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LEDTEC Asia 2013, Singapore

The Singapore International LED/OLED Technology Show, LEDTEC Asia 2013 was held from 7th to 9th May 2013 at Marina Bay Sands, Singapore. This impressive show presented the latest technology approaches and offered great networking opportunities. The event showcased LED industry product exhibits such as LED Chips, LED lighting, green lighting, packages and modules, LED applications, power supply, and outdoor advertisement display, etc. OLED industry product exhibits are AMOLED, PMOLED, FPD, LCD, PDP, panel, display, parts and equipment. There was some 80 exhibitors from across twelve countries occupying 3,880 sqm area and total trade visitors was 6,500.

The exhibition was supported by Building & Construction Authority (BCA), Singapore Exhibition & Convention Bureau (SECB), Korea Ministry of Knowledge Economy (MKE), CCPIT-ECC, Singapore Manufacturer's Federation (SMA), Lighting Association of Singapore (LAS), Singapore Electrical Trades Association (SETA), Shenzhen LED Industry Association (SZLEDIA), Taiwan LED Lighting Association (TELA), Korea LED Association (KLEDA), LED R&D Association of Korea, and Decoration LED Lighting Spread

Association Japan (DLEDA).

During the exhibition, an overseas buyer biz-matching programme was organised. The then TEEAM President, Engr Fu Wing Hoong was invited as a VIP overseas buyer to join the biz-matching programme. He had seven business meetings with the LED exhibitors organised by the exhibition organiser, Exporum Inc.

Held along the exhibition was the LEDTEC ASIA Technology Conference 2013 which brought together key decision makers and industrial personnel throughout Singapore, East and South East Asia, and beyond. The conference focused on the topics important to the LED community such as illuminating the future of LED/OLED technology through discussion



Conference – Participants engrossed in the presentation.



What's up – Visitors looking for the latest in LED technology.

of LED global and regional analysis, product innovation, and LED application.

LEDTEC Asia promised a comeback in May 2014.



Supportive – Engr Fu Wing Hoong (the then TEEAM President) attended business matching meetings.



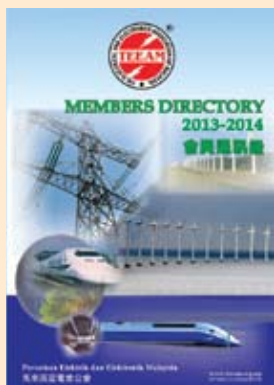
Display of products – Participants viewing LED range of products.



At the registration counter – Visitors in queues to register.



Advertisement Booking in TEEAM Members Directory 2013-2014



Cover design subject to change

TEEAM is pleased to announce the publication of a new Members Directory for 2013-2014. The directory is a useful reference material to both overseas buyers and local electrical and electronics business community. It contains the following features:

- Members' business contacts
- Guide to Ministries, Government Departments, Statutory Bodies & Utilities
- List of ACEM panel firms on M&E discipline
- Contacts of Embassies and High Commissions in Malaysia
- List of MATRADE Overseas Network
- AFEEC, FAPECA & IFEC Members' contacts

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If artwork is needed, it will be charged separately.

Please contact the TEEAM Secretariat for advertisement booking:

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Courtesy Visit from Reed, Thailand

On 23rd May 2013, Mr Suttisak Wilanan (Project Director) and Mr Wishchanont Vichaiyuth (International Business & Marketing Officer) of Reed Tradex, Thailand paid a courtesy visit to TEEAM. On hand to receive them were Mr Suresh Kumar Gorasia (International Affairs Chairman & Past President), Mr Subramaniam Karuppan (Vice President) and Council Members, Mr Ho Khai Hong and Mr Ooi Eng Guan.

The courtesy visit aimed to promote NEPCON, the largest international showcase for electronic parts manufacturing in ASEAN.

NEPCON Thailand 2013

NEPCON Thailand 2013 was held from 20th to 23rd June 2013 at BITEC, Bangkok. The theme for the 2013 edition was 'Connect ASEAN's potentials' which provided a dynamic networking platform for electronics manufacturing industry professionals in the region. Apart from being a meeting place for many new partnerships to establish, visitors and business delegations also had the opportunity to acquire trend-setting knowhow from the conference onsite, as well as the chance to expand their business with the co-located "Manufacturing Expo". This was the centre of activities for the empowerment of electronic part manufacturers to advance technologies and business trade.

Why Invest in Thailand?

The Office of Industrial Economics, Thailand has revealed that the productivity in the electrical and electronics appliances has increased by 8.37% in the second quarter of 2012 when compared to the first quarter. While the export of electrical and electronics has increased from 16.45% from the first quarter due to the recovery of production line for electrical and electronics products at Sony, Electrolux, Hitachi, Panasonic, Sharp, Western Digital and many others, but there is still room for growth in this segment. This dynamic



For the album – (3rd & 4th from left) Mr Suresh Kumar Gorasia (TEEAM International Affairs Chairman & Past President) received a souvenir from Mr Suttisak Wilanan (Project Director, Reed). With them are (from left) Mr Ho Khai Hong (TEEAM Council Member), Mr Subramaniam Karuppan (TEEAM Vice President), Mr Wishchanont Vichaiyuth (International Business & Marketing Officer, Reed) and Mr Ooi Eng Guan (TEEAM Council Member).



Fruitful discussion – Information being shared.

productivity testifies that there will be a need for more machinery and equipment to help speed up Thailand's production line back to the level prior to the Thai floods last year.

NEPCON Vietnam 2013

NEPCON Vietnam 2013 is Vietnam's only exhibition on SMT & testing technologies and supporting industries for electronics manufacturing. Apart from exhibitor side, there will also be overseas business delegations from Japan, Hong Kong, Germany, Thailand and many other countries

to capitalise upon the profitable business matchmaking at the show.

NEPCON Vietnam 2013 will be held from 10th to 12th October 2013 at SECC, Ho Chi Minh. TEEAM members are encouraged to participate in this event. For details, please log on to www.nepconvietnam.com.

Both parties exchanged information on E&E industry between Malaysia and Thailand. It was a fruitful and informative meeting. Both parties hope to foster a closer working relationship in the future. A group photo capped off the visit.



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- **KL International Trade Forum**
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- **FTA@INTRADE**
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- separators/converters



Korea Power Forum

On 27th June 2013, a delegation of leading vendors from the Korea Electric Power Corporation (KEPCO) was in Kuala Lumpur to seek business partnership with Malaysian companies. A Power Forum on “Smart Grid & Transmission” was held at Berjaya Times Square Kuala Lumpur and later followed by business partnering meetings.

The event was organised by KEPCO and TNB with the support from Malaysia-Korea Technology Center (MYKOR), Malaysian Industry-Government Group for High Technology (MIGHT) and TEEAM. The Korean delegation hoped to share their experiences and knowledge with the local business community in the E&E sector while seeking business opportunities. TEEAM members attended business partnering meetings with the Korean companies.



Power forum – A KEPCO vendor delivering a technical paper.



Networking – (from left) Ir Yong Ah Huat (TEEAM Deputy President), Mr Hong Byung Chul (PDS Global Chairman) and Mr Suresh Kumar Gorasia (TEEAM International Affairs Chairman & Past President).

Korean Companies	
Company	Products
Duri Electric & Instrument Co., Ltd www.duri21.co.kr	Multicon (connection box for street-light), distribution box, on-grid solar street light
Samwha Capacitor Co., Ltd www.samwha.com	Power factor correction (electrical): capacitor bank & harmonic filter bank, power capacitor unit
Nuri Telecom Co., Ltd www.nuritelecom.co.kr	AMI system: C&I CDMA model, GSM modem, low voltage zigbee& PLC modem
Genad System Co., Ltd www.genadsys.co.kr	Diagnostic devices, SDD-OT, STT-UHF, smart meter
Kirim Indus. Co., Ltd www.kirim21.co.kr	Electricity: bushing (for transformer), low voltage connector
Vitro C&C Co., Ltd www.vitroccc.com	Power distribution equipment: pole mounted / power & distribution transformer
Kepid Amstech Co., Ltd www.amstech.co.kr	Power distribution equipment: digital watt-hour meter, portable standard meter
Hajung Ind Inc www.ha-jung.com	Distribution: ICC (insulated power cable cover)
Dong Nam Petroleum	Lubricant oil, industrial wax: insulating oil (KS1-2, 1-4)
Kwang Myung Electric Co., Ltd www.kmec.co.kr	Electrical power unit: MV & LV switchgear, motor center, bus duct
Gum Sung Electric & Controls Co., Ltd www.igsec.co.kr	Detection device: switchgear, motor control centre
Nasan Electric & Controls Co., Ltd www.nasanec.co.kr	Detection device: switchgear, motor control centre (modular type)
Seojin Electrical Metal Co., Ltd www.sjeleco.com	Copper, aluminium: copper connector, copper base for computer cooler
Sungjin General Electrical Co., Ltd www.sjtr.co.kr	Transformer (oil immersed, cast resin)
Intech FA Co., Ltd www.intech-fa.co.kr	Off grid solar power inverter, solar pumping system



TEEAM shows support – (from left) Mr Ooi Eng Guan (Council Member), Mr Suresh Kumar Gorasia (International Affairs Chairman & Past President) and Ir Yong Ah Huat (Deputy President).

