

ABSTARK

Benhard Oloan Tua Simanjuntak : Usulan Perbaikan Tingkat Efektivitas Mesin Stringer Dengan Menggunakan Metode *Overall Equipment Effectiveness* (OEE) Dan SHERPA (Studi kasus : PT. Len Industri (Persero)Bandung, Jawa Barat)

PT Len Industri (Persero) bagian produksi modul surya merupakan perusahaan manufaktur yang telah mengembangkan bisnis dan produk-produk Modul Surya yang telah terpasang di berbagai pelosok Indonesia. Pada proses pembuatan modul surya mengalami masalah pada mesin yang digunakan dimana memiliki tingkat downtime tinggi sehingga mengakibatkan terganggunya proses produksi. Maka dari itu perlu adanya analisis mengenai tingkat efektivitas mesin yang bertujuan untuk mengetahui kinerja produksi dan mengidentifikasi terhadap permasalahan yang terjadi dan faktor-faktor terjadinya permasalahan sehingga usaha perbaikan terfokus dengan menggunakan metode *Overall Equipment Effectiveness* (OEE) dan *Systematic Human Error Reduction and Prediction Approach* (SHERPA). Hasil penelitian didapatkan rata-rata nilai OEE pada mesin stringer sebesar 65%. Dan faktor *six big losses* yang memengaruhi adalah *reduced speed losses* dengan nilai presentase sebesar 59% diikuti nilai presentase *idle minor stoppage losses* sebesar 18%, nilai presentase *setup and adjusment losses* sebesar 17%, nilai *equipment failure losses* sebesar 3% dan nilai *deffect losses* sebesar 3%. Dan usulan perbaikan dengan menggunakan metode SHERPA adalah selalu memeriksa secara rutin kesiapan setiap alat dan komponen penunjang pada mesin stringer saat akan melakukan produksi. Serta secara bersama-sama staff dan operator menjaga, memelihara dan merawat mesin stringer guna terus dapat meningkatkan efektivitas mesin dan dapat mengurangi faktor penyebab *losses*.

Kata Kunci: *Overall Equipment Effectiveness* (OEE), *Six Big Losses*, *Systematic Human Error Reduction and Prediction Approach* (SHERPA), *Human Error*.

ABSTRACT

Benhard Oloan Tua Simanjuntak: Proposed Improvement of the Effectiveness of Stringer Machines Using the Overall Equipment Effectiveness (OEE) and SHERPA Method (Case Study: PT. Len Industri (Persero) Bandung, West Java)

PT Len Industri (Persero) solar module production section is a manufacturing company that has developed the business and Solar Module products that have been installed in various parts of Indonesia. In the process of making solar modules, there are problems with the machines used which have a high level of downtime, resulting in disruption of the production process. Therefore it is necessary to have an analysis of the level of effectiveness of the machine which aims to determine the performance of production and identify the problems that occur and the factors causing problems so that the improvement effort is focused using the Overall Equipment Effectiveness (OEE) method and Systematic Human Error Reduction and Prediction Approach (SHERPA). The results obtained an average OEE value on the stringing machine by 65%. And the six big losses factors that influence are reduced speed losses with a percentage value of 59%, followed by the percentage value of idle minor stoppage losses of 18%, the percentage of setup and adjustment losses of 17%, the value of equipment failure losses of 3% and the value of the effect losses of 3%. And the proposed improvement using the SHERPA method is to always routinely check the readiness of each tool and supporting components on the stringer machine when it will do production. And together staff and operators maintain, maintain and care for the engine stringers in order to continue to improve the effectiveness of the engine and can reduce the factors causing losses.

Keywords: Overall Equipment Effectiveness (OEE), Six Big Losses, Systematic Human Error Reduction and Prediction Approach (SHERPA), Human Error.

