The handbook contains case studies pertaining to resource efficient and cleaner production principles implemented by the Resource Efficient and Cleaner Production Centre at the enterprises in Kyiv, Vinnytsia, Zaporizhzhia and Odesa regions of Ukraine.

The material has been designed and compiled for the benefit of company management and engineers, different institutions and organizations, faculty and students of technical universities, and of others wishing to know more about saving and rational use of natural resources.
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CONTENTS

INTRODUCTION 2
What are the success components for an enterprise? 2
What is the resource efficient and cleaner production methodology? 3
What is the mission of the United Nations Industrial Development organization (UNIDO)? 4
How does the Resource Efficient and Cleaner Production Centre operate? 6

FOOD INDUSTRY 8
BAKERY 8
CATERING FACILITIES 10

PROCESSING INDUSTRY 12
PLASTIC PRODUCTS 12

CONSTRUCTION INDUSTRY 14
REFRACTORY MANUFACTURING 14
ROOFING AND INSULATION MATERIALS PRODUCTION 16

AGROPROCESSING INDUSTRY 18
GROWING FLOWERS IN GREENHOUSES 18

MACHINE-BUILDING INDUSTRY 20
FILTERS MANUFACTURE 20

CLOSING REMARKS 22
INTRODUCTION

WHAT ARE THE SUCCESS COMPONENTS FOR AN ENTERPRISE?

The success of the enterprise is a complex of simple components – high-quality personnel, loyal customers, available innovations and affordable taxes. The key point is a good balance between costs spent and profit gained.

Starting from 2013, the Resource Efficient and Cleaner Production Centre has examined over 100 enterprises and revealed some common problems the most businesses faced regardless of size, ownership and industry. These are:

- Irregular and incomplete capacity utilization (sometimes less than 50%);
- Excessive production and non-production areas earlier designed for bigger products turnover;
- Lack of skilled engineering staff;
- Out-dated engineering standards and philosophy, and;
- Energy consuming and raw material-intensive productions.

The above problems result in inefficient resources use at the overwhelming majority of domestic enterprises– and this is a systemic feature of the industry and tertiary sector of Ukraine. Within constant price spiralling for resources this fact significantly reduces the companies’ competitiveness and becomes a serious barrier to keep their position in traditional markets, not to mention stepping over into new ones.

Implementing the resource efficient and cleaner production practices (RECP) allows solving these problems comprehensively. The RECP approach helps to reduce resource consumption during production process at the same time maintaining the same level of outputs due to reducing the costs of the final product, amount of harmful wastes, emissions and discharges.
The brochure presents cases with implemented RECP principles at Ukrainian enterprises, and that resulted in average water consumption reduction by 8-13%, electricity – by 17-21% and CO₂ emissions – by 10%.

**WHAT IS THE RESOURCE EFFICIENT AND CLEANER PRODUCTION METHODOLOGY?**

The Resource Efficient and Cleaner Production Methodology has been developed by the United Nations Industrial Development Organization (UNIDO) together with the United Nations Environment Program (UNEP). This methodology intends providing continuous control over resources consumption to increase its efficiency. Reducing the costs of resources in natural units per unit of production is the criterion for successful methodology implementation.
WHAT IS THE MISSION OF THE UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION (UNIDO)?

Established in 1966 as a specialized agency of the United Nations, the UNIDO has vested power in promoting international industrial cooperation and development in countries with transition economies and the developing ones.

The UNIDO promotes industrial efficiency leading to economic growth and sustainable development of the member countries.

In 2009-2010, the UNIDO presented a series of design concepts to the international community and started implementing them in different regions of the world. The main ones are:

- Green industry concept. It is guided by the core idea to start and develop business with a slogan «produce more, consume less» (i.e., creating more value with less impact) due to more efficient use of natural resources and introducing clean technologies;

- Resource efficient and cleaner production concept, built on a UNIDO-UNEP common view of improving the model to improve output efficiency via rational use of material resources, replacing out-dated technologies with resource and eco-efficient ones, minimizing waste production. Created within UNIDO concept the RECP methodology provides industries with tools to run sustainable development with further improving the level of business competitiveness and at the same time reducing environmental footprints.

The UNIDO consists of 174 member countries, with its head office in Vienna (Austria) and representative centres in New-York, Geneva and Brussels.

