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Analysis of Quality Control of Moreo Table Products with the Six Sigma Method at PT. X

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ABSTRACT :*The development of the furniture business market which continues to increase exponentially causes the impact of company competition to be higher and sharper. Therefore, business people should pay attention to quality to be more competitive, one of which is by controlling production quality. handling of production quality using the Six Sigma method. Consisting of the Define, Measure, Analyze Improve, Control, (DMAIC) phases in a company engaged in Furniture, namely PT. X which is located in the Tangerang area with the dominant product, namely Table Top.*
After doing the analysis, it is known that the main problem being faced by the company is a break in the cutting process C2 = the release of laminated material, size error, drilling process or table leg connection. with as many as 24000 units, Defect (D) which states the number of defective products that occurred during the observation time as many as 557 units, it is known that for Sigma DPMO = 5800.42 has a Sigma level of 4.02, further analysis and improvement are still needed. Repair). After the cause of the failure of the analysis process, the root of the problem is searched and after the potential failure is identified and the risk value is made, the next process proposal is made.
KEYWORDS *Product quality, Six sigma method, DMAC, DPMO defects, Improve*.

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I. INTRODUCTION

In general, the purpose of a manufacturing industry is to produce goods economically in order to gain profits and to be able to deliver products on time. In addition, the manufacturing industry also wants the production process to continue and develop so that the survival of the company is guaranteed. Now companies are also required to be more competitive so they can compete in seizing the existing market. Therefore, companies must be able to carry out the right business strategy in order to be able to survive in the face of competition

Progress and development of the times change the perspective of consumers in choosing a desired product. Quality becomes very important in choosing a product in addition to competitive price factors. Repair and improvement of product quality with the hope of achieving a product defect rate close to zero defects requires a lot of money[1]. Quality improvement and process improvements to the production system as a whole must be carried out if the company wants to produce good quality products in a relatively short time[2]. A company is said to be qualified if the company has a good production system with controlled processes. Through quality control, it is hoped that the company can increase the effectiveness of controls in preventing defects from occurring, so that waste can be reduced in terms of material and labor which can ultimately increase productivity[3].

In this study, researchers wanted to examine production planning and control at the Furniture Company PT X. which is located at Jl.Otomen 426, Jl.Raya Serang km 5, Jatiuwung Tangerang. Furniture is a primary need that must be consumed by the community, especially in households, offices, hotels, and boarding houses. As a primary need, humans like it or not they have to fulfill it. With the community's demand to meet their growing needs, furniture companies are required to be able to produce in large quantities.

Product manufacturing process activities are adjusted for each customer/customer order (job order)[4]. Of the several products produced by PT X, wardrobe products with various models are favorite designs so that the number of orders is the highest each month when compared to other designs.

From the data obtained by the researchers, currently PT X. Tangerang has a fairly high level of disability, which is 1.5% of the 10,393 units of total product produced on average each month.
To reduce the number of product defects above, it is necessary to carry out a product quality control evaluation to find out whether the current process is in accordance with the correct work method or not. Furthermore, identification of critical factors that influence product quality can be carried out. Therefore, it is necessary to do a process improvement, namely by implementation

Six Sigma with the goal of achieving zero defects (0% defect). Six Sigma is not just an improvement methodology, but a management system that aims to make improvements that benefit all elements of consumers, shareholders and elements of the company itself. Measuring the level of process capability, as well as improvements to achieve near-perfect results. It is hoped that the application of the DMAIC (Define, Measure, Analyze, Improve, Control) cycle can reduce defects that occur in the production process up to 3.4 DPMO (Defects Per Million Opportunity) which will provide a direction for systematic and continuous improvement[5].

II. RESEARCH METHOD

A research variable is an attribute or trait that has certain variations determined by researchers to study and draw conclusions[6]. This study uses 2 types of research variables, namely quality control as the first variable and sub-variables for quality measurement studied, namely attribute measurements used to determine the level of discrepancy that occurs with products produced by the company[7]. Quality control to achieve product quality levels standardized by the company in accordance with the quality guidelines set by the company[3]. This is to achieve, maintain and improve the quality of the company's performance so as to produce a product or service in accordance with the quality objectives set by the company at the beginning of the activity.
Quality control includes 3 (three) stages, namely:
A. Control of raw materials / production materials
B. Control over the ongoing production process
C. Control of finished products before packing

Research Instruments

1. Attribute Quality Measurement

Quality measurements used in implementing quality control in companies are carried out by attribute, namely measuring quality on product characteristics that cannot or are difficult to measure. Later, by using this measurement method, it will be known whether the product quality characteristics are good or bad, successful or failed. The five product characteristics that are considered defective are:

a. Broke in the Cutting process
b. Loose Laminate Material

It is possible for defects that occur in each production result to have not only one type of damage, but can be more than one type. Therefore, the type of damage recorded is the most dominant type of damage found in each product produced.

