Resource Efficiency and Cleaner Production PRIMER

EaPGREEN Partnership for Environment and Growth

Programme carried out with the financial assistance of the European Union

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"Resource efficiency and clean production" (RECP) Demonstration project in Armenia

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"Resource efficiency and clean production" (RECP) Demonstration component project is being implemented in Armenia since 2014. For industrial development projects implementation RECP uses tested preventive environmental approaches: improved efficiency of resources (reduced production costs and materials, energy and water consumption), reduced environmental impact (less waste products and pollution) and improved professional and social health and protection.

In the framework of "Greening Economies in the Eastern Neighborhood" (EAP Green) project the main aim of RECP pilot project is to improve resource efficiency and environmental action particularly in the fields of agricultural/ food production, chemical and construction materials production.

The aim of the efficient and clean production handbook is to locally implement and support the RECP methodology, tools and experience in Armenia.

The publication illustrates several business models and successful examples that were developed by RECP national experts' team and by the project during 2014 RECP assessment.

The author and the project coordination staff express their deep gratitude to UNIDO Chief technical Advisor Mr. Rene Van Berkel, UNIDO RECP expert Mr Nazir Abijanov, RECP national experts and representatives of pilot organizations for their support in preparing the handbook.

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"Resource efficiency and clean production" (RECP) pilot project is implemented in cooperation with UNIDO and REC Caucasus.

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INTRODUCTION

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What kind of problems does RECP solve? How to achieve the desired goals?
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What business benefits could be expected from RECP application?
What tools and methods are used by RECP?

RESP substantially contributes to a successful business establishment.
The development and implementation of RECP project is necessary for achieving the main strategic goal of any company operating in a competitive market economy – "better, cheaper, and quicker".

RECP covers almost all business processes: timely management, main and subsidiary production processes, raw materials, technology stocks management, and forward planning.

RECP solves the problems of increasing the efficiency of raw materials, water and energy exploitation, minimization of waste production and pollution.
The results of RECP implementation are economic, environmental and social benefits, improvement of environmental situation.

Introducing RECP enables

- **Reduction of production costs and technological needs;**
- **Increase in labor productivity;**
- **Possible improvement in product quality;**
- **Reduction of costs associated with waste production and pollution;**
- **Possible improvement of production conditions;**
- **Improvement of the company's status in different kinds of negotiations**
- **Improvement of the public opinion about the company, etc.**

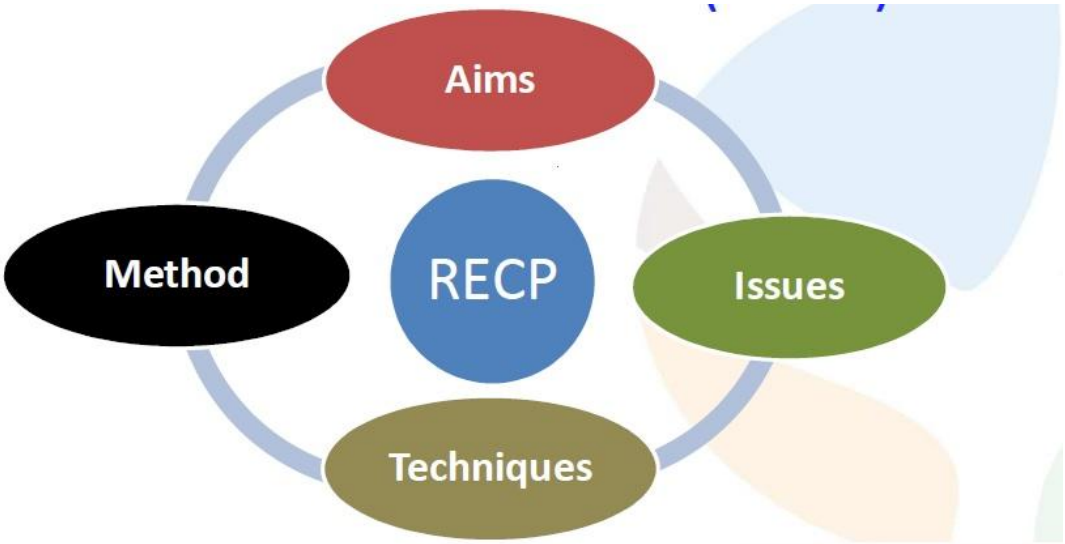
RECP gives fourfold advantages "Win-Win-Win-Win": that is to say, implementing RECP benefits customers, business, government and nature.
RECP is a policy of no regrets.

This handbook may make your business more successful.

Resource efficiency and clean production (RECP) project

What kind of resources does RECP deal with? What environmental benefits can be expected with introduction of RECP? What productivity and clean production is intended? What is an "environmentally friendly product"?

RECP definition. Integrated and consistent application of preventive environmental behavior and comprehensive methods with the aim of increasing the productivity of goods and services production process and mitigating risks for environment and people.



The aim of RECP project

- Optimization of natural resources (materials, water, energy) efficient exploitation;
- Minimization of the negative impact of production systems on nature and environment by means of decreased waste production and pollution;
- Mitigation of negative impact risks for people and societies and insuring development opportunities.

Resources

Natural resources are components of the environment that are used or can be used as objects of labor, tools or consumption goods.
Natural resources can be exhaustible and inexhaustible, renewable and non-renewable.

For example, the sunlight energy is an inexhaustible resource, plants are renewable resources and minerals are non renewable resources.

Resources are classified by their origin (water, land, biological, climate and mineral resources), as well as by their interchangeability etc.

For example, timber, metal, natural fiber, leather, fur etc. are replaceable resources, but oxygen and fresh water are irreplaceable for people.
Resources can be given by nature or man made. Resources can be economic, labor, financial, etc. Economic resources are material and non material resources used to produce goods and services.

Man, together with all the labor tools, is considered to be the labor resource[1].

Many resources on Earth are on the edge of depletion.

RECP project will mainly discuss the efficient exploitation of the following resources:

- **Materials,**
- **Energy,**
- **Water.**

Efficiency

According to the proverb 'If the ax is blunt, it needs a double force, but the success is in skillful hands'. The main driving force of efficiency is the rational management – by means of expansion and efficient exploitation of the existing resources. Though this idea may seem quite obvious, finding a systemic method for its implementation yet may become a real challenge.

Comparative criterions and indicators are usually used to define efficiency.

For example, energy efficiency is defines as legal, administrative, scientific, production, technical and economical targeted activity - aimed at reducing energy resources specific consumption.

The increase in absolute value of production does not necessarily imply increased productivity or increased efficiency.

With the desire to avoid referring to complex economic concepts in our handbook, nevertheless, to make judgments about business management, analysis and development we need to use some concepts like productivity, efficiency, income, costs, expenditures, cost price of goods, profit, etc.

Performing analysis is connected with classification of incomes and costs that can be done using various features. By the feature of inclusion in the cost price of a product all costs can be divided into direct and indirect costs. Direct expenditures on materials, water and energy comprise the cost price of the product.
Several indicators are used to evaluate the inventory stocks efficiency – material unit average profitability, average consumption of material, average return on a unit of material.

[1] Work is purposeful human activity, during which material and spiritual wealth are created to meet the needs of society. The work process involves the work itself, work substances, work means and work outcomes.:

Clean production

You may ask why we need to spend time, effort and money to improve the environment. People have ignored this aspect for ages.
Those days are left behind; paying attention to environmental problem nowadays is a business direction.
In many leading markets, the environmental security is of crucial importance and application of appropriate standards enables not only to comply with daily tightening legal requirements, but also to meet the increasing consumer demand and develop a profitable business.

Environmental issues already gradually start to influence the decisions to buy particular products in Armenian consumer market.

Recent social surveys indicated that the majority of consumers in developed markets are willing to change their supplier and the brand they are using for the sake of a cleaner and better world surrounding us. This fact alone is sufficient to prove the financial benefits of using "green technologies".

Ecologically sustainable innovation is a stimulus for a profitable business development.
Eco-sustainable business means doing business that creates exceptional value for customers, shareholders and employees, simultaneously ensuring care and respect for natural ecosystems, humans and societies.
In recent years, environmentally friendly or organic food consumption is getting widespread.[2]

A product (service) is considered "environmentally friendly" if during the whole life cycle (production, consumption, exploitation) it creates less negative impact on the environment compared to other products (services) of similar category.

RECP BUSINESS BENEFITS

A company performing economic activity makes expenditures and creates income. These important characteristics of performance reflect all aspects of the company's economic activity.

Income in the reporting period is the increase in economic benefits (value), that may arise from assets inflows or increases or decreases in the liabilities and lead to an increase in shareholders' capital.[3]

[2] As a result of the study, State Commission for the Protection of Economic Competition of Republic of Armenia revealed that some of the business units produced products by "clean products", "bio", "eco", "organic" and similar lettering without proving their relevance grounds.
[3] With the exception of the equity investments as a result of the equity increase or decrease in distributions.

Expenditures in the reporting period are decreases in economic benefits (value) that may arise from outflows or decreases in assets or creation or increases in liabilities that can lead to a decrease in shareholders' capital.

Income and expenditure have crucial impact on financial results of a business, which is created by matching them. For this reason, the analysis of income and expenditures has an extreme importance for every business.

The income from operational activities (operational income) comprises the biggest share in a company's total income. It is consists of sales revenues and other operational income.
Operational costs mainly comprise the cost price of goods and services sold, distribution and administrative costs and other costs.

RECP project mainly discusses the following business benefits:

1. **Cost savings**
2. **Productivity increase**
3. **Improved product quality**
4. **Organizational efficiency and effectiveness**
5. **Licence-to-operate**

In market economy, every company receives financial results from its economic activity that are characterized by profit or loss. The profit is considered the main, total synthetic measure of economic efficiency of a company.

To illustrate the business and environmental benefits that may arise from implementation of RECP methods and tools in Armenian SMEs, the **Appendix 1** represents the analysis of measures suggested and performed in 10 SME companies by RECP national experts team in the framework of RECP pilot project. All measures carried out in experimental companies are classified by RECP tools and methods used business and environmental benefits. Representation of practical examples will greatly contribute to RECP methodology domestification and to the development of current handbook mission.

1. Cost savings (materials, energy, water)

It is known that according to economic concepts/rules
Profit = Income (Total) – Costs.
According to the RA "Law on Accounting", during profit calculation the total income is decreased by the amount of properly documented costs associated with income. Total annual income is the sum of all kinds of income received during the reporting year (independent of the source).
The expenditures include material costs (including raw materials, water, and energy), expenditures made on producing goods and services, capital and current expenditures on fixed assets, depreciation costs, salary remunerations, social security costs, taxes, duties, etc. Physical losses are also classified under expenditures, for example losses that may occur during delivery, maintenance and sales due to physical and chemical processes and unfavorable weather conditions.[4] It is possible to reduce costs using various RECP tools.