Ukraine joined UNIDO in 1985 and within its support Ukraine has already carried out a number of projects in the field of industrial development, sustainable water and waste management, environmental restoring of industrially polluted areas, etc.
FIG. 1. RECP METHODOLOGY: THE KEY ELEMENTS.

PRODUCTION EFFICIENCY THROUGH
Optimization of productive use of natural resources (materials, energy, water) at all stages of production cycle

ENVIRONMENTAL MANAGEMENT THROUGH
Minimization of adverse impacts of industrial production systems on nature and the environment

HUMAN DEVELOPMENT THROUGH
Minimization of risks to people and communities, and support to their development

The final RECP implementation goal «Produce more – consume less».

The RECP Methodology allows minimizing financial costs to eliminate harmful effects the industrial production does over the environment by actually preventing these phenomena.

Each step aimed at reducing the consumption of raw materials and energy as well as managing wastes increases the enterprise productivity and guarantees financial benefits.

The mission to ensure RECP methodology implementation in Ukraine was delegated to the Resource Efficient and Cleaner Production Center.
HOW DOES THE RESOURCE EFFICIENT AND CLEANER PRODUCTION CENTRE OPERATE?

The Resource Efficient and Cleaner Production Centre was established in 2013 under the UNIDO initiative and funded by the Governments of Switzerland and the Republic of Austria. The representative centres are now open in six regions of Ukraine: Vinnytsia, Zaporizhzhia, Kyiv, Lviv, Odesa, Kharkiv.

The Center provides the implementation of the resource efficient and cleaner production practices through:

• Setting up a team of experts at the enterprises and further training them on RECP methodology;
• Conducting a comprehensive technical audit of the company basing on the RECP methodology and jointly with a team of experts;
• Developing technical recommendations aiming to improve the efficient use of resources depending on the assessment results achieved.

Complex technical auditing is an assessment process that helps revealing the efficiency of all resources use in production processes and the enterprise in total (the efficiency is a ratio of products output and services to the resources consumed). It covers:

• Assessment of actual resources consumption at the company;
• Identifying optimal resource consumption within production processes and facilities, and;
• Detecting an excessive use of resources and evaluating possibilities to reduce and optimize their consumption.

Cooperation with enterprises in terms of implementing RECP principles is a complex of activities and apart from the above it also involves providing consultancy services for enterprises as for receiving concessional financing to implement technical solutions and options followed by further efficiency monitoring.
We are offering you some case studies carried out by the RECP Centre while implementing RECP methodology at some individual enterprises.
COMPANY DESCRIPTION

The designed installed capacity of the plant allows producing about 34,000.00 tons of bread and bakery products yearly.

The average daily output is 47 tons of bread and other bakery products (the enterprise is 50% loaded currently).

The staff – 320 employees.

THE POTENTIAL OF RESOURCES USE (TECHNICAL ASSESSMENT RESULTS)

The manufacturing process is based on a traditional technique of sourdough bread. Basic preliminary operations for dough kneading are automated; however, bread baking is done in a gas-fired tunnel oven.

The assessment revealed the following:
- 14% of heat from the oven heated up to 275°C is withdrawn with flue gases;
- 38% of the heat is withdrawn with the heat of the vapor-air mixture heated to 115°C;
- 21% of the heat from the oven and hot baked products is accumulated inside the bakehouse;
- Approximately 5 m³ of water is daily released into the atmosphere as part of a steam-air mixture (from the oven).

FOOD INDUSTRY: BAKERY

<table>
<thead>
<tr>
<th>Expected savings, per year</th>
<th>893.3 thousand UAH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural gas – 132.5 thousand m³</td>
<td>Reducing GHG emissions – 240 tons CO₂</td>
</tr>
</tbody>
</table>

RECP IMPLEMENTATION GOALS

- Reducing natural gas consumption;
- Reducing electricity consumption;
- Reducing water consumption.
## The Efficiency of Proposed Technical Solutions (Summary)

