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BOARD OF ENGINEERS MALAYSIA

THE INGENIEUR

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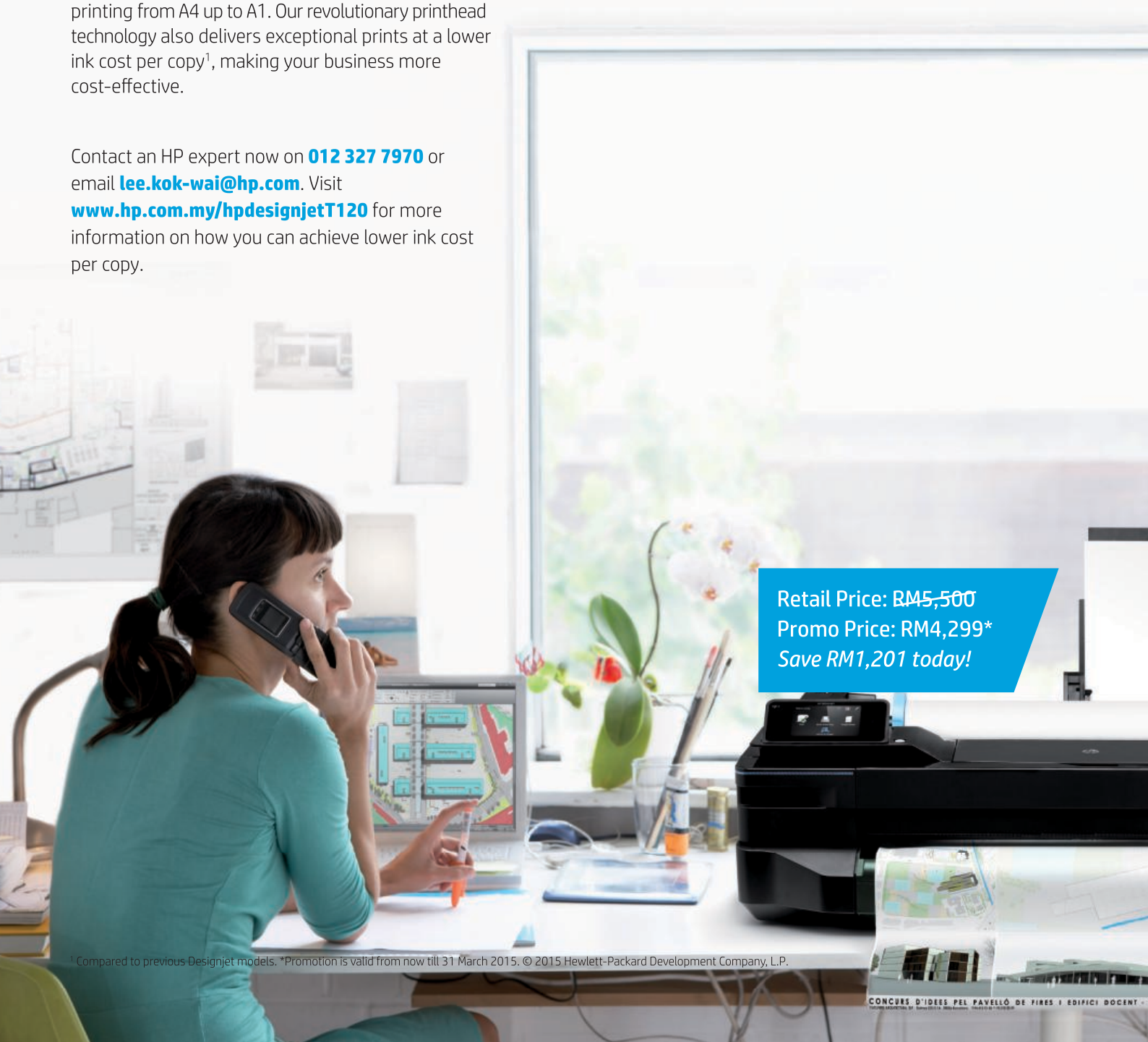

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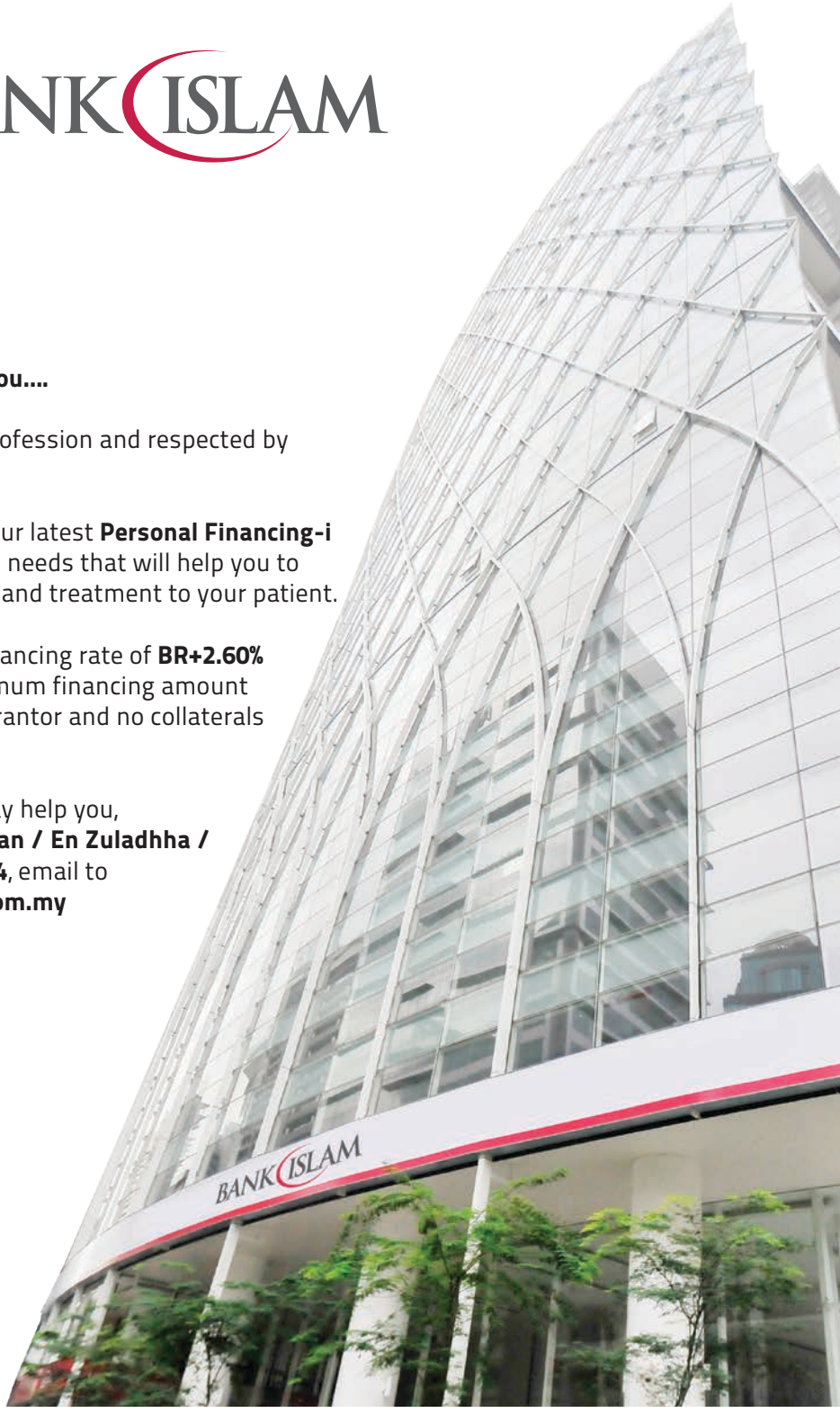

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100,000	8,569.92	4,396.10	3,006.08	2,371.50	1,956.61	1,680.99	1,484.94	1,338.62	1,225.45	1,135.48
150,000	12,854.87	6,594.15	4,509.12	3,557.24	2,934.92	2,521.49	2,227.42	2,007.93	1,838.18	1,703.22
200,000	17,139.83	8,792.20	6,012.16	4,742.99	3,913.23	3,361.99	2,969.89	2,677.25	2,450.90	2,270.96

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CONTENTS

6 President's Message

BEM News

7 Welcome Speech by Dato' Ir. Hj. Annies bin Md. Ariff, BEM President

9 Opening Address by YB Datuk Haji Fadillah Bin Haji Yusof, Minister of Works Malaysia

Announcement

12 Update - Amendment to Registration of Engineers Act 1967

Publication Calendar

Cover Feature

13 ASEAN Mutual Recognition Arrangement on Engineering Services: Moving Forward

22 Benchmarking to International Best Practices

27 Globalisation, Networking, and Engineering Technologies

Special Report

36 Apec Connectivity Blueprint 2015-2025

43 APEC Strategic Blueprint - Global Value Chains Development and Co-operation

47 Introduction to Four Modes of Supply for International Services.

49 Third Culture Generation – Product of Globalisation

Feature

50 Borderless Asean Energy Co-Operation

58 Harmonisation Study of Grid Codes and Technical Standards for ASEAN Power Grid

66 Reducing Costs of Poor Quality & Building Quality Products

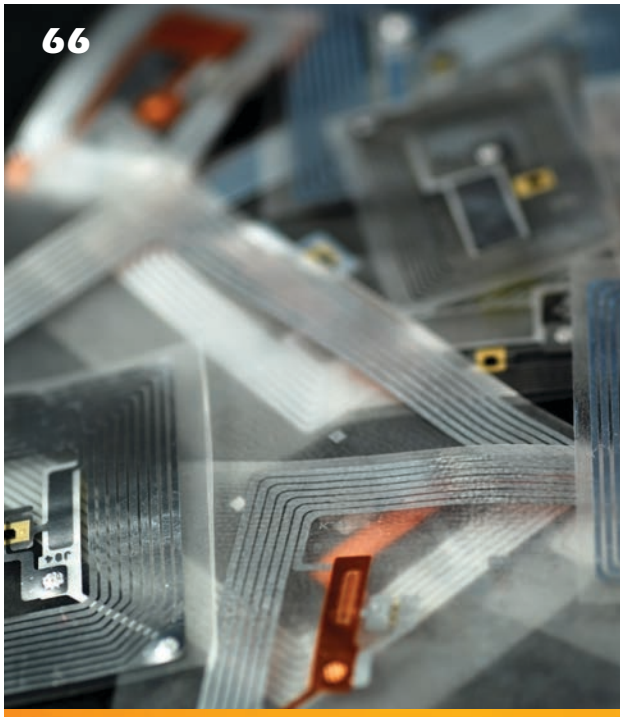
73 Intelligent Items Traceability System – RFID vs QR

Engineering Feature

77 Ancient Town of Bandipur, Nepal

Engineering Nostalgia

80 Construction of Jalan Kuching Dual Carriageway in 1967



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GLOBALISATION

As we bid farewell to 2014, the year will always be remembered as the milestone year for BEM in which amendments to the Registration of Engineers Act (REA) 1967 incorporating provisions for the liberalisation of engineering services were finally passed by Parliament. The event is most timely considering that Malaysia will hold the ASEAN Chair in 2015, which is also the year the ASEAN Economic Community will take effect.

Construction and Related Engineering Services is one among 12 broad sectors under the Liberalisation of Service Sectors agreed among ASEAN leaders. In this issue, an article summarizing the amendments to the REA 1967 addresses the concerns of the general engineering fraternity and the benefits when looking at the broader picture.

Taking cognizance of the tide of globalisation and the benefits it brings, several FTAs and MRAs were signed. The recently concluded APEC Economic Leaders Summit in Beijing in November 2014 covered extensively matters such as economic and technical co-operation; advancing global value chains development and supply chain connectivity; economic reform; and pursuing free, open trade and investment. These initiatives together with scores of new investments funds established, such as Asia Infrastructure Investment Bank (AIIB), New Maritime Silk Road Fund and Special ASEAN Fund, are expected to provide new impetus to the overall economy of the region. The construction industry will be among the first beneficiaries as more new infrastructure works will be implemented in the ASEAN region and beyond.

Greater mobility of engineering professions and cross border engineering services are imminent. The global trend on value chain and connectivity is well documented in the articles namely *APEC Strategic Blueprint for promotion of Global Value Chains Development and Co-operation* and the article *APEC Connectivity Blueprint 2015-2025.*

Globalisation is not something new, but with liberalisation of engineering service in place soon on our own shores, local professional engineers need to assess themselves in the light of an ASEAN Economic Community of 610 million population.

Dato' Ir Hj Annies bin Md Ariff
President, BEM

BEM ROAD SHOW 2014/2015

Welcome Speech by Dato' Ir. Hj. Annies bin Md. Ariff, **BEM President**

This is an abstract of the speech at the BEM Roadshow 2014/2015 held in Kuala Lumpur on September 29, 2014.

These are indeed challenging times; the Prime Minister in launching the New Economic Model expects the private sector to drive this model. One of the major strategic reform initiatives that have a direct impact is the liberalisation of the services industry.

The Board of Engineers, as a policy maker, cannot take an "isolationist" stand in the engineering industry and the Registration of Engineers Act should not stifle the growth of this knowledge-based industry; but must support existing as well as future engineering industries in aeronautical, aerospace, automotive, nuclear, renewable energy and green technologies which fall under the purview of the Board.

It would bode well for the country to develop a healthy, vibrant and competitive engineering industry that contributes to the economy and benefits consumers and the public at large. An uncompetitive engineering industry has the tendency to be "protectionist", which in the longer term, will result in Government subsidies and handouts.

The Board has been consulted and has had many dialogues with other Government agencies and is confident that by allowing ownership of an engineering firm to be open, it will secure a better future for the engineering industry.

The 'old model' and 'business as usual' to regulate the engineering business have become outdated and have a tendency to stifle the industry's growth. It is time for engineers to change and transform the Malaysian economy.

At the same time, the Board does not forget why it exists. It exists because the work of engineers has a direct impact on the safety of the public. The Registration of Engineers Act is not meant to protect the engineering profession but was meant to protect the interest of the public.

This year has been horrendous and dreadful for the construction industry with injuries and loss of lives at Penang Second Bridge, MRT and LRT construction sites, for examples. As a consequence, the Board's Investigation Committees and the Disciplinary Committee have been very active;

I wish to remind practicing engineers to be more cautious before stamping your PE stamp. You have been accorded a privilege by virtue of your professional standing and qualification but it also carries with it responsibility and accountability under the law of tort, Registration of Engineers Act, The Street, Drainage & Building Act and CIDB Act; just to name a few.

The Uniform Building By-Laws mandate that whoever designs the building is responsible to supervise its construction and thereafter to certify its completion and compliance with the by-laws.

There were several cases where PEs signed the standard drawings for patented engineering

BEM President delivering his speech

systems, such as patented roof trusses which are built all over the country, but with little or no supervision from the PEs who have endorsed the drawings for submission. The same goes for PEs stamping on temporary works as standard plan but without checking the site conditions such as the ground bearing strength to support these temporary works, or the condition of the materials used as scaffolding.

To improve the competency of engineers and to ensure that engineers meet their obligations under the law, the Board is introducing a "licensing" scheme for professional engineers who wish to provide professional engineering services in this country.

The "license" will be issued only upon the professional engineer having sat and passed "The Professional Competency Examination". This examination will test the professional engineer on "what he does not know but which he ought to know".

The Board of Engineers has already prepared the necessary ground work for this examination, ready for implementation when the amended (Registration of Engineers) Act is enacted.

At the moment, there is nothing to stop anyone from questioning whether professional engineers are competent in their field or not. The mark of competency is that it recognizes the many excellent professional engineers who are out there

Participants at the BEM Roadshow

by clearly identifying those who meet the required standards set by the Board. It will renew public confidence and protect them, and will ultimately push 'the cowboys' out.

The Board of Engineer's objectives are clear; the Registration of Engineers Act is for the well-being of the nation.

The Board wants laws that set clear performance standards that enable innovation without compromising confidence in public safety or the standards achieved. Skills, hard-work, diligence, integrity and competence play key roles in performing what is expected of an engineer. ■

BEM ROAD SHOW 2014/2015

Opening Address by YB Datuk Haji Fadillah Bin Haji Yusof, **Minister of Works Malaysia**

This is an abstract of the speech at the BEM Roadshow 2014/2015 held in Kuala Lumpur on September 29, 2014.

Engineers play instrumental roles in all sectors of the economy particularly the built-environment, manufacturing, transportation, information communication as well as other industries. Engineers are important because you generate wealth for our economy and create innovations that enhance the quality of life of our people. As the Minister in charge of construction works, I earnestly hope that the image of the whole construction industry improves and it is for the engineers to take the necessary steps to uphold their professional standing, integrity and to always work within their level of competency.

I am happy to see a paper for this Road Show entitled "Responsibility and Accountability of Stakeholders in the Construction Industry". I was informed that this paper also contains a long list of recommendation to mitigate construction mishaps. It is therefore important that every stakeholder in the construction industry understand their roles well.

The construction industry must learn from experience because each incident has valuable lessons such as the standard of safety, professionalism, competency and accountability from all stakeholders. In 1968, a four-storey building at Jalan Raja Laut Kuala Lumpur collapsed; in 1988, the gangway at Penang Ferry Terminal collapsed; in 1993, the Highland Towers at Ulu Klang collapsed and; in 2009, the roof of the Gong Badak Stadium at Kuala Terengganu collapsed and Jaya Supermarket at Petaling Jaya collapsed during demolition. After each of these incidents, various legislations were amended and improved or new ones enacted to protect the safety and interest of the public.

The Ministry of Works intends to arrest such incidents in the future by instilling a pervasive "safety culture" within the construction industry. The Ministry recognizes that to instil a "safety culture" through legislation is difficult because "culture" can only evolve with time. Nevertheless with persistency, the apathetic culture towards public safety will be replaced with a new culture that looks after their interest.

The Ministry is optimistic that being a developed nation by 2020 is not merely by an increase of personal income; but also importantly the "human values" affecting us. One of these "human values" is to reduce the fatalities in the construction industry. Fatality as a result of poor safety culture amongst the stakeholders at the expense of human lives is just not acceptable.

Despite the mishaps in the construction industry, I have noted the progressive attitude of the Board towards liberalisation of the services industry. My perception of the Board of Engineers is that it is run by professionals of impeccable character. The Board has adopted a policy of optimism by providing pragmatic, intelligent and meaningful solutions to the Government.

Talking about globalization, I am glad to inform

Minister of Works Malaysia addressing the audience

the forum that the amendments to the three Professional Acts, including Engineers Act, with a view to embrace liberalisation of the professional services, is in the final stage and will be tabled in Parliament. Once passed, citizenship is no more a barrier for engineers from any part of the world to practice and to set up consultation services here. And similarly, our engineers would also be accorded the same opportunity to take on the world. This is in tandem with the Government agenda for full liberalisation of the services industry. It will attract foreign direct investments into the country, contribute to GDP growth and thus generate foreign exchange. To remain competitive, I encourage you to embark on capacity building and confidence building measures rather than to rely entirely on safeguard measures.

The Engineers Act has been amended to allow any engineer from any part of the world to register with the Board. At the same time, the amendments of the Act have these primary objectives:

First: To protect the public against the hazards of sub-standard services from foreign services providers.

Second: To safeguard local and national policies so that they are not negatively affected; and

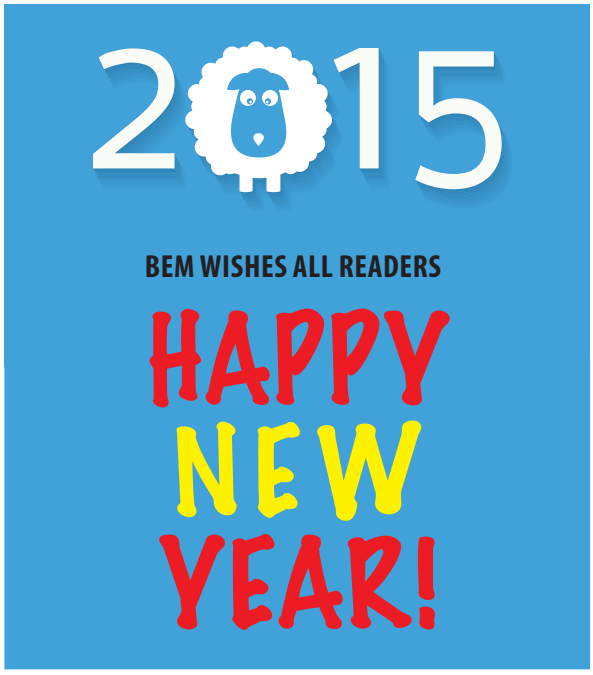
Third: To ensure that liberalisation promotes growth as originally intended.

According to the Federation of International of Consulting Engineers based in Geneva, the demand for consulting engineering services is increasing every year. The fees for professional engineering services worldwide was US$270 billion

in 2010 and have risen to US$330 billion in 2013, mainly in the areas of transport, buildings and facilities, land development, drainage, water and waste engineering. Fees earned in international markets are mainly in the Middle East, China, the Indian sub-continent, South East Asia and Africa.

Local consultants need to gauge themselves on their competitive edge in terms of good track record, competency and readiness to accept big scale projects. I have confidence in our local, renowned consultants since many of them have already ventured beyond our shores to places such as the Middle East and ASEAN countries. I hope others who have yet to work with foreign partners can learn from them and equip themselves to face the challenges of liberalisation and globalization.

As much as we are eager to transform the construction industry for the development of the nation, environmental and sustainability concerns should never be neglected. As we are aware, initiatives under the Green Agenda, can range from efforts in reducing our carbon footprint, optimizing usage of our natural resources, such as utilising solar energy, harvesting rain water, using of timber from replanted sources, recycling of waste products, using of renewable energy, and adopting energy efficiency technologies. Engineers have a leading role in planning, designing, building and ensuring a sustainable future. Engineers provide the bridge between science and society. In this role, engineers must actively promote and participate in multi-disciplinary teams with other professionals, such as ecologist, economist and sociologist to effectively adhere to the issues and challenges of sustainable development in Malaysia. ■



UPDATE - AMENDMENT TO REGISTRATION OF ENGINEERS ACT 1967

The latest amendments to Registration of Engineers Act (REA) 1967 had undergone various processes. The Bill was passed in both Houses of Parliament in December 2014. At the time of publication, the Bill was pending the Yang di-Pertuan Agong's consent.

PUBLICATION CALENDAR

The Ingenieur is published quarterly by the Board of Engineers Malaysia. The following are the themes for the coming issues.

- Vol. 62 April – June 2015
  Engineering Practices
- Vol. 63 July – Sept. 2015
  Capacity Building
- Vol. 64 Oct – Dec. 2015
  Waste Management

Articles and editorial contributions relevant to the themes are welcomed, but the decision to publish rests with the Editorial Board.

Advertising inquiries are also welcomed. Please refer to the BEM advertisement in this issue for the latest rate card and booking form.

ASEAN Mutual Recognition Arrangement on Engineering Services: Moving Forward

By Tan Sri Professor Dr Ir. Mohd Zulkifli Mohd Ghazali

This article addresses many questions on the ASEAN Mutual Recognition Arrangement on Engineering Services. How do we advance after the notice of participation from all member states is completed? How do we ensure that the objectives of the Mutual Recognition Arrangements are achieved? Can we as ASEAN Professionals in ASEAN member states contribute and play a significant role in helping to push for greater economic cooperation, collaboration and synergy? How do we facilitate the process of liberalisation of our (engineering) services industry?

The overview of the formation of ASEAN and the establishment of ASEAN Framework Agreement on Services are presented in a separate part under Background Information.

Recognising the objectives of the ASEAN Framework Agreement on Services (AFAS), which are to enhance co-operation in services among ASEAN Member Countries, and noting that Article V of AFAS provides that ASEAN Member Countries may recognise the education or experience obtained, requirements met, and license or certification granted in other ASEAN Member Countries, for the purpose of licensing or certification of service suppliers, noting the decision of the Bali Concord II held in 2003 calling for completion of Mutual Recognition Arrangements (MRA) for qualifications in major professional services by 2008 to facilitate free movement of professionals, skilled labour and talents in ASEAN, the Economic Ministers of ASEAN Member States on December 9, 2005 signed the ASEAN MRA on Engineering Services.

The MRA also serves to strengthen professional capabilities by promoting the flow of relevant information and exchanging expertise, experiences and best practices suited to specific needs of ASEAN Member Countries. The objectives of the MRA are to facilitate mobility of engineering services professionals and to exchange information in order to promote the adoption of best practices on standards and qualifications. Furthermore, the MRA can be considered an answer to the many issues during the negotiating rounds of WTO regarding trade liberalisation of the services sector, and these include:

- Restrictions on establishing commercial presence;
- Citizenship or residency requirements to practice;
- Limited or no recognition of foreign qualifications; and
- Compulsory memberships of professional associations

To facilitate the mobility of engineering professionals, the MRA provides for the creation and recognition of the ASEAN Chartered Professional Engineer [ACPE]. In general, a professional engineer in any of the ASEAN Member States who possesses the prescribed qualifications is eligible to apply to the ASEAN Chartered Professional Engineer Co-ordinating Committee ACPECC to be registered as an ACPE under the ACPE Register [ACPER].

The prescribed qualifications are as follows:

- An accredited engineering degree recognised by the professional engineering accreditation body whether in the country of origin or host country or assessed as having the equivalent of such a degree.
- Possess a current and valid professional registration or licensing certificate to practice engineering in the country of origin issued either by the Professional Regulatory Authority [PRA] of the ASEAN Member Countries or the Monitoring Committee.
- Acquired practical and diversified experience of not less than seven years after graduation, at least two years of which shall be in responsible charge of significant engineering work.
- Comply with Continuing Professional Development [CPD] policy of the Country of Origin.
- Obtained certification from the PRA of the Country of Origin with no record of serious violation on technical, professional, or ethical standards for the practice of engineering.