Cost Savings example (Food Industry)

In "Ashtarak Dzu" LLC the incandescent lamps [5] used in aviaries internal lighting system were replaces with energy efficient (fluorescent and LED) bulbs, resulting in about 550 thousend AMD annual reduction of electricity expenditures. At the same time the reduction in carbon dioxide emissions amounted to around 6.7 tons annually:

Internal lighting of aviaries

Incandescent lamp

Fluorescent bulb

LED bulb

Business benefits from **RECP** implementation: **Cost savings. RECP** environmental benefits: **Selection and efficient use of energy source** and **Reduction and controls over emmisions**, **RECP** tools used: **Good housekeeping** and **Technology change.**

"People are becoming rich not only by increase of their belongings but also by cost reduction" Aristotle

[4] In the accounting legislation, there are other deductions that relate to the purely accounting procedures, such as receivables and payables and the write-off of bad fame, discovered or understated income of overstated deductions, etc.
[5] Currently, many countries are implementing policy of gradual removal on the use of incandescent lamps, for example, the EU, Russia and elsewhere.

2. Productivity increase
(Reduction of non-product outputs)

The increase of productivity is the main condition on the way of enhancing production, enlarging personal and national wealth and increasing the welfare of the population.
The increase of productivity results in sparing materials, energy and water, decreasing production costs and increasing profitability.
Decreasing the amount of materials required for a unit of production and decreasing waste production results in increased labor productivity, which lowers the cost price of production.
Finally, the increased labor productivity contributes to improvement of working conditions, as the workforce and workers' health is preserved, which in turn further increases the labor productivity.
The concept of labor productivity implies a measure of work efficiency or in other words - the ability to produce a certain amount of goods and services in a unit of time.
Nowadays the issue of increasing productivity is of a crucial importance in our country, because our economy remains in unfavorable social economic condition.
In current situation it is very important to base on own scientific force, consolidate all strengths and resources in order to introduce new technologies, stimulate business activities and in this way to increase productivity.

Productivity increase example (Food Industry)

Introducing an automated feeding system in "UNIFISH" LLC fishery will lead to improved fodder adoption and at the same time will help to save some portion of fodder.[6] The idea of introducing an aoutomated feeding system and ventilation equipment is very valuable, it will help to control the feeding process.
At the same time the level of waste waters organic contamination will be reduced.

Business benefits of **RECP: Productivity increase. RECP** environmental benefits**: Selection and efficient use of water source** and **Reduction and treatment of waste water**. **RECP** tools used: **Good housekeeping, Input Change, Better process control**.

"Business continues to grow as long as developing its own advantages".
Herbert Newton Casson

[6] Annual saving of fodder for fish growing will amount to 126 tons or 105 mln. AMD.

3. Improved product quality
(Better product from better-controlled processes)

In market economy, one of the key concepts of economic activity of a firm is product quality improvement.

Market poses high requirements for the quality of products. At the same time, many firms make a lot of efforts towards gaining leadership in their market segment. The issue of product quality becomes the basis for the firm's business strategy and the guarantee of its financial sustainability.

The profitability of the firm becomes driven by the existence of Product Quality Control (PQC) system.

The concept of quality implies a synergy of consumer characteristics of a product, which meets the needs of consumers.

In market economy, the product quality improvement issue for a firm must be considered as an important factor of production and sales strategic controls, which affects its financial success. It must contribute to a steady increase in the firm's business activity and successful competition – with the aim of ensuring financial stability.

International practice attests that introducing an efficient PQC system enables firms to increase their profitability levels 3-4 times on average.

Product quality improvement example (Food Industry)

Air ionization equipment and air and water sterilization systems were installed in cheese and yogurt producer "Arame and Sofi" LLC - as a measure of preventing materials and products from possible perishing[7].

This non-chemical sterilization method at the same time enables to increase the cooling temperature by 1-2 degrees, which results in lower energy costs.

Business benefits of **RECP**: **Improved product quality**. **RECP** environmental benefits: **Selection and efficient use of materials and energy** and **Reduction and utilization of waste** and **Reduction and controls over emmisions**, **RECP** tools used: **Good housekeeping**, **Input Change, Better process control, Equipment Modification**.

"Most important, the most fundamental value that will never, never to be questioned, is integrity."
Art de Guus

[7] The cost of equipment installation is 50 thnd AMD,the positive impact levels are still under examination

4. Organizational efficiency
(Staff motivation, promotion and encourage business processes)

Administrative efficiency characterises the performance of the work carried out – productivity, or the amount of products and services produced within a unit of time (hour, shift, day, month, year).
The market poses some principal requirements for the firms' activities – to investigate alternatives for management decisions, perform a comparative analysis, choose the most effective alternative and measure the financial results of its implementation.
The improvement of administrative efficiency will have a positive impact on planning the resource exploitation, on development of engeneering skills, management of business conduct, market conduct, on insuring acurate quality controls over production processes.
As a result of staff inclusion in business activities of the company, motivation and renumeretion activities cost reduction and decrease of waste production, a better controls over processes and quality improvement can be achieved, the status of the firm in various negotiations can be strengthened and the public awareness about the company can be improved.

Organizational efficiency improvement example (Food Industry)

Several measures have been implemented in dairy and meat products producer “MARILA” LLC, including the following: Market research concerning issues of returning unsold goods, sales stagnation, food transportation and conditions of storing the food in sales points. Sensors were installed on production unit lamps, temperature controllers/regultors were set on heating system batteries (reduction of energy consumption by 20%):
Measures taken reduced the emission of greenhouse gases by 8.4 tons.

Business benefits of **RECP: Organizational efficiency, Cost savings. RECP** environmental benefits**: Reduction and utilization of waste** and **Reduction and controls over emmisions**, **RECP** tools used: **Good housekeeping, Better process control**.

" The first prerequisite for Business success is patience."
John Rockefeller

5. Licence-to-operate (Government, community and markets)

The government, the community, local, regional and international markets set specific rules to achieve business regulation, promotion of environmentally friendly economic activity, ensuring secure conditions for the health of people[8].

These rules are enacted through licensing process, product certification, normative regulations and bylaw decisions on waste production and recycling.

Creating equal conditions in markets for newly entering firms is a matter of promoting competition for governments[9]. There are certain requirements for entering international markets concerning qualitative features of products, controls over the production process, reliable guarantees for minimization of the negative impact of pollution on environment and the health of population.

Licence-to-operate example (Chemical industry)

Construction of treatment plant in "Kashi" OJSC created the opportunity to enter ineternational markets and created sales opportunities for half-manufactured products and final goods. The treatment station was constructed with joint efforts from US International Development Agency "Sustainable Water Resources Management for Enhanced Environmental Quality" and "Agribusiness Small Medium Enterprise Market Development (ASME)" projects. At the same time, the possible negative impact on Hrazdan river and the surrounding area was reduced.

Business benefits of **RECP: Licence-to-operate. RECP** environmental benefits**: Selection and efficient use of water source** and **Reduction and treatment of wastewater. RECP** tools used: **Good housekeeping, Better process control, Equipment modification**.

"It is essential to maintain Synopsys, fair and reliable partner's reputation and guide them. Our integrity should be irreversible, are the key to our success. "
Chi-Foon Chan

[8] The sanitary and epidemiological rules and norms and hygienic standards are being developed and applied on the human body to the harmful effects of exclusion.
[9] The companies are, however, often display behavior as unfair competition, due to availability of goods and commodities markets relatively low ability to pay by population.

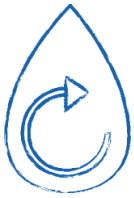
RECP OBJECTIVES AND ENVIRONMENTAL PROFILE

Increasing resource productivity - materials, water and energy.
Decreasing pollution intensity - emissions, waste water and waste.

Selection and efficient use of materials

Reduction and utilization of waste

Selection and efficient use of water source



Reduction and treatment of waste water

Selection and efficient use of energy source

Reduction and controls over emmisions

The RECP objectives include a correct selection and efficient exploitation of materials, energy and water sources in terms of time and location for production process purposes.

The environmental benefits that are expected from RECP tools and methods implementation are minimization, neutralization, recycling, and management of waste production, wastewaters and pollution.

Summary information on industrial and environmental situation in Armenia is represented in **Appendix 2**.

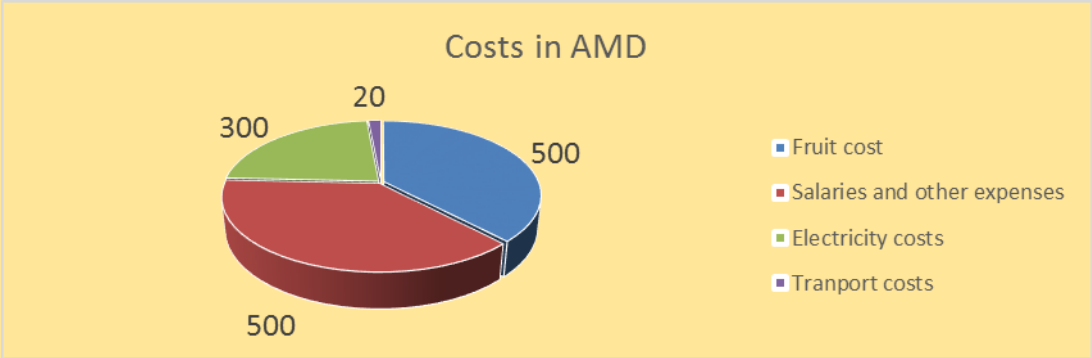
1. Selection and efficient use of materials

RECP discusses: stocks and row materials obtained from external suppliers, own resources, auxiliary materials (materials that do not become a product), intermediate products (that comprise a part of the final product), wrapping materials, etc.
Standards and indicators: absolute and specific quantities of consumed materials, the efficiency of material exploitation.
Measurement units: (ton, liter, quantity, currency, etc.) /year or unit of production.

The large share in a company's current assets belongs to production stocks, especially in recent years, due to the increase in competition, loss of sales markets, law income of the customers, high levels of production cost price and other factors. The wrong selection of materials and their further inefficient exploitation, increasing stocks of unsold production lead to current assets and cash flows freezing, payables increasing and consequently - solvency decreasing and financial unsustainability of the company that may eventually result in bankruptcy.

Example of Selection and efficient use of materials (Food Industry)

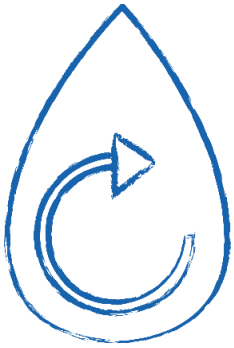
Dry fruit producer "Ervandashat agricultural association " consumer cooperative company performs material selection using maretial from external suppliers, as well as material grown in own orchards. Dry fruits produced by village residents also is bought and resold. Company works in a highly competitive environment and can survive only by improving its product quality and decreasing the cost price[10] . In the framework of RECP project the strategy of increasing the share of self-grown local materials from orchards was proposed, analysed and assessed. This strategy will result in various benefits.



Business benefits of **RECP: Cost savings, Organizational efficiency, Licence-to-operate. RECP** environmental benefits**: Selection and efficient use of materials** and **Reduction and utilization of waste**, **RECP** tools used: **Good housekeeping** and **Input Change**.

[10] The wholesale cost of Turkish and Iranian dry apricot is 1.0 kAMD/kg, while the cost price of cooperative products vary around 1.4-1.65 kAMD per kg.