<table>
<thead>
<tr>
<th>Technical solutions implementation – goals to achieve</th>
<th>Technical solution</th>
<th>Results achieved</th>
<th>Investment, UAH</th>
<th>Savings, UAH, per year</th>
<th>Payback period, years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reducing natural gas consumption</td>
<td>Installing condensation savers (economizers) on the steam and hot water boilers</td>
<td>85,300.00 m³/ year</td>
<td>60,000.00</td>
<td>563,980.00</td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td>Installing a heat exchanger to heat storage rooms with exhaust gases heat and for HWS</td>
<td>40,557.00 m³/ year</td>
<td>120,000.00</td>
<td>267,680.00</td>
<td>0.45</td>
</tr>
<tr>
<td></td>
<td>Using the vapor-air mixture for HWS purposes</td>
<td>5,088.00 m³/ year</td>
<td>30,000.00</td>
<td>45,541.00</td>
<td>0.7</td>
</tr>
<tr>
<td>Reducing water consumption</td>
<td>Replacing old irrigation devices with spray balls</td>
<td>1,600.00 m³/ year</td>
<td>16,000.00</td>
<td>11,430.00</td>
<td>1.4</td>
</tr>
<tr>
<td>Reducing electricity consumption</td>
<td>Replacing old bulbs with energy efficient LED light bulbs</td>
<td>2,774.00 kWh/ year</td>
<td>4,500.00</td>
<td>4,715.00</td>
<td>0.95</td>
</tr>
</tbody>
</table>
CATERING FACILITIES

COMPANY DESCRIPTION
The restaurant is specialized in Italian cuisine and provides food delivery upon request.

The production output of the restaurant mainly depends on the following:
• Visiting intensity;
• Food delivery orders;
• Seasons of the year;
• Visiting hours;
• Holidays and weekends.

THE POTENTIAL OF RESOURCES USE (TECHNICAL ASSESSMENT RESULTS)
Resource and energy consuming processes:
• Washing raw materials;
• Washing plates and dishes;
• Cleaning equipment, utensils and appliances;
• Food storage;
• Heating and ventilation, and;
• Thermal treatment (except for cold course).

RECP IMPLEMENTATION GOALS
• Reducing electricity consumption;
• Reducing water consumption;
• Sorting and recycling of waste.

Expected savings, per year
54 thousand UAH
Electricity – 38 thousand kWh
## The Efficiency of Proposed Technical Solutions (Summary)

<table>
<thead>
<tr>
<th>Technical solutions implementation – goals to achieve</th>
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<th>Savings, UAH per year</th>
<th>Payback period, years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reducing electricity consumption</td>
<td>Replacing old bulbs with energy efficient LED light bulbs</td>
<td>26,735.5 kWh</td>
<td>13,625.00</td>
<td>25,707.00</td>
<td>0.36</td>
</tr>
<tr>
<td></td>
<td>Installing lighting switches for individual working surfaces</td>
<td>8,672.00 kWh</td>
<td>1,496.00</td>
<td>12,227.52</td>
<td>0.12</td>
</tr>
<tr>
<td></td>
<td>Insulation of the freezers provided by the suppliers and/or their partial replacement</td>
<td>326.9 kWh</td>
<td>153</td>
<td>460.9</td>
<td>0.33</td>
</tr>
<tr>
<td></td>
<td>Boiler insulation</td>
<td>429.24 kWh</td>
<td>153</td>
<td>605.23</td>
<td>0.25</td>
</tr>
<tr>
<td></td>
<td>Insulation of an expansion-tank</td>
<td>605.23 kWh</td>
<td>153</td>
<td>506.4</td>
<td>0.3</td>
</tr>
<tr>
<td></td>
<td>Building tambour space to reduce heat losses penetrating through the glass door</td>
<td>850.5 kWh</td>
<td>7,275.00</td>
<td>1,199.2</td>
<td>6</td>
</tr>
<tr>
<td>Reducing water consumption</td>
<td>Installing spray taps for sinks in the cooking area for hot and cold courses</td>
<td>656 l</td>
<td>455</td>
<td>9,380.8</td>
<td>0.04</td>
</tr>
<tr>
<td>Sorting and recycling of waste</td>
<td>Selling used cooking oil for recycling</td>
<td>-</td>
<td>-</td>
<td>3,875.00</td>
<td>-</td>
</tr>
</tbody>
</table>
THE POTENTIAL OF RESOURCES USE
(TECHNICAL ASSESSMENT RESULTS)

The on-site examination detected that manufacturing line producing polypropylene, polyethylene, polystyrene, ABC and polyamide due to injection molding at thermoplastic machines (TPM), appeared to be the most energy consuming unit.