An ACPE will be eligible to practice in a host country after being registered as a Registered Foreign Professional Engineer [RFPE]. The RFPE will, subject to domestic laws and regulations and where applicable, not making submissions to statutory authorities of the host country, be permitted to work as a Registered Foreign Professional Engineer, not in an independent practice, but in collaboration with designated Professional Engineers in the host country.

A Monitoring Committee [MC] shall be established in and by each participating member country. The MC will be recognised as competent and will be able to certify the qualification and experience of individual professional engineers.

An ACPECC will be established and will have the authority to confer or withdraw the title ACPE. Members of the ACPECC will comprise one appointed representative from each Monitoring Committee of the participating ASEAN Member Countries.

The MRA provides for mutual exemption from further assessment by the PRA that controls the right to practice in each country only with

the involvement and consent of the PRA and the relevant Government agencies.

ASEAN CHARTERED PROFESSIONAL ENGINEER CO-ORDINATING COMMITTEE (ACPECC)

- Initiatives and Implementation Strategies

ACPECC was officially formed in May 2008 with Indonesia as the Chairman and Malaysia as the Vice-Chairman, with the Chairmanship rotated every two years. In 2010, Malaysia became the Chairman and Lao PDR the Vice Chairman. In July 2012, the Chairmanship was handed over to Myanmar assisted by the Philippines.

The ACPECC Secretariat is currently located in Jakarta, Indonesia. The Secretariat facilitates the administration of ACPECC and processes and maintains an ASEAN Chartered Professional Engineer Register [ACPER]. Currently, the Secretariat is responsible for the preparation and issuance of the ACPE certificates which are distributed to the successful new ACPEs.

ACPECC meetings have been held back to back with the CCS meetings because some ASEAN Countries prefer this arrangement. Furthermore, not all the ASEAN Countries are fully on board with the MRA and ACPECC. Efforts are being made to ensure that most ASEAN Countries, if not all, will in the future participate in the MRA on Engineering Services. The Meetings of ACPECC, must be attended by the Chairman, Vice Chairman, Secretary, not more than three delegates from each of the participating ASEAN Member Countries and not more than three observers from each of the non-participating ASEAN Member Countries.

So far, the effort of ACPECC has been on creating the ACPER for each Member Country. Currently, all Member Countries have formed their own Monitoring Committees and submitted their Assessment Statement.

The total number of ACPEs is 794; with 154 from Indonesia, 199 from Malaysia, 218 from Singapore, 113 from Vietnam, 72 from Myanmar and 38 from Philippines.

A Networking Session and Seminar, later called Roundtable Discussion, was an effort introduced by Malaysia, and later hosted by Singapore and Thailand, to expedite the co-operation and understanding among ACPEs and Professional

Source: acpecc.net

Engineers in the ASEAN Member Countries. The Second Networking Session was held in Singapore (2011) and the third in Bangkok (2012). Of late, the Roundtable Discussion has been combined with the ASEAN Architect Council.

PROFESSIONAL ENGINEERS EXCHANGE PROGRAMME (PEEP)

The Professional Engineers Exchange Programme (PEEP) which has been adopted by ACPECC Meeting was an initiative introduced by Malaysia to spearhead and expedite the co-operation and understanding among ACPEs and Professional Engineers within the ASEAN Member States and also an initiative to facilitate the mechanism for mobility and transfer of knowledge and technology among ACPEs.

IMPLEMENTATION STRATEGIES FOR THE ACHIEVEMENT OF MRA OBJECTIVES

It should be emphasised that the objectives of the MRA are not only to facilitate the mobility of engineering services professionals but also to strengthen the professional capabilities by promoting the flow of relevant information and exchanging expertise, and experiences and to

promote adoption of best practices on standards and qualifications.

Hence, PEEP can be considered as an initiative to fulfil the above objective of promoting the flow of relevant information and exchanging expertise.

Another initiative which was proposed by Malaysia is the ASEAN Engineering Programme Accreditation Council or Committee; however, this has not been seriously discussed at ACPECC Meetings as yet. This concept or idea can be considered as an initiative to promote the adoption of best practices for Qualifications. It should be emphasised here that Singapore and Malaysia are already full members of the Washington Accord, which is an international agreement on the accreditation of undergraduate engineering programmes. Thailand is at the stage of applying for the provisional membership, and indications are that Thailand may be considered at the next Washington Accord meeting.

The ideas of both the ASEAN Engineering Programme Accreditation Council or Committee and PEEP could be further developed through the roundtable discussions or future ACPECC meetings so as to ensure that all the ASEAN Member Countries could participate and benefit from the programmes. It is important that ACPECC and ACPEs exchange ideas and thoughts on how to develop further the ACPE and the understanding among the ASEAN Countries on engineering services so that mobility of professionals and the enhancement of trade in services could be successfully attained. It is important to realise that the final outcome of all these efforts should be the acceleration of economic growth, social progress and cultural development within all Member Countries leading to a prosperous and peaceful community of ASEAN.

PROFESSIONAL SERVICES MRAs

The Economic Ministers of ASEAN Member States signed the ASEAN MRA on Engineering Services on December 9, 2005 to realise the decision of the Bali Concord II held in 2003 calling for completion of MRAs for qualifications in major professional services by 2008 to facilitate free movement of professional, skilled labour and talents in ASEAN.

Consequently, ACPECC meetings were held back to back with CCS meetings to discuss issues relating to the notification of participation of the Engineering MRA by the Professional Regulatory Authorities of all ASEAN Member States and the implementation mechanism of the MRAs.

The ASEAN MRA was signed on December 9, 2005 but it took two and half years for the ACPECC to have the first meeting, which was in 2008, which was the year the MRA was anticipated to be completed by the Bali Concord II Meeting.

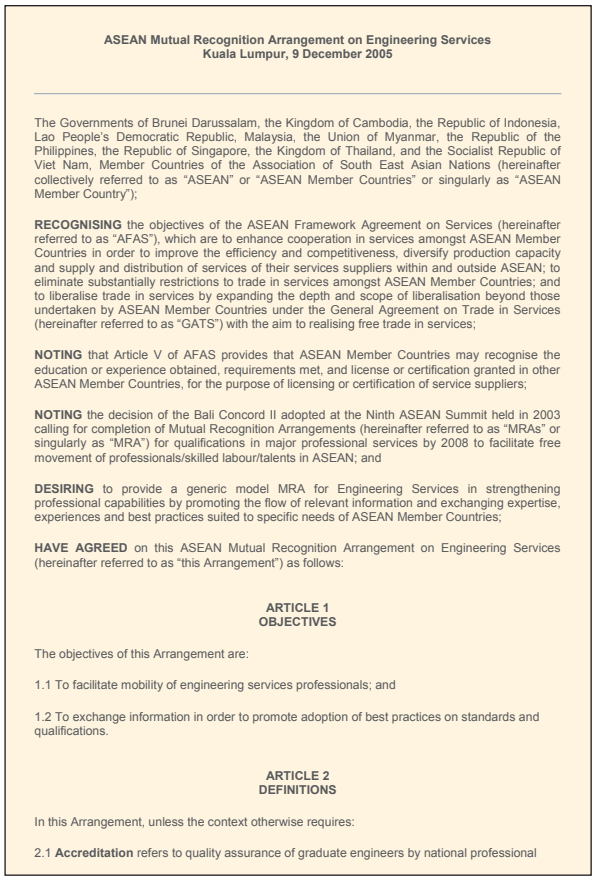
It took six years and 25 ACPECC meetings to arrive at where we are now and to finally have all Member States register their Notice of Participation and submit their Assessment Statements and Monitoring Committees. And yet, the Engineering MRA is considered to be the most advanced amongst all the Professional MRAs [Architecture, Land Surveying and Accountancy].

Currently, ACPECC has registered 794 engineers with Indonesia at 154, Malaysia at 199, Singapore at 218, Vietnam at 113, Myanmar at 72 and Philippines at 38. Malaysia and Singapore have worked out the mechanism to register Registered Foreign Professional Engineer [RFPE]. Malaysia has recently registered four FRPEs from Singapore. Other countries have not submitted their mechanism to register their RFPEs.

The Engineering PRAs of some Member States are also involved in other international engineering alliances and mutual recognitions. This provides an opportunity for ASEAN Member States to take advantage of the ASEAN Engineering MRA and to experiment with services trade liberalisation and mobility amongst themselves first prior to the inevitable liberalisation to other nations, but this may be lost if the ASEAN MRA is not fully implemented.

At other international Engineering Alliance Meetings, such as the Washington Accord for accreditation of engineering degrees, EMF and APEC Engineers for the mutual recognition of engineering professional qualifications, great strides have been achieved through the formulation and adoption of graduate attributes outcome, exemplar standards and engineering competency.

Although currently, ASEAN Engineering MRA calls for mutual recognition based on trust of the various Member States Monitoring Committees, in the final analysis, ACPECC must, I believe, begin to discuss capacity and capability building of our ASEAN Chartered Professional Engineers; and within an acceptable time frame, to formulate and implement higher standards both at University



ASEAN Mutual Recognition Arrangement on Engineering Services
Kuala Lumpur, 9 December 2005

The Governments of Brunei Darussalam, the Kingdom of Cambodia, the Republic of Indonesia, Lao People's Democratic Republic, Malaysia, the Union of Myanmar, the Republic of the Philippines, the Republic of Singapore, the Kingdom of Thailand, and the Socialist Republic of Viet Nam, Member Countries of the Association of South East Asian Nations (hereinafter collectively referred to as "ASEAN" or "ASEAN Member Countries" or singularly as "ASEAN Member Country");

RECOGNISING the objectives of the ASEAN Framework Agreement on Services (hereinafter referred to as "AFAS"), which are to enhance cooperation in services amongst ASEAN Member Countries in order to improve the efficiency and competitiveness, diversify production capacity and supply and distribution of services of their services suppliers within and outside ASEAN; to eliminate substantially restrictions to trade in services amongst ASEAN Member Countries; and to liberalise trade in services by expanding the depth and scope of liberalisation beyond those undertaken by ASEAN Member Countries under the General Agreement on Trade in Services (hereinafter referred to as "GATS") with the aim to realising free trade in services;

NOTING that Article V of AFAS provides that ASEAN Member Countries may recognise the education or experience obtained, requirements met, and license or certification granted in other ASEAN Member Countries, for the purpose of licensing or certification of service suppliers;

NOTING the decision of the Bali Concord II adopted at the Ninth ASEAN Summit held in 2003 calling for completion of Mutual Recognition Arrangements (hereinafter referred to as "MRAs" or singularly as "MRA") for qualifications in major professional services by 2008 to facilitate free movement of professionals/skilled labour/talents in ASEAN; and

DESIRING to provide a generic model MRA for Engineering Services in strengthening professional capabilities by promoting the flow of relevant information and exchanging expertise, experiences and best practices suited to specific needs of ASEAN Member Countries;

HAVE AGREED on this ASEAN Mutual Recognition Arrangement on Engineering Services (hereinafter referred to as "this Arrangement") as follows:

ARTICLE 1
OBJECTIVES

The objectives of this Arrangement are:

1.1 To facilitate mobility of engineering services professionals; and

1.2 To exchange information in order to promote adoption of best practices on standards and qualifications.

ARTICLE 2
DEFINITIONS

In this Arrangement, unless the context otherwise requires:

2.1 **Accreditation** refers to quality assurance of graduate engineers by national professional

The ASEAN MRA was signed on December 9, 2005

and Professional level, so that ASEAN Engineers would be professionally competent and in a more confident position to compete with the more developed countries.

PEEP, as a mechanism to encourage mobility, networking, information gathering and technology transfer should be activated as best as possible, not only for reason of engineering professionalism but also economic and cultural.

Taking cognizance of the slow acceptance of the ACPE and the ASEAN MRAs, and the seemingly lack of commitment to activate mechanisms for engineering services liberalisation and mobility amongst ASEAN Member States, the question ACPECC or for that matter the ASEAN Member States should ask is, "How do we move forward to fully implement the ASEAN Mutual Recognition Arrangement on Engineering Services? How do we strategise consolidating capability building and Engineering mobility through co-operation and collaboration?"

In developing the strategy to move forward ACPE mobility, issues such as mutual respect, mutual recognition, capability building, professional competency, professional ethics and integrity, professional exchange programmes and ASEAN strengths in facing the challenges of globalisation will always be on the table.

As ASEAN Member States have diverse standards and codes of engineering practice, there is a need in the future to begin discussing whether harmonising standards and understanding cultural diversity would pave the way for better integration of engineering services amongst ASEAN professionals.

The MRA provides an avenue for ACPEs of other Member States to register as RFPE in the host Member States and to provide engineering services under Mode 3 or Mode 4 mechanisms. There is an urgent need for ACPECC to discuss RFPE and its effective implementation within all Member States.

In order to expedite the RFPE registration, National Monitoring Committee [NMC] Malaysia has recently approved the procedure for registration of RFPE from other ASEAN Member States. Applications by ACPEs for RFPE can be made to the Board of Engineers Malaysia through NMC Malaysia using BEM Form 3.

CONCEPT OF WIN-WIN NEGOTIATION

Negotiation of CCS or ACPECC or any other Professional MRAs is a Multi-Party, Multi-Issue Negotiation. In such a negotiation, it is important that all parties identify their options and interests on the many issues, understand which are the more important issues and create a win-win integrative negotiation through trade-offs.

A Pareto-optimal solution is a solution where the "economic cake" has been expanded to the maximum, and that the various parties' interests and needs will be satisfied, at least beyond the reserve points or walk-away positions of all parties. Such solution or agreement is possible when parties realise that "an agreement is better than no agreement", and that co-operation is better than competition.

As in many negotiations, the objective of the negotiation is to create good options, build trust and maintain relationships. With the ASEAN

spirit, this approach becomes more important for successful negotiations

CONCLUSION

Since the MRA encourages the effort to promote adoption of best practices on standards of engineering and qualifications of engineers, there is a need for ASEAN Member Countries to co-operate and collaborate on acquiring the relevant knowledge and technology so that the level of competency and expertise in engineering among ASEAN Countries could be enhanced.

The PEEP, if administered properly, would provide the platform for the exchange of information, knowledge and technology. It would also provide an avenue for professionals from Member Countries to keep track and benchmark with each other, and perhaps to have a "peep" at what the other countries are doing.

The ASEAN Councillor Committee on Engineering Programme Accreditation [ACEPA] should be recognised as an effort and initiative to rationalise and enhance the quality of the various engineering programmes within ASEAN Member Countries to a common benchmark in terms of the core engineering knowledge and codes of practice, but allowing flexibility and latitude as far as language, culture and national interests are concerned.

Efforts should be geared towards formulating the RFPE Mechanism; and all Member States should look at the impediments to the implementation of the RFPE within their existing regulations.

Finally, innovative ideas and continuous commitments are necessary in order for trade in engineering services to become a major contributor and driver of the ASEAN economy. ■

ACKNOWLEDGEMENT

The author would like to record his gratitude and appreciation to the World Trade Organisation, the ASEAN Secretariat, MITI Malaysia, CCS and ACPECC Secretariat. Thanks also to Board of Engineers Malaysia and University of Technology Malaysia for their support of the author's involvement in areas related to the engineering profession.

"The total number of ACPEs is 794; with 154 from Indonesia, 199 from Malaysia, 218 from Singapore, 113 from Vietnam, 72 from Myanmar and 38 from Philippines.

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BACKGROUND INFORMATION

Formation of ASEAN

The Association of Southeast Asian Nations, or ASEAN, was established on August 8, 1967 in Bangkok, Thailand. The founding members of ASEAN, namely Indonesia, Malaysia, Philippines, Singapore and Thailand were the initial signatories of the ASEAN Declaration, which was also known as the Bangkok Declaration. For almost 16 years and five months, these nations maintained their co-operation and understanding among themselves for mutual benefits, and later further enhanced and strengthened ASEAN to include more Member States.

ASEAN accepted five more new members; Brunei Darussalam on January 7, 1984, Vietnam on 28th July 1995, Lao PDR and Myanmar on July 23, 1997, and Cambodia on April 30, 1999. Thus, ASEAN is currently a regional group consisting of 10 Member States.

The noble objectives of ASEAN were set out in the ASEAN Declaration. ASEAN seeks to strengthen the foundation for a prosperous and peaceful community of Southeast Asian nations by creating a conducive environment which encourages joint endeavours on the basis of equality and partnership.

ASEAN hopes that the co-operation and understanding together with the mechanisms thus forged would accelerate the economic growth, social progress and cultural development within her Member States. ASEAN also hopes to promote regional peace and stability by upholding the respect for law and justice.

One of the noble aims of ASEAN is to collaborate and co-operate for the expansion of their trade and mutual assistance on matters of common interest in the economic, technical, scientific, social and cultural fields.

In their modus operandi, the ASEAN Member States have adopted the fundamental principles as contained in the Treaty of Amity and Cooperation in Southeast Asia [TAC] of 1976. These fundamental principles are:

- Mutual respect for the independence, sovereignty, equality, territorial integrity and national identity of all nations.
- The right of every State to lead its national existence free from external interference, subversion or coercion.
- Non-interference in the internal affairs of one another
- Settlement of differences or disputes by peaceful manner
- Renunciation of the threat or use of force
- Effective Co-operation among member states

Noting that world trade is becoming more competitive and is being liberalised through World Trade Organisation [WTO], taking cognisance that there are about 90 WTO Members with the European Community [EC] considered as one Member and realising that even developed countries were forming economic blocs and economic communities, the ASEAN leaders, at the 9th ASEAN summit in 2003, resolved that an ASEAN Community shall be established.

The Cebu Declaration on the Acceleration of the Establishment of an ASEAN Community by 2015 was signed on January 2007. The three pillars of the ASEAN Community are ASEAN Political-Security Community, ASEAN Economic Community and ASEAN Socio-Cultural Community.

To effect the formation and the implementation of the ASEAN Community, the ASEAN Charter entered into force on December 15,2008. This Charter, which provided the legal status and institutional framework for ASEAN, has become the legally binding agreement among the 10 ASEAN Member States.

General Agreement on Trade in Services [GATS] and ASEAN Framework Agreement on Services [AFAS]

The General Agreement on Trade in Services [GATS] came into existence in April 1974 and is one of the instruments of the World Trade Organisation [WTO]. The Agreement exists because members of WTO recognize the growing importance of trade in services for the growth of world economy, and wish to establish a multilateral framework of principles and rules for trade in services with a view to the expansion

of such trade under conditions of transparency and progressive liberalisation and as a means of promoting the economic growth of all trading partners and the development of developing countries.

GATS recognize the right of Members to regulate, and to introduce new regulations, on the supply of services within their territories in order to meet national policy objectives and, given asymmetries existing with respect to the degree of development of services regulations in different countries, the particular need of developing countries to exercise this right.

GATS Article V Clause 1 states that GATS agreement shall not prevent any of its Members from being a party to or entering into any agreement liberalising trade in services between or among the parties to such an agreement, provided that such an agreement:

- Has substantial sector coverage;
- Provides for the absence or elimination of substantially all discrimination, in the sense of Article XVII, between or among the parties, in the sectors covered under subparagraph (a), through,
  - i. Elimination of existing discriminatory measures, and/or
  - ii. Prohibition of new or more discriminatory measures,

  Either at the entry into force of that agreement or on the basis of a reasonable time- frame, except for measures permitted under Articles XI, XII, XIV, and XIV bis.

Article XVII describes how Members handle *National Treatment. Each Member shall accord to services and service suppliers of any other Member, in respect of all measures affecting the supply services, treatment no less favourable than that it accords to its own like services and service supplier. Formally identical or formally different treatment shall be considered to be less favourable if it modifies the conditions of competition in favour of services or service suppliers of the Member compared to like services or service suppliers of any other Member.*

It should be noted that with the introduction of GATS, Governments still have the power and the right to regulate; the right to introduce new regulations even after commitments to GATS.

Trade in Services

Traditionally, services were considered not "trade-able" and not storable. Services have also been traditionally strongly monopolised by Governments and Public Service. A majority of services managed by Governments or Public Service have been those that provide for non-economic objectives and more focused on social, cultural or safety objectives.

However, in the recent years Services have become more trade-able as a result of technical progress such as e-banking, telemedicine, and distance learning. Furthermore, Government is focusing on its core business and downsizing. Hence, with market liberalisation and regulatory reform, trade in services has been increasing.

World exports of goods and commercial services have almost doubled since year 2000. Service exports data by economic groups for developed and developing countries for the year 1980-2004 shows that in 1980, 80% of the exports came from developed countries while 20% came from developing countries, including least developed countries (LDC) and Commonwealth Independent States (CIS) countries. However in year 2004, the percentages have changed to 76% for developed countries and 24% for developing countries, which includes LDC and CIS.

One observation from the above data [Source WTO database] is that it seems the developed countries combined benefited so much more from trade in services and liberalisation of services. Furthermore, if we take into account that there are more countries in the category developing countries, LDC and CIS countries, then the disparity between the benefit achieved by the developed countries and the non-developed countries will be huge.

ASEAN Framework Agreement on Services [AFAS]

The AFAS was signed by ASEAN Economic Ministers [AEM] with the objectives of:

- Enhance co-operation in services among Member States in order to improve the efficiency and competitiveness, diversify production capacity, and supply and distribution of services within and outside ASEAN.
- Eliminate substantially restrictions to trade in services among Member Countries.
- Liberalise trade in services by expanding the depth and scope of liberalisation beyond those undertaken by ASEAN Member Countries under GATS with the aim of realising a free trade area in services.

AFAS has provided a basis for ASEAN Member States to improve Market Access [MA] and ensure equal National Treatment [NT] for service suppliers in all four modes of services supply.

The four modes of supply are:

- Mode 1 [Cross Border Supply], meaning services flow from the home Country into the country of another.
- Mode 2 [Consumption Abroad], meaning a service consumer from the home country moves into another country to obtain service.
- Mode 3 [Commercial Presence], implying a service supplier from another country establishes a territorial presence, including through ownership or lease of premises, in the home country to provide a service.
- Mode 4 [Movement of Natural Persons], meaning persons of one Member Country entering the territory of another Member Country [the home country] to supply a service.

ASEAN liberalisation targets for AFAS has suggested the following specific equity thresholds under Commercial Presence [Mode 3]

Priority Sectors:	49% by 2006, 51% by 2008, 70% by 2010
Non-priority Sectors:	30% by 2006, 49% by 2008, 51% by 2010, 70% by 2015

Engineering Services

Engineering services is categorised as non-priority sector.

ASEAN provided for 15% overall flexibility of the sub-sectors list, which may not be committed and/or may not comply with the agreed parameters of liberalisation.

ASEAN through AEM also agreed that Market Access [MA] limitations for a few sub-sectors in the schedules of commitments can still be maintained, such as a maximum of two types of MA limitations for priority services sectors.

It should also be noted that AEM has also agreed that NT limitations will be removed on a voluntary basis.

THE INGENIEUR

Promotion of Mutual Recognition Arrangement For Mobility of Engineering Services Professionals

BENCHMARKING TO INTERNATIONAL BEST PRACTICES

By Ir. Rocky H.T. Wong

This paper is based on the author's presentation at the Bali Consolidated Roundtable Discussion on September 22, 2014. As there is extensive use of acronyms, a list of various terms and organisations are provided at the end of the paper.

Mutual Recognition Arrangement (MRA) is for cross border trade, particularly for stakeholders in business. It includes goods that come under WTO's TBT principles (meaning products that are standards centric), and for services; either regulated professional services (qualifications/experience deterministic), or (of public interest related) trade-based engineering/ technology services, which are skills/competency certification/licensing dependent.

In ASEAN, there are MRAs on goods. One such is the ASEAN Electrical and Electronic Equipment MRA (EEE MRA). This commenced in 2000 and was realised in 2002. Since coming into force and operationalised, the EEE MRA gave rise to the ASEAN Harmonised EEE Regulatory Regime (AHEEERR) Agreement by the end of 2005. This was the first step towards Regional Coherence to realising the ASEAN Economic Community (AEC) - post 2015.

With GATS in place (underpinning WTO) that entered into force on January 1, 1995; ASEAN, created a GATS-plus model which formulated the ASEAN Framework Agreement on Services (AFAS) and set about developing various MRAs on regulated Professional Services.

***Note**: It is worthwhile noting that ASEAN, since 1995 - with both CEPT (underpinning ASEAN Free Trade Agreement (AFTA) established 1992), and AFAS; the groundwork for preferential (free) intra ASEAN trade, in both goods and services, was established. The formation and actualization of the ASEAN Economic Community (AEC) was the logical progression.*

Source: acpecc.net

ASEAN MRA on Engineering Services

First such MRA, concluded in 2005, was the ASEAN MRA on Engineering Services (specifically for CPC 8672 only – Engineering Services: similar to BEM defined "professional engineering services"). This gave rise to Government to Government recognised/ASEAN registered grade

of the ASEAN Chartered Professional Engineer (ACPE). An ACPE is a "non-submitting person" professional engineer practicing in a cross-border host ASEAN Member States (AMS) as a Registered Foreign Professional Engineer (RFPE), either in consortium or JV with a host-domestic registered/ licensed professional engineer in practice, who is the Enterprise's domestic Submitting Person.

It is to be noted the MRA caters for "Engineering Services Professionals" (ESPs); and ACPE is only the starter grade for ESP ~ two other grades of ESPs to follow.

First Generation MRA

The MRA on Engineering Services is in fact a First Generation (1 G) MRA; More of a "snap shot" of existing status quo of AMS that have their respective regulatory regime over the practice of "professional engineering services" offered by natural persons - registered/ licensed professional engineers in private practice; e.g. Malaysia's Profession Regulatory Authority (PRA) on Engineering Services ~ the BEM; administrating the Registration of Engineers Act, 1967, but on the parts/sections/subsections relating to "Professional Engineer" only.