Business Partnering Meetings



LIGHTING & TRANSFORMERS

Success Electronics & Transformer Manufacturer (SUCCESS) is a well known lighting and low-voltage transformer manufacturer based in Malaysia, with the ISO9001:2008 accreditation. The company was established since 1980.

SUCCESS is the specialist in both lighting and transformers, in which the expertise lies in the design, integration, manufacture and supply of the premium quality products.

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ISO9001

The lighting laboratory is well equipped with high-end facilities enabling the team to fully test all the lighting products, including the energy efficient lighting in order to comply with the GREEN ENERGY product category standard. The company is moving towards renewable energy and energy efficient lighting products, such as solar and LED lightings.

Looking into the power products segment, Success is capable of producing power transformers up to 2MVA using the most advanced production technology. The products are designed and developed by experienced engineers. SUCCESS serves the clients by providing professional expertise. The workforce comprises professionals in their respective fields, who never hesitate to go the extra mile to exceed the customers' expectations.

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- Automatic Voltage Stabilizer
- SES Current Transformer (ASTA)



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Making the Connection – Plugs and Cable Colours

Almost all new electrical appliances now come complete with a fitted 13 Amp 3-pin plug. If the appliance you buy has no plug fitted or if your home has 2-pin or 3-pin round plug sockets you will need to fit an appropriate plug-top. If you are not sure how to wire a plug, have it done by a competent person. Remember, a wrongly wired plug can result in a serious or fatal accident.

The first thing to know is the colour code for connecting the cables to the appropriate pin/terminal in the plug.



The colour codes for cables are:
BROWN to the Live (L) terminal
GREEN/YELLOW to the Earth (E) terminal
BLUE to the Neutral (N) terminal



You may have old appliances with cables that have an OBSOLETE colour code and in this case the connections are made as follows:
RED to the Live terminal
BLACK to the Neutral terminal
GREEN to the Earth terminal

If you find an appliance with colour codes other than those mentioned above, look for advice from a competent person before connecting a plug. When an appliance is 'Double insulated' and carries the symbol it does not need to be earthed. These appliances will have just two wires, the brown LIVE and blue NEUTRAL; they do not have a green/yellow earth wire.

Wiring a Plug Safely

When you connect each wire to the appropriate terminal it is most important that no loose strands of wire are exposed and that all the screw connections are fully tightened. You should also leave a little extra slack on the green/yellow earth wire within the plug in order to avoid strain on this vital connection should the cord grip loosen. When the wires are securely connected to the terminals, make sure that the flex is properly anchored in the plug by the cord grip; make sure that the grip secures the outer cover of the flex and



Fit in the correct size fuse.

is not simply gripping the coloured insulated wires. DO NOT use a plug if the cord grip is missing or if it can't be fully tightened.

Some plugs have a cord grip consisting of two 'wings' that tighten on the flex if it is pulled. In such cases make sure that the complete flex is firmly pressed between the two wings for a secure grip.

What Size Load?

The common flat-pin 13 Amp plug is suitable for appliances with a loading of up to 2.9 kW and this covers most of the commonly used 'non-fixed' appliances at home – washing machine, dryer, microwave oven, tools, entertainment equipment, etc. In general it is wise to use the 2.9 kW loading as the maximum for portable appliances. Appliances with a loading greater than 2.9 kW should be permanently connected through a switch to their own circuit. In some cases manufacturers may recommend this practice even where the loading is below this figure.



Using Appliances Safely

Fixed appliances

Fixed appliances such as a cooker, water heater, storage heater, electric shower as well as any appliance rated above 3.6 kW must be permanently wired through a switched outlet; they must not be connected through a plug and socket.

Free standing and portable appliances

Always read the manufacturer's instructions carefully before using a new appliance and keep the instructions for reference. The most vulnerable part of many appliances is the connecting flex and its plug. Most electrical accidents associated with electric appliances are caused either by damaged or badly-repaired flexes or through wrongly-wired plugs. For your own safety, keep electrical appliances well maintained and don't abuse them. The following DOs and DON'Ts will help:

Flexes

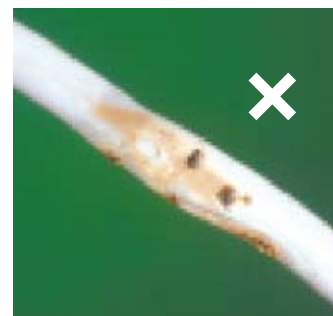
DO check flexes regularly for signs of wear, particularly on electric irons, kettles, vacuum cleaners and portable tools.

DO make sure you have a long enough flex to comfortably work at an ironing board or when vacuuming without straining the flex.

DON'T make joints in a flex, replace it with one of adequate length.

DON'T repair a defective or damaged flex; replace it.

DON'T use 'bell-wire' or telephone/alarm wire for any mains-voltage appliances or connections.



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..... Continue Making the Connection – Plugs and Cable Colours

Handling and using appliances

DON'T drag an appliance by the flex or pull on the flex to remove a plug from the socket.

DON'T plug any appliance into a light bulb holder.

AVOID using multiple outlet adaptors; use fused multi-socket boards instead; better to have additional sockets fitted.

TRY to avoid 'spaghetti-junction' type cable connections behind music systems or computer equipment. Try to keep power cables separate from other connecting cables.

DO note the maximum load allowed for a coiled extension lead – its rating is much lower with the cable fully wound than fully unwound.

Many leads cannot safely handle electric heaters; they are only suitable for smaller appliances such as light portable tools.



Remember

If a plug shows signs of damage or defective operation – cracked or broken casing, signs of excessive heating, marked pitting of the metal contact – replace it without delay.

General

DO unplug an electric kettle before filling it and make sure that the element is covered by the water.

DO unplug a steam iron before filling it.

DON'T ...have flexes trailing across either the cooker hob or sink.

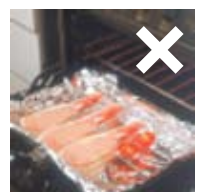
DON'T ...wrap flexes around kettles, irons or toasters while they are still hot; the flexes may be damaged.

DON'T ...clean or wash any appliance while it is still plugged in.

DON'T ...try to release jammed toast from a toaster while it is still plugged in.

DON'T ...handle plugs or switches when your hands are wet; dry them first.

DON'T ...line the grill pan with cooking foil; the foil could make contact with the live terminals.



This article is extracted from ESB Networks Safety Booklet on Safe Use of Electricity in the Home www.esb.ie/esbnetworks/booklets.jsp



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Surge Arrester with Integrated Backup Fuse

Surge protective devices are provided with external backup fuses to be able to meet the requirements of product and installation standards for surge protective devices. Expertise in the tripping behaviour of fuses is required to ensure standard-compliant dimensioning of these backup fuses. In many cases, backup fuses used for surge protective devices take up a lot of space in the switchgear cabinet. This article describes the dimensioning parameters and the benefits of the new modern arresters with integrated backup fuse.

Considering all requirements, a 315 A gL/gG backup fuse is ideal for a type 1 arrester with a discharge capacity of 25 kA (10/350 μ s). Figure 1 shows a typical installation.

It can be seen that the backup fuses (3 x NH2 315 A gL/gG) take up considerably more space than the actual surge protection. Moreover, the cables must be connected which also add up to the total cable length of the surge protective device which should not exceed 0.5 m and must not exceed 1 m as required in MS IEC 60364-5-53. The time required for planning and installing an adequate backup fuse must not be underestimated.

