Seminar PROMEEC - on Energy Efficiency and Conservation for Industries
EE Improvement Case Studies in Steel Industries

Ghazali Talib
Principal Engineer
Pusat Tenaga Malaysia

Thailand
17 November 2006

Outline

1. **Background**
2. **EE Best Practices Implemented**
   - **Company Profile**
   - **Project Main Areas Investigated**
   - **Potential Energy Savings (No, Low Cost)**
   - **Future Projects (High Cost)**

BACKGROUND

THE MALAYSIAN INDUSTRIAL ENERGY EFFICIENCY IMPROVEMENT PROJECT (MIEEIP)

The MIEEIP is a project which is jointly funded by the Government of Malaysia, the Global Environment Facility (GEF), the United Nations Development Program (UNDP) and the Malaysian private sector. The Ministry of Energy, Water and Communications is the executing agency for the project and Pusat Tenaga Malaysia is the implementing agency

MIEEIP OBJECTIVES

he MIEEIP was developed to improve energy efficiency (EE) in Malaysia's ndustrial sector by removing barriers to efficient industrial energy use.

he *objectives* of the MIEEIP are: -

- **To implement and demonstrate the effectiveness of energy saving technologies together with the financial incentives.**
- **To provide skilled energy audit and engineering services, project financing, training and information to plant managers and operators.**
- **To implement energy efficiency program by strengthening the institutional capacity for energy program design and implementation, monitoring and evaluation.**
- **To build the capacities of PTM and other existing organizations in order to provide energy management advisory services, and energy engineering and services.**
- **To create sustainable follow-up program after the completion of the project that will build on the achievements and experiences gained, and where necessary, improve the activities and deliverables.**

OBJECTIVES ENERGY TECHNOLOGY DEMONSTRATION PROGRAM (ETDP)

- To replicate the demonstrated energy efficiency technologies in other industrial facilities
- To demonstrate the applicability and feasibility (technical and economic) of proven energy efficiency technologies
- Able to realize an energy cost savings of 10% or more
- To document and disseminate information on the applications and benefits of energy efficiency technologies in local industry settings
- To provide the technical and financial assistance to industrial energy users

STAGES OF ETDP PROJECT IMPLEMENTATION

Malaysia Energy Centre

Select Projects & Host Sites

Show of interest by host sites

- Host commits interest to MIEEIP by signing an MoA with PTM
- PTM/MIEEIP team conduct energy audit and/or pre-feasibility studies and investment grade audit (IGA)
- Project cost > RM500K and justify 10% cost savings

- *Groundwork by MIEEIP team*
- *50% financing of project up to RM1.4million*

Conduct Investment Grade Audit (IGA)

INVESTMENT GRADE AUDIT (IGA)

Detailed Audit

- Description of existing plant
- Establish baseline
- Energy consumption & cost
- O & M cost
- Cost savings
- Technical & financial analysis including assessment of risk

Conceptual Design

- Detail description and conceptual design of the demonstration project

- *IGA will be carried out by MIEEIP project team in collaboration with the host*
- *MIEEIP engaged local and international consultants and experts for the execution of this work*
- *Consensus on IGA report with Host*

Project Implementation, Installation, Testing & Commissioning

Implementation, Installation, Testing & Commissioning

- Engineering design and specification
- Prepare tender documents and floating of tenders
- Project planning and execution
- Budget/payment plan
- Price scheduling for variation works

- *To be carried by Host company*
- *Upon request from the Host the MIEEIP team will provide technical advise during this phase*

Monitoring & Verification

Performance monitoring & evaluation

- MIEEIP & the host will come up with a monitoring plan
- Performance evaluation to be carried out on a regular basis

- *Will be carried out until the investment cost is recovered by the MIEEIP team in collaboration with the Host*

(11/17

Pusat Tenaga Malay

ETDP PROJECT TEAM

- Chief technical coordinator (PTM)
- Factrory management (Factory)
- Project Manager (PTM/Factory)

Overall co-ordination and support

PTM Team

- Task manager and coordinator (PTM)
- MIEEIP project team (PTM)
- International consultants (PTM/Fichtner)

Factory Team

- Energy manager or counterpart
- Chief engineer (case by case)
- Engineers & Technicians

Auditing Process

PREPARATION
Marketing, Kick-off meeting, Walk-through and Documentation Study

ON-SITE ACTIVITIES
-Data verification thru discussions and field study/measurements
- Discussions of findings

ANALYSIS AND REPORT WRITING
-Macro and micro analysis of the collected and measured data
-Preparation of a draft report

PRESENTATION
-Draft report presentation and discussion

REPORT REVIEW (By Factory)
-Factory shall review the presented report for any comment

FINALIZATION OF REPORT
-Factory reply the comment or consent about the report
-Production of final report

IMPLEMENTATION & FOLLOW-UP
-Factory implement energy savings ideas
-Report the outcome to PTM

THE EE BEST PRACTICES IMPLEMENTED

COMPANY PROFILE

1961 – Malayawata was incorporated as a private limited company, the result of a Malaysian-Japanese joint venture. Malayawata, coined from the word `Malaya' and `Yawata', became the first integrated steel mill in Malaysia as well as South East Asia.