The assessment included electricity consumption metering and analysis of reactive and total power.

The conclusions made: TPMs add significant reactive component to the grid, \( \cos \varphi = 0.386 – 0.636 \) at TPM and that is very low. Moreover, the cumulative reactive power at TPM unit is \( \frac{90}{153} = 0.59 \), which makes 59% out of total reactive capacity.

Due to the above the estimated reactive power is 683,781.20 kVArh.

<table>
<thead>
<tr>
<th>Expected savings, per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>590.25 thousand UAH</td>
</tr>
<tr>
<td>Electricity – 260,940.00 kWh</td>
</tr>
<tr>
<td>Reactive power – 602,850.00 kVArh</td>
</tr>
</tbody>
</table>

PROCESSING INDUSTRY:

PLASTIC PRODUCTS

COMPANY DESCRIPTION

The main goods produced – granules, bushings for paper receipt tapes, boxes, furniture and small range of products.

Annual output – 240 tons.

The staff – 47 employees.

Three work shifts, 8 hours each, 240 working days.

RECP IMPLEMENTATION GOALS

- Reducing electricity consumption;
- Reducing rejects production.
## Overall specific electricity consumption to produce 1 kg of products (benchmarking)

<table>
<thead>
<tr>
<th>ENTERPRISE</th>
<th>BEST PRACTICES IN THE INDUSTRY</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.11 kWh</td>
<td>0.2 – 0.7 kWh/kg</td>
</tr>
</tbody>
</table>

## THE EFFICIENCY OF PROPOSED TECHNICAL SOLUTIONS (SUMMARY)

<table>
<thead>
<tr>
<th>Technical solutions implementation – goals to achieve</th>
<th>Technical solution</th>
<th>Results achieved</th>
<th>Investment, UAH</th>
<th>Savings, UAH per year</th>
<th>Payback period, years</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Reducing electricity consumption</td>
<td>Replacing plastic molding tools, increasing the number of cavities, pooling the production of various products</td>
<td>20,520.00 kWh</td>
<td>100,000.00</td>
<td>396,000.00</td>
<td>0.25</td>
</tr>
<tr>
<td></td>
<td>Installing a reactive power compensator</td>
<td>602,850.00 kVarh</td>
<td>25,000.00</td>
<td>120,570.00</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td>Replacing old TPM with a new one (see clause 1)</td>
<td>220,000.00 kWh</td>
<td>575,000.00</td>
<td>36,930.00</td>
<td>15.5</td>
</tr>
<tr>
<td>2. Reject reduction</td>
<td>Installing electricity meters, implementing separate electricity consumption accounting per facility, monitoring and control over energy consumption</td>
<td>10,600.00 kWh</td>
<td>10,000.00</td>
<td>19,080.00</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>Replacing old bulbs with energy efficient LED light bulbs</td>
<td>9,820.00 kWh</td>
<td>25,000.00</td>
<td>17,670.00</td>
<td>1.4</td>
</tr>
</tbody>
</table>
CONSTRUCTION INDUSTRY:

REFRACTORY MANUFACTURING

<table>
<thead>
<tr>
<th>Expected savings, per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,313.00 thousand UAH</td>
</tr>
<tr>
<td>Natural gas – 282 thousand m³</td>
</tr>
<tr>
<td>Reducing GHG emissions – 532 tons CO₂</td>
</tr>
<tr>
<td>Electricity – 54.9 MWh</td>
</tr>
</tbody>
</table>

COMPANY DESCRIPTION

Being the leader in fireclay refractory production, the company also produces magnesia, high-aluminous and silicon carbide materials. There are aluminum silicate, magnesia and unmolded production workshops within the enterprise.

Annual output – approximately 150-200 thousand tons.

Fixed operation mode – continuous.

The staff – 2,503 employees.

THE POTENTIAL OF RESOURCES USE (TECHNICAL ASSESSMENT RESULTS)

Electricity and drinking water are the power sources, however natural gas – is the primary energy source for fireclay refractory. The thermal balance forecasts the potential to reduce natural gas consumption by 27-30%.