Lightning Current and Surge Arresters with Integrated Arrester Backup Fuse

To offer a solution to these different requirements and problems, a complete new line of arresters with integrated backup fuse are needed. Different type 1 and 2 arresters allow the user to select an adequate arrester depending on the type of installation, installation options and requirements of the lightning protection zone concept and to integrate it into the installation in a space and time-saving way. In addition to DIN rail mounted devices, alternatively product solutions which allow ideal integration in low-voltage distribution boards with busbar systems or NH fuse strips are to be used.



Figure 2: Integrated unit takes up to 75% less space.

Type 1 Arrester with Integrated Arrester Backup Fuse

Particularly type 1 arresters with integrated backup fuse considerably save space. Combined arresters with integrated backup fuse take up to 75% less space than conventional designs with external backup fuse (Figure 2).

The combined arrester (Figure 3) combines the features of a practice-proven device family and a lightning current carrying backup fuse in an enclosure with a width of only two modules. The energy-coordinated arresters allow cable lengths ≤ 5 m between the surge protective device and loads and even protection of sensitive electronic terminal equipment of overvoltage category I. The patented RADAX FLOW technology for follow current limitation and extinction ensures high availability of electrical consumer installation to be protected. The combined arrester presented in this article can also be used for short-circuit currents up to 100 kA_{rms} without restrictions.



Figure 3: Combined arrester in a TN-C system installed on a busbar adapter

Fuse Monitoring

In a conventional design with an external arrester backup fuse, the arrester is disconnected from the system as soon as the backup fuse trips. Consequently, protection is no longer provided. Monitoring of the backup fuse is only possible with great effort. Thus, the integrated fuse monitoring devices, which reliably indicates failure and prevents an unsafe condition is major advantage.

Use of Arresters with Integrated Backup Fuse

The main fields of arresters with integrated backup fuse are:

- Installations with main fuses exceeding 315 A gL/gG if a type 1 arrester is installed or exceeding 125 A gL/gG if a type 2 arrester is installed (industrial buildings, large functional buildings),
- Limited-space applications, particularly when retrofitting
- In plant construction to be able to fulfil the common requirement of up to 20% space reserve,
- Especially in case of systems for which the nominated person in control of an electrical installation defines "priority of reliable supply" as per MS IEC 60364-5-53 as top priority.

Conclusion

Arresters with integrated fuse ideally combine arrester backup fuse and surge protection element in a single device. These surge protective devices offer various benefits such as minimum space requirements and ease of installation. Moreover, no in-depth knowledge of dimensioning criteria of backup fuses is required since the ideal match for each other was already considered by the manufacturer.

This article is written by:

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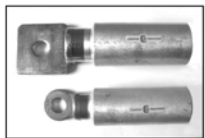
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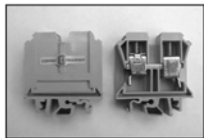
Bimetal Link



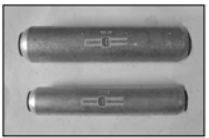
Mccb Bimetal Lug
(For MCCB)



STP
Bimetal Lug



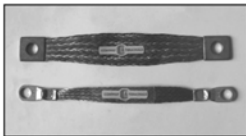
Terminal Block



Aluminium
Ferrule



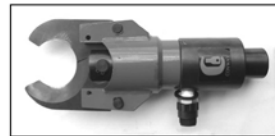
'C' Clamp



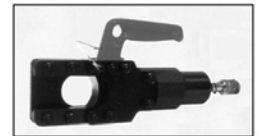
Flexible Braid



Outdoor Cable Lug
(Solder Sealed)



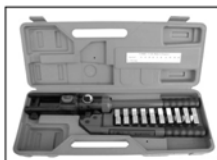
CC-630 Cable Cutter
(Non-Armoured)



S-100H
Cable Cutter



CP-120
Crimping Tool



CP-240
Crimping Tool



CP-400
Crimping Tool



CP-630
Crimping Tool



HC-115
Hole Cutter



Hand Crimping Tool



Hand Cable Cutter



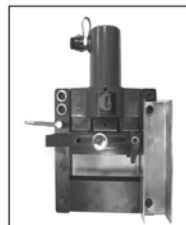
CH-240
Indent Tool



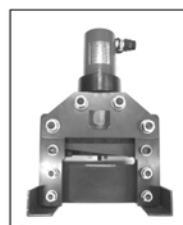
CH-630
Indent Tool



CP-1000
Crimping Head



BB-150
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PM-1000
Electric Pump

Half Day Talk on : Electrical Safety @ Workplace

19th September 2013

“Accident is unpredictable” !

It can happen so fast without showing any early sign or warning



**Electrical
safety**

Any miss flow of electrical current, not only could cause fire, explosion and electrical shock but could lead to someone becoming paralysed, disabled and even dead. According to records, electrical short circuit is the major cause of fires, which has incurred millions of dollars of losses to the industries.

“Do you realise that most electrical accidents at work place or at home occur as a result of human error?”

These accidents can be prevented if people had obeyed or acted according to the Electrical Acts, Rules and Regulations.

Electrical Acts 1990 and Regulation 1994 pertaining to electrical installation and maintenance practice clearly states that any electrical installation, modification, service or maintenance work must be done or supervised by a qualified Electrical Competent person and he must be registered with Energy Commission (ST).

Speaker

Harpajan Singh Dhillon, a specialist trainer in electrical & power system training. Knowledgeable with more than 25 years of hands-on experience, he has a passion to teach and share.

He is currently working as Head of Unit, System Competency Training, Rail Academy for RapidRail Sdn Bhd @ PRASARANA. Harpajan is entrusted with all rail related skill competency training and delivering operational, maintenance and technical training to all Rail Operations & Engineering Division Staff specialising in the area of Electrical Power & Distribution System (DC & AC up to 33KV). He is an active TEEAM member since 2011.

Objectives

- to become critically aware of the Acts and Regulations pertaining to workplace electrical safety
- to understand the hazards posed by various electrical installation and power distribution system
- to gain important knowledge of the “do’s and don’ts” when handling electrical equipment/appliance
- to take greater responsibility of electrical safety improvement at workplace

Contents

- Why Electrical Safety?
- Effect of Electrical Shock
- Basic Electric Terms
- Ohm’s Law
- Electricity Acts & Regulations
- Video on Electrical Safety
- “The 3 Electrical Behavioral Rules”
- Electrical Safety DO’s & DON’Ts
- Case Study

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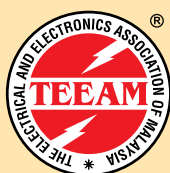
Date : Thursday, 19th September 2013

Time : 2 pm – 6 pm

**Venue : TEEAM Training Centre
No. 5-B, Jalan Gelugor
Off Jalan Kenanga, Kuala Lumpur**

**Fee : Member – RM50
Non-Member – RM100**

Closing Date: 13th September 2013



Organised by:

Education & Training Sub-Committee

The Electrical and Electronics Association of Malaysia

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Challenges and Opportunities in Electrical Industry - Part 20

This paper is prepared by Ir Chew Shee Fuee, TEEAM President.

NIOSH Safety Passports

The cost of doing business is increasing due to requirements by certain companies in the interest of safety. NIOSH is given the task of organising the training and issuance of safety passports. If your clients are the companies concerned you will need to prepare the cost of training and time allocated for it. Very often you may be caught in not able to get the safety passports in the time frame you need. This is especially the case when a large project is involved and thousands of workers need to obtain safety passports.

The various safety passports are listed below:

NIOSH SAFETY PASSPORT PROGRAMMES

No	Types of Safety Passports	Duration	Fees RM
1	Contractor Safety Passport System (CSPS)	0.5 day	75
2	Oil and Gas Safety Passport (OGSP)	1 day	250
3	NIOSH-TM Safety Passport (NTMSP)	1 day	250
4	NIOSH - Port Safety Passport (NPTSP)	1 day	85
5	NIOSH-TNB Safety Passport (NTSP)	1 day	250
6	NIOSH-OSFAM Safety Passport (Assessment)	1 hour	50
7	NIOSH UiTM Safety Passport (NUTMSP)	0.5 day	
8	Safety Induction System for Oleochemical Industry (SISO)	1 day	250
9	SYABAS – NIOSH Safety Card (SNSC)	1 day	120
10	NIOSH MAYBANK SAFETY PASSPORT (NMSP)	1 day	250
11	NIOSH-Genting Safety Passport (NGSP)	1 day	250

It is my opinion that such requirements across the board is quite a waste of time and money. In our line of work we are dealing with electrical switchgear and equipment. Except for the location where this apparatus will be placed, the work and safety aspects are identical. Therefore it is very costly just to obtain all relevant safety passports for various kinds of locations. The qualification of workers differs but no waiver is given. It appears that it is a smart way of making revenue by just qualifying people with safety passports. If the trend continues we can have hundreds of safety passports for each worker in order to satisfy the requirements.

