

RECP BUSINESS CASES

Resource efficiency and cleaner production

Business cases for SMEs

Yerevan 2017

Greening Economies In The European Union's Eastern Neighbourhood (Eap Green) Programme



RECP business cases Resource efficiency and cleaner production (RECP) demonstration project in Armenia



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Notification

The following report has been developed within the framework of Green Economy in the Eastern Partnership region (EaP Green) program and is funded by the European Union. It is implemented with the cooperation of the Economic Development and Cooperation Organization, United Nations Environmental Program, United Nations Industrial Development Organization, United Nations Economic Organization. The views expressed in the document do not necessarily reflect the official opinion of the European Union.

About EaP GREEN project

The Greening Economies in the European Union's Eastern Neighborhood (EaP GREEN) programme aims to support 6 eastern partnership countries move to green economy. European Union (EU) and the following international organizations fund the program.

- The Organization for Economic Cooperation and Development (OECD)
- The United Nations Economic Commission for Europe (UNECE)
- The United Nations Environment Programme (UNEP)
- The United Nations Industrial Development Organization (UNIDO)

European Union



The EU is one of the largest donors of the world's state development assistance; it plays a key role in the issues on the international efforts directed to the promotion of sustainable development in the world, including the environmental protection and the maintenance of competitiveness in the global market.

The key objectives of the EU Environmental Action Program are:

- Protection, maintenance and expansion of EU's natural capital,
- EU's transition to resource efficiency, green, competitive, low carbon economy,
- EU citizens' health and welfare insurance from the threatening environmental risks and impacts.

UNIDO



The UNIDO's mandate, funding the program, is primarily aimed at promoting the industrial development in developing countries. This international organization contributes to the overcoming of various interconnected issues by means of specialized and effective services' provision.

The main goals of UNIDO are:

Poverty reduction by means of production process

• The integration of developing countries into global market by means of national capacities' strengthening in the field of trade

- Environmental sustainability promotion in the field of industry
- Improvement of accessibility to clean energy sources.



In Armenia the program is being implemented in cooperation with the Armenian offices of the United Nations Industrial Development Organization (UNIDO) and the Regional Environmental Center of Caucasus (REC Caucasus).

REC CAUCASUS



The REC Caucasus is an independent, non-commercial, non-political organization founded in 1999 by the governments of three countries of South Caucasus and the European Union within the framework of "Environment for Europe" process. RECC's main aim is to assist in solving environmental problems, supporting SMEs on

their way to green economic path, as well as in developing the civil society in the

countries of the South Caucasus. To achieve its mission REC Caucasus facilitates cooperation among environmental stakeholders by supporting exchange of information, offering advice and technical expertise, and promoting public participation in environmental decision-making.

Preface

Green economy

"Green economy" is a branch of economic science that has been formed during the last two decades.

The following definitions are given to the term "Green Economy" within the framework of the UN Environment Program (UNEP):

• Economic system connected with the production, distribution and consumption of the services and products which leads to the improvement of human well-being within a long-term prospect without subjecting the future generations to significant environmental risks and ecological deficit.

• Efforts targeted to humanity's well-being improvement and social justice at the same time significantly reduce environmental risks and ecological deficit. Green economy is low carbon, resource-efficient and socially inclusive. In green economy the income growth and employment should be conditioned by public and private investments reducing the emissions and pollution, raise energy and resource efficiency and prevent the loss of biodiversity and the exploitation of ecosystems.

• Green economy is a system that leads to human well-being improvement and reduces inequalities without subjecting the future generations to considerable environmental risks and ecological deficit. It seeks to provide long-term social benefits due to short-term activities directed to environmental risk mitigation. Green economy is an important component to be achieved on the path to sustainable development.

• Green economy "is a viable economy, which provides a better life quality for everyone within the frameworks of the earth's ecological limitations".

• "Green economy" is described as a system, where the economic growth and the responsibility towards the environment work together in complementary innovative ways and simultaneously supports social development progress.



• "Green economy" is not static; it is a dynamic and stable process of metamorphosis. The green economy stays away from systematic distortion and inactive trends of current economy: it leads to improvement of human well-being and the creation of equal opportunities for all people, protection of environmental and economic completeness with condition that the planet will stay within the limits of capacities. The economy cannot be Green without being equitable and impartial.

"Resource efficiency and clean production" (RECP) program

"The Resource efficiency and cleaner production" demonstration program is one of the components of the "Green economy in eastern partnership region" (EaP Green) program being implemented in the Eastern partnership countries (Armenia, Azerbaijan, Belarus, Georgia, Moldova and Ukraine) the main goal of which is to improve the environmental activity and resource efficiency of the target industrial sectors' SMEs by means of investing RECP's terminology, concepts, methods, tools and policies, thereby contributing to sustainable industrial development and the increase of employment and income levels particularly in agricultural/food, chemical and construction materials production fields.

The main objectives of RECP are the efficient use of raw materials/source materials, energy and water, the proper selection of their sources, as well as waste reduction and neutralization, wastewater reduction and recycling, reduction and control of emissions to the air pool.

The target of the project is naturally the industry, which, as it is known, is the basis of Armenia's economy. According to official data the Government of the Republic of Armenia is guided by the imperatives targeting raise of competitiveness in the field of economy and continuous economic growth, it has accepted the need to build a knowledge-based economy and has initiated to implement an export-oriented industrial policy.

The RECP methodology widely includes the elements "Green economy" and "Green growth/development" mentioned above, which are used during the REC C studies of SMEs, audits and rapid assessments being implemented within the framework of the project.

The RECP website in Armenia

A bilingual English-Armenian website has been created within the framework of the program, which operates with the following link <u>www.recp.am</u>. It includes a detailed information on project activities, RECP resources, RECP guide, methodology and RECP assessment tools.

RECP implementation examples

Researches, analysis and evaluations on RECP environmental and industrial situation in the Armenian enterprises of the production's target areas have been implemented in 2015 (in the first phase by the qualified experts) and during 2016 (in the second phase by the qualified experts).



The list of enterprises in the second phase - names, location and production sphere are presented below:

- "Thermo Caps" LLC (Yerevan, Armenia) (Metal-Plastic and poly-laminate Production)
- "ELBAT" CJSC (Yerevan, Armenia) (production of electric batteries)
- "Yerevan Telecommunication Research Institute" CJSC (Yerevan) (Yerevan, (modem-controllers', thermal sensors' production)
- "Artashes " LLC / Kotayk marz, Abovyan city, (production of jams, canned food, juices)
- "ARGEL" CJSC / Kotayk Marz, Argel village (basalt fiber production)
- "Sam_Har" LLC / Kotayk marz, Amboyna city, (production of jams, canned food, juices)
- "Hamlet Hovsepyan" Private Entrepreneurship / Aragatsotn Marz, Aparan city (Canned Meat Production)
- "Ava-Shoes" LLC / Yerevan, (shoes design and production)
- "Sedrak-Tigran" LLC / Lori Marz, Tashir village, (cheese production)
- "Vada Bek" LLC / Kotayk Marz, Bjni village (production of bottled mineral water and lemonade)
- "Rose Food" LLC / Lori Marz, Vanadzor city (production of jams, canned food, juices)
- "Anashart" LLC / Lori Marz, Vanadzor city (Coffee Production)

The brief results of RECP studies implemented in the demonstration organizations in the second phase (in the spheres of food/beverage, chemical and construction fields) are presented below.

RECP detailed assessments

Consultations on raising the SMEs' activity efficiency have been carried out by the RECP experts in 22 pilot SMEs of 2014-2016 target sectors using the RECP's method. Relevant suggestions have been provided as well.

RECP's detailed audits have been implemented in 5 mentioned enterprises which have provided financial and economic analysis to SMEs as well – except pointing out the non-productive wastes' reduction and reusing methods, energy's efficient water use options-including the amount of investment needed for the proposed measures' implementation and other economic indicators, the pure given cost, the internal profitability norm, the payback period etc.

These deep RECP studies can further be transformed into RECP business plans and be included in green loaning projects. The RECP detailed audits have been carried out:

- "Ashtarak Dzu" LLC Aragatsotn Marz, Aghdzq village, (egg production)
- "Kashi" OJSC Yerevan, (leather production)
- "Lukashin Agricultural Association" CC (Consumer Cooperative) / Armavir Marz, Lukashin village , (dried fruit production)
- "Marilla" LLC Syunik Marz, Kapan city, (dairy and meet products' production)
- "Yervandashat Agricultural Association" CC (Consumer Cooperative) / Armavir Marz, Yervandashat village, (dried fruit production).