2. Selection and efficient use of water source



Water can be obtained from the following sources: urban or community water pipes, surface waters (water reservoir, lake, river, etc.), underground water sources (including own artesian wells), gathered rainwater, wastewaters of other companies, etc.
Standards, indicators: absolute and specific levels of water consumption, water exploitation efficiency.
Measurement units: (ton, cubic meters, liters, currency, etc.)/ Year or unit of production.

The sectorial water consumption of RA has the following structure: 88% of the share belongs to irrigation, fisheries and forestry sector, 8% - to the industry sector, 4% - to household consumption of potable water.
There are no large rivers in Armenia except river Araks. Nevertheless the river network is quite thick (215 rivers of lengths over 10 km) with a total length of 13 thnd kms.
Most of these rivers do not have a permanent flow and dry out in summers. The spatial and seasonal distribution of Armenian water resources is extremely unequal. Water resources are scarce in the densely populated Hrazdan river catchment basin, which is located in the central part of Armenia. The correct selection and efficient exploitation of water sources is highly important for fisheries. Optimal conditions require that the oxygen saturation of water ranges between 65-75%, water temperature for sturgeons ranges between 18-19 ^{0}C and for salmon fishes – between 13-15 ^{0}C, which ensures high growth rates for fish production. Water supply through gravity flows of artesian waters, quality water with constant temperature, correct balance of combined vitaminized mineral fodder and sunny weather give an opportunity to grow a 1.5 kg trout in less than 12 months.

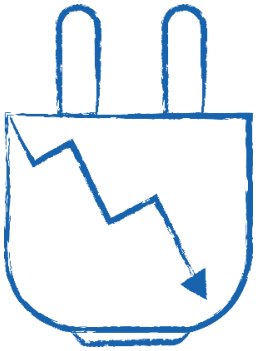
Example of Selection and efficient use of water source (Food Industry)

Erlift recirculation technology introduced in UNIFISH fish producing, processing and selling LLC, which uses artesian wells as a water source, gives an opportunity to increase production volumes by 6-8 times without increasing water consumption or water surface used.[11] Along with business benefits, the multiple use of water, application of water closed circulation cycles greatly benefits also the environment.

RECP measures environmental benefit: **Selection and efficient use of water source** and **Reduction and treatment of wastewater. RECP** business benefits: **Productivity increase**, **Organizational efficiency, Licence-to-operate. RECP** tools used: **Good housekeeping, Input Change, Technology change.**

[11] Water supplied by 29 artesian wells, where the permanent temperature of water is 14-18 degrees and almost has no dependence on weather conditions, which creates an opportunity for the fishery to operate continuously all year round.

3. Selection and efficient use of energy source

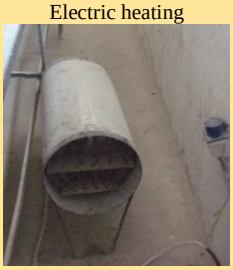


RECP expects that energy consumed by a firm may include exploitation of the following energy sources: locally produced electricity and thermal energy (sun, wind, water energy, natural gas, oil, coal, biofuel, solid waste, etc.), centralized electricity supply, heat supply, refrigeration, steam supply, engine energy (gasoline, diesel, biofuel) etc.
Standards, indicators: consumed energy/ efficiency of absolute and specific consumption of energy.
Measurement units: (ton, cubic meters, liters, currency, etc.) / year or unit of production.

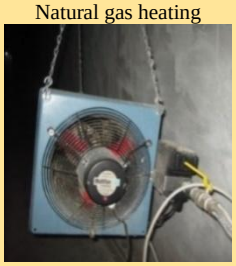
Armenia does not posses own energy resources and satisfies its needs by importing energy. Natural gas is the main source of energy (75-80%); gas coverage is 96% across the country. The main consumers of energy are housing sector (around 30%), transportation sector[12] (around 25%) and energy sector (between 20-35%). Electricity is produced in Thermal power stations (30-40%), in Nuclear power plant (20-35%) and in Hydroelectric power plants (20-30%). The selection and efficient exploitation of energy source are important issues in food, chemical productions and manufacturing of construction materials.

Examples of Selection and efficient use of energy source (Food Industry)

Electric heating



Natural gas heating



Mercury lamp

Natrium Lamp

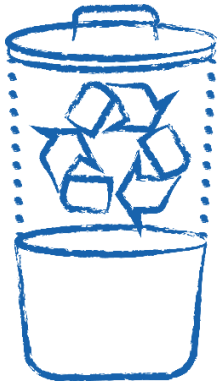
External LED lighting fixtures

Several measures directed on efficient exploitation of energy resources, including changeing the energy sorce, were applied in Astarak Dzu LLC, a company workin in the egg production industry.
Aviaries and secondary spaces are heated with natural gas, instead of electricity[13].
Mercury lamps were replaced with energy efficient (natrium and LED) lighting fixtures in external lighting system[14]: At the same time, as a result of energy efficiency measures applied in the LLC, the emissions of greenhouse gases has decreased by around 24 tons of $CO_{2\ equivalent}$ annually.

RECP measures environmental benefits: **Selection and efficient use of energy source** and **Reduction and controls over emmisions. RECP** business benefits: **Cost savings, Organizational efficiency. RECP** tools used: **Good housekeeping, Input Change, Equipment modofication** and **Technology change.**

[12] Around 60 % of transport operates on compressed natural gas.
[13] Annual financial savings or cost reductions of 750 thousand AMD.
[14] The reduction of energy costs amounted to 330 thousand AMD. The walls of newly built paultry yards were heat insulated using locally produced pearlite plates. It was suggested to obtain energy from the air ducts by installing recuperators. The expedience of constructing a combined (cogeneration) electricity and thermal energy plant working on biofuel was also considered.

4. Reduction and utilization of waste



According to RECP, methodology amounts of the following types of waste products resulted from the production process is being considered: waste materials sent to trash site, landfilled, neutralized, sent for recycling, hazwaste materials, farming waste, gardening waste, urban solid waste etc.
Standards, indicators: absolute and specific indicators of waste production, waste production intensity.
Measurement units (ton, cubic meters, liters, currency, etc.)/ year or unit of production.

48 of solid waste sanitary landfills existing in Armenia are going to be closed; the waste is going to be sorted and by means of 10 loading points is going to be transferred to 5 new regional landfills. In major closed landfills (Yerevan, Gyumri, Vanadzor) landfill gas is intended to be extracted and burnt and the open burning of solid waste products is intended to be stopped. Primary products, materials, scraps, remainders of other products or materials, as well as products that have lost their initial consumer characteristics are considered to be waste products of production and consumption. Waste products with physical, chemical or biological characteristics that constitute or may constitute danger to human health or the environment are considered hazwaste and must be dealt with special methods, means and techniques. According to the "Law on waste products" of RA, legal entities engaged in waste products utilization are required to register the waste products produced, utilized, neutralized and transferred to third parties in the way stipulated by the law.

Example of Reduction and utilization of waste (Chemical Industry)

An interesting option for waste reduction was introduced in "KASHI" OJSC, with the help of RECP. The remainders of materials: salt and pieces of leather are reused in livestock farms as a fodder admixture, as well as a component in organic fertilizer extraction process (compost).

It is a typical example of a case, when waste from one production process becomes an input for another production-creating basis for bilateral successful cooperation.

RECP measures environmental benefits: **Selection and efficient use of materials** and **Reduction and utilization of waste. RECP** business benefits: **Cost savings, Productivity increase. RECP** tools used: **Good housekeeping, On site reuse/recycling.**

5. Reduction and treatment of wastewater

Waste waters created during production and disposed of from the territory of the firm by pipelines, in bins, or other transportation means, outflows of water for production purposes, sanitary cleaning needs or unexpected outflows of water (the volumes are being measured or estimated), the effluent penetrating through soil and other outflows are being considered according to RECP methodology.
Standards, indicators: absolute and specific indicators of waste water production, outflow intensity.
Measurement units (ton, cubic meters, liters, currency, etc.)/ year or unit of production.

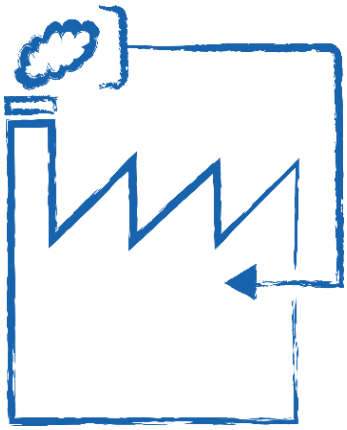
Urban wastewaters include household and industrial wastewaters. In past there used to exist 20 wastewater cleaning stations in Armenia, with a total capacity of 958 thnd m^3 per day. Currently the stations are in an extremely bad condition or totally damaged, except reconstructed mechanical cleaning stations located in Martuni, Vardenis and Gavar. Decrease of wastewaters is a result of the decrease in population, more rational use of water resources and the decline of the industrial sector. In the largest cleaning station "Aeratsia", located in Yerevan a partial mechanical cleaning of wastewaters is carried out. Currently there is an ongoing modernization project for "Aeratsia" cleaning station. Biological cleaning of wastewaters, sludge removal, methane extraction is not performed in Armenia, and cleaning stations factually represent shallow pools called "defecate pools", which emit a great amount of organic materials and greenhouse gases.

Example of Reduction and treatment of wastewater (Food Industry)

RECP pilot project implemented several wastewater reduction measures in dry fruit producing "Lukashin agricultural association" cooperative company. Wastewater effluent during initial cleaning of material is used for adjascent territory irrigation.
Reuse of third stage cleaning (rinsing) waters for initial cleaning process reduced the consumption of drinking water by 30%. Giving up on using caustic soda for initial processing of some fruits reduced the volumes of harmful wastewaters and decreased production costs.

RECP measures environmental benefits: **Reduction and treatment of wastewater. RECP** business benefits: **Cost savings, Productivity increase, Organizational efficiency. RECP** tools used: **Good housekeeping, Input Change, Technology change.**

6. Reduction and controls over emmisions



Air pollution considered in the framework of the RECP include the following:
Contamination due to own production of electricity and thermal energy (hot water and steam) and purchased energy (centralized electricity, heat and steam supply). Other burning processes, physical and chemical processing, getaway emissions, etc.
Standards, indicators: absolute and specific indicators of greenhouses gases emission, emission intensity.
Measurement units. (ton $CO_{2\ equivalent}$, cubic meters, currency, etc.) / year or unit of production.

Every year approximately to 10 000 mln tons of oil equivalent energy is consumed in the world. Global worming has the biggest impact of energy consumption on the environment. Climate change or global worming is the average global increase in the earth surface air temperature. The most important greenhouse gas is the carbon dioxide (CO_2) the emission of which is a result of fossil fuel burning, which comprises 80% of the manmade emission of carbon dioxide. Methane (CH_4) is the second important greenhouse gas and nitrogen suboxide (N_2O) is the third. The global warming potential (GWP) of greenhouse gases is estimated for the equivalent of CO_2 and the three more widespread GHGs, the potentials are equal to:
CO_2 =1, CH_4 = 21, N_2O = 310[15]. The "Carbone footprint" is the amount of greenhouse gases that anyone emits as a result of some activity.

