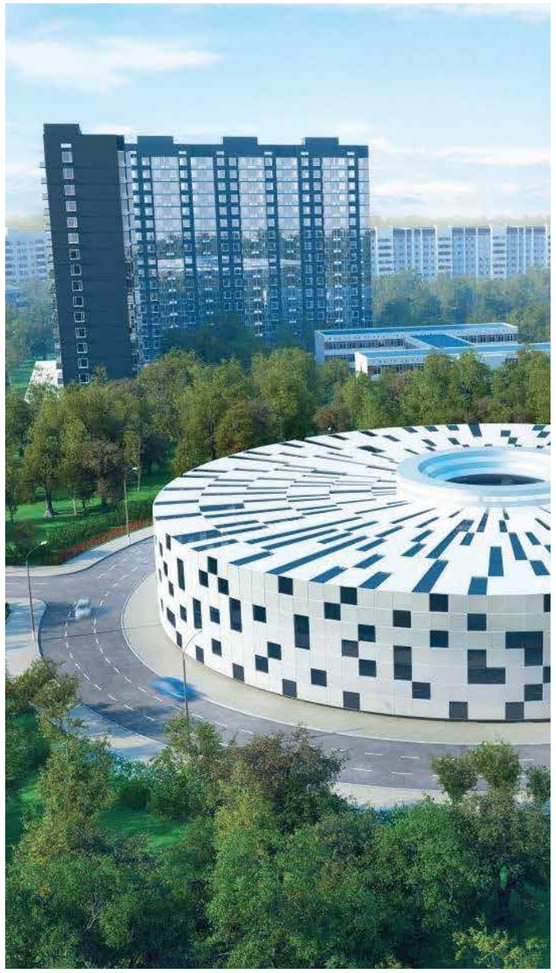
MEGAPOLIS® PROJECT

Rapid growth of the urban population necessitates construction of new residential buildings or even entire residential districts. Yet the conditions of the utility infrastructure limit the development possibilities for many reasons, the main one being removal of sewage. An ECOS Group innovative development consists of the new generation Megapolis® Plant with zero emissions, designed for wastewater treatment in places where it is impossible or not economically feasible to connect to existing networks.

ZERO EMISSIONS

The Plant is extremely compact and enclosed to the maximum: all treatment processes, sludge treatment, auxiliary operating areas and services are located in the same building, this allowing the construction area to be reduced to a fifth or a sixth. Air purification is carried out by electric charge action on gas molecules, which are subsequently captured and neutralised by special filters.

Environmental pollution is thus reduced to zero and the sanitary protection zone to a minimum.



Megapolis® STP design

ECONOMIC EFFICIENCY

The compactness of the Megapolis® Plant and reduced sanitary protection zone allow the building construction area to be minimised and the plant to be located almost anywhere within a residential area. The area released can be used more efficiently.

Reduced length of onsite utilities and number of pumping stations cut costs for construction and power consumption for pumping. The resulting treated water may be used for economic purposes and for industrial water supply, this providing additional economic benefit.

Sludge dewatered at the plant after special treatment may be used as:

- fertiliser for agricultural purposes;
- biofuel.

Megapolis® WWTP interior design

Megapolis® WWTP design

Megapolis® WWTP interior design

MEGA

MEGAPOLIS® PROJECT

INNOVATION

Megapolis® Plants are truly innovative solutions in the field of wastewater treatment, in terms of both applied technologies and business model.

The innovativeness of Megapolis® Plants is achieved by the following characteristics:

COMPACTNESS

All the processes of wastewater treatment, sludge treatment, auxiliary operation and service areas are located in the same building, and the area of construction and the sanitary protection zone are reduced to a fifth or a sixth (compared to the standard arrangement).

GREEN OPERATION

The Plant treats all resulting pollution, thereby precluding its discharge into the atmosphere.

COMPLETE AUTOMATION

Operation of the plant may be controlled even via the Internet (however, if necessary, control can be switched to manual mode at any time).