Today – Listed in KLSE

- 1 Electrical Arc Furnace Steel Making Plant annual capacity of 700,000 tons/year
- 3 Rolling Mills with the capacity of 550,000 tons/year
- Electricity bill amounted to RM 6 million monthly

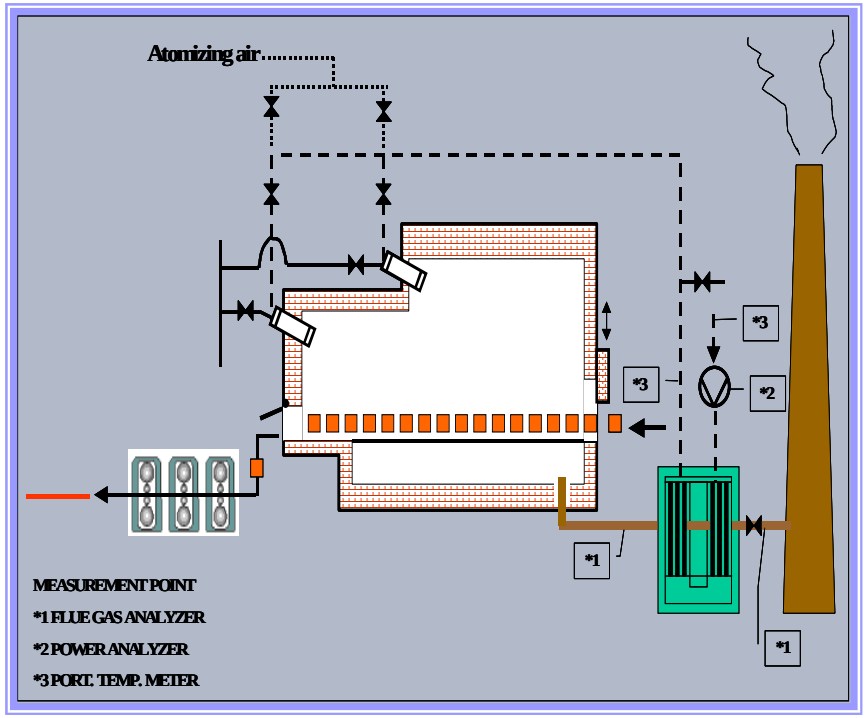

MALAYAWATA
STEEL BERHAD
Scrap Receiving Preparation
Scrap Charging
Scrap Bucket Loading
DC Arc Furnace
Tapping
Billet
Reheating Furnace
Rolling
Laying
Wire Rod
Deformed Bar
Flat Bar
Angle Bar
Round Bar
Ladle Furnace
Continuous Casting Machine
Process Flowchart

Main areas investigated

- Furnace (Reheat, Induction, EAF)
- Compressed Air System
- Boiler & Steam System
- Electricity Supply & Consumption
- Cooling water system

Observation

- The Reheating furnace have low combustion efficiency (might due to sulphur deposit, design of the recuperator does not allow it to reach higher eff. – one stage), furnace in-leakages, excess air adjustment is done by the operator by monitoring the smoke coming out from the furnace inlet door.
- Compressed air system- no integration on piping line, old piston type, air leakages
- Cooling water pump- quenching system cooling water were controlled manually by throttling valve.



Parameter	Place	Item	Unit	Control room	Audit measure-ment	Calculate figures
Billet 100x100x3040 weight 240,21kg	output	pieces	1/h		64	
		weight	t/h		15,4	
		heat	GJ/h		7,3	
Combustion air temperature	before recuperator		^{0}C		30,8	
	after recuperator		^{0}C		283	
Flue gas	waste gas		^{0}C	664		
	before recuperator		^{0}C		701,6	
	after recuperator		^{0}C		539,6	
Flue gas analysis	before recuperator	O_2	%		7,5	
		CO_2	%		9,9	
		CO	ppm		2	
	after recuperator	O_2	%		10,7	
		CO_2	%		7,6	
		CO	ppm		6	
Combustion in zones	heating zone	combustion air flow	Nm3/hr	75		
		fuel flow	l/hr	289		
		temperature	^{0}C	1153		
	soaking zone	fuel flow	l/hr	354		
		temperature	^{0}C	1334		
Temperatures analysis	recuperator	gas/air average Dt	^{0}C			4
		Pinch point	^{0}C			2
Recuperator internal leakage	before recuperator	air excess	1			
	after recuperator	air excess	1			
Operating hours			h/yr			80
Fuel input	into furnace		GJ/h			24
			%			1
Heat losses	flue gas		%			
	incomplete combust.		%			0,0
	furnace	other losses	%			
Heat output	after furnace	billet sensible heat	%			
Net furnace efficiency			**%**			