2 . Population and Sample

The population in this study were Moreo Table products that were damaged/defective during December 2014, an unknown number, namely defective products that were recorded or missed from quality monitoring by the Quality Control department so that they reached consumers. Sampling in this study using purposive sampling technique. Puposive sampling is a sampling technique using certain considerations. The sample used in this research is at PT. X found to be defective and recorded by the Quality Control section.

The research flow framework in problem solving is useful to make it easier to carry out a research activity[8]. The research flow framework in solving problems in this final project is as follows:

a. Conduct a company survey
b. Conducting interviews / interviews
c. Determine the definition of the problem
d. Determine the item / object of research
e. Determine the length of time the research
f. Determine the six sigma method
g. Collect the required data, the intended data is the number of defects in the cable product.
h. Define (causes that become the most potential)
i. Performing measures (conducting statistical quality control)
j. Performing control chart analysis (p.hart)
k. Create a cause and effect diagram

l. Improve (do a plan to improve quality)
m. Control (pressing documentation and disseminating opinions)

III. RESEARCH RESULTS AND DISCUSSION

Stage Definition (Define)

At this stage the goal is to identify problems, define customer specifications, and determine objectives (defect/cost reduction and time targets). There are several steps taken by the author in carrying out this stage including setting consumer requirements, observing the types of defects that occur, determining what types of defects occur by making Pareto Diagrams, making IPO (input-process-output) diagrams, making Process Flow Diagrams.

***Critical to Quality* (CTQ)**

Critical To Quality (CTQ) are all attributes that are very important to pay attention to because they are directly related to consumer needs and satisfaction. CTQ can be in the form of elements of products, processes, or practices that have a direct impact on customer satisfaction.

In the Cutting and Laminating process, the CTQ is determined based on the compatibility between the melamine table top product produced and the specifications provided by the consumer. In this case the consumer will feel dissatisfied if the product he receives does not match the specifications he wants.

Based on the results of the author's observations, it can be seen that the melamine table top with metal produced by the company has a type of non-conformity (defect) as follows:

1. Broke in the Cutting process
2. Loose Laminate Material
3. Size Error
4. Drilling Process or Table Leg Connection.

So it can be stated that the potential CTQ that can lead to failure (a lot of CTQ characteristics) is four.

Determine the amount of DPO (Defect Per Opportunity), DPMO (Defect Per Million Opportunity) and Sigma Level in the Company

During 2014, after examining the moreo table products produced by the company, the total number of defects was 557 out of 24,000 products examined. After the frequency of defects can be identified, DPO (Defect Per Opportunity) and DPMO (Defect Per Million Opportunity) calculations are then performed and the sigma level in the company is used as a performance baseline in a six sigma project.

Table 1. Control chart Sigma Pattern Company Process Product Moreo Table

LOT		Checked (Set)	Cacat (Set)	CTQ	DPMO	SIGMA
Month	Week					
Januari	1	500	12	4	6,000	4.01
	2	500	7	4	3,500	4.20
	3	500	14	4	7,000	3.96
	4	500	10	4	5,000	4.08
Februari	1	500	10	4	5,000	4.08
	2	500	12	4	6,000	4.01
	3	500	15	4	7,500	3.93
	4	500	9	4	4,500	4.11
Maret	1	500	11	4	5,500	4.04
	2	500	8	4	4,000	4.15
	3	500	14	4	7,000	3.96
	4	500	7	4	3,500	4.20
April	1	500	23	4	11,500	3.77
	2	500	12	4	6,000	4.01
	3	500	12	4	6,000	4.01
	4	500	8	4	4,000	4.15
Mei	1	500	13	4	6,500	3.98
	2	500	15	4	7,500	3.93
	3	500	9	4	4,500	4.11