The Amendment to the Electricity Supply Regulations 1994

The document can be downloaded at http://www.st.gov.my/v4/images/stories/about_us/20130503_P_U__A_151-PERATURAN_-_PERATURAN_ELEKTRIK_PINDAAN_2013.pdf

The amendment of Regulation 47

“ in the case of a Professional Engineer in Electronic engineering that he has not less than eight years experience working in an environment in the power sector where electrical equipment is in operation and has had experience of controlling live equipment”

New Regulations 97A, 97B, 97C, 97D, 97E and 97F

97A- Recognition of foreign conformity assessment body

97B- Registration of local conformity assessment body

97C- Registration of manufacturer and importer

97D- Submission of test report or Certificate of Conformity by manufacturer

97E- Submission of test report or Certificate of Conformity by importer

97F- Duties to keep technical files of equipment, etc

New Regulations 101A, 101B and 101C

101A- Efficient use of electricity by equipment

101B- Energy performance test report

101C- Submission for test and seizure for the purpose of efficient use of electricity

New Regulation 109A

Market Surveillance

Selling of equipment without the labelling requirement of Regulation 98 is an offence.

The phasing out of incandescent lighting will be done through the implementation of the Minimum Energy Performance Standards (MEPS). The amendment to the Electricity Supply Regulations 1994 has been gazetted on the 3rd of May 2013 which incorporates the efficacy value that must be achieved by incandescent lighting (20 lumens/watt) in order for it to be able to be sold in the Malaysian market. However ST has also included a few exemptions towards the usage of incandescent lighting in the amended regulations.

As of 3rd May 2013 all manufacturers, suppliers and importers are encouraged not to produce and import incandescent lighting which cannot meet the efficacy value stated in the regulations. From 3rd May 2014 enforcement work will commence.

Ir Chew Shee Fuee B Sc (Hons) (Strathclyde), PEng, CEng, FIEM, MIEE Member, IEEE Member, 1st Grade Electrical Engineer (Competent up to above 500 kV).

Ir Chew is the current President of The Electrical and Electronics Association of Malaysia (TEEAM). He was TEEAM President for 2001 - 2003 and 2003 - 2005. He is the Past President of the Asean Federation of Electrical Engineering Contractors (AFEEC).

Ir Chew is the Managing Director of G H Liew Engineering (1990) Sdn Bhd and QATM Engineering Services Sdn Bhd. He graduated from the University of Strathclyde, Glasgow with a B Sc (Hons) in Electrical & Electronics Engineering. He is a Professional Engineer and is also licensed by Energy Commission as a competent engineer (without voltage limits) and a service engineer to carry out electrical testing up to a voltage of 500 kV.

Ir Chew has more than 30 years experience in electrical control and relay protection. He is also specialised in electrical site tests on power equipment, electrical fault investigation, service and maintenance of electrical switchgear and relays. His work also includes electrical supervision of substations and electrical audit. He presents lectures on electrical apparatus and the protection system. He is at present a WG representative in the development of Green Technology Road Map Phase 1. He is also a member of the National Energy Efficiency Technical Working Group. He is the Immediate Past President of IET Malaysia (Institution of Engineering & Technology) and Board Member of IET's APRB (Asian Pacific Region Board). He can be reached at E-mail: sfchew@ghliew1990.com.

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The Challenges Of Indonesian Electricity Development: Accelerating Rural Electrification Toward 2020 And Energizing The Economic Growth Toward 2030

Dr. Herman Darnel Ibrahim

Chairman of Indonesian National Committee of CIGRE

Member of DEN, the National Energy Council Republic of Indonesia

Senior Advisor AKLI, the Indonesian Electrical and Mechanical Contractors Association

Paper Presentation for AFEEC-FAPECA Conference, Bali 5-7 June 2013

ABSTRACT

Energy and economic statistics show a linear correlation between the countries' Gross Domestic Product [GDP] per capita and their energy consumption per capita. A nation having high GDP per capita is always followed by high-energy consumption per capita. It is a fact that the Indonesian energy consumption per capita is still relatively low compared to that of average world level and even of the ASEAN countries. Although the Indonesian energy consumption is low, ironically the shortage of power supply happened on and off repeatedly. In addition, the electrification ratio of the country is only about 65% leaving the rest as off-grid and approximately 20% out of 71,000 rural areas has not been electrified yet. Moreover, the electricity provision in Indonesia has to face a high production cost because some power plants are still fuelled by petroleum. With diesel fuel consumptions per year of more than 10 million kiloliter, the subsidy provided by the government reaches US \$ 9 billion per year to run all those petroleum-fuelled power plants. To enhance the people's prosperity and to support the vision of Indonesia becoming an emerging economy country toward 2030, Indonesia still needs an enormous electricity development in the future. This paper describes the recent situation and problems of electricity supply, outlines the projection of electricity development and the strategy for boosting electrification toward 2020 and for meeting the higher electricity demand toward 2030.

Keywords: gross domestic product [GDP], energy consumption, rural electrification, economic growth, and electricity development challenges.

1. The Economic Growth Needs Sufficient Electricity

The economic growth of a nation is always followed by the national energy and power consumption. It is widely spoken in many scientific forums that the economic advancement of a country has a linear correlation with the usage of primary energy and the utilization of electricity. The greater the economic growth identified by high GDP, the larger the energy consumption of the country. Figure 1 shows the graph of energy consumption vs GDP per capita of several countries. Meanwhile, the income, consumption and installed electric capacity of Indonesia, ASEAN, OECD and other developed countries are displayed in Table 1.

Based on data from the Institute of Energy Economic of Japan, in 2008 the GDP per capita of USA was US\$ 47,266 with the electricity consumption of 12,536 kWh per capita per year. A group of 30 OECD countries contributed to GDP per capita of US\$ 36,518 per year with energy consumption of 7,763 kWh per capita per year. Japan and China had GDP per capita of US\$ 38,179 and US\$ 3,411 and the energy consumption of 7,526 kWh and 2,140 kWh per capita per year, respectively. As an emerging country, the GDP per capita of India was US\$ 1,134 and electricity consumption of 527 kWh per capita per year. Group of some ASEAN countries attributed to the GDP per capita of US \$ 2,655 and electricity consumption of 914

kWh per capita per year. Meanwhile, the GDP per capita of Indonesia was US \$ 2,251 per year and electricity consumption of 572 kWh per capita per year. This shows both GDP and energy consumption of Indonesia is still low compared with the world average and of the ASEAN countries.

The economical activities are always related to the production and consumption. And both aspects mostly require energy and electricity as the prime mover. Electricity is favourable for any single actions leaving it become the basic needs. It is one of the first things asked by the investors when they want to start their business in Indonesia. Thus, for a developing country, it can be said that the economic growth will really depend on the sufficient energy and electricity provision in the region.

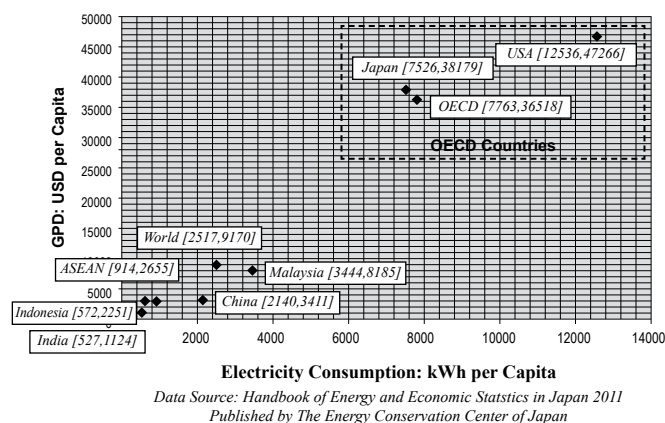


Figure 1. Correlation between GDP per capita vs electricity consumption for some countries

Table 1. Installed Capacity, Electricity Consumption and GDP of World, ASEAN and OECD countries in 2008

Parameters	Unit	Indonesia	World	ASEAN9	OECD30	USA	India	China	Malaysia
Population	Million	227	6673	568	1190	304	1140	1325	27
Installed Capacity	GW	32	4500	120	2400	995	170	800	21
Electricity Consumption	TWh	130	16802	519	9238	3811	601	2835	93
GDP Purchasing Power Parity	Billion US\$	511	61189	1508	43457	14369	1281	4520	221
Capacity per capita	Watt	141	674	211	2017	3273	149	604	778
Electricity consumption per capita	kWh	573	2518	914	7763	12536	527	2140	3444
GDP per capita	US\$	2251	9170	2655	36518	47266	1124	3411	8185

Source: Handbook of Energy and Economy Statistics in Japan 2011, Energy Conservation Centre, Japan 2011.