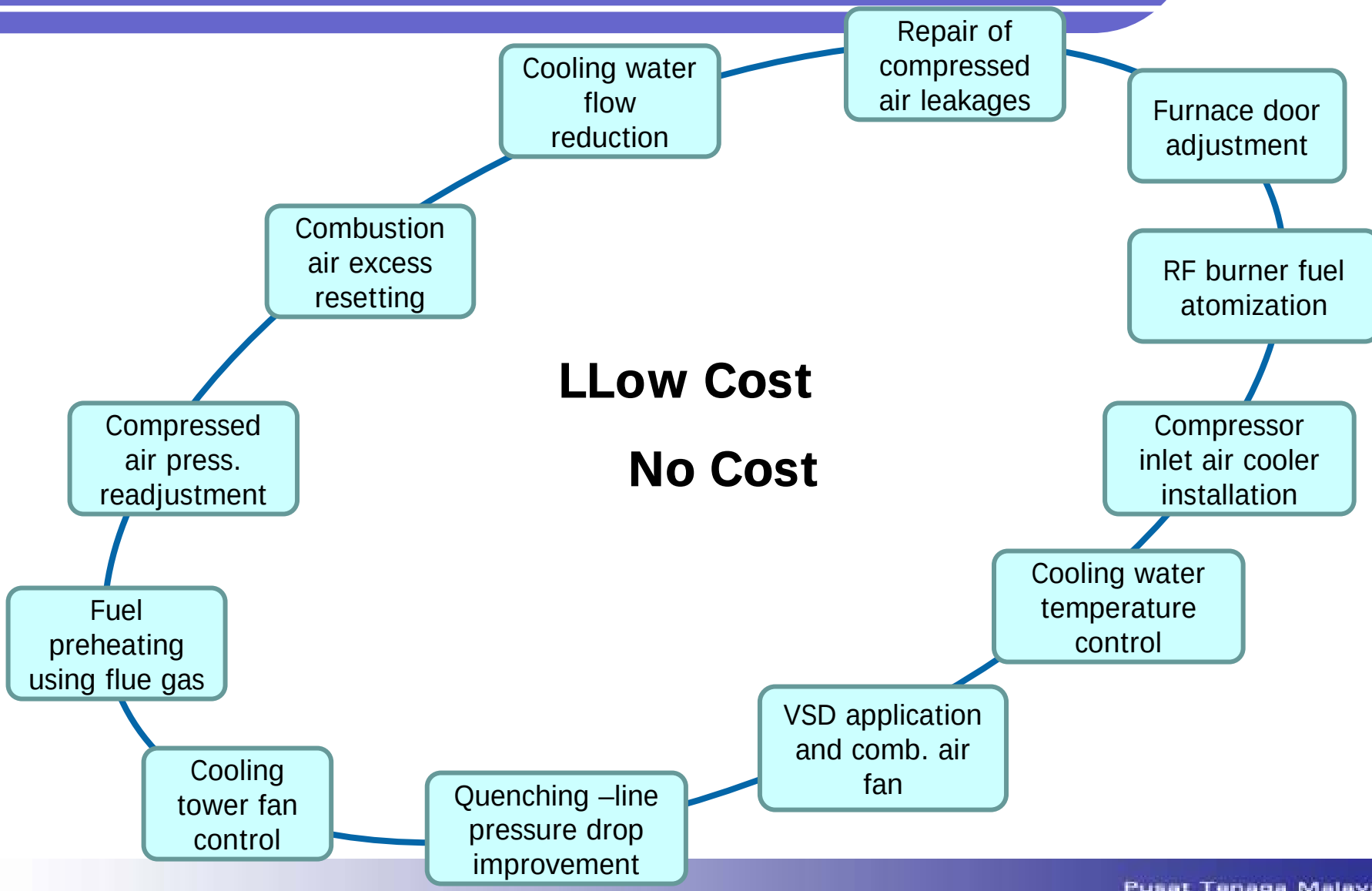
Based on measurements taken on 3.10.2000 from 4.05 p.m to 6.05 p.m.

Compressor Station-installed with two stations supplying for RM and RF respectively. Leakage test and load test were conducted at these stations.

- Possibility of integrating these two distribution system together.
- A fair amount of air leakages is occurred.

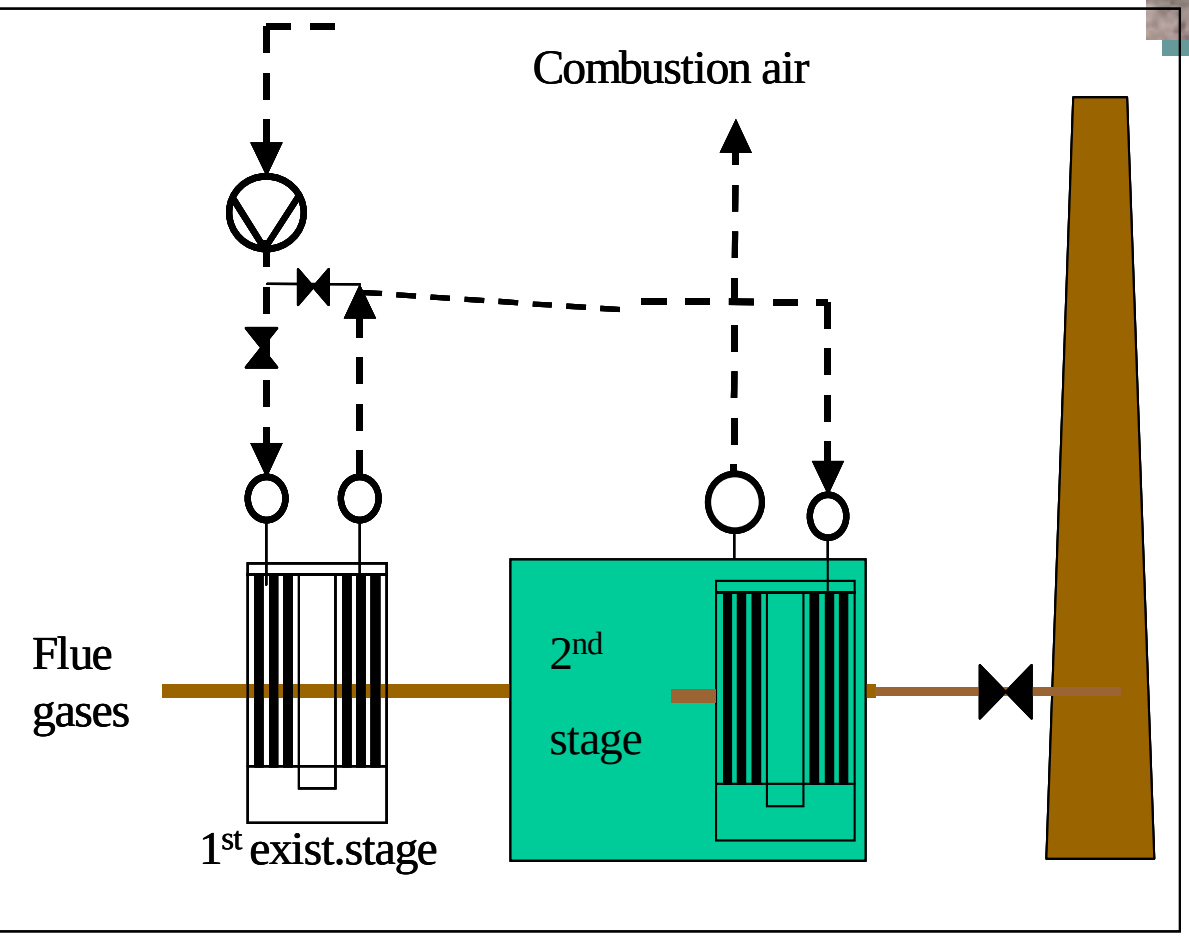
Item	Parameter		Unit	Common air system	RM air system				Furnace air system		
					air system	Compressor No			air syst.	Compres. No	
						1	2	3		1	2
Plate reading	Flow rate		m3/h							894	720
	Rated pressure		barg			7	7	7		7	7
	Compressor power		kW			75	75	75		75	75
	Motor		kW			78	78	78		78	78
Measured compressor capacity	Pressure adjusted	max	barg				2	4		2,9	2
		min	barg				6	6		5,7	5
	Air flow		m3/h							0,35	
	Power	oper.	kW			49,1				54,4	69
		idle	kW			28				17,6	28
Actual system	Total air consumpt.		m3/h	0,23	0,18			0,18	0,05	0,05	
	Leakage		m3/h								
	Effective (Tot.-leak.)		m3/h								
	Pressure variation	max	barg				6,4	6,5			
		min	barg				5,8	5			
	% of time	operation	%				54	72		50	47
		idling	%				46	28		50	53
	Electricity consumpt.		kWh/h				39,4	43,2		36,2	47
	Operating hours		h/yr	8016					8520		