	4	500	11	4	5,500	4.04
Juni	1	500	7	4	3,500	4.20
	2	500	13	4	6,500	3.98
	3	500	4	4	2,000	4.38
	4	500	12	4	6,000	4.01
Juli	1	500	12	4	6,000	4.01
	2	500	15	4	7,500	3.93
	3	500	9	4	4,500	4.11
	4	500	17	4	8,500	3.89
Agustus	1	500	8	4	4,000	4.15
	2	500	11	4	5,500	4.04
	3	500	15	4	7,500	3.93
	4	500	10	4	5,000	4.08
September	1	500	16	4	8,000	3.91
	2	500	14	4	7,000	3.96
	3	500	7	4	3,500	4.20
	4	500	10	4	5,000	4.08
Oktober	1	500	11	4	5,500	4.04
	2	500	11	4	5,500	4.04
	3	500	9	4	4,500	4.11
	4	500	12	4	6,000	4.01
November	1	500	19	4	9,500	3.85
	2	500	14	4	7,000	3.96
	3	500	17	4	8,500	3.89
	4	500	8	4	4,000	4.15
Desember	1	500	8	4	4,000	4.15
	2	500	16	4	8,000	3.91
	3	500	7	4	3,500	4.20
	4	500	13	4	6,500	3.98
Jumlah		**24000**	**557**	**4**	**5802.1**	**4.02**

From the calculation results in Table 1 we can see that the Melamine Table Top (MTT) product process has good process capability. As a performance baseline based on the data in the table above using a DPMO value of 5802.1 and a sigma capability of 4.02 sigma for establish a six sigma project in order to control defect-free products towards zero defects (zero defect oriented). With the current capabilities of the company, it can be said that the company's capabilities are included in the US industry's average capability level (2012), which is 4 sigma. Therefore, the company must make more efforts to improve the company's capabilities to be at the world-class industry average capability.

Based on table 1, a graph of DPMO and sigma capability against time can be made. The following is a graph created based on this data.

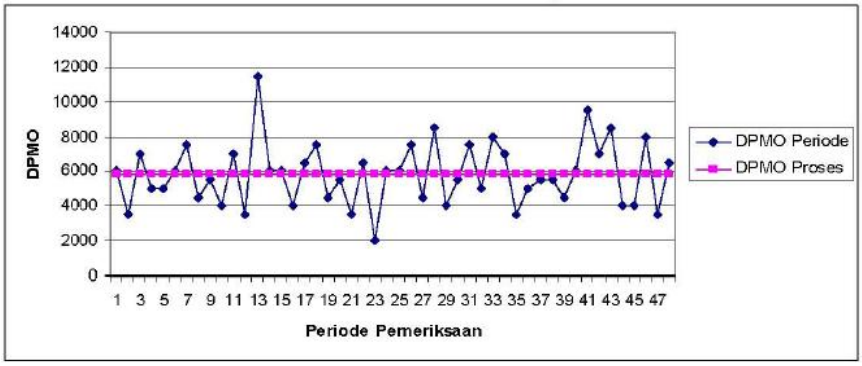


Figure 1. DPMO Pattern Control Chart Product Process Moreo Table

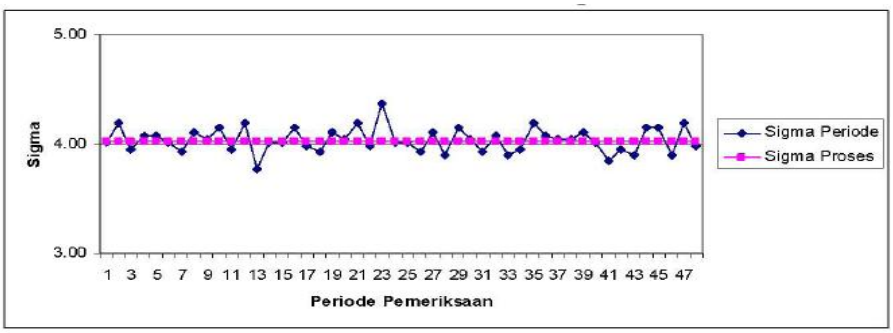


Figure 2. Control chart Sigma Pattern Company Process Product Moreo Table

From Figures 1 and 2 it can be concluded that the DPMO level of the Melamine table top production process produced by the company fluctuates greatly, where there is one point of the highest DPMO, namely the period of the first week of April and one point of the lowest DPMO, namely in the period of the first week of June. third, when viewed from the achievement of the sigma level which is still unstable and still varies throughout the production period, indicating that the process of cutting and laminated products has not been carried out properly, the existing sigma level should have a tendency to increase because this illustrates that there is effort on the part of companies to make continuous improvements to increase the level of sigma or performance capability. If a cutting and laminated process can be controlled, it will show a pattern of DPMO that continues to fall and a pattern of sigma capability that continues to increase all the time.