Example of Reduction and controls over emmisions (Chemical Industry)

In order to meet the demand for hot water- solar water heaters were installed on "KASHI" OJSC production units rooftops, which led to significant saving of natural gas and electricity, reduction of production cost price and reduction of emissions into the air.According to calculations the annual savings will amount to 230 thnd AMD. The exploitation of solar energy (including PV panels) and other kinds of renewable energy sorces, along with environmental benefits, can significantly raise the company's rating.

RECP measures environmental benefits: **Selection and efficient use of energy source** and **Reduction and controls over emmisions. RECP** business benefits: **Cost savings** and **Licence-to-operate. RECP** tools used: **Good housekeeping, Input Change, Equipment modification** and **Technology change.**

[15] According to 2007 IPCC Fourth Assessment Report (AR4), GWP of this GHG are equal to 1 for CO_2, 25 for CH_4, and 298 for N_2O, but while preparation of national reports still 1995GWP data referred in the text is used.

RECP TECHNIQUES

There are various methods and tools for resource efficiency and clean production. After analysing the importance of the implementation of environmentally friendly technologies and efficient business development, RECP project classifies the tools and methods in the following format.

1. Good housekeeping,
2. Input Change,
3. Better process controls,
4. Equipment Modification,
5. Technology change,
6. On-site reuse and recycling,
7. Useful byproduct,
8. Product modification.

In market economy the company projects and implements its economic activity itself. In doing so the company relies on the contracts signed with suppliers and customers and projets its further development based on consumer demnad. Any company can use RECP methods and tools to achieve its strategic and production goals and to benefit in various ways.

For example, as a result of improved housekeeping and input material change, the reduced material consumption of production can lead to sparing material stocks and enable producing additional quantity of products. Better process controls, consistent modification and proper maintainance of equipment and production lines will hetp in planning and ensuring production of necessary quality products.

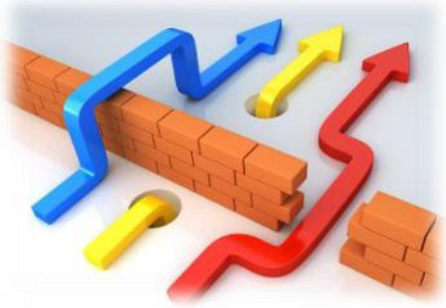
Development and implementation of new advanced technological processes, installation of new improved equipment, their timely maintenance, management and improvement of production processes, simultaneous usage of renewable energy sources, efficient consumption of fossil fuel and water together with advanced technologies bring various business and environmental benefits.
Product modification, on-site reuse and recycling[16] as well as useful byproduct production minimize waste generation.

[16] Waste recycling - technology connected with changing physical, chemical or biological characteristics of waste.

1. Good housekeeping

Change of exploitation and operation procedures, management and business practices, minimization of ineffective work and losses, care and motivation.

Examples of Good housekeeping practices



- ✓ Switch off what is not in use,
- ✓ Repair the equipment in time,
- ✓ Target usage of workspace property,
- ✓ Keep workplace organized and clean,
- ✓ Discuss and approve the cost efficient and technically correct solutions for tasks,
- ✓ Prevent material losses,
- ✓ Minimize water and energy losses,
- ✓ Implenet the exploitation and maintainance rules properly,
- ✓ Preserve the caring and motivated behavior of the staff.

Example of Good housekeeping (Production of Construction Materials)

In "HATM" household union that produces construction materials and furniture currently used administrative spaces were optimized and matched with current production volumes[17]. As a result of several taken measures[18] there is an annual saving of costs of about 2.7 mln AMD.
At the same time, the electricity consumption is reduced, and emissions of CO_2 decline by around 30 tons.

RECP tools used: **Good housekeeping, Better process control. RECP** business benefits: **Cost savings, Organizational efficiency. RECP** environmental benefit: **Selection and efficient use of energy source** and **Reduction and controls over emmisions.**

"Anything you can do better than has been done until now."
Henry Ford

[17] This is typical to many post Soviet Union economies.
[18] The heating surface of administrative sector decreased by 280 m^2, infrared heating system was installed in the manufacturing sector, unnecessary use of the transformer was reduced, and the power supply system modifications were made.

2. Input Change

Use of alternative input materials, so that less or less harmful waste is created. Simultaneous use of renewable resources and less problematic and harmful materials.

Typical examples and solutions:

- ✓ Use less harmful substances,
- ✓ Use materials for their purpose,
- ✓ Use raw materials and inputs from local sources,
- ✓ Recycle[19] and utilize[20] waste,
- ✓ Use of renewable energy in all posible cases,
- ✓ Organize secondary use of materials, water and energy,
- ✓ Use sustainably-sourced renewable materials,
- ✓ Continuously look for ways to replace the use of harmful substances,
- ✓ Use materials with longer biocycle where possible.

Example of Input Change (Food Industry)

By combining electic and solar drying units, a technology change for dry fruit production was performed in "Ervandashat agricultural association" consumer cooperative company. As a result of using solar energy the saving of electricity amounted to around 75% or 4.7 MWh annually. Emissions reduction amounted to 2 tons of $CO_{2\ eq}$. The annual saving is equal to 200 thnd AMD and the payback period is 10 months. There are evident environmental benefits.

RECP tools used: **Input Change, Technology change** and **Equipment modification.**
RECP measures business benefits: **Cost savings, Improved product quality. RECP** environmental benefits: **Selection and efficient use of energy source and Reduction and controls over emmisions.**

"You will never be able to solve the problem, if you store the same thinking and the same approach that led you to this problem." Albert Einstein

[19] Waste utilization- use of waste to produce goods, energy or for other purposes.
[20] Waste recycling – reuse of waste as a secondary material or energy source.

3. Better process control

Improve control over processes and equipment in order to operate those continuously at highest efficiency and lowest wastage.

Typical examples and solutions

- ✓ Continuous implementation of standard operating practices and process monitoring,
- ✓ Improvement of working procedures,
- ✓ Ensure the proper execution of equipment and mechanisms operational tasks,
- ✓ Keep operational records and analyze equipment bugs,
- ✓ Periodical and current trade and technical accountability of raw materials, energy and water and results analysis,
- ✓ Improvement of automated production systems,
- ✓ Introduction of quality controls systems,
- ✓ Development conditions for production systems that provide maximum efficiency and minimum waste and emissions,
- ✓ Execution of preventive maintenance in order to reveal possible damages in advance.

Example of Better process control (Food Industry)

Improvement of controls in fruit production process concerning fruit squeezing and juice production (from the highest level of density to the lowest: juice, juice liquid, nectar) was performed in "Ararat food factory" LLC, a company producing juice, canned fruits and vegetables, concentrates and purees. Several other measures were also taken[21] that brought business and environmental benefits.

RECP tools used**: Better process control, Good housekeeping. RECP** measures business benefits: **Cost savings** and **Organizational efficiency. RECP** environmental benefits: **Selection and efficient use of materials** and **energy source, Reduction and utilization of waste** and **Reduction and treatment of waste water.**

"An ounce of prevention is worth more than a pound of cure" Rene Van Berkel

[21] Replacement of caustic soda with 60-70^0 C hot water for fruit cleaning purposes. Reduction of cleaning waters, installing a double tariff electricity meter.

4. Equipment Modification

Replacement of production processes, technological equipment and improvement of technical means with the purpose of avoiding wastages, losses or overruns, reducing waste and emissions and improving efficiency.

Typical examples and solutions.

- ✓ Proper selection and maintenance of production lines, equipment and mechanisms,
- ✓ Improvement of production processes (whipping, mixing, supplying, transferring, selling, refurbishing, storing etc.),
- ✓ Improvement of equipment operating conditions (temperature, pressure, speed etc.),
- ✓ Using rational solutions in energy distribution and consumption systems for production and utility purposes,
- ✓ Optimization of production procedures through pooling steps and stages of some processes.
- ✓ Fully ration exploitation of available equipment,
- ✓ Insulation etc.

Example of Equipment Modification (Food industry)

In "Arame and Sofi" cheese producing LLC the boilers working on liquified petrolium gas used for sterilization of products were modified by installing electric heating system[22] between double layered metal walls of tanks. The boilers wera also insulated. Required investments totaled to 750 thnd AMD, and monthly costs were reduced by 75 thnd AMD. Savings of the workforce increased working safety and reliablity is evident.

RECP tools used: **Equipment Modification, Good housekeeping** and **Technology change. RECP** measures business benefits: **Cost savings** and **Organizational efficiency. RECP** environmental benefits: **Selection and efficient use of energy source** and **Reduction and controls over emmisions.**

"When I did not have enough money - I sat down to think, instead of running make. The idea - the most expensive product in the world."
Steve Jobs

[22] As a cheaper and more environmentally friendly fuel, natural gas use was naturally viewed, but because of the great distance to the connection point, it was estimated inappropriate at the date of the study.

5. Technology change

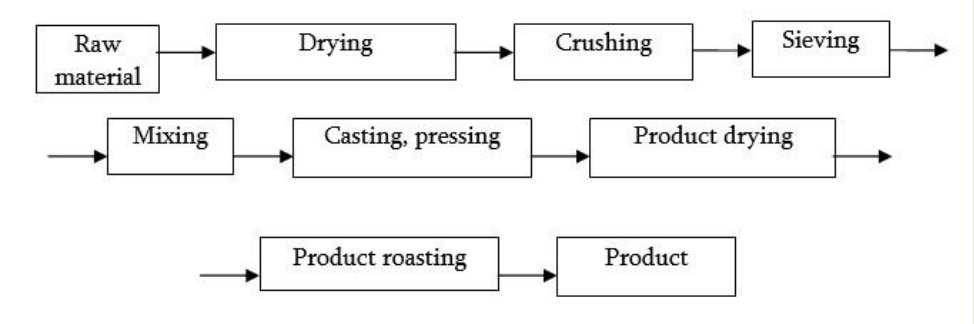
Replacement of (process) technology with more efficient and/or less wasteful technology.

Typical examples and solutions

- ✓ Changes in main production processes:
  - Shift from chemical to mechanics,
  - Using multistage technologies,
  - Change of process chemistry, e.g. to catalytic or solvent free,
  - Minimize the use of synthetic cleaning substances in order to reduce the outflow of non biodegrading organic substances,
- ✓ Use of effective boilers, engines,
- ✓ Use of renewable energy sources for electricity and heat production purposes (electricity, heating, cooling, hot water),
- ✓ Changes in materials processing and synthesis in order to reduce emissions,
- ✓ Use of equipment with regeneration loops,
- ✓ consideration of advanced options for process segregation etc.

Technology change example (Production of Construction Materials)

A group of measures on technology changes were proposed to implement in "M and Mavr" ceramic construction materials producing OJSC: storing the raw materials under the stalls (1 MWh annual saving of energy due to decreasing humidity by 5-10%), laying the pipes for emitted gases through raw materials storage unit, installing dust filters, exploitation of nearby ceramic mines,changing the location of raw materials and damaged products crashing and filtering unit, etc.



