Persidangan Jurutera-jurutera
@PICC, Putrajaya
4 – 5 September 2013

Energy Effiency - Sultan Salahuddin Abdul Aziz Shah (SSAAS) Building Modeling

zilaila@jkr.gov.my

Isi Kandungan

1. **Latar Belakang**
   - **Kajian Penggunaan Tenaga**
2. **Analisis Penggunaan Tenaga**
   - **Bil Elektrik kWh**
3. **Methodologi Modeling Energy Efficiency - Experimental Setup**
4. **Hasil Kajian**

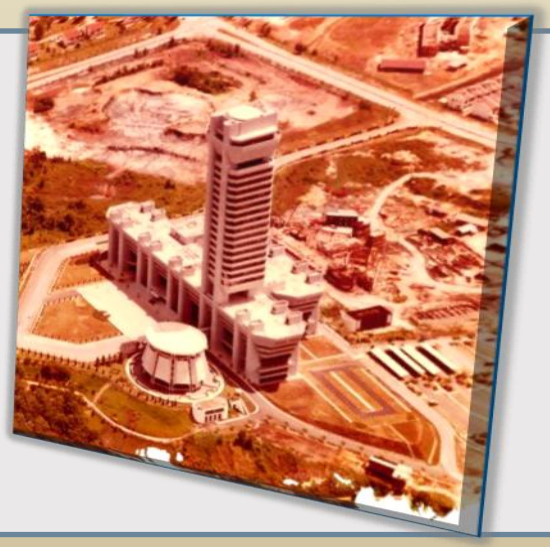
1. Latar Belakang

Kajian Penggunaan Tenaga Di Bangunan SSAAS

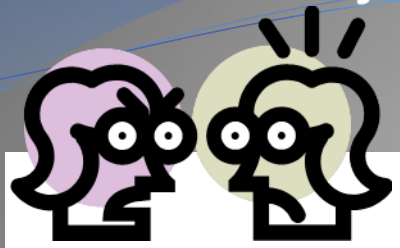
Bangunan Sultan Salahuddin Abdul Aziz Shah adalah antara mercu tanda terawal yang dibina dimana lokasinya terletak di Bukit SUK, Seksyen 5, Shah Alam.

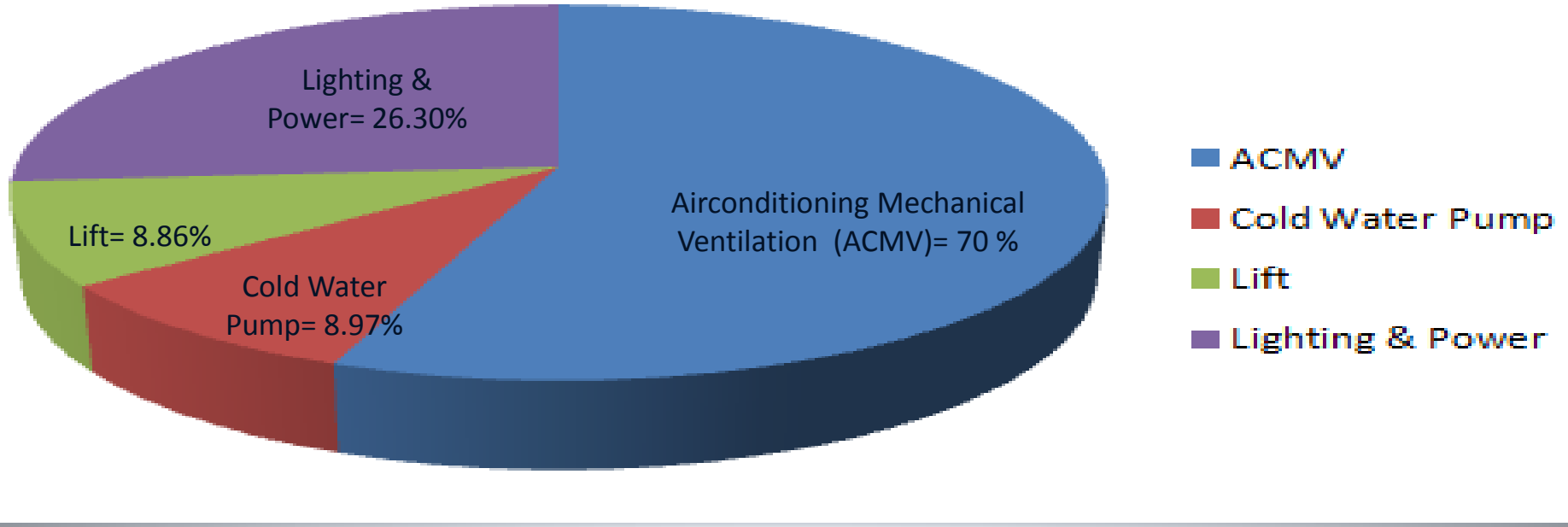
Dibina pada 2hb Feb 1982 serta siap sepenuhnya 1984 dan telah dirasmikan oleh Sultan Salahuddin Abd Aziz Shah pada 2hb Feb 1985.

Bangunan setinggi 24 tingkat ini dibina berkonsepkan Kapal Kargo tradisional Bugis, menempatkan Pejabat Setiausaha Kerajaan serta jabatan-jabatan Kerajaan Negeri Selangor.



Kajian Penggunaan Tenaga Di Bangunan SSAAS

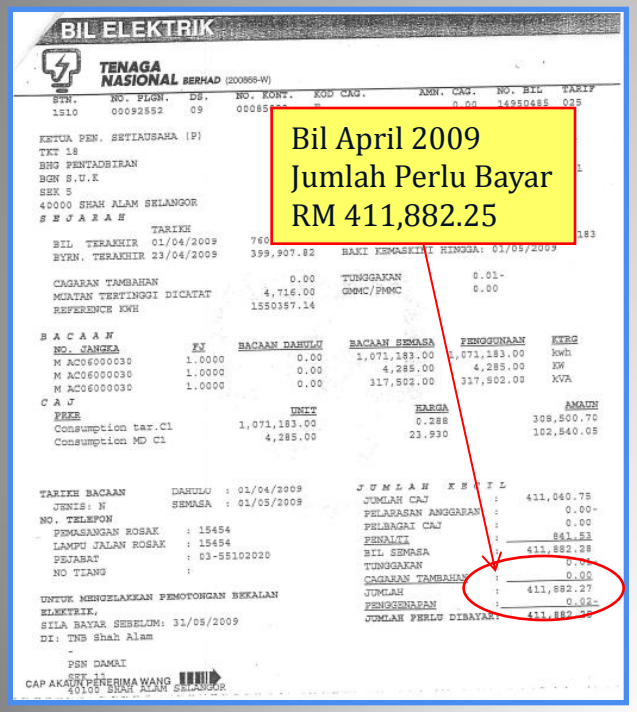


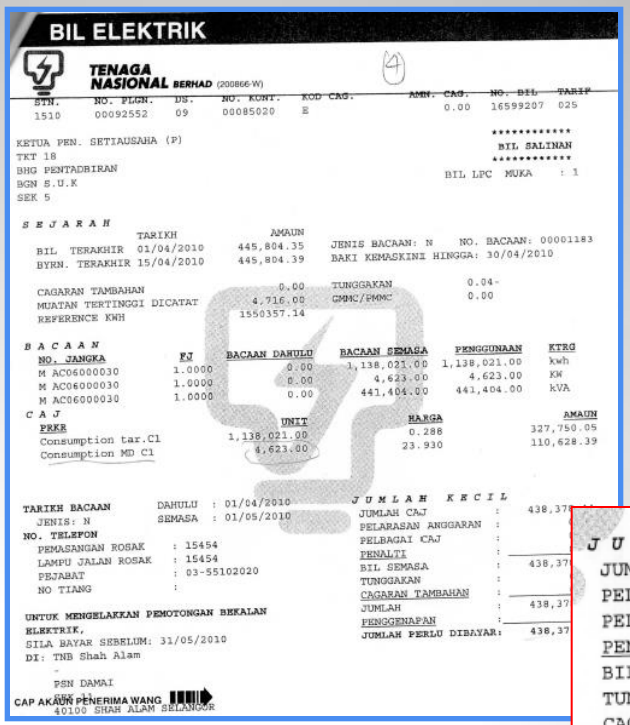


Airconditioning Mechanical Ventilation (ACMV) merupakan penggunaan tenaga terbesar seterusnya penyumbang tenaga bil elektrik tinggi

Kajian Penggunaan Tenaga Di Bangunan SSAAS

Penggunaan tenaga elektrik di Bangunan Sultan Salahuddin Abdul Aziz Shah (SSAAS) Shah Alam berdasarkan bil elektrik adalah kira-kira **RM 400,000.00 sebulan.**



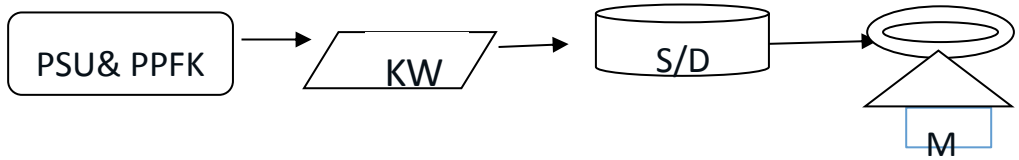


Bil April 2010
Jumlah Perlu Bayar
RM 438,378.40

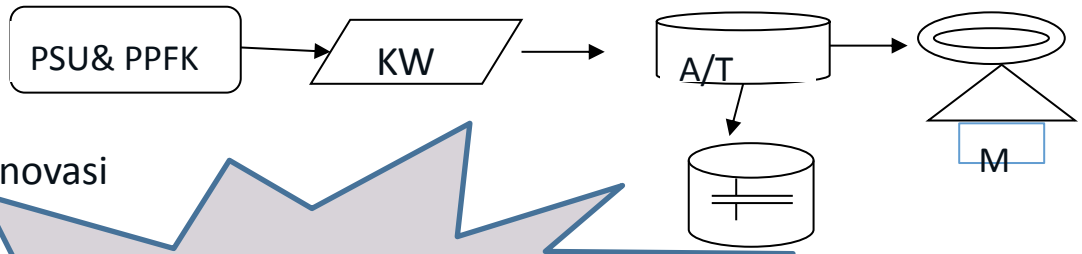
JUMLAH KECIL	
JUMLAH CAJ	438,378.44
PELARASAN ANGGARAN	0.00-
PELBAGAI CAJ	0.00
PENALTI	0.00
BIL SEMASA	438,378.44
TUNGGAKAN	0.04-
CAGARAN TAMBAHAN	0.00
JUMLAH	438,378.40
PENGGENAPAN	0.00
JUMLAH PERLU DIBAYAR:	438,378.40

SISTEM INOVASI

Sistem Asal



Sistem Inovasi



Nota :
MSB: Main Switch Board
KW :Kawalan Motor
A/T:Autotransformer
M: Motor
C: Optimal Capacitor Placement
S/D: Star Delta

Kos Pemasangan :RM250,000.00
Pulangan Modal : 5 bulan

- Mengurangkan arus permulaan (Starting Current)
- Mengurangkan muatan tertinggi (MD)
- Seterusnya dapat mengurangkan bil elektrik
- Memperbaiki dan mengekalkan Faktor Kuasa
- Meningkatkan kecekapan tenaga dengan mengurangkan kehilangan kuasa


LOKASI INOVASI: Bilik Pam Motor
(Semasa Kerja-kerja Pemasangan)