POTENTIAL ENERGY SAVINGS MEASURES



POTENTIAL ENERGY SAVINGS MEASURES

RM1-RF two stage recuperator installation



Annual Potential Savings

Fuel : 452 ton

Amount : RM 213 000

Capital Expenditure

RM 400 000

Payback Period

1.9 YEAR

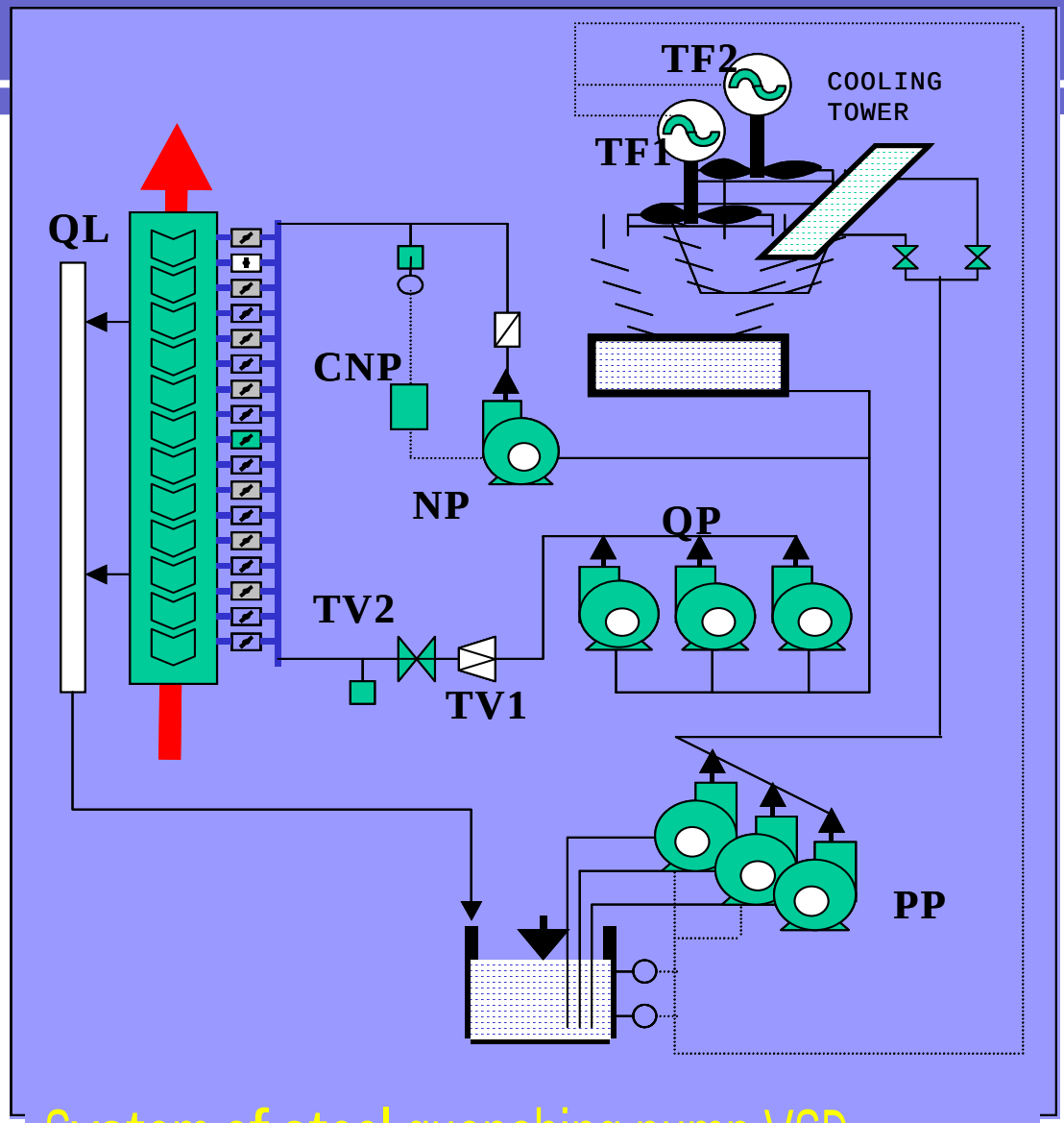
POWER CALCULATION BETWEEN PISTON & SCREW TYPE COMPRESSORS BASED ON REQUIREMENT OF 1570 M^3/hr