RECP SECOND STAGE APPLICATION EXAMPLES: FOOD PRODUCTION

"ANASHART" LLC Beverage production

Address: 5 building 3 lane G. Nzhdeh str. 2001, Vanadzor, Lori Region, Armenia Telephone: +374 91 43 61 30 E-mail: anashart@mail.ru Director: Mr. Artur Budaghyan Number of employees: 6 The enterprise was founded in 2010.



"ANASHARTT" LLC, founded in 2010, produces and sells high quality ready to drink beverages in disposable glasses. The company offers 3 types of coffee and tea. In addition to beverage production and sales the company has a warehouse.

Annual coffee production capacity of company is 2000000 cup per year, but now it's working to capacity 6-7% and produce 150000 cups of drink per year. This is due to the impossibility of exports and sales to other regions. The company sells its products in Lori Region and it is planning to implement the sales in Armenia and to export products.



Coffee bucket equipment



RECP recommendations and expected results



Requiring no expenses

The enterprise has all thermal insulation materials such as refractory brick. It will be reducing gas expense and carbon emissions. There is enough quantity of refractory brick at company disposal. It will be possible to thermally insulate the boiler without additional expenses using the bricks. As a result the gas expenses will be reduced 4-5% for boiling the water.

Requiring small expenses

Review lighting lamps used at the company exchanging them with energy-efficient lamps. The exchange of the external lighting lamp will be economically justified, because there is enough light inside the building at daytime and the energy expense is low. Exchanging 400W capacity lamp by 1000 dram cost to LED lamp 60W capacity by 15000 dram cost, annual savings will be 20000 drams. CO2 emissions will be reduced by 401 kg.

Requiring considerable expenses

Exchange present water boiling system to pasteurizer of corresponding capacity, which will allow to export the product, increase the profit, reduce the spoiled and rollback product, reduce gas expenses of the product unit, carbon emissions, water and plastic and aluminum wastes.

Pasterizer price	Pasterizer cost impact on the unit cost	Real increase of product cost	Annual quantity of products	Annual savings	Discounted payback period
dram	dram	dram	Item	dram	year
2,600,000	4	3.3	225,000	900,000	3

Pasterizer price and payback

If the pasteurizer will not be settled, it is suggested to settle sun heater, which will allow to heat the technology used water to 70-80°C for free and to bring the water up to boil. Water, heated by sun heater, will also be used in auxiliary processes and with household purposes.

The RECP assessments of "Anashart" LLC were carried out by the leading expert of RECP Perch Bojukyan and RECP assistant expert Armen Bodoyan.



"Artashes" LLC

Production of jams, preserves and juices

Address: 5, Barekamutyan Street, Village Dzoraghbyur, Kotayk Region, Armenia Telephone: + 374 63 65 68 Website: www.artashes.am E-mail: artashes@netsys.am Founding director: Artashes Gasparyan Number of employees: 20-50 people (depending on the season) Year of establishment: 1991



"Artashes" is specialized on production of canned fruits and vegetables. The company produces more than 70 ecologically clean and high quality products: preserves, jams, canned vegetables, pickles, compotes, nectarines, drinks and natural juices. Canned food is produced by order only, from fresh raw products and without preservatives. Glass jar packaging is used for final products.

All production is exported to USA, Russian Federation, France and other European countries.

In 2013 the company was awarded an ISO 22000 certificate by introducing a food safety management system.





RECP Recommendations and expected results

Not requiring financial investments

Sale of raw material residuals. Sale of fruit kernels for processing and fruit residuals for the use as bio humus or establishing own production of organic fertilizer (a vermicomposting) with the help of earthworms (the Red Californian worm and the worm Prospector).

The production area consists of nine interconnected but separate rooms, where specific pieces of equipment are spread. Centralization of equipment in one production area will allow saving energy and gas, as well as vacating additional space for possible rent out.

Requiring small investments

Thermal isolation of the 50 meter pumps from the boiler house to the production site, in total will require 50 000 AMD.

Replacement of incandescent lamps with LED lamps installing them on lower level and with movement sensors. All this will reduce the share of total lighting energy consumption by 40%.

Installation of piping system, that will irrigate the own gardens next to the production plant from the reservoire, where the sewage water flows from the production plant.

Requiring significant investments

Purchase of a new E1 boiler from the manufacturer, together with transportation and installation would cost approximately 4 mln AMD, which will be covered in 2-3 months, grace to the economy of the natural gas only.

Installation of a reservoir and new pump lines in the production site, that will allow to use the annually produced 115 200 liters of clean heated water from the steam of autoclaves for the washing of boilers, jars and production lines.

The RECP assessments of "Artashes" LLC were carried out by the leading expert of RECP Nune Gabrielyan and RECP assistant expert Lusine Taslakyan.



Hamlet Hovsephyan Individual Entrepreneur Canned meat and fish production

Address, 46-42 Jrvej, Kotayk marz Tel. + 091 40 49 29 Contact person: Hayk Hovsepyan, Director Number of employees: 30 Year of establishment: 2006.



For the production of preserves both imported and local meat is used. Around 70% of the products are sold in the internal market and 30% is exported, mainly to Russia and Georgia.

Individual entrepreneur has got ISO 22000:2005 and HACCP certificates in 2015 which are valid until 2018.

The entrepreneur has initiated the construction of modern factory according to the international standards.

In the future the entrepreneur is planned to complete the construction of the factory and expand markets, particularly exports to Russia. Besides the entrepreneur is planning to produce new types of products, such as meat products and canned green beans.

Main Products

Canned meat and fish with different packaging media, including vegetable, vegetable oil,tomato sauce, brine and/or hot pepper sauceproduced in metal containers 550g, 325g and 250g volumes.





RECP Recommendations and expected results. No cost RECP options

Suggestions for prevention of waste



Training technicians, staff working in production line and workers in shipment to reduce waste streams generated by the people. Liability for breakage could be applied.

Repairing the production line to reduce the material waste.

Suggestions for reduction of waste generation

Staff training. Staff working in production line, warehouse staff and staff involved in the relocation process to reduce waste streams generated by human neglect or lack of skills. Liability for breakage could be applied.

Recycling the existing production line to reduce meat and fat losses.

Waste Management Mitigation Activities:

Waste Material Sales: bones and meat debris could be sold to meat processing and animal food producer factories, or delivered to the zoo.

Low cost RECP options

Selling fat to soap producers: fat is a raw material for production of soap. According to preliminary estimations it will be possible to collect 20kg fat, which could be sold to soap factories by 300 AMD per 1kg. By doing this the company will save 1,6mIn. AMD annually.

Cardboard boxes could be sold as a paper for delivered to Grand Candy by 300 AMD per 1 kg.

Significant RECP options

Establishment of plastic chamber with water treatment filtersand fat catching tank.

Domestic chamber will give the possibility to collect 90% of fat from the waste water, besides the treated water from the waste could be collected and used in autoclaves for several times and for technical purposes. Further possibilities of its use depend on the level and the quality of selected final treating means, which will further be elaborated. The establishment will cost around 4 million USD.

As a result it will be possible to collect more fat than before, to reuse the water in autoclaves for several times or industrial purposes, as well as to save costs for chamber discharge monthly 170000 AMD.

Modernization of the production line which will allow decreasing the losses of meat and fat, which are the most expensive resource inputs in the company, and will eliminate the additional cleaning costs of the production line.

Application of Industrial Defroster will allow to decrease the waste of the main raw material (meat) at least by 1%. Defroster will cost around 20 million AMD, but will allow to save annually around 4.8 million AMD.

The old steam boiler should be replaced with new one, which will allow to increase the energy efficiency by around 50%.

The water used in autoclaves could be cleaned by special treatment and reused many times, thus decreasing waste water generation.

Establishment of the animal canned food production as a byproduct, mainly using waste of the current production.

The RECP assessments of "Hamlet Hovsepyan" IE were carried out by the leading expert of RECP Lilit Apujanyan and RECP assistant expert Nune Gabrielyan.