Baru
Sedia ada


1
2
3
4
4 Step Autotransformer


Panel Kawalan
Optimal
Kapasitor

2. Analisis Penggunaan Tenaga

Analisis Bil Elektrik

ANALISA STATISTIK INISIATIF INOVASI

- Jadual Penggunaan Elektrik Bagi Tempoh April 2010 Hingga Mac 2011

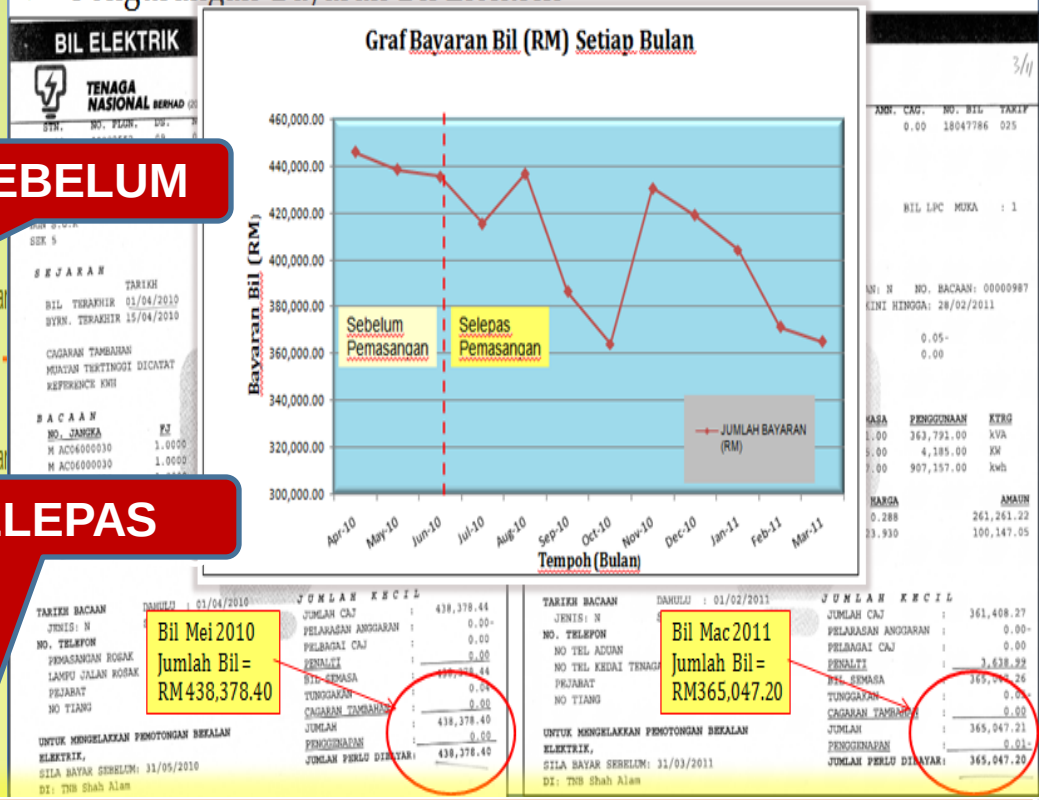
BIL	TARIKH BIL	MUATAN TERTINGGI (MD)	CAJ MUATAN TERTINGGI (MD) (RM)	JUMLAH BAYARAN BIL (RM)
1	1 Apr-10	4,469.00	106,943.00	445,804.35
2	1 May-10	4,623.00	110,628.39	438,378.40
3	1 Jun-10	4,625.00	110,676.25	435,475.40
4	1 Jul-10	4,438.00	106,201.34	415,552.45
5	1 Aug-10	4,450.00	106,488.50	436,859.60
6	1 Sep-10	4,181.00	100,051.33	386,392.40
7	1 Oct-10	4,224.00	101,080.32	364,272.80
8	1 Nov-10	4,357.00	104,263.01	430,417.50
9	1 Dec-10	4,445.00	106,368.85	419,040.05
10	1 Jan-11	4,152.00	99,357.36	404,332.05
11	1 Feb-11	3,945.00	94,403.85	371,308.60
12	1 Mar-11	4,185.00	100,147.05	365,047.20

SEBELUM

SELEPAS

Statistik Inovasi

- Pengurangan Bayaran Bil Elektrik



Contoh Anggaran penjimatan dari penurunan MD

Perbezaan MD pada Mei 2010 dan Mac 2011 = 4,623 – 4,185 = 438 unit

Kadar caj MD/unit = RM 25.90 (tarif baru TNB)

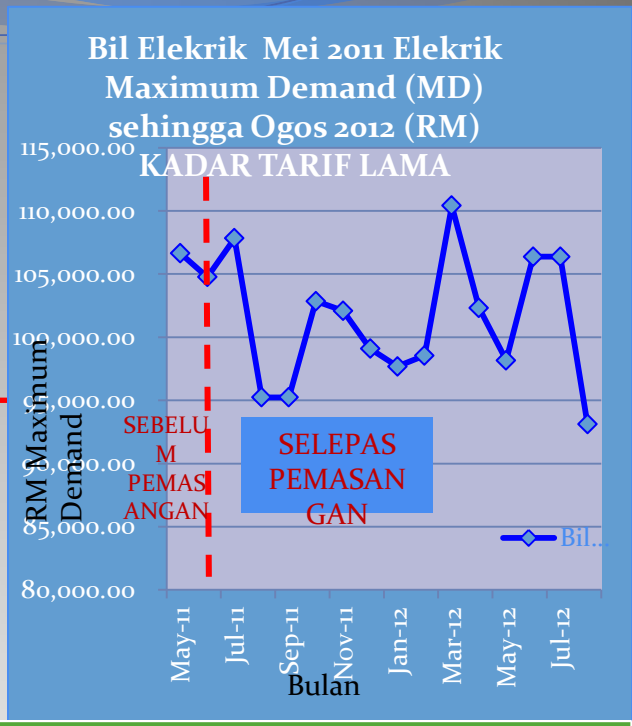
Jumlah bayaran caj MD = 438 x RM25.90 = RM 11,344.2 (untuk sebulan)

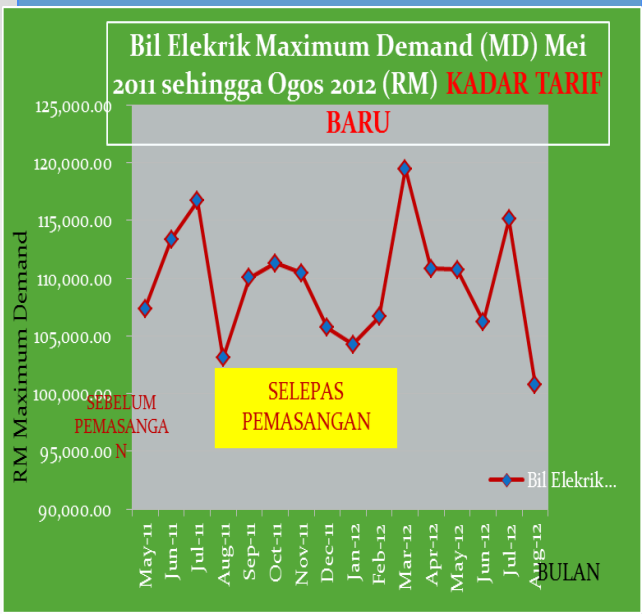
Anggaran untuk setahun = RM 11,344.2 x 12 bulan

= RM 136,130.40

Bil elektrik TNB selepas kadar kenaikan tarif elektrik. 1 Jun 2011

BIL	TARIKH BIL	MUATAN TERTINGGI (MD)	CAJ MUATAN TERTINGGI (MD) (RM)	JUMLAH BAYARAN BIL (RM)
1	1 Apr-11	4,221.00	101,008.00	416,292.00
2	1 May-11	4,457.00	107,374.39	446,534.40
3	1 Jun-11	4,378.00	113,390.00	467,295.00
4.	1 Julai-11	3,980.00	103,082.00	480,022.22
5	1 Ogos-11	4,248.00	110,023.20	403,438.16
6	1 Sep-11	4,298.00	111,318.20	429,514.94
7	1 Okt-11	4,298.00	111,318.20	445,773.15
8	1 Nov-11	4,266.00	110,489.40	427,706.98
9	1 Dis-11	4,144.00	105,723.80	427,443.69
10	1 Jan-12	4,082.00	104,263.01	430,417.50
11	1 Feb -12	4,614.00	106,656.20	408.843.24
12	1 Mac-12	4,118.00	119,502.60	474,443.77
13	1 Apr -12	4,279.00	110,826.10	442,186.74
14	1 Mei-12	4,276.22	110,748.40	473,077.63
15	1 Jun-12	4,102.00	106,241.80	440,203.29
16	1 Julai-12	4,445.00	115,125.50	453,385.83
17	1 Aug-12	3,891.00	100,776.90	370,901.56





Penghargaan Johan Inovasi 2011

SETIAUSAHA KERAJAAN,
NEGERI SELANGOR DARUL EHSAN,
TINGKAT 19,
BANGUNAN SULTAN SALAHUDDIN ABDUL AZIZ SHAH,
40503 SHAH ALAM,
SELANGOR DARUL EHSAN.

Tel : 03-5514 2134 (Teru
: 03-5544 7042 (Am)
Fax : 03-5510 3062

"KEJUJURAN DAN KETEKUNAN"
SELANGORSHINES

Ruj. Tuan :
Ruj. Kami :IPK.SEL.BK.20684/72/2 Jld. 2 (70)
Tarikh : 15 Februari 2012

Dato' Ir. Abdullah bin Abd. Rahman
Pengarah Kerja Raya Negeri Selangor
Tingkat 1, Bangunan SSAAS,
40582 Shah Alam,
Selangor Darul Ehsan.

YBhg Dato',

SURAT PENGHARGAAN

2. Pentadbiran Kerajaan Negeri Selangor dengan ini mengucapkan setinggi-tinggi tahniah kepada Jabatan Kerja Raya Negeri Selangor di atas pengiktirafan dan anugerah yang diterima sepanjang Tahun 2011 seperti berikut:

i. Johan Perbarisan Terbaik Kategori Jabatan Kerajaan
Sempena Majlis Sambutan Maulidur Rasul Peringkat Negeri Selangor

ii. Persijilan Amalan Persekitaran Berkualiti 5S
Ibu Pejabat JKR Negeri Selangor

iii. Persijilan Amalan Persekitaran Berkualiti 5S
Pejabat JKR Daerah Kuala Selangor

iv. Johan Anugerah Inovasi JKR Malaysia
Bahagian Elektrik, JKR Negeri Selangor

v. Tempat Ketiga
Anugerah Penyenggaraan Jalan Terbaik JKR Malays
Pejabat JKR Daerah Kuala Selangor

vi. Tempat Ketiga
Anugerah Pejabat JKR Daerah Terbaik JKR Malaysia
Pejabat JKR Daerah Hulu Selangor

PIALA PUSINGAN

ANUGERAH INOVASI JKR 2011

JABATAN KERJA RAYA MALAYSIA

Dengan sukacitanya menganugerahkan kepada

Cawangan Kejuruteraan Elektrik
JKR Negeri Selangor

Johan

ANUGERAH INOVASI JKR TERBAIK 2011

untuk inovasi

(PROTOTYPE MODEL 4 STEP AUTOTRANSFORMER STARTER TO REDUCE ENERGY CONSUMPTION)