RECP toolsused: **Technology change, Equipment Modification, Input Change** and **Better process control. RECP** measures business benefits: **Productivity increase**, **Improved product quality**, **RECP** environmental benefits: **Selection and efficient use of materials, Reduction and utilization of waste** and **Reduction and controls over emmisions.**

"The difficulty is not to find new ideas, and to get rid of the old ones."
John Maynard Keynes

6. On-site reuse and recycling

Useful application of waste (material, energy, water) within the same company for similar or alternative purpose

Typical examples and solutions

- ✓ Reuse of waste for producing goods, energy or for other purposes,
- ✓ Using the waste created during initial processing of materials in the production process of other goods,
- ✓ Waste utilization: using as a secondary source of material or energy,
- ✓ Countercurrent or cascaded use of water and energy,
- ✓ Condensate and heat recovery, heat recuperation,
- ✓ Reuse of incoming packaging for outgoing products,
- ✓ Using the products that have lost their initial consumer characteristics or cleaning solvents in the production process for other goods or for next batch of products,
- ✓ Using the cleaning solvents and waste water flows for irrigation and other purposes.

Example of On-site reuse and recycling (Food Industry)

Due to on-site reuse of hard nucleus and other agricultural wastes as a compost and apricot nucleus for local deserts production proposed by RECP pilot project an annual saving of 750 thnd AMD was achieved in “Lukashin agricultural association” cooperative company that is engaged in dry fruits production.

RECP tools used: **On-site reuse and recycling, Good housekeeping** and **Useful byproduct. RECP** measures business benefits: **Productivity increase** and **Licence-to-operate, RECP** environmental benefits: **Reduction and utilization of waste .**

"Failure is simply the opportunity to start again, this time in a more reasonable manner." Henry Ford

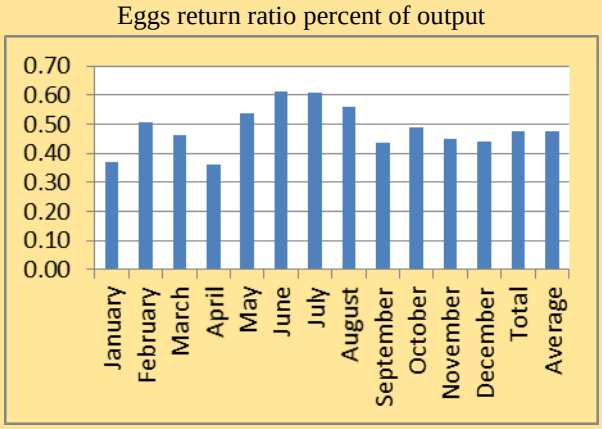
7. Useful byproduct

Convert a previously wasted material into a substitute input material for another company or user.

Typical examples and solutions

- ✓ Provision of used heating or cooling water for external heating or cooling purposes (buildings, fish farms etc.)
- ✓ Segregation of useful byproducts for processing and recycling (as well as for selling to other companies).
- ✓ Industrial symbiosis[23], e.g. use of inorganics in cement making, slags in construction, etc.

Example of Useful byproduct (Food Industry)



In "Ashtarak Dzu" LLC, due to organization of: 1. Egg powder production (from rational and technical eggs, returned or overproduced useful eggs) and 2. Paultry meat powder (meat meal fodder) production (recycling of dead chicken and other wastes) the generation of waste will be annually reduced by around 25 tons.
Business benefits will simultaneously increase by several indicators.

RECP tools used: **Useful byproduct, Good housekeeping** and **On-site reuse and recycling.** **RECP** measures business benefits: **Productivity increase** and **Licence-to-operate**, **RECP** environmental benefits: **Reduction and utilization of waste.**

"Your well-being depends on your own decisions."
John Rockefeller

[23] Physically close mutually beneficial interaction between the two organisms.

8. Product modification

Redesign product in order to reduce its environmental impact during production, use and/or disposal.

Typical examples and solutions

- ✓ Design for optimal product lifetime,
- ✓ Design for minimum use of water, energy, secondary materials, etc.
- ✓ Design for low-waste manufacturing and use of associated advanced technologies,
- ✓ Obtaining information on no waste production,
- ✓ Design for refurbishment and modernization of the product, with the possibility to recycle the wastes generated during the production process with no adverse impact on the environment and people's health.

Product modification example (Chemical Industry)

In case of installing necessary equipment in "KASHI" OJSC, it will be possible to prepare two kinds of products out of 4mm thick leather material: genuine leather of 1.5 mm thickness and 2.5 mm thick suede.
At the same time, it will enable to extract liquid soap from recycling waste materials (fats and oils). Total annual saving of costs in "KASHI" OJSC amounted to about 7%.

RECP tools used: **Product modification** and **Technology change. RECP** measures business benefits: **Productivity increase** and **Improved product quality. RECP** environmental benefits: **Reduction and utilization of waste.**

"Survival is not the strongest nor the most intelligent type, but the one that best adapts to change." Charles Darwin

RECP METHODOLOGY

RECP follows the principle of using environmentally friendly tools and methods for business prosperity accepted worldwide. Implementation of RECP tools and methods is necessary for any industry and any company operating in a market economy. RECP implementation will create a favorable situation regardless of the political environment, legal system imperfections and corruption risks, etc. present in the sphere or the country.
As a result of RECP implementation there are evident economic, environmental and social benefits for consumers, economic agents SME, government and the country as a whole.

Conceptually: Option generation through root source and cause diagnosis.

Procedurally: Preparation, initial and detailed assessment, feasibility studies and implementation.

RECP project application is especially important for Armenia, which is not rich with fossil resources, the goal of becoming a prosperous country and producing competitive goods may be achieved through developing mental and intellectual capacity and force.
Naturally, every businessperson, shareholder and head of production has the best outlook of the business he is engaged in, with all the problems included and tries to overcome all associated challenges. Pursuant to the saying, “the clever man learns from his own mistakes, the wise man learns from the mistakes of others”, RECP is called to be useful in such situations. No business owner will refuse to get an advice from a wise and experienced expert, especially the advisor like RECP that has been tested in many developed countries. Like an Armenian proverb “To serve for the wise, not to be pleasing to the stupid”.

The Victory Path

Aimed for domestication, adaptation and adoption of RECP in Armenia, development of RECP way of thinking, principles, terminology and embedding provided format and approach in Armenia: RECP center will be established in Yerevan to assist the prosses. Targeted to engage and refine - Forums will be organized with participation of stakeholders, involved ministries, governmental, private and non-governmental organizations, SMEs and other partners.

Many RECP clubs will be established in different regions of the country in order to domesticate, embed, strengthen and create a habit of the resource efficiency and clean production lifestyle in Armenia.

"It's good to have productive hands of expressive lips." Start to Act…

Annex 1. Measures proposed and implemented in RA enterprises during RECP pilot program

RECP initiated / implemented measures		Materials			Energy Savings						
"Ashtarak Dzu" LLC http://ashtarakdzu.am/ Armenia, Aragatsotn Mars, Akhdzk community "Ashtarak Dzu" LLC is one of the leading companies in egg production industries of the republic, occupying over 8% of the market. Annual egg production is 43.5 eggs or 3.6 eggs monthly average, and meat 61.8 t per year.		Egg powder production organization	Flour forage fodder production	Optimization of chicken feed distribution regime	Recovering heat from the ventilation system	Replacement (fuel switch) of electrical energy heaters with natural gas ovens	Changing the internal inefficient incandescent lamps with more efficient bulbs	Aviaries envelope walls and roof insulation	Replacement of external lighting system with efficient one	Solar photovoltaic panels use	Poultry Manure Treatment for cogeneration
Business Case	Cost savings	-	-	+	+	+	+	+	+	+	-
	Productivity increase	+	+	+	-	-	+	-	-	-	-
	Improved product quality	-	-	+	-	-	+	-	-	-	-
	Organizational efficiency	-	-	+	-	-	+	-	-	-	+
	Licence-to-operate	+	+	-	-	-	-	-	-	+	+
Environment Benefit	Materials	+	+	+	-	-	-	-	-	-	+
	Water	-	-	+	-	-	-	-	-	-	-
	Energy	-	-	-	+	+	+	+	+	+	+
	Waste	+	+	+	-	-	-	-	-	-	+
	Effluents	-	-	-	-	-	-	-	-	-	-
	Emissions	-	-	-	+	+	+	+	+	+	+
Technique	Good House-keeping	+	+	+	+	+	+	+	+	+	+
	Input Material Change	-	-	+	+	+	-	+	-	+	+
	Better Process Control	-	-	+	+	-	-	-	-	-	-
	Equipment Modification	-	-	-	-	+	+	+	+	+	-
	Technology Change	-	-	+	+	+	+	+	+	+	+
	Onsite Reuse & Recycling	+	+	-	+	-	-	-	-	-	+
	Useful Byproduct	+	+	-	-	-	-	-	-	-	+
	Product Modification	+	-	+	-	-	-	-	-	+	+
Further comments and/or lessons learned	Continuously applying RECP measures include production process optimization, installation of new equipment for recycling of resources and reduction of energy use, potentially amounting to AMD 35.0 mln per year. Additional benefits, comprising social and environmental aids were improvements in working practices and a reduction of the company's carbon footprint.										

RECP initiated / implemented measures		Materials Efficiency		Energy Savings				Water Savings		
"Arame & Sofi" LLC Armaenia, Ararat Marz. Lusagyugh Main accent is being done on cheese production, developing possibilities of matzoun too. Despite of the production is currently on going and during summer months (the most overloaded) it was processing 2.0 – 3.0 ton of milk per day; it has 6.0 – 7.0 ton possible capacity. Cheese production was chosen to conduct RECP study within this pilot project.		Installation of air ionizers	Installation of air & water disinfection systems	Energy source heating system changes	Insulation pipes and boilers	Covering the open lid surface of boilers	Refrigerator-stock restructuring.	Wastewater (whey) recycling for fats (butter) production	Wastewater (whey) recycling for animal feeding	Wastewater (whey) recycling using as an irrigation water
Business Case	Cost savings	+	+	+	+	+	+	-	-	+
	Productivity increase	+	+	-	-	-	-	+	+	-
	Improved product quality	+	+	-	-	-	-	-	-	-
	Organizational efficiency	-	-	+	-	+	-	+	+	+
	Licence-to-operate	+	+	-	-	-	-	-	-	-
Environment Benefit	Materials	+	+	-	-	-	-	+	+	+
	Water	-	-	-	-	-	-	+	+	+
	Energy	-	-	+	+	+	+	-	-	-
	Waste	+	+	-	-	-	-	+	+	+
	Effluents	-	-	-	-	-	-	+	+	+
	Emissions	-	-	+	+	+	+	-	-	-
Technique	Good House-keeping	+	+	+	+	+	+	+	+	+
	Input Material Change	-	-	+	-	-	-	+	+	+
	Better Process Control	+	+	+	-	-	-	+	+	+
	Equipment Modification	-	-	+	+	-	+	-	-	-
	Technology Change	+	+	+	-	-	-	+	+	+
	Onsite Reuse & Recycling	-	-	-	-	-	-	+	+	+
	Useful Byproduct	-	-	-	-	-	-	+	+	-
	Product Modification	-	-	-	-	-	-	+	+	-
Further comments and/or lessons learned	Through raising awareness and capacity building at "Arame & Sofi" LLC, exchange/management of knowledge in regard to RECP principles and concept was applied in practice. This program served as good incentive for entrepreneur to start own observations and make the system "smart" to ensure profitable production as soon as possible.									