"RozFrood" Ltd Conserves Factory

Address: 1a/1Hakobyan Street, Vanadzor, Lori Marz, Armenia Telephone: <u>+ 374 98 94 18 48</u> Executive director: Armine Mirzoyan Number of employees: 20-50 (depending on the season), Year of establishment: 2005



"RozFrood" Ltd has been specialized on conservation and freezing of fruits and vegetables, as well as on sorting and packing of cereals.

More than 150 000 kg vegetables and fruits treated yearly and around 80 different articles produced: jams, conserved and frozen vegetables, compotes, natural juices etc. All articles are produced by the order of company's main office located in Russia and exported only to Russian Federation.

"RozFrood" Ltd. is the owner off all buildings, mechanisms and equipments included in the production process. Total surface area of the enterprise is around 0.9 ha, only 0.2 ha of which is employed by the production.



Production activity





RECP Recommendations and expected results. No Cost Recommendations

Restructuration of Process Chain-this recommendation will help to ensure production continuity, minimize production interruptions, which will permit to save gas, electricity and water resources, as well as the loss of row materials and final products damaged during the transportation from initial treatment to the production and to the final production storage workshops, which are far from each other and transported mainly by hand and/or non- proper equipment.

Isolation and ventilation of buildings (storages) with existing means-The Company owns lots of building isolation materials (sandwich panels, plastic films, glass) and metal and plastic pipes, and should organize row material storage areas and workshops insolation and ventilation system in order to keep required conditions of row material conservation, with which at least 5% of total row materials can be saved, as well as energetic resources (gas, electricity) during winter for heating and cooling in summer seasons.

Low cost Recommendations

Recycling and reuse of wastewaters –It is proposed to build a mechanical wastewater sedimentation basin or use the company's existing 2-2.5t containers for mechanical treatment of wastewater and reuse water - for irrigation or technical purposes.

Significant cost Recommendations

We propose to replace the steam boiler with a new one. The replacement will permit to reduce the annual gas costs at least 800,000 drams. 115-130C dry heat, steam generating automated, insulated boiler price is US \$ 5,000 or 2400000 AMD. Payback with simple terms is 3 years. The CO2 emission reduction will be around 7500 kg.

In order to save water resources (245m3/year) it is recommended to purchase and install carbon and/or UV filters (price 2000- 3000 USD), which will permit to save 90% of water loss and reuse water at least for technical purposes.

The RECP assessments of "Artashes" LLC were carried out by the leading expert of RECP Armen Bodoyan and RECP assistant expert Perch Bojukyan.



"Sam-Har" LLC

Production of jams, preserves and juices

Address: Abovyan city, Kotayk Region, Armenia Director Robert Manukyan Production technologist Felix Nazaryan Number of employees: 15-45 (depending on the season), Year of establishment: 2003



"Sam-Har" LLC: produces 15 types of compotes and jams, 2 types of jams, 10 types of natural juice and 4 types of marinade.

90% of the product is exported mainly to Russia, the USA, Kazakhstan, Iraq, as well as to the Eastern European countries.

Organic compotes are as well produced in the manufactory (blackberry, raspberry, apricot) for which the raw material is bought from producers of organic berries and fruits and organic sugar (labeled) is used.

"Sam-Har" LLC obtains raw material for compotes, jams and marinades from individuals who are obliged to deliver high quality goods. Low quality goods are returned and are not accepted in the manufactory.

The raw material for making juice is bought from different companies in 200kg aseptic containers, which are returned to the providers.

The company works with ISO 22000 international standards and all of its products are accepted both in Armenia and abroad.



Production activity







RECP Recommendations and expected results.

No Cost Recommendations

Drying quince core 850-1200 kg annually) and pomegranate peel (350-500 kg annually) and sell them to tea manufacturers. Even if 1 kg is sold with a price of AMD 100, the economic benefit will be 170000 AMD.

Repairing and adjustment of equipment on time and with a proper quality (current costs). Replacement of lighting lamps at workplaces by optimal altitudes (current costs).

Low cost Recommendations

Collect the organic wastes (except apricot and peach stones) and make biohumus in the Company's area, which can further be used as organic fertilizer for fertilizing their own garden.

Process (break) apricot and peach stones (about 7-8 tons annually) and sell to food, perfume, creams, scrub, or forage manufacturers. As a result, the Company will have economic benefit of 800000 AMD/year.

Rinswashing waters are to be cleaned and used for irrigation, as they do not contain other chemicals. Build a pool for washing launches on the work area and carry out irrigation of the garden from there. As a result, 6300m3 of water will be saved annually. As a result of reuse, the enterprise will have an economic benefit of 1134,000 AMD.

Organize trainings for employees every year at the beginning of the season – for teaching them a good practice- with the best employees' examples, which will allow to reduce the raw material losses at the raw material workshop.

Significant cost Recommendations

Replace the lamps for lighting of manufactory and the administrative area with LED lamps, as a result of which the Company will save 4000 kW/h of electric energy annually, having an economic benefit of 168000 AMD.

Separate the finished product storage area from the general manufactory area and heat only the storeroom during winter season for keeping the product at a proper temperature. As a result, it will be possible to save about 1000-1200 m³ of gas per month, having 600000-750000 AMD economic benefit during the entire winter season.

The RECP assessments of "Artashes" LLC were carried out by the leading expert of RECP Candidate of Biological Sciences Arevik Hovsepyan and RECP assistant expert Alisa Savadyan.



"Sedrak-Tigran" LLC Cheese production

Address: Lori Marz, Armenia, v. Tashir Number of employees: 12 Year of establishment: 1994



The Sedrak-Tigran LLC cheese producing company has been operating in Tashir, Armenia since the independence of the Republic of Armenia. The average annual volume of production of the company is 35-40 tons of cheese. The main raw material used by the company is cow milk. During the production and storing processes the company heavily uses electricity and gas for heating, cooling, and lighting purposes. The number of employees working in the production facilities is seven. The length of working days varies from season to season. On average 9-10 months of the year employees work a full day and 2-3 months a half-a-day. The company exports the vast majority of its output to Russia (95%), and only a small portion of it (5%) is sold in the local market. The company owner has more than 50 years of experience in cheese production. From the prospective of RECP, the company has a good potential for improvements and resource efficiency.



Production activity





RECP Recommendations and expected results.

No cost reccomendations

The recommendation is to install a thermometer, to set up a monitoring for the freezing process. The salt water thrown to the sewerage contains organic materials that can be consumed by animals. The recommendation is to provide the used salt water to the local farmers to feed cattle.

The whey as well contains significant amount of organic materials (proteins). The recommendation is to give or sell the whey to the local farmers as an animal feed.

Low cost actions

The recommendation is to insulate the walls of the cooling storages from inside.

The required amount of the material for all 3 storage rooms with basins is 120 m^2 with total cost of 120000 AMD. The annual saving will be 170.000 AMD, which is obviously higher than the initial investment needed. In addition, 1.1 tons of CO₂ emission will be reduced per annum.

The self-made gas burners are self-made and inefficient. The recommendation is to change the type of gas burners under the boilers. This action will increase the proper utilization of the natural gas by nearly 20%. As a result, 2.7 tons of CO₂ emissions will be reduced.

The cooling rooms are cooled even if just one of the basins is filled with cheese. So, additional energy is spent on unnecessary cooling of the whole facility. The recommendation is to make removable barriers (made from Styrofoam) inside the cooling facilities that can artificially reduce the area of the room if needed, so, a significant amount of energy will be saved.

Significant cost Recommendations

Install a cooling container for the milk. This action may improve the non-productive costs, such as the amount of gas needed do bring the boilers to the necessary temperature for starting the production process. The payback period of the equipment is impossible to determine since there is limited information about the number of runs of the production process per month.

Install a pasteurization tank, from which the milk will flow out already with a high temperature so, no additional expenditure will be needed for bringing it to the necessary temperature; plus a major food safety problem can be solved. This investment can be payed back within 3 years (assuming the average price of a pasteurizer is 4000 USD).

The RECP assessments of "Sedrak - Tugran" LLC were carried out by the leading expert of RECP Hovhannes Mnatsakanyan and RECP assistant expert Mher Sadoyan.



"Vada Bek" LLC Bottled spring water and lemonade production

Address: Bjni village, Kotayk Region, Armenia Telephone: <u>+ 374 9121307</u> Website: <u>www.aquastone.am</u> E-mail: <u>mail@aquastone.am</u> Founding director: David Parsadanyan Number of employees: 7 people Year of establishment: 2012





The enterprise production includes: bottled spring water "Aquastone" (both still and carbonated), six sorts of lemonades, including tarragon, cherry, pear, orange, peach, cream-soda and grape flavored under brands "Havlabar", "Mer", "Fresh".