DATO' Ir. HJ. MOHD NOOR BIN YAACOB
Ketua Pengarah Kerja Raya Malaysia

JABATAN KERJA RAYA MALAYSIA

Dengan sukacitanya menganugerahkan kepada

Cawangan Kejuruteraan Elektrik
JKR Negeri Selangor

PIALA PUSINGAN
TIMBALAN KETUA PENGARAH
KERJA RAYA MALAYSIA (PAKAR)

bagi

ANUGERAH
INOVASI JKR TERBAIK 2011

Sempena
Hari Inovasi JKR Malaysia
Di Dewan Kerbau, Permai Hotel, Kuala Terengganu, Terengganu
Pada 15 November 2011

NATIONAL SEMINAR

ON ASSETS AND PROJECTS MANAGEMENT

Jointly organised by:

MAPMA

THE MALAYSIAN ASSET AND PROJECT MANAGEMENT ASSOCIATION

JKR

PERTUBUHAN PROFESIONAL JKR MALAYSIA (ProJKR)

Supported by:

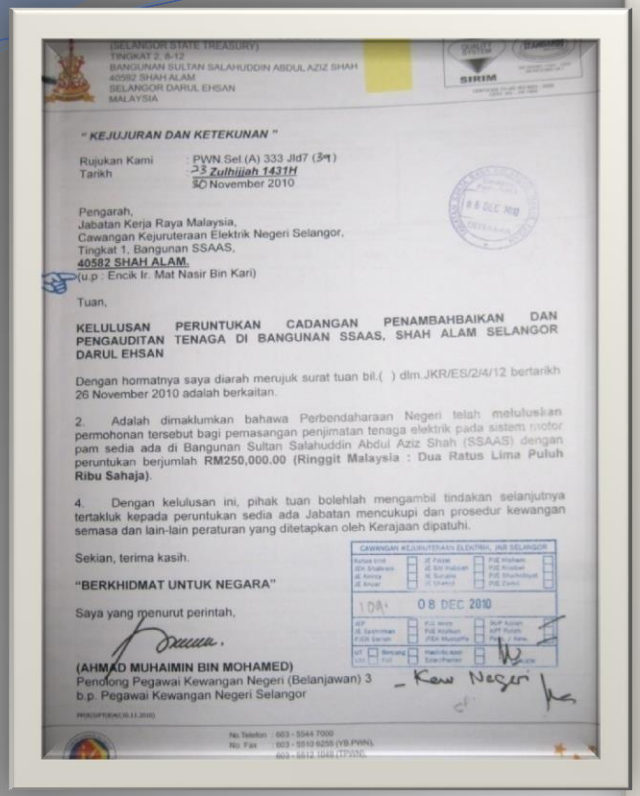
JKR

Menyertai Conference, Pameran dan Seminar

Pameran di Dewan Tan Sri Khalid Mahfuz 1 Nov 2012

Lawatan Panel Penilai

Peruntukan / Dana



" KEJUJURAN DAN KETEKUNAN "

Rujukan Kami : PWN.Sel (A) 333 Jld7 (34)
Tarikh : 23 Zulhijjah 1431H
30 November 2010

Pengarah,
Jabatan Kerja Raya Malaysia,
Cawangan Kejuruteraan Elektrik Negeri Selangor,
Tingkat 1, Bangunan SSAAS,
40582 SHAH ALAM.
(u.p : Encik Ir. Mat Nasir Bin Kari)

Tuan,

KELULUSAN PERUNTUKAN CADANGAN PENAMBAHBAIKAN DAN PENGAUDITAN TENAGA DI BANGUNAN SSAAS, SHAH ALAM SELANGOR DARUL EHSAN

Dengan hormatnya saya diarah merujuk surat tuan bil.( ) dlm.JKR/ES/2/4/12 bertarikh 26 November 2010 adalah berkaitan.

2. Adalah dimaklumkan bahawa Perbendaharaan Negeri telah meluluskan permohonan tersebut bagi pemasangan penjimatan tenaga elektrik pada sistem motor pam sedia ada di Bangunan Sultan Salahuddin Abdul Aziz Shah (SSAAS) dengan peruntukan berjumlah **RM250,000.00 (Ringgit Malaysia : Dua Ratus Lima Puluh Ribu Sahaja)**.

4. Dengan kelulusan ini, pihak tuan bolehlah mengambil tindakan selanjutnya tertakluk kepada peruntukan sedia ada Jabatan mencukupi dan prosedur kewangan semasa dan lain-lain peraturan yang ditetapkan oleh Kerajaan dipatuhi.

Sekian, terima kasih.

"BERKHIDMAT UNTUK NEGARA"

Saya yang menurut perintah,

(AHMAD MUHAIMIN BIN MOHAMED)
Pembantu Pegawai Kewangan Negeri (Belanjawan) 3
b.p. Pegawai Kewangan Negeri Selangor

On-line Application
MESITA
Malaysia Electricity Supply Industries Trust Account

HOME PROJECTS ENQUIRY

Please click on the short-cut menu below to navigate the each category of project details

PROJECT SUMMARY APPLICATION FORM SCHEDULE MEETING REPORTS

Form Application Details

APPLICATION DETAIL FOR FUNDING FROM ELECTRICITY TRUST FUND

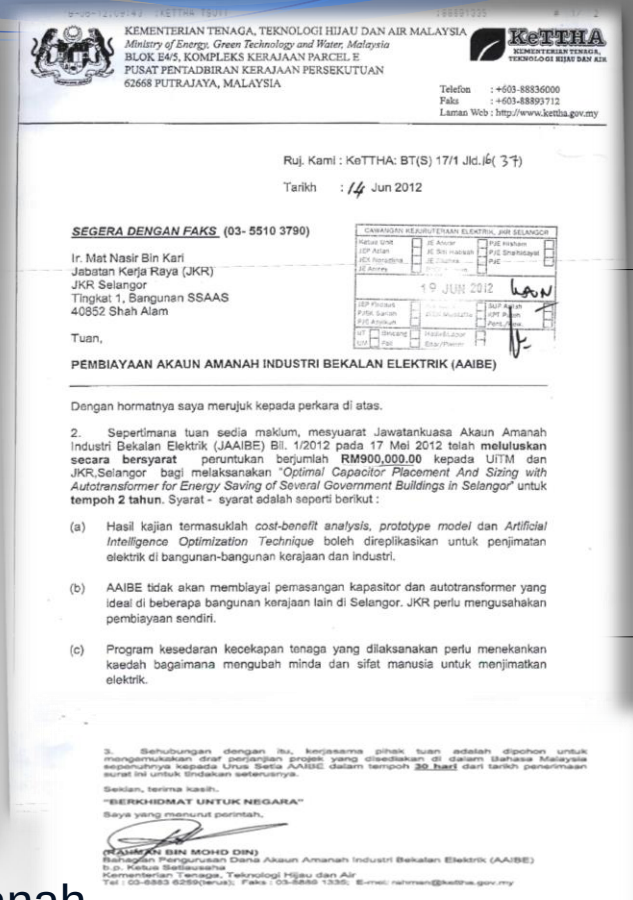
I. PROJECT IDENTIFICATION

PROJECT NO.	04-2-15-1500
PROJECT TITLE	Energy Effiency In Bangunan Sultan Salahuddin Abdul Aziz Shah, Shah Alam, Selangor
ORGANISATION	Jabatan Kerja Raya (JKR)
KEY WORDS	Harmonics|Capacitor bank|Motor (Water Pump)|Starting Current|Improvement energy
APPLICATION DATE	08/02/2011

II. OBJECTIVES OF THE PROJECT

A. OBJECTIVE(S) OF THE PROJECT	1. To improve usergy efficiency in motor operation (Water Pump) 2. To define & reduce losses during operation process
B. RESEARCH BACKGROUND OF PROJECT (FOR RESEARCH PROJECTS)	
PROJECT STATUS	Modification Previous Project
PROJECT LEADER	Dato' Abdullah Bin Abd Rahman Ir. Mat Nasir bin kari Ir. Zilalia Binti Hj. Zakaria
LITERATURE REVIEW SUMMARY	The efficiencies of the current motors (Water Pump, Chillers) are relatively low. It would not be economically viable to replace the operated pumps with higher efficienc However, it is recomended that in future to emphasize more power factor improvement. Nomal Star-Delta coupled with Autotransformer for motor starting wou subject the motor to high torque and current surges up to 10 times the full load curre However it is recomended 4 Steps Autotrasfermer for a starting device to reduce starting current & starting high torque.
RELATED RESEARCH	To echieve energy consumption by improving efficiency of motor pumps. Thhis would lessen mechanical and electrical stress on the motor system and can reduce maintenance and repair cost and extend mo
TYPE OF RESEARCH	Technology Development (Applied Research)
RESEARCH METHOLOGY	1. Installation Energy Saving Device (ESD) 2. Improvement starting current system u using $ Steps Autotransformer coupled with capacitor banks parralel operation to reduce starting current & improvement power factor.

III. BENEFITS OF THE PROJECT



KEMENTERIAN TENAGA, TEKNOLOGI HIJAU DAN AIR MALAYSIA
Ministry of Energy, Green Technology and Water, Malaysia
BLOK B4/5, KOMPLEKS KERAJAAN PARCEL E
PUSAT PENTADBIRAN KERAJAAN PERSEKUTUAN
62668 PUTRAJAYA, MALAYSIA

KeTTHA KEMENTERIAN TENAGA, TEKNOLOGI HIJAU DAN AIR

Telefon : +603-88836000
Faks : +603-88893712
Laman Web : http://www.kettha.gov.my

Ruj. Kami : KeTTHA: BT(S) 17/1 Jld.16(37)
Tarikh : 14 Jun 2012

SEGERA DENGAN FAKS (03- 5510 3790)

Ir. Mat Nasir Bin Kari
Jabatan Kerja Raya (JKR)
JKR Selangor
Tingkat 1, Bangunan SSAAS
40852 Shah Alam

19 JUN 2012

Tuan,

PEMBIAYAAN AKAUN AMANAH INDUSTRI BEKALAN ELEKTRIK (AAIBE)

Dengan hormatnya saya merujuk kepada perkara di atas.

2. Sepertimana tuan sedia maklum, mesyuarat Jawatankuasa Akaun Amanah Industri Bekalan Elektrik (JAAIBE) Bil. 1/2012 pada 17 Mei 2012 telah **meluluskan secara bersyarat** peruntukan berjumlah **RM900,000.00** kepada UITM dan JKR,Selangor bagi melaksanakan "*Optimal Capacitor Placement And Sizing with Autotransformer for Energy Saving of Several Government Buildings in Selangor*" untuk **tempoh 2 tahun**. Syarat - syarat adalah seperti berikut :

(a) Hasil kajian termasuklah *cost-benefit analysis, prototype model* dan *Artificial Intelligence Optimization Technique* boleh direplikasikan untuk penjimatan elektrik di bangunan-bangunan kerajaan dan industri.

(b) AAIBE tidak akan membiayai pemasangan kapasitor dan autotransformer yang ideal di beberapa bangunan kerajaan lain di Selangor. JKR perlu mengusahakan pembiayaan sendiri.

(c) Program kesedaran kecekapan tenaga yang dilaksanakan perlu menekankan kaedah bagaimana mengubah minda dan sifat manusia untuk menjimatkan elektrik.

3. Sehubungan dengan itu, kerjasama pihak tuan adalah dipohon untuk mengemukakan draf perjanjian projek yang disediakan di dalam Bahasa Malaysia sepenuhnya kepada Unus Setia AAIBE dalam tempoh **30 hari** dari tarikh penerimaan surat ini untuk tindakan seterusnya.

