ASEAN PLAN OF ACTION FOR ENERGY COOPERATION (APAEC) 2016-2025

PHASE I: 2016-2020

ASEAN CENTRE FOR ENERGY
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Edited by

Christopher G. Zamora

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ACE Building 6th Fl.

Jl. HR. Rasuna Said Block X-2, Kav. 07-08

Jakarta 12950 Indonesia

Tel: (62-21) 527 8027 | Fax (62-21) 529 6382

E-mail: secretariat@aseanenergy.org

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www.aseanenergy.org

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EXECUTIVE SUMMARY

Energy is key to the realisation of the ASEAN Economic Community (AEC) which calls for a well-connected ASEAN to drive an integrated, competitive and resilient region.

Energy is key to the realisation of the ASEAN Economic Community (AEC) which calls for a well-connected ASEAN to drive an integrated, competitive and resilient region.

ASEAN is now one of the most dynamic and fastest growing economic regions in the world, and through the implementation of the AEC by end of December 2015, this growth is expected to continue. The region is projected to grow by at least 4% per year on average over the next five years, but could be as high as 6% - provided ASEAN moves towards greater integration, where member states continuously implement domestic structural reforms to raise their productivity and competitiveness under the framework of the AEC.[1]

To fuel this growth, the demand in primary energy[2] is expected to grow by an average of 4.7% per year from 2013 to reach 1,685 Mtoe in 2035, according to the ASEAN Centre for Energy's (ACE) 4th ASEAN Energy Outlook (AEO4). Addressing this growing demand for energy, which is driven by both economic and demographic growth, has been a challenge for ASEAN ahead of the AEC.

Against this backdrop, the 32nd ASEAN Ministers on Energy Meeting (AMEM) held on 23rd September 2014 in Vientiane, Lao PDR, endorsed the theme of the new ASEAN Plan of Action for Energy Cooperation (APAEC) 2016-2025 as *"Enhancing Energy Connectivity and Market Integration in ASEAN to Achieve Energy Security, Accessibility, Affordability and Sustainability for All"*. The theme also reflects the central elements of connectivity and energy security captured in the Nay Pyi Taw Declaration on the ASEAN Community's Post 2015 Vision adopted by the ASEAN Leaders at the 25th ASEAN Summit in Nay Pyi Taw, Myanmar, on 12th November 2014.

[1] Various projections by IMF, ADB, OECD, etc.
[2] Also known as Total Primary Energy Supply (TPES).

The key initiatives under this APAEC include embarking on multilateral electricity trading to accelerate the realisation of the ASEAN Power Grid (APG), enhancing gas connectivity by expanding the focus of the Trans-ASEAN Gas Pipeline (TAGP) to include Liquefied Natural Gas (LNG) regasification terminals as well as promoting clean coal technologies. It also includes strategies to achieve higher aspirational targets to improve energy efficiency and increase the uptake of renewable energy (RE) sources, in addition to building capabilities on nuclear energy. Plans to broaden and deepen collaboration with ASEAN's Dialogue Partners (DPs), International Organisations (IOs), academic institutions and the business sector will be stepped up to benefit from their expertise and enhance capacity building in the region.

The APAEC 2016-2025 will be implemented in two phases. Phase I will cover the period 2016-2020 for the implementation of short to medium-term measures to enhance energy security cooperation and to take further steps towards connectivity and integration. In 2018, there will be a stocktake of the progress of Phase I, which will guide ASEAN in charting the pathways and directives for Phase II (2021-2025).

The key strategies of the seven Programme Areas of the APAEC 2016-2025 Phase I are as follows:

ASEAN Power Grid	To initiate multilateral electricity trade in at least one sub-region by 2018.
Trans ASEAN Gas Pipeline	To enhance connectivity for energy security and accessibility via pipelines and regasification terminals.
Coal & Clean Coal Technology	To enhance the image of coal through promotion of clean coal technologies (CCT).
Energy Efficiency & Conservation	To reduce energy intensity[3] by 20% in 2020 based on 2005 level.
Renewable Energy	Aspirational target to increase the component of renewable energy[4] to 23% by 2025 in ASEAN Energy Mix[5].
Regional Energy Policy & Planning	To better profile the energy sector internationally.
Civilian Nuclear Energy	To build capabilities in policy, technology and regulatory aspects of nuclear energy.

[3] Energy Intensity is calculated as TPES per GDP PPP at constant 2005 USD.
[4] All sources of renewables, including hydro power of all sizes, but excluding traditional biomass.
[5] Energy Mix is based on TPES.

1. INTRODUCTION

1.1 Development of the APAEC

The APAEC is a series of guiding policy documents to support the implementation of multilateral energy cooperation to advance regional integration and connectivity goals in ASEAN. It serves as a blueprint for better cooperation towards enhancing energy security, accessibility, affordability and sustainability under the framework of the AEC for the designated period.

The APAEC 1999-2004: The first 5-year APAEC supported the energy cooperation agenda of the Hanoi Action Plan (HPA) under the ASEAN Vision 2020. Six fundamental Programme Areas were identified, namely the: 1) ASEAN Power Grid (APG); 2) Trans-ASEAN Gas Pipeline (TAGP); 3) Energy Efficiency and Conservation; 4) New and Renewable Sources of Energy; 5) Coal and Clean Coal Technologies; and 6) Regional Energy Outlook, Energy Policy and Environmental Analysis.

This laid the foundation for sound policy frameworks and implementation modalities for energy cooperation within ASEAN and for cooperative partnerships with relevant Dialogue Partners (DPs) and International Organisations (IOs).

The APAEC 2004-2009: The second APAEC supported the energy cooperation agenda of the Vientiane Action Plan (VAP) under the ASEAN Vision 2020. Cooperation focused on capacity building to enhance the integration of regional energy infrastructure, promote energy security, create frameworks to progressively enhance market transformation and ensure sustainable energy supply. Notable achievements included the signing of the Memorandum of Understanding (MoU) for the ASEAN Power Grid (APG) and the introduction of the annual ASEAN Energy Awards (AEA) on energy efficiency. The Regional Energy Policy and Planning Sub-sector Network (REPP-SSN), which replaced the Regional Energy Outlook, Energy Policy and Environmental Analysis, was established to oversee the overall implementation of the APAEC and to undertake policy reviews and recommendations towards deeper and closer regional energy cooperation.