RECP initiated / implemented measures		Materials Efficiency					Energy Savings			Water
"Ararat Food Factory" http://ararat-food.am/ Armaenia,Yerevan Sharuri St., Building 37 The Ararat Food Factory belongs to Karolina Group LLC, was founded in March 2011, and currently is the largest factory for the production of natural juices and soft drinks. The plant is provided with modern equipment and laboratories. Currently, the factory already produces not only juice, but also tea, conserves, fruit and vegetable concentrate puree		Planning the squeezing and juice production process schedules	Exclude or minimize use of synthetic detergents in washing processes	Replace the procedure of washing the fruit with caustic soda solution	Consider utilizing organic waste for returning into production	Organic waste selling for forage or bio-humus/compost	Reusing for heating systems the steam used for water heating	Installation of two-tier tariff meter for electricity	Steam consumption system regulation	Establishing washing water recirculation
Business Case	Cost savings	+	-	-	+	-	+	+	+	+
	Productivity increase	+	-	-	+	+	+	-	+	-
	Improved product quality	-	+	+	-	-	-	-	-	-
	Organizational efficiency	+	-	-	+	+	+	+	+	+
	Licence-to-operate	-	+	+	-	-	-	-	-	-
Environment Benefit	Materials	+	+	+	+	+	-	-	-	-
	Water	+	-	-	-	-	+	-	+	+
	Energy	-	-	-	-	-	+	+	+	-
	Waste	+	+	+	+	+	-	-	-	-
	Effluents	+	-	-	-	-	+	-	+	+
	Emissions	-	-	-	-	-	+	+	+	-
Technique	Good House-keeping	+	-	-	+	+	+	+	+	+
	Input Material Change	-	+	+	+	+	+	-	+	+
	Better Process Control	+	-	-	+	-	+	+	+	+
	Equipment Modification	+	-	-	-	-	-	-	+	-
	Technology Change	-	+	+	-	-	+	-	-	-
	Onsite Reuse & Recycling	-	-	-	-	+	+	-	+	+
	Useful Byproduct	-	-	-	-	+	-	-	-	-
	Product Modification	-	-	-	-	+	-	-	-	-
Further comments and/or lessons learned	The Ararat Food Company has acknowledged the recommendations and underlined, that to this date, they have not been aware of the potential solutions to reduce resource inefficiencies. Actually, for embarking on a committed path of resource efficiency and clean production per avoided cleaning of equipment, the company would need in-depth cost analysis which would monetize not only the expenditures of technical and procedural upgrades, but also monetize the resource savings to the benefit of the company.									

RECP initiated / implemented measures		Materials Efficiency					Energy	Water
"Agricultural Association Lukashin" Consumer Cooperative Armenia, Armavir Marz. Lukashin The main activity of the SME is production of dried fruit from technical grade and table sorts of fruits (apricots, peaches, plums, apples, pears, figs and grapes) and melons grown on the lands of Lukashin rural community located in the heart of Ararat valley, famous for the taste qualities of its fruits and vegetables. Average production capacity is 14,000 kg/year of finished produce (dried fruit) that are mainly consumed in the internal market and partly exported		Sulfur product packaging instead of using nitrogen,	Fruits preliminary treatment without the use of caustic soda	The unavoidable plant waste (stalk, peel, pit, seeds, pulp), is used as fresh forage for livestock	The kernel of apricots is used locally in confectionary	The pits / stones and other agricultural solid waste are utilized by composting	Ventilation pipes (for water vapour removal) modification	Reuse the effluents (without caustic soda) for irrigation
Business Case	Cost savings	+	+	-	-	-	+	+
	Productivity increase	-	-	+	+	+	-	-
	Improved product quality	+	+	-	-	-	-	-
	Organizational efficiency	+	-	+	-	+	+	+
	Licence-to-operate	-	+	-	+	-	-	-
Environment Benefit	Materials	+	+	+	+	+	-	-
	Water	-	+	-	-	-	-	+
	Energy	-	-	-	-	-	+	-
	Waste	+	+	+	+	+	-	-
	Effluents	-	+	-	-	-	-	+
	Emissions	+	-	-	-	-	+	-
Technique	Good House-keeping	+	+	+	+	+	+	+
	Input Material Change	+	+	+	+	+	-	+
	Better Process Control	+	+	-	-	-	+	-
	Equipment Modification	-	-	-	-	-	+	-
	Technology Change	+	+	-	-	-	+	+
	Onsite Reuse & Recycling	-	-	+	+	+	-	+
	Useful Byproduct	-	-	+	+	+	-	+
	Product Modification	-	-	+	+	+	-	-
Further comments and/or lessons learned	Assisted by the RECP experts, a concept-proposal for a follow-on project on high-cost RECP recommendations, namely, installation of three convective solar dryer and a solar water heater has been developed, to be implemented under GEF/UNDP Small Grants Program 2015. This successful case created a precedent for a RECP model that can be replicated in other dried-fruit-producer SMEs of Armenia, by disseminating the proven RECP practices and building capacities to bring in "green" production culture.							

RECP initiated / implemented measures		Materials Efficiency				Energy Savings			Water
"Agricultural Association Yervandashat" Consumer Cooperative Armenia, Armavir Marz. Yervandashat The main products, dried fruit are from local raw materials: apricot fruit ("SATENI" type), peaches (Ararat valley and cultivated current and later scores), pears (mainly the "beauty of the forest"), black plums (three species), and cherries. The majority of the products sold in the domestic market and the Russian Federation		Expanding the production base of raw materials	Flavored water from the dryer may be used for the purpose of manufacture of perfumes	The solid waste used as fertilizer	Soft waste is used as fresh forage for livestock	Dried fruit production technology change, through a combination of electric and solar dryers	Dryer ventilation system modification	Installation of two-tier tariff meter for electricity	Implementation of drip irrigation
Business Case	Cost savings	+	-	-	-	+	+	+	+
	Productivity increase	+	+	+	+	+	-	-	-
	Improved product quality	+	-	-	-	+	-	-	-
	Organizational efficiency	+	+	+	+	-	+	+	+
	Licence-to-operate	-	-	-	-	+	-	-	+
Environment Benefit	Materials	+	+	+	+	-	-	-	-
	Water	-	+	-	-	-	-	-	+
	Energy	-	-	-	-	+	+	+	+
	Waste	+	+	+	+	-	-	-	-
	Effluents	-	+	-	-	-	-	-	+
	Emissions	-	-	-	-	+	+	+	+
Technique	Good House-keeping	+	+	+	+	+	+	+	+
	Input Material Change	-	-	+	+	+	+	-	+
	Better Process Control	+	+	-	-	-	+	+	+
	Equipment Modification	-	-	-	-	+	+	-	-
	Technology Change	-	-	-	-	+	+	-	+
	Onsite Reuse & Recycling	-	+	+	+	-	-	-	-
	Useful Byproduct	-	+	+	+	-	-	-	-
	Product Modification	+	+	+	+	-	-	-	-
Further comments and/or lessons learned	As a result of RECP assessment the company has benefited from reduction in water and energy consumption by improving efficiency of irrigation system, and modification of electric dryers. Options regarding improvement of product marketability, development of the side products (flavored water to be used in manufacture of perfumes), as well as alternative use for water for supplying other industries were suggested. Besides the economic and environmental benefits mentioned above, the RECP programme brought improvements in working practices and overall image of the company.								

RECP initiated / implemented measures		Materials Efficiency					Energy Savings			Water
"Marila" LLC **Armenia**, Syunik Marz, Kapan city "Marila" LLC started implementing cleaner production in 2014, was established in 2010. Since then, "Marila" has been one of the most demanded and successful diary and meat production companies in Armenia. The company pays lots of attention to the quality of the product, and has set up high standards of operations. 70% of "Marila: dairy products, such as matzoun, cheese, curd, sour cream, milk and tan are consumed in Syunik region, and the rest 30% in Yerevan		Replacement and modification of production equipment,	Replace plastic containers with environmentally friendly bags	Bottle filling system modification	Production lines for milk moves through the compressed air instead of water	Serving market research	Installation of the lighting system sensors in the maintenance workshop	Refrigerator outer wall insulation and light hole covering	Install thermo regulators on the radiators of the heating system	Wash water use for irrigation
Business Case	Cost savings	+	-	+	+	+	+	+	+	+
	Productivity increase	+	-	+	+	-	-	-	-	-
	Improved product quality	+	+	-	+	-	-	-	-	-
	Organizational efficiency	-	-	+	-	+	-	-	-	+
	Licence-to-operate	+	+	-	-	-	-	-	-	-
Environment Benefit	Materials	+	+	+	+	+	-	-	-	-
	Water	+	-	-	+	-	-	-	-	+
	Energy	+	-	-	-	-	+	+	+	-
	Waste	+	+	+	+	+	-	-	-	-
	Effluents	+	-	-	+	-	-	-	-	+
	Emissions	+	-	-	-	-	+	+	+	-
Technique	Good House-keeping	+	+	+	+	+	+	+	+	+
	Input Material Change	-	+	-	-	-	-	+	-	+
	Better Process Control	-	-	+	+	+	-	-	-	-
	Equipment Modification	+	-	-	+	-	+	+	+	-
	Technology Change	-	+	+	+	-	+	+	+	+
	Onsite Reuse & Recycling	-	-	-	-	-	-	-	-	+
	Useful Byproduct	-	-	-	-	-	-	-	-	+
	Product Modification	-	+	-	-	-	-	-	-	-
Further comments and/or lessons learned	RECP assessment has suggested the following options for improvement of resource efficiency/use and cleaner production practices within Marila company: elimination of harmful emissions, reduction in the energy consumption through equipment modification, prevention of water and raw material loss through equipment modification and introduction of new technologies, waste recycling options, improvement of market assessment. Company could potential improve co-operation schemes and its marketability trough the reduction of waste and unitization to be reduce the loss of produce (matzoun, sour cream and milk).									