Initially the production was established for bottled water. Lemonade production was added later. Water is mainly produced in plastic bottles, for lemonades 50% is in glass and 50% - in plastic bottles. A portion of the production is exported to the United States and Russia, some are delivered to local restaurants in Yerevan and the regions of Armenia.



Production activity





RECP Recommendations and expected results. No Cost Recommendations

It is highly recommended to organize empty bottles collection from the clients and gradually switch to 100% glass reusable bottles.

The only source of water used in production processes is the high quality groundwater source. This water is used for bottling as non-carbonated and carbonated drinking water, for lemonade production, as well as for bottling and other household needs.

Reasonable farming can prevent water losses that occur without a controlled rubber pipe through sewage flowing fresh spring water, which also uses bottles.

Low cost Recommendations

Replacing a damaged gland will prevent water losses and allow to save 300 liters of water 0.5 liter glass bottles produced every 1000 liters of lemonade during production.

Significant cost Recommendations

The total loss of CO2 gas and energy consumed for one ton of carbonated water can be prevented by changing glass bottling equipment.

The calculations showed that replacing the gas heater with the infrared heater would not bring considerable savings to the company, but this change would allow the use of direct heating, thereby creating more comfortable conditions for the staff.

Taking into account the fact that during the period, when there are large number of orders, the enterprise also works during the late hours, the replacement of existing lamps at the production lens will provide additional energy saving with LED lamps.

The RECP assessments of "Varda Bek" LLC were carried out by the leading expert of RECP Lusine Taslakyan and RECP assistant expert Hovhannes Mnatsakanyan.



CONSTRUCTION MATERIALS PRODUCTION

"Argel" CJSC Basalt fiber production

Address - Building 11, 2nd street, village Argel, Kotayk region, Armenia Tel./Fax.: +374 11 990822 Internet page <u>http://www.armbas.com</u> E-mail - <u>info@armbas.com</u> Director`Edik Grigoryan The company is founded in 2014



Armenia possesses inexhaustible reserves of basalt-stone. Huge reserves of Armenian basalt rocks are of special interest, the chemical composition of which provides continuous basalt fiber (CBF) of the highest quality. The availability of affordable and high-quality raw materials contributes to produce basalt fiber with a low cost price, and with the features that provide the highest quality products made of it. Moreover, the CBF has a number of characteristics due to which it favorably differs from fiberglass, particularly by a cost price, durability, chemical resistance and application temperature.

"Argel" CJSC manufactures basalt roving to produce a basalt rebar and a reinforcing mesh, which surpasses a metallic rebar and a fiberglass rebar due to its technical characteristics. "Argil" CJSC also produces equipment to manufacture basalt rebars and reinforcing meshes.

The global demand for basalt fiber and the products made of it is increasing, and the spheres of application are being expanded from year to year. Basalt fiber is widely and successfully applied in manufacturing of a wide range of products, with higher technical characteristics and environmental friendliness.



Waste



Manufacturing facility and equipment





RECP Recommendations and expected results.

No Cost Recommendations

The basalt waste is not used but it can be used in the construction process and will have the same price and quality as basalt. It is offered to sell it to the some construction companies. On the monthly basis about 1,500 kg basalt trash is produced and it will cost 15,000 AMD.

Requiring small investments

In order to save energy in the administrative building all old windows should be repaired and replaced by new ones.

In order to save water it is necessary to install the closed cycle water cooling system with a contact by the cooling tower. The cool water obtained from the industrial wastewater treatment should be moved to the equipment cooling system. By the establishment of this system the water intake will be significantly reduced.

It is suggested to review the electrical lighting system with the support of the company's electrician, particularly the 200 Watt lamp will be replaced with 40 watt energy- efficient lamp. In the the case of 160 lamps replacement, the saving will be 30800 AMD for 1 month.

Requiring significant investments

In case of all five furnaces' work-it will be possible to install 125kW capacity condensing steam PRC turbine. The cost is about \$ 100,000 US Dollars.

The utilization boiler is additionally installed on the outgoing gases which in its turn produces thermal energy equivalent to 900 kilowatt. Its' The cost is about \$1,000,000 US Dollars.

The RECP assessments of "Argel" CJSC were carried out by the leading expert of RECP Vahagn Sargsyan and RECP assistant expert Susanna Hakobyan.



CHEMICAL AND OTHER PRODUCTION

«Ava shoes» LLC Shoe production

Address 6 Bryusov str., Yerevan Tel. +374 94 788797 URL <u>http://ava-shoes.com/ARMENIA/</u> Email `<u>nfo@ava-shoes.com</u> Contact person Andranik Safaryan, director Number of employees ` 12 Year of establishment 2014





Company has been established by Syrian-Armenian refugee in 2014 in Yerevan; however the founders were in shoe making business in Syria since 1950.

Company highly values the customers' needs and constantly tries to offer the most comfortable but also fashionable and long lasting choices in footwear, with the best prices.

Company in the establishment phase has got considerable technical and financial support from SMEDNC.

Products are made of high quality and are mainly imported from Turkey.

Products are sold locally through brand shop in Yerevan. Products are exported to Russia and currently presented at the well-known Henderson retail chain.

In the future it is planned to expand the volume of production and assortment.

Average monthly production capacity is 450 pairs, 18-20 pairs per day.











Production activities and equipment





RECP Recommendations and expected results.

No cost options

Improvement of raw material acceptance, storage and production organization. Sorting leather pieces by size for later use.

Low cost options

Sorting / sorting of leather slices according to their size, purpose of use, color, etc., separation of packages for further use of garbage, fur collection in separate sacks and so on. These activities will significantly reduce the amount of time spent by the employee and the leather and fur waste.

Windows isolation for energy saving. Fabric delivery of toy and furniture workshops. Preparation of labels, which symbolizes the production of natural leather from leather.

Significant RECP options

Establishment of the production of the other leather products, such as bags, accessories, using mainly the wasted raw materials. Production of emblems from small pieces of the leather indicating genuine leather.

Kid's shoes



The RECP assessments of "Ava shoes" LLC were carried out by the leading expert of RECP Mher Sadoyan and RECP assistant expert Lilit Apujanyan



"ELBAT" CJSC

Lead-acid batteries production

Address: 37/29 Sharuri str... 0043, Yerevan, Armenia Telephone: +374 10 461949 Web site:



http://www.elbat.am

E-mail: info@elbat.am

Technical Director: Mr. Hakob Hakobyan Number of employees: 118 The enterprise was founded in 2007.



Armenian-German joint enterprise, "ELBAT" CJSC, founded in 2007, is one of the leading manufacturers producing high quality lead-acid batteries. The company offers a wide range of batteries for every vehicle (cars and commercial vehicle) 40-100 A/H and 120-200 A/H.

Besides battery production and sale, the enterprise also provides services particularly for checking the compliance of a vehicle with this or that type of a battery and for choosing the battery, which exactly complies with that particular vehicle.

The annual production capacity of the Enterprise is 300 000 batteries, but it works by only 5% of its capacity at present.

The enterprise has introduced ISO 9001:2008 "Quality Management System" and ISO 14001:2004 "Environmental Management System" standards.

RECP Recommendations and expected results.

No Cost Recommendations

Timely and properly perform equipment repair and adjustment works (current expense),

reinstallation of lighting lamps in production units based on optimal altitudes (current expense).

Perform periodic inspections of thermal networks (external piping) and, if necessary, thermal Insulation (current expense).

Low cost Recommendations

 \checkmark Carry out (regularly) the regulation of natural gas combustion process in lead smelting ovens to prevent petal burning of natural gas. The annual energy savings up to 7.8 MWh (about 115 thousand AMD) and reduction of 1.6 tons of CO2 emissions into the air will be achieved.

Taking into account the fact that currently the enterprise operates not at full capacity and not with stable schedule, it is recommended to perform optimization (compared with current production volumes) of production and administration units during the partly-loaded regime.

Reduction of a heated surface in administrative sector. Ο



o Installation of infrared heating in production units.

• Modification of power supply systems, in particular, to reduce the labor of transformer dle mode and increase flexibility in terms of heat regulation circuits.