DAFTAR ISI

LEMBAR PERNYATAAN	ii
LEMBAR PENGESAHAN	iii
KATA PENGANTAR	iv
ABSTARK	vi
<i>ABSTRACT</i>	vii
DAFTAR ISI	viii
DAFTAR TABEL	xi
DAFTAR GAMBAR	xiii
BAB 1	1
PENDAHULUAN	1
1.1 Latar Belakang	1
1.2 Rumusan Masalah	3
1.3 Tujuan Penelitian	3
1.4 Batasan Masalah	4
1.5 Asumsi Penelitian	4
1.6 Manfaat Penelitian	4
1.7 Sistematika Penulisan	5
BAB II	6
TINJAUAN PUSTAKA	6
2.1 Produktivitas	6
2.2 <i>Total Productive Maintenance (TPM)</i>	6
2.2.1 Tujuan <i>Total Productive Maintenance (TPM)</i>	7
2.3 <i>Overall Equipment Effectiveness (OEE)</i>	7
2.3.1 Pengukuran Nilai <i>Overall Equipment Effectiveness (OEE)</i>	8
2.3.1.1 Availability Rate	8
2.3.1.2 Performance Rate	8
2.3.1.3 Quality Rate	9
2.4 <i>Six Big Losses</i>	9
2.5 Diagram Pareto	11

2.6 Diagram Sebab- Akibat (<i>Fishbone Diagram</i>)	11
2.7 <i>Systematic Human Error Reduction and Prediction Approach</i> (SHERPA) 13	
2.8 Penelitian Terdahulu.....	15
BAB III	17
METODOLOGI PENELITIAN.....	17
3.1 Jenis Penelitian	17
3.2 Jenis Data	17
3.3 Waktu dan Objek Penelitian.....	18
3.3.1 Waktu Penelitian.....	18
3.3.2 Objek Penelitian.....	19
3.4 Tahapan Penelitian	19
3.4.1 Tahap Pengambilan Data	19
3.4.2 Tahap Prosedur Penelitian	21
3.4.3 Tahap Analisis Data.....	22
3.5 Peralatan yang digunakan dalam Penelitian	23
3.6 <i>Flowchart</i> Penelitian	23
BAB IV	26
HASIL DAN PEMBAHASAN.....	26
4.1 Gambaran Umum Perusahaan	26
4.1.1 Profil Perusahaan	26
4.1.2 Visi dan Misi Perusahaan	26
4.1.3 Produk yang dihasilkan.....	27
4.1.4 Struktur Organisasi	28
4.1.5 Proses Produksi.....	31
4.2 Pengumpulan Data	32
4.2.1 Data Jam Kerja.....	32
4.2.2 Data <i>Downtime</i>	34
4.2.3 Data Produksi.....	36
4.3 Perhitungan nilai OEE (<i>Overall Equipment Effectiveness</i>).....	37
4.3.1 <i>Availability Rate</i>	37
4.3.2 <i>Performance Rate</i>	41

4.3.3 <i>Quality Rate</i>	44
4.3.4 <i>OEE (Overall Equipment Effectiveness)</i>	45
4.4 <i>Perhitungan Six Big Losses</i>	46
4.4.1 <i>Equipment Failure Losses</i>	46
4.4.2 <i>Setup And Adjustment Losses</i>	47
4.4.3 <i>Idle Minor Stoppage Losses</i>	50
4.4.4 <i>Reduce Speed Losses</i>	52
4.4.5 <i>Defect Losses</i>	54
4.4.6 <i>Reduced Yield</i>	56
4.4.7 <i>Akumulasi Six Big Losses</i>	57
4.5 <i>Analisis Fishbone</i>	58
4.5.1 <i>Diagram Fishbone Equipment Failure Losses</i>	59
4.5.2 <i>Diagram Fishbone SetUp and Adjustment Losses</i>	60
4.5.3 <i>Diagram Fishbone Idle and Minor Stoppage Losses</i>	62
4.5.4 <i>Diagram Fishbone Reduced Speed Losses</i>	64
4.5.5 <i>Diagram Fishbone Deffect Losses</i>	66
4.5.6 <i>Rekapitulasi Fishbone Six Big Lossses</i>	67
4.6 <i>Rekomendasi Perbaikan Dengan Metode SHERPA</i>	69
4.6.1 <i>Deskripsi Operation Process Chart</i>	69
4.6.2 <i>Identifikasi Hirarchical Task Analysis (HTA) Mesin Stringer</i>	70
4.6.3 <i>Identifikasi Human Error dengan Menggunakan SHERPA</i>	73
4.6.4 <i>Analisis SHERPA dan Usulan Strategi Perbaikan Human Error</i>	74
4.7 <i>Pembahasan Dan Diskusi</i>	78
BAB V.....	80
KESIMPULAN DAN SARAN.....	80
5.1 <i>Kesimpulan</i>	80
5.2 <i>Saran</i>	81
DAFTAR PUSTAKA	82