CUSTOMISATION

A wide variety of architectural and building solutions can be used in the design and construction of the plant. For example, a Megapolis Plant may be rectangular, this being dictated by economic efficiency of the solution to enclose (localise) only highly contaminated areas of wastewater treatment lines.

Megapolis® WWTP interior design

Megapolis® WWTP design

Megapolis® WWTP interior design

ENVIRONMENTAL COMPATIBILITY

Megapolis® Plants with zero emissions have minimal environmental impact, in contrast with standard treatment plants that have open systems of aeration, sedimentation tanks and sludge pits. All stages of the wastewater treatment processes are localised inside the plant and harmful emissions are treated and not released into the atmosphere, making the Megapolis® Plant the most environmentally friendly. The level of treatment is very high and the resulting water can be used for many purposes, including washing streets and watering green spaces.

TECHNOLOGIES

Basically the classical cycle of wastewater treatment is used in Megapolis® Plants:

- mechanical treatment;
- full-scale biological treatment;
- tertiary treatment;
- disinfection;
- treatment of resulting sludge.

Operating and auxiliary areas, as well as service facilities, are optimally located inside the plant. A guaranteed stable degree of wastewater treatment is already provided for in the basic design. Use of optional solutions such as MBR Technology allows the list of options for reuse of treated water, from irrigation to industrial and other engineering purposes, to be extended.

ARCHITECTURE

The diversity of the architectural solutions allows Megapolis® Plants to be introduced into any urban or natural landscape. At the construction stage, the client may choose one of the designs developed by the Company or use its own design. It is no exaggeration to say that there have never been any plants with similar architecture and interiors on the market. Depending on the client's request, any modern decorative solutions may be used in the interior design

	M-5	M-10	M-15	M-30	M-60
Capacity, m³/day	5 000	10 000	15 000	30 000	60 000
Plant diameter, m	34.2	43.0	48.0	65.0	87.0
Plant depth, m	9.6	9.6	9.6	9,6	9.6
Plant height, m	12.3	9.3	9.3	9.3	9.3
Sanitary protection zone, m			50 – 100		
Quality of treated wastewater as for BOD and SS, mg/dm³	3/3	3/3	3/3	3/3	3/3
Energy requirement, kW h/m³	0.65	0.6	0.58	0.5	0.5

NOTE! Only basic parameters are indicated. Correction is required for each individual project, considering the local conditions and the Client's specific requirements.

MONOBLOCK

New design developed by ECOS Group - Monoblock provides optimization of capital and operation cost. All process stages are arranged in a compact way inside one process block with minimum length of the engineering networks. This saves expenses during construction and operation, water transportation expenses are remarkably reduced.

One integrated block allows to reduce the capital cost by 30%

The tanks have GRP covers

INNOVATION

Monoblock solution is innovative as design and also as process applied

COMPACTNESS

All process tanks and Plant building containing auxiliary operation zones, office and service areas are arranged in one block. The process tanks have GRP covers to prevent from bad odors and noise.

AUTOMATION

Automation level may have various options, from local to fully automated, depending on Client's budget.

ENVIRONMENT FRIENDLY

Monoblock type WWTP has minimum impact on the environment, compared with the conventional type with its open aeration basins, clarifiers and sludge beds. The design allows to place all bad odor zones in one location and thus to enable its collection and purification. High TSE quality allows to reuse the treated waste water.

DESIGN SPECIFIC FEATURES

The Plant design looks like one integrated block, containing process building and lines of process tanks. The process building is divided by partitions into several zones, each one designated for specific process equipment. Process tanks are also divided into several parts in accordance with the applied process chart. Each tank has GRP cover to prevent from hazardous emissions.

ECONOMIC EFFICIENCY

- Arrangement of all process tanks inside one integrated block results in sufficient reduction of the Plant footprint.
- Capex saving for construction of the building and all process tanks is about 30%
- The cost price of 1m3 of TSE is 30-40% less, compared with conventional WWTP's.
- Treated waste water fits for reuse in irrigation, industrial and municipal purposes
- Dewatered sludge (75-80% humidity) can be used as fertilizer, biofuel or construction material.

