RESOURCE EFFICIENT AND CLEANER PRODUCTION CENTRE

ASSESSMENT OF THE RESOURCE EFFICIENCY OF COMPANIES: BEST PRACTICES – 2014

Kyiv
2015

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The catalogue contains examples of best practices of Resource Efficient and Cleaner Production Centre (RECP Centre) in implementation of resource-efficient and cleaner production methodology at the industrial enterprises, institutions and organizations in Ukraine.

The publication may be of interest for managers, engineering staff, institutions and organizations; non-governmental organizations involved in energy saving and energy efficiency; technical specialists, and university students, who are committed to learn more about resource efficiency and cleaner production.

INFORMATION ABOUT RESOURCE EFFICIENT AND CLEANER PRODUCTION CENTRE

Resource-efficient and cleaner production Centre (RECP Centre) was established in 2013 within the framework of the United Nations Industrial Development Organization (UNIDO) resource efficient and cleaner production programme. The project is funded by the Swiss Confederation and the Republic of Austria. Swiss Confederation in Ukraine is represented by Swiss Cooperation Office in Ukraine.

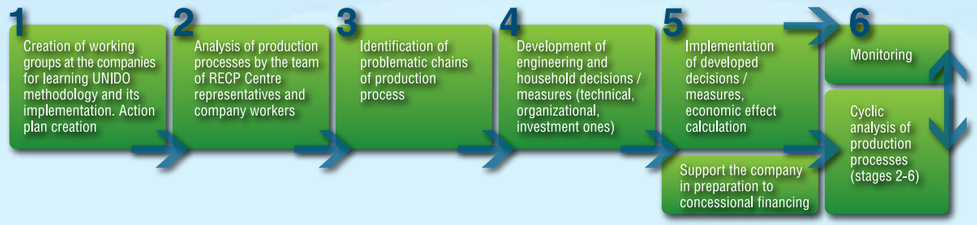
The objective of the Centre establishment is to improve resource efficiency, competitiveness of Ukrainian industry and reduce its environmental impact.

Project activities are aimed at implementation of UNIDO cleaner production methodology for providing all necessary tools for sustainable development of national industry. This allows national enterprises to meet national and international quality and environmental standards.

RECP Centre transfers its experience and supports the enterprises to:

- ➔ Create a team from the staff of the company, which constantly and systematically will use UNIDO methodology at different levels of production, realizing the goals, objectives and benefits of resource efficiency.
- ➔ Learn the way of material and energy balances creation, which allow identifying and assessing problem areas using an integral approach.
- ➔ Calculate explicit and implicit losses / costs of input materials.
- ➔ Evaluate the effectiveness of processes and equipment, the potential of the company development.
- ➔ Develop solutions for technical and technological problems with different kind of complexity.
- ➔ Raise awareness of the employees about simple and effective methods, helping to reduce the production expenditures.
- ➔ Prepare documents for concessional financing for new technologies and equipment implementation.

MAIN STAGES OF COMPLEX TECHNICAL AUDIT FOR THE COMPANY:



*1. Creation of working groups at the companies for learning UNIDO methodology and its implementation. Action plan creation

2. Analysis of production processes by the team of RECP Centre representatives and company workers.

3. Identification of problematic chains of production process.

4. Development of engineering and household decisions / measures (technical, organizational, investment ones).

5. Implementation of developed decisions / measures, economic effect calculation.

Support the company in preparation to concessional financing.

6. Monitoring

Cyclic analysis of production processes (stages 2-6)

Further the examples of raising resource efficiency at the companies are presented, based on the results of the work implemented in 2014 at the companies of Vinnytsia, Zaporizhya, Odessa and Kyiv regions.

EFFICIENT WATER CONSUMPTION: HIGHER EDUCATIONAL INSTITUTION (UNIVERSITY)

UNIVERSITY DESCRIPTION

The University is composed of 19 faculties, 10 institutes, 152 departments; the University trains students of higher qualification in 118 specialties.

Thirty two training buildings, sports facility, scientific library, the central canteen, students' polyclinics, sanatorium, cultural center, students' quarter (20 hostels), administrative buildings and residential houses are located on the University campus.

The University has 21 265 students, 851 post-graduate students, 33 postdoctoral students, 3 138 lecturers and scientists, 3 500 support staff.

WATER CONSUMPTION

The University consumes potable water from the city water supply system and discharges waste water into the city sewerage.

The annual water consumption is about 1 260 121 m^3. The biggest water consumers are: the campus (77%), training buildings with cafes and laboratories (11 %), sports facility (4%) and residential houses (3%).

Water consumption in the campus exceeds water use rate by 38 %, at the same time in the training buildings and sports facility water consumption for sanitary needs is under the set rate by 57% and 76% relatively. This causes exceeding the rate of biogenic substances (ammonia nitrogen and phosphates) in waste water discharged into the city sewerage.

The abovementioned problems result from systematic water losses in water-pipes and other plumbing equipment due to non-hermetic, inefficient and wasteful water consumption.

GOALS OF RECP PROJECT

- ➔ stop of systematic water losses (leaks) from water-pipes;
- ➔ avoiding systematic water losses from plumbing equipment;
- ➔ avoiding exceeding of water use rates.

Improvement of water use system results in:

- ➔ reduction of inefficient water consumption, and as a result discharge of waste water (in the first turn, in the students' quarter);
- ➔ increase of efficiency of water target consumption in the training buildings;
- ➔ increase of a level of waste water dissolution thus avoiding penetration of biogenic substances into waste water discharged into the city sewerage.

OPTIONS AND IMPROVEMENTS

Low-cost measures:

1. Increase of culture of water use among the university students and employees: conducting educational lectures, presentation of visual information about economic attitude to water consumption and the necessity to adhere to rules of plumbing equipment use (potential of reduction of water consumption on 10%).