Sekian, terima kasih.

"BERKHIDMAT UNTUK NEGARA"

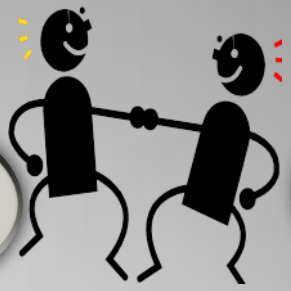
Saya yang menurut perintah,

(RAHMAN BIN MOHD DIN)
Bahagian Pengurusan Dana Akaun Amanah Industri Bekalan Elektrik (AAIBE)
b.p. Ketua Setiausaha
Kementerian Tenaga, Teknologi Hijau dan Air
Tel : 03-8883 6259(terus); Faks : 03-8888 1335; E-mel: rahman@kettha.gov.my

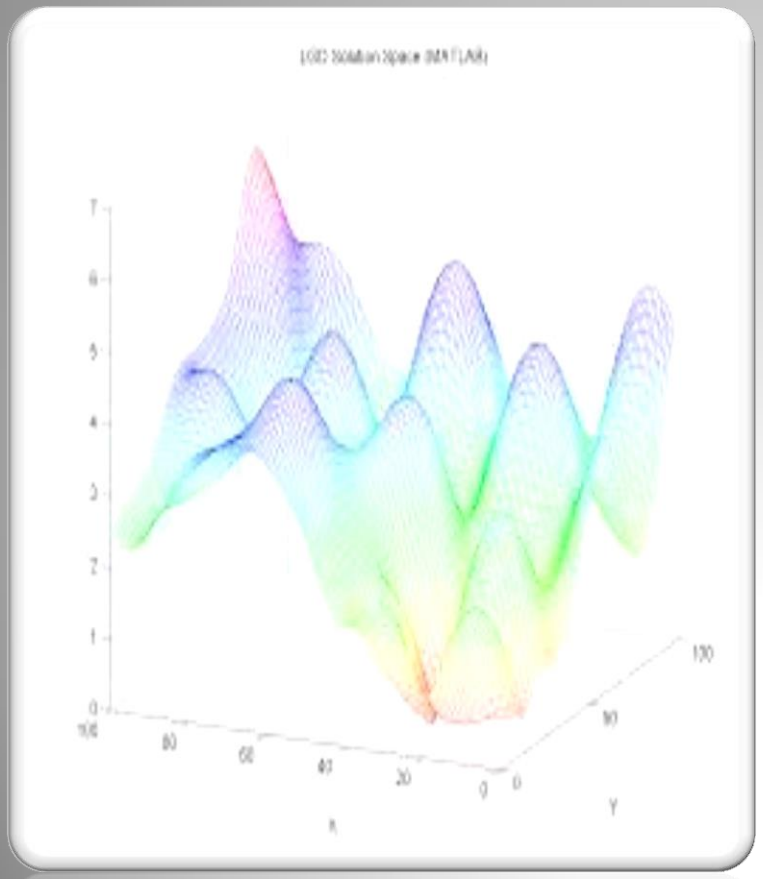
Peruntukan sebanyak RM 250,000.00 dari Perbendaharaan Negeri Selangor bagi pemasangan Peralatan penjimatan tenaga di Bangunan SSAAS.

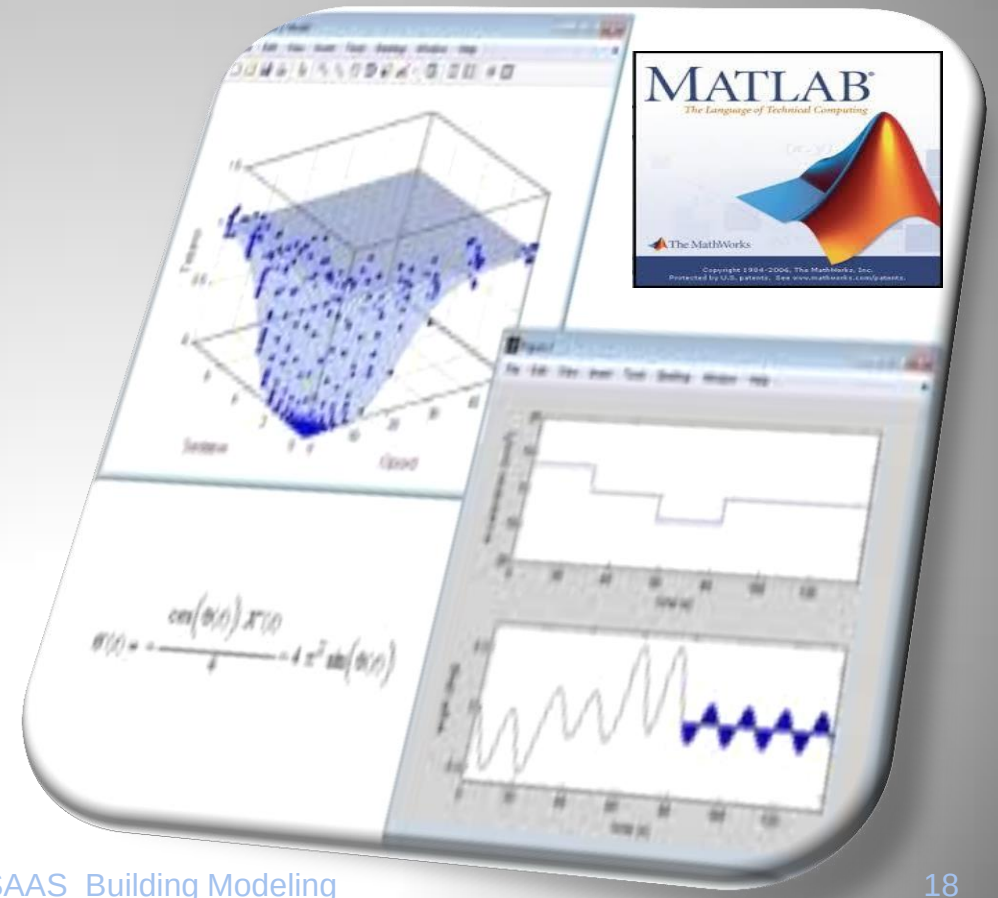
Peruntukan dari Akaun Amanah Industri Bekalan Elektrik (AAIBE/MESITA) dengan kolaborasi bersama Universiti Teknologi Mara Malaysia sebanyak RM900.000.00

Kolaborasi JKR-UiTM – Projek Penyelidikan



3. Metodologi Modeling





TEKNOLOGI HIJAU

- **Meminimakan kesan negatif kepada alam sekitar**
- **Penggunaan tenaga yang cekap dan tiada pembaziran tenaga**
- **TENAGA LESTARI**

Objektif

NEGARA

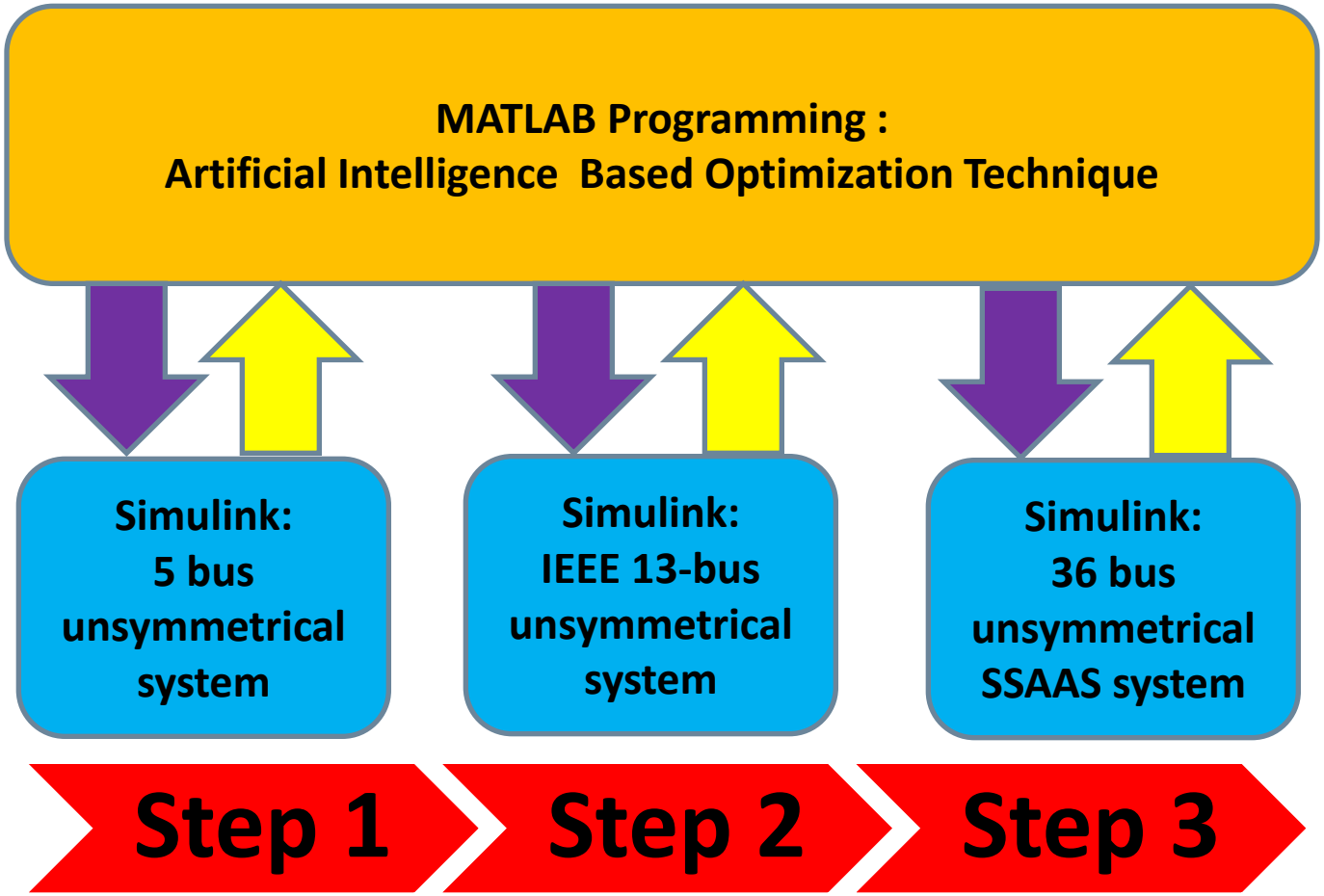
Kos operasi kerajaan dapat dikurangkan

- Dapat disalurkan ke Program yang berfaedah kepada Rakyat

ORGANISASI

- **Penggunaan sumber manusia yang lebih efisyen**
- ***'Delighting the customer Customer'***