In 2008, the population of Indonesia was 227 million, which was about 3.4 % of world population. However, the electricity consumption of Indonesia of 130 TWh was only 0.8 % of the world. At that time, the power per capita of Indonesia was only 141 watt, whereas the world average and OECD countries was 674 watt and 2 kW, respectively. Those values indicate a large gap, which shall be overcome by electricity provision, at least to a level similar to the world average.



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With the population of more than 230 million people, Indonesia in fact is endowed by a huge domestic captive market, which may support the industrial development. At present, 8.6 million cars are on demand of which the new cars take account for 500 thousand units per year and motorcycle with a market of 70 million units has a market share of 3 million per year. The cellular phone has now exceeded the level of 200 million sets. Also, the same trend is found for other electronic devices and appliances such as TV, refrigerator, washing machine, air conditioner, fan and other equipments. If domestic captures 30% of those markets, a significant growth in economy may occur and many labours can be employed.

2. Current Electricity Provision: Low Electrification Ratio, Repetitive Power Shortage and High Production Cost

PLN is the only state-owned company responsible for electricity provision in Indonesia. Meanwhile most private companies are supplying their power to the limited industrial complex, own use and as independent power producer [IPP] for PLN. The electricity provision in Indonesia has not well distributed yet. More than 80% of electricity consumers are located in Java, 11% and 3% each in Sumatera, Kalimantan, Sulawesi, and Maluku, Papua and Nusa Tenggara. Figure 2 displays the share of population, energy consumption and electrification ratio in Indonesia.



Notes:
 SEC: Share of Electricity Consumption.
 SOP: Share of Population
 ER: Electrification Ratio
 PES: Primary Energy Source; C=Coal; NG=Natural Gas; O=Oil; H=Hydro; G=Geothermal

Figure 2. Disparity of Electricity Provision in Java and Outside Java Island

Besides the above gaps, there are 3 big problems to be solved in this sector: [1] low electrification ratio, currently near to 70%, meaning more than 80 million people are living without electricity, [2] repetitive power shortage and [3] high generating cost mainly due to utilization of petroleum-fuelled power plants.

As the only company in charge to provide electricity to Indonesian people, PLN annually always publish RUPTL [Rencana Usaha Penyediaan Tenaga Listrik or the Electricity Provision Planning] by which the endorsement is issued by the government. RUPTL basically comprises of the electricity composition, number of consumers and infrastructure needs for transmission, distribution and generation. Ideally, PLN plans to provide sufficient electricity to Indonesian people, however, not all these plans can be realized, as many projects are not well managed. As a consequence, every single delayed project has contributed to the lack of power in the country. During the period of 2000 to 2010, the electricity consumption growth was 6 to 7%, but the additional generation capacity only increased about 3% averagely. The same trend occurred for transmission and distribution facilities.

Many of the delayed and unrealized projects are commonly caused by 2 factors: [1] PLN does not have long-term funding and [2] problems associated with land acquisition for the projects. The former factor is due to the tariff and subsidy regulation, which could not accommodate the revenue requirement for the operational

aspects in the respective fiscal year and investment for the services expansion development and for the rehabilitation of ageing infrastructures. Determining subsidy is a dilemma, where on one side, the government sets the electricity tariff below the average generating cost, but on the other side, the subsidy provided does not have a clear basic formula. As a model, in the countries where electricity market is regulated, the formula of revenue requirement of an electricity company is described as:

$$[\text{Revenue Requirement}] = [\text{Operation Cost}] + [\text{Development Margin}] = [\text{Revenue}] + [\text{Subsidy}]$$

Revenue Requirement: revenue based on long-term marginal [break even] cost projection including both operational and development cost.

Operation Cost: an annual operational expenditure [OPEX] including depreciation.

Development Margin: a margin covering the investment expenditure [CAPEX] for the development and is not a profit to be saved and shared.

Revenue: an income of the company from its electricity sale, kWh sale multiplied by the average tariff.

Subsidy: the fund given by the government as a public service obligation [PSO] if the company implements the electricity tariff under the average of breakeven cost.

In a regulated electricity market, the government provides a sufficient margin for long-term development. When the electricity demand becomes steady or the growth of electricity development is almost zero, the margin will not be required anymore. If the government does not inject its fund as a margin, they may add more equity share for the development, as applied for PLN before it became a limited company [Persero]. If the government intends to set a low tariff by giving sufficient subsidy, it will cover its margin for development and support the utility. On the other hand, when government wants to provide less subsidy, a higher tariff has to be set by taking into account its competitiveness with neighbouring countries, especially for industrial sectors. However, what happens so far in Indonesia is that the subsidy cannot meet the needs of infrastructure development and the additional equity to PLN is also not provided.

The second reason of unrealized project as planned is because the utility also plays as the project executor. Most of the projects on the 10,000 MW phases 1 and 2 are tendered without a cash-in-hand funding. Therefore the start of the project implementation takes a longer time. The same case happens for the IPP scheme. The IPP companies generally will only secure their funds or finance after they sign the power purchasing agreement [PPA] with PLN. Thus, one cannot be certain when the power plants can be completed. Moreover, the problems on land acquisition and licensing are also contributing to this barrier. Besides, the 1998 economic crisis that hits Indonesia, the annulment of the Electricity Act No. 20 year 2002, and the removal of petroleum subsidy to the utility in 2005 had brought significant impacts to the development of electricity in the country.

The monetary crisis in 1998 made PLN collapsed due to the sudden increase in production cost, which was not followed by the increasing of tariff. Later, only in 2003 the tariff was then adjusted. As such, no electricity development at all could be done during the period of 1998 to 2003. The new enacted Act No. 20 Year 2002 stipulated PLN as the Holder of Electricity Business Authority [PKUK] and in line with autonomy spirit, the responsible bodies that provide electricity are given to the local and centre government. However this new law was revoked by Constitutional Supreme Court [MK] on December 14, 2004. Because of this incident, PLN did not do any significant electricity developments until 2005. The rising price of petroleum in 2005 due to the government policy to reduce the subsidy had burdened PLN, which had just tried to "wake up" from collapse, as many PLN power plants were fuelled by petroleum. This was the beginning of PLN subsidy swelling.

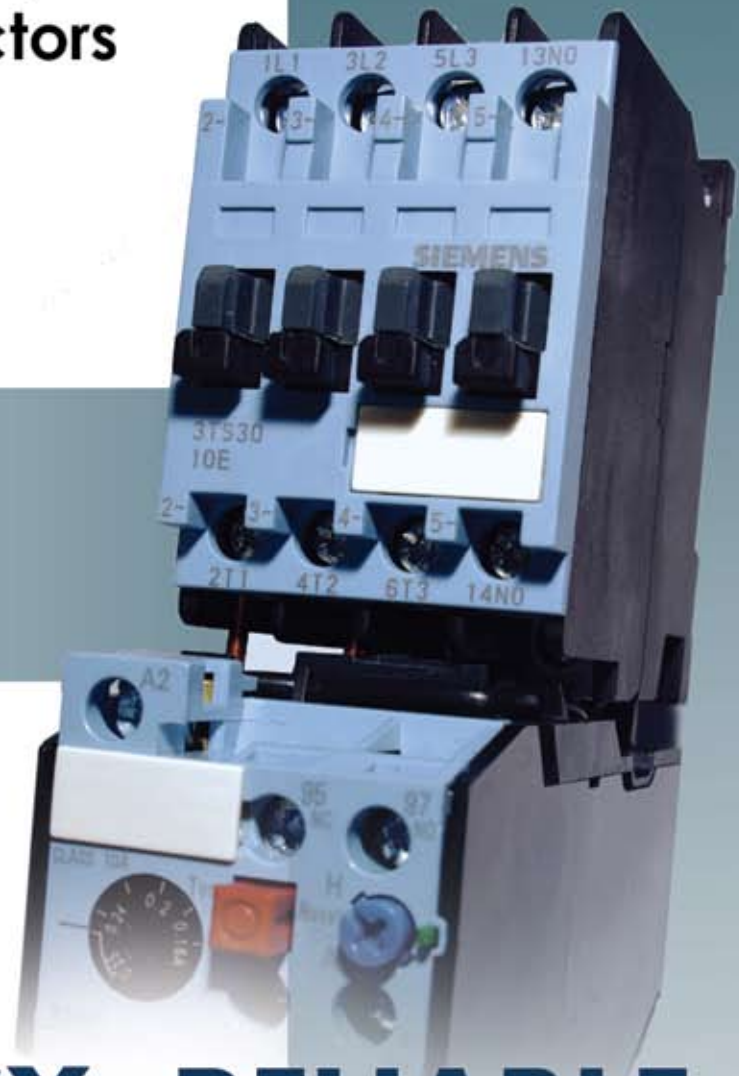
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..... Continue The Challenges Of Indonesian Electricity Development: Accelerating Rural Electrification Toward 2020 And Energizing The Economic Growth Toward 2030