RECP initiated / implemented measures		Materials Efficiency				Energy Savings			Water	
"UNIFISH" LLC http://www.unifish.am/ **Armenia**, Ararat Marz. Sayat-Nova Fish farm "UNIFISH" is the biggest fish farm in Armenia. The farm was constructed in 2006 and in a few years, it has become well known not only in Armenia, but also in many countries. The company realizes production, processing and selling of fish food, sturgeon and trout, eggs, fingerlings, brood stock. "UNIFISH" LLC accommodates 396 basins. Currently the production capacity for up to 2,000 tons of sturgeons, and 2,200 tons for salmons.		Place the fish in an automatic feeding system	Fish processing of organic residues can be used in the production of compost as an organic component	Re-use of secondary waste	Fish processing organic residues can be used for combined food production	Renewable energy sources (solar, geothermal) uses	Install dissolved oxygen concentration readers in aquaria	Install automatic feed dispensers and aerating devices, which will control the feeding process in accordance with oxygen saturation levels	Move to water re-use system	Water recycling technology investment
Business Case	Cost savings	+	-	-	-	+	-	-	+	+
	Productivity increase	+	+	+	+	-	+	+	-	-
	Improved product quality	+	-	-	-	-	+	+	-	-
	Organizational efficiency	+	+	+	+	-	+	+	-	-
	Licence-to-operate	-	-	-	-	+	-	-	-	-
Environment Benefit	Materials	+	+	+	+	-	+	+	-	-
	Water	+	-	-	-	-	-	-	+	+
	Energy	-	-	-	-	+	-	-	-	-
	Waste	+	+	+	+	-	+	+	-	-
	Effluents	-	-	-	-	-	-	-	+	+
	Emissions	-	-	-	-	+	-	-	-	-
Technique	Good House-keeping	+	+	+	+	+	+	+	+	+
	Input Material Change	+	+	+	+	+	-	-	+	+
	Better Process Control	+	-	-	-	-	-	-	+	+
	Equipment Modification	-	-	-	-	+	+	+	-	-
	Technology Change	+	-	-	-	+	+	+	-	-
	Onsite Reuse & Recycling	-	+	+	+	-	-	-	+	+
	Useful Byproduct	-	+	+	+	-	-	-	-	-
	Product Modification	+	+	+	+	+	-	-	-	-
Further comments and/or lessons learned	The RECP Demonstration Project in Armenia, besides the economic and environmental benefits, brought improvements in working practices and overall image of the pilot company. Besides that, the implementation of suggestions will provide the decrease of fishery products price, the rise of fish growth rates, decrease in water discharge, and production growth due to embezzlement of photosynthetic oxygen in the pools.									

RECP initiated / implemented measures		Materials Efficiency			Energy Savings			
"HATM" House Components Manufacturing Factory LLC **Armenia**, Shirak Marz. Mayisyan "HATM" House Components Manufacturing Factory LLC (the former Armenian-American Housing Manufacturing entity) of "Hayastan" All-Armenian Foundation was established in 1991 by joint efforts of the Government of Republic of Armenia and Armenian Assembly of America. One of the main directions of production of the enterprise is considered the production of school, office and kitchen furniture. Elite furniture for apartments also produced here.		Equipment productivity compliance with existing orders	Re-use of manufacturing defects and waste	Wood pellet or briquettes production based on wood waste	Production process framework focuse in one compact area	Optimization of production areas	Electricity supply system in line with current demand	Reduce administrative heated space
Business Case	Cost savings	+	+	-	+	+	+	+
	Productivity increase	+	+	+	-	-	-	-
	Improved product quality	-	-	-	-	-	-	-
	Organizational efficiency	+	+	+	+	+	+	+
	Licence-to-operate	-	-	+	-	-	-	-
Environment Benefit	Materials	+	+	+	-	-	-	-
	Water	-	-	-	-	-	-	-
	Energy	+	-	+	+	+	+	+
	Waste	+	+	+	-	-	-	-
	Effluents	-	-	-	-	-	-	-
	Emissions	+	-	+	+	+	+	+
Technique	Good House-keeping	+	+	+	+	+	+	+
	Input Material Change	-	+	+	-	-	-	-
	Better Process Control	+	+	+	+	+	+	+
	Equipment Modification	+	-	-	-	-	-	-
	Technology Change	-	-	-	-	-	-	-
	Onsite Reuse & Recycling	-	+	+	-	-	-	-
	Useful Byproduct	-	-	+	-	-	-	-
	Product Modification	-	-	-	-	-	-	-
Further comments and/or lessons learned	As the company has downsized operations, the operational procedures have followed the same routine, which due to lost scale effect, has resulted in major inefficiencies. The Company management has started implementing recommendations and has seized some of the lowest cost opportunities first and foremost as a way to increase cost-competitiveness and reduce operational losses. Should affordable financing become available, the proposed measures will help the enterprise not only improve resource efficiency and stem for cleaner production, but also improve economic viability of the firm.							

RECP initiated / implemented measures		Materials Efficiency				Energy Savings		
"M&Mavr" OJSC **Armenia**, Ararat region. Artashat "M & MABR" was established in 1999. The main activity is the production of ceramic construction materials, sales of consumer goods, engineering-structural design and construction. The main production is ceramic tiles, blocks, heat-soundproofing materials. Primarily, the production is used in the internal market and partially is exported to Georgia.		Use raw materials of the mines near to production	After dryers the dusty gases should be passed via bag filters in order to economize a great deal of raw materials	Equipment replacement with modern automated ones	Use of bag filters during cutting and grinding of raw materials and defective products	Changes in raw material storage conditions	Dryer exhaust gas heat recovery	Creation of production of compact system
Business Case	Cost savings	+	+	+	+	+	+	+
	Productivity increase	-	-	+	-	-	-	-
	Improved product quality	-	-	+	-	+	-	-
	Organizational efficiency	+	+	-	+	+	+	+
	Licence-to-operate	+	-	+	-	-	-	-
Environment Benefit	Materials	+	+	+	+	+	-	+
	Water	-	-	-	-	-	-	-
	Energy	+	-	+	-	+	+	+
	Waste	+	+	+	+	+	-	+
	Effluents	-	-	-	-	-	-	-
	Emissions	+	-	+	-	+	+	+
Technique	Good House-keeping	+	+	+	+	+	+	+
	Input Material Change	+	-	-	-	-	-	-
	Better Process Control	+	+	-	+	+	+	+
	Equipment Modification	-	-	+	-	-	+	-
	Technology Change	-	-	-	-	+	+	-
	Onsite Reuse & Recycling	-	+	-	+	-	+	-
	Useful Byproduct	-	-	-	-	-	-	-
	Product Modification	-	-	-	-	-	-	-
Further comments and/or lessons learned	RECP project methodologically helps the company both in the stage of design and performance to handle the problem of reducing waste, increasing the efficiency of the raw materials and energy usage resulting economic and ecological achievements. Namely, reduction of pollution, waste, improvement of technology, cutting and grinding process modification and sanitation improvement measures were recommended because of RECP assessment.							

RECP initiated / implemented measures	Materials Efficiency	Energy Savings	Water

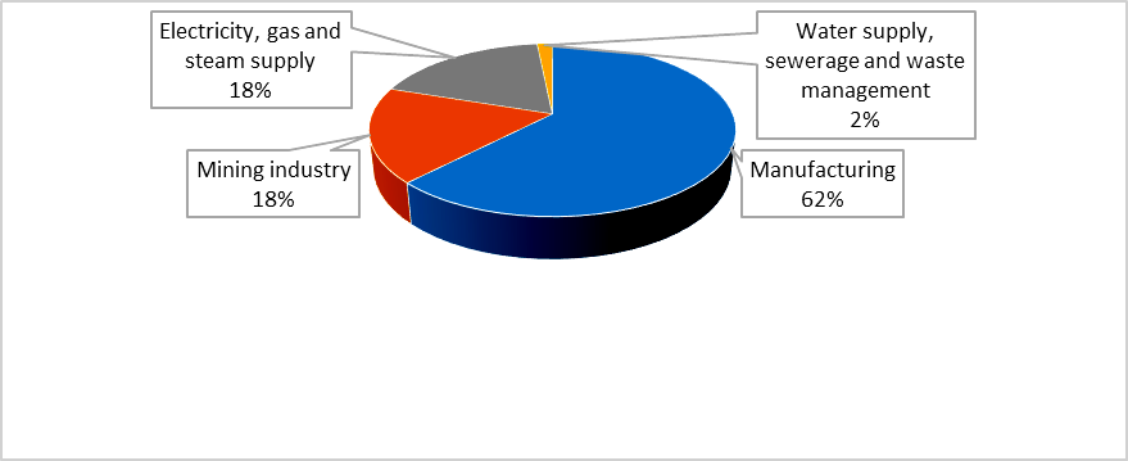
"Kashi" OJSC **Armenia**, Yerevan, Erebuni District The mill retained the old tradition. It operates in very competitive conditions with Turkish and Iranian products. Factory-treatment plant reconstruction made possible convenience sales opportunities in international markets for finished products and materials.		Raw materials surplus use as an additive for forage	Raw materials surplus use as an organic fertilizer	Processing of raw material surplus for receiving liquefied natural soap	Production of two types (finished leather and suede / chamois) products from raw leather	Hot-water heater replacement condensing boiler on natural gas	Installation of solar water heaters for hot water generation	Water treatment system improvements
Business Case	Cost savings	-	-	-	+	+	+	-
	Productivity increase	+	+	+	+	+	-	-
	Improved product quality	-	-	-	-	-	-	-
	Organizational efficiency	+	+	+	+	-	-	+
	Licence-to-operate	-	-	-	-	-	+	+
Environment Benefit	Materials	+	+	+	+	-	-	-
	Water	-	-	-	-	-	-	+
	Energy	-	-	-	-	+	+	-
	Waste	+	+	+	+	-	-	-
	Effluents	-	-	-	-	-	-	+
	Emissions	-	-	-	-	+	+	-
Technique	Good House-keeping	+	+	+	+	+	+	+
	Input Material Change	+	+	+	+	+	+	-
	Better Process Control	-	-	-	-	-	-	+
	Equipment Modification	-	-	-	-	+	+	-
	Technology Change	-	-	-	+	+	+	+
	Onsite Reuse & Recycling	+	+	+	+	-	-	+
	Useful Byproduct	+	+	+	+	-	-	-
	Product Modification	+	+	+	+	-	+	-
Further comments and/or lessons learned	RECP assessment has suggested the following options for improvement of resource efficiency/use and cleaner production practices within “Kashi” company: elimination of harmful emissions and effluents, reduction in the energy consumption by improving the equipment modification, utilization of waste and wastewater effluents treatment, improvement of product marketability are accepted and implemented in “Kashi” company.							