Significant cost Recommendations

Taking into consideration that 70% of annual consumption of natural gas is used for heating of buildings, it is appropriate to thermo-moderate a covered structures of the buildings, particularly Increase the heat transfer resistance of walls to isolate the administrative external walls by the local produced perlite slabs (coefficient of thermal conductivity is 0.06-0.14 W / m 0 C), or by using other insulating materials available on the market (foam-poli-uretan, extruded foam-polystyrene, etc.)

Thermo-insulation fo roof and attic ceiling by the locally produced mineral wool blankets (the coefficient of thermal conductivity is 0.037-0.044 W / m 0 C).

Optimization and minimization of translucent surfaces, (mainly the northern orientation), installation of higher class windows and doors (providing up to 0.4-0.5 m 20 C / W thermal conductivity resistance) and / or partial replacement by insulated and light structures.

Based on the provided information (the surface of external walls of the administrative building and production units is 8,000 m2, 800 m 2 of which are windows) and the lack of measurement, estimates are very approximate-- the investment is 40-60 mln AMD, energy savings are 30-35% or 40.0 MWh annually repurchase 7-8 years, the annual reduction of CO2 emissions is over 82 tons.

Replace all existing lamps with LED lamps. The work should be carried out in stages (the first stage has already started) starting with the most used lamps. The RECP environmental benefits in terms of reducing greenhouse gas emissions should be very significant (up to 60 % energy savings)







Production activities and equipment

Measures undertaken jointly by Enterprise Professionals and RECP Experts

An auxiliary cooling system has been installed in order to reduce the amount of water used for the freezing of the battery in the refrigeration unit, the automatic system fires 50 ° C in a basement of 10 tonnes in a water tank. Here the water is frozen to 10-20 ° C and is dispatched in a closed circuit to the charging system battery freezer container. Due to this event, it was possible to significantly reduce the cost of water in the charging plant.

The amount of the investment made is approximately 4 million AMD. Water consumption has been reduced for approximately 10 times.

The RECP assessments of "Elbat" CJSC were carried out by the leading expert of RECP Alisa Savadyan and RECP assistant expert Candidate of Chemical Sciences Liana Margaryan.



"Thermo Caps" LLC Production of PVC and polylaminate

Address: 2/1 Building, Acharyan str., Yerevan 0040, Armenia (Avan administrative region) Tel: <u>+374 10 618 630</u> Web page: <u>http://forsage.am/</u> E-mail: <u>forsage@arminco.com</u> Executive Director: Ashot Zakharyan Founding Director: Araik Stepanyan Number of employees: 6 Year of establishment: 2002



"Thermo caps" LLC supplies decorative thermo-shrinkable caps to wine, vodka and cognac production. The company was founded in 2002 and began the production of PVC and polylaminate capsules. It is the only company in Armenia that produces this product. Due to a high quality of the product, the company has been awarded several international and local certificates.



Production process

RECP Recommendations and expected results. No Cost Recommendations

During the thermo-shrinkable caps production process the installation of appropriate additional facility will be performed to spool the PVC waste at 3mm thickness. Thus, the ribbon splint will be sold to decorative salons, flower halls, and more. The earnings will be about 200000 AMD annually.

Sell PVC ribbons from small color waste products that produce 100kg per month for the production of Shutterstocks. The earnings will be around 50000 drams anually.



Sell the PVC waste to plastic profiles producing companies for the secondary use.

Sell the aluminum waste to intermediary organizations for making the aluminum alloy, which will be used in non-food industries to produce different aluminum details (aluminum cable, car motor's details, etc.). The upcoming benefit is calculated to 368000 AMD annually.

Cost – demanding recommendations

Installation of the air conditioning system in the materials (PVC and aluminum tapes bobbins) storage room during the summer will contribute to the total use of the materials by reducing the losses by defected products. The 6% of the material saving and significant reduction of the work times for equipment calibration will be achieved.

Install the fume hood on top of the gluing device in the production site for preventing the spread of bad smell (odor) of acetone and other toxic chemicals, which are included in glue.

Expectations and suggestions

80-90% reduction of production losses and about 618000 AMD economic benefits annually.

The environmental effects will be achieved by reselling the PVC and aluminum wastes for their secondary use.

RECP assessments of "Thermo Caps" LLC were carried out by the leading expert of RECP Candidate of Chemical Sciences Liana Margaryan and RECP assistant expert Candidate of Biological Sciences Arevik Hovsepyan.



"Yerevan Telecommunication Research Institute" CJSC

Production of modem-controllers, thermal

sensors

Address: 26 Dzorapi Street, Yerevan, Armenia Phone :(+37410)566061 Fax: (+37410)561737 Web site: <u>http://www.yetri.am;</u> Email address: <u>mark@yetri.am</u> Director Mher Markosyan; Number of employees – 90; The company is founded in 1978

The Yerevan Telecommunication Research Institute CJSC was founded as a branch of Moscow Scientific Research Institute of Radio Communication and is specialized in the field of creation of the means and units of space communication. The institute has accepted the ISO 9001: 2000 international quality management system.



Production cycle



The list of the institution products is very diverse:

 \rightarrow Control Measuring Complexes: Multi-channel digital analyzer; The Controller of Technological Processes.

- \rightarrow Specialized Computer Complexes: ACS of process technology.
- \rightarrow Information Security System: System of calls registration.



 \rightarrow Wireless Facilities of Communication: TV-broadcasting transmitters of VHF and UHF band; Band pass filters VHF, UHF and MW ranges; Repeaters and Jammer of the cellular phones.

 \rightarrow Wiring Facilities of Communication: Analogue and Digital Conference Systems.

 \rightarrow Hybrid-Integrated Micro-assemblies: SAW filters and other SAW devices.

→ Microstrip Directional Couplers & Power Ring Adders/Dividers; Different functional microelectronic elements and devices by orders.

 \rightarrow Advertising Informative Devices: Advertising panels; Electronic-light panel with running line; Tower, facade and advertising street clocks and other technical devices.

RECP Recommendations and expected results.

No Cost Recommendations

Reducing of solution removal from technological baths can be carried out by choosing the optimal designs of pendants, by installing visors between the technological and the washing baths - with a slope towards technological baths, as well as by reasonable increase of the time of hanging details above the surface of the bath.

Low cost Recommendations

For more water economy - it is necessary to adjust the closed cycle of water cooling system for galvanic manufacture equipment. Investment - 118000 drams, pay back - 1 year.

Significant cost Recommendations

The price of the most effective solar collectors - Investment is 500 thousand AMD, pay back within 3.5 years. Replacing Windows. The investment is 1000000 AMD, the pay back within 5 years.

The RECP assessments of "Yerevan Telecommunication Research Institute" CJSC were carried out by the leading expert of RECP Susanna Hakobyan and RECP assistant expert Vahagn Sargsyan.



RECP ADVANCED ASSESSMENTS

"Ashtarak Dzoo" LLC Aragatsotn Marz, Aghtsk, Egg production



The enterprise was founded in 2007 Number of employees: 80 Telephone: +374-55-506342 URL <u>http://www.spyur.am/ashtarakdzu</u> E-mail: <u>info@ashtarakdzu.am</u> All fixed assets, property and equipment in the balance of the

poultry farm are the property of the company. The total area of the factory - 7.3 ha.

An aviary for the young and 4 aviaries for laying hens are operated at the time of the study. The stern cuisine is operating (productivity is 4 tons per hour), 3 (pcs) a packaging workshop, industrial warehouses and a warehouse of finished products etc.

World-known crosses for the egg production are used: Lohmann or Hi-Line.

All aviaries have a fairly high level of automation systems including feed dispenser system, water supply system, manure removal system, lighting system, heating system, ventilation system, automatic egg collection system, automatic microclimate control system.

Products:

The best specific indexes for egg production (on average- the quantity of eggs produced monthly per bird) were recorded in 2013 in March and April- 27 eggs for each bird per month. The minimum index was 13 eggs monthly, in June. The average annual index was 20 eggs per month, which corresponds to 177,497 birds on average monthly index.







RECP Expected Results

The benefits of Investment Project in "Ashtarak Dzoo" an egg production facility, after continuously applying Resource Efficient and Cleaner Production (RECP) measures include production-process optimization, installation of new equipment for recycling of resources and reduction of energy use, amounting to 83,800 Euro per year. Investments are 248,400 Euro, simple payback period is 3 years. CO₂ emission reduction is 61.5 tons, IRR 34%, NPV 422,761 Euro, reductions of waste materials is 25 ton per year. Additional benefits are the social and environmental improvements, the work experience broadening and an additional reduction of the company's carbon footprint (including CH₄, N₂O) etc.