The APAEC 2010-2015: The third APAEC supported the energy cooperation agenda of the ASEAN Economic Community (AEC) Blueprint 2015. Of note, the ASEAN Energy Ministers and the Executive Director of the International Energy Agency (IEA) signed a MoU in 2011 in Brunei Darussalam and established an annual ASEAN Ministers on Energy Meeting (AMEM)-IEA Energy Dialogue. In 2013, the Ministers signed the "Instrument to Extend the TAGP" MoU for another term of 10 years till 20 May 2024. Significantly, during this APAEC period, ASEAN exceeded the aspirational targets of 8% reduction in energy intensity and 15% share of renewable energy in total installed power generation capacity mix. The ASEAN Coal Awards (ACA) was also launched to encourage the implementation of best practices in coal-fired power generation. In addition, the seventh programme area on Civilian Nuclear Energy (CNE) was established to facilitate information exchange and capacity building in nuclear energy.

The APAEC 2016-2025, has been developed by building on the progressive achievements of the previous plans. With the theme, "Enhancing Energy Connectivity and Market Integration in ASEAN to Achieve Energy Security, Accessibility, Affordability and Sustainability for All", the plan will implement the outcome-based strategies and action plans through the seven Programme Areas. Extended over a longer period of 10 years, the plan will be implemented in two phases, namely Phase I: 2016-2020, which will focus on the short to medium-term strategies required to achieve energy security cooperation and move towards greater connectivity and integration. A mid-term review of Phase I will be conducted in 2018 in order to guide ASEAN in charting the roadmap for the next phase, i.e. Phase II: 2021-2025.

1.2 Global Energy Landscape

Several key global trends could impact developments in ASEAN's energy landscape. Firstly, the International Monetary Fund (IMF) forecasts that global growth will rise moderately at 1.6% for the Organisation for Economic Co-operation and Development (OECD) countries and 5.2% for emerging economies during 2015-2020. Secondly, geopolitical factors are increasingly influencing the oil markets. Oil prices have also fallen by more than 50% since mid- 2014. The impact could translate into lower costs and support economic activities for oil importing countries including ASEAN. However,

prolonged low energy prices may adversely impact global economic growth in the long term. Thirdly, new carbon schemes are being introduced in many countries to improve energy and environmental security. Finally, the rebound in oil and gas production in the North America, driven by upstream technologies that are unlocking light and tight oil and shale gas resources, is stimulating economic activities and shaping the role of North America as a major energy exporter in global energy trade.

While global energy demand is expected to grow by 37% by 2040[6], the growth slows markedly, from above 2% per year over the last two decades to 1% per year after 2025. This is the result both of price and policy effects, and a structural shift in the global economy towards services and lighter industrial sectors. The global distribution of energy demand is shown in Figure 1. In the early 2030s, China will become the largest oil-consuming country, crossing paths with the United States, where oil consumption falls back to levels not seen for decades. But, it is India, Southeast Asia, the Middle East and sub-Saharan Africa that take over as the engines of global energy demand growth.

By 2040, the world's energy supply mix is made up of almost four equal parts, i.e. oil, gas, coal and low-carbon sources (IEA, WEO 2014). While resources are not expected to be a constraint over this period, each of these face a distinct set of challenges. Policy choices and market developments that bring the share of fossil fuels in primary energy demand down to just under three-quarters in 2040 are not enough to stem the rise in energy-related carbon dioxide (CO_2) emissions, which is expected to grow by one-fifth.

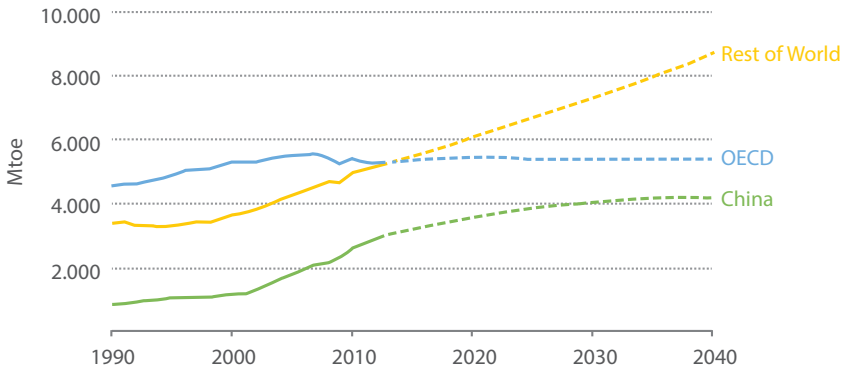

Figure 1. World Total Primary Energy Supply (IEA, 2014)

[6] IEA, World Energy Outlook 2014

Beyond 2015 will be critical for global energy markets as countries around the world address challenges related to burgeoning energy consumption, and security of energy supply in a sustainable manner to address the environmental effects. The 2015 United Nations Framework Convention on Climate Change (UNFCCC) Conference of Parties (COP21) in Paris, set objectives for reaching an international agreement on addressing climate change. As such, 2015 is a crucial time to improve policy frameworks for encouraging responsible energy consumption, higher efficiency, and international standards for emissions, while supporting the growth of energy markets and ensuring security of supply.

1.3 ASEAN Energy Development

Since the signing of the 1986 Agreement on ASEAN Energy Cooperation, the ASEAN Leaders have expressed their strong support to advance ASEAN energy connectivity, an important issue that ASEAN must address, especially given the growing demand for energy in the region. They expressed their support for regional energy connectivity projects such as the APG and the TAGP and provided instructions to look into the next level of details, and seriously consider how to harmonise regulatory frameworks and standards to facilitate regional energy connectivity. The Energy Ministers also emphasised the important role of private sector participation in enhancing energy investments to support the AEC.

The 4th ASEAN Energy Outlook. Under the Business as Usual (BAU) scenario, ASEAN is expected to see its Total Primary Energy Supply (TPES) increase from 619 Mtoe in 2013 to approximately. 1,685 Mtoe by 2035. This corresponds to an average growth rate of 4.7% per annum. In the Advancing Policy Scenario (APS) which takes into account the progressive policies and action plans of the ASEAN Member States (AMS) in achieving the official national targets for renewable energy and energy efficiency, ASEAN's TPES is expected to reach 1,468 Mtoe in 2035, resulting in a slower average growth of 4% p.a., which is 0.7% lower than in the BAU scenario. As shown in Figure 2, coal is expected to play a dominant role, increasing the share of ASEAN's energy mix from 20% in 2013 to 33% under the BAU scenario or 26.4% under the APS in 2035.