Notwithstanding the fact that the MRA is a "do-able" First Generation MRA (i.e. 1-G MRA) to overcome inertia whereby all 10 AMS could buy in at the time of its conclusion. It has however taken a long time to realise this and just as long for actualising the MRA's operation (nine years have lapsed).

Why is there a delay in implementing the present (1-G) MRA on Engineering Services?

***Note**: Delay in implementing the MRA represents missed opportunities for ASEAN CBTS suppliers/ providers who look forward to having related (and coherence in) domestic/ASEAN measures improved progressively; based on experience gained in the implementation of the MRA; even though it's only a 1-G version. The expansion of scope & coverage of the MRA, and/or other sector specific MRAs could not be attempted otherwise.*

The answer is any or combination (even all) of the following:

- Protectionism/national safeguards akin to NTM/NTB/discrimination;
- Absence of an appropriate domestic regulatory regime;
- Different levels/stages of engineering education development among AMS;
- Perceived exclusiveness rather than inclusiveness; or perhaps
- Continued inertia.

Cross Border Trade in Services

For Cross Border Trade in Services (CBTS ~ including engineering, architectural & construction services) to take place, there will have to be in place the following regulations/measures reciprocal to both trading nations/AMS, market access (MA), commercial presence (CP), and national treatment (NT).

ASEAN Economic Community means Inclusiveness/non-discrimination

For seamless cross border trade to take place in a Common Market and coupled with Borderless Production Base that in sum defines AEC, there should none or lowest possible limitation on MA, CP and NT. In short there should be inclusiveness and non-discrimination which means the ASEAN MRA on Engineering Services (for CPC 8672 only); if WA were the international best practice benchmark for the entry qualification for engineers to progress on to be ACPE, then those AMS which are non signatories of the WA will feel threatened. This will lead to the preservation of "exclusiveness" among developed AMS that would appear to benefit from the MRA at the expense of other lesser developed AMS.

This perception of exclusiveness does not encourage seamless trade. Only win-win positions on a "level playing field" will encourage and facilitate cross border trade in a preference market that should be available in the post 2015 AEC.

Other Professional Engineering and related Construction/O&M Services

Besides CPC 8672 – Engineering Services; trade in engineering and construction services also includes:

- CPC 8673 – Integrated Engineering Services (PMC &/or EPCC); and

"For seamless cross border trade to take place in a Common Market and coupled with Borderless Production Base that in sum defines AEC, there should be inclusiveness and non-discrimination which means the ASEAN MRA on Engineering Services

- CPC 511 to 518 – Construction and Engineering (trade-based) Services.

To deliver these engineering cum construction services, we need, besides Engineers (who are benchmarked to WA for entry level only); other grades of ESPs such as Engineering Technologists (benchmarked to SA), and Technicians (benchmarked to DA).

Besides Engineering, Science, Technology & Innovation (ESTI) type projects delivery via Services as identified by CPC 8672, 8673, and 511 to 518; ESPs are also expected to be employed in other WTO defined services sectors/sub sectors, for example:

- Energy generation and transportation ~ e.g. power generation, transmission and distribution,
- Telecommunication Services, and
- Treatment plants of various kinds (e.g. Environmental Services related); etc.

These types of plants and facilities could be the result of cross border investment(s). The ESPs from the AMS that provided the investment (representing the investors) would have to cross the border to "man" the plants and facilities, i.e. to manage, operate & maintain (O&M) them

A way forward with a complete Engineering Team to deliver ESTI Services

For the reasons advanced earlier, it is logical to revisit the 1-G ASEAN MRA on Engineering Services and to expand its scope;

Firstly, to include CPC 8673 – Integrated

Summary

Among the various concerted efforts in promoting and achieving Regional Coherence in ASEAN when AEC comes into being, post 2015; there will be a need (inter alia):-

- To frame a more (regulated industries related) sector/sub sector specific MRAs , such as the proposed E2WMRA;
- To have incremental improvements and progressive convergence of MRAs so developed to finally attain the status of ASEAN Directives; possible after having aligned; better still harmonised related, and
- To have associated regulatory regimes for the regulated industry in question.

The start to this mindful process is the promotion of MRAs for engineering and technology type of professional services with respective grades of companion Engineering Services Professionals (ESPs) benchmarked to matching IEA Accords such as the WA (engineers' entry level for onwards progression to professional engineers); the SA (for engineering technologists); and the DA (for technicians).

Besides CBTS, the other important MRA that needs review and up scaling in scope is the 1-G MRA on EEE being implemented by the JSCEEEMRA under the oversight of ACCSQ reporting to SEOM, then AEM/ASEAN Summit.

The present MRA's scope (limited to regulated Consumer Products/Office Equipment only) is to be expanded to also include all EEE and illumination products/systems.

The fortunate thing relating to this proposal is that international standards such as IEC & CIE Standards covering these additional products and/or systems are in existence.

The proposed up scaling process, when initiated and in time, can lead to ASEAN Directives that will be International (IEC/CEI) Standards centric – adding/contributing to Regional coherence of the AEC/ASEAN.

Another equally important Regional Economic Grouping is the TPPA (which Malaysia, for example, joined in October 2011); the FTA is still work in progress. It places great emphasis on Cross Border Trade in Services (CBTS). The flexibility built in the proposed framework allows for participating TPP member nations/economies to work out; either bilateral or plural lateral arrangements such as MRAs for regulated professional services.

For Professional Engineering Services covering both CPC 8672 & CPC 8673; the MRA will promote the APEC Engineer grade of Professional Engineer – the entry level of which is an engineering qualification benchmarked to and accredited/recognised/accepted by the WA.

It is to be remembered TPPA is the primer for the longer term and ambitious goal of attaining the FTAAP (a 21st century FTA of the Asia Pacific, which encourages true free trade) that could cover what the 21 economies of today's APEC; with ASEAN forming the centre of the scheme of things. APEC has in place a MRA on E&E Equipment (completed, done and in place earlier than the ASEAN version), implemented on a non-binding basis.

Engineering Services (PMC Services and/or EPCC Services), and secondly, to include the other two grades of ESPs who will then complete the "Engineering Team" (the "Team") which will consist the Professional Engineer grade (the ACPE) – the entry level of which is to be benchmarked to WA; next, the Engineering Technologist grade ESP - to be benchmarked to SA; and the third member category ESP of the Team, the Technician – benchmarking to the DA.

If and when the Engineering Team is complete, and coverage of professional engineering services

expended to include CPC 8673 – on top of 8672; the MRA will be seen as inclusive and non-discriminating ~ stakeholders in all AMS will then have a level playing field and will be prepared to compete.

Besides revisiting the MRA on Engineering Services to expand its scope and coverage, AMS should set about negotiating other sector specific engineering and construction type MRA, for example the industry proposed Electrical Engineering Works MRA (E2WMRA).

To realise this additional MRA, for example; besides the Engineering Team being dealt with in the ASEAN MRA on Engineering Services, the MRA will have to deal with the substantive equivalence for the certification and/or licensing of skilled or competent tradesmen, operators and/or testers working in the regulated electricity/power supply industry and related energy sub sectors. These can either be employed in project delivery teams; or as skilled and competent operators and maintenance personnel of electrical networks and facilities of all voltages, capacities and types.

Conclusion

In the context of the AEC, for any AMS to gain a "First-mover advantage" in ASEAN/AEC (post 2015) when the 1-G ASEAN MRA on Engineering Services (specifically for CPC 8672 only) will be finally operationalised:

- The PRA for Professional Engineering Services (of the 10 respective AMS), should promote domestically and at both the ACPECC/CCS; the expansion of scope of the MRA to also include CPC 8673.
- To introduce the other two grades of ESPs to complete the Engineering Team, such that WA will be the benchmark to measure the entry level for Engineers on route to becoming ACPE (SA for Engineering Technologists; and DA for Technicians). and
- Move to promote the cross-border mobility of all grades of Engineering Services Professionals (ESPs) that will encourage inclusiveness and trade.

In the context of TPPA, MRA on Engineering Services (carried out on either bilateral or plural lateral basis, or multi lateral even) should, at on the onset cater to both CPC 8672 & 8673; and APEC Engineer in the grade of Professional Engineer authorised for cross border mobility – the entry level of which is the WA. Because TPPA is the starter of the larger FTAAP (being foot-printed by APEC centre for ASEAN); it should be the aspiration of stakeholders within the prospective economic grouping to adopt the APEC E&E MRA and to reproduce an E2WMRA equivalent in TPPA/FTAAP. ■

ACRONYMS

ACCSQ	ASEAN Coordinating Committee on Standards & Quality
ACPECC	ASEAN Chartered Professional Engineer Coordinating Committee
AEM	ASEAN Economic Ministers' Meeting.
APEC	Asia Pacific Economic Cooperation.
BEM	Board of Engineers Malaysia.
CCS	Coordinating Committee on Services.
CIE	French Acronym for: International Commission on Illumination.
CPC	Central Product Classification (in UN/WTO).
DA	Dublin Accord
EPCC	Engineering, Procurement, Construction & Commissioning.
G to G	Government to Government.
GATS	General Agreement on Trade in Services.
IEA	International Engineering Alliance/ Agreements.
IEC	International Electrotechnical Commission
JSC	Joint Sectoral Committee
JV	Joint Venture
NTB **NTM**	Non-Technical Barrier Non-Technical Measure
PMC	Programme or Project Management Consultancy/Consultant
PRA	Profession Regulatory Authority.
SA	Sydney Accord
SEOM	Senior Economic Officers' Meeting.
TBT	Technical Barrier to Trade.
TPP	Trans Pacific Partnership.
WA	Washington Accord
WIP	Work in Progress.
WTO	World Trade Organisation.

Globalisation, Networking, and Engineering Technologies

By Alexander M. Korsunsky, Professor of Engineering Science, University of Oxford

In our rapidly shrinking world, countries and affairs that once seemed far away have ever stronger and more profound impact on our lives. This globalisation process is undoubtedly technogenic. The first vehicle for this phenomenon is the rise of rapid communications, highlighted by the degree to which the Internet and wireless communications permeate our environment, providing email, web, IP telephony, video-conferencing, remote banking and other services. The second important technological contributor is air travel. The volumes of passenger and freight air traffic worldwide continue to grow exponentially, as they have done now over several decades. This growth drives further globalisation by accelerating the interchange of people and goods, but questions about the sustainability of such development also become more acute. The third crucial technogenic phenomenon is the globalisation of manufacturing, services and engineering development: remarkably, not only engineering technologies create the basis for globalisation, but they themselves become involved in the resulting global pattern of research and development activities. What phenomena arise in the context of technology-driven globalisation? What is the social and economic impact of globalisation? Can organisations and communities suffer or benefit from it?

Note: This is a reprint and edited version of the original article which appeared in the Proceedings of the International Conference of Engineers & Computer Scientists 2010.

No one is surprised today to come across the word "globalisation" in a wide variety of contexts, from politics and economy to climate and ecology to human and social issues. It is small wonder, considering how the events happening and decisions made halfway across the world now affect what and how we buy, wear, eat, sing and dream of. In Britain one takes for granted that lamb comes from New Zealand, orange juice from California, and much of the manufactured goods from China. This world that we live in today is a relatively (in fact, historically – very) recent development. That we have been able to adjust to this rapid change has generally been for the good. It should not be difficult to realise, however, that this may not necessarily last, i.e. that the present state of affairs, or, rather, the present direction of development, may not be sustainable.

As is common in social (and also natural) sciences, in order to begin figuring out what future developments one might expect and how one might best prepare for them, one might try to look back the history – in this case, the history of globalisation. That way one might be able to glean answers to some important questions.

How did we get here? Where are we going next?

GLOBALISATION HISTORY

The history of globalisation is intricately linked with the world's political and economic history. Over the centuries, globalisation progressively enveloped trade, economies, finances, manufacturing and ultimately incorporating the globalisation of knowledge generally, and engineering design in particular.

The Establishment of Global Trading Routes

Andrew Sherratt [1] illustrates the development of global trading routes as they became established over the centuries from 3500BC to 1500AD (Figure 1).

An early example provided is of the obsidian trade within western Asian communities that can be traced back to 9th to 6th millennium BC, thus pre-dating the Bronze Age. Obsidian is a natural black volcanic mineral glass that possesses excellent engineering properties, being both strong and tough, and hence suitable for making cutting tools. It was used to make sharp and strong blades, and was traded in small quantities up to 1000 km away from its sources in the mountains. Since obsidian was traded through gift-exchange, many other valued materials (e.g. plant products used as medicines) probably circulated along the same routes [1].

Sherratt points out how progressive urbanisation drives the development of supply chains for goods and foods. Trade connections between the earliest Mesopotamian cities in the fourth millennium BC became extended with the spread of populations into the Eastern Mediterranean, the site of the present Turkey and Greece. It is "the greater material wealth of urban communities, with their specialized manufacturing and bulk transport of commodities" that allowed them to draw high-value resources from the surrounding countryside, creating and making use of the local exchange cycles [1]. It is readily apparent that the transport of goods was motivated by the increase in wealth it brought to the agents. This was sustained by the know-how possessed by the producers about certain materials and methods, on the one hand, and the knowledge held by the procurers of the utility and use of goods, and the supply and sale channels for them on the other hand.

Roman Empire integrated the entire basin of the Mediterranean into a single political entity, thus creating a politically integrated economy that promoted stronger trade connections. Under this common umbrella, a more complex network of chains between different parts of the empire could emerge.

The development of the interaction between Europe and China already became evident in AD1. This trade led to the creation of new trade routes across the Indian Ocean. Centuries later, the discovery of the New World brought new importance to the Atlantic routes and coastal areas. Figure 1 illustrates the network of global trade routes in AD1500.

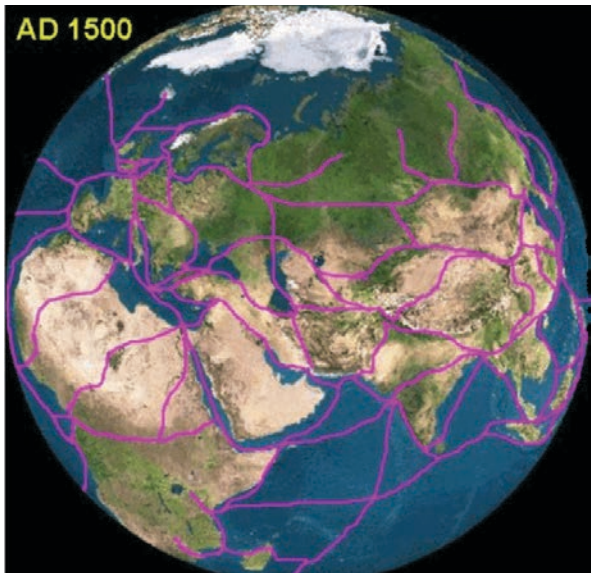


Figure 1. Global trade routes in AD1500 (from [1]).

The Emergence of a Global Economy

While originally the trade routes served the principal purpose of facilitating the exchange of goods, their development naturally brought with it the transport of ideas, wealth and influence. In the context of the emergence of a global economy, the British Empire played a pivotal role. Britain became the world's foremost power in the 18th century. The following centuries of *Pax Britannica* were characterised by the increase in wealth across the globe. The British East India company that ruled the subcontinent before the mutiny, had by 1850 acquired the wealth and turnover that exceeded that of Britain itself. The presence of imperial trading and administrative outposts ensured that the dissemination and uptake of technological advances across the world proceeded at an unprecedented rate. The global market emerged under the political umbrella of the British Crown, similarly to the way that the Roman Empire which, in its time, unified the then

known world both politically and economically. The global penetration of common methods of trading, accounting, construction and manufacturing, together with the coverage of a third of the world's land mass (with influence evident in every part of the globe) resulted in the emergence of an integrated economic system that for the first time could be called global.

It is interesting to note the debate that arose in recent years regarding the relationship between investment and return within the British imperial system. Some have argued that the net flow of wealth within the British empire was outwards, from the metropolis to the colonies. While making a definitive judgment on such a complex matter remains a challenge, it is probably correct to observe, at least qualitatively, that the engineered products of industrialised Britain at the time had few substitutes or competitors anywhere in the world. This makes it difficult or impossible to assess their true value by comparison with equivalents, but suggests that it should be placed appropriately high. In addition, one should not neglect the future benefits of economic and financial integration and the development of local structures and organisations. Some of these advantages became apparent in economies such as India and China many decades later.

Avner Offer [2] opens his review on the subject with the question; "Was the British empire an asset or a liability?" He continues with the quotation from Adam Smith, who thought the "the American colonies were an asset, but… the effort to govern them from London was a folly". These observations place into context the earlier comments about the full spectrum of benefits of the globalised market, and lead us to the subject of the emergence and effects of the globalised financial institutions.

tBy the start of the 20th century, a global financial system was in place. Its existence was necessitated by the fact that large scale engineering projects were undertaken in places far removed from the investors, be it individuals or organisations. The scale of the projects, such as the construction of major canals, required the involvement of multiple investors, and that, in turn, motivated the creation of financial market with instruments such as shares and bonds. Information was also required by the investors to allow them to make qualified judgments about the value of projects, commitments, etc.

An important role in international trade and finance is played by the national currencies and their exchange rates. Fixing these rates with respect to some reference provides stability for the currency market, such as the classic gold standard prior to 1934, and during the 25-year period following World War II, when a system of fixed exchange rates pegged to the dollar prevailed [3]. The modern de-regularised world offers greater flexibility and flow of funds, but sometimes at the expense of massive swings of exchange rates, as seen in the late 20th and early 21st centuries.

Although this introduces additional uncertainties for companies operating globally, it also increases the room for manoeuvre, as far as planning and operations are concerned.

Globalized Manufacturing

In the course of the 20th century the world witnessed the progressive involvement of new territories and populations in the global economic process. This expansion was driven by the relentless requirement to reduce costs and improve competitiveness. Recognising situations where labour costs constitute a substantial fraction of the total manufacturing expenditure, large and small companies sought the possibilities of moving some of their production to locations where labour was cheap and readily available. The longer term consequences of such activities were profound and manifold. On the one hand, this brought not only jobs to the poor regions, but eventually increase in the wealth of the local population. In the long run, this inevitably resulted in higher salaries, and served to undermine the original motivation for moving the manufacturing facility to a particular locale because labour was no longer cheap. On the other hand, the increase in wealth led to the emergence of a local consumer market, opening up the possibilities for sales and further wealth creation.

Gradually the new consumer markets became more diversified and sophisticated. Ultimately, such markets demanded the development of new bespoke products. This laid down the foundations for the globalisation of the engineering process itself.

Globalisation of Engineering Design in the 21st century

As a consequence of the developments in the global trade, markets and finance, by the end of the 20th century the world arrived at a fundamentally new junction. For the first time the globalisation process became applied to the very source of wealth creation: the intellectual activity that creates added value by inventing, designing, manufacturing and marketing new products. Lynn and Salzman [4] describe this transition and introduce the concept of the 'new globalisation of engineering'.

Lynn and Salzman [4] start by pointing out that in the second half of the 20th century, "the typical multinational (MNE) was vertically integrated and hierarchically organised. Key functions were headquartered in one of the triad economies of the US, Japan or Europe. In the case of technology development, for example, more basic R&D work might be conducted by central research laboratories, with more applied work done at triad production facilities. Some engineering activities were conducted in emerging economies, but these had little to do with the core engineering programmes of the firm."

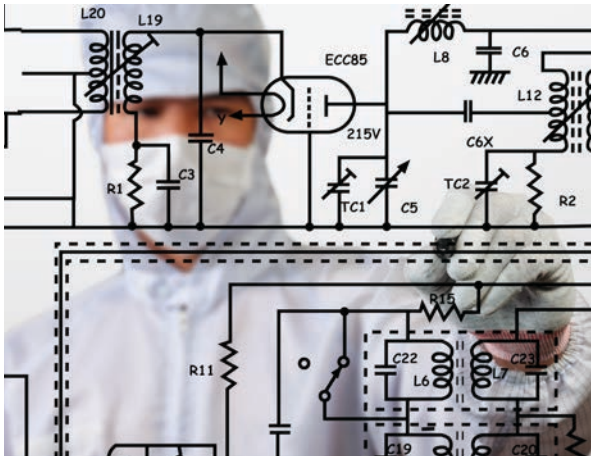
Of course, some engineering design activities necessarily took place locally. However, the nature of such activities were specific and restricted. Lynn and Salzman [4] give the example of a Whirlpool facility in India, where "washing machines were redesigned to keep out rats, to survive shipment on bad roads, and to cope with power ebbs and surges in electrical current". They further assert that engineering managers at an electronics firm in India "did not consider doing work on their more advanced technologies at a site in India because, until recently, there was no market in India for products based on the newer technologies, and no sense that India provided a viable export platform." The situation meant that "engineering teams in the emerging economies worked in relative isolation from their counterparts at triad facilities and provided little that was useful in the triad economies."

The fundamental shift took place around the turn of the century, when "the geography of technology development underwent profound shifts as multinationals dispersed core activities, "unlocking" them from long standing forms of organisational integration. Geographic embeddedness that, only a few years ago, seemed to confer unassailable advantages to areas such as Silicon Valley must be examined anew now that the "developing countries" are developing some of the world's leading-edge technology. Triad multinationals are racing to shift cutting-edge work on cellular telephones and other aspects of telecommunications to China. They are moving software development and some pharmaceutical research to India. Advanced aerospace work is being done in Brazil." [4]

The authors call this emerging pattern of activities in technology development 'the new globalisation of engineering'. They summarised the nature and the significance of the transition as follows: "The reduction of international trade barriers and the development of new technologies allowing globally dispersed work on engineering have coincided with the push by firms to cut costs by dispersing engineering activities globally and the pull of growth markets in the emerging economies that requires new engineering and technology development, and offers the availability of highly skilled human resources. The result has been a massive transfer of technological capacity to the emerging economies." Importantly, the authors also note that "the transition is not yet complete, and its full ramifications are as yet poorly understood." Some aspects of this change give particular concern to Lynn and Salzman, e.g. analyzing the possibilities and threats posed by this evolving pattern, and whether "boundaries might exist between change that is adaptive and change that risks the loss of control over essential functions."

Against the backdrop of this adaptive development of the world engineering activities, other significant drivers for change exist. Camuffo [5] focuses his attention on the automotive industry. More specifically, the author carried out a case study of the concept of the Fiat Palio - the "world car", i.e. "a car that involves absolute cross-country identity of interior/exterior design, parts, and quality standards."

One of the questions of major concern to the author is the relationship between globalisation, modularisation and outsourcing in the auto industry. In line with the general trend identified above of globalized manufacturing following



Cutting edge work on cellular telephones

the market expansion, in the 1990's most automotive OEMs "pursued a 'produce-where-you-sell' strategy, opening up new plants in foreign countries and asking some suppliers to follow them with direct investment". Camuffo [5] writes: "More generally, assemblers have employed a series of measures to lower the minimum scale of vehicle assembly plant in order to reduce the investment risk, respond more flexibly to volume changes, speed up models turnover, facilitate equipment upgrading, minimize job impact and social cost in case of crisis. Financial considerations are especially critical given the enormous amount of money required by foreign direct investment strategies and the uncertainty of their rate of return and payback time."

These important organisational and management developments present the background against which the changes in engineering design practice took place. The very relationship between automotive OEMs and suppliers became re-adjusted for the new situation, so that "suppliers play a larger role in terms of parts' design, technology development and sometimes even assembly, while OEMs focus on their [core] activities, narrowing the scope of the operations they carry on."

Another important observation made by Camuffo concerns the crucial role played in this process by networking and the information technology. He notes that "new (especially Internet related) technologies are facilitating knowledge codification (Nonaka and Takeuchi, [6]), reductions in information costs, and evolution towards mass customization and build-to-order (Helper and Mac Duffie, [7])".

This is a junction where the different threads and concepts that appear in the title of the present study come together. The most important (for the purpose of the present study) consequence of the globalisation process, the emergence of distributed and outsourced engineering activities, only becomes possible with ubiquitous spread of networking and data interchange. Distributed engineering relies on the availability of highly sophisticated, detailed and robust technical data formats, as well as the software capable of handling large data volumes of this type.

Camuffo [5] continues that "in the new global auto industry, there have been (and, to a certain extent, there still are) incentives to transfer component design/manufacturing responsibility to suppliers. This has entailed, from the OEM perspective, more outsourcing, and determined a power shift in favour of suppliers." He concludes that "within a global strategy, modularisation and outsourcing, though remaining conceptually distinct, tend to become, in practice, increasingly inseparable. The modularisation of design, production and organisation is intimately related to how to reduce risky investment, while trying to save costs, and manage the institutional constraints deriving from globalisation, OEMs and suppliers partition their tasks, defining a new international division of labour."

The general thrust of these processes is toward increasing *complexity* in design, technology, management and operations. Camuffo [5] observes that "*modularisation* is one possible way to address this issue and reduce complexity". Modularisation means that, in the future, vehicles will probably result from the integration of a series of self-contained functional units with standardised interfaces within one or more standardised product architectures, units conceived, manufactured or supplied, and assembled as autonomous 'modules' [8]."

The best known example of such modularised car manufacture is the MCC plant located in France (Hambach), that is "a joint venture between Mercedes Benz and Swatch (Swiss watch producer), that assembles a two-seater "mini-car" (named Smart). A small group of suppliers, defined as "system partners", located nearby the

MCC plant located in France (Hambach)

MCC plant, build and deliver complete modules like doors and cockpits directly to the MCC final assembly line." Camuffo [5] continues to consider the effects that modularity in manufacturing has on the organisational modularity of companies and manufacturing networks, taking up "a typical organisational meaning and mingling with those of standardisation, scalability and replication", with each "organisational module" also corresponding to a "design module".