Analysis

At this stage, the factors that most influence the process are determined, meaning that it is looking for one or two factors which if corrected will affect the production process dramatically. There are several steps that the author takes in carrying out this stage, namely making a Cause-Effect Diagram (fishbone) to show the main factors that influence and have an impact on the main factors.

Cause and effect diagrams are diagrams that are used to analyze problems by looking for the causes of a problem that arises, so that we can see the main factors that influence and have an impact on the problem we are studying.

The following is a causal diagram (fishbone) made based on the author's analysis to determine the main factors that influence defects in the Melamine Table Top production process.

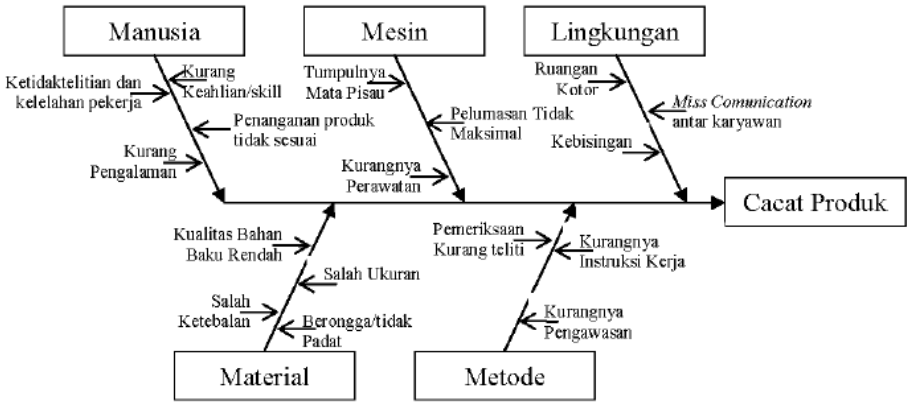


Figure 3. Cause and Effect Diagram (Fishbone) for Production Process Defects

Improvement

At this stage we discuss ideas for improving the work system based on the results of the previous analysis, where the priority in this improvement is to reduce or even eliminate product defects in the cutting and laminated processes, and create an improvement concept, conduct experiments to see the results. Based on the results of the analysis carried out at the analyze stage, the author seeks to make improvements based on factors known as 5M. This is done to increase efforts to prevent the level of defective products, so that it is expected to increase its sigma capability.

The following describes several ways that companies can do to prevent defective products caused by low quality raw materials and auxiliary materials.

1. Size

The size that will be used for the production process is examined by re-measuring the raw materials that will be processed further.

2. Thickness
   Inspection with re-measurement is also carried out on the thickness to comply with the standards applied by the company.
3. Hollow or not solid
   Examination of raw materials that are hollow or not solid needs to be carried out and is an important part of the process of inspecting raw materials so that they comply with the standards applied by the Company.
4. Quality of Auxiliary Ingredients (Incompatible Composition)
   Keeping laminate materials in accordance with company standards.
5. Human
   Labor makes the biggest contribution to the occurrence of product defects. Factors causing product defects originating from this workforce can be done by holding special handling in the form of conducting training and research programs. In addition, companies can handle their workers by placing workers according to the expertise and skills possessed by workers. More stringent supervision of workers who do workers because of their inaccuracies. Then setting more appropriate rest hours is needed to improve discipline.
6. Machine
   The machine needs to be checked periodically in an effort to maintain the condition of the machine so that it can operate normally. Activities that can be carried out in order to prevent product defects caused by machine factors are increasing maintenance by doing periodic lubrication, changing the blades periodically.
7. Method
   The method for controlling in order to prevent product defects is by using a worksheet tool in providing work instructions in the form of work letters (SPK), carrying out tighter supervision of the production process and examining the results of the production process more thoroughly.
8. Environment
   Improving good working conditions and environment for companies can be done by maintaining cleanliness by carrying out routine cleaning, increasing good interaction between employees by holding regular meetings both formal and non-formal, as well as in terms of reducing noise can be done by using a good damper that lasts workers and dampers placed in the factory area.