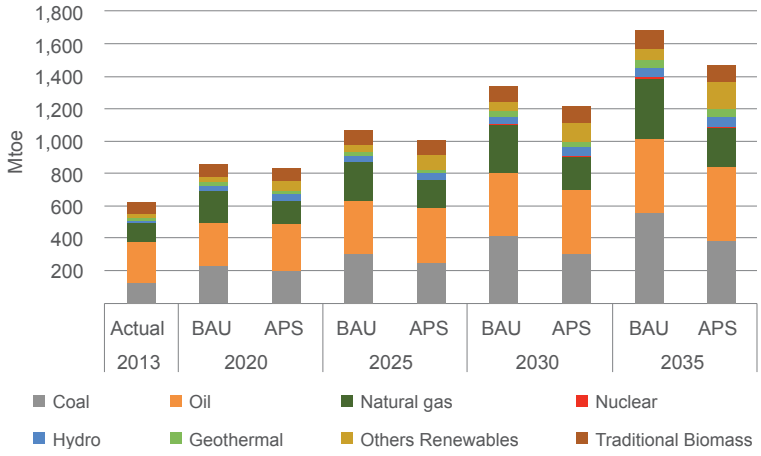

Figure 2. ASEAN Total Primary Energy Supply in BAU & APS (ACE, 2015)

The increasing energy demand over the next two decades will require joint efforts within the ASEAN region beyond the targets set by individual nations. In particular, ASEAN should step up cooperation in the field of policy development and harmonisation. As several countries have already successfully deployed effective policy instruments in various areas, such as energy efficiency and renewable energy, these best practices could be shared with all ASEAN Member States. The aspirational targets set for renewable energy and energy intensity should be used as drivers to foster stronger regional cooperation and economic integration.

2. IMPLEMENTATION AND MONITORING MECHANISMS

2.1 Implementation Arrangement

The **ASEAN Ministers of Energy Meeting** (AMEM) provides overall guidance and advice on the implementation of the APAEC. The AMEM also provides guidance to address key issues, challenges and concerns of common interest and to set policy directions to achieve the goals of the energy cooperation under the framework of the AEC.

The **Senior Officials Meeting on Energy** (SOME) collectively determine the implementation priorities and provides directions and advice on the APAEC to ensure coordination, and integration of APAEC strategies and actions. In addition, SOME guides the formulation and implementation of the yearly Work Plan of each of the APAEC Programme Area and provides the annual progress updates to AMEM. To encourage the transfer of latest technologies, SOME provides guidance on deepening engagement with DPs, IOs and the private sector.

The relevant **sub-sector networks** (SSNs) and **specialised energy bodies** (SEBs), namely; Heads of ASEAN Power Utilities/Authorities (HAPUA), ASEAN Council on Petroleum (ASCOPE), ASEAN Forum on Coal (AFOC), Energy Efficiency and Conservation Sub-sector Network (EE&C-SSN), Renewable Energy Sub-sector Network (RE-SSN), Regional Energy Policy and Planning Sub-sector Network (REPP-SSN) and Nuclear Energy Cooperation Sub-sector Network (NEC-SSN) shall serve as the SOME's implementing arms in their respective Programme Areas. They shall convene their respective meetings as necessary, to identify the priorities and implementing arrangements, further develop the work programmes and prepare the necessary project proposals and documents.

The **ASEAN Centre for Energy** (ACE), in coordination with the ASEAN Secretariat, shall assist SOME, SSNs and SEBs in carrying out the above responsibilities, including technical support and assistance in the supervision, coordination and review of the cooperation programmes and activities. ACE shall provide technical coordination, facilitate and integrate the tasks of the implementing organisations, such as the

planning and fund sourcing, and provide policy analysis and statistics. The **ASEAN Secretariat** shall be responsible for policy coordination and other requirements with the other ASEAN coordinating bodies and the ASEAN DPs.

Engagement with **DPs** and **IOs** will be enhanced by each Programme Area to achieve their respective outcome-based strategies. Recognising the contribution of ASEAN's DPs, IOs, and other partners, such as, academic institutions and Industries to the completion of the APAEC 2016-2025, ASEAN welcomes any interest and collaborative partnerships to implement influential initiatives towards enhancing energy connectivity and market integration under the framework of the AEC.

2.2 Monitoring Mechanism

The REPP-SSN, jointly with the ASEAN Secretariat and ACE, acts as the monitoring body and shall undertake the regular monitoring and evaluation of the progress of the APAEC, for submission to the annual SOME/AMEM meetings. A monitoring mechanism will be put in place to systematically track the progress of the activities undertaken by the SSNs and SEBs to ensure the timely completion of the projects, and will be reported annually through electronic communication and presentation at the annual meeting of REPP-SSN.

To better reflect the actual progress of each action plan, a scoring system – on a scale of 0 to 5 – will be used, as shown below:

5: Done, equal to 100% of the work.
4: Nearly completed, equal to 80% or more of the work.
3: Half way, equal to 50% or more of the work.
2: On going, equal to 30% or more of the work.
1: Just started, equal to 10% or more of the work.
0: No Action.
N/A: Not Applicable.


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3. PROGRAMME AREAS

The APAEC Phase I 2016-2020 will continue to focus on the seven programme areas as in the previous APAEC, namely:

1. ASEAN Power Grid (APG)
2. Trans-ASEAN Gas Pipeline (TAGP)
3. Coal and Clean Coal Technology (CCT)
4. Energy Efficiency and Conservation (EE&C)
5. Renewable Energy (RE)
6. Regional Energy Policy and Planning (REPP)
7. Civilian Nuclear Energy (CNE)

Details on the background, key achievements and proposed plans of each of the programme areas to support the APAEC goals for the next 5 years will be described in the following sections.

3.1 Programme Area No.1 – ASEAN Power Grid

Background

3.1.1 ASEAN recognises the critical role of an efficient, reliable and resilient electricity infrastructure in stimulating regional economic growth and development. To meet the growing electricity demand, huge investments in power generation capacity will be required. In recognising the potential advantages to be gained from the establishment of integrated systems, ASEAN established the electricity interconnecting arrangements within the region through the APG under the ASEAN Vision 2020 adopted in the Second ASEAN Informal Summit in Kuala Lumpur on 15 December 1997. HAPUA, as SEB, is tasked to ensure regional energy security by promoting the efficient utilisation and sharing of resources. The construction of the APG is first done on cross-border bilateral terms, then expanded to a sub-regional basis[7] and finally to a total integrated regional system. It is expected to enhance electricity trade across borders which would provide benefits to meet the rising electricity demand and improve access to energy services in the region.