Annex 2. Summary information on industrial and environmental situation in Armenia

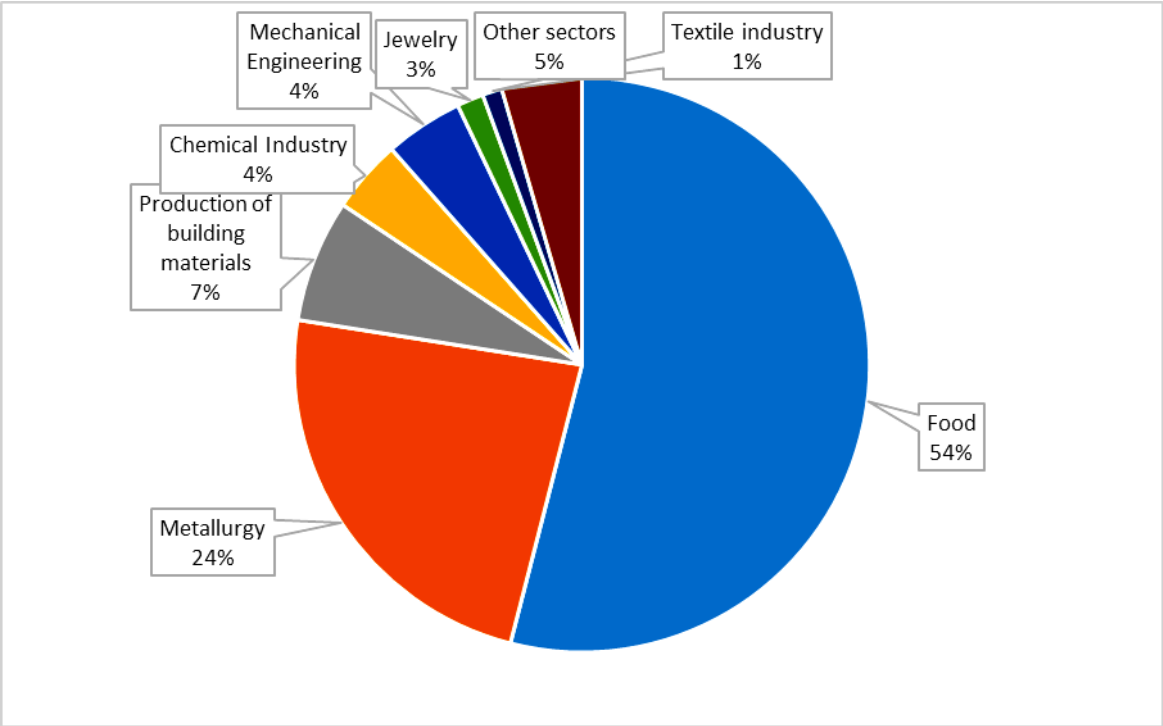
Industry

According to official sources, industry comprises that base of Armenian economy. The government of RA follows the goal of increasing the competitiveness of Armenian economy and achieving continuous economic growth. The government admitted the necessity to construct a knowledge-based economy and initiated an export oriented policy implementation.
The industrial production of RA by economic activity types and the structure of manufacturing sector are shown below:

Output by economic activity types



The structure of manufacturing sector



Analysis of production is crucial for industrial companies.

The following objectives are set during the analysis:

- Perform market analysis,
- Analyze the assortment of goods, its structure, quality and symmetry,
- Define the impact of various factors on the volumes of output.

Analytical research is carried out basing on following information sources:

- Business plan,
- Report on output,
- Report on fixed assets,
- Report on inventory stocks,
- Data from marketing service,
- Accounting data.

Continuous improvement of competitiveness in the economy is one of the priority issues in a country's economic policy. Competitiveness provides a favorable environment for economic activity, development of markets and their coherence with internationally accepted standards, for broader fulfilment of the society's vital needs as well as for fair protection of consumers' interests.
In recent years, some effective steps towards ensuring sufficient conditions for honest competition, improvement of business environment, development of SME sector have been undertaken in Armenia, which is reflected in various ratings granted by international organizations.

Environmental issues

As a UNFCCC Non-Annex I country, Armenia does not have quantitative commitments for GHG emission reduction. However, to support the objective of the Convention and, given that slowing GHG emissions is in line with the country's economic, energy, and environmental objectives, Armenia is implementing and, in its development perspectives, is planning climate change mitigation measures.
Several laws and bylaws were amended and adopted, national and sectorial development projects, that are based on sustainable and low Carbone development are drafted and implemented in Armenia in recent years.

Laws: RA Law "On Atmospheric Air Protection", RA Law "On Energy", RA Law "On Energy Efficiency and Renewable Energy", RA Law "On Waste", Forest Code of RA, etc.

RA Government Decisions: On the approval of norms for maximum permissible concentrations (MPC) of air-polluting substances in settlements, and maximum permissible concentrations of dangerous substances in exhausts from motorized transport, etc.

Government policy on waste is directed on reduction of waste generation and minimization of waste danger through following measures:

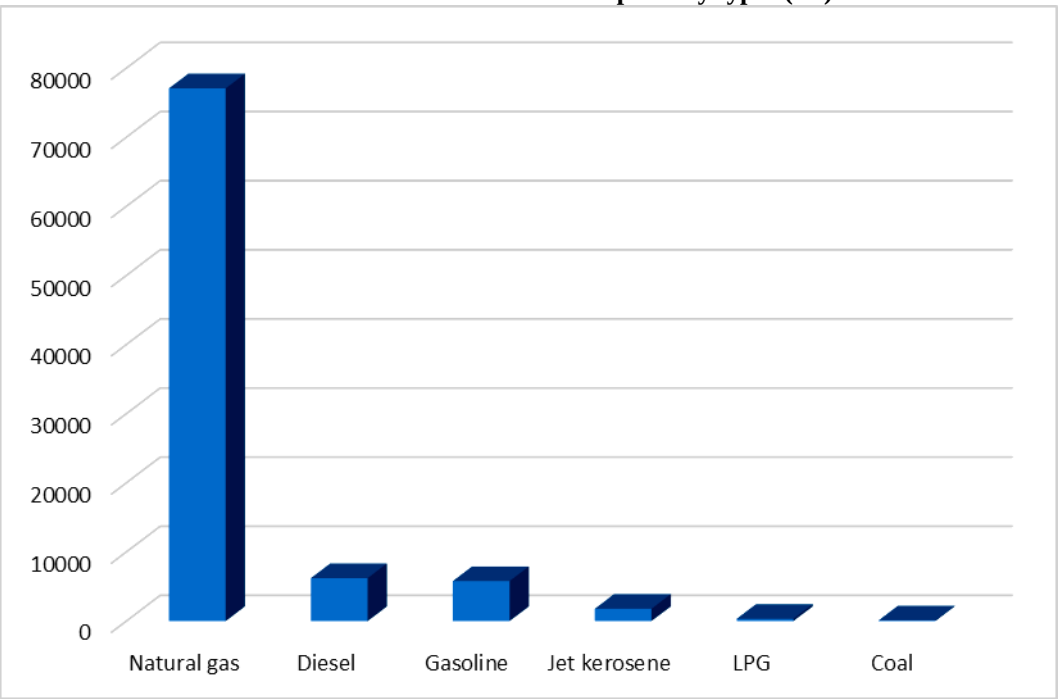
- Use of contemporary scientific achievements to introduce no waste or low waste technologies;
- integrated utilization of material resources in order to reduce waste volumes;
- Direct, secondary or alternative consumption of waste bearing material value;
- Ensuring safe disposal of non usable waste with appropriate waste neutralization technologies, developing environmentally safe methods and measures;
- Providing available information on waste utilization;
- Define mechanisms for economic motivation

Armenia does not have own energy resources and mainly imports fuel to meet internal demand.

The main type of fuel is natural gas (around 80% of total). The structure of RA fossil fuel consumption by types and the structure of CO_2 emissions by category[24] generated by energy sector[25] are shown in the graphs below.

[24] According to the IPCC classification, "Energy" sector includes fuel combustion-related functions :

The structure of fossil fuel consumption by types (TJ)



Main issues in ensuring energy security of RA are the following:

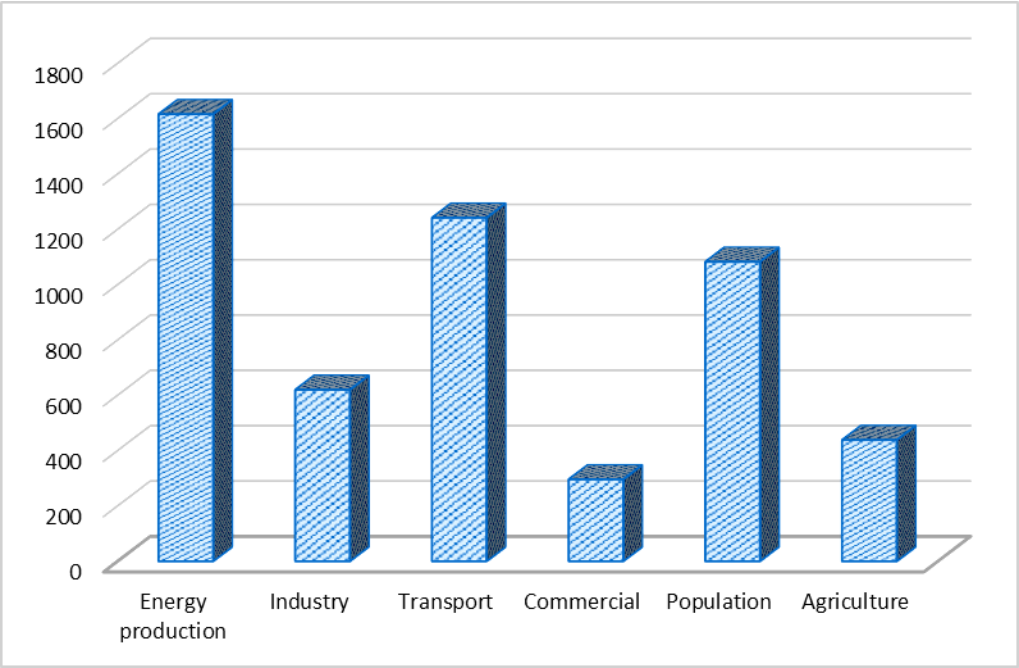
- Creating conditions for sustainable development of RA ;
- Ensuring a self sustained electric power system and developing export potential in the region;
- Creating favorable investment climate in the sectors of renewable and alternative energy, nuclear power ;
- Ensuring energy efficiency and energy conservation;
- Reduction of GHG emissions,
- Developing concepts aimed at preserving the stated level of energy security in RA.

Main directions of ensuring energy security of RA are the following:

- Developing the system ensuring energy security,
- Ensuring efficient and rational exploitation of renewable energy resources;
- Promoting nuclear power;
- Regional integration of energy systems and diversification of energy resources supply;
- Financial sustainability of energy sector and ensuring stated level of economic efficiency;
- Ensuring energy security in emergencies and during wars.

[25] These are the most recent official data for 2012, however later years energy resources consumption structure has remained virtually unchanged.

The structure of CO_2 emissions by category generated by energy sector (Gg)



In order to adjust the economy to changing environment and to mitigate the impact of climate changes on water resources the following complex measures are suggested for implementation:

- Administrative and planning
  - consider the climate change factor during development of management plans for all major river drainage basins;
  - optimization and renovation of the hydrologic observation decks network with contemporary equipment;
  - granting water usage permitions taking into account the climate change risks;
  - creating hydrologic reservations in all river basin areas of river flow formation;
- Informative and research.
  - assessment of climate changes on water resources of mountain lakes;
  - assessment of the snow storage change for all major river drainage basins in Armenia, application of computer modeled climate change scenarios for all major river drainage basins;
  - assessment of climate changes on underground waters;
  - amendment of ecologic flow calculation method;
- Economic and technical.
  - construction of new small reservoirs and renovation of out of-service ones;
  - monitoring and controls over underground waters;
  - reduction of flow losses in water supply and irrigation systems;
  - develop economic mechanisms to promote application of advanced irrigation methods in agriculture.

Currently there are no projects for renovation and reconstruction of waste water treatment systems in Armenia.

EaPGREEN Partnership for Environment and Growth

Programme carried out with the financial assistance of the European Union

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