In the context of design globalisation, it is interesting to note also that "international rules (trade barriers, local contents, etc.), regional/national institutions, and cross-country cost differentials impact on the transfer of component design/manufacturing responsibility to suppliers and, as a consequence, on the degree of decomposability and information partitioning into visible design rules of new and existing products (Schilling [9]).

To conclude this section of the present paper, it is convenient to draw on the points made by Rycroft [10], who asserts that globalisation "can be said to have *co-evolved* with rapid and pervasive technological innovation. By this it is meant that changes in technological advancement appear to have helped create increasingly global markets and other institutions, and these ever more global political and economic institutions appear to modify emerging technological innovations." Rycroft [10] goes on to ask the question about the major indicators of the "globalisation/technology co-evolutionary process". He identifies several dimensions, or groups of indicators of technological globalisation, namely, *technological exploitation, technological generation*, and *technological collaboration*. The author then chooses to focus his attention on innovation networks as organisations that can help provide insight and measure the depth of technological globalisation processes.

THE COMPLEX SYSTEM OF WORLD ECONOMY

The dimension of globalisation that concerns technology and engineering design is played out against the backdrop of company level and national and international level economic realities. The world economy is one of the most important and well-studied complex systems of great significance to the vast proportion of the global population. Yet, as past and recent experiences show, despite extensive research effort and investment, all attempts at predicting or controlling this system appear to enjoy very limited success.

Of particular significance in the rapidly developing world are the issues of global capital flows and their impact on the wealth of nations. Of note here must be the work of Paul Krugman [11] on the New Trade Theory. This approach criticizes international free trade, asserting that using protectionist measures in certain countries may allow the build up of a strong industrial base in certain industries that will then allow these sectors to dominate the world market. As an example, it is argued that this was the pattern

that allowed the development of the Japanese automotive industries in the middle of the 20th century, when companies were allowed and encouraged to import production technology from abroad, but nevertheless required to produce 90% of components locally.

Modern computer simulation tools may help shed some light on the processes that take place in complex systems, by carrying out increasingly large scale agent-based simulations. In these simulations, agents must represent businesses that interact with each other, and also with the "landscape" that represents the world. The test of the validity of the model is obviously its ability to predict financial and economic situations that are observed in practice. Notable attempts to develop such agent-based, complex systems models of global wealth flows have been reported [12].

OUTLOOK AND CONCLUSION

The different aspects of globalisation touched upon in the brief outline presented here stand in complex, interactive relationships with each other. The size and complexity of the modern global economy, finance, manufacturing and engineering design present a great challenge to politicians, economists and engineers alike. Under the umbrella of such complex systems, decisions made by significant players may have effects that are profound and often difficult to predict. Therefore, efforts aimed at identifying and developing network metrics would seem well-placed, e.g. measures of impact of particular decisions on the global system. ■

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Asia-Pacific
Economic Cooperation

APEC CONNECTIVITY BLUEPRINT 2015-2025

Compiled by Ir. Tan Bee Hong

Strengthening comprehensive connectivity and infrastructure development will help open up new sources of economic growth, promote co-operation and mutual assistance, and advance prosperity and the spirit of community in the Asia-Pacific region. Implementation of the APEC Connectivity Blueprint will achieve an overarching goal of strengthening physical, institutional and people-to-people connectivity. This will be done by taking agreed actions and meeting set targets by 2025 with the objective of creating a seamless and comprehensively connected and integrated Asia Pacific. The APEC Leaders at the close of the APEC Economic Leaders meeting endorsed the APEC Connectivity Blueprint 2015-2025.

CONTENTS OF THE APEC CONNECTIVITY BLUEPRINT

Background

In the APEC Leaders' 2013 Declaration, we shared our aspiration to reach a seamlessly and comprehensively connected and integrated Asia-Pacific through the pillars of Physical Connectivity, Institutional Connectivity and People-to-People Connectivity.

Connectivity represents an ambitious target for a diverse regional organisation such as APEC, but it is precisely that ambition that will drive strong and tangible achievement.

Connectivity will be important not only for Governments and business, but also for APEC as a community. By connecting APEC's developed and emerging growth centres, the region's quality of growth will improve, contributing to the Asia-Pacific's economic prosperity and resilience.

In this regard, we note with appreciation that significant work has already been done by various APEC forums and working groups in advancing connectivity in the region. APEC economies have also undertaken substantial amounts of work to improve connectivity, both at the domestic and regional levels.

However, despite the many achievements and successes of APEC in promoting connectivity in previous years, many challenges still remain. On physical connectivity, there is still a disparity in access to and quality of physical and Information and Communications Technology (ICT) infrastructure throughout the region.

On institutional connectivity, there is also a significant gap in the ability of existing institutions to promote connectivity due to various regulatory constraints or lack of capacity.

On people-to-people connectivity, much work needs to be done to ease existing barriers to interaction and mobility, and to develop joint endeavours that will support seamless flows of people.

We have, therefore, developed this Blueprint as a strategic guide for current and future initiatives that will bring the APEC region closer together. It is a high-level framework towards which many APEC work streams should focus their efforts.

The Vision of APEC Connectivity in 2025

As stated above, we commit to strengthen physical, institutional, and people-to-people connectivity by taking agreed actions and meeting agreed targets by 2025, with the objective of achieving a seamless and comprehensively connected and integrated Asia Pacific.

In order to attain this overarching goal, APEC member economies will undertake specific tangible actions at the physical, institutional, and people-to-people pillar levels.

The Blueprint contains existing connectivity-related initiatives; encourages reviving those initiatives that require further progress; and, proposes future initiatives for more efficient flow of goods, services, capital and people to drive APEC's progress. It is also broad in scope and adaptable to the ever-changing conditions in Asia-Pacific.

We envision the Blueprint accelerating and encouraging balanced, secure, sustainable and inclusive growth, as well as connecting growth poles in the region and bringing APEC closer together as a community.

Physical Connectivity

Under Physical Connectivity, with regard to cross-sectoral issues, we will focus on improving the investment climate, enhancing infrastructure financing through public private partnerships

We will develop, maintain and renew quality infrastructures, including energy, ICT and transport. We will seek to increase the quality and sustainability of APEC transport networks; increase broadband internet access; promote sustainable energy security; and build resiliency into the energy infrastructure.

(PPP) and other means in APEC economies. We will adopt comprehensive assessment methods that consider key quality elements in the evaluation of infrastructure project proposals and enhance the application of good practices and people-centred investment for planning and implementing infrastructure projects.

We welcome the substantial work that has been done under the Finance Ministers' Process (FMP) to promote knowledge sharing and capacity building in the area of infrastructure PPPs.

We are pleased to note that the APEC PPP Experts Advisory Panel has launched work under the FMP, which supports, on a voluntary basis, a Pilot PPP Centre based in Indonesia. We note with appreciation the role of the Panel in helping APEC economies tap into private sector sources of funding for infrastructure development, particularly through promoting PPPs, by acting as a repository of skills that will bring to life good practices in the APEC region and will help channel technical assistance to developing economies seeking such assistance.

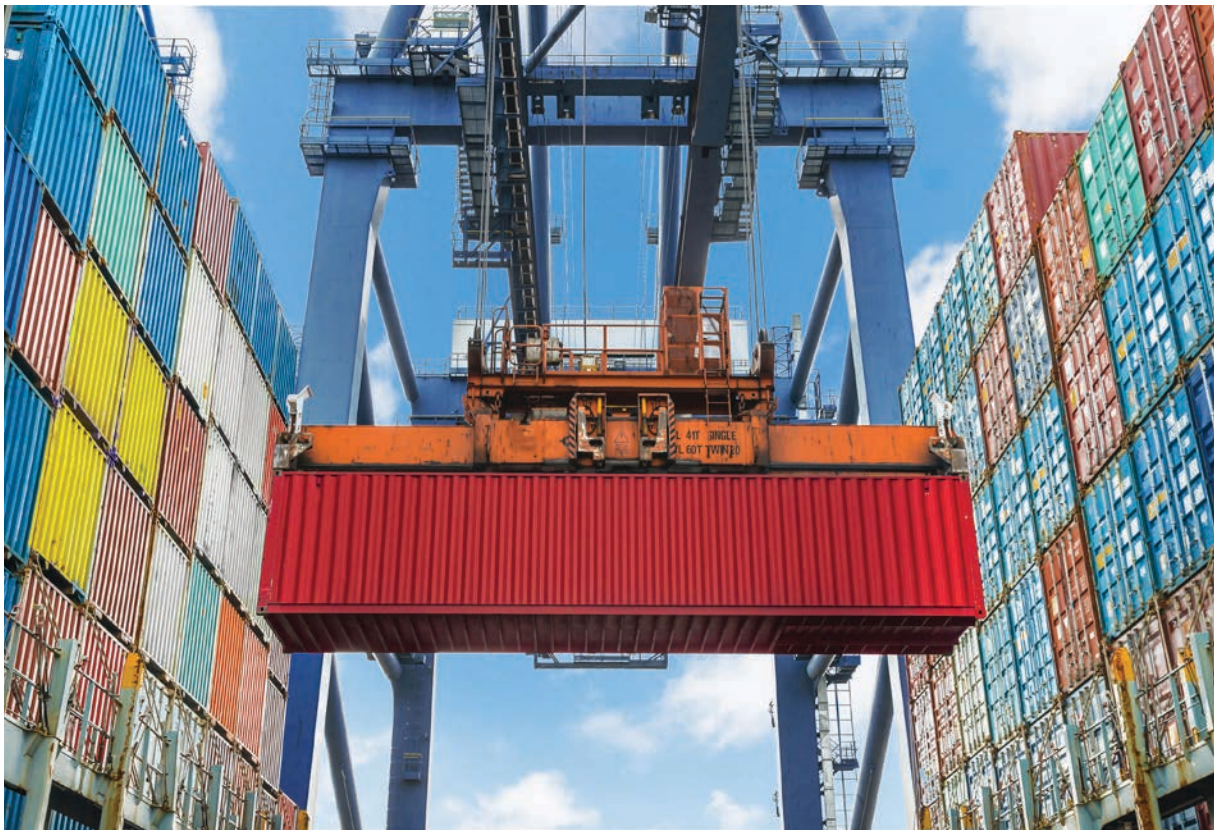
We commit to further establish dedicated PPP centres in APEC economies, with a view to developing a regional network of PPP centres to share good practices. In the longer term, these centres can play an important role in supporting the establishment of an APEC-wide market for infrastructure financing. We also welcome the Implementation Roadmap to Develop Successful Infrastructure PPP Projects in the APEC Region and the Action Agenda on Promoting Infrastructure Investment through PPP.

We will develop, maintain and renew quality infrastructures, including energy, ICT and transport. We will seek to increase the quality and sustainability of APEC transport networks; increase broadband Internet access; promote sustainable energy security; and build resiliency into the energy infrastructure.

We will help facilitate the efficient and effective operation of maritime transportation and shipment, especially taking into account that the majority of maritime infrastructure development projects happen on a unilateral basis. We take note of several pathfinder initiatives where future co-operation might produce tangible results.

We will strengthen air transportation co-operation to boost robust trade and people-to-people connections, share experiences and good practices to promote efficiency and security of air connectivity

We note that ICT development has been a focus of APEC's work since its inception in 1989, as increased information sharing and improved communication technology allow for faster and more reliable connections



Institutional connectivity will address issues of trade facilitation

between people and organisations throughout Asia-Pacific, facilitating trade and economic growth. We resolve jointly to continue our efforts in enhancing the access to ICT resources by using available technologies to reduce digital divide and increase greater connectivity in the region.

We resolve to tap into APEC's considerable potential in fostering future energy co-operation initiatives, especially in the areas of energy-related trade and environmental sustainability. APEC represents an ideal forum to explore the concept of expanded cross-border energy trade and renewable energy in a non-binding manner. We will further aspire to ensure quality electricity supply for all member economies.

Institutional Connectivity

Under Institutional Connectivity, we will strive to make progress in jointly addressing issues of trade facilitation, structural and regulatory reforms as well as improved transport and logistics facilitation, which are of critical importance to APEC as a regional forum.

We aim to modernise customs and border agencies and enable a whole-of-Government approach in the development of regulations, including co-ordination across regulatory, standards, and trade agencies.

We support APEC's work to encourage each member economy to develop its own Single Window system by 2020 and we encourage efforts to promote international interoperability between Single Window system and paperless trading.

We will further strengthen the initiatives under the APEC Supply-Chain Connectivity Framework Action Plan (SCFAP) by systematically improving supply chain performance by implementing a capacity building plan to assist economies in overcoming specific obstacles within the eight chokepoints of the SCFAP.

On regulatory coherence, we will implement initiatives that focus on regulatory co-operation by sharing best practices on regulatory issues. We note that industry dialogues are already well advanced in this process. The Internet is a good and effective tool to help economies

strengthen their implementation of good regulatory practices (e.g. ensuring internal co-ordination of regulatory work, assessing the impact of regulations, and conducting public consultations). Economies will further explore using Internet-based tools to strengthen the implementation of good regulatory practices, including new initiatives APEC economies could take to strengthen the conduct of public consultations on proposed regulations in the Internet era.

Under structural reform, the APEC Ease of Doing Business (EoDB) Multi-Year Project (MYP) facilitates tailored capacity building activities to support economies in achieving the target of making it 25% cheaper, faster, and easier to do business. We aim to achieve these goals by harmonising local policies with existing international agreements, and agree to consider the continuation of our work on the EoDB until 2020.

We commit to fostering transparency, safety, competition and better functioning markets, including e-commerce, in the Asia Pacific and aim to expand the application of secure and trusted ICT and e-commerce environment by 2025.

APEC needs to develop a strategy to tackle the policy challenges raised by the Middle-Income Trap (MIT). Improving an economy's competitiveness, productivity levels and its regulatory environment for the ease of doing business can contribute to overcoming some of the issues that underpin the MIT.

Under People-to-People Connectivity, we will strive to facilitate the movement of people across borders, and to facilitate the exchange of innovative ideas. As such, issues of business travel mobility, cross-border education, tourism facilitation, and skilled labour mobility will be addressed under this pillar.

We commit to continue expanding the number of holders of the APEC Business Travel Card (ABTC) and to improve the efficiency and effectiveness of ABTC scheme.

We undertake to improve cross-border education (CBE) co-operation, in recognition that student, academic and provider mobility helps to strengthen regional ties, facilitate people-to-people exchanges and promote economic development through knowledge and skills transfer. We resolve to achieve one million intra-APEC student exchanges per year by 2020, and to increase the number of student exchanges to developing economies.

Tourism is an important part of APEC economic growth strategies, and this is reflected in the many tourism facilitation and promotion initiatives that have been implemented within the APEC region. In this regard, we welcome domestic efforts by several economies to implement measures to ease visa restrictions for tourists as well as initiate programmes to facilitate immigration processing.

We will make efforts to achieve 800 million APEC tourist arrivals by 2025, and commit to establishing an APEC-wide Code of Conduct for Travel Providers in order to reduce travellers' costs and uncertainties relating to tourism.

We will intensify co-operation within APEC in promoting cultural exchanges, by aiming to hold at least one cultural awareness event by each APEC economy in every other APEC economy per year by 2017.

We resolve to advance work on cross-border science, technology, and innovation exchanges. We note with appreciation the annual APEC Science Prize for Innovation, Research and Education (ASPIRE) which recognises young scientists who have demonstrated co-operation with scientists from other APEC member economies, as well as a commitment to excellence in scientific research.

On professional and skilled labour mobility, we welcome initiatives to benchmark qualifications in the transport and logistics industry, allowing businesses within the region to have more certainty over the skill sets of workers from other economies. There are various bilateral Mutual Recognition Agreements (MRAs), and going forward, APEC can undertake work to help expand the number of bilateral and multilateral MRAs in the region. Mutual recognition of skills and credentials can play an important role in facilitating skilled labour mobility. Timely and accurate information on skills gaps and labour market imbalances will also need to be gathered and analyzed to ensure responsive policymaking in this area.

We commit to strengthen people-to-people connectivity

The annual APEC Science Prize for Innovation, Research and Education (ASPIRE) recognises young scientists

through human resources development and welcome the APEC Action Plan for Promoting Quality Employment and Strengthening People-to-People Connectivity through Human Resources Development.

Strategies for Implementation: Capacity Building and Private Sector Co-operation

Economic and technical co-operation (ECOTECH) is one of the key pillars of APEC, focusing on narrowing the gap between developed and developing APEC economies. To help implement the connectivity agenda, we will direct ECOTECH activities at upgrading skills and institutions by providing relevant capacity building activities for APEC economies and adhering to key ECOTECH objectives. In this regard, ECOTECH is an important tool for implementing the Blueprint.

The development and implementation of connectivity initiatives will require a significant amount of information on APEC economies' needs, expectations, gaps, and on market direction and imbalances. Information on what infrastructure projects are needed, what gaps exist in institutional frameworks, and where skills imbalances lay in the labour market will be crucial to support economies in achieving connectivity targets.

To gather this information, economies should work with the private sector. In this regard, the APEC Business Advisory Council (ABAC) and APEC's policy partnerships and industry dialogues can contribute significantly by providing private sector feedback or insights on market needs, trends and expectations.

We urge the private sector, with co-ordination from ABAC, to provide direct support for many of the more bankable connectivity initiatives being undertaken in the region. In addition to PPP for infrastructure projects, the private sector could help support capacity building programmes as well as educational and cultural exchanges. The private sector could also help in proposing and producing connectivity-enhancing innovations in the region.

International organisations have taken initiatives and launched projects on physical, institutional and people-to-people connectivity in the Asia-Pacific. These efforts could help advance the implementation of this Blueprint, and where

The Connectivity Blueprint will spur more economic activities as detailed in the APEC 2014 Joint Ministerial statement on areas such as APEC Port Service Network (APSN), transportation Connectivity Map, Cross-Border Education Co-operation and Tourism Co-operation

possible and appropriate APEC should look to co-ordinate and collaborate with these organisations to ensure we avoid duplication of efforts.

Monitoring, Evaluation and Review

In order to reach the overarching goal of strengthening physical, institutional, and people-to-people connectivity by taking agreed actions and meeting agreed targets by 2025, with the objective of achieving a seamless and comprehensively connected and integrated Asia Pacific, we instruct Ministers and Senior Officials to oversee the implementation of the Blueprint on a yearly basis, particularly in reviewing the targets and objectives.

We direct Ministers and Senior Officials to develop a dedicated arrangement to monitor, review and evaluate implementation of the Blueprint, and to conduct a mid-term review of the Blueprint in 2020. We further direct Ministers and Senior Officials to work with APEC fora to develop additional ambitious and measurable actions and targets under each of the connectivity pillars. These actions and targets need to be forward-looking and directed towards the vision of APEC Connectivity in 2025.

Future Development

The Connectivity Blueprint will spur more economic activities as detailed in the APEC 2014 Joint Ministerial statement on areas such as APEC Port Service Network (APSN), transportation Connectivity Map, Cross-Border Education Co-operation and Tourism Co-operation. The recent announcement of new funds such as the Asia Infrastructure Investment Fund, the 21st Maritime Silk Road Fund and Special Fund for ASEAN are seen as part of enabler of the Connectivity Blueprint. ■

APEC Strategic Blueprint - Global **Value Chains Development** and Co-operation

Compiled by Jane Fong Jeng Sing

Global Value Chains (GVCs) are an increasingly common way of organising production in the Asia-Pacific, and elsewhere in the world. Goods are moving across borders multiple times before being shipped to the final consumer at the end of a complex production process. GVCs allow businesses to work together across borders to capitalise on the advantages that different economies offer.

APEC Economic leaders gathered for the 22nd APEC Economic Leaders Meeting on November 11, 2014 in Beijing and recognised that GVCs have become a dominant feature of the global economy and offer new prospects for growth, competitiveness and job creation for APEC economies at all levels of development. At the conclusion of the meeting, the APEC leaders endorsed the APEC Strategic Blueprint for promoting Global Value Chains Development and Co-operation.

APEC STRATEGIC BLUEPRINT

GVCs have become a dominant feature of the global economy. Better understanding and supporting the "trading tasks" involved in adding value to the final products that cross borders has become paramount to realising a more effective policy and regulatory framework for global trade. Efficient and workable GVCs within and between APEC economies has accordingly become a key focus for economies at all levels of development.

Given the diverse needs and situations of APEC economies participating in global trade networks today, an overall policy direction guiding improved co-operation and a more focused GVC evolution is essential to facilitating sustainable, inclusive and balanced growth in the Asia-Pacific region.

Source: www.apec.org

Consistent overall policy based on input from each economy is essential for moving APEC's trade and investment agenda forward, and facilitating APEC's push for regional economic integration.

In 2013, APEC Leaders agreed to *promote GVC development and co-operation in the APEC region on the basis of previous work on connectivity.* This agreement highlights the need for APEC economies to work strategically and take action in creating an enabling environment for GVC development and co-operation. In response to the Leaders' instruction, APEC economies agree to develop a Strategic Blueprint for promoting global value chains development and co-operation, and agree to:

1. Address trade and investment issues that impact GVCs. Reducing trade and investment barriers will improve APEC economies' access to global production networks and allow firms to source less expensive inputs globally. This in turn lowers costs, increase efficiency and enhance competitiveness. For 2015, APEC may launch initiatives in the areas of enhancing GVCs; and studying the impact of measures on the growth of GVCs, participation of economies and businesses in GVCs, and our regional economy. These initiatives would address areas of importance ranging from well-known issues to next generation issues. APEC could then explore best practices to help economies adopt more trade and investment friendly approaches in these areas, while achieving their domestic economic or regulatory objectives, lowering trade costs, and enhancing GVCs.

2. Co-operate on improving statistics related to GVCs. In light of the principles of "from easy to hard" and "moving from technical proficiencies to policy", we will take a step-by-step approach in compiling domestic account and foreign trade statistics, and developing categories harmonised to realise effective correlation of data among APEC economies that can contribute to the WTO-OECD Trade in Value-Added (TiVA) database. Without duplicating existing work at the WTO and OECD, the Committee of Trade and Investment will undertake further efforts in 2015 and future years on policy research, information exchange, developing shared approaches on statistics collection, and offering focused capacity building

programmes. In order to support and facilitate the work in this area, APEC should explore the establishment of an 'expert group' on value-added trade to help member economies undertake trade policy capacity research, exchange information, develop approaches to statistics collection, and conduct focused capacity building efforts.

3. Realise the critical role of trade in service within GVCs. We shall continue on-going work to promote open, efficient, and internationally-competitive service sectors, and maximise the contribution that services can make to strong, resilient and reliable supply chains in this region. We need to conduct targeted capacity building to help economies better understand and stimulate the development of innovative services within GVCs, and build on shared information among economies. We will work with economies at all stages of development to create an open and competitive environment for services development.

4. Enable developing economies to better participate in GVCs. In light of the diversity of APEC member economies, we recognise that comprehensive economic and technical co-operation will play a key role in ensuring greater participation of developing economies in GVCs, and help them achieve their domestic economic objectives. We will integrate economic and technical co-operation into the paths identified for future development, and further leverage co-operation activities, including targeted capacity-building programmes for helping developing economies enter and move up GVCs. Examples of these include public-private GVC collaboration partnerships, programmes on human resource development, and further work on technology dissemination and commercialising creative content. We will emphasise and adopt a multi-year strategic plan based on the core agenda of APEC and employ goals-oriented, focused approaches.

5. Assist Small and Medium Enterprises (SMEs) to benefit from GVCs. We shall develop and implement initiatives to assist our SMEs in the areas that matter most to GVCs: infrastructure, supply chain connectivity, innovation, skills, and adoption of international standards. We will take steps to enhance capacity building activities and raise SMEs understanding of how to participate in GVCs. APEC shall achieve this by facilitating SMEs access to trade and investment related information via increased utilisation of information and communication technologies (ICTs),enhancing intellectual property protection, and providing further information on tools and processes that would help them enter and move up GVCs. APEC will also foster linkages between SMEs and MNEs by helping our economies build an open and transparent regulatory and investment climates.

6. Improve the investment climate for GVCs Development. We recognise the importance of adopting and maintaining laws, regulations, and practices that facilitate investment. We reaffirm the importance of continued efforts to improve the investment climate in the APEC region. This includes taking concrete steps to facilitate investment as per existing APEC investment documents, such as the APEC Non-Binding Investment Principles, the APEC Investment Strategy and the APEC Investment Facilitation Action Plan (IFAP). APEC will help economies:-

- implement sound investment strategies which deal with investment applications expeditiously, fairly, and equitably; and
- facilitate investment through creating and maintaining transparent and sound administration procedures that apply for the lifetime of the investment.

7. Adopt effective trade facilitation measures. We reaffirm our commitment to achieving an APEC-wide target of a 10% improvement in supply-chain performance by 2015, in terms of reduction in the time, cost, and uncertainty of moving goods and services throughout the region. Accordingly, we will further advance a capacity building programme to address the identified supply chain connectivity (SCC) chokepoints and improve the performance of supply chains. To this end, we will carry out additional concrete actions, including the establishment of an APEC Supply Chain Alliance and promoting co-operation on green supply chains. We welcome the framework for advancing supply chain connectivity through mutual recognition of control, mutual assistance of enforcement and mutual sharing of information (SCC-3M) among customs agencies and other

"Malaysia which has been promoting herself as trading hub due to its strategic geographic position at the heart of ASEAN, its conducive investment environment, its high score in the world ranking for ease of doing business should benefit from this GVCs' Blueprint, particularly the SMEs.

Government agencies related to trade, and will advance the Model E-port Initiative. We will also share best practices of ICT infrastructure development and efficient trade facilitation measures. We also reaffirm our commitment to implement the WTO Agreement on Trade Facilitation and encourage greater contribution by APEC.

8. Enhance resiliency of GVCs. APEC will make a collaborative effort to enhance cross-border value chain resilience in the region, establish more secure value chains, and conduct quantitative value chain research and analysis in the region. APEC may also carry out discussions of potential co-operation in the development of practical policy, and capacity building projects based on these analyses.