RECP Measures Proposed For Implementation

1. 1. Recovering heat from the ventilation system of aviaries through recuperation options. Annual savings 4,300 kWh electricity and 3,640 cubic meter of Natural Gas or 650,000 AMD (1,200 Euro) per year.



Investments- 9,200 Euro, simple payback period 7.7 years. CO2 emissions' reduction- 9.1 tons, internal rate of return (IRR)- 12%, net present value (NPV)- 924 Euro.



2. Replacement (fuel switch) of electrical energy heaters with natural gas ovens (heaters) in the aviaries. Annual savings 810,000 AMD (1,500 Euro) or usage of 2,600 cubic meter of Natural Gas vs 1,125,000 kWh of Electricity per year for heating.

Investments 4,800 Euro, Simple payback period- 3.2 years. CO2 emissions' reduction- 6.1 tons, IRR- 31%, NPV- 7,246 Euro.



3. Reducing the electricity bills by changing the internal inefficient incandescent and luminescent lamps with more efficient LED bulbs. Annual savings- 14,400 kWh Electricity or 648,000 AMD (1,200 Euro) per year.

Investments- 3,500 Euro, simple payback period- 2.9 years. CO2 emission reduction 6.4 tons, IRR 34%, NPV 6,106 Euro.





4. Decreasing the heat losses from the aviaries envelope by thermal insulation options. Annual savings 2,900 cubic meter of Natural Gas or 378,000 AMD (700 Euro) per year.

Investments- 5,900 Euro, simple payback period- 8.4 years. CO2 emissions' reduction- 5.6 tons, IRR- 10%, NPV- 54 Euro

5. Reducing electricity consumption by the replacement of external lighting system from metal halogen luminaries to high-pressure sodium or LED ones. Annual savings 8,400 kWh Electricity or 378,000 AMD (700Euro) per year.



Investments- 2,700 Euro, simple payback period- 3.8 years. CO2 emissions' reduction- 3.7 tons, IRR- 26 %, NPV- 2,963 Euro.

Financial Indicators of the Proposed Package (all 5 measures together) are: Investments- 14,094,000 AMD (26,100 Euro), Annual savings 2,864,000 AMD (5,304 Euro), Simple Payback period- 4.92 years, IRR -20%, NPV 9,353,000 AMD (17,320 Euro), Discount Rate 10%, Lifetime cycle- 20 years.





RECP Measures Recommended For Implementation

1. Egg powder production (based on the overproduction and reuse of returned eggs with food or technical quality). Annual savings-11,178,000 AMD (20,700 Euro) per year.



Investments- 50,000-70,000 Euro, simple payback period- 2.4 years IRR- 41 %, NPV- 114,755 Euro.



2. Poultry meat production - purchase of special equipment for waste materials utilization (dead chicken recycling). Annual savings 9,882,000 AMD (18,300 Euro) per year.

Investments 60,000-80,000 Euro, simple payback period 3.3 years, IRR- 30 %, NPV- 87,089 Euro.



3. Optimization of poultry nutrition and feeding due to upgrading the feed distribution regime, molecular diagnostics and maintaining relevant internal climate, i.e. temperature and relative humidity favorable conditions. Annual savings-18,414,000 AMD (34,100 Euro) per year.



Investments 70,000-100,000 Euro, simple payback period- 2.0 years, IRR- 49%, NPV- 200,284 Euro.

Feed cost is the largest single item in poultry production and accounts for some 75% of the total production cost.



4. Installation of solar water heaters. Annual savings-70,640 kWh or 7,440 cubic meter of Natural Gas or 1,160,000 AMD (2,200 Euro) per year.

Investments- 9,300 Euro, simple payback period- 4.2 years, CO2 emissions' reduction- 14.3 tons, IRR- 23 %, NPV- 8,573 Euro.

5. Installation of solar PV panels. Annual savings 37,000 kWh Electricity or 1,700,000 AMD (3,200 Euro) per year.

Investments 33,000 Euro, simple payback period- 10.3 years. CO2 emissions' reduction- 16.2 tons, IRR- 7 %, NPV (5,233) Euro



The financial Indicators for the implementation of the Recommended Package (all 5 measures together) are :Investment- 117,800,000 AMD (222,300 Euro), annual savings 41,600,000 AMD (78,500 Euro), simple payback period- 2.8 years, IRR- 35%, NPV- 214,900,000 AMD (405,468 Euro), Discount Rate 10%, life period cycle-20 years.





Environmental Impacts

- Reductions of waste materials- 25 tons (per annum).
- Reduction of the volumes of greenhouse gases released into the atmosphere- 61.5 tons of CO2 (per annum).
- Reduction of the soil and wastewater pollution level.
- Reducing the emissions of volatile organic compounds contributing to the spread of unpleasant odors.
- Reducing the risk of infections and infectious bacteria and weed seeds' spread

Detailed RECP assessment of "Ashtarak Dzoo" LLC have been implemented by the leading expert of RECP, Tigran Secoyan.



"KASHI" OJSC Yerevan Leather Production

The present "Kashi" OJSC tannery was founded in 1894 by Gabrielian brothers, as "Yerevan leather factory" which initially used a semi-domestically technique for processing of nearly 3000 furs-annually.

The final product

Skin is the raw material of leather processing; it is exposed to two types of impact during the processing in the basis of which are the following:

- Chemical and physico-chemical processes: in case of group processing within huge drums;
- Mechanical processes: one or separate processing of semifinished product.





Back in old Armenia production of colored leathers for shoes made of goat fur, parchment making, etc. were well-known. Whereas in the 1st quarter of the 19th century there were already two guilds of tanners in Yerevan.

Although leather processing was considered to be one of the most popular crafts in Yerevan, it had housework character and leather processing mechanization was out of the question. Leather manufacturers made inner soles out of leather of oxen and bullocks for cheap shoes, and other types of hides were used for making saddles, shoes face, etc.

The 1st innovation by the company was an equipment that caused revolution in the field of leather



industry; the equipment operated with water and completely eliminated leather washing and mashing with feet and hands, and increased productivity for several times. In 1995 the number of workers at the plant reached several dozen. Now the tannery employs 30%, and sometimes 50-60%.



TECHNOLOGICAL PROCESS SCHEME

According to "Kashi" OJSC representatives, if support provided, Armenian specialists will be able to process all the leather raw material procured in our country and provide 40-50% of the RA demand for leather production.

The leather raw material pre-processing









Scudding equipment



Tanning drums



RECP recommendations and expected results No Cost Recommendations

1. Sale of the raw-material residues: salt, leather pellets. Salt will be used as a food additive in livestock farms, and pellets will be used for producing organic fertilizers (compost). In case of small quantities, salt can be provided to the Municipality's cleaning service as anti-icing method, to combat against snow build-up and icing in winter (the residual quantities of grease and other natural organic matter are so small that they can be neglected).

Low cost Recommendations

2. Processing of the raw material residues, primarily fats and grease, for producing natural liquid soap.

Financial means necessary for installation, operation and packaging of the equipment required for the programme, and for market study -30.000 USD

3. Preliminary washing of hair removed in the process of unhairing and their sale to the carpet companies.

Installation of wool and hair prewash containers - 10.000 USD

During the unhairing process, the hair cover of the skin and the epidermis are destroyed under the influence of chemical substances (lime, sodium sulfide, sodium hydrosulfide - NaHSO₃, as a preservative and antioxidant, Perdol 816 h Perdol Extra chemical additives). The skin cleaned from hair and saturated with water is known as "smooth leather" (offal) in leather industry.



4. Sheep wool processing and supply to the carpet enterprises Installation of containers for wool prewash containers - 8000 USD



Significant cost Recommendations

5. Replacement of old inefficient boilers with modern energy efficient gas-fired hot water boiler

6. Installation of solar heaters (collectors), on the roof of production shops which will result in annual savings in gas and electricity.

Investment 50,000 US dollar

7. Waste processing and feed production occuring in the result of scudding. Investment 50,000 US dollar

Scudding equipment



Waste generated from scudding



Environmental Impact

Hair, offcuts and sludge waste (sludge) are the main types of solid waste. Solids are usually located in landfills. Dewatered sludge from "Kashi" OJSC tannery are disposed to controlled landfills without significant environmental problems being incurred. Tanning sludge may immediately be covered with inert material to avoid odor generation and insect infestation. Apart from odor (natural organic materials, ammonia, hydrogen sulphide), few major air impacts are expected outside a fellmongering or tannery operation.