[7] Northern Sub-System, Southern Sub-System and Eastern Sub-System.

Key Achievements 2010-2015

3.1.2 Despite the scope and complexity of power interconnection projects, HAPUA has made good progress in laying the necessary groundwork for the realisation of the APG. To date, six (6) out of the 16 power interconnection projects for the APG have been implemented, connecting Singapore and Peninsula Malaysia, Thailand and Peninsula Malaysia, and via Thailand to Cambodia, Lao PDR and Vietnam, with a total of 3,489 MW in power exchanges and purchase achieved.

3.1.3 A key achievement of HAPUA was the completion, in 2012[8], of the ASEAN Interconnection Master Plan Studies (AIMS) II, which incorporates key updates from ASEAN Member States including long-term power demand forecasts and identification of feasible interconnection projects.

To move forward on the harmonisation of the technical, legal and regulatory framework and identification of financial modalities, HAPUA successfully worked with the Asian Development Bank (ADB) on the "Harmonisation of Technical Codes and Guidelines in the Area Planning and Design, System Operation and Maintenance for the ASEAN Power Grid" project which was completed in 2013. To address the regulatory and legal issues related to cross border barriers, the ASEAN Power Grid Consultative Committee (APGCC) has undertaken joint studies on the regulatory framework. HAPUA and the ASEAN Energy Regulatory Network (AERN) will work closely to address the legal and regulatory issues of cross border interconnections.

3.1.4 In 2013, ASEAN's total installed generation capacity was 184,156 MW of which 45,673 MW or around 25% was from renewable energy sources. As such, ASEAN has surpassed its 2015 target of 15% share of renewable energy in installed power generation capacity mix. Separately, electricity generation in 2013 was 821 TWh of which 169 TWh or about 21% was from renewable energy sources. The historical data for 2010-2013 is shown in Figure 3.

[8] AIMS II was revised based on HAPUA's initial AIMS I which was completed in 2003.

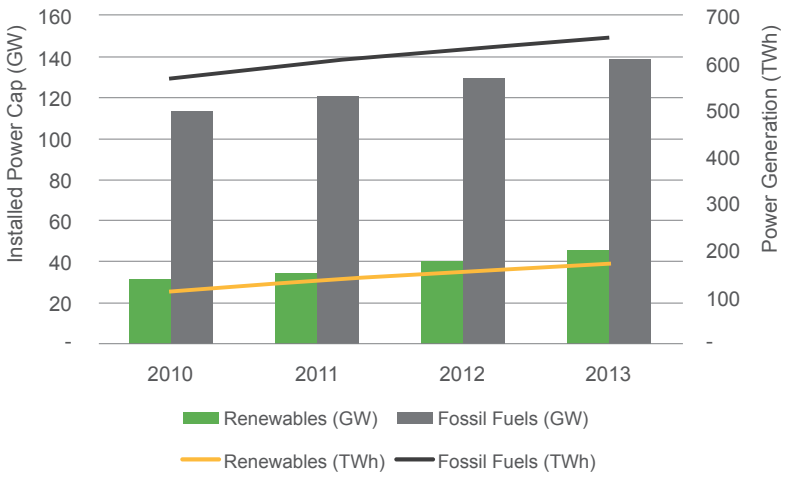
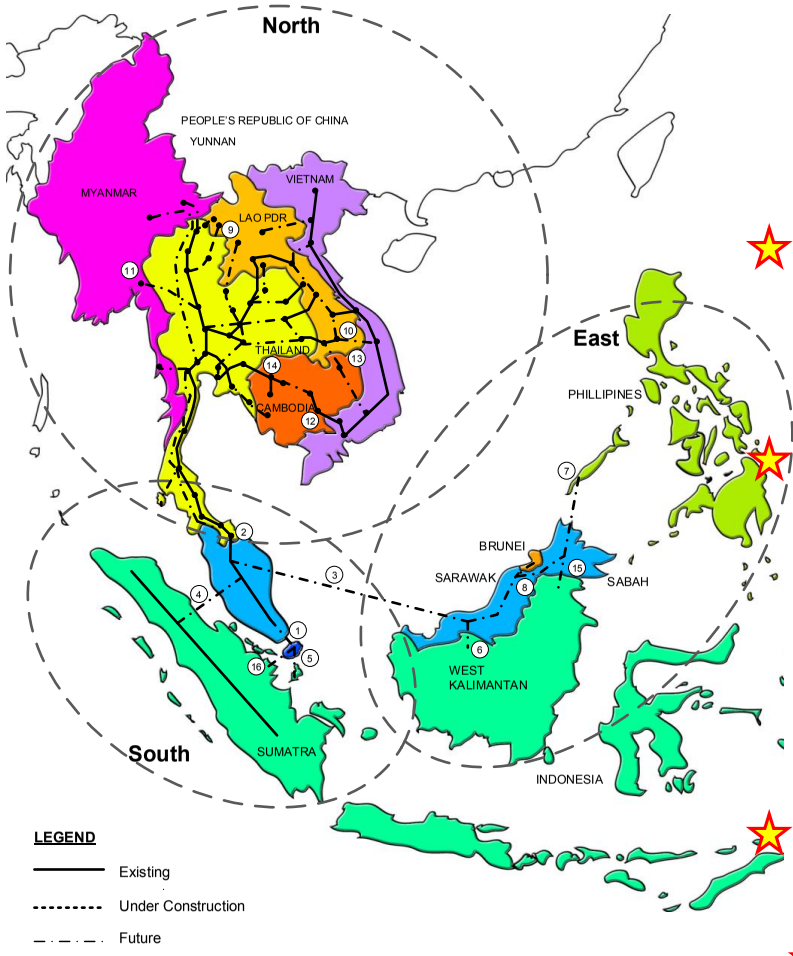


Figure 3. ASEAN Installed Capacity and Power Generation 2010-2013 (ACE, 2015)

Strategies and Action Plans 2016-2020

3.1.5 Electricity demand in ASEAN is expected to grow by 5% to 6% per year for the period 2016-2020. To meet this demand, HAPUA's strategy to accelerate the realisation of the APG is to first encourage on a cross-border bilateral basis, then gradually expand on a sub-regional basis, namely; System A (North System), System B (South System) and System C (East System) and finally to a fully integrated ASEAN power grid system. Given that progress has so far been focused on bilateral interconnections, the new strategy is to embark on multilateral interconnections. At the 32nd AMEM held on 23 September 2014 in Vientiane, Lao PDR, the Ministers welcomed the new initiative to undertake a pilot project to explore cross-border power trade involving four (4) ASEAN Member States. The pilot project, entitled "Lao PDR, Thailand, Malaysia, Singapore (LTMS) Power Integration Project (PIP)", will serve as a pathfinder to enhance multilateral electricity trading beyond neighbouring borders towards realising the APG.