9. Encourage public-private partnerships for GVCs. APEC will continue to make good use of the Public-Private Partnership Guidebook as a tool for encouraging sector level partnerships for investment in regional value chains infrastructure and capacity building within a high-quality institutional and regulatory framework. APEC will also enhance trust and shared understanding between participants to foster interaction between private and public sectors across APEC economies.

10. Strengthen collaboration with other stakeholders on GVCs. APEC will promote collaboration with international organisations and partner institutions, such as the WTO, UNCTAD, OECD, G20, the World Bank, IMF and ADB to enhance synergies in policy making with regard to GVCs through technical assistance and capacity-building. Further, inter-Governmental co-operation and NGO promotion of activities in GVCs will also be encouraged.

Conducting activities contained within this Strategic Blueprint will be essential to strengthening our mutual economic ties in the global network, and ensuring our regional economy is resilient, our growth is inclusive, and our economies become ever more connected. We believe that our people should secure equitable benefit from GVC development and that this is key to shaping a sound future through our Asia-Pacific partnership. We are determined to demonstrate APEC's leadership in fostering further GVC development and will immediately begin with concerted efforts upon the approval of this Blueprint that is being proposed.

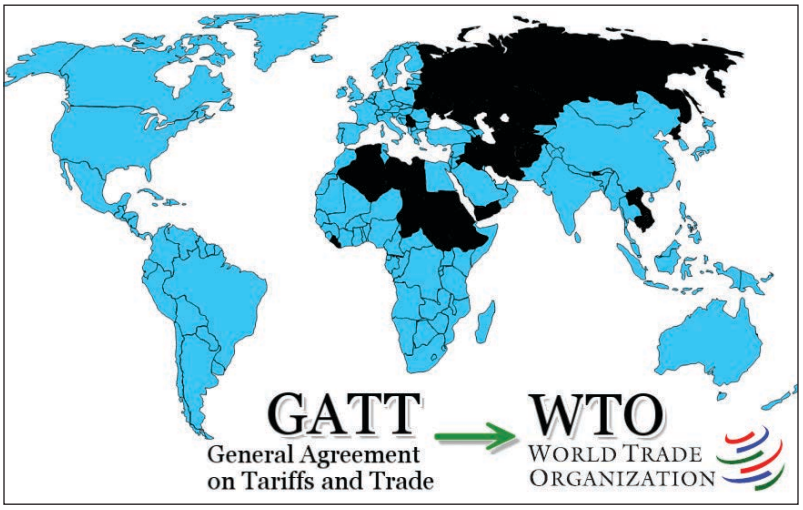
The Way Forward

With the endorsement of the GVCs blueprint, the Committee of Trade and Investment, Friends of the Chair Group on GVCs will put forward new initiatives under the Strategic Blueprint in 2015 and beyond.

Malaysia which has been promoting herself as trading hub due to its strategic geographic position at the heart of ASEAN, its conducive investment environment, its high score in the world ranking for ease of doing business should benefit from this GVCs' Blueprint, particularly the SMEs. ■

Introduction to **Four Modes of Supply** for International Services.

Compiled by Lim Tau Wee



During the Uruguay Round of the General Agreement on Tariffs and Trade (GATT), the General Agreement on Trade in Services was drafted. This has become enshrined as one of the four pillars of the international treaty comprising the World Trade Organisation (WTO) Agreement in 1995.

General Agreement on Trade in Services aims to establish a multilateral framework of principles and rules for trades in services. The objective of the agreement is the expansion of such trade under conditions of transparency and progressive liberalisation. In addition, it is seen as a means of promoting the economic growth of all trading partners and the development of developing countries.

It recognises the right of Members of WTO to regulate, and to introduce new regulations, on the supply of services within their territories in order to meet national policy objectives. Given asymmetries existing with respect to the degree of development of services regulations in different countries, the particular needs of developing countries to exercise their rights is recognised. This will also call for the facilitation of increasing participation of developing countries in trade in services and the expansion of their service exports including, inter alia, the strengthening of their domestic services capacity and their efficiency and competitiveness.

Trade in Services refers to the sale and delivery of an intangible product, called a service, between a producer and consumer. Trade in services takes place between a producer

and consumer that are, in legal terms, based in different countries, or economies, this is called International Trade in Services.

International trade in services is defined by the *Four Modes of Supply* of the General Agreement on Trade in Services (GATS).

Mode 1: Cross-border supply is defined to cover service flows from the territory of one Member into the territory of another Member (e.g. banking or architectural services transmitted via telecommunications or mail, distance learning). Mode 1 contributes to 35% of services traded internationally. The service supplier is not present within the territory of the member.

Mode 2: Consumption abroad refers to situations where a service consumer (e.g. tourist or patient) moves to another Member's territory to obtain a service. The service supplier is not present within the territory of the member.

Mode 3: Commercial presence implies that a service supplier of one Member establishes a territorial presence, including through ownership or lease of premises, in another Member's territory to provide a service (e.g. domestic subsidiaries of foreign insurance companies or hotel chains). The service supplier is present within the territory of the member.

Mode 4: Presence of natural persons consists of persons of one Member entering the territory of another Member to supply a service (e.g. accountants, doctors or teachers). The Annex on Movement of Natural Persons specifies, however, that Members remain free to operate measures regarding citizenship, residence or access to the employment market on a permanent basis). This mode includes self-employed persons and employees on temporary assignment (intra-corporate transferees). The terminology "natural persons" is used to differentiate between individuals and the generic use of "persons," which covers individuals, branches, partnerships, associated groups, associations, estates, trusts, Government agencies, and others. The service supplier is not present within the territory of the Member.

Services Sector Classifications

Services Sector Classifications addressed in the GATS are defined in the so-called "W/120 list", which provides a list of all sectors which can be negotiated under the GATS. The title refers to the name of the official WTO document, *MTN.GNS/W/120*. ■

Third Culture Generation – Product of Globalisation

By Ir. Fong Tian Yong

I was first introduced to the term "third culture generation" by the Vice President of Shangri-La Hotel of Beijing, Christopher Chia, a Malaysian expatriate while I was attending the APEC CEO Summit 2014 in Beijing. The subject came about when he described to me about a number of Malaysian expatriates working with Shangri-La hotel chains in China, transferred within China for years and the corresponding impact on their children's culture identity and sense of belonging. He then mentioned this term 'third culture generation' which is new to me although it is a common term among expatriates. You may call them the creatures of globalisation whereby the mobility of natural persons becomes common place.

Third culture generation or third culture kid (TCK) is a new term to describe children who were raised in a culture outside of their parents' culture for a significant part of their development_years. The definition is not limited to describing only children, but can also be used to describe adults who have had this experience of being a TCK. The experience of being a TCK is unique in that these individuals are moving between cultures before they have had the opportunity to fully develop their personal and cultural identity.

Vice President Shangri-La Hotel Beijing, Christopher Chia posing with BEM editor.

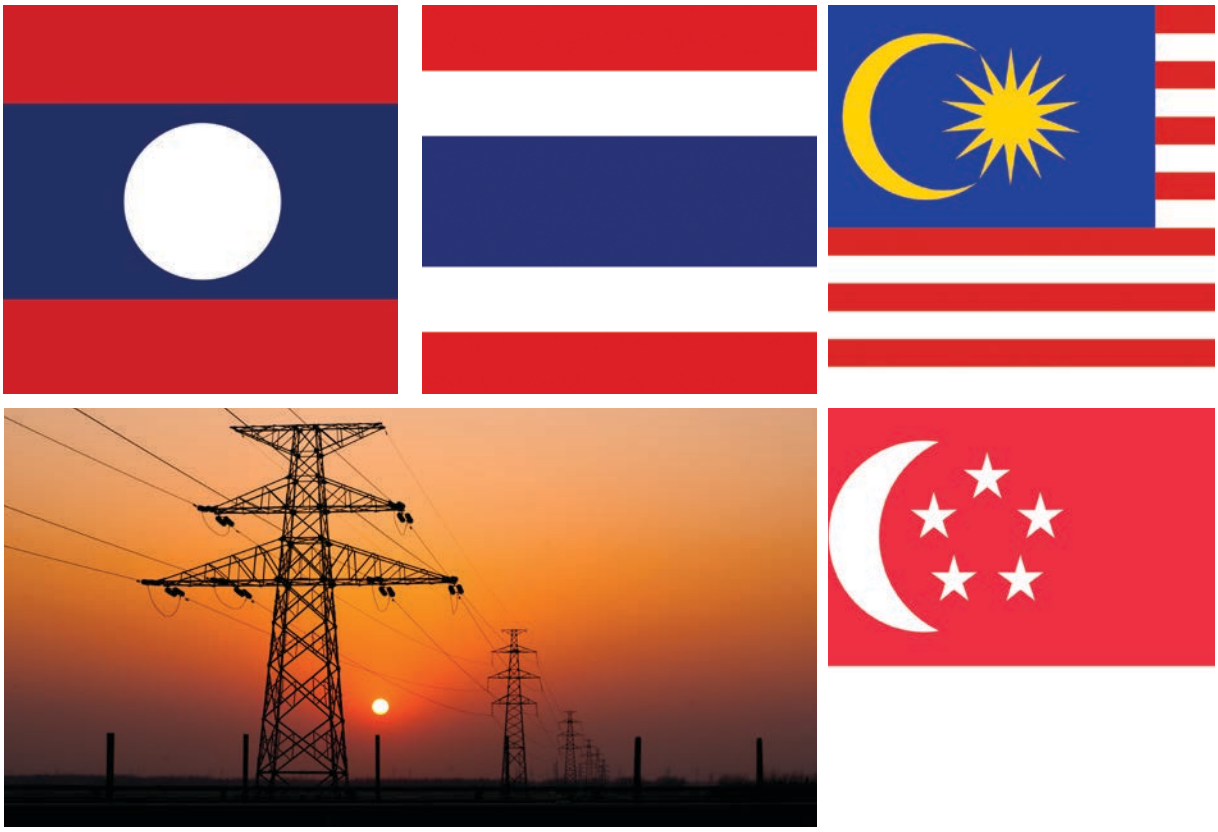
The first culture of children refers to the culture of the country from which the parents originated, the second culture refers to the culture in which the family currently resides, and the third culture refers to the amalgamation of these two cultures. The third culture is further reinforced with the interaction of the third culture individual with the expatriate community that currently resides in the host country.

Today, the number of TCKs, also referred to as third culture individuals (TCI) is increasing with globalisation, more opportunities for jobs and work overseas, international education being more accessible, and various other factors. Nowadays, more children are bilingual or multi-lingual as parents are more exposed to the global business world. TCIs are often exposed to a second (or third, fourth, etc.) language while living in their host culture. This means that TCIs are often bilingual, and sometimes even multilingual.

Most TCKs suffer less cultural shock when they move from city to city. However, when they return to a culture of homogeneity in their belief system, it can be challenging for them as the expanded worldview they often practice may be perceived as offensive. Nevertheless, they are generally more adaptable to changes culturally and socially.

Taking on from here, it is no wonder that when expatriates visit their potential employment office overseas, the first thing that comes to their mind is to assess whether their wives and children are happy with the new place of residence in the foreign land.

With the impending liberalisation of market entry for professional engineers, movement of natural persons is expected to increase in the big ASEAN market of 610 million population as well as opportunities in other global region. TCK will then be a common term where concerns on education, culture, social lifestyle and identity will have to be addressed. ■



Lao DPR, Thailand, Malaysia, Singapore Power Integration Project

BORDERLESS ASEAN ENERGY CO-OPERATION

By Nor Ziha Zainol Abidin,
Aeni Haryati Hashim, and
Ir. Joon b. Ibrahim
Single Buyer Department, Tenaga Nasional Berhad

Four ASEAN countries, Lao PDR, Thailand, Malaysia and Singapore, have unanimously agreed to undertake a pilot project termed “Lao PDR, Thailand, Malaysia, Singapore Power Integration Project (LTMS PIP). This pilot project will serve as a pathfinder to complement existing efforts towards realizing the ASEAN Power Grid and the ASEAN Economic Community by creating opportunities for multilateral electricity trading beyond neighbouring borders.

ASEAN, has for many years envisaged having its own integrated regional power network. Blessed with abundance of natural resources, the ASEAN Power Grid (APG) is the key infrastructure that will enable efficient utilisation of indigenous resources for power generation among the ASEAN countries. Mooted in 1997, the APG however experienced almost a stagnant growth due to multitude of reasons. National impediments to promotion of power trade and the electricity industry restructuring and evolution into a single power market are among the barriers hindering the pursuit of the APG [1] .

The recent 32nd ASEAN Ministers on Energy Meeting (AMEM) in Vientiane, Laos, has finally brought a new light for ASEAN energy integration. In a joint statement during the meeting in September 23, 2014, Lao PDR, Thailand, Malaysia and Singapore unanimously agreed to undertake a pilot project entitled "Lao PDR, Thailand, Malaysia, Singapore (LTMS) Power Integration Project (PIP)" to study cross-border power trade from Lao PDR to Singapore [2]. The project will serve as a pathfinder to accelerate the realization of the APG and ASEAN Economic Community (AEC).

ASEAN Community

During the 9th ASEAN Summit in 2003, the ASEAN leaders consented that an ASEAN Community should be established by 2015 [3]. Originally targeted to commence in 2020, the ASEAN Community is built on three pillars, namely the ASEAN Political-Security Community, ASEAN Economic Community and ASEAN Socio-Cultural Community.

The AEC is the realisation of the end goal of economic integration by 2015. AEC aims to transform ASEAN into a region with free movement of goods, services, investment, skilled labor, and free flow of capital. The AEC blueprint bears the following four key characteristics [4]:

a. a single market and production base
b. a highly competitive economic region
c. a region of equitable economic development, and
d. a region fully integrated into the global economy.

One of the enablers in creating a highly competitive economic region is infrastructure development. Under the initiative of economic co-operation, AEC emphasises regional co-operation to develop Trans-ASEAN Gas Pipeline (TAGP) and APG which would allow for optimisation of the region's energy resources for greater security.

2015 marks an important milestone for Malaysia as the country will assume the chairmanship of ASEAN. In his speech at the closing of 25th ASEAN Summit in Myanmar, Prime Minister Datuk Seri Najib Tun Razak has pledged Malaysia's commitment to make ASEAN Community a reality [5].

Figure 2: Three Pillars of ASEAN Community

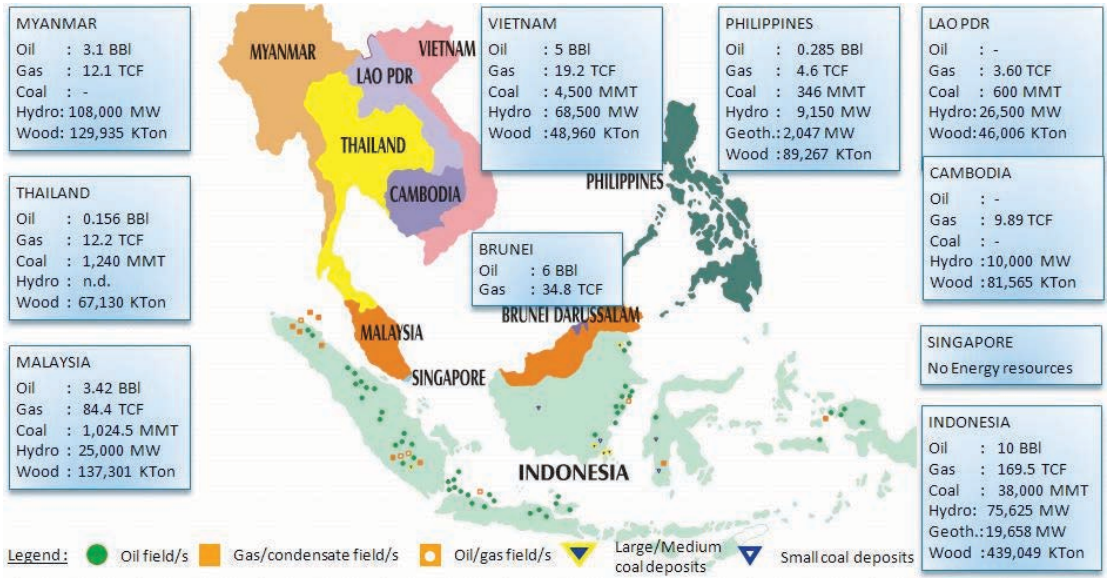


Figure 3: ASEAN Energy Resources [7]

ASEAN POWER GRID

ASEAN Energy Resources

ASEAN is one of the fastest growing regions in the world with a steep rise in energy demand, propelled by economic and demographic growth. According to International Energy Agency [6], the region's energy demand has increased by two and a half folds since 1990. Thus, ensuring a secure supply of energy is an overriding concern for ASEAN.

Fortunately, ASEAN region is blessed with vast indigenous resources. For example, Myanmar, Vietnam, Cambodia and Lao PDR possess huge hydro potential while Brunei and Malaysia are bestowed with oil and gas reserves. Equitably, Indonesia owns most of the region's coal resources.

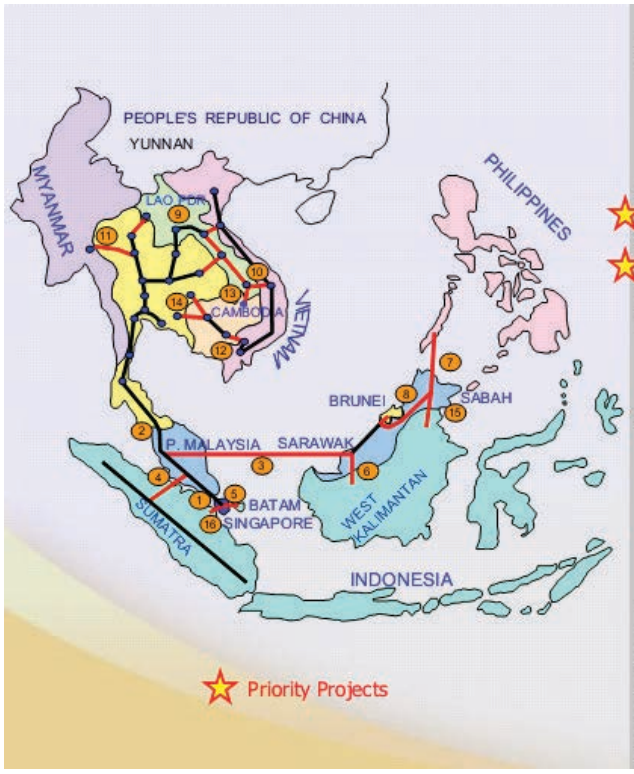
Rich and diversified resources, coupled with a rapid growth of electricity demand, present a compelling reason for further integration of the grids, both cross-border and national. The imminent benefits include enhanced grid reliability and lower costs resulting from cheap hydro potential resources and pooling of generation reserves. These would delay the need for investment in new generation capacity of non-integrated system [6].

ASEAN Power Grid

APG is the answer for the region's envisaged grid integration. A flagship programme mandated in 1997 by ASEAN Heads of States/Governments under ASEAN vision 2020, APG aims to create economic benefits and opportunities for power exchange and trade among ASEAN member countries to support ASEAN Economic Community [1]. APG seeks to ensure energy security and to establish a Southeast Asian regional electricity grid by 2020.

The Heads of ASEAN Power Utilities/ Authorities (HAPUA), assisted by ASEAN Power Grid Consultative Committee (APGCC), was tasked to conduct the ASEAN Interconnection Master Plan Study (AIMS). AIMS proposed a comprehensive plan of regional transmission network that links ASEAN power systems, initially on cross-border bilateral terms, then gradually expand to sub-regional basis and finally to a totally integrated APG system [9]. The AIMS study consists of AIMS-I which was completed in 2003 and AIMS-II in 2010, identified 16 interconnection projects as depicted in Figure 4. The interconnection projects comprise partially existing links, in on-going projects as well as future projects.

AIMS-II studies reported a substantial potential saving in investment of new power projects and operating costs within member countries. By



		Earliest COD
1)	P.Malaysia - Singapore (New)	2018
2)	Thailand - P.Malaysia	
	• Sadao - Bukit Keteri	Existing
	• Khlong Ngae - Gurun	Existing
	• Su Ngai Kolok - Rantau Panjang	2015
	• Khlong Ngae – Gurun (2nd Phase, 300MW)	2016
3)	Sarawak - P. Malaysia	2015-2021
4)	P.Malaysia - Sumatra	2017
5)	Batam - Singapore	2015-2017
6)	SarPhilippiawak - West Kalimantan	2015
7)	Philippines - Sabah	2020
8)	Sarawak - Sabah – Brunei	
	• Sarawak –Sabah	2020
	• Sabah – Brunei	Not Selected
	• Sarawak – Brunei	2012, 2016
9)	Thailand - Lao PDR	
	• Roi Et 2 - Nam Theun 2	Existing
	• Sakon Nakhon 2 – Thakhek – Then Hinboun (Exp.)	Existing
	• Mae Moh 3 - Nan - Hong Sa	2015
	• Udon Thani 3- Nabong (converted to 500KV)	2018
	• Ubon Ratchathani 3 – Pakse – Xe Pian Xe Namnoy	2018
	• Khon Kaen 4 – Loei 2 – Xayaburi	2019
	• Thailand – Lao PDR (New)	2015-2023
10)	Lao PDR - Vietnam	2011-2016
11)	Thailand - Myanmar	2016-2025
12)	Vietnam - Cambodia (New)	2017
13)	Lao PDR - Cambodia	2016
14)	Thailand - Cambodia (New)	2015-2020
15)	East Sabah - East Kalimantan	2020
16)	Singapore – Sumatra	2020

Figure 4: The envisioned ASEAN Power Grid (APG) [8]

2025, there will be up to 19,576MW of cross-border power purchase and 3,000MW of energy exchange through cross-border interconnections. The integration of ASEAN network will result in net saving of US$788M and a reduction in installed capacity totalling to 2,013MW [10].

Challenges in realising ASEAN Power Grid

Despite HAPUA commitment to accelerate the implementation of APG, the project has not made impressive progress since its conception in 1997. To expedite the completion of APG, a number of challenges have to be urgently addressed and resolved first.

Cross-border issues are among those requiring immediate action. In the second meeting of ERIA Research Working Group in Kuala Lumpur on April 23 2014, the MOU of APG expressed concerns on cross-border issues. First, there is a need for harmonisation of legal and regulatory framework for bilateral and cross-border power interconnectivity and trade. Similarly, as individual ASEAN countries have their own technical standards or codes particularly in the areas of Planning and Design, System Operation and Maintenance, a common regional standard has to be established as the way forward. There is also a need to formulate institutional and contractual arrangements for cross-border electricity trade.

BACKGROUND ON ASEAN

The Association of Southeast Asian Nations, or ASEAN, was founded on August 8, 1967 in Bangkok, Thailand, with the signing of the ASEAN Declaration (Bangkok Declaration) by the Founding Fathers of ASEAN, namely Indonesia, Malaysia, Philippines, Singapore and Thailand. Brunei Darussalam, Viet Nam, Lao PDR, Myanmar and Cambodia subsequently joined the establishment making it ten member country- association as what it is today. Timor-Leste officially applied to join ASEAN on March 4, 2011. ASEAN aims, among others, are to accelerate the economic growth, social and cultural development among its member states, foster regional peace and stability, and promote and maintain regional co-operation in various fields including economic, social, cultural, education, technical, scientific and administrative fields [3].

Id	Description	Existing (MW)	On-going (MW)	Future (MW)	Total (MW)
Northern System		**2,619**	**6,550**	**17,004**	**26,183**
9	Thailand-Lao PDR	2,111	3,352	3,095	8,558
10	Lao PDR- Vietnam	248	2,898	TBD	3,146
11	Thailand- Myanmar	-	-	11,709	11,709
12	Vietnam- Cambodia	170	-	-	170
13	Lao PDR- Cambodia	-	300	-	300
14	Thailand- Cambodia	100	-	2,200	2,300
Southern System		**450**	**600**	**1,800**	**2,850**
1	P. Malaysia- Singapore	450	-	600	1,050
4 ★	P. Malaysia- Sumatra	-	600	-	600
5	Batam- Singapore	-	-	600	600
16	Singapore- Sumatra	-	-	600	600
Eastern System		**-**	**430**	**800**	**1,230**
6 ★	Sarawak- W. Kalimantan	-	230	-	230
7	Philippines- Sabah	-	-	500	500
8	Sarawak- Sabah- Brunei	-	200	100	300
15	E. Sabah- E. Kalimantan	-	-	200	200
Northern- Southern Link		**380**	**100**	**300**	**780**
2	Thailand- P. Malaysia	380	100	300	780
Southern- Eastern Link		**-**	**-**	**3,200**	**3,200**
3	Sarawak- P. Malaysia	-	-	3,200	3,200
Grand Total		**3,459**	**7,680**	**23,104**	**34,243**

★ Priority Projects

Note:
1. *Ongoing Projects are projects with Tariff MOU/ Contract Signed*
2. *TBC stands for To Be Confirmed*
3. *SCOD stands for Scheduled Commercial Operating Date*

Table 1: Status of ASEAN Interconnection Projects [1]

These include issues on Taxation, Tariff and Third Party Assess or Wheeling Charge. Finally, it is also necessary to identify and recommend financing modalities including Public Private Participation (PPP) in the development of APG Projects [11].

The National agendas of ASEAN countries to some extent become an impediment to the promotion of power trade. Presently, there are considerably diverse national energy policies across the region. These policies reflect the differences in political direction, economic development and utilisation of natural resources. Some countries desire for self-sufficiency before interconnectivity is even considered, while others express concern over restructuring to be competitive under APG. To sum up, there is a need for greater stability and consistency in the application of energy -related policies to make APG achievable [1].