	Piston Type	Screw Type
Capacity	= 1860m^3/hr (31m^3/min)	1968m^3/hr (32.8m^3/min)
Capacity After Correction	1860m^3/hr x 70% = 1302m^3/hr (21.7m^3/min)	1968m^3/hr (32.8m^3/min)
Total Power	250 KW	209.8KW
Specific Power	250 ÷ 1302 = 0.192 KWH/m^3	209.8 ÷ 1968 = 0.106 KWH/m^3
Produce 1570m^3/hr	0.192 x 1570 = 301.44 KW	0.106 x 1570 = 166.42 KW

VSD For Rolling Mill Cooling Water Pump Process

- The System is designed to control the water flow.
- The existing drive to run 160KW pump at its fixed speed consumes 160KW of energy.
- Used the throttle valve to control water flow.
- VSD shall be able to reduce 20% of its rated speed by fully open the throttle valve to maintain the required flow rate.

POTENTIAL ENERGY SAVINGS MEASURES



System of steel quenching pump VSD

Rolling Mill Bar Quenching Pump Process Of VSD Result

Before Installation of VSD					After Installation of VSD			
No.	Date	Time	Power (KW)	Running Amp.(A)	Date	Time	Power (KW)	Running Amp.(A)
1	11/10/2003	10:40:30	159.00	241	2/7/2004	15:44:17	120.90	201
2	11/10/2003	12:40:30	165.60	246	2/7/2004	19:44:17	120.90	201
3	11/10/2003	13:40:30	165.60	251	2/7/2004	21:44:17	120.80	200
4	11/10/2003	14:40:30	164.70	245	2/7/2004	23:44:17	120.80	199
5	11/10/2003	15:40:30	165.00	248	2/8/2004	2:44:17	120.50	197
6	11/10/2003	17:40:30	165.30	248	2/8/2004	5:44:17	120.50	199
7	11/10/2003	19:40:30	158.10	238	2/8/2004	8:44:17	120.50	203
8	11/10/2003	20:40:30	157.50	249	2/8/2004	9:44:17	119.80	197
9	11/10/2003	21:40:30	158.40	248	2/8/2004	10:44:17	120.40	198
10	11/10/2003	22:40:30	153.00	235	2/8/2004	13:44:17	121.70	199
11	11/10/2003	23:40:30	157.80	247	2/8/2004	14:44:17	120.70	200
12	11/11/2003	2:40:30	158.40	247	2/8/2004	17:44:17	120.60	197
13	11/11/2003	3:40:30	158.10	247	2/8/2004	19:44:17	120.40	197
14	11/11/2003	7:40:30	157.50	246	2/8/2004	22:44:17	120.50	199
15	11/11/2003	9:40:30	163.20	251	2/9/2004	1:44:17	120.80	199
16	11/11/2003	10:40:30	162.600	249	2/9/2004		120.40	197
Total Power			2569.80				1930.20	
Average Power			**160.61**				**120.63**	