Diagram of Research Methodology

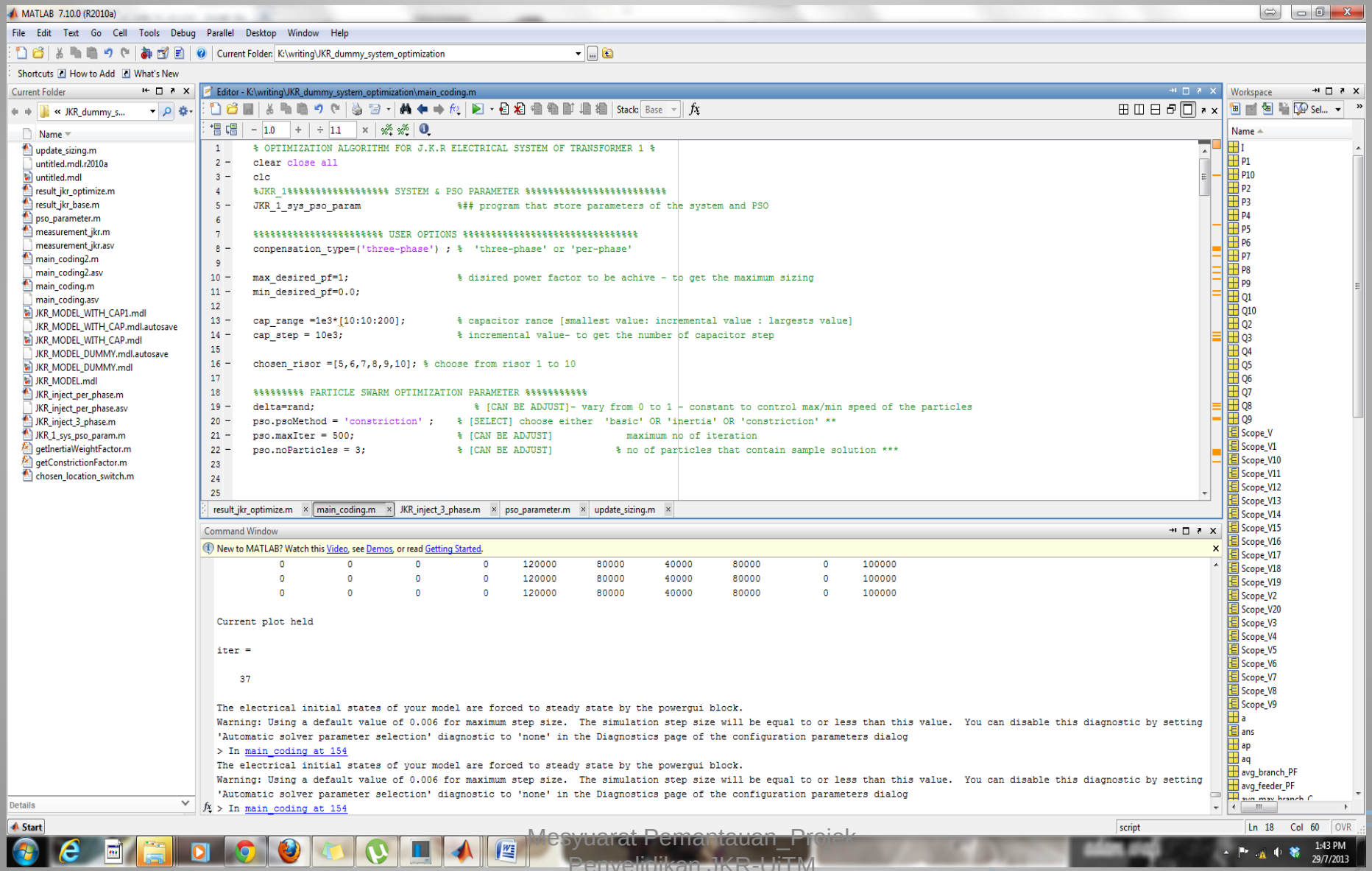


Legend :

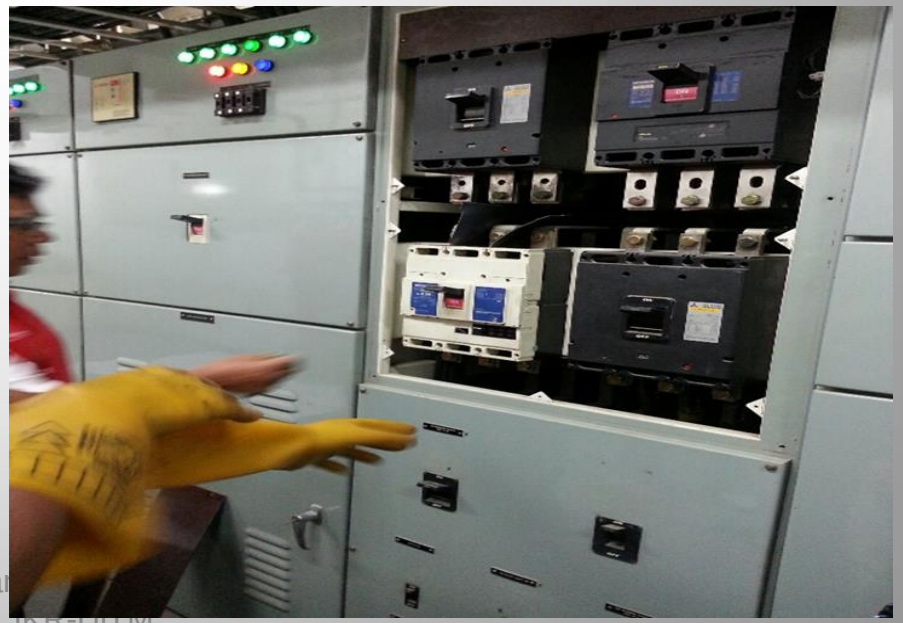
a) Capacitor Sizing and location.
b) Instruction to execute power flow solution.

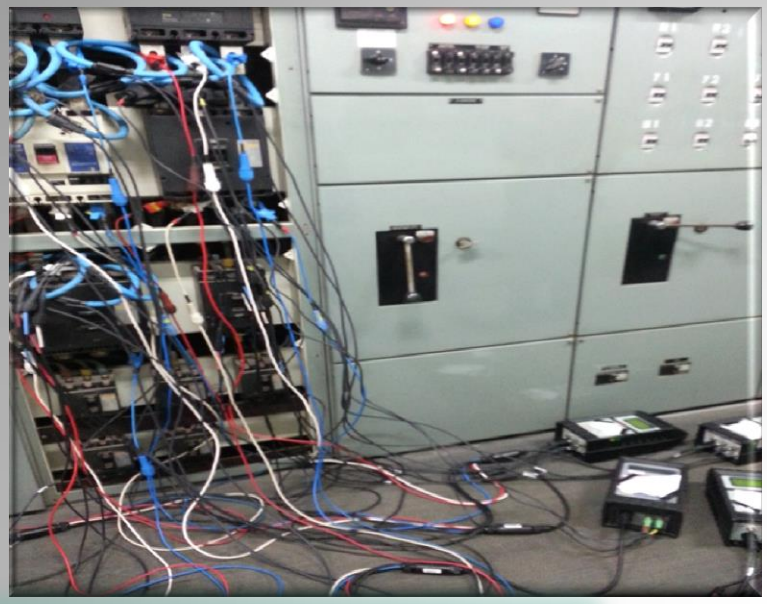
Transfer the results of voltage, current, THD, real power , reactive power and power factor.

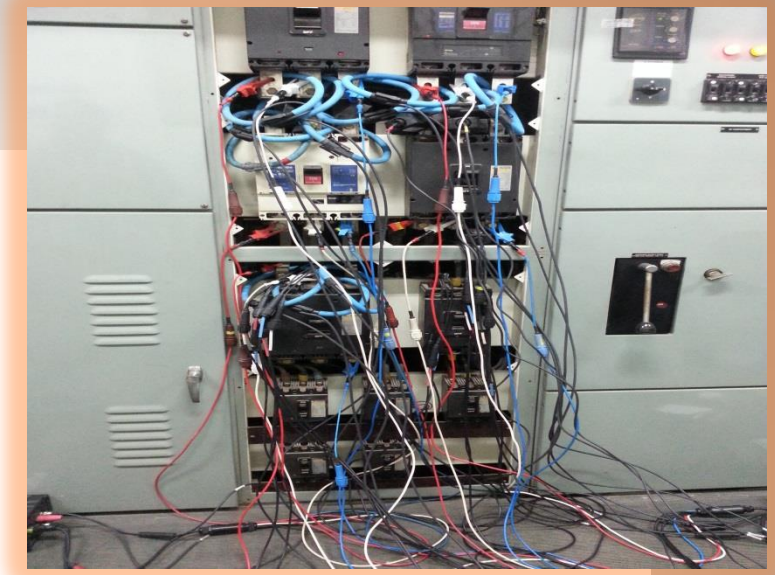
MATLAB Programming :
Artificial Intelligence Based Optimization Technique

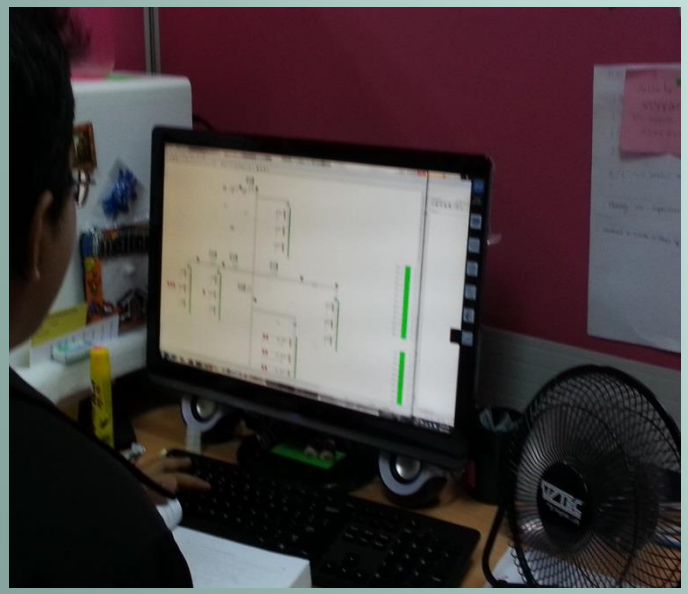


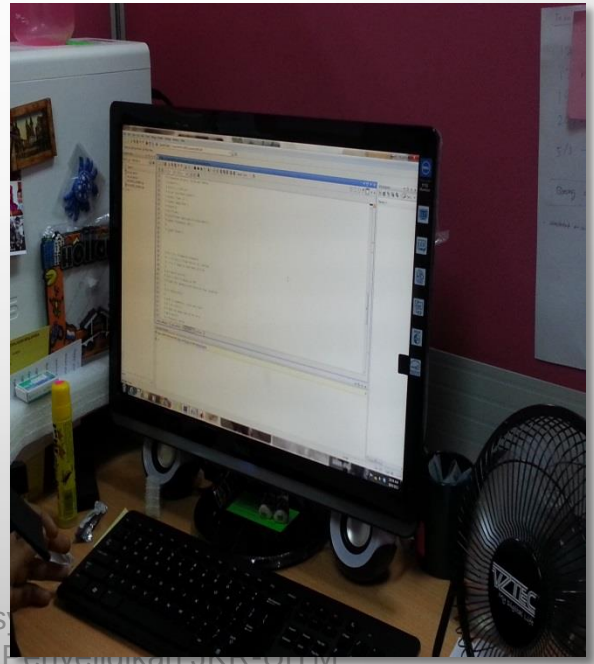
Program Pengumpulan Data Berperingkat – Data Logger