Measures that require investments:

2. Repair/replacement of obsolete water-pipes and plumbing equipment:
   - in internal network of the training buildings to avoid systematic losses of water due to leakages, in the first turn, during non-working hours;
   - in external distribution network of the University.
3. Installation of pressure regulators on general entering water-pipes of water supply system for reducing pressure in external distribution network of the University and reduction of systematic water losses due to leakages during the night hours (potential of reduction of water losses by at least 50%);
4. Adjustment of pressure regulators on entering water-pipes in the training buildings to reduce water pressure in internal water-pipes during the night and non-working hours (days off and holidays)(potential of reduction of water leakages by at least 50%).

COSTS AND BENEFITS OF PROPOSED MEASURES

MEASURES	FINANCIAL INDICATORS			SAVINGS
	Investments [UAH]	Savings, [UAH/y]	Payback [y]	Water [m^3/y]
1. Repair/replacement of obsolete water-pipes and plumbing equipment in internal network of the training buildings.	1'000	373,0	2,5	74'000
2. Repair/ replacement of obsolete water-pipes in external distribution network of the University.	500	77,8	6,4	15'436
3. Installation of pressure regulators on general entering water-pipes.	468	224,3	2,5	7'500
4. Adjustment of pressure regulators on entering water-pipes in the training buildings.	100	90,7	1,1	18'000
5. Organizational/educational events to increase students' ecological culture.	30	117,8	0,25	37'000
TOTAL	2'098	883,6		151'936

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WATER RELATED RECP ASPECTS IN CONSTRUCTION INDUSTRY: PRODUCTION PLANT FOR REINFORCED CONCRETE AND CONCRETE PRODUCTS

COMPANY DESCRIPTION

The company produces a wide range of reinforced-concrete and concrete products, as well as commercial concrete.

The main types of products are reinforced-concrete products amounting to 61,4% of total production volume, including pips for sewerage collectors and parts for wells, intermediate slubs, heat chambers parts.

Yearly raw material consumption in production processes include cement (14 417,8 t), gravel (48 095,3 t), sand (35 573,7 t), water (11 830 m^3), reinforcement metal (1 675,9 t), admixtures for producing concrete with certain characteristics (4 400 t).

The company has six production subdivisions, the main of which is a concrete production plant, as well as twelve administrative and management departments. The total number of employees is 314 persons.

In 2013 the total production volume amounted to 43 667,6 m^3 of concrete.

GOALS OF RECP PROJECT

Total volume of water consumption by the company is 31 181 m^3/year, of which 62% stem from artesian water from the own bore-drain and 38 % are abstracted from a nearby river (technical water).

Domestic waste water is discharged through the company's sewerage pump station to the city sewerage system; waste water used for production purposes is discharged into grit-gully and infiltrated into the ground. The company also collects waste water from neighbors' facilities into its sewerage pump station.

Total volume of waste water discharged into sewerage pump station amounts to 137 482 m^3/year, of which only 22% is the company share.

The main water use problems

- ➔ exceeding of domestic water allowance and/or non-target use of potable water (total exceedance amounts to 60%);
- ➔ the lack of separate measuring of domestic waste water discharged by the company into sewerage pump station resulting in overpayment of at least 37% for waste water discharge comparing to actual amount of waste water discharged by the company;
- ➔ significant losses of electricity used for waste water pumping from sewerage pump station to the city sewerage system due to obsolete pumping equipment;
- ➔ big volume and high share of technical water consumption (48% of total consumption for production purposes) for additional activities – equipment and vehicles washing and territory watering resulting in exceeding fresh water and electricity use rates due to excessive water pumping.

Resolution of the abovementioned problems requires the following:

- ➔ finding the alternative sources of water supply for technological purposes;
- ➔ modernization of sewerage pump station (replacement of obsolete energy consuming pumping equipment);
- ➔ measuring volume of waste water discharged by the company;
- ➔ maintaining of water supply system in appropriate condition, avoiding non-target use of potable water.

OPTIONS AND IMPROVEMENTS

Low-cost measures

1. Maintaining of water supply system in appropriate condition, avoiding non-target use of potable water (artesian water). Savings may achieve up to 50% of actual exceed of artesian water use rate, i.e. 5 750 m^3/year of economy of water resources.

Measures that require investments

2. Collection and use of rain water instead of artesian water for vehicles washing and territory watering in the vehicle workshop allows saving of potable water in the amount of 450 m^3/year .
3. Collection and use of rain water at concrete product plant for territory wateringallows saving of river water in the amount of 2200 m^3/year and 2760 MWh/y of electricity currently used for water pumping;
4. Replacement of obsolete energy consuming pumping equipment for modern energy saving equipment allows saving electricity currently used for waste water pumping ;
5. Installation of measuring device for separate measuring of volume of waste water discharged by the company into sewerage pump station allows measuring of actual volume of waste water discharged by the company and avoiding payment for waste water discharged by neighbors' facilities.

COSTS AND BENEFITS OF PROPOSED MEASURES

MEASURES	FINANCIAL INDICATORS			SAVINGS	
	Investments [UAH]	Savings, [UAH]	Payback [y]	Water [m^3/y]	Electricity/ heat energy, [MWh/y]
1. Maintaining of water supply system in appropriate condition, avoiding non-target use of potable water.	0	30,6	0	5'800	
2. Collection and use of rain water for vehicles washing and territory watering.	12,5	5,8	2,2	2'650	2,76
3. Replacement of obsolete energy consuming pumping equipment for modern energy saving equipment.	300,0	30,5	9,8		21,41
4. Installation of measuring device for separate measuring of volume of waste water discharged by the company into sewerage pump station		40,6	0,9		
TOTAL	36,0	107,5		8'450	24,17

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MEAT PROCESSING INDUSTRY: SAUSAGE PRODUCTION

COMPANY DESCRIPTION

The company is specialized in sausage and smoked meat products (in total about 100 product items). The main production lines are sausage workshop (see picture below), cooling chambers, administrative building, laboratory, store, water treatment facilities and vehicle washing facility.