RECP IMPLEMENTATION GOALS

🔥 Reducing natural gas consumption;
💧 Reducing harmful and GHG emissions.
## THE EFFICIENCY OF PROPOSED TECHNICAL SOLUTIONS (SUMMARY)

<table>
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<tr>
<th>Technical solutions implementation – goals to achieve</th>
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<th>Payback period, years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reducing harmful and GHG emissions</td>
<td>Repairing carriage furnace hearth</td>
<td>156 thousand m³/year</td>
<td>2,683,000.00</td>
<td>1,282,000.00*</td>
<td>2.1</td>
</tr>
<tr>
<td></td>
<td>Air heat recovery supplied to the tunnel kiln burner</td>
<td>96.4 thousand m³/year</td>
<td>100,000.00</td>
<td>791,000.00</td>
<td>0.12</td>
</tr>
<tr>
<td></td>
<td>Utilization of flue gases heat behind the tunnel kiln</td>
<td>25.9 thousand m³/year</td>
<td>500,000.00</td>
<td>212,000.00</td>
<td>2.4</td>
</tr>
<tr>
<td></td>
<td>Insulating external metal components of the tunnel kiln</td>
<td>3.4 thousand m³/year</td>
<td>30,000.00</td>
<td>28,300.00</td>
<td>1.06</td>
</tr>
</tbody>
</table>

* After modernization of all carriages full saving potential can be achieved at the 2nd year end.
ROOFING AND INSULATION MATERIALS PRODUCTION

Expected savings, per year

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>167 thousand UAH</td>
<td></td>
</tr>
<tr>
<td>Electricity – 29,900.00 kWh</td>
<td></td>
</tr>
<tr>
<td>Material resources – 12.8 tons</td>
<td></td>
</tr>
</tbody>
</table>

THE POTENTIAL OF RESOURCES USE (TECHNICAL ASSESSMENT RESULTS)

Durational preheating raw materials up to 200°C demands lots of power, thus making the manufacturing processes energy consuming. It should be noted that only 74% go to actually heat the material, whereas the rest 26% is radiated into the air from the equipment surface and the mixer, in particular.

Almost 6% raw materials loss was recorded on the way to the final product.

The boiler to heat bitumen mixture is the largest electricity consumer – 85% of electricity to power the boiler. However, total boiler efficiency component of energy utilization – 34-37%.

COMPANY DESCRIPTION

The main products: waterproof aluminum foil insulation material (folgoizol), heat insulating material (termoizol), bitumen felt roofing, tarred wrapping paper.

Annual output – 293 tons of products.

The staff – 67 employees.

RECP IMPLEMENTATION GOALS

- Reducing electricity consumption;
- Increasing efficient use of materials.
## THE EFFICIENCY OF PROPOSED TECHNICAL SOLUTIONS (SUMMARY)

<table>
<thead>
<tr>
<th>Technical solutions implementation – goals to achieve</th>
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<th>Investment, UAH</th>
<th>Savings, UAH per year</th>
<th>Payback period, years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reducing electricity consumption</td>
<td>Mixer insulation. Differentiating the operation of heaters, installing automatic control system to monitor heaters operation on the mixer</td>
<td>17,500.00 kWh</td>
<td>5,000.00</td>
<td>32,375.00</td>
<td>0.15</td>
</tr>
<tr>
<td></td>
<td>Thermal insulation of the boiler for bitumen mixtures. Thermal insulation of the basin where the paper is covered with bitumen mixture</td>
<td>9,600.00 kWh</td>
<td>12,000.00</td>
<td>3,500.00</td>
<td>3.4</td>
</tr>
<tr>
<td></td>
<td>Withstanding bitumen until the water gets separated. Improving the heaters efficiency (design upgrade).</td>
<td>2,800.00 kWh</td>
<td>5,180.00</td>
<td>3,000.00</td>
<td>0.6</td>
</tr>
<tr>
<td>Increasing efficient use of materials</td>
<td>Using bitumen of higher quality</td>
<td>6 tons</td>
<td>22,800.00</td>
<td>60,000.00</td>
<td>3.8</td>
</tr>
<tr>
<td></td>
<td>Dosing bitumen mixtures</td>
<td>6 tons</td>
<td>10,000.00</td>
<td>60,000.00</td>
<td>0.17</td>
</tr>
<tr>
<td></td>
<td>Using moisture-free oil</td>
<td>0.8 tons</td>
<td>30,400.00</td>
<td>8,000.00</td>
<td>3.8</td>
</tr>
</tbody>
</table>
AGROPROCESSING INDUSTRY:

GROWING FLOWERS IN GREENHOUSES

By-effects:
• Drainage water gets accumulated and discharged with nutrients, and;
• Reverse osmotic concentrate becomes wastewater as a result.