3.1.6 HAPUA has also identified three (3) APG Priority Projects for completion and three (3) additional APG projects which will commence construction, out of the sixteen (16) APG planned and committed projects for commencement, as shown in Figure 4. Through these interconnection projects, it is expected that



		Earliest COD
1)	P.Malaysia - Singapore (New)	post 2020
2)	Thailand - P.Malaysia	
•	Sadao - Bukit Keteri	Existing
•	Khlong Ngae - Gurun	Existing
•	Su Ngai Kolok - Rantau Panjang	TBC
•	Khlong Ngae – Gurun (2nd Phase, 300MW)	TBC
3)	Sarawak - P. Malaysia	2025
4)	P.Malaysia - Sumatra	2020
5)	Batam - Singapore	2020
6)	Sarawak - West Kalimantan	2015
7)	Philippines - Sabah	2020
8)	Sarawak - Sabah – Brunei	
•	Sarawak –Sabah	2020
•	Sabah – Brunei	Not Selected
•	Sarawak – Brunei	2018
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)	2019
•	Ubon Ratchathani 3 – Pakse – Xe Pian Xe Namnoy	2019
•	Khon Kaen 4 – Loei 2 – Xayaburi	2019
•	Nakhon Phanom – Thakhek	2015
•	Thailand – Lao PDR (New)	2019-2023
10)	Lao PDR - Vietnam	2016-TBC
11)	Thailand - Myanmar	2018-2026
12)	Vietnam - Cambodia (New)	TBC
13)	Lao PDR - Cambodia	2017
14)	Thailand - Cambodia (New)	post 2020
15)	East Sabah - East Kalimantan	post 2020
16)	Singapore – Sumatra	post 2020

★ Priority Projects

Figure 4: Interconnection Projects of ASEAN Power Grid (HAPUA, 2015)

power exchange and purchase will almost triple from 3,489 MW in 2014 to 10,800 MW in 2020, and further increase to 16,000 MW post-2020.

3.1.7 With support from various DPs and IOs, HAPUA is elevating its efforts to harmonise the legal and regulatory practices, technical standards and to identify possible financing models, including the review of the recommendations of the ADB Study to establish the APG Transmission System Operator Institution (ATSO) and the APG Generation and Transmission System Planning Group Institution (AGTP) to support the realisation of the APG. HAPUA has also opened up to feasibility studies for individual project sponsors under Infrastructure Feasibility Studies and to provide guidance to HAPUA on implementing market outreach programme to potential investors and creditors. On regulatory and legal issues, HAPUA will cooperate with the ASEAN Energy Regulatory Network (AERN) to carry out various studies, such as on Taxation and Tariff for Cross-Border Transaction, and Regulation on Public-Private Participation in APG Projects.

Table 1. Outcome-based Strategies for ASEAN Power Grid

Outcome-based Strategy 1: To accelerate the development and completion of the following APG Projects identified under AIMS II by 2020. 1. APG Priority Projects: Project 13 (2017), Project 8 (2018) and Project 4 (2020). 2. APG On-going Projects: Project 2 (TBC), Project 9 (2019) and Project 10 (2016).	
Action Plans	a. Conduct a study and identify areas where indigenous resources can be fully utilised to benefit the region. b. Conduct a study on the ASEAN Primary Energy Resources for Power Generation.
Outcome-based Strategy 2: Initiate multilateral electricity trading. 2.1 LTMS Power Integration Project (PIP). 2.2 Establish electricity trading in at least one sub-region by 2018 namely: the Northern Sub system (Cambodia, Lao PDR, Myanmar, Thailand and Vietnam), Southern Sub System (Indonesia, Malaysia, and Singapore) and eastern Sub System (Brunei Darussalam, Indonesia, Malaysia and Philippines).	
Action Plans	a. Conduct a study to address barriers to interconnections, cross-border trade and investments by the five (5) HAPUA Working Groups, including: • Harmonisation of legal and regulatory framework for bilateral & cross-border power interconnections and trade. • Formulation of institutional and contractual arrangements for cross-border trade to include taxation, tariff and Third Party Access (Wheeling charges). • Development of Public Private Partnership, including the incentive scheme. b. Review recommendation to support establishing new APG Institutions by 2018, namely: • APG Transmission System Operator Institution (ATSO) • APG Generation and Transmission System Planning Institution (AGTP) c. Provide inputs on framework and schemes to facilitate multilateral electricity trade in the region.

3.2 Programme Area No.2 – Trans-ASEAN Gas Pipeline

Background

3.2.1 The other major infrastructure project conceived as part of the ASEAN Vision 2020 is the TAGP. The TAGP aims to interconnect existing and planned gas pipeline infrastructure within ASEAN, to transport gas across borders to ensure greater security of gas supply. The ASCOPE is responsible for the effective implementation of the TAGP Project through multiple physical pipeline interconnections and regasification terminals (RGT). During the 20th AMEM on 5 July 2002 in Bali, Indonesia, the Ministers signed the ASEAN MoU on the TAGP Project. The MoU sets out the cooperative framework for greater public-private partnership and collaboration in the implementation of TAGP. Under the TAGP MoU, ASEAN countries should study the regulatory and institutional frameworks for cross-border supply, transportation, and distribution of natural gas in the region involving multilateral countries.

Key Achievements 2010-2015

3.2.2 ASCOPE updated the TAGP Master plan in 2008, and in 2012 expanded its strategic direction to include LNG, as a means to further connect the ASEAN nations, as well as to provide strategic buffer management in the region. As of 2015, a total of 13 bilateral gas pipeline interconnection projects connecting six (6) countries bilaterally and with a total length of approximately 3,673 km have been successfully commissioned. These interconnections, listed in Table 2 and in Figure 5, form part of the backbone of energy security and sustainability of gas supply in the region to spur the region's economic growth.