DAFTAR TABEL

Tabel 2.1 Penelitian Terdahulu	15
Tabel 3.2 <i>Gantt Chart</i> Penelitian	19
Tabel 4.3 Data Jam Kerja.....	33
Tabel 4.4 Data <i>Downtime</i>	34
Tabel 4.5 Data Hasil Produksi	37
Tabel 4.6 Data <i>Planned Downtime</i>	38
Tabel 4.7 Data <i>Loading Time</i>	38
Tabel 4.8 Data <i>Availability Losses Time</i>	39
Tabel 4.9 Data <i>Operation Time</i>	39
Tabel 4.10 Data <i>Availability Rate</i>	40
Tabel 4.11 Data <i>Performance Losses</i>	41
Tabel 4.12 Data <i>Operation Time Performance</i>	42
Tabel 4.13 Data <i>Performance Rate</i>	43
Tabel 4.14 Data <i>Quality Rate</i>	44
Tabel 4.15 Data Nilai OEE Mesin Stringer	45
Tabel 4.16 Data <i>Equipment Losses</i>	47
Tabel 4.17 Data <i>Setup And Adjustment Losses</i>	48
Tabel 4.18 Data <i>Setup And Adjustment Losses</i>	50
Tabel 4.19 Data <i>Idle Minor Stoppage Losses</i>	51
Tabel 4.20 Data <i>Idle Minor Stoppage Losses</i>	52
Tabel 4.21 Data <i>Reduce Speed Losses</i>	53
Tabel 4.22 Data <i>Reduce Speed Losses</i>	54
Tabel 4.23 Data <i>Defect Losses</i>	55
Tabel 4.24 Data <i>Defect Losses</i>	55
Tabel 4.25 Data <i>Reduced yield</i>	56
Tabel 4.26 Hasil Kumulatif <i>Six Big Losses</i>	57
Tabel 4.27 Rekapitulasi <i>Six Big Losses</i> Mesin Stringer	68
Tabel 4.28 Probabilitas <i>Error</i> Proses Produksi PV Cell	74
Tabel 4.29 Analisis SHERPA dan Strategi Perbaikan <i>Human Error</i>	75

Tabel 4.30 Strategi Perbaikan <i>Task</i> Menggunakan APD.....	76
Tabel 4.31 Strategi Perbaikan <i>Task</i> Memeriksa Perlengkapan Alat.....	77
Tabel 4.32 Strategi Perbaikan <i>Task</i> Menyalakan Mesin Stringer	77
Tabel 4.33 Strategi Perbaikan <i>Task Setting</i> Mesin Stringer.....	77
Tabel 4.34 Strategi Perbaikan <i>Task</i> Proses Stringer Welding.....	78
Tabel 4.35 Strategi Perbaikan <i>Task</i> Proses <i>Inspection</i> PV Cell.....	78

DAFTAR GAMBAR

Gambar 1.1 Data Hasil <i>Output-Reject</i> Mesin Stringer.....	2
Gambar 2.2 Bentuk Umum Diagram Sebab-Akibat	12
Gambar 2.3 Tabel <i>Mode Error</i> dalam SHERPA	14
Gambar 3.4 <i>Flowchart</i> Penelitian	24
Gambar 3.5 <i>Flowchart</i> Penelitian	25
Gambar 4.6 Logo PT. Len Industri (Persero)	27
Gambar 4.7 Modul Surya Type 200 Wp <i>Monocrystalline</i>	28
Gambar 4.8 Struktur Organisasi PT. Len Industri (Persero).....	29
Gambar 4.9 Diagram Pareto <i>Six Big Losses</i> Mesin Stringer.....	58
Gambar 4.10 Diagram <i>Fishbone Equipment Failure Losses</i>	59
Gambar 4.11 Diagram <i>Fishbone SetUp and Adjustmnet Losses</i>	61
Gambar 4.12 Diagram <i>Fishbone Idling Minor Stoppage Losses</i>	63
Gambar 4.13 Diagram <i>Fishbone Reduced Speed Losses</i>	64
Gambar 4.14 Diagram <i>Fishbone Deffect Losses</i>	66
Gambar 4.15 <i>Operation Process Chart</i> mesin stringer.....	69
Gambar 4.16 <i>Hirarchical Task Analysis</i> (HTA) Proses Produksi PV Cell Mesin Stringer.....	71