The company works one shift – 8 hours, 240 working days. Production capacity is about 850 t/year of meat products. The company employs 101 persons. In 2013 the company produced 470 tons of cooked sausage, 165 tons of semi-cooked sausage, 101 tons of uncooked smoked sausage, 161 tons of smoked products (pork, beef and chicken).

ПРОЦЕСИ У КОВБАСНОМУ ЦЕХУ:
ПОДРІБНЕННЯ НА БЛОКОРІЗЦІ, ПРИГОТУВАННЯ ФАРШУ В КУТЕРІ, ТЕРМООБРОБКА КОВБАС

PROCESS DESCRIPTION

Technological processes of raw cured meat production have been analyzed from RECP prospective; it can be divided into the following main stages:

1) raw product and spices weighting;
2) meat defrosting and shredding;
3) farce meat shredding and production;
4) sausage staffing, formation and cording;
5) fermentation and drying;
6) delivery to storage cooling chamber.

The main equipment applied: shredding equipment, grinder, cutter and mixer, sausage staffing and forming, universal fermentation and drying chambers, cooling chambers.

The main energy-consuming equipment: cooling chambers, universal fermentation and drying chambers

GOALS OF RECP PROJECT

The company consumed 1 412 MWh of electricity and 7 500 m^3 of water in 2013; thus reduction in electricity consumption is one of the main goals agreed with the company for this project.

OPTIONS AND IMPROVEMENTS:

Low-cost measures:

1. reduction of expedition refrigerator capacity results in decrease of cold by 3,13 times, allowing to save 34 MWh/y of electricity;
2. reduction of cooling chamber capacity results in decrease of cold by 1,38 times, allowing to save 14 MWh/y of electricity;
3. replacement of electric boiler with gas boiler results in reduction of electricity consumption by 29,65 MWh; in this case natural gas consumption will amount to 32,22 MWh. This measure leads to reduction of CO_2 emissions by 6 t/year due to other energy resource combustion – natural gas;
4. installation of 47 m^2 of solar collectors results in satisfaction of need in warm water in summer and saving of 14,82 MWh of electricity, which is used in summer for water heating in electric boiler. The abovementioned reduction in energy consumption will allow reducing CO_2 emissions from electricity production by 6 t/year;
5. replacement of the luminous tube lamps (in the process of their getting out of order while in service) with LED lamps will result in reduction of energy consumption from 374,49 MWh to 261,48 MWh/day (from 121,65 MWh to 84,94 MWh per year).

COSTS AND BENEFITS OF PROPOSED MEASURES

MEASURES	FINANCIAL INDICATORS			SAVINGS
	Investments [UAH]	Savings, [UAH/y]	Payback [y]	Electricity/heat energy, [MWh/y]
1. Reduction of refrigerating equipment capacity.	36'200	43'860	0,83	34
2. Reduction of cooling chambers capacity.	21'700	18'060	1,2	14
3. Replacement of electric boiler with gas boiler.	36'940	24'780*	1,5	29,65
4. Installation of solar collectors for receiving warm water in summer.	134'300	19'118	7,02	14,82
5. Replacement of the luminous tube lamps (in the process of their getting out of order while in service) with LED lamps.	215'800	47'370	4,56	36,72
TOTAL	444'940	153'187		97

*Consumed natural gas cost was taken into account during calculation of potential savings.

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MEAT PROCESSING INDUSTRY: SAUSAGE AND DUMPLINGS PRODUCTION

COMPANY DESCRIPTION

The company is specialized in sausage and smoked meat products (in total about 120 different product items – sausages and dumplings).

The main facilities are sausage and dumplings workshops, cooling chambers, administrative building, laboratory, store, water treatment facilities and vehicle washing facility.

The company works currently one shift, i.e. 8 hours/day, 240 working days/year. Production capacity is about 1 400 t/year of meat products. The company employs 264 persons.

In 2013 the company produced 490 tons of cooked sausage, 160 tons of semi-cooked sausage, 224 tons of uncooked smoked sausage, 38 tons of liver sausage, and 450 tons of smoked products (pork, beef and chicken).



MEAT FARCE PRODUCTION IN CUTTER-AND-MIXER, SAUSAGE STUFFING AND FORMING.

PROCESS DESCRIPTION

Technological process of dumplings production has been analyzed in details from RECP perspective as it shows the highest specific electricity consumption; it can be divided into the following main stages:

1) production in separate premises;
2) delivery to dumplings production workshop in special куіукмщшк;
3) pinning out and dumplings formation;
4) freezing in a freezing chamber (t = - 27°C);
5) dumplings packaging and delivering to storage chamber (t = - 15°C);
6) storage and shipment to a customer.

Workshop capacity: up to 600 kg of ready product per shift.

The main equipment: mixing and forming equipment for dumplings, freezing chamber, storage chamber and packaging equipment.

The main energy-consuming equipment: freezing chambers (about 80% of electricity consumed for dumplings production).



ЛІНІЯ ФОРМУВАННЯ ПЕЛЬМЕНІВ, ЛІНІЯ ФАСУВАННЯ ТА ГОТОВА ПРОДУКЦІЯ

GOALS OF RECP PROJECT

In 2013 the company consumed 1 800 MWh of electricity and 14 700 m^3 of water. The main electricity consumers in dumplings workshop are freezing chambers which consume about 80% of electricity consumed for dumplings production.

Thus the main goals include:

➔ Reduction of electricity consumption;
➔ Reduction of electricity consumption.