With VSD Achieved 25% SAVING of POWER

Saving per day = 25% of 160 KW x 24 hours
= 960 KWH

Electricity cost per KWH = RM 0.17

Therefore saving per day = RM 0.17 x 960
= RM 163.20

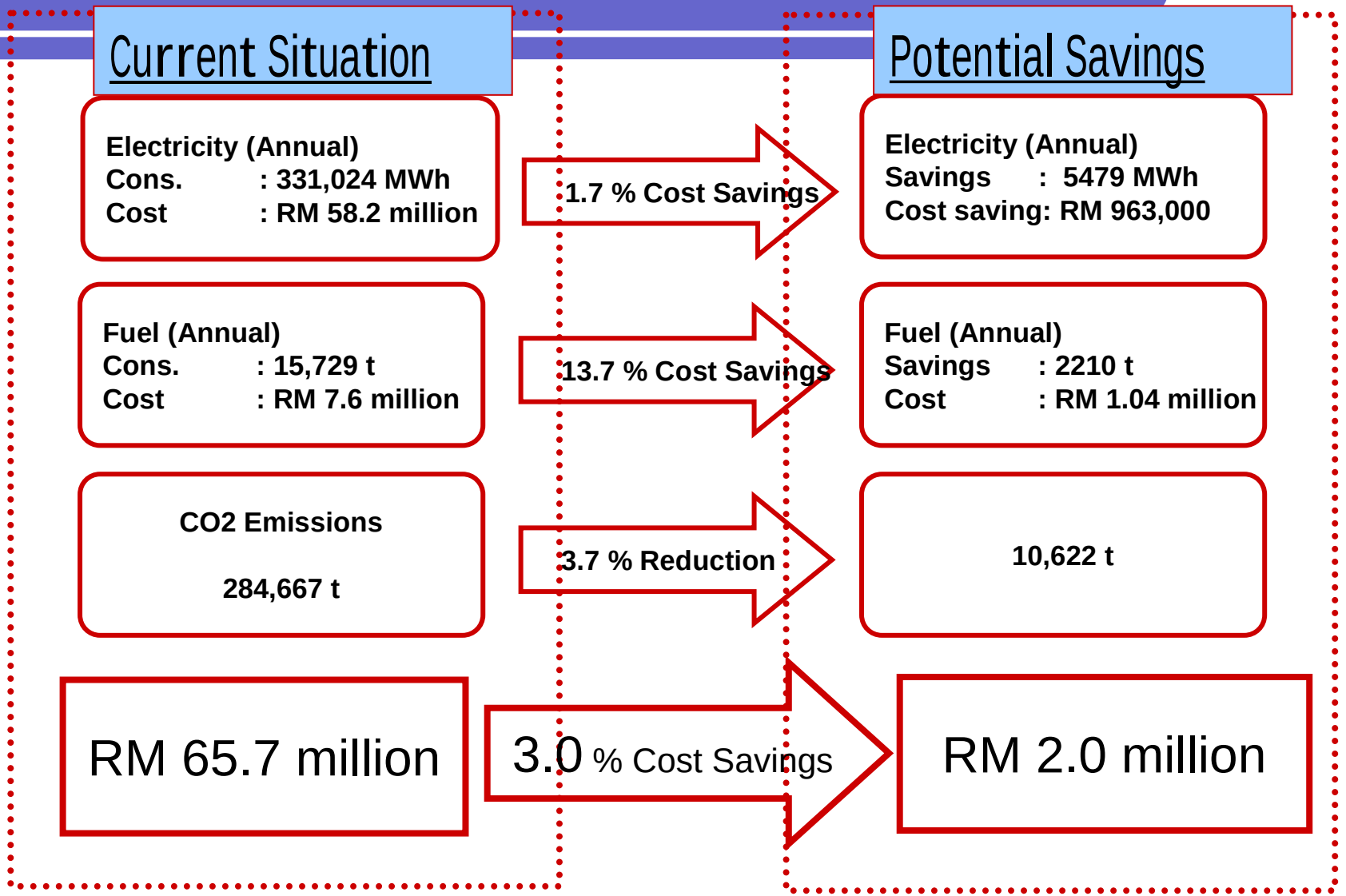
Saving per month (26 days operating) = RM 163.20 x 26
= **RM 4,243.20**

Saving per year = RM 4,243.20 x 12
= **RM 50,918.40**

Initial investment = RM 60,000.00

Pay back period = RM 60,000.00
RM 50,918.40
= **1.18 Year**.