These challenges are well acknowledged. As such, HAPUA and APGCC have formulated strategies, as depicted in Figure 6, to accelerate the APG development and ultimately enable ASEAN Electricity Market Integration.

LAO DPR, THAILAND, MALAYSIA, SINGAPORE POWER INTEGRATION PROJECT

Existing Interconnections in Malaysia

Peninsular Malaysia's grid is interconnected with Thailand in the North and Singapore in the South. Currently, TNB grid system is interconnected with Electricity Generating Authority of Thailand

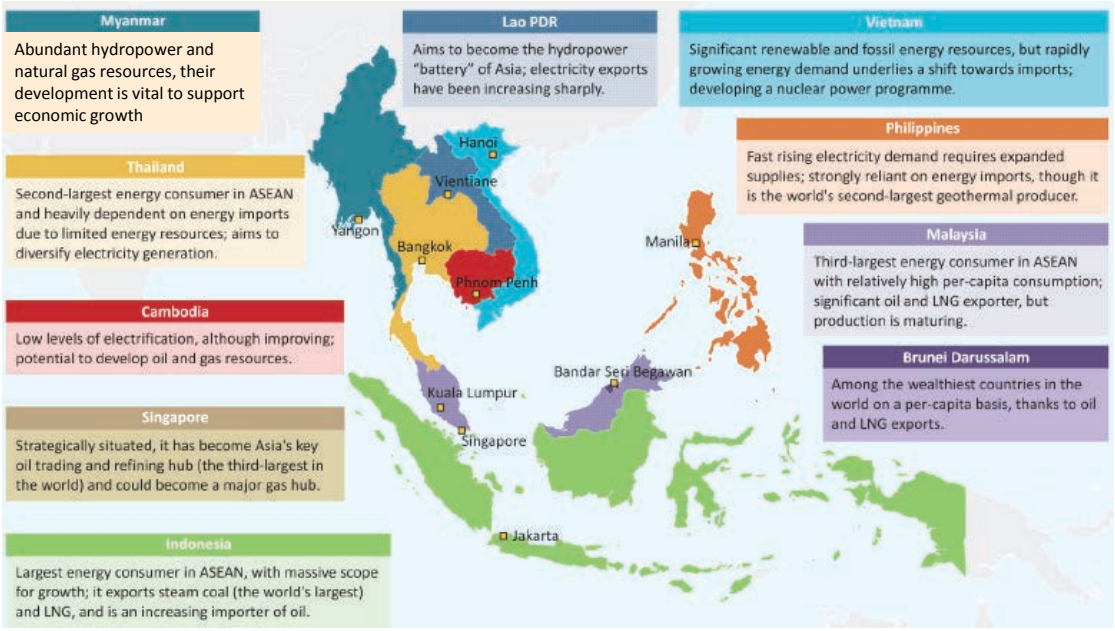


Figure 5: ASEAN Energy Policy

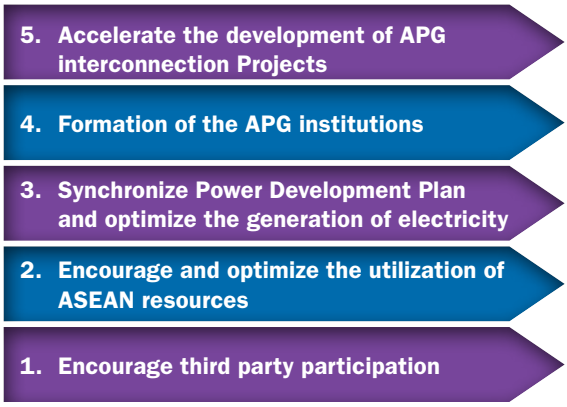
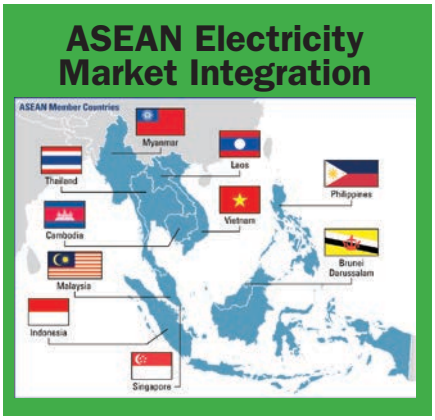


Figure 6: APGCC-Strategies for APG Development [1]



(EGAT)'s grid via 300kV High-Voltage Direct Current (HVDC) and 132kV High-Voltage Alternating Current (HVAC) links. The system interconnection arrangement for TNB-EGAT HVDC link is based on energy transactions.

Meanwhile, the grid interconnection between Peninsular Malaysia and Singapore is based on energy exchange. The objective is to enable mutual energy transfer in times of need and more economical mode of system operation through sharing of spinning reserves.The southern TNB grid is connected to PGL of Singapore via 275kV HVAC cables.

Both interconnections have many times proved to be beneficial to Malaysia and the interconnected countries alike. For example, when Malaysia experienced a generation shortfall during an emergency condition, the interconnected system reacted instantaneously providing the much needed fast reserve, saving Malaysia from impending blackout. Taking advantage of interconnected systems, more interconnection projects are in the pipeline to further strengthen the national grid.

A Step Closer Towards ASEAN Power Integration

The APG, which has experienced stagnant development, finally sees progress with the launching of the cross-border power trade project between Lao PDR and Singapore. Through a joint statement during Lao PDR's chairmanship of the 32nd ASEAN Ministers on Energy Meeting (AMEM), four ASEAN countries, Lao PDR, Thailand, Malaysia and Singapore, have unanimously agreed

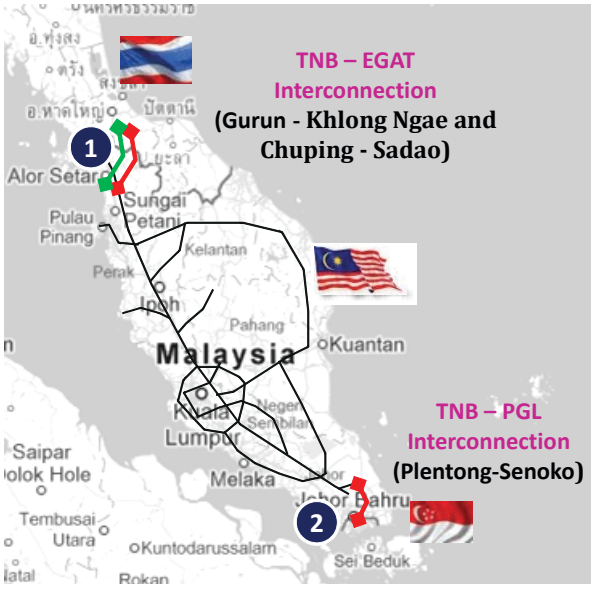


Figure 7: Existing Interconnections in Peninsular Malaysia

to undertake a pilot project termed "Lao PDR, Thailand, Malaysia, Singapore Power Integration Project (LTMS PIP). This pilot project will serve as a pathfinder to complement existing efforts towards realizing the APG and the AEC, by creating opportunities for multilateral electricity trading beyond neighbouring borders [2].

It is envisioned that this initiative will contribute towards energy security by strengthening the power integration network and enhancing the economic prosperity of the region. The project is also expected to help identify and resolve issues affecting cross-border electricity trading in ASEAN. The success of this project will pave the way towards further multilateral electricity power trade.

As a first step towards realising LTMS PIP, a working group was established consisting of representatives from utilities, regulators and Government agencies from the four involved countries. The task of the LTMS PIP Working Group is to formulate a conceptual framework for multilateral cross-border power exchange/ trading between ASEAN countries generally and for the pilot project specifically. The working group will examine the relevant policy, legal, regulatory and commercial issues involving cross-border electricity trading more closely. For a start, a maximum of 100MW of power will be wheeled to Singapore through the existing interconnections. Malaysia is represented by subject matter experts from Tenaga Nasional Berhad, Suruhanjaya Tenaga and Kementrian Tenaga, Teknoloji Hijau dan Air (KeTTHA).

OPPORTUNITY FOR MALAYSIA

LTMS PIP is a worthwhile pursuit. According to ERIA study, as much as US$26 billion of potential saving over the period of 10 years can be expected from the project. Although Lao PDR and Singapore reap the most advantage from this multilateral trade, Malaysia and Thailand will also benefit from it since the power has to be wheeled through the countries' territories. As such, the two countries can carry out a relay power trade in between [12].

The success of LTMS PIP will chart the path for more multilateral power trade and Malaysia indeed will gain the benefit in the longer term. Envisioned to become the 'battery of Asia', Lao PDR possesses huge hydro potential of about 30,000MW, which largely remains untapped. With a surplus of generation capacity, Lao PDR can sell its excess power to a more costly system like Malaysia that largely depends on more expensive fossil fuels. Malaysia relies mostly on imported fuels and by importing cheaper and more stable-priced electricity from hydro power plants, will help cushion the impact of fuel price volatility. In addition, interconnected systems will surely yield greater grid reliability and enhance security of electricity supply.

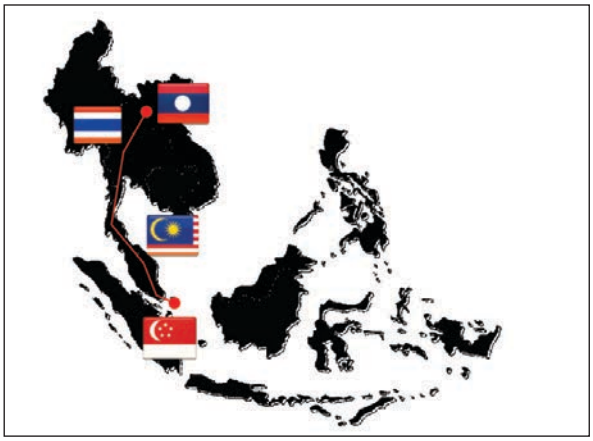


Figure 8: LMTS-PIP

CONCLUSION

ASEAN has long emphasised co-operation among the member countries. Various initiatives in the fields of political-security, economic and socio-cultural have been carried out to further strengthen the regional collaboration. Year 2015 marks an important milestone for ASEAN as it aims to see the emergence of the ASEAN Community. One of the pillars, the ASEAN Economic Community (AEC), is the goal to attain regional economic integration by 2015. Malaysia, as the elected ASEAN chairman for 2015, has pledged its commitment to lead ASEAN to achieve the goal [5].

Energy is the key ingredient to transform ASEAN into a stable, secure, prosperous, competitive and resilient economic region. The blueprint of AEC, that puts emphasis on collaborative partnerships in the field of energy, saw the birth of flagship programmes, the APG and TAGP. Both APG and TAGP, which called for co-operation to establish interconnecting arrangements for electricity and natural gas within ASEAN, seek to ensure regional energy security while promoting the efficient utilisation and sharing of resources [9].

Yet, despite relentless efforts to realise APG, the full integration of ASEAN power grid has not materialised. Factors such as cross-border issues and lack of political will are among barriers that have been hampering the progress of APG. Fortunately, the recently announced pilot project, Lao DPR, Thailand, Malaysia, Singapore Power Integration Project brings the ASEAN energy co-operation to a new height. This is a showcase of economic co-operation among ASEAN countries. It is envisaged that the success of project will pave the way towards further multilateral cross-border power trade in the region for a more resilient and prosperous ASEAN. ■

ACKNOWLEDGMENT

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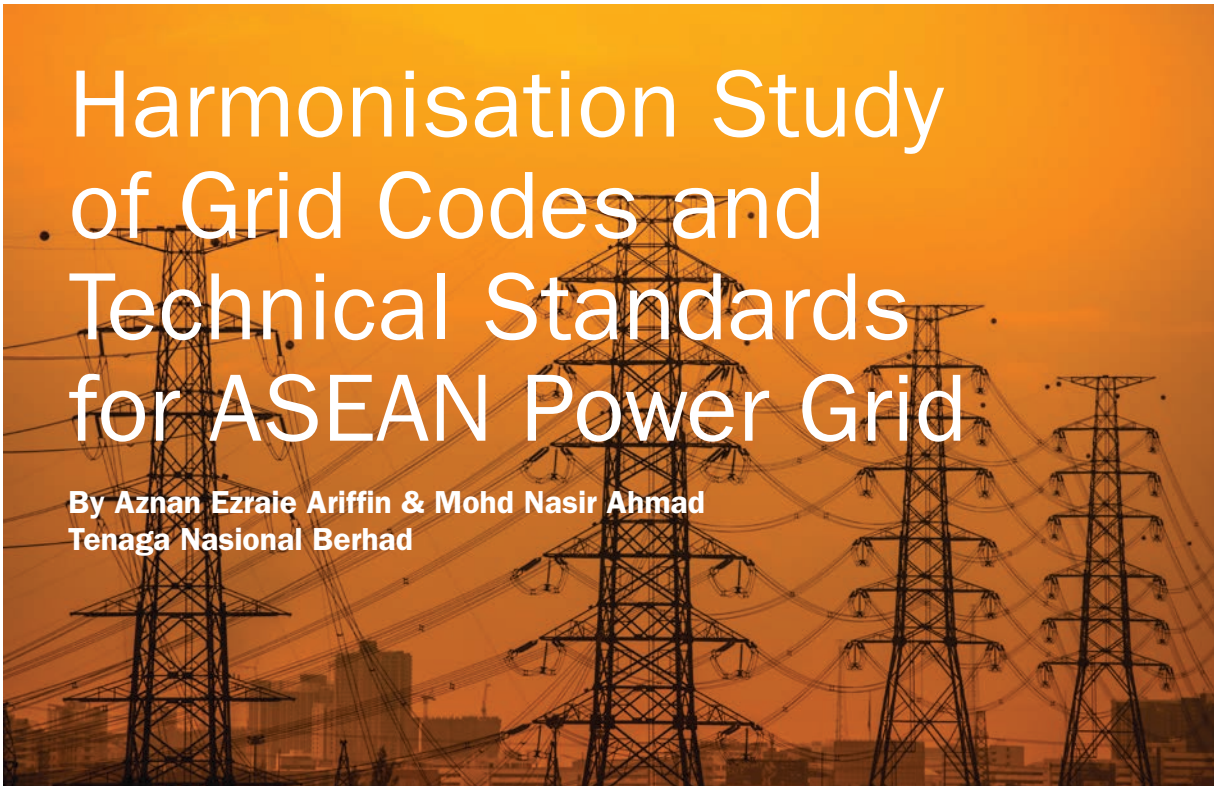
Harmonisation Study of Grid Codes and Technical Standards for ASEAN Power Grid

By Aznan Ezraie Ariffin & Mohd Nasir Ahmad
Tenaga Nasional Berhad



Various parts of the world have implemented interconnection of national grids. Such interconnections are considered feasible commercially and are successful when common practices, particularly for planning and operating codes, commercial arrangements for importing and exporting power and certain ancillary services. Success also depends on institutional arrangements, such as an arrangement by power utilities of the participating countries being established. Technical harmonisation of power grids of the ASEAN Member States (AMS) is therefore one of the pre-requisites for interconnection of AMS national power grids to achieve the vision of the ASEAN Power Grid (APG).

The Heads of ASEAN Power Utilities Association (HAPUA), with the assistance of the Asian Development Bank (ADB), have engaged consultants to undertake a harmonisation study for ASEAN power grids, including making recommendations on possible solutions for technical harmonisation and barrier alleviation. At the inception meeting held in Jakarta, Indonesia in February 2013 national experts from nine AMS and representatives from the ADB were present to review the scope of work, work schedule and the terms of reference. Valuable suggestions and comments were received from APGCC, HAPUA Working Group No. 2, ASEAN Centre of Energy (ACE) and national experts present at the inception meeting.

During the first phase of the harmonisation study, valuable data and information were collected with the help of AMS national experts. The project recommends possible solutions for technical harmonisation and barrier alleviation for whole of ASEAN power system. [1]

The ASEAN Power Grid Vision

It is well known that collectively, the ASEAN region is generously endowed with abundant and reasonably diverse energy resources ranging from oil reserves, natural gas, and coal to the large potential of hydropower, and geothermal. However these resources are unevenly distributed between the countries.

In the Greater Mekong Sub-region (GMS) which covers areas where the Mekong River flows - Lao PDR, Myanmar, Cambodia and Vietnam; there is a large potential for hydropower energy generation. It has been reported

that East Malaysia and Lao PDR, each has more than 20GW of potential for hydro power generation. Indonesia, Brunei and Malaysia have considerable amount of reserves and are among the largest exporters of natural gas in the region. There are also known coal reserves in Indonesia, Myanmar, the Philippines, Thailand and Vietnam. Among these countries, Indonesia possesses the largest share of coal reserves, where about two-thirds are located on Sumatra Island and the remaining found on the islands of Kalimantan, Java and Sulawesi. Indonesia is also known to be among the top 20 producers of oil in the world. Indonesia and the Philippines also have enormous resources of geothermal potential.

Building an AMS regional power grid through cross-border transmission links to utilise all the indigenous resource for power generation, so as to lessen the dependency on imported fuel from other regions, is indisputably a wise strategy which the AMS Heads have adopted.

No	Interconnection List	Type
1	P. Malaysia – Singapore *	HVAC
2	Thailand – P. Malaysia *	HVDC
3	Sarawak – P. Malaysia	HVDC
4	P. Malaysia - Sumatera	HVDC
5	Batam - Singapore	HVAC
6	Sarawak – West Kalimantan	HVAC
7	Philippines - Sabah	HVDC
8	Sarawak – Sabah - Brunei	HVAC
9	Thailand - Lao PDR	HVAC
10	Lao PDR - Vietnam	HVAC
11	Thailand - Myanmar	HVAC
12	Vietnam - Cambodia	HVAC
13	Lao PDR - Cambodia	HVAC
14	Thailand – Cambodia *	HVAC
15	Sabah – East Kalimantan	HVAC

*Existing inter-country connection

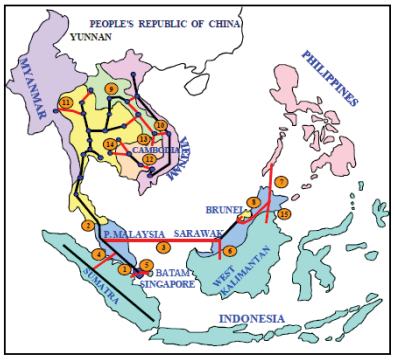


Figure 1: Potential Electricity Interconnections in ASEAN

Benefits of the Proposed ASEAN Power Grid

The APG is a flagship programme mandated by the ASEAN Governments under the ASEAN Vision 2020 towards ensuring regional energy security while promoting the efficient utilisation and sharing of resources. In the ASEAN Plan of Action for Energy Co-operation 2010 – 2015 (APAEC 2010 – 2015) published by ACE, it is stated that ASEAN recognises the critical role of an efficient, reliable and resilient electricity infrastructure for stimulating regional economic growth and development. [2]

An integrated electric power grid across a large region would make energy supplies more secure and less costly because electric power will flow either way across the borders of countries or sub-regions, in response to real-time pricing signals and supply-demand situations. Countries and sub-regions may leverage on their respective indigenous resources to construct power generation plants, that produce relatively lower cost electricity. This will help to reduce the overall cost of electricity for the whole region. The strengthening and/or restructuring of respective electricity markets in AMS are therefore oriented towards the creation of APG.

A sizeable population in ASEAN does not have access to reliable and secure power supplies from national power grids. They are often supplied from off-grid or islanded power supplies, such as stand-alone and localised power generation systems. Electricity is produced through a mix of oil, gas, coal, hydro, geothermal and other renewable energy sources. Regional electricity production grew at an average yearly rate of 6-8%. Enhancing electricity trade across borders, through integrating the AMS national power grids, is expected to provide benefits of meeting the rising electricity demand and improving access to energy services.

Although output of some renewable generation sources may be subjected to weather, environmental or other constraints, with an integrated power grid, such generation can be complemented by more secure though higher cost generation in other countries or sub-regions at times of need. Due to the different time zones of and habits of people living in different sub-regions, the electrical demands of these sub-regions may peak at different times of a day. This will allow for better use of the available generation capacity of integrated power grids.

The above factors will significantly boost the overall reliability and security of the integrated power grids compared

with the power grids operating in smaller independent units.

Approach for Technical Harmonisation

Taking into consideration the challenges described above, the approach for harmonising the technical standards of AMS power grids to prepare for full development of APG is discussed briefly in this section. Practices that are essential for harmonisation to ensure a secure and reliable APG, particularly interconnecting points between AMS power, that deliver electricity supplies of desired quality to all interconnected countries, need to be identified through an analysis of data and information submitted by nominated AMS national experts.

A set of minimum common standards, consisting mainly of common elements in AMS current grid codes that have been in force for many years and some recommended standards compiled from lessons learnt from other large integrated power grids, must then compiled for further analysis.

Potential Challenges of Technical Harmonization

The power system of one country may be very different from its neighbouring countries. Differences include total system demand, generation fuel mix, seasonal load variations, system voltages, etc. Such differences may cause some difficulties if common technical standards of a few countries are to be adopted throughout an ASEAN integrated APG.

Generation and transmission capacities of some national power grids are relatively smaller in some countries compared with their neighbours. The ability of smaller power systems to withstand disturbances and power swings is generally weaker than power systems with large capacities. This will have to be taken into consideration when developing the minimum common technical standards.

A few AMS do not have integrated national power grids – certain regions within the country may operate on "islanded" power grids not connected to power grids of other regions. Although it is desirable that these countries should integrate their regional power grids into a large national power grid before the full development of APG, this may not be economically and technically feasible. Careful planning and development of the minimum common technical standards will have to take into consideration that these countries may wish to integrate their regional power grids into the APG at some stage in the future.

There are mandatory local technical and performance standards in each country to meet the country's specific needs for electricity supply to serve the consumers and its economic activities. The minimum common technical standards to be developed will have to complement local technical and performance standards. Each country may have different priorities in its own way of controlling and operating its power grids and the operators in power system control centre/load dispatch centres are familiar with these practices. Again, the minimum common technical standards to be developed will have to complement such priorities and practices in normal power system operation.

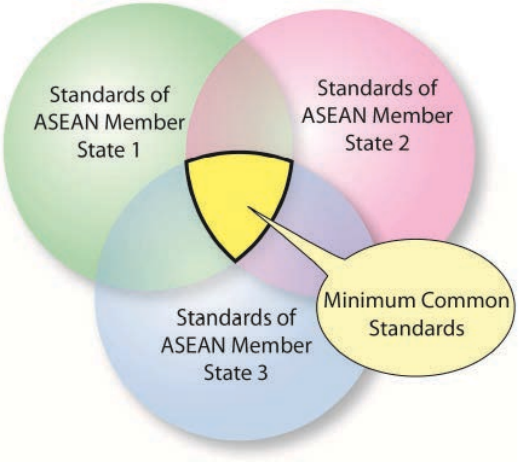


Figure 2: Harmonization of Grid Standards

Legislation and Grid Codes

Based on the information submitted and information gathered from authoritative documents, Table 1 summarises the current states of legislation of electricity sector and grid code in each of the AMS.

ASEAN Member States	Legislation	Technical Performance Standards	Regulator	Power System Operator/Power Grid Controller	Regular reviews?	Derogation and Exemption provisions
Brunei Darussallam	Electricity Act	There is no Grid Code yet.	Office of the Minister of Energy, Prime Minister's Office	The Department of Electrical Services, Prime Minister's Office, and Berakas Power Management Company [BPMC]	There is no Grid Code yet.	There is no Grid Code yet.
Cambodia	The Electricity Law of the Kingdom of Cambodia	Cambodia Grid Code & Electric Power Technical Standard of the Kingdom of Cambodia	Electricity Authority of Cambodia (EAC)	Electricite du Cambodge (EDC)	No, the reviews of technical standards and requirements are carried out on ad hoc basis whenever there is a need to do so.	Yes, there are provisions for derogation and exemption and the authority is EAC.
Indonesia	UU No. 30 /2009: Electricity Law PP No. 14/2012: Government Regulation On Electricity Supply Business Permen ESDM No. 3/2007: Grid Code of Jawa-Madura-Bali. Permen ESDM No. 37/2008: Grid Code of Sumatera	Permen ESDM No. 3/2007: Grid Code of Jawa-Madura-Bali _Ministerial Regulation. Permen ESDM No. 37/2008: Grid Code of Sumatera	Electricity General Directorate	Regional Load Dispatch Centre (LDC) e.g. Jawa-Bali LDC, Sumatera LDC, Batam LDC, East Kalimantan LDC, South Sulawesi LDC, etc.	Yes, there is a structure and process for regular reviews of technical standards and requirements. This is done on annual basis by Grid Code Committee.	No
Lao PDR	Lao Electric Power Technical Standard of Ministry of Energy and Mine	Lao Grid Code	Department of Energy Management	Ministry of Energy and Mine	Yes, there is a structure and process for regular reviews of technical standards and requirements.	No
Malaysia	1. Electricity Supply Act 1990 2. Malaysian Grid Code	Transmission System Reliability Standards (TSRS)	Energy Commission	National Load Dispatch Centre (Tenaga Nasional Berhad)	No, the reviews of technical standards and requirements are carried out on ad hoc basis whenever there is a need to do so.	Yes, there are provisions for derogation and exemption and the authority is Energy Commission.