The power shortage had in fact been predicted about 3–4 years before it occurred because of the delay of power plants and transmission projects. A simple and fast solution to overcome the power shortage was by generating the petroleum-fuelled power plants, whose generating cost had achieved US\$ 35 cents per kWh. Up to now, at least 25% of electricity production is still coming from petroleum-fuelled power plants, with PLN consumes 10 million kiloliter of petroleum annually.

The average electricity production cost of PLN in 2010 was Rp 1,187 per kWh. Meanwhile, the electricity sale was about Rp 703 per kWh. The decrease of petroleum consumption from 10 million kiloliter to 2 million kiloliter can possibly save the subsidy for about Rp 50 trillion per year. Therefore the fair average electricity tariff is about Rp 900 to 1000 per kWh, and that for industry is Rp 700 to 800 per kWh. In order to avoid the power shortage in the future, PLN shall be reformed by at least two actions: [1] PLN shall rationalize the generating cost of petroleum-fuelled power plants to gas and coal power plants and [2] the government shall regulate the electricity tariff and give adequate subsidy based on long-term marginal costs as outlined above.

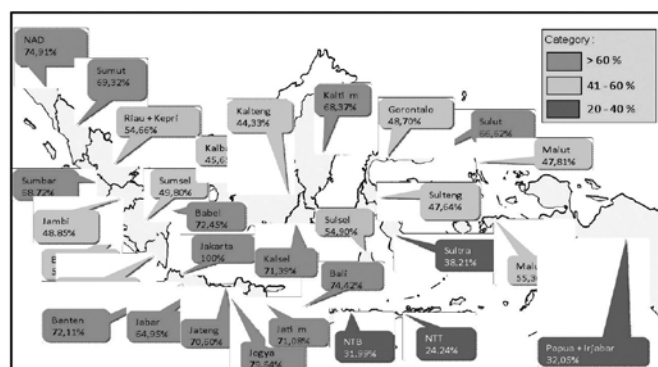
The next important thing in order to secure the power supply is to make sure that the power generation and transmission are available for the next 4 years. The construction of new power plants, transmission and distribution system shall be prepared from now to fulfil the electricity requirement in 2015. The experiences told that if the electricity growth is 7% per year, the development of electricity infrastructure should also at least grow with the same value. If the utility cannot achieve that target, the government shall immediately overtake by pouring in more subsidies with a margin or share more equity as additional investment capital [share].

3. Medium-term Electricity Provision: Electricity Access with Electrification Ratio ~ 100% Towards 2020

In the short-term planning period until 2025, the main challenge is to complete the constructions of coal power plant of 10,000 MW phase 2 which may substitute most of petroleum-fuelled power plants and decrease the generating cost to the rationale level. The other agenda are to achieve the electrification ratio to 85% and increase the electricity consumption to 950 kWh per capita in 2015. After that, actions shall be taken to accelerate the electrification ratio to be close to 100 % by 2020. Besides, the power capacity shall be boosted and renewable energy sources have to contribute to the energy mix, endorsed by the government policy. The electricity infrastructure development shall be encouraged in order to achieve electricity consumption of more than 1,500 kWh per capita in 2020. For that, the electricity supply and production costs shall be secured in the affordable level.

Up to now, only about 85% out of 71,000 villages are electrified. Most villagers really hope their villages can be supplied by electricity as soon as possible. Due to this, some community leaders proclaim that in fact they still have not obtained their “independence” as mandated by Indonesian Constitution Act Year 1945. Electricity can only be provided to those who are living in the urban and suburban areas and some to certain prosperous villages. It contradicts with the Act of Energy No 30 Year 2007, especially in the article 19 stating that the government must provide access to energy for all Indonesian people. The electrification ratio for each region in Indonesia is displayed in Figure 3.

At present, it is predicted that about 20% of world population [~ 1.3 billion people] are still not getting electricity supply. Among them, a few hundred million people are inhabited in China and India and about 80 million people in Indonesia. It is ironic the problem happens after 122 years since the electricity was discovered in New York in 1890 and 67 years after Indonesia attained her independence from Japan in 1945. Thus, the government shall be responsible for this unfair condition.



Source: Ministry of Energy and Mineral Resources 2009

Figure 3. Electrification Ratio of Indonesia in 2009

Now it is time for the government to provide electricity for rural areas in Indonesia. Electricity not only may give a comfortable life to the villagers but also may support their economic advancement. As a model of policy, we can refer to the Vietnamese government's strong policy, which states that electricity is the key element to combat poverty and encourage equitable growth. In Bangladesh, rural electrification is handled by a certain body of the national level called Rural Electrification Board and in the regency level maintained by a cooperative.

The projection of electricity development to achieve close to 100% of electrification ratio until 2020 is shown in Table 2. With a population of 262 million people, at that time it is predicted new additional consumers will be 30 million new connections or about 3 million connections annually. This target is quite reasonable, as PLN had done similar works for 3.5 million new consumers in 1990s. To accelerate the electrification ratio, the additional power capacity needed will be 60 GW. By assuming the investment cost for constructing power plants, transmission and distribution system of US\$ 2.5 million per MW additional generation, thus at least is US\$ 135 billion required during the period of 2012–2020. This amount of annual investment is equal to 1% of projected GDP by that time.

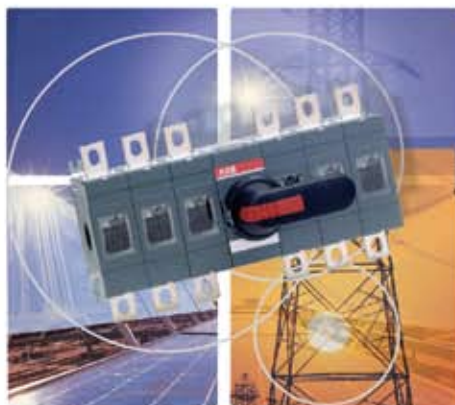
Table 2. The projection of electricity development towards 2020

Parameters	Unit	2010	2012	2014	2016	2018	2020
Population	Million	238	243	248	253	258	262
Population Growth	%	1.99	1.04	1.02	1.00	0.89	0.77
GDP per Capita	US\$	2987	3724	4698	5929	7414	9239
GDP Growth	%	6.6	12.8	13.5	13.5	12.8	12.5
Residential Customer	Million	41.5	46	53.6	60.5	68	71.9
Electrification Ratio	%	65.0	70.0	80.0	88.5	95.0	99.0
Electricity Consumption	TWh	148	173	212	266	332	420
Consumption Growth	%	7.9	8.0	10.9	11.9	11.8	12.4
Electricity Consumption per Capita	kWh	662	710	855	1050	1290	1605
Aggregate Peak Load	GW	27.6	29.8	36.7	45.9	57.5	72.6
Requirement for Power Generation	GW	35	40.3	49.5	62.0	77.6	94.4
Estimated Investment Need	Billion US\$	NA	6.6	11.5	15.6	19.4	21.0
Ratio Investment to GDP	%	NA	0.7	1.0	1.0	1.0	0.9

At present, the access to electricity is only found in the urban and suburban areas which can be reached by car. However, for the villages which are located more than 20 km from PLN networks or can not be reached by car are still lacking access for electricity. Housing for fisheries is commonly situated in a group, while the farmers are much wide spread. Therefore, the provision of electricity in rural areas shall be integrated with the development of road infrastructure and settlement arrangement. The better the settlement the cheaper the cost of electricity access.