SUMMARY OF SAVINGS



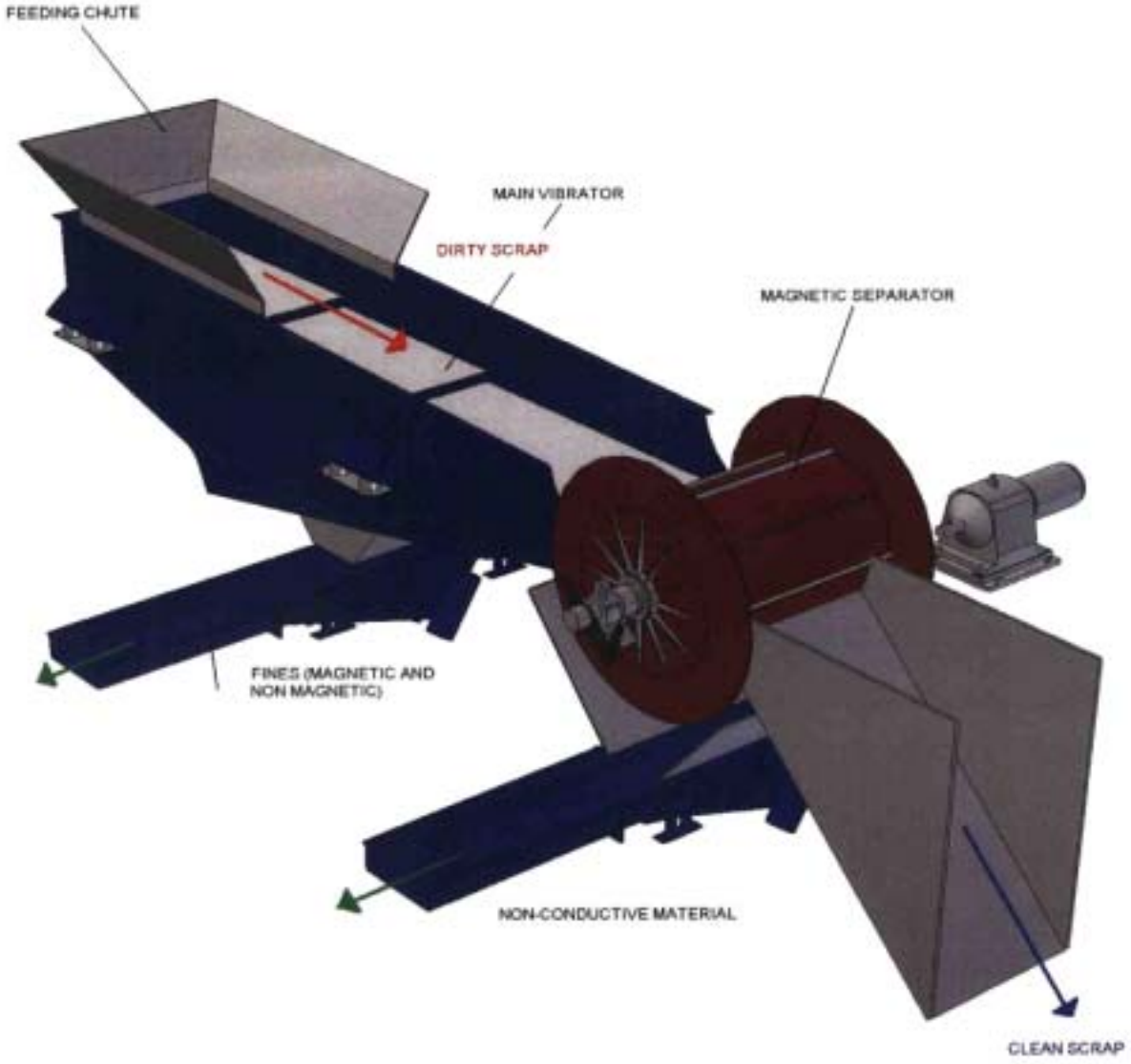
THE FUTURE PROJECT

High Cost Measure

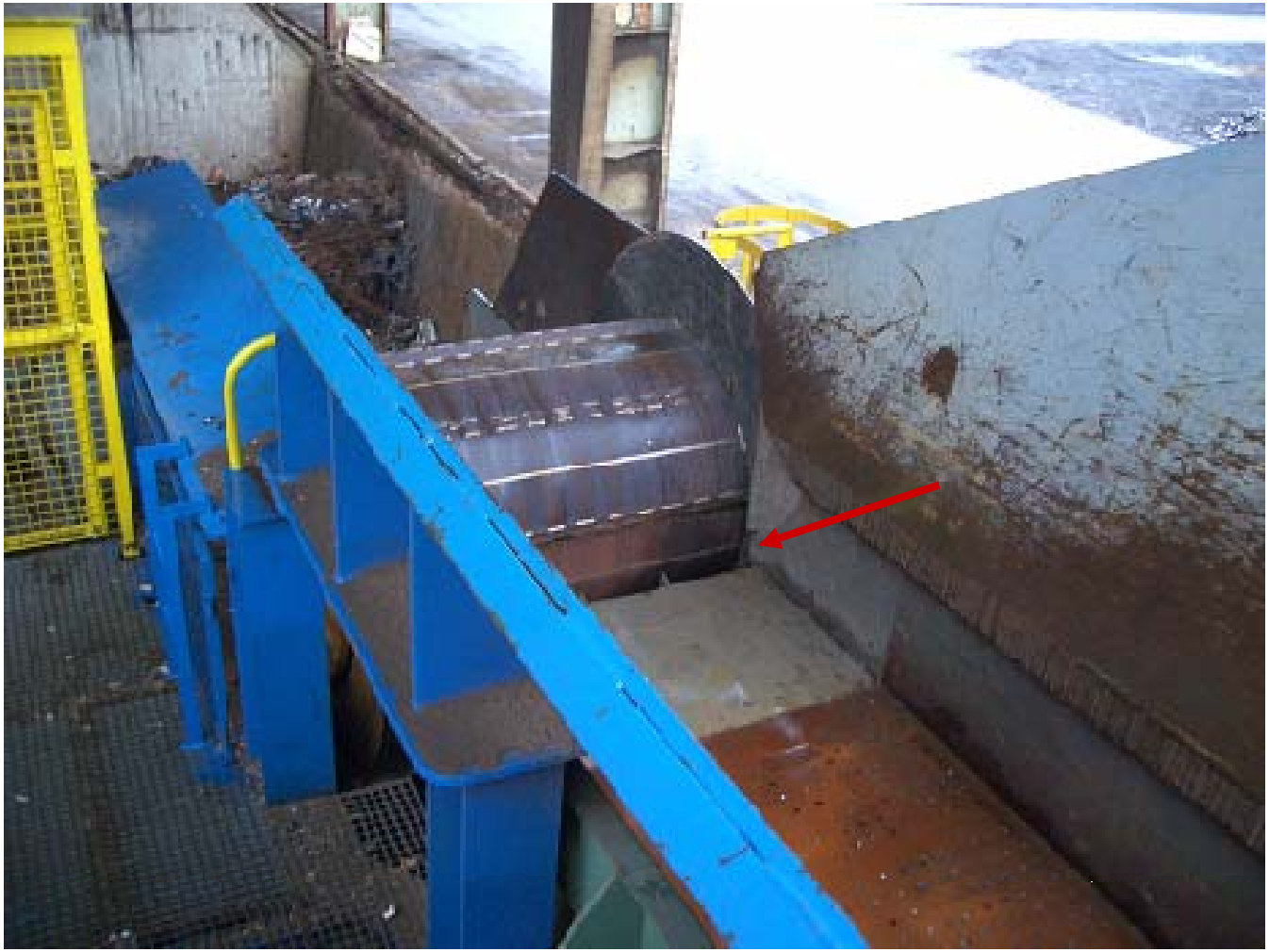
Scrap Cleaning System

- The scrap cleaning system consists of two main cleaning mechanisms namely
- • Vibration mechanism-to separate the fine particles materials such as dust from the scrap
- • Magnetic separation-to separate the non-ferrous material such as ground, rubber, plastic etc

- The machine is operated by discharging a dirty scrap into the feeding hooper and conveyed to the main vibrator feeder. The vibrator may consist of one or more stages.
- At the end of the vibrator, there is a gap between the vibrator plate and the magnetic drum. The rotating magnetic drum will attract the iron material (ferrous) and discharge the cleaned scrap to the other end.
- The non-ferrous material will fall down through the gap between the vibrant feeder and the magnetic drum to another vibrant feeder. All the non-ferrous material will be discharged to the deposit area.