Table 1: Comparison of Regulatory Regime

ASEAN Member States	Legislation	Technical Performance Standards	Regulator	Power System Operator/Power Grid Controller	Regular reviews?	Derogation and Exemption provisions
Myanmar	Electricity Act 1984, which will be renewed soon. New draft is ready for internal discussion before submitting to the Parliament.	The grid code is not yet enacted pending enactment of the new Electricity Act. The existing power system performance standards refer to IEC and JB related to IEC.	Ministry of Electric Power for electricity and Ministry of Energy for natural gas resources	Power System Department under the management of Myanmar Electric Power Enterprise (MEPE) authorized by the Ministry of Electric Power (MOEP)	The grid code is not enacted, and the reviews of technical standards and requirements are carried out on ad hoc basic whenever there is a need to do so.	Yes, there are provisions for derogation and exemption and the authority is Ministry of Electric Power.
Philippines	RA 91367 and its Implementing Rules and Regulations (IRR) /RA 95118 / RA 76389 and its Implementing Rules and Regulations (IRR)	Performance Standards and Connection Requirements are also included in the Philippine Grid Code and Philippine Distribution Code.	The Energy Regulatory Commission, which is an independent, quasi-judicial regulatory body	National Grid Corporation of the Philippines (NGCP), which also serves as the System Operator	Yes, this is done once every three years.	Yes, there are provisions for derogation and exemption and the authority is the Energy Regulatory Commission, Grid Owner/ Operator or as may be stated by relevant codes.
Singapore	Electricity Act	Transmission Code	Energy Market Authority (EMA)	Power System Operator	No, the reviews of technical standards and requirements are carried out on ad hoc basis whenever there is a need to do so.	Yes, there are provisions for derogation and exemption and the authority is EMA.
Thailand	Energy Industry Act B.E. 2550 (2007)	IPP Grid Code (2007)	Energy Regulatory Commission	EGAT Control Centre	No, the reviews of technical standards and requirements are carried out on ad hoc basis whenever there is a need to do so.	No
Vietnam	Electricity Law, Power Development Master Plans	Circulars 12 & 32 issued by the Ministry of Industry and Trade (Transmission and Distribution Codes)	Electricity Regulatory Authority of Vietnam and General Directorate of Energy	National Load Dispatch Centre of EVN	No, the reviews of technical standards and requirements are carried out on ad hoc basis whenever there is a need to do so.	Yes. The authority is Electricity Regulatory Authority of Vietnam.

Table 1: Comparison of Regulatory Regime (continued)

Overview of Regulatory Regime

The information gathered throws some light on the status of the development of AMS electricity sectors. All the countries have comprehensive legislation and regulatory documents that regulate the electricity industry, but not all have implemented fully functional grid codes. However, these countries have drafted or in the process of drafting the grid codes.

While two countries have fully liberalised their electricity industry, most are in the implementation phase of some form of restructuring of traditionally Government-owned monopolies. It is envisaged this trend will continue to develop further. All but one country has established a Government department or agency as the electricity industry regulator. The Energy Regulatory Commission of Philippines is operating as a quasi-judicial body or third party. Only the Energy Regulatory Commission of Thailand is an independent regulating body.

While all generation companies, transmission companies and distribution companies have to comply with the relevant legislation/ regulatory documents/grid code and the directives from the regulator, a few countries do not require consumers, and one country does not require power system operator to comply with such regulatory requirements. Another country only requires generation companies, including IPPs to comply. Only a few of countries indicated that they have clear definitions of terms used in interconnections and in the planning, design, operation, especially under emergency and system disturbance situations, etc. There will need to be consensus when developing appropriate definitions of terms that will be required for the interconnection between the AMS national power grids as well as in the planning, design and operation of APG as a whole.

Only three countries have structures and processes for regular review of the relevant legislation/regulatory documents/ grid code. The remainder only review these documents on an ad hoc basis or whenever there is a need to do so.

Proposed Principles for Technical Harmonization

Learning from operations of and outages suffered by large integrated power grids in other parts of the world, major principles that are required to be adopted for operating in an integrated large transmission grid system include the following:

- Maintain supply and unrestricted flow of electricity at all times;
- Balance of supply and demand over each control area;
- Ensure transmission of power, including maintaining adequate reactive power levels and providing adequate reactive power when needed;
- Respond to system faults in a co-ordinated manner; and
- Provide communication to ensure power system operators in each control area know what is happening.

Due to the close inter-relationship between a number of issues related to grid connection and power system operation, the following criteria have to be applied in deciding whether a specific issue is dealt within a minimum common standard/grid code:

- Issues involving the active participation by grid users are addressed in the minimum common standard/grid code.
- Issues affecting only power system operators, with no role for Grid Users, are addressed in the interconnection agreements.
- Issues which are relevant to both grid connections and system operation, are as a minimum, mentioned in both the minimum common standard/grid code and, where necessary, also specified in more detail in interconnection agreements.

Some redundancies might emerge from this approach, but priority has been given to avoid the omission of important aspects.

Most, if not all AMS have embarked on or are in the process of liberalising their electricity sector; i.e. unbundling their power grid services to facilitate market operation and transforming the power system infrastructure towards a platform for user-oriented services with ever-changing new concepts that interact with different market participants and a variety of independent grid users. In view of this potential development, it is foreseeable

that the role of the power system control centres/national load dispatch centres will be transformed into the role of a Transmission System Operator (TSO). TSOs also include all grid owners/operators regardless of unbundling status.

Since nine out of ten AMS operate on a nominal system frequency of 50Hz, it is envisaged that interconnections between the AMS national power grids within the APG will mostly be AC interconnections, except asynchronous interconnection with the national power grid of the Philippines, which operate on 60Hz DC asynchronous interconnection will not have the type of operational issues associated with synchronous AC interconnections, potential solutions recommended for operational issues in this document will focus on solutions for synchronous interconnections.

Potential solutions proposed take these developments into consideration and use the term TSO instead of power system operator or load dispatcher in the deliberation.

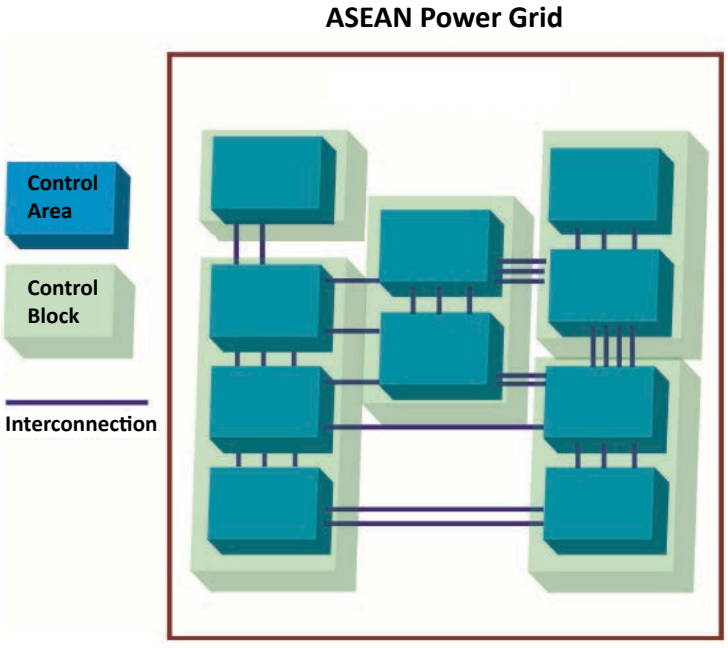


Figure 3: Relations between Control Blocks, Control Areas and APG

Way Forward

Most of the potential solutions recommended are deemed essential to be implemented before the APG is in full operation. These recommended requirements or provisions will require more in-depth examination taking into consideration specific situations in existing grid codes and power grids of all AMS. Such examination and development of specific requirements may have to be undertaken in consultation with respective national regulatory bodies and other stakeholders.

There are examples of minimum common standards of other large regional power grids that have been in operation for quite some years. HAPUA may wish to explore the adoption of some of the major elements, e.g. frequency and voltage control standards, warning and alert systems, etc. as the bases for minimum common standards for APG.

One very vital provision is to develop real-time monitoring capability of all TSOs and to establish an efficient and reliable communication network for information sharing among all TSOs. This would minimise the risks of miscommunication among TSOs and expedite necessary remedial action within the shortest possible time. However, due to the infrastructure and costs involved, an implementation plan would have to be drawn out jointly by all countries in order to achieve the stated objectives.

Comprehensive system defence plan and System Restoration plan for the APG is another important set of processes and procedures that need to be developed in consultation with all stakeholders.

Other Important Factors

ASEAN members are at different phases of economic development as well as at different phases of restructuring their electricity sectors. It is important to ensure that the minimum common standards which are to be adopted would not hinder economic development or restructuring electricity sector. Similarly, AMS Government agencies

> *ASEAN is also developing mechanism for cross-border electricity trade, transit and harmonisation.*

responsible for economic development and electricity sector restructuring will have to be made aware of the implications of the minimum common standards that would have to be applied in the APG. Necessary amendments and enhancements to these minimum common standards could then be carried out if necessary to serve the needs of the desired economic development and electricity sector restructuring.

Every AMS has its own energy and environmental policies that may decide the generation mix of the country. Certain generation technologies, such as wind power and solar power, may need particular operational support and possess specific operational characteristics. These technologies may have an impact on the secure and reliable operation of the APG if their aggregate generation capacity is a substantial percentage of the total capacity of a Control Area or the whole of APG. There will be a need to include in the minimum common standards more stringent requirements on new Generation Facilities with such generation technologies before they are allowed to be commissioned and connected to the APG.

Most AMS have unbundled or have the intention to unbundle or are in the process of unbundling their traditionally state-owned vertically integrated electricity utilities. Some countries have also established or in the process of establishing wholesale electricity markets. ASEAN is also developing mechanism for cross-border electricity trade, transit and harmonisation. All these will invariably require more real-time metering and monitoring of power flows within national power grids and across borders. Power will flow in every possible network topology and changing direction from time to time, to take advantage of price signals of the electricity market. There may be a need in future to carry out more frequent system-wide security assessment studies than the initial minimum common standards envisage.

Summary

Integration of national power grids of all AMS into the APG is an evolving process. Similarly, harmonisation of technical standards for APG will also be an evolving process. However, a set of minimum common standards and a mechanism for the periodic review and enhancement of these minimum common standards will need to be established as soon as possible to facilitate the smooth integration and the secure and reliable operation of APG that provides smooth exchange of power and Ancillary Services with quality electricity supply.

It is vital that operation of the APG will have to ensure that disturbances or serious faults in one Control Area will be contained within the Control Area and not spread to other Control Areas. On the other hand, other Control Blocks or Control Areas should help the Control Area that has suffered disturbances or serious faults restore its power grid to a steady operating state as soon as possible. Co-ordination and information sharing among the Control Blocks and Control Areas will be crucial to the secure and reliable of the operation of APG.

Solutions proposed in this project are based on the assumption that the operation of the APG will be a synchronous operation that facilitates controlled power exchange between most AMS national power grids and the interconnections of other Control Areas with power grids in the Philippines will be asynchronous interconnections. ■

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Reducing Costs of Poor Quality & Building Quality Products

By Ir. Dr Oh Seong Por, Director of Manufacturing, Samsung SDIEM

Costs of Poor Quality or COPD refers to Quality cost and Hidden Cost. Deficiencies in product quality such as defects, rework, scrap, customer returns or other not fit for use losses fall under Quality Cost. Non visible losses such as opportunity losses because of poor sales, longer lead times, complaint handling costs, holding and delay costs are hidden costs. The author looks at many approaches and tools to reduce these two costs so that companies can create quality products.

The basic purpose of a business organisation is to create wealth through profit generated by selling product to customer. This was cited by Eli Goldright, a computer scientist who developed the algorithm of Optimized Production Technology, a scheduling system developed around bottlenecks of a production system. Without profit, an organisation regardless of size or business nature will undeniably perish. To ensure profit, the selling price must always be greater than the cost involved as shown by the following simple equation, Profit = Selling Price – Cost. In the highly competitive and borderless market, the selling price tends to depreciate over time once the product becomes commoditised. Therefore, to sustain an acceptable profit margin, the cost reduction initiative should become a key focus of the organisation. Getting the right and effective cost reduction measures requires clear understanding and analysis of the cost components.

COST COMPONENTS

Product cost generally consists of two major components. They are :

1.Required cost or target cost (TC)

This is ideal cost without any losses or wastage that must be invested to make the product. In lean thinking (Womack & Jones, 1996), target cost is the sum of value added costs of material, parts, equipment, labour and any other resources which are needed to develop the product that a customer is willing to pay for.

2.Cost of poor quality (COPQ)

Costs are incurred because of deficiencies in product quality, such as defects, rework, scrap, customer returns or other not fit for use losses. These are normally visible quality related losses, which are also known as quality cost or Q-cost. There are also non visible losses involved, such as opportunity losses because of poor sales, longer lead times, complaint handling costs, holding and delay costs etc. These losses are called hidden costs or H-costs (Goetsch & Davis, 2000). The sum of Q-costs and H-costs is the COPQ as represented by the simple equation;

COPQ = Q-cost + H-cost

Therefore,

Total cost = TC + Q-cost + H-cost

Then,

Profit = Selling Price – (TC + Q-cost + H-cost)

The equation illustrates clearly the relationship between profit and quality. Reduction in COPQ will bring about better profit. Making quality products not only eliminates losses, generates profit but more importantly, guarantees the continual acceptance of the product by customers. These reasons emphasise management's responsibility to engage in quality improvement initiatives.

FRAMEWORK FOR QUALITY IMPROVEMENT

Product managers or plant managers, must have a clear understanding of the product life cycle since this is where quality improvement initiatives can be identified to build quality into the product, thus reducing the overall cost. Typically, the product life cycle starts with product planning and continues through such phases, such as:

i. Product design
ii. Product process design
iii. Production
iv. Maintenance and product service.

The concept of building quality into a product requires decisions about quality at the design stage so that the cost of quality control at the production stage can be significantly reduced. This is clearly demonstrated by Harry and Schroedar (2000) who pioneered the Six Sigma breakthrough improvement methodology Their research concluded that – although design typically represents the smallest actual cost element in products, it leverages the largest cost influence. Any incremental improvement in the design has large direct impact on cost. For example, a 30% saving in design simplification would translate into over 21% cost saving overall, while the same 30% applied to labour or overhead would result in just 1.5% saving overall. This explanation is best described in Figure 1.

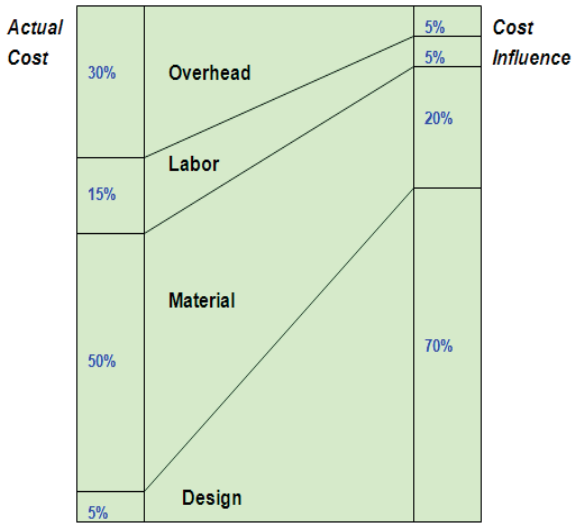

Figure 1 : Design Improvement vs. Cost Reduction

Therefore, the preferable approach to improving product quality is to build quality into the product at the design stage, followed by improvements at the process design stage and then at the production engineering, maintenance and product service stage. Management must plan the correct quality improvement initiatives for reducing each cost category including TC, Q-cost and H-cost in order to obtain the best result for profit maximisation.

TARGET COST – QUALITY IMPROVEMENT

Off line quality control activities conducted at the product and process design stages in the product development cycle include getting the right information on customer or market needs and translating it into the product design and determining and creating a series of robust process designs which can be efficiently incorporated in the manufacturing process to create added value.

Various design approaches and innovative tools have been developed which are helpful in meeting quality improvement objectives of TC. These include:

i. Quality Function Deployment or QFD (Mitsubishi Kobe Shipyard, 1972) – also known as house of quality. It relates customer or market needs to high level internal technical design requirements using a planning matrix as shown in Figure 2.

The purpose of matrix is to show clearly and concisely the data needed to make decisions regarding product definition (customer needs), design attributes, relevant manufacturing processes and delivery. This is illustrated in Figure 2;

Matrix 1 – House of quality. – Translating customer requirements into technical attributes.

Matrix 2 – Converting technical attributes into characteristics or functions of major parts of the product.

Matrix 3 – Converting characteristics of major parts into the process to produce these parts.

Matrix 4 – Integrating characteristics of the production process into detailed manufacturing procedures and control methods.

ii. Value engineering or VE (Miles, 1961) – analysing product value and creating the right product function(s) that can excite the customer.

iii. Lean Product Design or LPD (Oh, 2011) which consists of seven design steps to seek out and eliminate wasted or excessive design features, hence increasing product value, reducing cost and speeding up product design. Figure 3 shows the roadmap for Lean Product Design.

It was reported that one of the major electronic companies in the country has enjoyed 23% reduction in target cost by consistently implementing the lean product design approach.

iv. Design for Manufacture or DFM and Design for Assembly or DFA (Boothroyd & Dewhurst, 1987) - design concepts to achieve the manufacturability and ease of assembly of

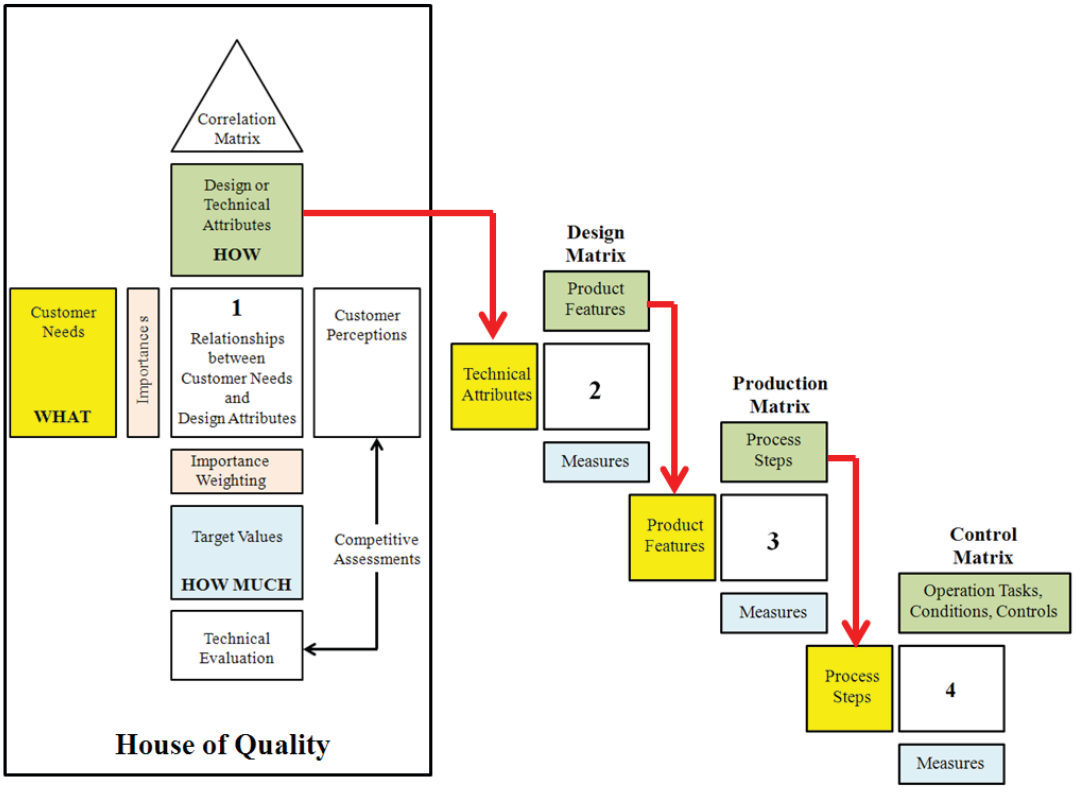

Figure 2: QFD (House of Quality) and information flow

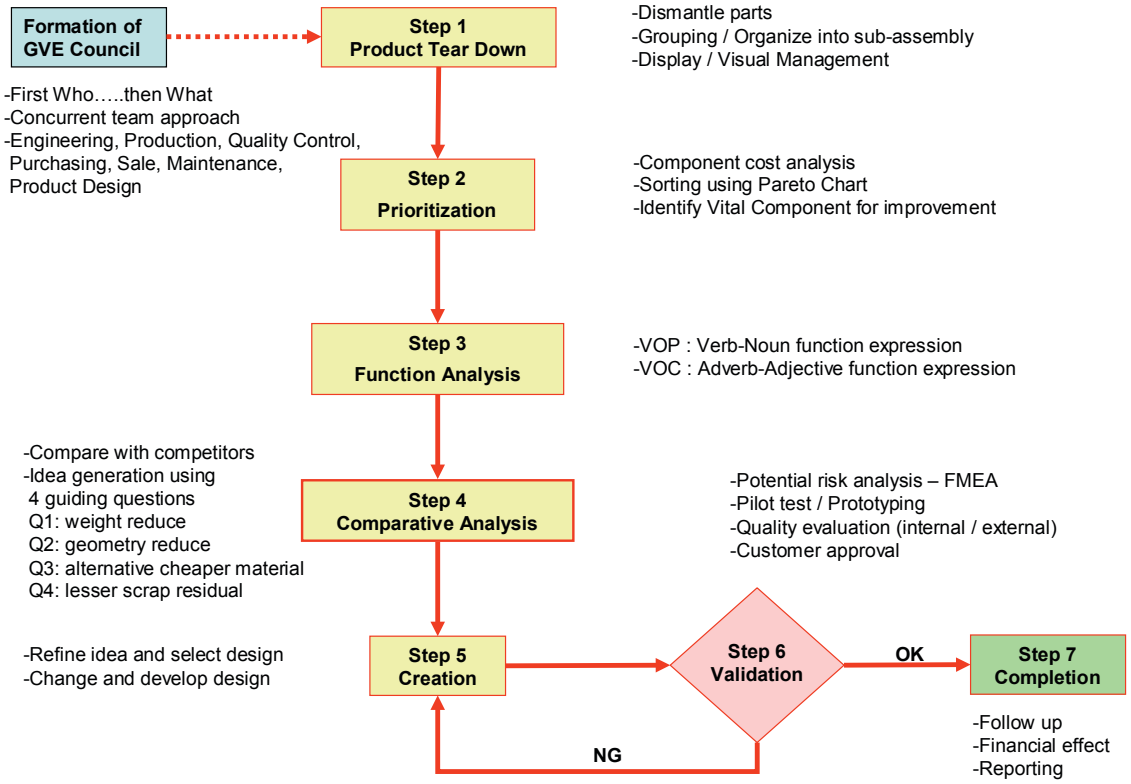

Figure 3: Lean Product Design Roadmap developed by Oh (2011).

parts. These will drive down labour, overhead and material cost components of TC.

QUALITY COST – QUALITY IMPROVEMENT

Q-Costs are on line quality control activities conducted at the production stage where raw materials or parts are being transformed mechanically or chemically by series of processes to become final product. These activities include reduction of process variations that become the origin of product deficiencies, inspecting materials or products to detect deficiencies and correcting rework parts or products. These activities can be generally classified as follows:

Internal Failure cost (IF-cost)

Costs incurred due to deficiencies which occur in the internal process and are detected before delivery to the customer. The main deficiencies are scrap and rework. In the case of scrap, the IF-costs are incurred through losses in material, labour and overhead costs. Rework losses arise from labour and overhead costs and are a major of IF-cost. In the manufacturing process, value added costs to a product increases as it progresses to a more advanced stage of the process. Therefore, IF-costs increase if a deficiency is found at the more advanced phase of the manufacturing process. Therefore, preventing slip of defects from one step to the next step in the manufacturing process is necessary for minimising IF-costs. IF-costs diminish when internal process quality improves. By analysing the IF-cost of each process, it is possible to identify the highest cost and action can be taken to resolve the quality problem. The common IF-cost improvement activities are:

i. Statistical process control using control charts (Shewhart, 1924) to monitor the trend and performance of production process and parts. The chart interprets the stability of the process by graphically illustrating whether the process is controlled or heading towards abnormality.

In this way, action can be taken before a deficiency occurs. Figure 4 shows a typical control chart.

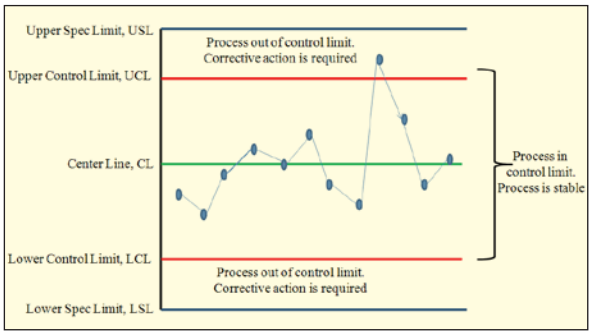

Figure 4: Control Chart

ii. Quality circle group or formation of small group of shop floor employees. This initiative was championed by Toyota who believes employees working at production lines know the work and process best. Therefore, they should be empowered and encouraged to recommend quality improvement as part of their work assignments. Employees are not considered as just workers but as members of an improvement team. They are encouraged to contribute ideas and recommend actions to reduce defects as well as to improve productivity.

External Failure cost (EF-cost)

EF-costs are those costs incurred when deficiency is found after delivered to customer. It includes warranty costs, compensation costs, after service costs and business trip expenses to send staffs or engineers to support customers on quality issues. At times when deficiency is too serious, the entire product batch is returned and the cost involved is also considered in the EF-cost calculation. The main factors that contribute to EF-costs are human or equipment errors that lead to defects slipping through to the customer. Therefore, the following quality improvement initiatives should be implemented:

i. Institute regular training programmes to upgrade operator skills and knowledge, followed up by practical tests to ascertain their competency level. Only operators who pass the test and are certified should be allowed to work on the production line. In this way, defect creation and slippage to downstream processes or the customer can be controlled.

ii. Wherever possible, manual work should be automated to help establish quality consistency and avert human error. This initiative may incur additional expenditure but will result in long term quality improvements which may more than cover the initial investment cost.

iii. Periodically flow dummy defective test parts through defect filtering process or machine in order to instil quality awareness among operators and evaluate the reliability of machine performance. The ultimate objective is to stop defective parts at the processing station and avoid slippage through to the customer.