Out of 30 million new connections to be connected towards 2020, it is estimated that 75% or about 24 million connections are located in the villages and isolated islands. The low electrification ratio is found in Kalimantan, Maluku, North Maluku, Papua, West Papua and Nusa Tenggara and part of Sumatera. The options for electricity sources can be supplied by PLN networks for the villages located less than

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20 km from PLN networks and for isolated areas can be provided by small power plants and micro grid systems. One family in the village only needs no more than 200 watt or equal to 50 kWh per month.

For isolated rural, the first option for electricity access is to utilize local affordable renewable energy sources, such as mini and micro hydropower, if available. If it is not available, we can utilize solar power, diesel power and the hybrid between diesel and solar power. The solar power has disadvantage in its continuity of supply where in Indonesia, it can only supply for about 5 hours per day or 1600 hours per year. If the sun is cloudy, the supply may stop. Therefore, solar power is currently only used for lighting purpose as other high power home appliances require advanced batteries and inverters. Electric provision through diesel generation can be another option, which helps to overcome the continuity of supply and gives a comfortable service to the consumers. For a village occupied by 50 families, a 10 kW diesel generator can be installed, which approximately requires US\$ 600 per grid connection. This generator will produce electricity as much as 30 MWh per year. It at least requires 10,000 litres diesel fuel per year [15 litres per day] if it is operating for 6 hours per day or 2,000 hours per year. This amount is in fact equal to the fuel consumption of a car in the city. The last option is by using the hybrid between diesel and solar power, if it is economically feasible. Therefore, it is important to prioritize the utilization of local renewable energy. It shall be noted, however those alternative electricity sources shall not contradict and decelerate the rural electrification. Table 3 shows the options of power sources for rural electrification in Indonesia.

Table 3. Comparison of Options of Electric Sources for Rural Electrification

Characteristics	Local Energy Non PV	Solar Home PV System	Mini Diesel and Micro Grid	Hybrid Diesel and PV
Continuity of Supply	Seasonal-dependent	Intermittent [Not continue]	Continue	Continue
Transmission	Locational-dependent	Off-grid	Less expensive	Less expensive
Operational	Practical	Operated by user	Applicable	Sophisticated
Comfortability	Comfort: TV, lamp, and other use	Less comfort: small lamps only	Comfort: TV, lamp and other use	Comfort: TV, lamp and other use
Investment Cost	Various	More expensive	Cheap	Medium
Sustainability	Medium	Low	High	High

The rural electrification for isolated areas may be managed by a local government-owned company or a cooperative under the supervision of PLN and local government. To realize the rural electrification towards 100%, the establishment of a responsible body in the national and regional level is crucial. At the national level, a Directorate General for Rural Electrification should be formed and at the regional level a similar body may be created, especially for the areas where electrification ratio are still low. If the management is given to a cooperative in the regional level, it is better for a regency to have one main cooperative in charge of electricity provision. If subsidy is needed, the local or regional government shall provide it.

4. Long-Term Electricity Provision: Support Indonesia's Vision to be a World Economic Power Toward 2030

After reaching 100% of electrification ratio, the challenges in the period of 2020 to 2030 may lie on the spurring of electricity infrastructure growth to support the economic development in order to achieve at least top ten of the greatest economic growth as stipulated on Master Plan for Acceleration of Development of Indonesia Economy [MP3EI] published by the Government of Indonesia in 2011. The next scenario is to reach the electricity consumption of 2,500 and 3,500 kWh per capita by 2025 and by 2030, respectively. The infrastructure development shall mainly be directed on utilization of efficient, reliable and high quality technologies and boosting the development of renewable energy and low carbon energy sources in order to enhance the national energy security and producing cleaner energy.

In 2007, the Indonesia Forum promoted 2030 vision to the President, which was later included in the MP3EI. The main idea of this vision is to make a great jump in Indonesian economy with the main indicator: Indonesia to become a top five world economy [in 2008 Indonesia ranked 18th] with income per capita more than US\$ 18,000 [in 2008 that was US\$ 2,250]. In line with that vision, the Presidential administration has launched the triple track strategies which are Pro Growth: the development which supports the economic growth, Pro Job: the development which strives to create new jobs and reduce unemployment and Pro Poor: the development favours side to poor people where the number is still abundant in the country. As stipulated in the projection above, as the economic activities are closely related with the development of energy and electricity infrastructures, the plan to accelerate the increasing of electrification ratio toward 2020 and the 10,000 W program phase 1 and 2 are believed to run in the right track in line with 2030 vision Indonesia Forum, MP3EI and the triple track strategy as well.

To be a top five world economic superpower country means Indonesia will compete with USA, Japan, Germany, British, France and China. In order to achieve the GDP per capita of more than US\$ 18,000 by 2030, the present value of that with the discount rate of 4 to 5% will be US\$ 6,000 to 7,000. By this projection we can derive a linear correlation between the GDP per capita and electricity consumption, which is predicted in the range of 4,500 kWh per year or 3,500 kWh per year if the energy efficiency and conservation program is run.

Table 4. Electricity Development to Support the 2030 Vision

Parameters	Unit	2010	2015	2020	2025	2030
Population	Million	238	250.5	262	271.6	282
Population Growth	%	1.99	1.03	0.86	0.76	0.75
GDP Per Capita	USD	2987	5329	9239	15674	24089
Residential Customer	Million	41.5	57.5	71.9	77.5	80.5
Electrification Ratio	%	65	85	99	99.9	99.9
Electricity Consumption	TWh	148	238	420	676	994
Consumption Growth	%	7.92	11	12	10	8
Electricity Consumption per capita	kWh	622	951	1606	2490	3524
Aggregate Peak Load	GW	27.6	41.2	72.6	117	171.9
Requirement for Power generation	GW	35	55.6	94.4	146.2	214.9
Cumulative GDP for 5 years	Billion USD	NA	5115	9378	16683	27625
Cumulative Investment Need	Billion USD	NA	52	97	130	172
Ratio Investment to GDP	%	NA	1	1	0.8	0.6

In order to achieve this vision, the electricity consumption per capita should reach 3,500 kWh by 2030. The projection scenario of electricity development in Indonesia toward 2030 is shown in Table 4. At that time, the population is predicted at 282 million people. The electricity consumption shall be higher than 1,000 TWh or about 6 times larger than that of 2011 or 2.5 time of 2020. Thus, it at least requires 12% of electricity consumption growth for the period of 2015 – 2020. Figure 4 shows the projection of GDP per capita vs the electricity consumption towards 2030.

The needs for additional installed capacity are projected to be 35 GW in 2010 to 220 GW in 2030 or additional power of 180 GW. In the period of 2010 to 2020 and 2020 to 2030, the need of annual additional capacity is 6 GW and 12 GW, respectively. By assuming the investment cost of infrastructure development for power generation, transmission and distribution as much as US\$ 2.5 million per MW additional capacity, the investment in this sector is outlined in Paper H. Darnel Ibrahim, AKLI AFEEC-FAPECA Conference Bali, 5-7 June 2013 8 which is estimated to be US\$ 450 billion for the period of 2010 to 2030 or US\$ 15 billion per year for 2010 to 2020 and US\$ 30 billion per year for 2020 to 2030. This investment cost is equal to about 1% only of the projected GDP for 2010 to 2020 and about 0.5% only for that of 2020 to 2030, a very reasonable portion if the GDP for those periods can be achieved.

The next electricity development after 2020 until 2030 is to provide additional capacity of 120 GW or 12 GW per year. China and



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India have recently developed at least 100 GW and more than 15 GW per year respectively. For Indonesia, it is reasonable to build additional 120 GW for 10 years by boosting the supporting industries both up and downstream in the country. Utility has to concern on the procurement by selecting 2 or 3 qualified contractors who insist giving their licenses to construct their factory in Indonesia. To realize the above achievement, well planning is a must. A blueprint containing the project financials and procurements, the role of private sectors, government and state-owned enterprises should be outlined. Besides, it also should describe the details of power generation to be built, locations, fuel supply, transmission and distribution systems, etc. Last but not least, the human resources and the expertise from top to down to support the target from the upstream to the downstream of industries should be prepared and developed.