Table 2. TAGP's Completed Bilateral Gas Pipeline Interconnections Projects

Pipeline Interconnections		Length	Commenced operations
1	Singapore - Malaysia	5 km	1991
2	Myanmar - Thailand	470 km	1999
3	Myanmar - Thailand	340 km	2000
4	West Natuna, Indonesia - Singapore	660 km	2001
5	West Natuna, Indonesia - Duyong, Malaysia	100 km	2001
6	Malaysia/Vietnam Commercial Arrangement Area (CAA) - Malaysia	270 km	2002
7	South Sumatra, Indonesia - Singapore	470 km	2003
8	Malaysia/Vietnam CAA – Vietnam	330 km	2007
9	Malaysia - Thailand/Malaysia Joint Development Area (JDA)	270 km	2005
10	Singapore - Malaysia	4 km	2006
11	Thailand/Malaysia JDA –Thailand	100 km	2009
12	Zawtika Block M9, Myanmar – Thailand	302 km	2013
13	Block 17 (Thailand/Malaysia JDA) to Kerteh, Terengganu, Malaysia	352 km	2015

3.2.3 ASCOPE has successfully completed an assessment of TAGP's strategic direction taking into consideration the dynamic changes and challenges in the global gas industry. In 2012, AMS welcomed the new expanded strategic focus of TAGP from being limited to connectivity via physical gas pipelines to include connectivity via RGTs that can serve as virtual pipelines. In this regard, ASCOPE has successfully embarked on several preliminary studies on LNG cooperation, including studies on ship-shore compatibility, gas specification and LNG destination flexibility clauses. As of 2015, the total capacity of the four (4) operational RGTs amounted to 17.8 million tonnes per annum (mtpa) or 2,492 Million standard cubic feet per day (mmscfd). The existing regasification terminals within ASEAN are listed in Table 3.

Table 3. Regasification Terminals within ASEAN

Regasification terminals		Capacity	Commenced operations
1	Map Ta Phut LNG Receiving Terminal, Thailand	5 mtpa	2011
2	West Java FSRU, Indonesia	3 mtpa	2012
3	Singapore LNG (SLNG)	6 mtpa	2013
4	Sungai Udang, Melaka, Malaysia	3.8 mtpa	2013

3.2.4 To provide the framework for AMS to cooperate towards the realisation of the TAGP Project, the TAGP MoU, which entered into force on 21 May 2004 for a period of 10 (ten) years was extended for another 10 years, i.e., from 2014-2024. The Instrument to extend the TAGP MOU was successfully signed at the 31st AMEM in 2013 in Bali, Indonesia.

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3.2.5 Driven by economic growth, natural gas demand in the region is expected to grow from 14.5 billion standard cubic feet per day (BSCFD) in 2013 to 23 BSCFD by 2035. Considering the challenges in global gas developments, including in the East Natuna Gas Field, the strategic focus of TAGP will expand from piped gas to LNG as the option for gas supply in the region. In this regard, further to the four (4) RGTs, it is expected that there will be at least one additional RGT in operation by 2020.

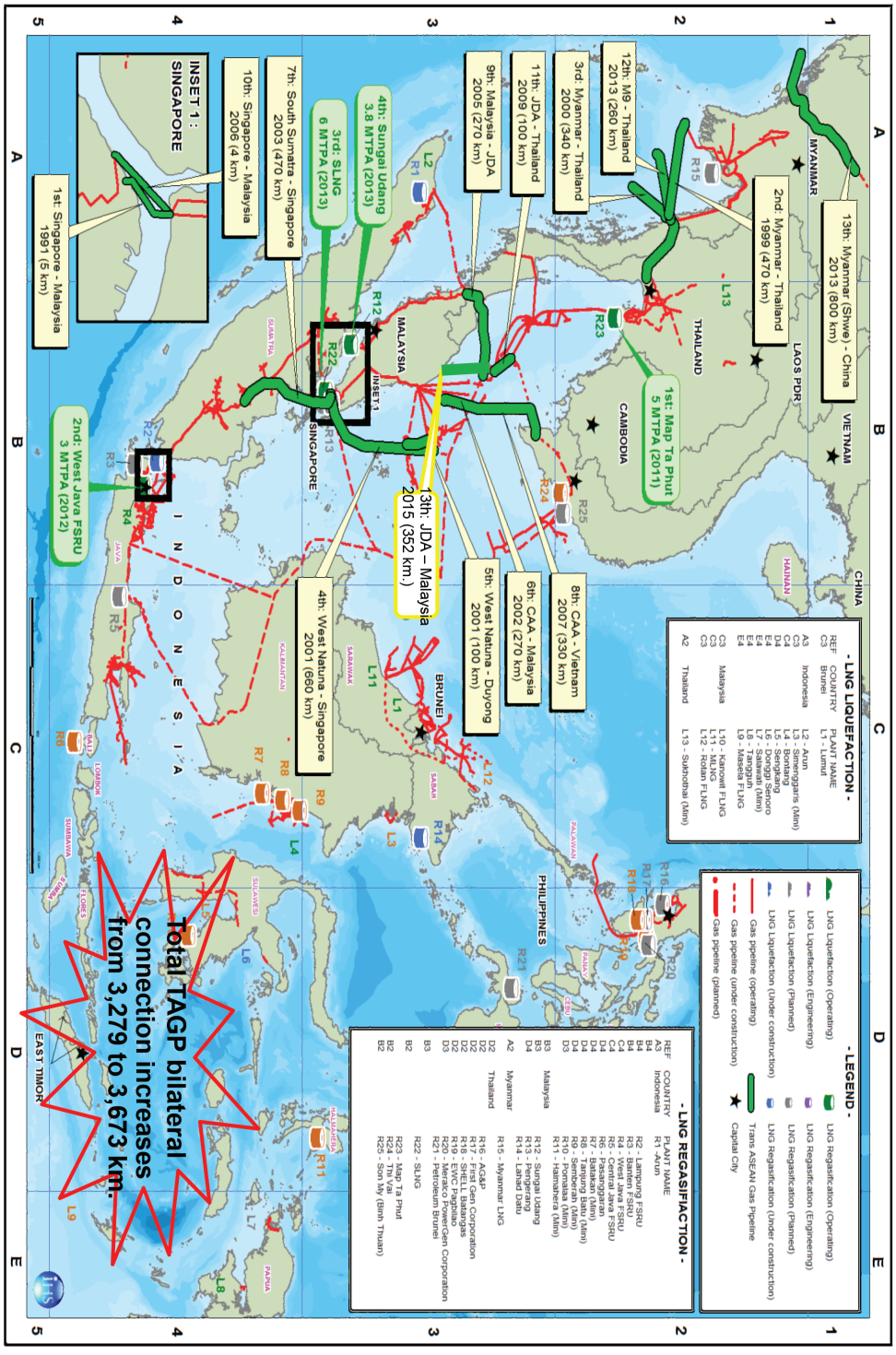

Figure 5. Updated Trans-ASEAN Gas Pipeline Projects and LNG Regasification Terminals

3.2.6 The new strategic focus of TAGP will also assure AMS of gas availability during gas shortages through strategic buffer management. The ASEAN Petroleum Security Agreement (APSA), which aims to enhance petroleum security amongst AMS through an emergency petroleum sharing scheme during times of critical oil and/or gas supply shortage, will be operationalised through the development of the APSA-Coordinated Emergency Response Measures (APSA/CERM).