SLUDGE DEWATERING TILL

80%

ALLOWS TO USE IT IN CONSTRUCTING

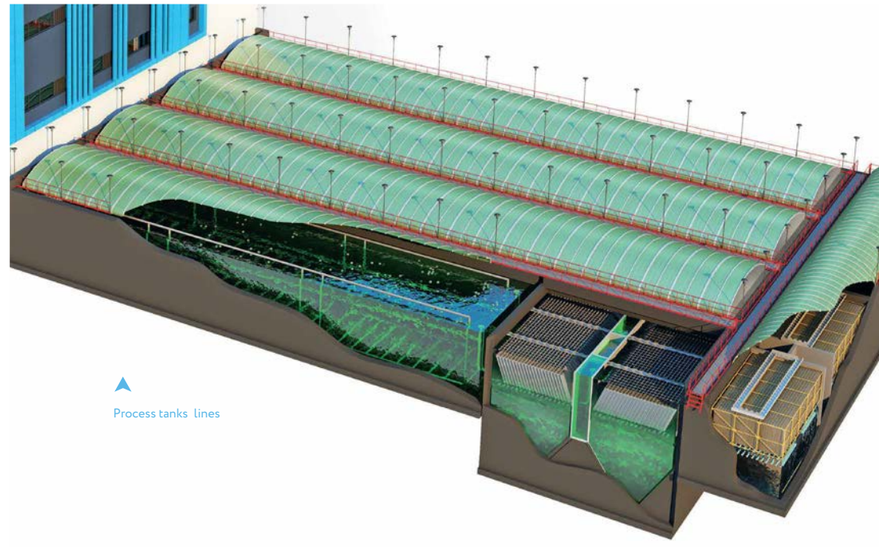
SINGLE BLOCK ALLOWS TO REDUCE CAPITAL CONSTRUCTION COSTS

30%

TECHNOLOGIES

Conventional treatment stages are applied in Monoblock WWTP:

- mechanical treatment;
- complete biological treatment;
- deep tertiary treatment;
- disinfection;
- sludge treatment.



Process tanks lines

	MB-5	MB-10	MB-20	MB-30	MB-45	MB-60	MB-70	MB-140	MB-210	MB-280
Capacity, m³/day	5 000	10 000	20 000	30 000	45 000	60 000	70 000	140 000	210 000	280 000
Plant footprint, m	45/18	50/34	68/50	48/126	72/126	96/126	60/205	120/210	180/215	240/220
Depth of process tanks, m	7	7	7	7.5	7.5	7.5	6.5	6.5	6.5	6.5
Height of process buildings, m	6	6	6	21	21	21	9	9	9	9
Estimated installed power for process needs, kW	104	212	424	550	825	1100	1107	2214	3321	4428
Rated power consumption for treatment, kW/m3	0,5	0,5	0,5	0,44	0,44	0,44	0,38	0,38	0,38	0,38
Rated construction cost, USD for 1m3/day capacity	650	637	610	585	545	505	480	400	400	400

NOTE! The Table indicates basic parameters. It should be amended for each specific project, considering local conditions and Client requirements.

REUSE OF TREATED WASTE WATER

Waste water, when properly treated, can be converted from huge global problem into precious resource with great useful potential and benefits, like:

- electric power;
- thermal power;
- organic fertilizer;
- pure water for various purposes.