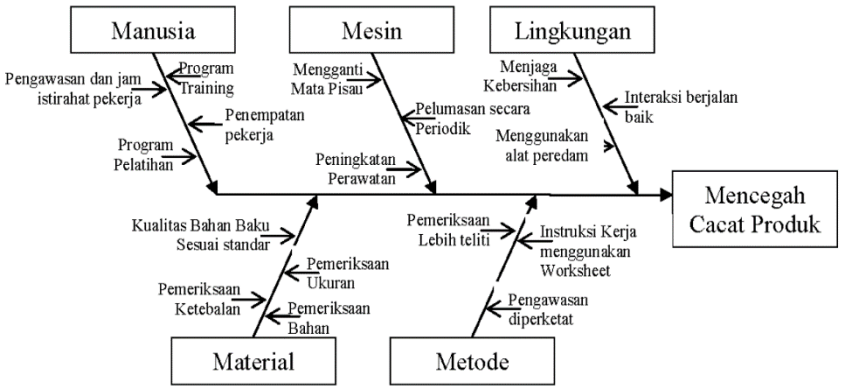


Figure 4. Cause and effect diagram (fishbone) made based on the details above

Control

Based on the results of the previous stage (analyze), it can be seen that the priority in this improvement is reducing or even eliminating defects in the cutting and laminated processes. Therefore, at this stage the company is looking for ways to prevent product defects from occurring in this process. Process to output. In terms of the causes of the problem of the cutting process, it is a cause that cannot be controlled by the company but can be estimated. Therefore, to be able to overcome this, the company made an effort to prevent defects caused in the cutting process by creating a control system for the use of blades and the lubrication process (dies). Control over the use of blades is carried out by replacing them periodically and regularly after the lubrication process is carried out 4 (times) x in 1 (one) day of production. production process for 1 (week) or knife replacement is done once a week.

Improve Production Quality After the Implementation of the Six Sigma Method.

This calculation was carried out by measuring the data on the amount of production, the number of defective products carried out by researchers in the period July and August 2015 for 4 (four) weeks where 2 (two) measurements were taken each week so that the total measurement was 16 measurements, and CTQ (Critical Total Quality) as many as four, namely breaking in the Cutting process, Lamination Material Release, Size Errors and Drilling Processes or Foot Joints.

IV. CONCLUSION

From the calculation above it can be seen that the company's production quality has reached 1625 DPMO or 4.44 sigma. This level of achievement includes achieving very high quality in industrial companies in Indonesia. It can also be seen especially in the 6th and 12th measurements until the company really does not produce defective products (Zero Defect). This means that the improvement steps taken at the improve stage can be one of the factors for achieving Zero Defect, so that product defects in the cutting and laminated processes can be minimized.

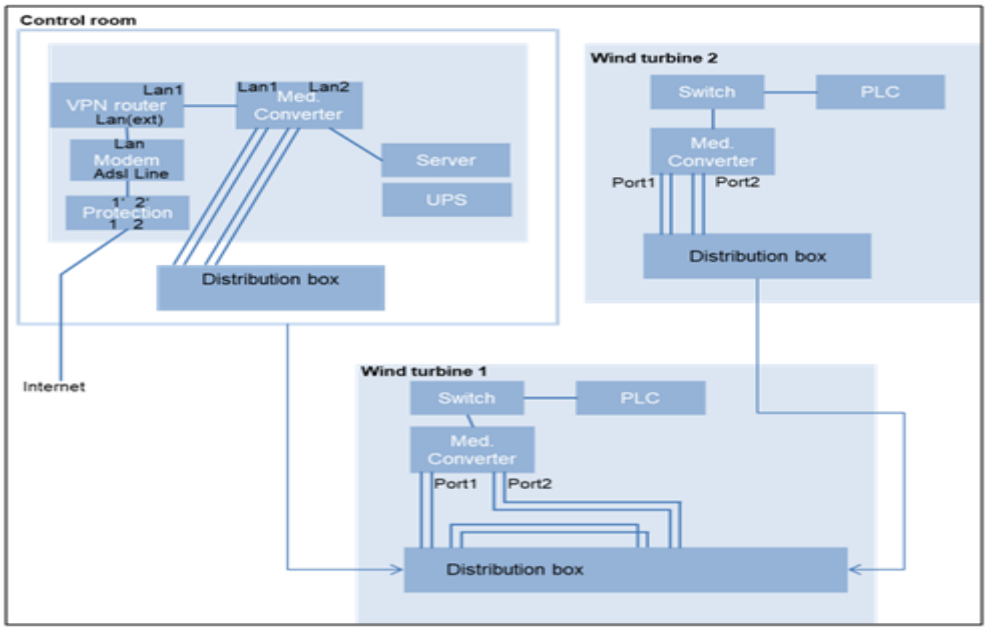
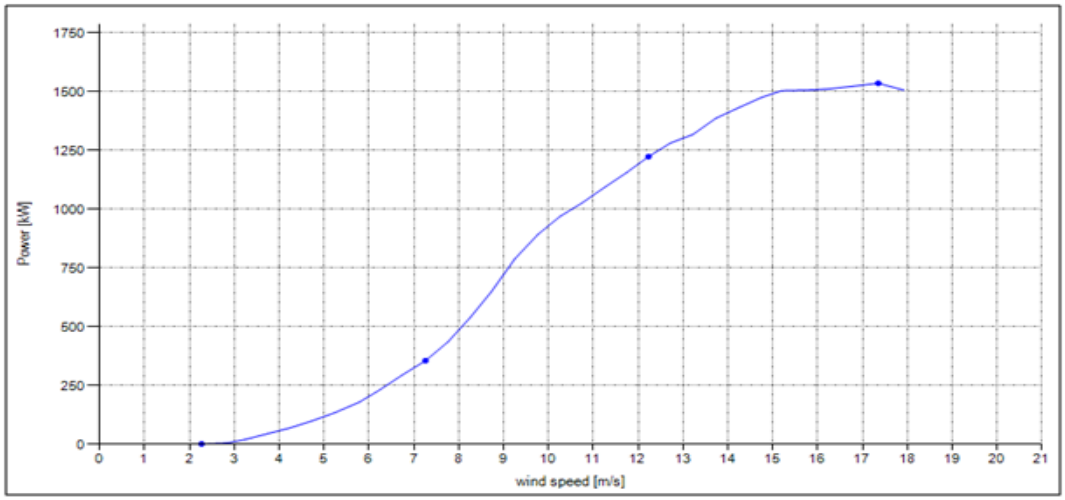