OPTIONS AND IMPROVEMENTS

Low-cost measures:

1) CIP-washing machines are available, but they are not used because water penetrates into electric parts of equipment. Thus use of available CIP-washing machines should be combined with protection of electric parts of equipment to avoid water penetration. Change of equipment washing technology results in saving of about 5 137 m^3 of water per year.
2) Replacement of sealant in freezing chamber door with simultaneous change of damaged insulation of pipes in freezing and storage chambers allows reduction of heat consumption at damaged equipment sections (average temperature on damaged sections t = -5°C, air temperature t =24°C); these measures result in saving of 12,6 MWh of electricity per year.

Measures that require investments:

3) Replacement of the luminous tube lamps (in the process of their getting out of order while in service) with LED lamps will result in reduction of energy consumption from 18,24 MWh to 14,63 MWh.
4) Installation of automation of condensing radiator for reactive capacity compensation allows reduction of reactive electricity up to 3 MVAr-hr per shift.

COSTS AND BENEFITS OF PROPOSED MEASURES

MEASURES	FINANCIAL INDICATORS			SAVINGS	
	Investments [UAH]	Savings, [UAH/y]	Payback [y]	Electricity/ heat energy, [MWh/y]	Materials [units/y]
1. Installation of compensators of reactive capacity.	108'300	76'370	0,95	740*	
2. Use of CIP-washing machines.	0	15'300	-		5 137 m^3 of water
3. Replacement of sealant in freezing chamber door.	1'500	2'970	0,5	2,2	
4. Replacement of damaged insulation of pipes in freezing and storage chambers.	4'500	16'125	0,3	12,6	
5. Replacement of the luminous tube lamps (in the process of their getting out of order while in service) with LED lamps.	21'000	4'660	4,5	3,61	
TOTAL	135'300	115'425		758	See above

*Reactive capacity MVAr-hr
**TOGETHER WITH THE OPTION NO 3

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FOOD INDUSTRY: BAKERY NO-1

COMPANY DESCRIPTION

This small enterprise is specialized in the production of 12 types of bread and produces 8 types of cookies making use of small bakeries technologies. The company uses traditional technologies for dough production based on liquid sponge method. The main operations of dough preparation are mechanized; rotary and hearth oven are used for baking.

Natural gas (53 000 m³/year) and electricity (55,6 MWh) are used as energy resources; water is supplied from the city's public water supply system. Process water is heated by

gas and electric boilers.

GOALS OF RECP PROJECT

- Reduction of electricity consumption in technological processes.
- Reduction of excessive water use.
- Reduction of natural gas consumption.

OPTIONS AND IMPROVEMENTS

Low-cost measures:

1. Installation of water cutoffs in toilets and bathrooms.
2. Separate of water supply networks and installation of water measuring devices in the workshop and offices.

Measures that require investments:

3. Installation of LED lighting. Replacement of 25 luminous tube lamps with LED-lamps.
4. Replacement of gas burners in bread baking ovens with pellet ones.

COSTS AND BENEFITS OF PROPOSED MEASURES

MEASURES	FINANCIAL INDICATORS			SAVINGS		
	Investments [UAH]	Savings, [UAH/y]	Payback [y]	Electricity, [MWh/y]	Gas, [m³ /y]	Water [m³/y]
1. Replacement of the luminous tube lamps with LED-lamps.	5'750	3'970	1,4	4,27		
2. Replacement of gas burners in bread baking ovens with pellet ones.	120'000	172'800	0,7		40 m³ per year	
3. Installation of water cutoffs in toilets and bathrooms.		2'120				212
TOTAL	125'750	178'890		4,27		

FOOD INDUSTRY: BAKERY NO-2

COMPANY DESCRIPTION

The company is specialized in the production of four types of bread, bun goods and 38 types of confectionary. The company has 6 bakery ovens and 2 fermentation chambers.

The annual production volume is about 1 300 tons of bread.

The company uses traditional baking technologies. The main bread brand is baked following an old recipe without yeast and baking powder. The company has its own transforming substation and uses Artesian water.

The main energy resources are natural gas, electricity and firewood. The annual water consumption is 4 450 m³, flour – about 1 000 tons, natural gas – 85 400 m³, electricity – about 280 MWh. Thus, RECP proposals are focused on reduction of electricity and natural gas consumption by the company.

GOALS OF RECP PROJECT

With the management the following focus and goals of the project were agreed:

- Reduction of electricity consumption;
- Reduction of natural consumption;

COSTS AND BENEFITS OF PROPOSED MEASURES

MEASURES	FINANCIAL INDICATORS			SAVINGS	
	Investments [thousand UAH]	Savings, [thousand UAH/y]	Payback [y]	Electricity/ heat energy, [MWh/y]	Materials [units/y]
1 Replacement of the luminous tube lamps with LED-lamps.	40,3	20	2	25,6	
2. Replacement of electric boilers with pyrolysis boiler.	38,8	29,3	1,1	19	
3. Replacement of rotary ovens with channel oven.	1'400	133,5	10		47 m³ of natural gas
TOTAL	2'024,9	547,4		112,1	

FOOD INDUSTRY: DAIRY PRODUCTION

COMPANY DESCRIPTION

The company produces milk and cheese products. The company is specialized in production of pasteurized milk, sour cream, butter and chocolate butter, cottage cheese, creamed cheese, Adygei cheese, kefir (traditional fermented dairy in Ukraine), ryazhenka (fermented baked milk), yogurt, dairy drinks. The company's capacity is about 100 tons of milk per day.

The company employs 50 persons and produced 620 tons of diary products in 2013.

PROCESS DESCRIPTION

Technological process of dairy products production includes the following consequent processes:

1) raw material weighting;
2) two-stage separation (separation of cream and butter-milk);
3) pasteurization (heating up to 1050C);
4) normalization (increasing milk fat content to 72% through adding concentrated fat or butter-milk);
5) butter formation;
6) packaging (if necessary).