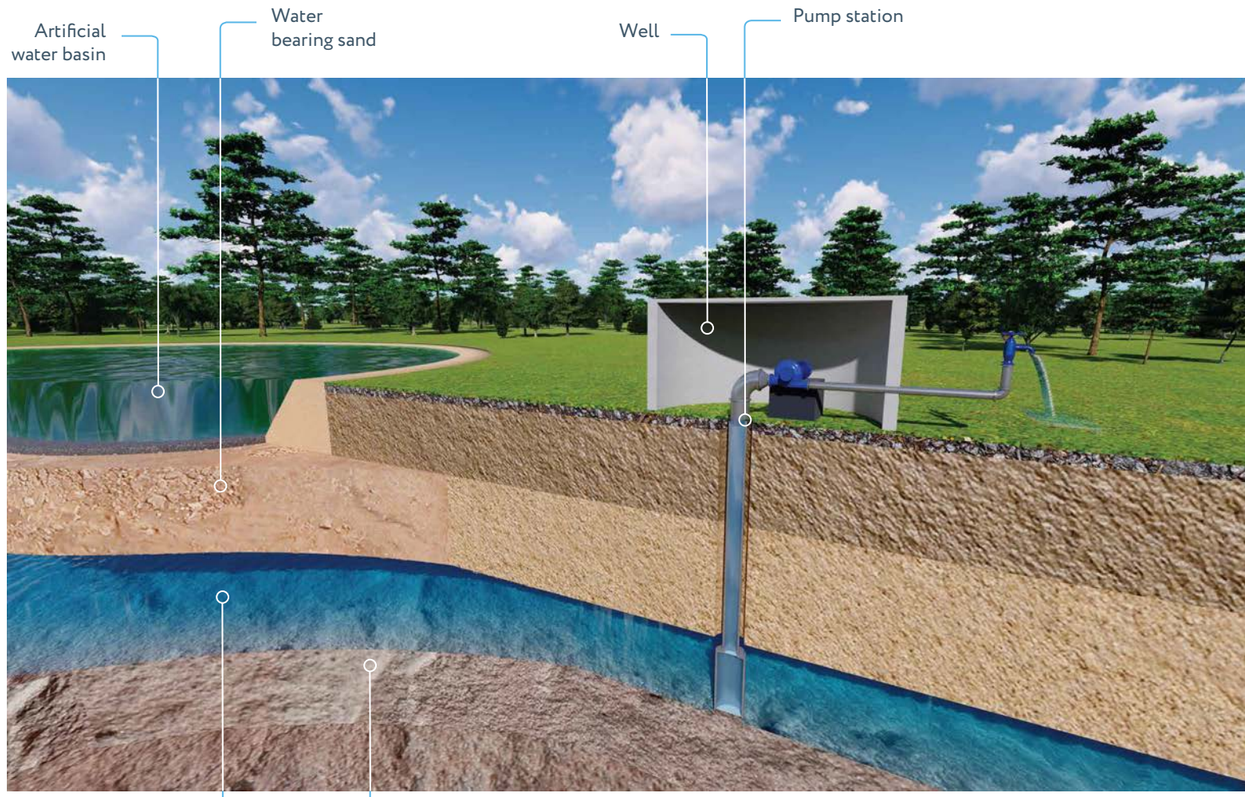
Pollution of fresh water sources and dry climate in many regions of the world create the main problems with water supply. The situation is aggravated by vast growth of population and industrial activities, as well as by other factors, including problems with waste water treatment systems.

ECOS Group has developed integrated solutions for waste water treatment with the purpose of treated water reuse for industrial, municipal and agricultural purposes.

FEED OF WATER BEARING FORMATIONS

Method of feeding water bearing formations with treated waste water is one of the efficient ways for improvement of water supply in the territories suffering from fresh water deficit.

This method is based on infiltration of water from water-storage basin through underground sand layers, which are acting like natural filtration material and purify water from bio-degradable organic materials. After such natural filtration water can be extracted on the surface through water wells and used for irrigation of parks and green zones, as well as for industrial enterprises.



Feed of water bearing formations

WASTE WATER AS RESOURCE FOR PARKS AND GREEN ZONES

Waste water is considered as precious resource for irrigation of parks and recreation areas. Artificial basin filled with treated waste water can be used for green zones irrigation. Dried sludge produced at waste water treatment plants is also valuable material for creation of good fertile soil. Waste water potential in hand gives opportunity to create green parks with beautiful landscapes and fountains, using water from water-bearing formations.

