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Resource Efficiency in Industry: A Concrete Plant Case Study

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Abstract

Resource management has always been an important factor in enhancing production efficiency. Resource-saving activities significantly reduce overall resource consumption and operational costs hence resulting with low product cost.Although Uzbekistan has rich natural resources, improper usages may perish them in near future, as experts claim. The purpose of this study is to develop proposals to reduce the cost of production taking into account plant capabilities. Feasibility of proposal is based on calculations of economic efficiency.

Keywords:*Resource efficiency, economic efficiency, energy saving technologies.*

I. INTRODUCTION

Reduction in production cost is an optimal solution in gaining competitive advantage. Increased labor productivity, efficient resource allocation, economized fuel and energy consumption, maintenance and management expenses downturn and support costs minimization are the most important sources of resource-saving activities. Above mentioned methods constitute internal measures among which efficient resource usage outstand. Resource-saving measures havetobe done by maintaining standards of raw materials supply and using available resources for secondary purposes.

Resource efficiency is a set of measures undertaken to facilitate key factors of production (land, labor and capital) efficiently and economically. The aim is achieved through resource and energy saving technologies; reduction in material consumption and capital-output ratio; increase in labor productivity.

Number of researches on resource efficiency has been done by both local and world economists. This proves resource efficiency is a very important topic in all sectors of the economy. Works byJunming Zhu (2013), Mokhtar Ahmed H.A. (1991), Gevorkyan V. S. (2003), Liss E. M. (1999), Popov A. S. (2006), Kuznetsova N. A. (2004), Adriyanova E. V. (2011), Kononenko E. S. (2003), Akhmadiev R. Y. (2002),Kosovich T. A. (2002)and Enkhtaivan D.(2013)were used as framework for his article.

This article reflects some PhD research findings by author; State Unitary Enterprise "Qoyliqkopriklartemirbetonqurilmalartajribazavodi'"s concrete plant was chosen as a case study.

The scientific novelty of theresearch article lies on resource efficiency measures developed by the author based on the financial and resource capabilities of the plant.

State Unitary Enterprise "Qoyliqkopriklartemirbetonqurilmalartajribazavodi" is included in the organizational structure of the State Committee forHighways and Roadsofthe Republic of Uzbekistan in accordance with Resolution of President PP- 2776 "About the organization of activities of the State Committee of the Republic of Uzbekistan for highways and Republican road fund under the Cabinet of

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Ministers of the Republic of Uzbekistan" on February 14, 2017.

The enterprise specializes in the production of high-quality and competitive road-building products (reinforced concrete structures, reinforced concrete and non-ferrous products) for construction, maintenance and improvement of roads for enterprises under the State Committee of the Republic of Uzbekistan for Highways and Republican roads. Plant "Qoyliqkopriklartemirbetonqurilmalartajribazavodi" is intended for the production of concrete structures for bridges, intersections, water pipes, as well as prefabricated reinforced concrete structures for the construction and improvement of highways and roads. Thefollowing technological complexes are available at the plant for production of reinforced concrete structures:

- Closed warehouse with hermetic container for storage;
- Tanks for cement;
- Concrete mixing compartment;
- The main building, which includes 6-piece assembly line for production of reinforces concrete structures together with welding section of the armature shop;
- Three open landfills for assembled constructionsstorage;
- Armature shop;
- Crushing shop to prepare and sort mixture of crushed stone and sand;

Current nomenclature of reinforced concrete structures produced by State Unitary Enterprise "Qoyliqkopriklartemirbetonqurilmalartajribazavodi"'s plant includes:

The main types of products

Product name	Product manufacture, m^3 per annum					Comment
	2019 January-April	2018	2017	2016	2015	
Tension – loaded plates	2095,9	4392,0	6127,0	5986,5	8607,2	Manufactured under standard design
Tension – loaded beams	83,8	1207,3	2959,4	1818,8	1845,0	
Bridge attachments	1575,6	2951,9	4347,3	3090,2	4069,7	
Layers of reinforced concrete for highways	668,7	1371,8	335,6	240,6	608,5	
Landscape design element for highways	6842,5	27091,6	20465,5	29635,0	34823,0	Manufactured under customers' design
Rigels	9,5	-	-	95,1	-	
Wall blocks	124,4	165,5	434,6	147,3	330,5	

Source: Developed by author based on data collected from concrete plant

It should be noted that, resource efficiency within any enterprise cannot be achieved by reducing quality or changing appearance of the end product. Therefore, it is very difficult to make positive changes in enterprise's financial condition and fixed assets depreciation. However, number of resource efficiency activities has already been implemented within the plant:

- In order to economize cement, which is the main resource of production, cement is transferred from receiving equipment to cement tanks and collection batches using pneumatic conductors.
- In tanks where cement solidifies with help of steam are heat-insulated and has hydraulic locks. These two factors prevent the loss of heat in production process. Since steam generation is the most

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expensive resource of production in the plant, its economy is essential.

- Moreover, steam conductive pipes at boilers are heat – insulated.

Having considered the above factors, the following resource efficient proposals have been developed:

№	Activities	Expected resource economy				
		Annual	In detail			
			I quarter	II quarter	III quarter	IV quarter
1	Mend steam boiler containers and its molds	117.3 thousandm^3 per annum	29.32	29.32	29.32	29.32
2	Mend Steam Boiler № 2 DE	184 thousandm^3 per annum	46	46	46	46
3	Prevent steam loss	12.9 thousandm^3 per annum	3.22	3.22	3.22	3.22

II. Calculations

1. Beams

- Losses at welding process – 9 Gcal / year
- Cracks between the base parts – 420 Gcal / year
- Cracks between formwork and roofm– 45 Gcal / year

2. Bridge foundation

- Cracks between the base parts – 420 Gcal / year
- Cracks between formworkandroof – 45 Gcal / year

Total: 939 420 Gcal / year =117375 m^3 per annum

Before applying resource efficiency measures: 742 m^3 per hour

After applying resource efficiency measures: 700 m^3 per hour

742 –700=42 m^3 per hour natural gas saved

42*12 (m^3) *365 (days)= 183960 42 m3 per year

Total heat loss is calculated using the following formula:

$$Q_{\text{српер}} = N * Q_{\text{ср}}$$

$Q_{\text{српер}}$ 8760*180 thousandKcal/hour = 1577 Gcal

Recovery of steam loss constitutes 6.53% of the total heat loss.

1577Gcal = 103 Gcal/gas

103*125 = 12875 м3gas

III. Conclusion

In the summary it can be said that resource efficiency measures applied at the plant are relatively cost efficient. However, the main disadvantage is that the most equipment at the plant has been operating since it was launched. Technical and technological modernization implemented at the plant is mainly at small equipment pieces, which impedes reduction in production costssignificantly. Employee participation is indispensable in the production process, because plant is not fully automated. This also results in low resource efficiency. Moreover, there are losses in raw materials delivery to the production process. To recoup the losses, current dispensers within the plant have to be updated. In this regard, the plant needs modernization via internal or external investment. Alsoimprovement

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in plants infrastructure and development in raw material delivery system are necessary to accomplish resource efficiency objectives.

Nowadays diversification is the key factor to survive in competitive business environment.Thus, it is necessary to make amendments to product rage which should reflect international standards. Proper marketing campaign cannot be omitted from the list, as it is the main driver of any business. Through acquiring right advertising techniques, number of customers,both local and international, can be increased. The implementation of above mentioned measures may give impetus to the overall plant's development, gain competitive advantage and find its niche in the economy.

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