The produced by-products are mixture of butter-milk and skimmed milk that are collected in a tank. The company uses materials for the total amount of 2,67 mln. UAH2013, of which the main raw material is unskimmed and skimmed milk.

The main waste product is whey (created during production of cottage cheese, Adygei cheese and creamed cheese); whey share in total ready product amounts to 27%.

GOALS OF RECP PROJECT

- ➔ In 2013 the company consumed 519 200M MWh of electricity, 93 944 m³ of natural gas and about 37 000 liters of fuel for the total amount of 1 260 000 UAH2013 and about 11 000 m³ of water. The company also produces a significant amount of waste (7 736,4 m³); in 2013 waste diversion cost about 43 000 UAH2013. Thus, the following goals have been agreed with the company:
- ➔ Reduction of consumption of electricity and gas consumption;
- ➔ Reduction of water consumption;
- ➔ Reduction of waste amount.

OPTIONS AND IMPROVEMENTS

Low-cost measures:

1. Replacement of 72 incandescent lamps or luminous tube lamps of total wattage 20 W with 80 energy saving lamps of various wattage: 11 W, 13 W and 15 W.
2. Heat insulation of pipes through use of cylinder heat insulation made of rockwool based on basaltic rock.
3. Installation of automatic water cutters will reduce the water consumption and save about 2 300 m³ of water.

Measures that require investments:

4. Installation of solid-fuelled (pellet) steam generator close to pasteurizers (exclusion of losses when transporting steam) and return of condensate.

COSTS AND BENEFITS OF PROPOSED MEASURES

MEASURES	FINANCIAL INDICATORS			SAVINGS		
	Investments [UAH]	Savings, [UAH/y]	Payback [y]	Gas, [m³/y]	Electricity, [MWh/y]	Materials [units/y]
1. Heat insulation of pipes.	21'024	86'094	-	18'800		0
2. Installation of automatic water cutters.	432	12'798	0,1		0	2'300 m³ of water
3. Replacement of all luminous tube lamps with LED lamps.*	9'432	2'592	3,6		1'470	
4. Installation of solid-fuelled (pellet) steam generator close to pasteurizers.	166'320	466'668	0,4	93'994		0
TOTAL	197'208	568'152		112'794	1'470	See above

*Reduction of 1 405 kg of CO_2 emissions.

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RECYCLING INDUSTRY: PLASTIC PRODUCTS

COMPANY DESCRIPTION

The company is specialized in molding plastic products on injection molding machines (IMM).

The main types of products include: products used for medical purposes – bed-slippers, laboratory containers, eye occluders, destructors, urine collectors, buckets and plastic bags.

The company works one shift – 12 hours, 240 working days per year.

Production capacity is 53 t/year of ready products.

The company employs 470 persons.

The company annually consumes 42 tons of polypropylene, 11 tons of polyethylene of low pressure, 150 kg of polymer paint.

In 2013 the company consumed 100 MWh of electricity and produced 3,9 thousand pieces of bed-slippers, 14,8 thousand pieces of urine collectors, 46,8 thousand pieces of polymer containers.

PROCESS DESCRIPTION

Technological production process with use of molding under thermoplastic method can be divided into the following main stages:

1. granules are mixed with paint, weighted and placed into IMM take-up chamber (hand work);
2. from IMM chamber plastic is directly poured into machine auger conveyor, where it is molded and under the action of sucker is delivered to a press-form under high pressure;
3. alloy goes through molding channels and with high speed fills in a press-form;
4. after being filled in with material the form is cooled and material sets forming a plastic part;
5. the press-form is opened, a part falls out and the whole cycle is being repeated again.

ТЕРМОПЛАСТАВТОМАТ, ПРЕСФОРМА ТА ГОТОВА ПРОДУКЦІЯ

The main electricity consumers are automatic molding machines. Electricity consumption per 1 tone of product amounts to 0,691 MWh. When using modern completely electric IMM this indicator is by 3 times lower.

GOALS OF RECP PROJECT

The following goals have been agreed with the company's management to pursue during this project:

- ➔ Reduction of electricity consumption;
- ➔ Secondary use of heat energy.

OPTIONS AND IMPROVEMENTS

Low-cost measures:

- ➔ installation of water-pipes for warm floor coming from IMM allows using warm water from IMM for heating 18 m² of floor at t = 20,5°C, and expected savings are 1,96 MWh of electricity for heating;
- ➔ obsolete heating helix of IMM consumes additional 0,275 kWh/kg for a product item. Replacement of heating helix results in reduction in excessive electricity consumption;
- ➔ recreation of heat insulation of heating IMM segments allows reducing heat losses from IMM surface and results in reduction of electricity consumption by 6,92 MWh per year;
- ➔ the result from installation of electricity measuring devices and introduction of separate electricity measuring maybe approximately evaluated (considering practical experience of controlling devices installation) as reduction of general electricity consumption by not less than 5%.

Measures that require investments:

- ➔ replacement of currently operated IMM with modern completely electric one will reduce specific consumption of electricity from 0,691 kWh/kg to 0,22 kWh/kg. Expected savings are 24,82 MWh per year.

COSTS AND BENEFITS OF PROPOSED MEASURES

MEASURES	FINANCIAL INDICATORS			SAVINGS
	Investments [UAH]	Savings, [UAH/y]	Payback [y]	Electricity, [MWh/y]
1. IMM replacement.	464'000	32'020	14,5	24,82
2. Installation of water-pipes for warm floor coming from IMM.	8'100	2'530	3,2	1,96
3. Replacement of heating helix at IMM.	300	6'440	0,05	5,00
4. Recreation of heat insulation of heating IMM segments.	2'120	8'930	0,24	6,92
5. Installation of electricity measuring devices and introduction of separate electricity measuring.	2'000	6'490	0,7	5,00
TOTAL	476'520	56'410		43,71

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PROCESSING INDUSTRY: GLASS BLOWING

COMPANY DESCRIPTION

The company is specialized in glassblowing with a total production volume of about 47 000 tons per year.