CONTAINER PLANTS WITH IBR® TECHNOLOGY

PURPOSE

Super compact container plants with IBR® (Immo bilised Biofilm Reactor) Technology perfectly solve the problem of treating municipal and industrial wastewater, which is characterised by:

- high daily and seasonal inflow fluctuation;
- fluctuations in the pollution load over a wide range;
- low concentrated wastewater;
- low ratio of BOD : N in incoming wastewater, of 3-4:1 or less.

Plants with IBR® Technology are successfully used for treating “non-standard” industrial wastewater with a high concentration of nitrogen impurities followed by reuse of the treated wastewater in the following industries:

- food processing industry;
- gas-processing industry;
- fertiliser plants.

In addition, plants of this series can effectively resolve the problem of municipal (domestic) wastewater treatment for small settlements and compact temporary residences away from the centralised sewerage system.

IBR TECH

KNOW-HOW: IBR® TECHNOLOGY

The IBR® technology relates to methods of wastewater treatment by biofilm microflora attached to an inert immobile carrier, patented ERSH® synthetic filling, which is placed inside the vessel (reactor).

The ERSH® filling has a welldeveloped surface, providing for a high density of attached microorganisms and, consequently, a high rate of biodegradation of organic impurities in the system. The attached microorganisms have a higher concentration of biomass and higher activity than the activated sludge and MBBR systems (Moving Bed Biofilm Reactor) and IFAS (Integrated Fixed-Film Activated Sludge).

BENEFITS

- A high quality of treated waste water allows reuse for industrial or irrigation purposes.
- Stable and reliable wastewater treatment is provided by the IBR® Technology.
- Modular-packaged solution 95% factory ready for commissioning minimises construction work on the site.
- All equipment operates automatically. Constant operation is not required.
- Reservoirs and pipes are made of durable stainless steel.
- Low operating costs.
- Minimum maintenance.
- Suitability for load fluctuations. The flow of treated water and the pollution load can be increased and decreased without damaging the treatment quality.
- Standard shipping containers, this reducing shipping costs.

The plant consists of one container with processing equipment and a concrete underground tank topped by a slab. This solution ensures reliable performance and easy operation of treatment facilities.

The modular-type solution allows the requisite performance to be attained by treatment facilities through use of several sets, as well as a stepbystep increase in capacity

BASIC TECHNICAL SPECIFICATIONS

Model	E-50 IBR	E-100 IBR	E-150 IBR
Maximum capacity, m³/day	50	100	150
Container overall dimensions L/W/H, m	6/2,4/2,6	12,2/2,4/2,6	12,2/2,4/2,6
Approximate dimensions of construction site, L/W, m	7/3,5	15/13	15/13
Effective capacity of underground concrete tank, m³	27	27	86
Quality of treated wastewater as for BOD and SS, mg/dm³	10/10	10/10	10/10
Energy requirement, kW h/m³	1.68	1.13	1.04

NOTE! Only basic parameters are indicated. Correction is required for each individual project, considering the local conditions and the Client’s specific requirements.

Container plant with IBR technology, E-150 IBR. Top view

Container plant with IBR technology, E-150 IBR

E-150 IBR® CONTAINER PLANT

IBR

CONTAINER PLANTS WITH LBR® TECHNOLOGY

PURPOSE

Container Plants with LBR® (Laminar Biological Reactor) Technology are the optimum solution for municipal (domestic) wastewater and wastewater similar in composition of settlements with a population from 1.5 to 50 thousand of reference residents.

Process flow considers local factors, ensuring highly efficient treatment facilities and reduced costs for wastewater treatment. Such factors include a high temperature (up to 35° C) of the wastewater incoming for treatment and a lack of fresh water sources.

KNOW-HOW: LBR® TECHNOLOGY

The LBR® technology relates to methods of biological wastewater treatment by free-flowing activated sludge, whereby the quality of the treatment is achieved by means of a uniformly (laminar) distributed process load during 24 hours at all facilities.