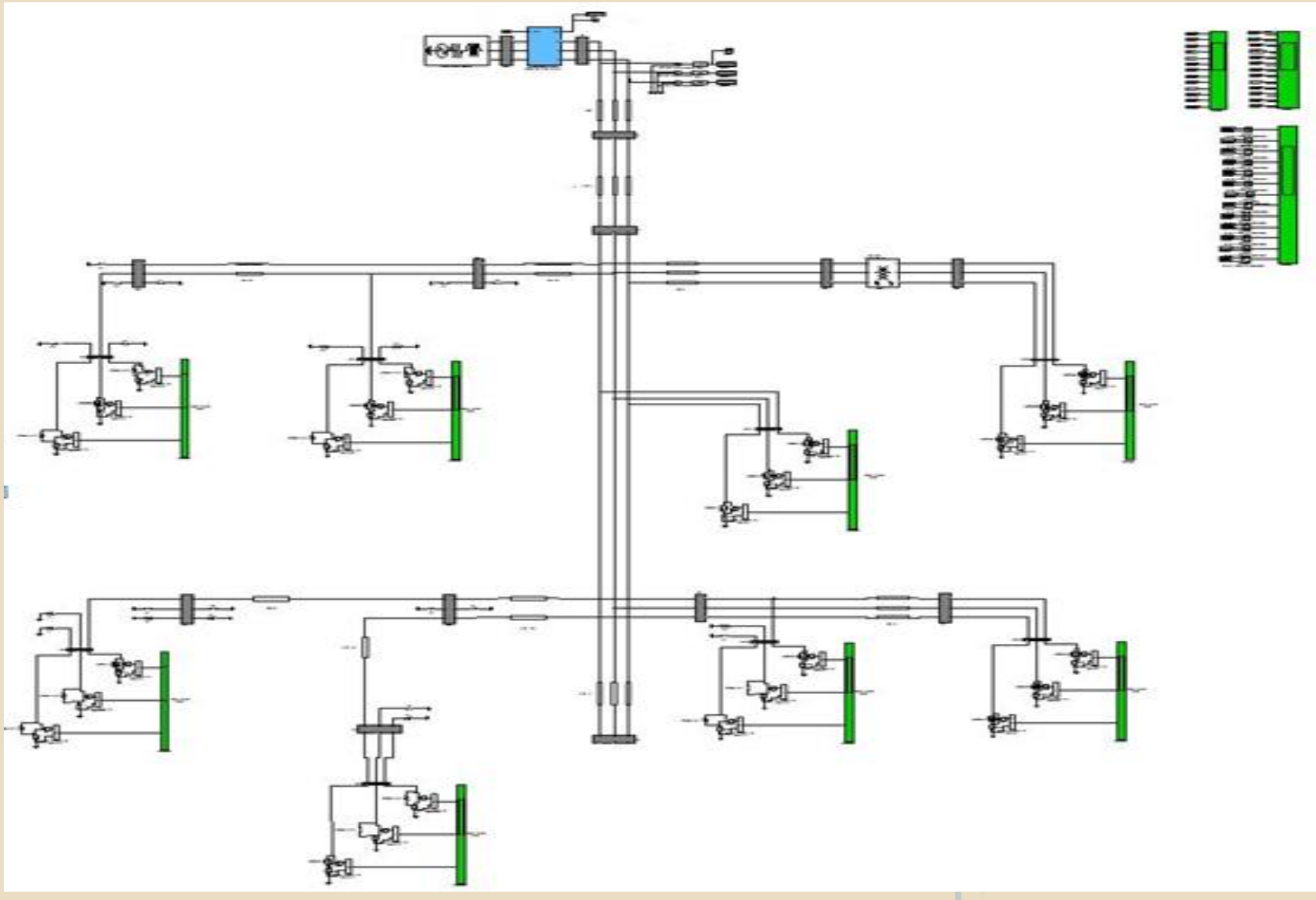




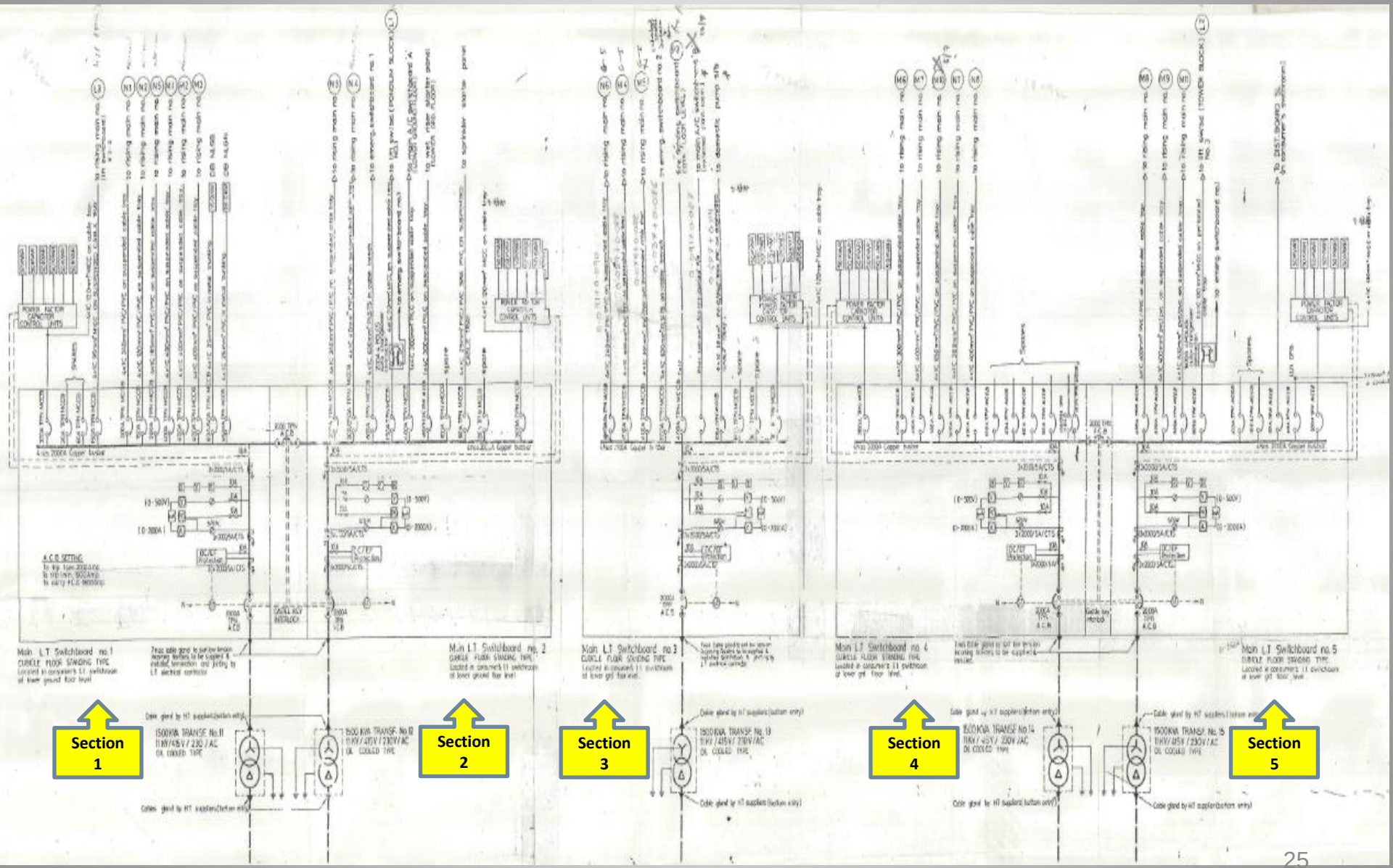




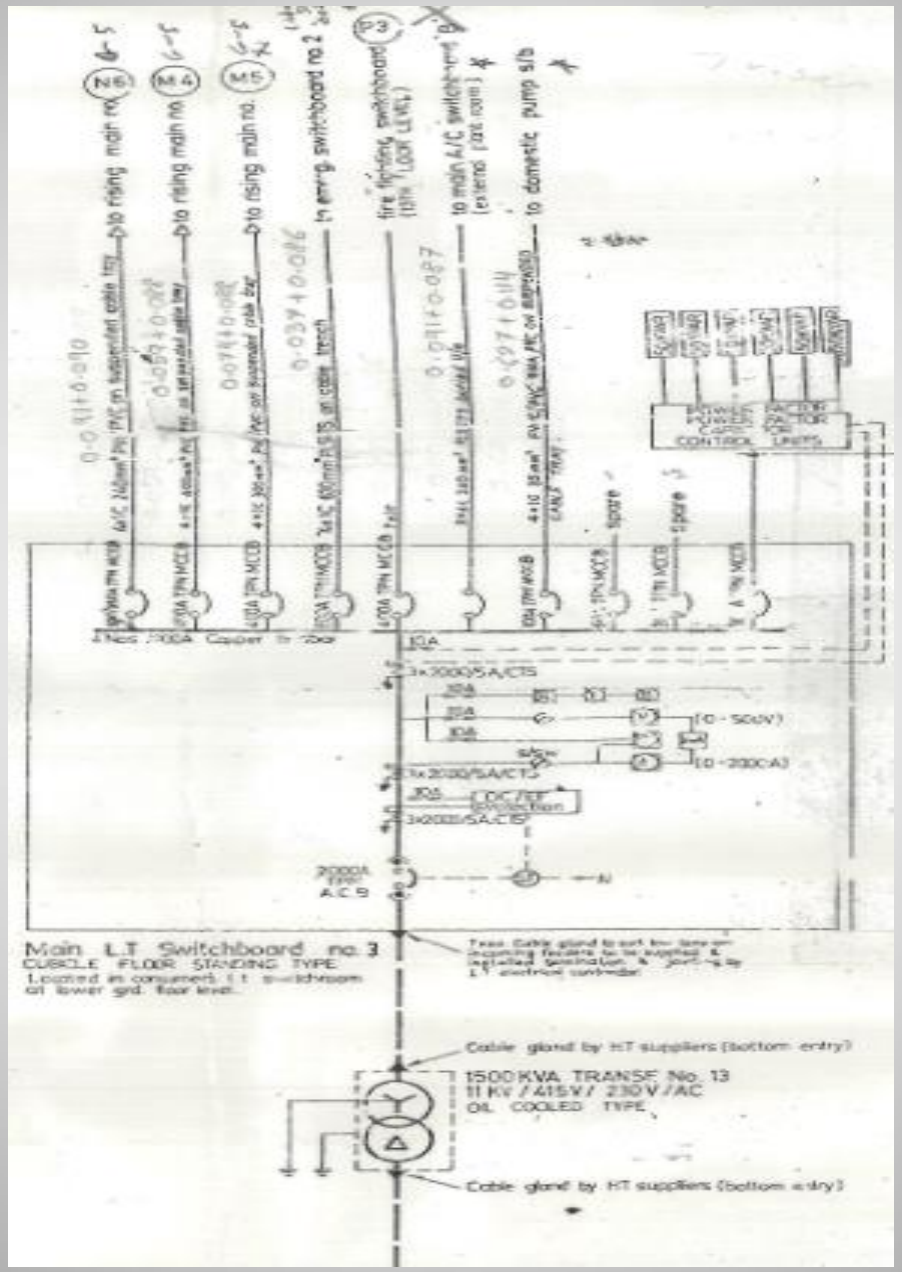
Simulink : IEEE13 Bus Unsymmetrical Electrical Distribution System



Five (5) Sections of Electrical Distribution System in SSAAS



Section Three (3) of Electrical Distribution System in SSAAS



Electrical Components Installed in Section 3 of Electrical Distribution System in SSAAS