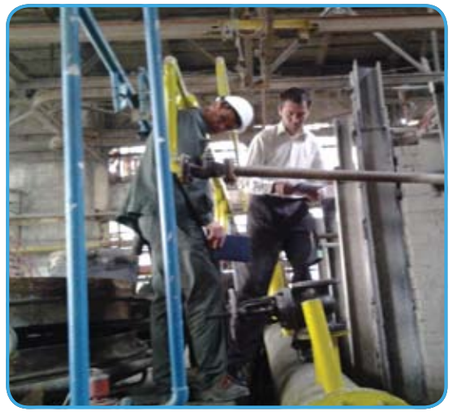
Annual electricity consumption amounts to 9 200 MWh, natural gas –10 540 000 m^3, and water – 49 720 m^3.

PROCESS DESCRIPTION

Production process includes the following main operations:

1) Preparation and drying of batch (if necessary);
2) Batch liquefaction in burner;
3) Granulation;
4) Drying.

Glass melting is a continuous process at the plant. The main glassblowing equipment which has been analyzed was the glass furnace, operated with the natural gas.

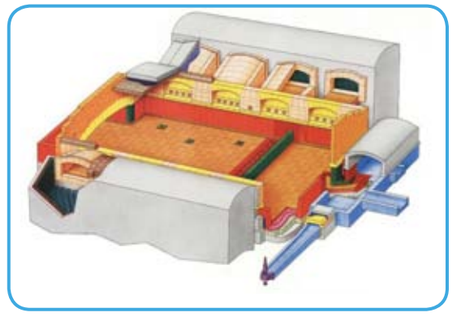


GOALS OF RECP PROJECT

In the analysis of the furnace operation and its efficiency the following problems have been identified:

- ➔ significant heat losses due to insufficient lining (in the first turn, due to one-layer furnace crown);
- ➔ penetration of excess air into burner through significant leaks in the furnace crown;
- ➔ insufficient recycling of slurry resulting in excessive use of material resources per product unit;
- ➔ recuperation of heat from flue gases is not taking place and results in significant heat losses;
- ➔ insufficient control over water temperature and pressure;

In general, increase of resource efficiency requires reduction of natural gas and electricity consumption and reduction of materials losses.



OPTIONS AND IMPROVEMENTS

Low-cost measures:

1. Creation of an additional lining layer will result in reduction of heat losses and decrease of air penetration into furnace. Within a year additional lining layer will reduce heat losses by 654 MWh, which is an equivalent to 68 000 m^3 of natural gas.

Measures that require investments:

2. Slurry recycling makes it possible to dewater and return slurry waste into batch composition. Total annual effect may amount to 75 tons.
3. Use of flea gases heat for their recuperation (instead of gas and electrical driers). This measure saves up to 24 000 m^3 of natural gas, 400 MWh of electricity and reduces greenhouse gases emissions on the level of 170 tCO_2/year.
4. Installation of additional equipment and control systems over water temperature and pressure during granulation reduces return of off-grade product for secondary blowing (total economic effect is evaluated as 507 300 UAH2013/year; natural gas saving - 83 000 m^3/year).

COSTS AND BENEFITS OF PROPOSED MEASURES

MEASURES	FINANCIAL INDICATORS			SAVINGS		
	Investments [UAH]	Savings, [UAH]	Payback [y]	Natural gas [m^3 /y]	Electricity/ heat energy, [MWh/y]	Materials [t/y]
1. Creation of an additional lining layer in the furnace.	22'548	424'654	0,05	68		
2. Recycling of slurry for its secondary use.	315'672	211'388	1,5			75
3. Batch and products drying with flea gases.	2'968'820	658'965	4,5	24	400	
4. Reduction of products return for secondary blowing.	1'954'160	507'330	4	83		
TOTAL	5'261'200	1'802'337	-	175	400	75

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MACHINE BUILDING INDUSTRY

COMPANY DESCRIPTION

This company is specialized in design and production of about 200 items made of metal, timber and polimer materials.

The main activity is design and production of parts for complete overhauling of rolling stock of “Ukrzaliznytsia” (Ukrainian Railway) company, in particular:

- 5 types of arm-chairs for class 1, class 2 and class 3 for carriage works and carriage repair plants;
- 60 items of window frames and 58 types of doors for interiors of multiple units and passenger roll-ing stock.

ОБСТЕЖЕННЯ ПРОВОДИЛОСЯ НА ЛІНІЇ АНОДУВАННЯ ВИРОБІВ ІЗ АЛЮМІНІЮ.

PROCESS DESCRIPTION

The survey was conducted with a focus on aluminum items hard coating line, which contains the fol-lowing equipment: etching bath, lighting bath, filling bath and baths for hot and cold intermediary washing.

Technological process includes parts degreasing, lighting and aluminum hard coating. Transfer from one technological operation to another is accompanied by parts hand washing in flowing water baths.

GOALS OF RECP PROJECT

The following goals were agreed with the management:

➔ Reduction of materials consumption;
➔ Reduction of energy resources consumption;
➔ Reduction of water consumption.

The conducted analysis showed that slime accumulated in treatment facilities and carried away con-tains aluminum, which may be recycled into coagulant (after regeneration from slime). In addition, heat losses caused by poorly insulated walls and bottom of hot washing bath, filling bath and steam generator line could be avoided through improved insulation.

OPTIONS AND IMPROVEMENTS

Low-cost measures:

1. External heat insulation of walls of hot washing bath, steam generator line reduces heat losses from their surface.
2. Use of polystyrene powder for covering bath mirror allows avoiding water losses due to evaporation from surface.