A unique feature of the LBR® Technology is that, if the sludge operating, concentration in the aeration tank is increased, the sedimentation efficiency also goes up. In addition, the ability to maintain a high sludge dose allows the aeration tank volume and capital expenditures to be reduced. The LBR® Technology enables a reduction in the installed capacity and power consumption, even at high wastewater temperatures.

BENEFITS

- Stable and high quality treated water.
- Possibility of reusing the treated wastewater (industrial or irrigation needs).
- GLS Aeration Tank made of enamelled steel can be quickly assembled on site.
- Reduced power consumption.
- Ease of control and maintenance.
- All equipment operates automatically. Constant operation is not required.
- Treatment facilities operate under big load fluctuations (often over a very wide fluctuation range) in terms of wastewater flow and the amount of impurities within 24 hours.
- Reduced space occupied by treatment facilities.
- Low operating costs.
- Minimum maintenance.

Standard shipping containers (20' and 40' Open Hard Top) are used, which cuts shipping costs.

Container Plants with LBR® Technology look like a set consisting of a land storage tank (GLS Tank), marine container of 40' Open Hard Top Standard with process equipment and underground concrete tank.

BASIC TECHNICAL SPECIFICATIONS

Model	E-300 LBR	E-600 LBR	E-1 200 LBR	E-4 800 LBR
Maximum capacity, m³/day	300	600	1 200	4 800
Approximate dimensions of construction site, L/W, m	18/15	25/18	35/20	60/50
Container 40' Open Hard Top, L/W/H, m, (pcs.)	12.2x2.4x2.8 (1)	12.2x2.4x2.8 (1)	12.2x2.4x2.8 (2)	12.2x2.4x2.8 (8)
Container 20' Open Hard Top, L/W/H, m, (pcs.)	-	-	-	6x2.4x2.5 (4)
GLS Aeration Tank Ø/H, m, (pcs.)	7/4.5 (1)	9/4.5 (1)	13/4.5 (1)	13/4.5 (4)
Effective capacity of the underground concrete tank, m³	163	330	572	1 640
Quality of treated wastewater as for BOD and SS, mg/dm³	10/10	10/10	10/10	10/10
Energy requirement, kW h/m³	1.05	0.86	0.72	0.61

NOTE! Only basic parameters are indicated. Correction is required for each individual project, considering the local conditions and the Client's specic requirements.

FLEXIBILITY OF MODULAR SOLUTIONS

We have developed four principal modules of such treatment plants to vary the complex performance merely by adjusting the process tank volumes and amount of equipment. This approach has made it possible to minimise the plant footprint and to cut operating costs.

LBR TECH

All variations by type series are presented in the table. In this respect, the solutions are so flexible that we can provide for intermediate capacity ranges of 1 000 m³/day and 3 000 m³/day with minimum modifications. At the same time, the high treatment quality, low operating costs and small footprint are guaranteed

Plant Model	Underground concrete tank, V, m³	Land GLS tank, V, m³	Container with equipment, Open Hard Top, (pcs.)	Complex capacity, m³/day.
E-300 LBR	112	80	40' (1)	200
	163	155	40' (1)	300
E-600 LBR	228	155	40' (1)	400
	330	255	40' (1)	600
E-1200 LBR	407	315	40' (2)	800
	572	530	40' (2)	1 200
	807	1 060	40' (4)	2 400
	1 210	1 600	40' (6)	3 600
E-4800 LBR	1 640	2 120	40' (8)/20' (4)	4 800
	2 017	3 215	40' (8)/20' (4)	6 000

Container plant with LBR technology, E-600 LBR. Top view

Container plant with LBR technology, E-600 LBR

E-600 LBR® CONTAINER PLANT

LBR

DESIGN AND CONSTRUCTION OF WWTP

We are ready to take responsibility for the project as a whole, from formulation of clear performance targets for the project and to operation and maintenance of constructed treatment facilities.