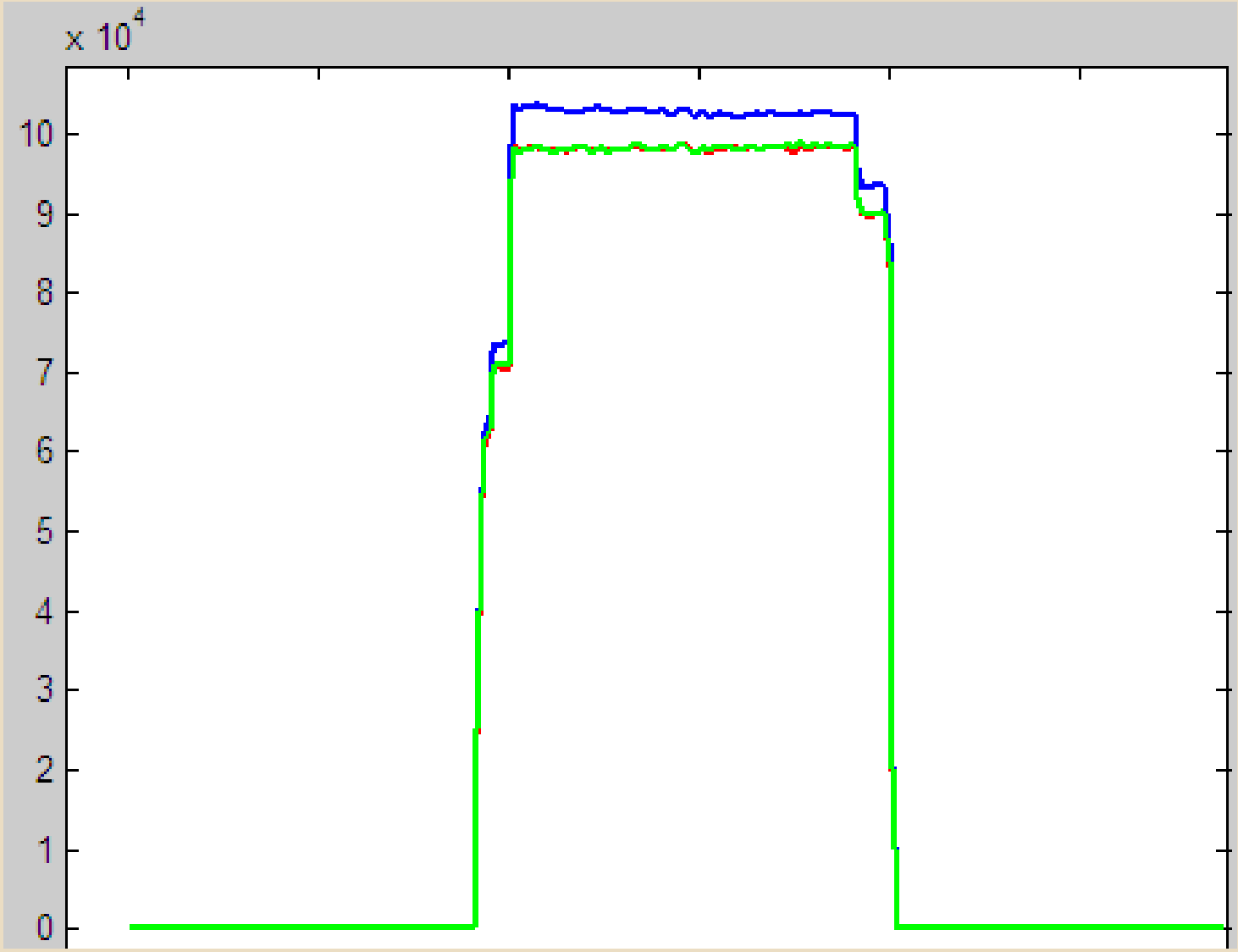
Number of risers		10 risers			
Type of cable used as a riser		4x1C 240mm^2	4x1C 400mm^2	4x1C 300mm^2	4x1C 35mm^2
Impedance of cable	R	0.091 Ω	0.059 Ω	0.037 Ω	0.627 Ω
	XR	0.09 Ω	0.088 Ω	0.086 Ω	0.114 Ω
Incoming Transformer Rating		11 kV / 433 V, 1600 kVA Δ/Y Connection			
Capacitor bank sizing		50 kVAR x 6 banks = 300 kVAR			

Data Sheet of Cables used as the Riser Installed in Section 3 of Electrical Distribution System in SSAAS

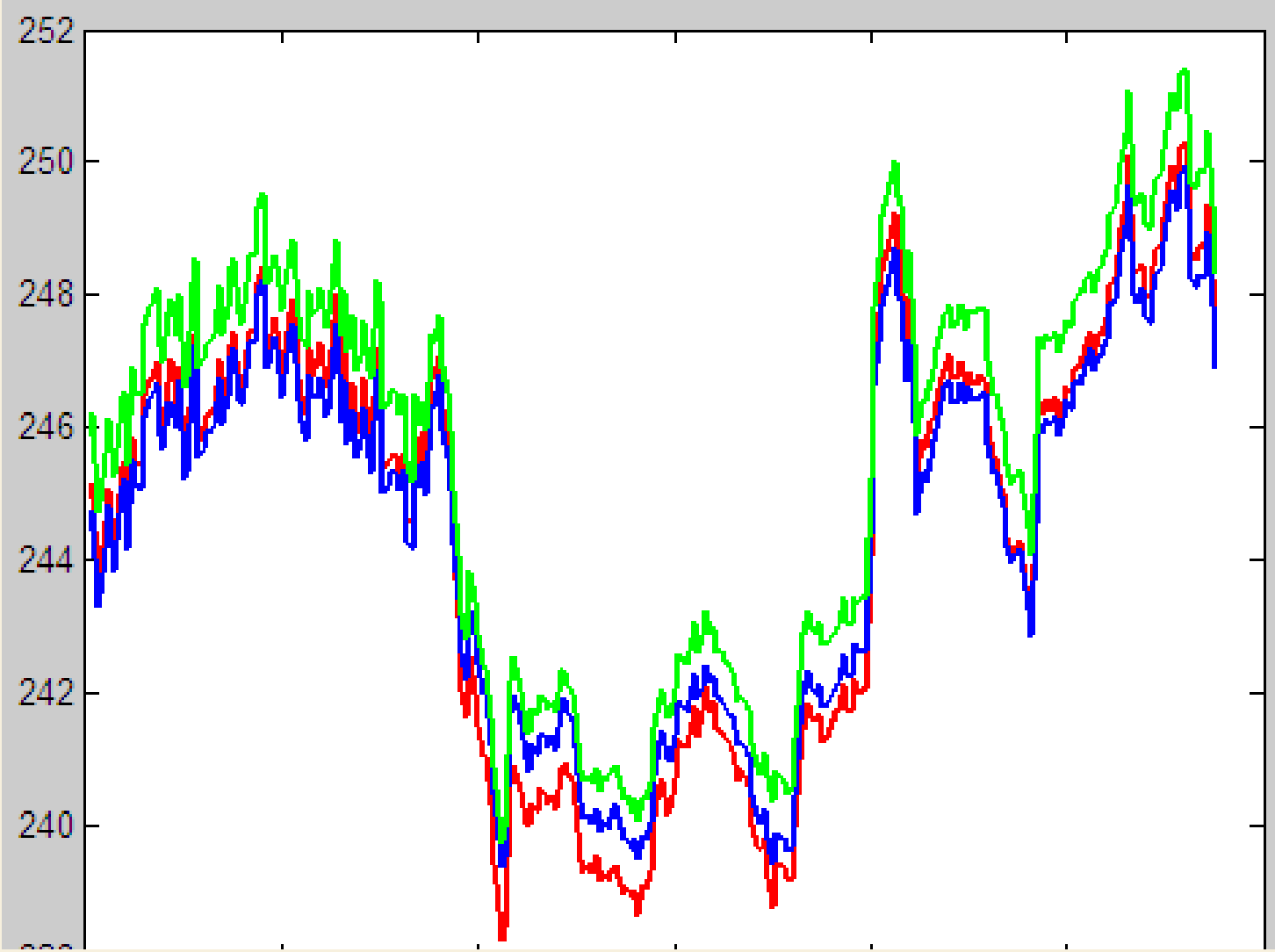
4 CORE COPPER PVC ARMOURED & UNARMOURED POWER CABLES

No. of cores & cross sectional area	Min. No. of Wires	Thickness of PVC insulation (Nom.)	Min. Thickness of PVC inner sheath mm	ARMOURED								UNARMOURED			Max. D.C. Resistance at 20	Max. A.C. Resistance at 70	Approx. Reactance at 50 Hz	Approx. Capacitance	CURRENT RATINGS		
				Nominal Dimensions of Armour		Min. Thickness of PVC Outer Sheath		Overall Diameter (Approx.)		Approx. Net Wt. of Cable		Nom. Thickness of Outer Sheath mm	Overall Diameter (Approx) mm	Net Wt. of Cable (Approx) Kg/Km					Direct Ground Amps	In Duct Amps	In Air Amps
				Strip mm	Wire mm	Strip mm	Wire mm	Strip mm	Wire mm	Strip (Kg/Km)	Wire (Kg/Km)				Ohms/Km	Ohms/Km	Ohms/Km	mFd/Km			
4C X 35	6	1.2	0.3	4x0.8	1.60	1.40	1.56	25.9	27.8	1955	2254	2.00	26.10	1744	0.524	0.62	0.097	0.98	120	110	99
4C X 240	34	2.2	0.6	4x0.8	2.50	2.36	2.36	56.7	60.1	11008	12415	3.00	57.20	10557	0.0754	0.091	0.087	1.34	345	355	295
4C X 300	34	2.4	0.7	4x0.8	3.15	2.52	2.68	62.9	68.0	13610	15877	3.40	64.10	13218	0.0601	0.073	0.086	1.41	385	400	335
4C X 400	53	2.6	0.7	4x0.8	3.15	2.84	2.84	70.6	75.3	17213	19697	3.60	71.50	16729	0.0470	0.059	0.086	1.45	425	455	360