3.2.7 Further to developing the knowledge management system for sharing/ information exchange on the natural gas industry, ASCOPE will implement its plan to promote capacity building activities on i) gas-related commercial, legal, and technical matters and ii) gas database.

3.2.8 ASCOPE has worked with the International Energy Agency (IEA) to operationalise the APSA/CERM, given IEA's experience in oil and/or gas supply shortage. In addition, ASCOPE is also working with various DPs and IOs, including the U.S. on the Asia Gas Market Workshop under the ASEAN-U.S. Energy Cooperation Work Plan 2016-2020 where it is expected that the U.S. will share best practices on regulatory frameworks and open access for gas/ petroleum pipeline and relating facilities, and provide capacity building on the collection of natural gas and petroleum statistics as part of their engagement with ASEAN.

3.2.9 On regulatory and legal issues, the AERN will collaborate with ASCOPE/ ASEAN Gas Consultative Council (AGCC) on academic studies of mutual interest to support the work of the ASCOPE/AGCC.

Table 4. Outcome-based Strategies for Trans-ASEAN Gas Pipeline

Outcome-based Strategy 1: Enhance gas & LNG connectivity via pipeline and regasification terminals.	
Action Plans	a. Develop at least one (1) new LNG regasification terminal or a cross border gas pipeline by 2020. b. Implement open access system by at least one (1) AMS by 2020. c. Develop consolidated information (Technical Database) on ASEAN Gas Infrastructure.
Outcome-based Strategy 2: Enhance gas & LNG accessibility via pipeline and regasification terminals.	
Action Plans	a. Establish a standard clause for LNG cargo diversion and destination flexibility for ASEAN LNG Contracts. b. Establish a manual and procedures for the operationalisation of APSA/CERM.
Outcome-based Strategy 3: Minimise environmental impact of CO_2 and other environmental contaminants on gas field development and utilisation.	
	a. Establish research and development in the areas of CO_2 and other environmental contaminants management. b. Establish a regional guideline for emissions.

3.3 Programme Area No.3 – Coal and Clean Coal Technology

Background

3.3.1 The ASEAN Coal Sub-sector Network was transformed into the ASEAN Forum on Coal (AFOC) in 1999 with the objective, among others, to promote ASEAN cooperation in the coal sector and to promote intra-ASEAN business opportunities on coal.

3.3.2 Recognising that coal is a major fuel source for power generation in the region, total coal production and utilisation has risen as shown in Figure 6. In 2013, electricity produced from coal was 258 TWh or around 31% of the total power generation, a steady increase from 27% in 2010.This increasing trend indicates that coal is expected to generate more electricity than other fuel sources for the foreseeable future.

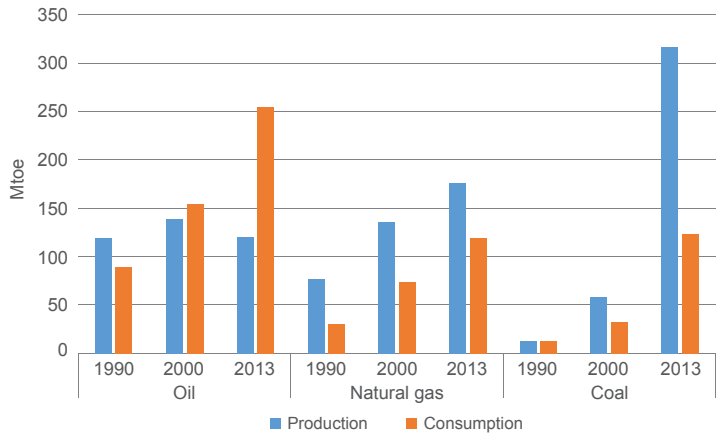

Figure 6. Historical Production and Consumption of Fossil Fuel in ASEAN

3.3.3 AFOC is responsible for promoting the development and utilisation of clean coal technologies and facilitating intra-ASEAN coal trade towards enhancing regional energy security and sustainable development.

3.3.4 In addition, AFOC is tasked to promote ASEAN cooperation in the coal sector as well as promoting intra-ASEAN business opportunities towards enhancing regional energy security while addressing environmental issues through clean coal technology.

Key Achievements 2010-2015

3.3.5 AFOC, assisted by ACE, implemented various activities to enhance the promotion and cooperation of the AMS on coal and clean coal technologies. In order to improve coal policies and strategies by the AMS, the AFOC has successfully organised various seminars, workshops and capacity-building activities focusing on the promotion of clean coal technologies, carbon capture and storage, upgrading of low rank coal, environmental emission standards for coal-fired power plants and the promotion of coal's image and the clean coal initiative for ASEAN. The ASEAN Coal Database and Information System (ACDIS) was launched in Indonesia in 2012 and today contains comprehensive data on, among others, coal resources, prices, projects, and country profiles. A series of training sessions were organised for the AMS to enable them to update data and information in the database. The AFOC and the ACE launched the ASEAN Coal Awards (ACA) in 2013, which is held once every two (2) years. The ACA focuses on the best practices in the areas of surface

coal mining, clean coal use and technology in power generation and industry, coal distribution, corporate social responsibility and special submission for the innovative application and use of coal.

3.3.6 The AFOC and the ACE have also published a "Strategic Paper on ASEAN Carbon Capture and Storage (CCS) Strategic Consideration" in 2014 in cooperation with the Global Carbon Capture and Storage Institute (GCCSI). The paper provides a high-level overview of some of the key matters related to CCS including its global status, cost capture technology, storage, legal and regulatory developments and public engagements. The ASEAN Clean Coal Technology (CCT) Handbook was also published in cooperation with Japan Coal Energy Centre (JCOAL) to facilitate high policy level dialogues and discussions on the deployment of CCT in the ASEAN region.