Each project in the field of wastewater treatment is unique in itself. Yet, whether existing waste treatment facilities need to be upgraded or new ones built "from scratch", we believe it is important from the very beginning to determine a convenient degree of involvement in project implementation for the Client.

Drawing on our own experience and summarising global practices, we highlight three basic forms of cooperation that, on the one hand, allow the client to select and assign to us a certain part of the project; on the other hand, such division does not have a detrimental effect on achieving the performance targets.

BASIC DESIGN AND MANUFACTURING SETUP

We develop the basic design for upgrading or constructing treatment facilities according to the Terms of Reference approved by the Client. All key technological solutions, including company "know-how", are introduced into the design at this stage. A specialised Construction Company, engaged by the Client, performs the detailed design and implements it. ECOS returns to the site only in order to carry out process adjustment and confirm the design parameters of the treated water quality.

EPC (ENGINEERING, PROCUREMENT, CONSTRUCTION)

We develop the basic and detailed designs, carry out construction and installation works, supply the equipment and perform integrated commissioning of treatment facilities with subsequent start-up of the constructed or upgraded treatment facilities. All that is required from the Client is approval of the Terms of Reference, timely financing and supply of wastewater for treatment by the start-up date.

BOT (BUILD, OPERATE, TRANSFER)

BOT is a form of cooperation that implies an actual partnership with the Client. This model is known and has been used successfully all over the world and includes design, construction, start-up and operation of treatment facilities during the agreed contract term, with subsequent transfer of the ownership to the Client. In this case, we undertake even fund raising and recoupment of the Project is our concern.

ECOS is ready to act as a co-investor in such projects and to ensure investment returns within the scheduled term

CONSTRUCTION SITE AREA

CONVENTIONAL TREATMENT PLANT

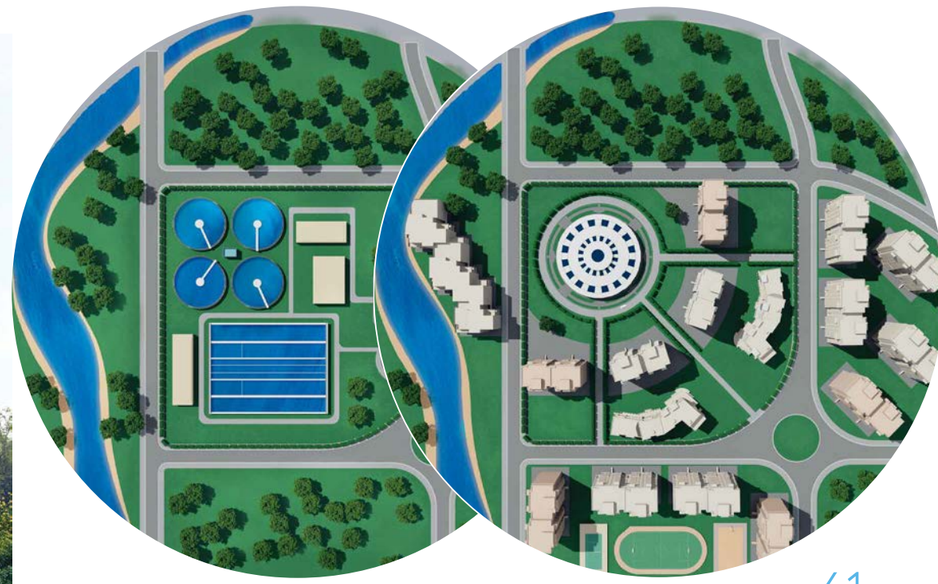
- Conventional treatment plant requires larger sanitary protection zone.

MEGAPOLIS PROJECT

- Five-fold reduction of the Plant footprint.
- Release of additional area for residential development.
- Reduction of on-site networks cutting power consumption for pumping.

Design of 30 000 m³/day Megapolis® WWTP at Odintsovo , Russia

BOT



UPGRADING OF WWTP

State-of-the-art technology development and the latest energy-efficient equipment, use of innovative solutions and sufficient experience allow us to say with confidence that existing wastewater treatment facilities can operate more efficiently and investments made in upgrading pay their way.