THE POTENTIAL OF RESOURCES USE (TECHNICAL ASSESSMENT RESULTS)

The company consumes yearly 280 thousand m³ of water, over 140 tons of fertilizers and almost 0.2 tons of insecticides and fungicides. 61.5% of electricity, 33.5% of natural gas and 5% of fuel are consumed to run technological process. There are two water resources involved – artesian and partially rainwater.

Industrial wastewater (86 thousand m³/year) and the water remaining from flowers management (1.7 thousand tons/year) are the main production wastes.

The assessment revealed that drainage water amounts to 30% of total water supplied to irrigate the plants and this is a standard global practice. However, it is not the same with fertilizers – over 50% of those are discharged

<table>
<thead>
<tr>
<th>Expected savings, per year</th>
<th>1.2 mln UAH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water – 47.5 thousand m³</td>
<td></td>
</tr>
<tr>
<td>Fertilizers – 85 tons</td>
<td></td>
</tr>
</tbody>
</table>

COMPANY DESCRIPTION
The main company activity – zerosoil gardening in greenhouses.

Annual output – 1.5 million bushes.

The staff – 680 employees.

Basic production process – constant irrigation/fertilizing the plants.

Manufacturing process stages:
• Dripping supply of water, fertilizers and protection substances;
• Water desalination by reverse osmosis for further irrigation, and;
• Maintain the content of gas, humidity and temperature to run the operation modes.
with drainage water. The assessment also detected contaminants penetrating into artesian water supply system resulting in accelerated sludge accumulation on the filters of the reverse-osmotic installation.

Getting the system sealed gives an opportunity to increase demineralized water production and save the materials. As a matter of fact, this is the main potential to conserve water and material resources as well as reduce the discharge of biogenic matters into the environment.

### RECP IMPLEMENTATION GOALS

- Increasing the efficiency of water and materials use for irrigation/fertilizing the plants;
- Improving wastewater management;
- Provide savings of water and fertilizers.

### THE EFFICIENCY OF PROPOSED TECHNICAL SOLUTIONS (SUMMARY)

<table>
<thead>
<tr>
<th>Technical solutions implementation – goals to achieve</th>
<th>Technical solution</th>
<th>Results achieved</th>
<th>Investment, UAH</th>
<th>Savings, UAH per year</th>
<th>Payback period, years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Drainage water and fertilizers recycling</td>
<td>46,000.00 m³ / years</td>
<td>85 tons of fertilizers</td>
<td>2,075,000.00</td>
<td>1,032,000.00</td>
</tr>
<tr>
<td></td>
<td>As an alternative: drainage water processing/treating to get complex fertilizers</td>
<td>46,000.00</td>
<td>18.5 tons of fertilizers</td>
<td>2,750,000.00</td>
<td>930,000.00</td>
</tr>
<tr>
<td></td>
<td>Get the artesian water supply system sealed up</td>
<td>1,500.00 (demineralized)</td>
<td>2,240.00 filters, 115 kg of chemical reagents</td>
<td>50,000.00</td>
<td>173,750.00</td>
</tr>
</tbody>
</table>
MACHINE-BUILDING INDUSTRY:

FILTERS MANUFACTURE

<table>
<thead>
<tr>
<th>Expected savings, per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity – 142,320.00 kWh</td>
</tr>
</tbody>
</table>

COMPANY DESCRIPTION

The main business activity – production and distribution of air, fuel, oil, hydraulic and other industrial filters for vehicles and agricultural machinery.

There are four production lines at the company. They ensure producing approximately 2,500 panel air filters, 3,400 round-shaped air filters and 8,500 oil filters for vehicles and tractors per one shift.

The staff – 139 employees.