Fig. 6.Wind turbine monitoring system



Power Curve

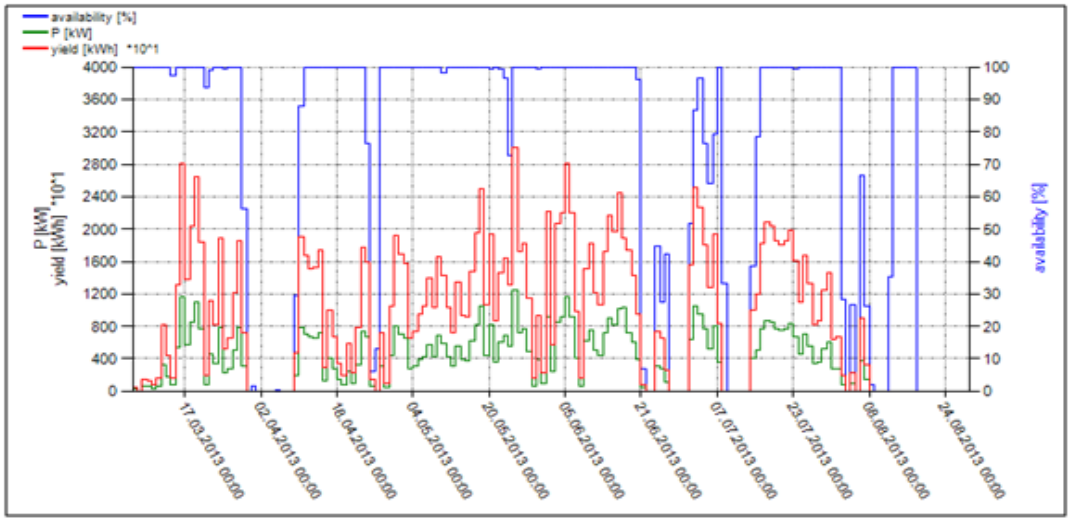


Fig. 7. Wind turbine monitoring system results

V. CONCLUSION

There are many benefits to installing a monitoring system — some of which strongly interrelate with each other. A properly designed and installed monitoring system offers a deeper understanding of the operational parameters of the system. A close appraisal of the data generated by a monitoring system can reveal a variety of overt and subtle opportunities, including:

Environmental —better knowledge of how energy is used allows you to identify an array of prospects to improve efficiencyand reduce energy consumption.

Reliability — assessment of data from the monitoring system can reveal existing or imminent issues that can adversely affect the operation and product within a facility. Historical data from monitoring systems can help locate and correct both acute and chronic problems, resulting in increased productivity.

Maintenance — Data trends can forecast and notify the appropriate people when discrete equipment parameters may be exceeded, allowing you to plan ahead instead of facing an unscheduled shutdown.

Financial — each benefit discussed above either directly or indirectly influences a business's bottom line. In most cases, the monetary impact from even one or two benefits can quickly justify the purchase and installation of a monitoring system.

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