Appraisal cost (A-cost)

Appraisal costs include all those costs involved in measuring, evaluating or auditing product components and purchased materials to ensure they conform with the standards and specifications. These appraisal activities generally require human effort. As such, the cost of quality inspectors or personnel who are assigned to perform the following activities:

i. Incoming quality inspection of raw materials and/or parts,
ii. Outgoing quality inspection on finished goods before shipment, and
iii. Quality inspection gates inside the process or production lines

These constitute a large portion of A-cost. Other components of A-cost are fees paid to the quality standard or product safety regulatory bodies (ISO, BSI, CCE etc) that audit and issue certificates of compliance to the company. Quality improvement initiatives for A-cost are mainly to cut down inspection tasks and reduce the number of inspector positions. These may include:

i. Engaging and supporting material suppliers in improving their quality systems which will result in then delivering quality materials, thus eliminating or minimising incoming quality inspection tasks.

ii. Streamlining all inspection tasks and eliminating any redundant ones. Value stream mapping technique (Rother & Shook, 2003)

may be applied to assess the work flow and eliminate the non value-added tasks and free the human effort from redundant inspections.

iii. Improving inspector skills and introducing multi-tasking where inspectors become competent to perform variety of evaluating jobs. This will help rationalise the number of inspectors without sacrificing any required inspection work.

Preventive cost (P-cost)

There is an old adage that an ounce of prevention is worth a pound of cure. The prevention philosophy is essentially concerned with making the product right so that it performs well during its intended period of use. Accordingly prevention costs include all the efforts to avoid or minimise internal failures, external failures and appraisal losses. Labour costs and overhead costs spent in improving processes, quality and preventing deficiencies are the major contributors of P-cost. The main labour cost comes from engineers or technicians who are assigned to optimise processes for improved quality outcomes and service equipments for stable operation. The cost of quality training for operators is also included as P-cost. Overhead costs may consist of expenses incurred in upgrading machine performance or sustaining the smooth running of production lines and purchase of new machines or parts that can enhance product quality.

The major quality improvement initiatives for P-cost are:

i. Fully engage engineers or technicians in optimising processes to prevent deficiencies. A systematic approach, such as the Six Sigma improvement roadmap (DMAIC - Define, Measure, Analyze, Improve, Control) that uses reliable statistical tools may be applied by learned engineers or technicians to enhance process settings for building quality products. The 'Define' phase helps to define the problem correctly while the 'Measure' phase deals with data mining to verify the problem and identify all potential causes. In the 'Analyze' phase, the vital few causes are selected for improvement. Design of Experiment or DOE (Taguchi, 1970s) and optimisation techniques may be used to improve the problem in the 'Improve' phase. Finally in the 'Control' phase, sustainable actions are recommended to ensure that all implemented improvements are maintained, thus prevent IF, EF and A failure.

ii. Implementing Total Preventive Maintenance or TPM throughout the production line. TPM helps to develop operators to be self sufficient in managing machine and improve machine overall equipment efficiency or OEE. It helps to prevent machine breakdown which is one of the main contributors of P-cost.

HIDDEN COST – QUALITY IMPROVEMENT

H-costs are basically non visible losses incurred by delays in production, delivery or supply of materials, holding parts or products, idling available resources such as human effort, equipment or space and incorrect planning or scheduling. The improvement initiative is to make the losses visible so that remedies can be applied. Two improvement actions may be useful.

i. 5S activities comprising of 5 stages - Sort, Set, Shine, Standard, Sustain.

Stage 1 – Sort. Check through all things (materials, parts, tools, machines, etc) at the work area and determine the usage frequency of each. Frequently used things are allowed to remain at the work area while unused or seldom used things are removed. The objective is to eliminate unused or hidden resources at work area.

Stage 2 – Set. Designate locations to place the required parts or materials so that they are easily retrieved for use. Visible setting approach may be applied such as labelling or marking to specifically identify the locations of materials or parts. This is to prevent loss time of searching for them which is an important hidden loss caused by delay.

Stage 3 – Shine. It means to clean up things. Impurity or contamination is one of the major hidden causes of product deficiency and equipment breakdown. While cleaning, operators can indirectly inspect machines and may able to detect abnormality before serious damage occurs.

Stage 4 – Standard. This involves drafting procedures to manage the activities of sort,

"By producing quality products and relentlessly carrying out the right improvements to eradicate the cost of poor quality, a company creates opportunities to improve profitability.

set and shine to create common understanding among all operators and ensure that the intended activities are correctly performed.
Stage 5 – Sustain. This deals with developing operators to habitually perform 5S activities. In this aspect, regular training, motivation and audit by 5S steering committee members in the presence of management staff may be introduced.

Continuous and effective execution of 5S can open up hidden issues, establish organised working area and create quality environment for producing quality product.

ii. Just-In Time or JIT production system. JIT basically means to produce according to order and eliminate holding stock (work in progress parts or over produced finished goods). It also includes purchasing the right amount of materials or parts which are sufficient to make the required production quantity. In JIT, keeping stock is considered as bad practice, because stock hides problem such as defects or scrap, unnecessarily consumes resources, and takes up valuable space which can all lead to hidden losses and H-cost. ■

CONCLUSION

By producing quality products and relentlessly carrying out the right improvements to eradicate the cost of poor quality, a company creates opportunities to improve profitability. It enforces the truth of an old notion; building quality in a product to create wealth is more relevant than ever in this highly competitive business environment. Therefore it becomes the responsibility of the decision makers in a company to proactively engage in quality management and encourage the total involvement of every employee in building quality product.

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Intelligent Items Traceability System – RFID vs QR

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Nowadays traceability systems are an inseparable part of international business and are essential in manufacturing and supply chain management systems. The advantages of the traceability system are more obvious for products that are exported and those imported from overseas. Traceability is highly important in food management and for products with short expiry. In recent years there have been several investigations and publications on traceability systems criteria especially in the food industry in the US, Europe and Southeast Asia. Figure 1 illustrates the general idea of a tracking system.

Based on the International Standard Organisation (ISO), traceability is defined as the "ability to trace the history, application, or location of that which is under consideration". In more detail, traceability is the capability to authenticate the production history, pricing structure, positioning and location, application and all the other information of an object, by means of documented data. In the other words, traceability refers to the ability to track the object through the supply chain management from raw materials supplier to the end user, and also tracking the product after it has been used through the recycling process.

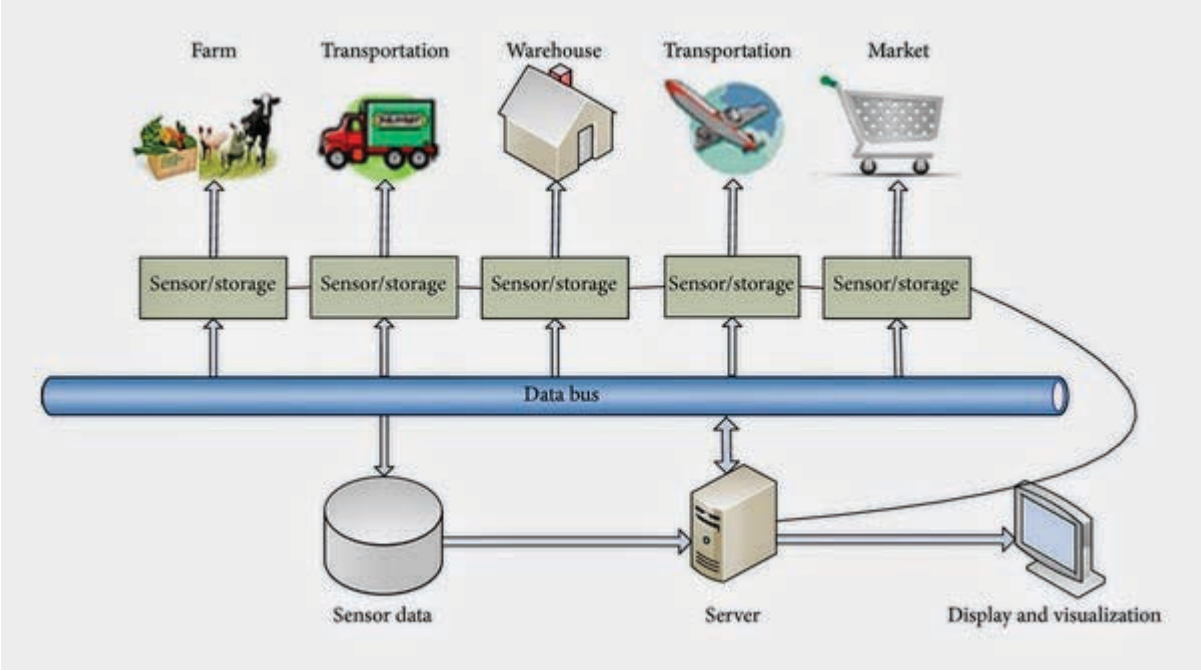


Figure1. General Idea of Tracking System (Source: ISO 22000 Resource Center)

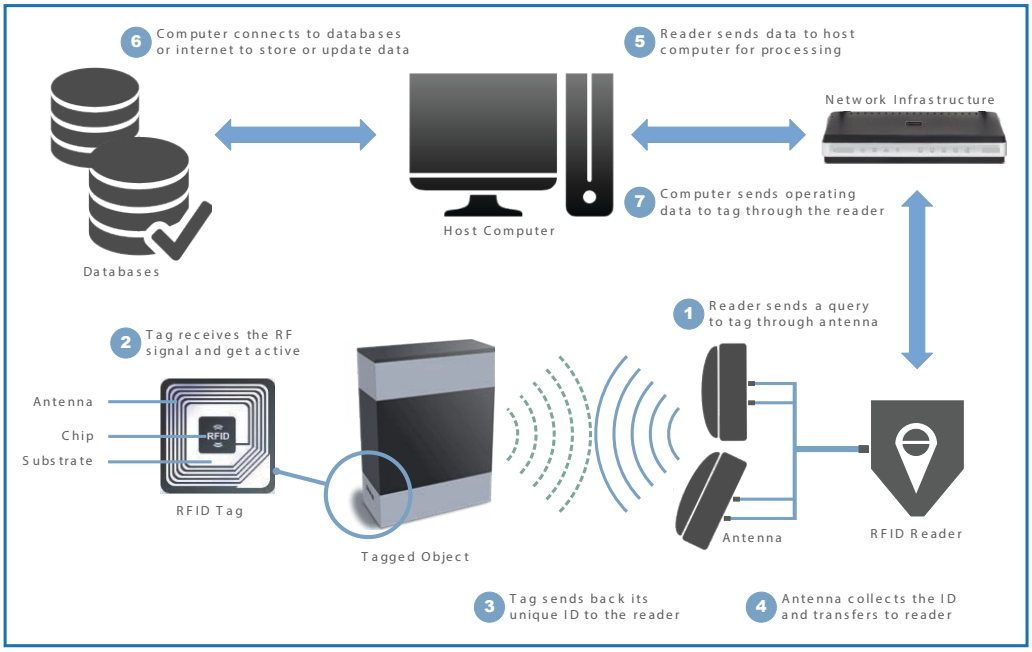


Figure 2: RFID Operation System

To achieve the objectives of the traceability system, we need to provide the product with a unique identification number and some required information. We need also a system to capture the information from the object, identify the object uniquely and manage the whole system. In this article, we investigate the two most popular technologies in traceability systems. Radio Frequency Identification (RFID) and Quick Response (QR) code are separately investigated as identification technologies. Their advantages in the traceability system and a comprehensive comparison between the RFID and QR are provided.

OVERVIEW OF RFID TECHNOLOGY

RFID provides a unique identification for tagged objects by transmitting radio signals. Tags, reader, antenna and the host computer are the four essential components of an RFID system. RFID technology provides a fast, reliable and flexible identification process for all tagged objects. Objects emit their unique ID trough the radio signals by utilizing the tag antenna. Transmitted signals are collecte, interpreted by the reader and transferred to the computer application, where the database or any specific applications that manage all the identification process. RFID technology is widely utilized in different scientific and industrial projects such as: tracking systems, supply chain management, warehouse and inventory management, manufacturing, construction, transportation, toll collections and so on.

How Does an RFID System Work?

In RFID systems the reader initiates the identification process. First the reader broadcasts the query to the tags through the antennas. The tags receive the RF signals; where, the RF signals induct the electric current through the coil antenna inside the tags. Next, a RFID chip utilizes the induced current to send back its unique ID to the reader through the antennas. Reader antenna collects the emitted data and transfer to the reader. The Reader sends all the data to the host computer for processing. Then the host computer connects to several databases or Internet at the same time, and sends the event based data to be stored on the tag. Figure 2 demonstrates the whole operation process of RFID systems.

OVERVIEW OF QR TECHNOLOGY

QR code is also known as a two dimensional barcode. It was developed in 1994 by DENSO Corporation of Japan to provide fast identification and track objects by scanning a tag optically. The general idea of the QR and barcode are the same.

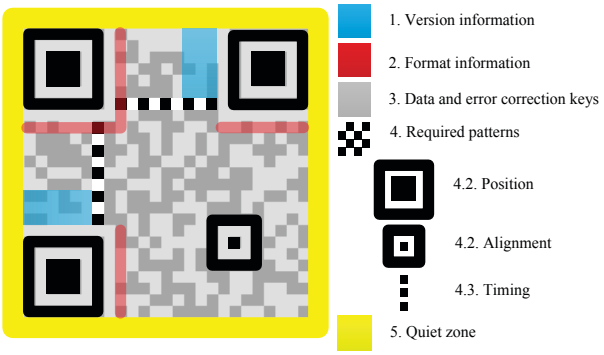


Figure 3: QR System Structure

However, QR enjoys several advantages over the barcode such as: more information storage capacity, information in a smaller space, more flexible design, more security and stronger data checking system.

How Does a QR System Work?

As we can see in Figure 3, a QR code is made up of several squares in black and white. Each square is known as a module. In each QR code, some modules are critical and cannot be covered or changed, otherwise the identification would fail. The critical modules of QR are:-

The modules in **blue** are representing the QR version information. Since there are several different versions of QR structures, this presents the version of the QR.

The **red** sections present the format information. The scanner based on this section will know the QR refers to the text, numbers, website, Chinese symbols or any mixed models.

The all **gray** part involves the whole data and error correction keys, which provide the identification process and specific structure to avoid potential errors.

The **black** and white squares are the required patterns. Where the three big squares in the three corners represent the position of the code and shows where the edges of the code are. The smaller square is alignment marker. Acts as a reference point and guarantee the position of the code for the reader to make sure all the vertical and horizontal lines are in the correct position.

The **yellow** line is the boundary of the code and is the quiet zone.

RFID vs QR

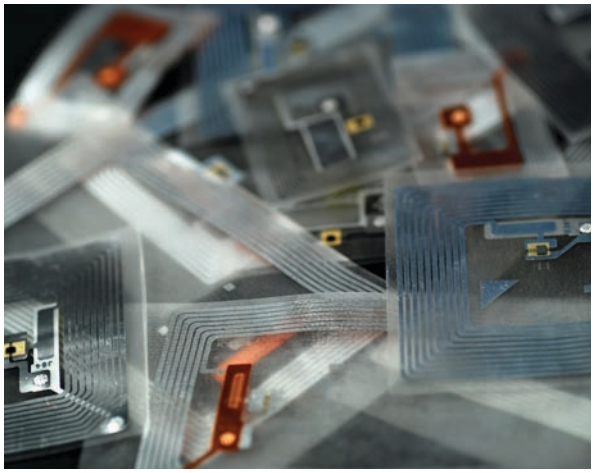
The RFID technology and QR code are compared through their functionality and capabilities. Table 1 presents a comparison of the two technologies.

Attribute	RFID	QR Code
Line of Sight	Not required	Required
Read Range	Passive tags up to 30 feet Active tags up to 100s feet	Several inches up to a foot
Read Rate	1000s tags simultaneously	Only one at a time
Read Speed	Microsecond	Second
Identification	Uniquely identify each item	Limited up to certain value
Read/write	Read and write capability	Read only
Operating Technology	Radio frequency	Optical
Effect of Degradation/ Wear	No effect	Susceptible
Dirt Influence	No effect	Susceptible
Metal Vicinity	Susceptible	No effect
Automation	No human operation (fixed reader)	Need human operation
Updating	Tag information can be updated	Cannot be updated
Tracking	No need for tracking	Manual tracking
Information Capacity	More than QR	Less
Ruggedness	Yes	No
Reliability	Nearly flawless read rate	Wrinkled tags may work 30% data recoverable
Unauthorized Copy	Ciphering	Susceptible
Memory Capacity	Active tags: 16 Bytes – 128 KB Passive tags: few Bytes – 2 KB	Up to 7089 characters
Orientation Dependent	No	No
Marginal Cost	0.05 US$	0.05-1 US$

Table 1. Comprehensive Comparison between RFID and QR (Adapted from Lotlikar et al. 2013)

RECOMMENDATION

Based on the comprehensive comparison between the RFID and QR technologies, and their features and capabilities, we need to consider several issues before implementation in industrial projects. Both technologies have their own advantages and disadvantages. For example, QR codes are easier and cheaper to use, and also do not need specific requirements and installations. Therefore, QR codes are preferable in small businesses; and in the industries with lower priced products or products with short expiry such as food. On the other hand, RFID technology is more flexible, has more memory capacity and fully automatic. But being more costly, it is preferable in industries with long production line and/or distribution chain; or in the industries with valuable products. ■



RFID technology is more flexible, has more memory capacity and fully automatic.

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ANCIENT TOWN OF BANDIPUR, NEPAL

Bandipur is an ancient town, along the old trade route between Nepal and Tiber. Those interested in the old methods of construction and the durability of timber structure will find the town an ideal place to explore and admire the engineering nostalgia of a once thriving trade route town.

By Chin Siew Yin

1

2

3

4

5

1. *Old religious building at the centre of town square*
2. *The old town library building that was granted heritage status as mentioned in the plague in front of the building.*
3. *A 100 years old building of Newari architecture resting firmly on hill slope*
4. *Guide map at the entrance to the town square*
5. *Contrast of old building with the adjoining extension wing , notice the slate paved street is still being preserved as the whole town is not accessible to vehicles.*

On my recent trip to Nepal, my team was introduced to a home stay with a good view of the Himalayas as well as to experience life in a forgotten, once thriving trade route ancient town. To my surprise, this ancient town called Bandipur which is 143 km west of Kathmandu is a living museum with well preserved ancient buildings, town square, ancient shop houses , library, hill side cooling fountain, rest areas and old lodging houses for traders and travellers who once popularized this township.

Bandipur is an ancient town built around 1800s that enjoyed its heyday between 1846 to 1950 as a transit point for trading activities between Nepal, India, Tibet and beyond. The town at 1,030 meter above sea level is close to the Himalaya range with clear view of some of the highest peaks of the Himalaya. The trade route passing Bandipur then was also called the salt trading route as salt was transported from Tibet through the Himalaya range to Nepal and moved on as far as the northern part of India. Spices and grains were in turn transported from Nepal to Tibet as barter trade.

In the 1800s, the Gurkhas kingdom from Kathmandu sent the Newar tribe who were skilled traders to develop Bandipur as a thriving trading centre. They built houses of brick and timber of Newari architecture. Roads were paved with cobbles and slates. Agricultural activities in the surrounding areas thrived with the cultivation of main crops such as rice, millets, corns, fruits etc.

The building construction resembles that of Newari architecture with cantilevered balconies, double columns and beams at the front wall, neoclassical facades and shuttered windows. Roof tiles were made of slates that were available abundantly in this hilly area. Main roads in the township were paved with slates in neatly cut rectangle or square shapes.

A cooling fountain with horizontal water jets from a hill slope was built together with a resting hut for travellers as well as for villagers during the drought period.

During the thriving period around the late 1800s, a central library was built. However, the town soon lost its prominence when the Pokhara –Kathmandu Highway was built in 1970 and trade declined sharply. With the more direct route linkage and better road condition and facilities along the new highway, transportation of goods and movement of people between Tibet (gateway of goods from China) and Nepal no longer choose to go through Bandipur. It soon became deserted with only the agricultural sector remaining the mainstay of the economy.

Today, it has been gradually redeveloped into a tourist destination taking advantage of the high point view of the Himalayas, the well preserved remains of rich heritage buildings, old town square, cool environment and car-free environment as vehicles cannot access into the town proper. Visitors' luggage will have to be manually transported by local porters as there are only stone steps and no ramps from place to place. Apart from small hotels and lodging houses, there are numerous home stays for those who want to experience the Nepalese houses formerly used by traders or farmers of Bandipur.

For the heritage interest group including the engineering fraternity interested in the old methods of construction and the durability of timber structure, this is an ideal place to explore and admire the engineering nostalgia of a once thriving trade route town.

9. *The intricate wood carving of wall cantilever reflects the skill craftsmanship of the old work force of that era .*
10. *Clear view of new construction using bricks over old structure built with old stones neatly constructed.*
11. *Unique way of house's foundation construction using flat stone on hilly slope*
12. *Double columns and beams construction of shop house buildings' front; a common feature of wooden buildings*
13. *Main street with shops, hotels against the backdrop of a hollow and half deserted townscape*
14. *Typical basket used by local to carry goods such as agriculture produce , construction materials or provisions. These are commonly used by local porters as vehicle cannot have access into the town proper due to presence of steps on the undulating landscape.*
15. *Old weighing balance using weights are still being used in shops selling vegetables*

THE INGENIEUR

Construction of Jalan Kuching Dual Carriageway in 1967

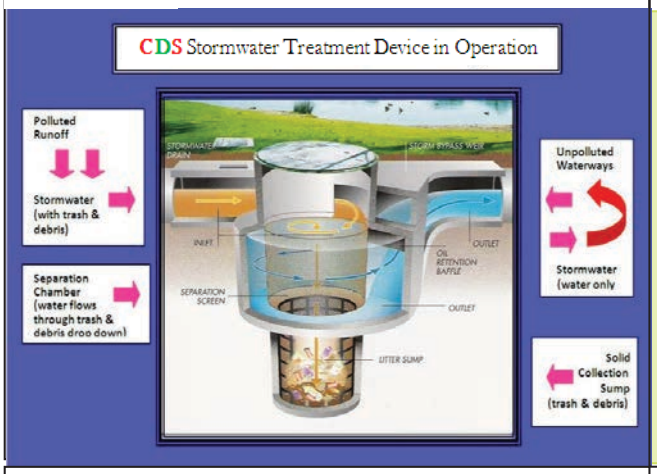
Submitted by Cheo Hong Keyong

May 2, 1967. The then Minister of Transport, Tan Sri Sardon bin Hj Jubir, who was also Acting Ministry of Works, Post and Telecommunication, inspecting the new dual carriageway carrying four-lane traffic from the Club Road Roundabout to Jalan Duta Roundabout (Segambut).

Source : Jabatan Penerangan

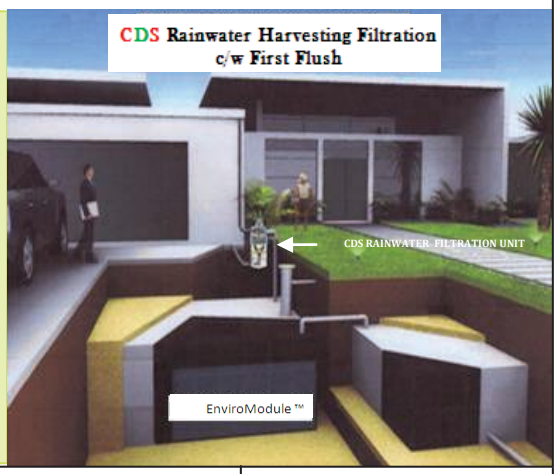
Recent photographs of same section of the road 46 years after completion showing the big contrast in the surrounding commercial development.

EcoClean Technology Sdn Bhd



EcoClean Ausdrain EnviroModule™

EcoClean Ausdrain EnviroModule™



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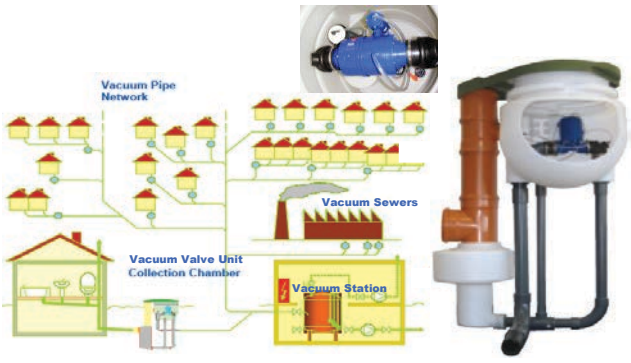

EcoClean Ausdrain Drainage Cell

List of Products / Systems

EcoClean CDS Stormwater Treatment Device (STD / GPT)
EcoClean CDS Combined Sewer Overflow Device (CSO)
EcoClean CDS Filternator
EcoClean CDS Fluid Ioniser
EcoClean CDS Water / Wastewater / Sewage Treatment Plant
EcoClean CDS Hybrid Advanced Immobilized Cell Reactor (AICR) Technology
EcoClean Ausdrain EnviroModule
EcoClean Ausdrain Drainage Cell

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Malaysia

What makes your world better?

For some, it's the thrill of bringing dreams to life
For some, it's the wonder of discovering new things
For some, it's the warmth of a helping hand when in need
While others just want to be loved

We all seek different things
But as priorities change with time
It's nice to know that one thing remains
And that's our promise:
To always keep the light on
To keep the energy flowing
To make it all happen

For you
For the planet
For our tomorrow

To make everyone's search for better
A much brighter one

Better. Brighter.

Watch the *Better. Brighter.* film on youtube.com/TENAGAofficial

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