Measures that require investments:

3. Installation of water measuring devices allows controlling losses on hard coating line and galvanic processes lines, as well as water use for economic and household needs.
4. Aluminum regeneration from slime for receiving coagulant results in potential saving of materials (Al).

COSTS AND BENEFITS OF PROPOSED MEASURES

MEASURES	FINANCIAL INDICATORS			SAVINGS		
	Investments [UAH]	Savings, [UAH]	Payback [y]	Electricity/ heat energy, [MWh/y]	Water [m^3]	Materials [tons]
1. Installation of water measuring devices.	51’660	16’740	3,09	-	2’500	
2. Insulation of walls and bottom of hot washing bath, filling bath and steam generator line.	14’400	11’160	1,29	7,54	-	-
3. Aluminum regeneration from slime for receiving coagulant.	108’000	14’400	7,5	-		0,52
4. Use of polystyrene powder for covering bath mirror.	250	470	0,53	-	-	-
TOTAL	174’310	42’770	-	7,54	2’570	0,52

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MACHINE BUILDING: MANUFACTURING OF EQUIPMENT FOR FOOD INDUSTRY

COMPANY DESCRIPTION

The company is specialized in manufacturing of equipment for sugar, dairy, cannery and meat processing industries, as well as bakery ovens and consuming goods. The company also manufactures auto-unloading equipment for grain and other bulk materials.

The production process includes a whole cycle of metalworking: ferrous and non-ferrous casing, thermal treatment, cutting, pressing, welding of ferrous metal and stainless steel, testing and painting.

Forming machines, machines of aligned casting and casting machines under high pressure are used for metal-forming process. Alloys are smelted in induction furnaces (model ИСТ-0,4 and ИСТ-0,16); for smelting and testing of aluminium alloys furnace of ЭСТ-250 model is used.

GOALS OF RECP PROJECT

The main energy consuming process is casting, which consumes 22% of total electricity. Casting is done in sand and clay forms, chilling, with use of aligned casting method (weighting from 0,1 to 350 kg), from grey pig iron - brands СЧ10, СЧ15, СЧ20, from aluminium alloys – brands АК5М2п; АК7п and aluminium bronze - brand Бра9Ж3л. Heating systems of plant facilities are the main natural gas consumers (69% of total natural gas consumption).

RECP analysis showed that that the main economically feasible tasks would be reduction of electricity consumption in technological processes and reduction in exceeding water use rates.

OPTIONS AND IMPROVEMENTS

No good housekeeping or low cost measures could be identified.

Measures that require investments:

1. Creation of a closed cycle of water consumption in a foundry shop –reduction of cost for water preparation, reduction of amount of electricity used for pumps.
2. Use of waste heat from water of coolant circuit of furnace cooling instead of electricity currently used for water heating for economic purposes in the foundry shop.

COSTS AND BENEFITS OF PROPOSED MEASURES

MEASURES	FINANCIAL INDICATORS			SAVINGS		
	Investments [UAH]	Savings, [UAH/y]	Payback [y]	Electricity, [MWh/y]	Water [m³]	Materials [units/y]
1. Creation of a closed cycle of water consumption in a foundry shop.	5'600	2'000	2,5	45,4	18'500	
2. Use of heat of water of coolant circuit of furnace cooling for economic purposes.	30'000	16'512	1,8	12,8		
TOTAL	35'600	18'512		58,2	18'500	

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INSTRUMENT ENGINEERING SECTOR: INSTRUMENT-ENGINEERING PLANT

COMPANY DESCRIPTION

This company is specialized in manufacturing instruments for control of operational process at metallurgical plants.

The main products are methane-sampling instruments for furnace hearths, ladles and other units, and units of thermo-electrical generators for measuring temperature of liquid metal.

The annual production volume amounts to 100 000 units.

The company employs 164 persons.

The main production materials include: paper – 426 t/y, liquid glass – 108 t/y, rolled metal products – 76 t/y. The company consumes 439 000 MWh/y of electricity, 2 700 m^3/y of water.

PROCESS DESCRIPTION

One of the main technological processes is the manufacturing of sampling instruments. This process includes rolling units of paper cylinders, stamping (manufacturing of sampling instruments parts), manufacturing of heads for sampling instruments and

packaging. Paper, liquid glass, metal, electricity, heat energy and compressed air are used in the production processes.

GOALS OF RECP PROJECT

The technical assessment identified a wide range of measures aimed at optimization of materials, energy resources and water consumption to reduce inefficient use of energy and other resources. The main goals agreed with the management therefore are:

1. reduction of the inefficient use of paper which is one of the main production materials;
2. reduction of the significant losses of electricity in the process of compressed air production and related losses in electricity network (up to 40 %) and overloading of compressor capacity;
3. address compressor cooling: up to 85 % of compressor electric capacity is used for heating air in the process of its compression with the following heating of all equipment; compressor is cooled with water with use of a cooling tower.

OPTIONS AND IMPROVEMENTS

Low-cost measures (amount to 40 % of total cost saving):

1. Use of narrower paper rolls to reduce the amount of shredded paper from the cylinders flat ends.
2. More accurate adjustment of rolling units of paper cylinders to avoid ”telescoping” effect.
3. Replacement of currently used compressors with optimized compressors having less capacity and that are placed closer to consuming units.
4. Secondary use of waste heat: reuse of compressors cooling water for heating the premises during the heating season;
5. Gradual transfer to use of LED light bulbs instead of the incandescent lamps or luminous tube lamps (in the process of their getting out of order while in service) resulting in reduction of not only electricity consumption, but also saving of additional funds on recycling of lighting devices.