Overall, on conditions of keeping the hygienic standards within the workplace, as well as in case of acidification of base sulfide solutions- alkaline sulphide liquors are oxidised before being allowed to mix with other (neutral/acidic) flows, thus avoiding the formation and stripping of odorous and toxic H₂S gas, atmospheric emissions should not normally create serious environmental problems.

Detailed RECP assessment of "KASHI" OJSC have been implemented by the leading expert of RECP, candidate of biological sciences Dshkhuhi Sahakyan.



"Agricultural Association Lukashin" Consumer Cooperative Armavir region, v. Lukashin, Dried fruit production

"Lukashin Agricultural Association "Consumer Cooperative (CC) was founded on April 1995 by 12 farmers. Now it unites 100 farmer economies (42 individual members). The main intention and objective of the Association, is to support the member farmers to develop their economic activities, and resolve their legal, financial, social and technical issues.



Product

A large amount of fruits and vegetables is produced in the community. Table sorts (species) of apricots, peaches, plums, grapes, etc. are realized at the local market or exported. Technical grade and lowquality table sorts are the raw material for the production of dried fruit.

Lukashin Agricultural Association has 4 dry rooms, 2 of which work with electricity (13 kWh each), 2 of them work with natural gas (4 cubic meters / h each). The drying process takes on average 2 days. To produce dried fruits of plums, fresh fruit is subjected to a preliminary heat treatment in 250-400l electric boilers (60-70°C).

To clean/remove the peel of some fruits, solution of caustic soda (NaOH) is used.

During the production of dried fruits, a large number of inevitable waste (approximately 15%) is generated as a result of the primary processing of fresh fruit, and the loss of weight in the result of drying is about 71% (untreated fresh fruit).



Model		AD-05SW		
Heat sou	rce of the dryer	Gas burner		
Overall d	imensions	2195mm(L) + 1040mm(M) + 2040mm(H		
Overall w	eight	570 Kg		
Electric p	ower source	220Volt + 50Hz + 1Phase		
Power co	nsumption	1.5 KW		
	Туре	Gun type		
	Control	On/Off control		
0	Fuel	Gas (LNG)		
Burner	Heating capacity	38,600 kcal/hr		
	Maximum fuel consumputate	100,000 kcal/hr		
	Sanderd fuel consumputate	38,600 kcal/hr		
	Туре	Axial fan		
Blower	Motor power	1.0 kW		
	Motor insulation	Class F		
	Material	Stainless steel		
Tray	Dimension	885mm(L) + 605mm(W) + 7mm(H)		
-	Quantity	28(ea)		
	Туре	Digital thermostat		
Income of	Temp, control range	Ambient ~ 90°C		
control	Temp. direction range	0~99℃		
	Control	Dry bulb temperature		
	Overheat prevention	105℃		
Serial Number		2012062603		
Date of manufacture		26. June. 2012		

Technical labels of gas and electric tray dryers

- HOLE	and the second second	ADAMA
Heat source of the down		Devices
Overall dimensions		cierric heater
Overall weight		2195mm(L) + 1040mm(M) + 2040mm(H
Electric power as		570 Kg
Promo	Heater C	220Volt = 50Hz = 1Phase
consumption	Heater On	10.0 KW
	rieaser Ott	1.0 kW
beater	lype	Fined tubular
	Heating capacity	9.0 kW
	Type	Axial tan
Blower	Motor power	1.0 kW
and the	Motor insulation	Class F
	Material	Stainless steel
Tray	Dimension	885mm(L) + 605mm(W) + 7mm(H)
	Quantity	28(ea)
	Type	Digital thermostat
	Temp, control range	Ambient ~ 80°C
control	Temp, direction range	0~990
	Control	Dry bulb temperature
	Overheat prevention	200
erial Number		2012062601
ate of manufacture		26. June. 2012
M. Barrand	DONGHO	AGRIMECHA CO., LTD.

The amount of fresh fruit needed to obtain 1 kg of dried fruit and the resulting waste

N/N	ltem	Measurement unit	The amount of fresh fruit needed to obtain 1 kg of dried fruit	The resulting waste, %
1	Apricot	kg	5	8
2	Plum	kg	6	8
3	Peach	kg	8-10 kg Cleaned	25
4	Grapes:	kg	6	5
5	Pear	kg	7	12
6	Apple	kg	10 kg Cleaned	25
7	melon	kg	16	35



RECP recommendations and expected results No Cost Recommendations

Reduce the use of synthetic detergents for fresh raw material's cleaning as far as possible and, where possible, not to use it at all.

Reuse of caustic soda and detergent free wash-up (rinses) water for primary raw material's washing or using it for residential area's irrigation as far as possible.

If possible, give up using the sulfur- used for the conservation/ preservation of apricot / plum dried fruit, which will reduce SO2 emissions and product cost.

Low cost Recommendations

Refuse to use a caustic soda solution for the processing of fruit (plum), replacing it with hot water at 60-70 $^{\circ}$ C.

As far as possible, reduce the height / length of the air conditioning (steam removal) pipes of the dryers, which will lead to the acceleration of the drying process and therefore energy efficiency.

Install two-part tariff meter (1 kVt / hr = 31.85 AMD), in the result of which the annual average electricity cost (1 kWh = 41.85 AMD) will decrease to (15200 kWh / year × 8/24 × 10 AMD) = 50666 AMD (by 8%):

Significant cost Recommendations

Install at least 3 solar convection dryers (solar hot air heaters):

Install solar water heaters (collectors) for the initial processing of fruits- for getting hot water of 60-70°C.

Strengthen the thermal insulation of inner walls and ceiling inside the refrigeration unit for long-term keeping and storage of fruits and vegetables (80 tonnes), which will lead to significant gas and electricity savings and cost reduction of the product.

Environmental Impact

"Lukashin Agricultural Association" Consumer Cooperative (CC), being mainly a small enterprise of dried food production, does not cause serious environmental / ecological problems (toxic substances' leakages, emissions and hazardous wastes) in the result of its activities. The annual average discharge of main wastewaters is \sim 60 µm. (1 ccm = 170.256 AMD) and sulfur dioxide emissions are 37kg.

Detailed RECP assessments of "Lukashin Agricultural Association "Consumer Cooperative have been implemented by the leading expert of RECP, Astghine Pasoyan.



"MARILA" LLC City of Kapan of Syunik region, dairy and meat production



Marila LLC is based in City Kapan of Sunik region. It was established in 2010, but was moved to current location in August of 2012. The factory has two production sections: dairy and meat.

Dairy production section (department) was chosen for RECP study. This factory has 55 employees, 22 of which work at dairy department. Approximately the 50% of products of Marila Company are consumed in Syunik region, and the rest 50%- in Yerevan. The production of "Marila" LLC is consumed/distributed by Kapmat interim Company LLC.

The company cooperates with Lamax LLC which provides the raw materials for two production sections (milk and meat) to Marila from its own farm. The factory does not import raw materials from any other source except the above mentioned farm. A separate analysis has not been implemented in the given farm as it is a separate production unit. According to the information provided by the directorate of "Marila" company there is a contract signed with the given company- according to which the provided raw material must be ecologically clean and the farm's activity must correspond to high standards.

In dairy production section the production is implemented with modern technologies. Whole production system is automated and is controlled by a central computer.

The Product

The dairy department of the factory produces matsun, cheese (Lori and Chanakh), curd, sour cream, milk and tan.





RECP expected results

Savings resulting from the increasing of energy and resource efficiency used in the company amounts to approximately 2.56 million AMD and investments are amounted to about 6.6 million AMD. The simple payback of the measures is about 2.6 years.

Technological equipment



Annual energy consumption (electricity and natural gas) by consumers





RECP recommendations and expected results No Cost Recommendations

To filter the whey from cheese and separate the cheese fines and return them to the manufacturing process.

1. Cheese fines separation from whey during the production process and returning them to the it, will provide about 2% increase in cheese production volume.

2. Provide storage containers for waters used during production process (except alkaline and acid solutions), where the collected water is used for the irrigation of the existings garden area adjacent to the factory, or for other purposes not contradicting sanitary hygienic norms.