FEEDING CHUTE
MAIN VIBRATOR
DIRTY SCRAP
MAGNETIC SEPARATOR
FINES (MAGNETIC AND NON MAGNETIC)
NON-CONDUCTIVE MATERIAL
CLEAN SCRAP

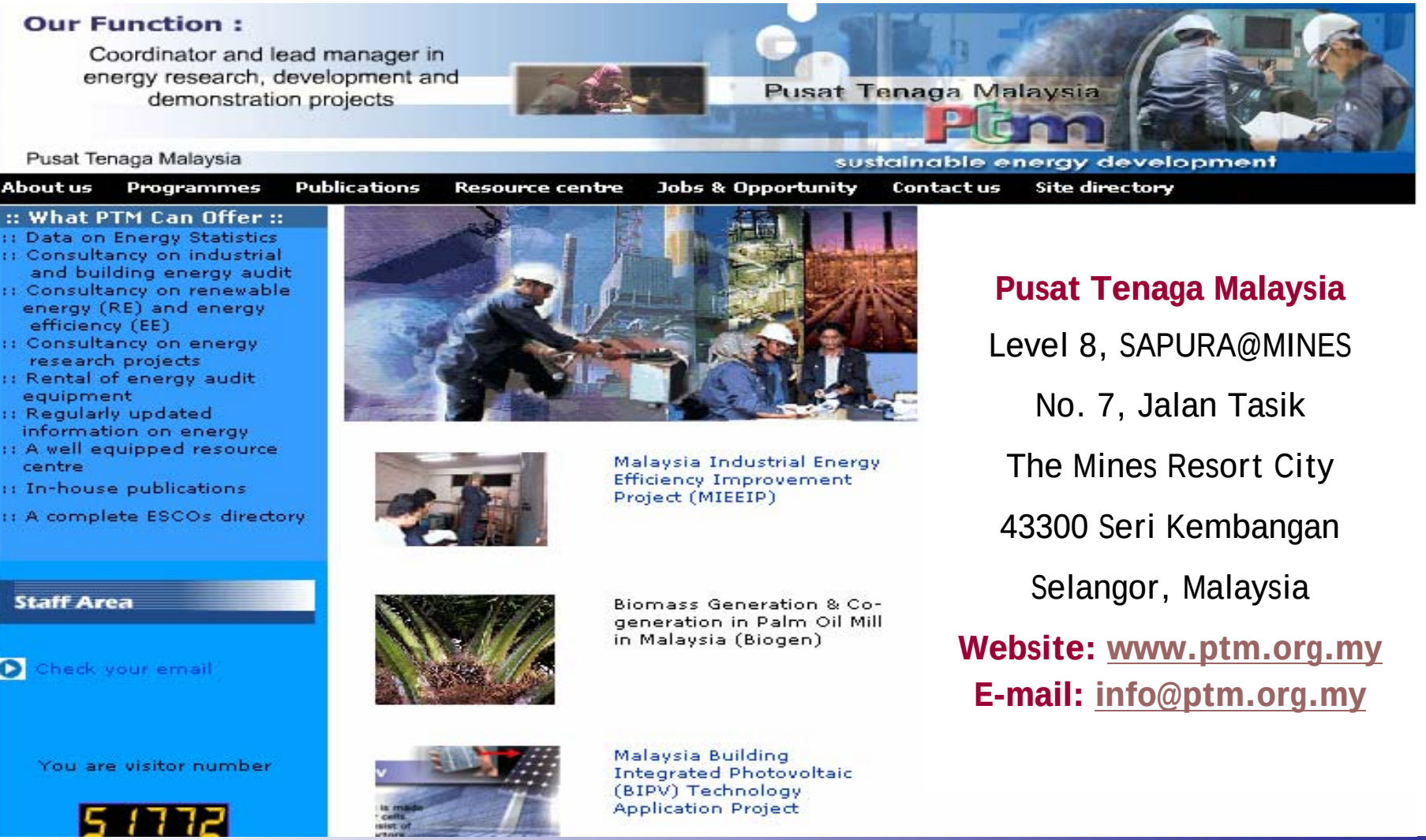

Non-ferrous material impurities discharge
Fine particles discharge



Summary of Cost Savings

ITEMS	UNIT (Million)	FIG
Electricity cost savings	RM/yr	3.5
Crude savings	RM/yr	0.4
Other savings (outsourcing)	RM/yr	0.5
TOTAL	**RM/yr**	**4.4**
Annual O&M cost	RM/yr	1.0
Net savings	RM/yr	3.1
CAPEX	RM/yr	3.0
Payback	yr	1.0

Thank You



Pusat Tenaga Malaysia

Level 8, SAPURA@MINES

No. 7, Jalan Tasik

The Mines Resort City

43300 Seri Kembangan

Selangor, Malaysia

Website: www.ptm.org.my

E-mail: info@ptm.org.my