THE POTENTIAL OF RESOURCES USE (TECHNICAL ASSESSMENT RESULTS)

The RECP Center conducted a preliminary assessment and selected the polymerization kiln as the most energy consuming facility. The assessment revealed:

- The heat losses are mainly recorded through the surface of the chamber, openings to get the material loaded in; the kiln has no optimally controlled heating mode;
- The kiln consumes up to 25% of overall electricity consumption depending on the type of products;
- Major heat losses in the polymerization kiln are caused by preheating the cold air. This process consumes 48% of the electricity.
### The Efficiency of Proposed Technical Solutions (Summary)

<table>
<thead>
<tr>
<th>Technical solutions implementation – goals to achieve</th>
<th>Technical solution</th>
<th>Results achieved</th>
<th>Investment, UAH</th>
<th>Savings, UAH per year</th>
<th>Payback period, working days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reducing electricity consumption by improving the efficiency of polymerization kiln</td>
<td>Total chamber sealing to reduce cold air inflow</td>
<td>96,000.00 kWh</td>
<td>4,500.00</td>
<td>78,000.00</td>
<td>0.03</td>
</tr>
<tr>
<td></td>
<td>Installing screens to separate the flow into the channel for filters cooling</td>
<td>16,000.00 kWh</td>
<td>1,500.00</td>
<td>19,000.00</td>
<td>0.04</td>
</tr>
<tr>
<td></td>
<td>Switching the tubular heating elements to run non-stop</td>
<td>12,400.00 kWh</td>
<td>1,200.00</td>
<td>12,000.00</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td>Insulating chamber bottom</td>
<td>9,920.00 kWh</td>
<td>2,500.00</td>
<td>9,700.00</td>
<td>0.12</td>
</tr>
<tr>
<td></td>
<td>Cleaning chamber surface</td>
<td>8,000.00 kWh</td>
<td>700</td>
<td>9,100.00</td>
<td>0.04</td>
</tr>
</tbody>
</table>

*The most effective should be infrared heating though requiring a complete refurbishment of the kiln.*

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**FIG. 3. THERMAL BALANCE EXPENDITURES IN kW.**

- Carrier Heating
- Filters Heating
- Losses to the environment through the chamber surface
- Losses to the environment due the leaking of the heated air

**RECP Implementation Goals**

- Reducing electricity consumption by improving the efficiency of polymerization kiln.

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![Thermal Balance Chart](image-url)
CLOSING REMARKS

Dear friends,

We have presented a set of case studies in this handbook. They demonstrate projects results on resource efficient and cleaner production methodology implemented at company level. All of them prove that even low-cost and zero-cost solutions, to say nothing about expensive ones, can promote significant positive results to develop and improve your business. While designing the handbook we were driven by the idea to make the company management and its staff clearly understand that rational use of resources guarantees financial savings and for sure leaves less environmental footprints.

We know for certain that our goal is promoting and assisting Ukrainian enterprises and leveling up their competitiveness status. For now, the Resource Efficient and Cleaner Production Centre possesses substantial potential to cooperate with companies and enterprises, regardless of their size and scale, business activity or ownership. And this is easy to do thanks to UNIDO’s methodology on RECP being so efficient and universal to get implemented.

We are pleased to share the news that the number of enterprises have been already collaborating with the RECP Centre gets multiplied constantly. The companies keep widening our partnership database and have no intentions to stop implementing RECP principles as they get proofs this methodology does work for benefit.

The RECP Centre has joined the RECPnet to get access to the best world practice in implementing RECP methodology, to know the up-to-date metering equipment and benchmarking. But the key point is – the RECP Centre experts are highly qualified and are capable to develop and offer innovative solutions that meet the needs of each and every customer.

We have been collaborating with many various enterprises for years and this achievement convince us to declare: “Each technical problem has its solution; all you do is find it!”. Why don’t you convince yourself? Let’s cooperate and do it together!

Regards,
RECP CENTRE TEAM
The handbook contains case studies pertaining to resource efficient and cleaner production principles implemented by the Resource Efficient and Cleaner Production Centre at the enterprises in Kyiv, Vinnytsia, Zaporizhzhia and Odesa regions of Ukraine.

The material has been designed and compiled for the benefit of company management and engineers, different institutions and organizations, faculty and students of technical universities, and of others wishing to know more about saving and rational use of natural resources.