Low cost Recommendations

3. For the control and monitoring implementation of the production process it is proposed to install separate meters for natural gas, electricity and water so as to clarify energy consumption and the volume of resources used for certain dairy product, which could have a positive effect on increasing the efficiency of energy and resource use.

4. Heat generation used in the existing waters after the end of the technological process (from 60-65 °C water flooding from separator Homogenizer and outgoing to sewage), in the result of which it will be possible to reduce the used natural gas consumption expenses by around 14% in the milk production section.

Significant cost Recommendations

5. Change existing fluorescent lamps of the lighting system located in the milk production section with new energy efficient LED lamps in the milk production section.

Change 150 fluorescent 36W tube lamps located in the production section (taking into account the additional devices' strength available in luminaires 40 W) replacing them with 22W new efficient LED tube lamps (market price of which is about 3800 AMD, with installation works included-it will cost 4000 AMD). The investments will be about 600 000 AMD, and the implementation of measures will result in electricity savings of approximately 7900 kWh. Simple payback of the measurements will be approximately 1.7 years.

6.Improve the ventilation system by installing heat recovery units.

During the heating season Heat recovery units for ventilation system uses the heat in the outgoing stale air to warm up the fresh air coming from outside hereby leaving the pre-



heated air to the building. The necessary investments for the application of this technology amount to approximately 2.5 mln, the thermal energy savings are approximately AMD, implementation of this measure will result in natural gas savings of approximately 150000kWh, or 5500 nm3 natural gas, or 815 000 AMD. Simple payback will be-approximately 3 years.

7.Install double-ring solar water heater system on the roof of the production building.

Install split solar water heater system on the roof of the building, with 400 vacuum tubes and 2 tone water tank, which will reduce the consumption of natural gas for the purchase of hot water for 9600 nm3 annually or to 1.4 mln. AMD, the investments will amount approximately 3.5 mln. AMD, providing approximately 2.5 year payback period.

Environmental Impact

For packaging the dairy products of "Marilla" company plastic containers are used the recycling of which is not controlled after the consumption. As a result of not being recycled they become non-degradable waste and pollute the environment.

Waste removal from the factory's territory is implemented by another company on contract basis- with 30 000 AMD rent per month. About 32m³ industrial waste (including domestic waste) is removed.

Production waste includes grunge, unfit products, etc.

Detailed RECP assessment of " "MARILA" LLC have been implemented by the leading expert of RECP, Arthur Tsughanyan.



"Yervandashat Agricultural Association" Consumer Cooperative Armavir region, v. Yervandashat Dried fruit production

"Yervandashat Agricultural Association" consumer cooperative is specialized in the sphere of production of dried fruit from Armenian fruits. Number of employees: 22 people (not including seasonal employees). Phone: +37493 18 47 55. E-mail:satenie@mail.ru.

The cooperative owns 7 solar and 2 electric dryers built in Yervandashat village area. The cooperative has its own water flow of 1 litre/sec.



The Product

The main products are dried fruit from the local raw material: apricots ("Sateni" sort), peaches (mid-season and late-season ripening peaches of Ararat valley), pears ("Forest Beauty" sorts mainly), black prunes (three types) and sweet cherries. The product is consumed mainly in the Russian Federation and on local market.

Inhabitants of two villages – Bagaran and Yervandashat are involved in the production process. 50% of raw materials is obtained from the economy of neighboring farms. The members of the cooperative own 20 hectares of apricot orchards, 3 hectares of which are irrigated mechanically. The average annual yield of the garden in the average crop year is- 1 ha - 20-25 ton of apricot, the main part- 75% is of Shalakh sort, which is cultivated for sale, and the other 25% of Sateni sort-is grown for dry fruit production.

The average annual volume of the company's production and sales is 10 tons, approximately 60% of which was the portion of apricot and the remaining 40 % was the portion of other fruits (peach, plum, pear and sweet cherry) in equal proportions. This co-relation may change significantly



depending on the yield indicators for the given year.



Images of Solar dryers



During the years of average yield the cooperative possesses a huge amount of raw material (about 400 t of apricot), which does not require significant transportation expenses for its' purveyance. The cost of purveyance in such favorable years is also reduced significantly to 100-200 AMD/kg. Nevertheless, there are certain limitations of production capacities and storage facilities for ready products.

Solution of these two issues (increase of production capacities and construction of new additional storage facilities) will provide an opportunity for the cooperative to create sufficient reserves of ready products, to carry out a continuous activity and the possible loss of the crop will be minimal.



Images of the electric dryer



Thus, the cost-price of the ready product varies within the boundaries of 1120 AMD to 1820 AMD/kg.



RECP recommendations and expected results No Cost Recommendations

It is recommended to perform recuperation of heat containing in the hot air.

1. In the technological process of dried fruit production electric energy is mainly consumed in the electric dryer, where the air (25-30 °C) is heated to the temperature 65-75 °C, and then the humid, hot air is discharged to the atmosphere, as a result of which losses of thermal energy and flavored water in the form of condensate are generated.

Investments for two electric dryers will be-approximately 140 000 AMD

Energy saving's potential will be 50% or 3150 kWh annual electric energy.

The simple payback period will be 1 year.

2. The fragrant water can be used for sale- for example parfume production etc.

Low cost Recommendations

3. Introduction of irrigation drip system.

The own orchards of the cooperative are irrigated via furrows using 400 m3 of water per week. Implementation of drip irrigation (4 600 m rubber hoses, corresponding conjunctions, 3.5 m3 and 6.5 m 3 water tanks etc. For the irrigation of about 650 existing trees on three hectares of apricot orchards, will require about 65m 3 of water (a total of 100 liters per tree) per week, while in fact the actual consumption is nearly 400 m3. As a result, both water and electricity consumption will be reduced by about 85%.

The investment is 622000 AMD. Potential for energy savings is 83%, or 3700 kWh / year of electric energy or 145000 AMD. The saved water is approximately-6700m3. The simple payback period of this improvement is 4.3 years.

4. It is recommended to purchase and install a two-part tariff meter and to



use electric equipment at night times. The required investments are amounted to 50 000 AMD, savings are-15200 AMD, simple payback is 3.3 years.

Significant cost Recommendations

5. Construction of dried storage areas.

The volatility of agricultural production volumes in RA are taken into account in relation to the climate conditions of the year, the uncertainty of the prices for the existing harvested fruits, with the necessity of 2-3 years reserve number provision.

6. Construction of new solar dryers.

For sufficient and stable profitability provision to the company approximately 50 tons of prepared product yearly and its' sale are needed. In case of recyclable capacities' (dryers and storehouses) availability it will be possible to process and store the total amount of crops in favorable years- in order to avoid the possible damages during the next unfavorable years.

Environmental Impact

The major part of emissions is generated during the process germination of the raw material. Thus, for germinating 1 ton of apricot- 2 kg of Sulphur is required. However, as the germinating process is carried out in a closed chamber and lasts from 5 to 10 hours, and approximately 4 kg of SO2 is generated as a result of burning 2 kg of sulphur, therefore, the hourly volume of emissions will amount to 4/10 = 0.4 kg/h, which is actually a negligible value.

The content of SO2 in the ready product is around 10 times less than the sanitary permissible norms' demands: 1kg of dried fruit, according to the laboratory data, contains 0.02 kg SO₂.

Detailed RECP assessment of "Yervandashat Agricultural Association" Consumer Cooperative have been implemented by the leading expert of RECP, candidate of Economic Sciences- Mkrtich Jalalyan.



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"The Resource Efficiency and Clean Production" (RECP) demonstration program is being implemented in Armenia since 2014. For the implementation of industrial development programs, the RECP uses already checked preventive environmental approaches- improved productivity of resources (reduced productive costs and use of materials, energy and water) reduced environmental impacts (less waste, emissions and pollution) and improved professional and public health and safety.

The aim of the RECP's demonstration programs- being implemented within the framework of "Green Economy in Eastern Partnership Region" (EaP GREEN) program is to improve the resource efficiency and environmental activity – particularly in agricultural/food, chemical and construction materials' production spheres.

The publication includes business cases and successful stories developed in the result of RECP's assessments implemented in 2015-2016 by the RECP's program and national team of RECP experts.

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Solely the authors are responsible for the contents of the booklet and it does not in any way reflect the viewpoint of the European Union or other participating organizations.

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