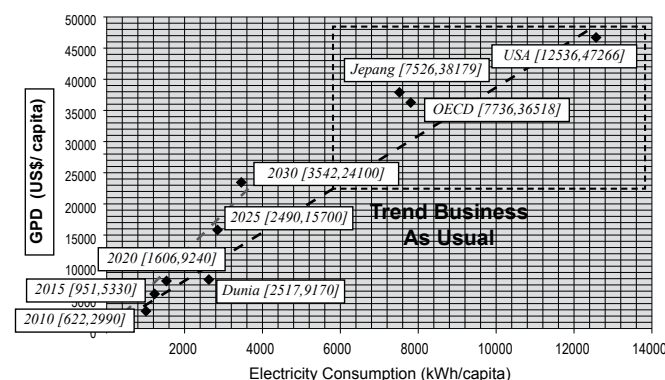


Figure 4. Projection of GDP per capita vs Electricity Consumption in Indonesia towards 2030

5. Conclusion

The fact has shown that economic developments require huge energy and electricity as the prime mover. The electricity shall first exist before the economic growth may occur. In the same point of view, the economic growth gives a chance for the development of electricity infrastructure identified by the increase of GDP per capita. Experiences from many developed countries tell that the GDP per capita has a linear correlation with the electricity consumption, thus the economic growth can only be boosted by the increasing of electricity consumption and its infrastructure development.

It is the right of all Indonesian people to gain access to energy, as mandated in Energy Act No. 30 Year 2007. Thus, the provisions of electricity for rural area and poor community have to be a priority on electricity development. The government should set the national policy that prioritizes the target with a regulation and legal certainty. The acceleration of electrification ratio to be close to 100% by 2020 can be carried out by installing isolated diesel generators and hybrid solar-diesel if those regions do not have local energy or renewable energy sources.

Connecting all the people with electricity access, solving the power shortage, and developing the electricity infrastructure in the future are among the challenges. However the main challenge is how to change the paradigm where at present the development of infrastructures are based on the budget that can be provided into new framework where the development shall be carried out by providing the budget at cost at which it is needed in order to build the utilities based on demand projection.

Additional power capacity until 2020 to 2030 is about 60 and 180 GW, respectively. To achieve that, it is required the investment on the range of US\$ 135 billion or US\$ 15 billion per year until 2020, and US\$ 300 billion or US\$ 30 billion per year from the period of 2020 to 2030. This average investment is only about 1% of the projected GDP for 2010 to 2020 and only 0.5% of that of 2020 to 2030. Thus, if this value of GDP can be achieved, the amount of investment infrastructure is on a very reasonable level.

To realize that target, the utility should be reformed. The subsidy should be minimized and is allocated to the poor people, by law. The determination of tariff by the government should be set based on its economical value or breakeven costs in the long-term period. The government should produce a regulation about revenue requirement for electric utility, which allows arranging its financial plan and long-term cash flow to realize the infrastructure development as planned.

To attain the national energy security, the primary energy shall be focused on renewable energy sources such as geothermal, hydropower, biomass, solar power and ocean energy. Those shall be secured by provision of coal and natural gas. Petroleum may only be utilized for the area where there is no alternative choice for other energy sources. The renewable source is predicted to supply about 20% of total capacity. In 2030, the coal consumption for electricity production could reach 300 to 350 million ton per year.

The development of electricity infrastructure, which requires huge investment, shall be viewed as the big project that can boost the growth of domestic industries on electric field. With a solid plan, this opportunity may encourage the establishment of new large machinery manufactures, engineering consultants and EPC companies in Indonesia.

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Biography of Herman Darnel Ibrahim

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Herman is Board Member of DEN, the National Energy Council of the Republic of Indonesia. It is a permanent and nationwide institution which is chaired by the President of Indonesia. He also serves as the Chairman of Indonesian National Committee of CIGRE [International Council of large Electric Systems], as the Board Member of International Geothermal Association [IGA], as the Chairman of IGA Asia Western Pacific Regional Branch, as the Vice Chairman of Expert Board of Indonesian Renewable Energy Society, as Advisory Board of Indonesian Power Society [MKI], and as the Senior Advisor to AKLI, the Indonesian Electrical Mechanical Contractor Association.

Herman got his First Degree in Electrical Engineering from Bandung Institute of Technology [ITB], M.Sc. Degree in Electrical Power System Analyses from the University of Manchester, UK, and PhD Degree in Energy and Environmental Policy for Power System Development from ITB Bandung. For about 30 years from 1978 to 2008 he worked with PLN, the Indonesian National State Electricity Corporation. Among his important positions at PLN were: Director of Transmission and Distribution of PLN [2003-2008], Director of PT. Indonesia Power, a subsidiary of PLN [1998-2003].

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Aquaculture Hi-Efficient Agro Plants / Bio normal Lamp
高效能农业种促长灯

适用于蔬菜
Suitable for AGRO Plants



specifications (产品参数):

Power rating/功率等级 (W):
18 W - 26 W

Warranty/质保期(months/月):
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选择性产品质保

Aquaculture Hi-Efficient Agro Aquatic Lamp
高效能渔业/水产促长灯

适用于水产/渔业
Suitable for Aquatic



specifications (产品参数):

Power rating/功率等级 (W):
26 W - 26 W

Warranty/质保期(months/月):
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Hi-Efficient Energy Saving CFL lighting (pf>0.90)
高效节能灯

适用于各种大小室内
Suitable for Office & House



specifications (产品参数):

Power rating/功率等级 (W):
8W - 26W/PLC-2 12W

Warranty/质保期(months/月):
12 Month

Hi-Efficient Energy Saving LED lighting/
高效节能LED灯

适用于灯光设计/花园/展示厅
Suitable for Lighting Design



specifications (产品参数):

Power rating/功率等级 (W):
4 W, MR16 - 12 W, PAR38

Warranty/质保期(months/月):
12 extendable to 24 mths
(可延长至24个月)

Hi-Frequency Magnetic Induction Lamp-Flood lighting
高频无极灯-高效节能泛光灯

适用于室外广告牌
Suitable for Office



specifications (产品参数):

Power rating/功率等级 (W):
130W - 200W - 2x165W

Warranty/质保期(months/月):
24 extendable to 60 mths
(可延长至60个月)

Hi-Efficient Energy Saving T5 E-Ballast, Lamp /
高效节能T5整流器, 灯管

适用于大小型办公室
Suitable for Office



specifications (产品参数):

Power rating/功率等级 (W):
14 W - 54 W

Warranty/质保期(months/月):
12 extendable to 24 mths
(可延长至24个月)

Hi-Efficient Energy Saving T5 Tabular lighting
高效节能T5灯

适用于大小型办公室
Suitable for Office



specifications (产品参数):

Power rating/功率等级 (W):
14 W - 28 W

Warranty/质保期(months/月):
12 extendable to 24 mths
(可延长至24个月)

Hi-Frequency Magnetic Induction Lamp - High Bay IP64 lighting
高频无极灯 - 高效节能

适用于大小型工厂
Suitable for Factory



specifications (产品参数):

Power rating/功率等级 (W):
130 W - 200 W

Warranty/质保期(months/月):
24 extendable to 60 mths
(可延长至60个月)

Hi-Frequency Magnetic Induction Lamp - High Bay lighting
高频无极灯 - 高效节能

适用于大小型工厂
Suitable for Factory



specifications (产品参数):

Power rating/功率等级 (W):
130 W - 200 W

Warranty/质保期(months/月):
24 extendable to 60 mths
(可延长至60个月)

Hi-Frequency Magnetic Induction Lamp - Street/ Carpark Lighting
高频无极灯-高效节能路灯

适用于各种道路
Suitable for Street / Carpark



specifications (产品参数):

Power rating/功率等级 (W):
120W - 180W - 2x180W

Warranty/质保期(months/月):
24 extendable to 60 mths
(可延长至60个月)



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- Telecommunication Poles

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LYCORPOLE® Hot Dip Galvanized columns, masts and poles are designed and manufactured in accordance with BS EN 40, BS 6399-2, BS EN 10025, BS EN 1011-1, 2, Institution of Lighting Engineers Technical Report No. 7, AS 4100, AS 1170.2, AS 1798, AS 2979, AWS D1.1 and AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals.

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