COSTS AND BENEFITS OF PROPOSED MEASURES

MEASURES	FINANCIAL INDICATORS			SAVINGS		
	Investments [UAH]	Savings, [UAH/y]	Payback [y]	Electricity/heat energy, [MWh/y]	Materials [tons]	Water [m^3]
1. Use of narrower paper rolls or cutting paper according to cylinders size.		57’524			15,76	
2. Replacement of compressors.	85’000	43’731	1,9	41		135,4
3. Replacement of the luminous tube lamps for LED.	20’700	5’900	3,5	2,14		
4. Use of compressor heat for premises heating.		47’490		81,36		
5. Repair of all water catching equipment.	8’900	3’530	2,5			409
TOTAL	114’600	158’175		124,50	15,76	544,4

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ADMINISTRATIVE BUILDING: TRANSPORTATION COMPANY

COMPANY DESCRIPTION

The transportation company is specialized in air transportation and freight service and operates two terminals. The freight terminal may accept up to 50 tons of cargo per day. The passengers operation has an acceptance rate of 120 passengers/hour. The company employs 230 persons.

GOALS OF RECP PROJECT

With the management the following RECP goals were agreed for this project:

- reduction of heat energy consumption used for premises heating;
- reduction of electricity consumption;
- reduction of potable water consumption.

A technical assessment of the four buildings (administrative building (i.e. the headquarters), airport, military security service building and sanitary and household building) was done to identify the reasons for excessive consumption of resources and to develop the options to increase the resource efficiency and reduce costs.

OPTIONS AND IMPROVEMENTS

Low-cost measures:

1. Collection of rainwater to be used for premises cleaning and territory watering.
2. Repair of plumbing equipment and fittings, installation of measuring devices.

Measures that require investments:

3. Heat insulation of administrative building and replacement of windows envisages insulation of administrative building foreside, replacement of old wooden windows for new made of metal plastic with two-chamber glass unit.
4. Replacement of the luminous tube lamps with LED-lamps and installation of the automated control over lightning on stairs and in the corridors.

COSTS AND BENEFITS OF PROPOSED MEASURES

MEASURES	FINANCIAL INDICATORS			SAVINGS	
	Investments [UAH]	Savings, [UAH/y]	Payback [y]	Electricity/ heat energy, [MWh/y]	Water [m³/y]
1. Heat insulation of administrative building and replacement of windows.	590’646	56’252	10,5	90 (heat energy)	-
2. Replacement of the luminous tube lamps with LED-lamps.	330’000	91’000	3,6	65	-
3. Collection of rainwater.	18’267	6’421	2,9	-	1’249
4. Replacement of the luminous tube lamps with LED-lamps and installation of measuring devices	60’781	18’270	3,32	-	2’117
TOTAL	999’694	171’943		See above	3’366

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SERVICE INDUSTRY: DEALERSHIP (SHOWROOM AND SERVICE STATION)

COMPANY DESCRIPTION

The dealership specializes in selling cars and provision of after-sales and post-warranty service, body repair, selling of original spare parts, accessories for cars and car care products; the dealership employs 79 persons.

The dealership was built with application of the newest construction standards and is one of the biggest in Europe. Total area is more than 7 000 m^2, construction volume of 28 903,5 m^3 includes a three-storied building and underground parking.

The basement floor (total area–1 790 m^2) accommodates:

- Parking for 49 cars;
- Service station with washing facility and painting chamber;
- Premises for engineering equipment and engineering infrastructure.

The first floor accommodates a showroom (total area – 5 262 m^2) and premises for car servicing, the second floor – administrative and household premises, the third floor – working space, gas boiler and ventilation chamber. The roof is flat with controlled internal water removal. Window blocks are filled in with energy saving float glass. In 2013 the company consumed 711,2 MWh of electricity, 71 684 m^3 of natural gas and2 540 m^3 of water.

GOALS OF RECP PROJECT

With the management the following focus and goals of the project were agreed:

➔ Reduction of electricity consumption;
➔ Reduction of natural gas consumption;
➔ Reduction of harmful emissions into enviro

The highest electricity consumption:

- Lightning system;
- Air conditioning system, which also includes chiller Climaventa MACS 0612/LN (capacity 58,9 kW, cold productivity 149,7 kW);
- Ventilation system;
- Service station electric equipment, etc.

The highest natural gas consumption: two water heating boilers Viessman Vitoplex – 100"SX, with each having a capacity of about 572 kW (efficiency - 93%) are working in systems of heating and hot water treatment.

In the process of operation, the dealership consumes annually raw materials and inputs for the amount of more than 52 000 UAH2013 and produces waste products for the amount of 26 000 UAH2013.

OPTIONS AND IMPROVEMENTS

Low-cost measures:

1. Replacement of the luminous tube lamps T8 in the show-room and halogen light with diode lamps of the same type in grille lamps, which does not require significant improvements. 300 luminous tube lamps to be replaced (75 grille lamps).
2. Use of electric boiler for hot water supply instead of heating with natural gas in summer reduces gas consumption by 19,5 m^3/m^3 of water with consumption of electricity - 40 kWh/m^3 of water.
3. Introduction of energy system management reduces general consumption of energy resources by 5 %.

Measures that require investments:

4. Replacement of natural gas with solar energy on the roof through installation of solar collector, which will provide energy for water treatment in summer and decreases natural gas consumption in winter.

COSTS AND BENEFITS OF PROPOSED MEASURES

MEASURES	FINANCIAL INDICATORS			SAVINGS		
	Investments [UAH]	Savings, [UAH/y]	Payback [y]	Gas, [m^3]	Electricity/ heat energy, [MWh/y]	Materials [units/y]
1. Installation of energy saving lightning.	35'010	17'424	1,63		55 200	50pcs of recycled lamps
2. Use of electric boiler for hot water supply instead of heating with natural gas in summer.	68'076	42'984	1,58	10 127		0
3. Installation of solar collector (use of solar energy).	368'136	17'424	20,7	2 900		0
4. Introduction of energy system management.	64'278	51'408	0,79	3 580	35 560	0
TOTAL	534'960	129'888		16 607	90 760	See above

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