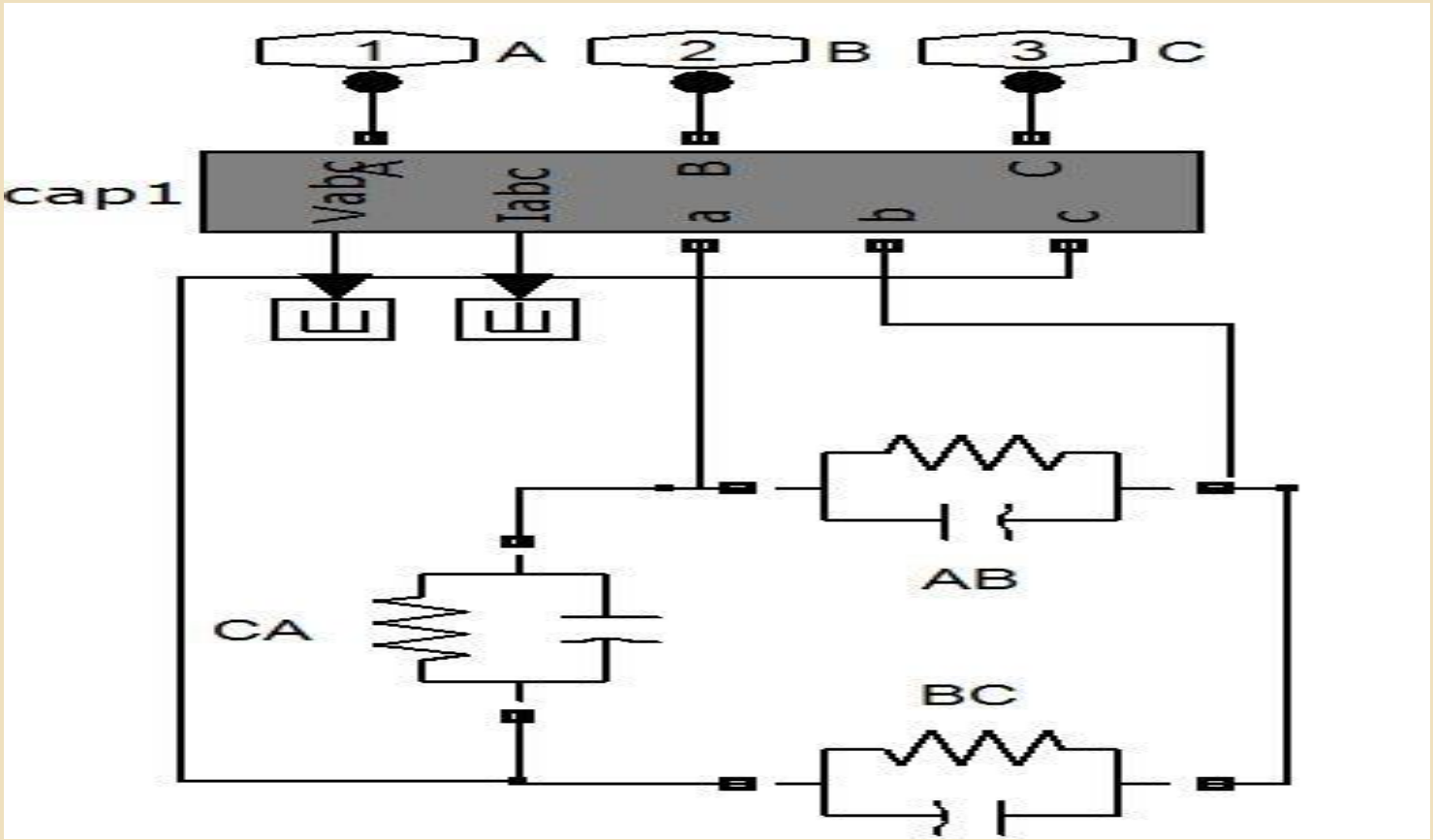
Active Power within the range of 103 kW and 97 kW at the riser of Main Switchboard Aircond



Voltage magnitude within the range of 244 V and 238 V at the riser of Main Switchboard Aircond



Delta-Connected Capacitors Considered in the Optimization: Section Three (3) of Electrical Distribution System in SSAAS



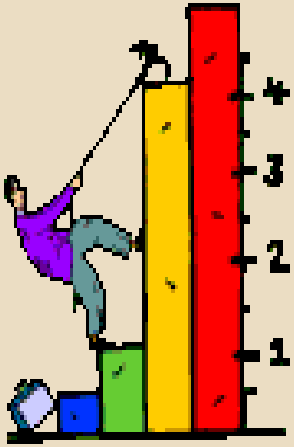
Delta-Connected Capacitors Considered in the Optimization: Section Three (3) of Electrical Distribution System in SSAAS

Delta connected	Wye connected
• Friendly to the electrical environment.	• It is not appropriate application
• Provides capacitance to each phase and also provides no voltage unbalances (harmonics).	• It has the potential to cause a catastrophic failure not only the capacitor but to the motor. • The main reason for this is because they are ungrounded and thus can present a potential difference on each phase of the capacitor which in turn contributes to the over-all deterioration of the capacitor and the attached motor.
• If a capacitor cell should fail for any reason in one phase, therefore a closed delta will become into an open delta configuration. In this instance the voltages on each phase stays the same. Failure of a capacitor cell would only mean a drop in the kVAR on the circuit. In other words, a 30kVAR delta connected three phase capacitor with a failed cell would provide 20kVAr to the electrical system instead of 30kVAR.	• The failure of any one cell of a Wye connected capacitor presents an unbalanced load to the motor. This will effectively destroy the motor due to unbalanced volt-age, temperatures.

Delta-Connected Capacitors Considered in the Optimization: Section Three (3) of Electrical Distribution System in SSAAS

Delta connected	Wye connected
• Unprotected delta connected capacitors usually used for Power Factor correction. In fact, the unbalance protection required for this type of application is cheaper.	• Unprotected Wye connected capacitors should not be used for Power Factor correction for similar reasons. In fact, the unbalance protection required for this type of application is more costly than the capacitors themselves and therefore not generally included with Wye connected capacitors.
• Delta connected capacitors unlike the Wye connected capacitors are able to circulate harmonics currents within the delta circuit and by doing so help to reduce the harmonics on the electrical system.	• Wye connected capacitors also do not circulate harmonics and thus are much more vulnerable to failure due to harmonics

4. Hasil Kajian – Sistem Pengagihan



Analysis for the Results of Section Three (3) of Electrical Distribution System In SSAAS

Objective function	Before Optimization (Base Case)	After Optimization		
		1st Run	2nd Run	3rd Run
Total Energy Consumption (kWh)	689.959 kWh	430.97 kWh	402.81 kWh	378.13 kWh
Total Energy Reduction/Saving		258.989 kWh	287.149 kWh	311.829 kWh
Percentage of Total Energy Reduction/Saving (%)		37.5%	41.6%	45.2%
Electricity Bil per month	RM 53,816.00	RM 33,615.00	RM 31,419.00	RM 29,494.00
Savings of Electricity Bil per month		RM 20,783.00	RM 23,043.00	RM 25,024.00
Percentage of Savings for Electricity Bil per month		37.5%	41.6%	45.2%
Constraints				
Voltage	0.9 p.u. < V < 1.1 p.u.			
THD Voltage	THDV < 5%			
Lowest Power Factor	0.71 p.f.	0.9155 p.f.	0.9150 p.f.	0.9151 p.f.

Electricity Bil Calculation

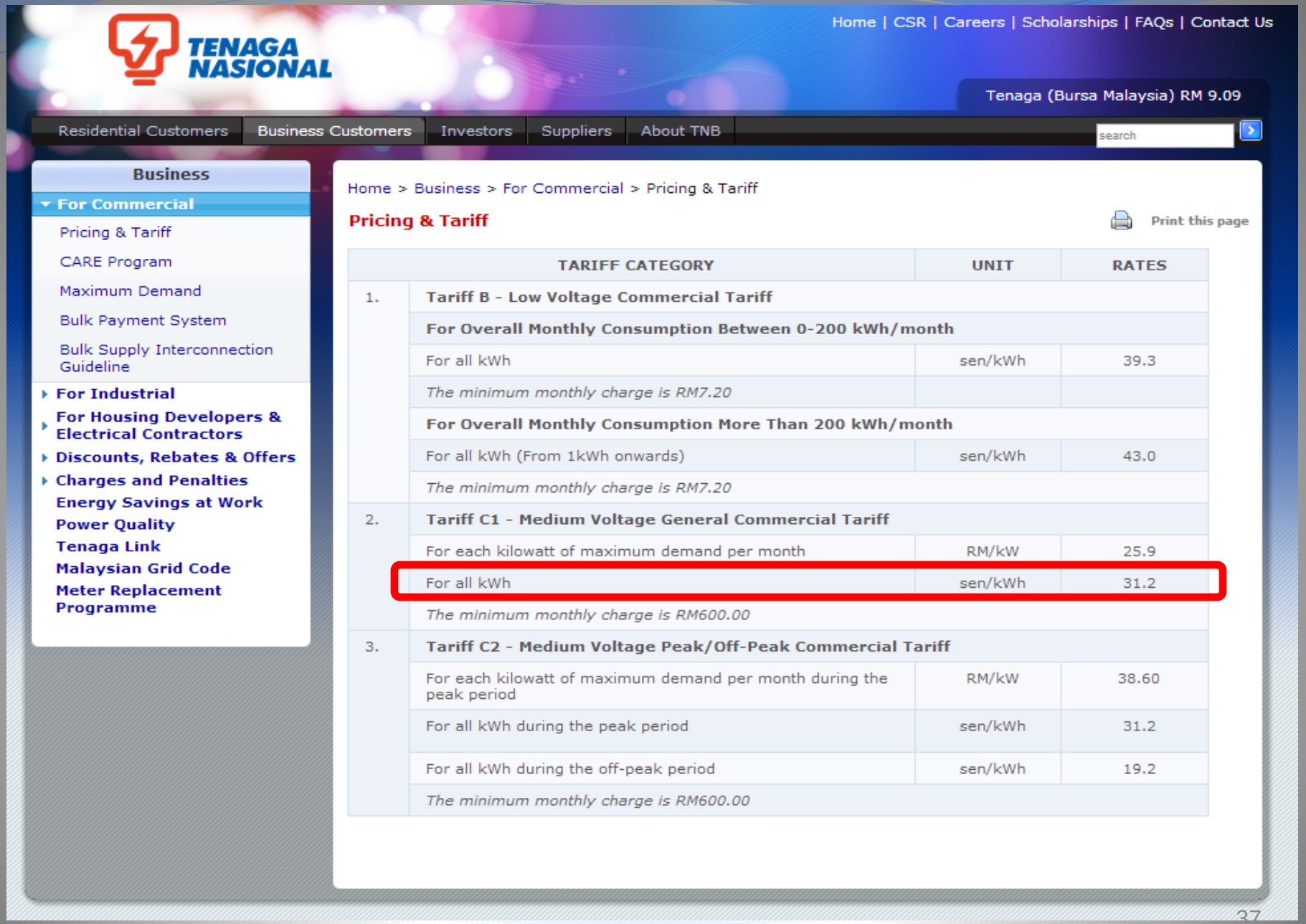
- Losses reduction is:

$$\Delta P = \frac{6795 - 3978}{6795} * 100 = 41.4\%$$

- Annual saved energy is:

$$\Delta S = \frac{\Delta P * hours\ /\ month * 12\ months}{1000} = \frac{2817 * 600 * 12}{1000} = 20282\ kWh$$

Electricity Tariff



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Pricing & Tariff

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	TARIFF CATEGORY	UNIT	RATES
1.	**Tariff B - Low Voltage Commercial Tariff**		
	For Overall Monthly Consumption Between 0-200 kWh/month		
	For all kWh	sen/kWh	39.3
	The minimum monthly charge is RM7.20		
	For Overall Monthly Consumption More Than 200 kWh/month		
	For all kWh (From 1kWh onwards)	sen/kWh	43.0
	The minimum monthly charge is RM7.20		
2.	**Tariff C1 - Medium Voltage General Commercial Tariff**		
	For each kilowatt of maximum demand per month	RM/kW	25.9
	For all kWh	sen/kWh	31.2
	The minimum monthly charge is RM600.00		
3.	**Tariff C2 - Medium Voltage Peak/Off-Peak Commercial Tariff**		
	For each kilowatt of maximum demand per month during the peak period	RM/kW	38.60
	For all kWh during the peak period	sen/kWh	31.2
	For all kWh during the off-peak period	sen/kWh	19.2
	The minimum monthly charge is RM600.00		

Conclusions

The implementation of the proposed strategy method is to mitigate starting current and reduce the maximum demand. Improving energy efficiency.

This is the core of sustainability energy in the hope that future generations can appreciate complex systems and energy usage.

This will enable cost saving and profit increase and may prove to be deciding factor providing the competitive edge to the final product.

TERIMA KASIH

Di atas perhatian anda .....

Energy is not free ….
but learning to save it…