Most currently operating local municipal wastewater treatment plants need upgrading: as a rule, they were built a long time ago and do not fully meet the latest requirements. This applies both to the efficiency of wastewater treatment, complexity of operation and the economic component, i.e., the costs of wastewater treatment and the possibility of reusing the treated wastewater, sludge and other resulting products and services.

Upgrading of Manfouha WWTP, 500 000 m³/day, Riyadh, Kingdom of Saudi Arabia

Upgrading of Manfouha WWTP, 500 000 m³/day, Riyadh, Kingdom of Saudi Arabia

Valve

SURVEY

Any project for upgrading wastewater treatment facilities begins with a comprehensive survey of the process chart components and analysis of the qualitative and quantitative composition of the wastewater. On the basis of the survey results, our specialists prepare guidelines for step-by-step upgrading of treatment facilities without interrupting their operation. If necessary, we offer our client several options.

At this stage, our engineers together with the client formulate the goals and objectives of the upgrading project. That is why this stage is crucial and quite time consuming.

UPGRADING TARGETS

As a rule, the following are the main objectives when upgrading wastewater treatment plants:

- greater efficiency of treatment facilities without additional extension of area;
- better performance reliability and simplified operation;
- process control automation;
- better wastewater treatment quality;
- reuse of treated effluents;
- reduced operating and wastewater treatment costs.

DESIGNING

The design stage determines the implementation methods for achieving the objectives. In this, we try to make full use of the existing facilities in order to minimise the scope of construction and installation works and total capital expenditure. In other words, our approach is not to waste funds but concentrate on the primary targets.

We do not offer process solutions and equipment for sewage treatment unless we are 100% confident. All the implemented developments for upgrading treatment facilities are checked and their efficiency is repeatedly confirmed in practice. If an innovative solution is offered for a project, we always recommend that the client performs preliminary tests of the technology at experimental installations.

PROJECT IMPLEMENTATION

At all stages of the project, whether it is design, supply of equipment, its installation or commissioning, we strive to minimise the Client's risks. All core-business departments involved are in close contact with the relevant client services, ensuring transparency and allowing full and continuous control.

ECOS experience gained in implementing integrated projects for upgrading treatment plants in Russia and abroad, as well as the company's scientific and innovative potential, make us confident in achieving the stated objectives and share this confidence with the clients

UPGRADING OF WWTP

UPGRADING OF THE AL-JAZEERA WWTP IN RIYADH, SAUDI ARABIA

The Client: Ministry of Water and Electricity of Saudi Arabia

The Al-Jazeera Plant is designed for a capacity of 3 000 m^3/day. The actual inflow is 5 000 m^3/day.

The aim of the project was to reduce concentrations of suspended solids and BOD from 30 mg/l to 10 mg/l, so the mission effectiveness of final treatment has been deter mined as 67% while the plant maintains an output of 5 000 m^3 of wastewater per day.

The Client was offered improvement of the process flow with implementation of AEF-60 anthracite and brush filters at the final stage of treatment, which have been specially designed, constructed and implemented on site by company engineers.

Upon completion the project targets were achieved and even improved.

During the guarantee operating period of 266 days, the averaged values of BOD and SS of the raw wastewater reached 41 mg/l and 42 mg/l, respectively, the content of SS in the treated effluent did not exceed 9 mg/l, and the BOD value did not exceed 8.8 mg/l.

The treated wastewater was used for service needs, this providing an additional economic benefit and ensuring project payback within one year.

Thus, as a result of plant upgrading, a double effect was achieved by introducing innovative technologies:

- efficiency of final treatment with respect to SS and BOD was more than 78%;
- performance improvement was 2 000 m^3/day (170%);
- at the same time, the increase in operating costs amounted to only 0,03 USD/m^3 (10%)

78%

Upgrading of Al-Jazeera WWTP, 5 000 м³/сут., Riyadh, Kingdom of Saudi Arabia

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