Strategies and Action Plans 2016-2020

3.3.7 Coal is expected to continue to be a major fuel for power generation in the future. Consequently, CCT is important in helping to ensure that coal is used in a sustainable manner that will contribute to significant improvements in coal utilisation efficiency and environmental performance compared to existing coal plants. As such, ASEAN will continue its effort to adopt the most appropriate, efficient and clean coal technologies in the region. Support from DPs is needed in this regard. The 11th AMEM+3 on 23 September 2014 in Vientiane, Lao PDR collectively agreed on the need for continued transfer of technology and public financial support from developed countries and Multilateral Development Banks (MDBs) in order to develop and deploy highly efficient coal-fired power plants.

3.3.8 The AFOC will continue to work with Dialogue Partners, including Japan, Australia and the U.S., to implement capacity-building activities on advanced CCT and knowledge transfer. A strategic capacity-building framework and financing mechanisms are also being planned to enhance the knowledge in the region on the technical information and technology of clean coal power plant systems as well as to strengthen the network and cooperative partnerships in the promotion and utilisation of coal and CCTs. In addition, the AFOC will continue to work with JCOAL and GCCSI on CCT.

Table 5. Outcome-based Strategies for Coal and Clean Coal Technology

Outcome-based Strategy 1: Promote clean coal technologies for power generation to contribute to clean energy development and economic competitiveness.	
Action Plans	a. Promote best practices through the annual ASEAN Coal Awards in areas of Coal Mining, Coal Distribution, CCT Utilisation in Coal Fired Power Plant and Industries to relevant stakeholders. b. Organise at least two (2) Capacity Building Workshops on CCT. c. Conduct at least one (1) feasibility study on CCT and disseminate results.
Outcome-based Strategy 2: Increase the level of awareness of the public on the benefits of coal use.	
Action Plans	a. Organise at least one (1) event to enhance coal's image in the light of global environmental concerns. b. Enhance the appreciation by the general public of coal's benefits through at least one (1) dissemination Workshop on ASEAN Coal Awards Best Practices on a particular CSR project.
Outcome-based Strategy 3: Promote intra-ASEAN coal trade and increase investment in CCT.	
	a. Organise at least one (1) ASEAN Coal Business Roundtable and Conference. b. Develop business/financing model to promote greater participation of public and private sector, DPs, IOs in the adoption of CCT. c. Study and propose (1) CCT demonstration project with the involvement of one (1) DPs IOs.
Outcome-based Strategy 4: Conduct policy research to enhance coal development and use, and build capacity.	
	a. Implement and publish at least one (1) joint policy research paper on coal. b. Intensify institutional and human capacity building in the ASEAN Coal Sector. c. Identify and establish one (1) ASEAN Coal Centre of Excellence. d. Organise high level policy discussion with at least one (1) DP/IO.

Outcome-based Strategy 5: Establish a fully functional ASEAN Coal Database and Information System (ACDIS).	
	a. Establish the focal point system and coordination mechanism in the AMS to submit data and information in a timely manner to the ACDIS. b. Organise ACDIS training in the AMS. c. Develop and maintain a yearly ACDIS Statistical Monitor including an integrated coal price and trade database, news on coal policy and related developments, to address harmonisation of statistics and data quality issues.

3.4 Programme Area No.4 – Energy Efficiency and Conservation

Background

3.4.1 Energy efficiency, viewed as the most cost-effective way of enhancing energy security and in addressing climate change and promoting competitiveness, has been successfully implemented in ASEAN since the establishment of the ASEAN Energy cooperation initiative in 1986. To address the limited global reserve of fossil fuels and volatile energy prices, the AMS have been following a deliberate policy of diversifying and using energy sources efficiently. The EE&C-SSN is responsible for the coordination of ASEAN's collective efforts on energy efficiency towards its target of reduction in energy intensity.

Key Achievements 2010-2015

3.4.2 During the past five years, ASEAN has implemented policies and programmes to improve energy efficiency of energy end-users. Specifically, energy efficiency programmes have been directed toward increasing energy efficiency in residential and commercial buildings, as well as toward increasing energy efficiency in energy intensive industry or transport sectors. These policies and programmes by the EE&C-SSN have successfully raised awareness and educated the market on the benefits of implementing energy efficiency activities.

As shown in Figure 7, these efforts have led to the reduction of energy intensity to 8.5% in 2013, based on 2005 levels, exceeding the 8% target of energy intensity set for 2015, as stipulated in the APAEC 2010-2015.

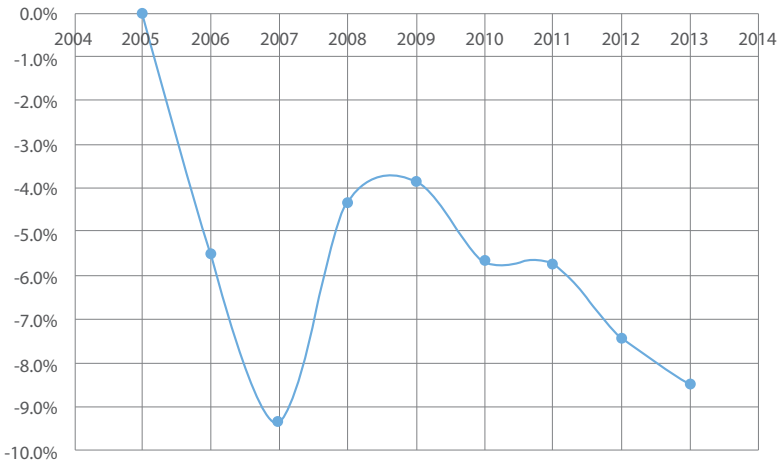

Figure 7. Reduction of Energy Intensity

3.4.3 A large number of programmes were implemented, jointly with DPs like the EU, Japan, Korea, the U.S. etc. and international organisations like the United Nations Environment Programme (UNEP) to improve energy efficiency in all major energy consumption areas including the residential, commercial buildings, industry and transport sectors. These include the ASEAN Energy Management System (AEMAS), Promotion of EE&C (PROMEEC), ASEAN-Japan EE Programme (AJEEP), Energy Conservation Workshop under AJEEP (ECAP), Energy Market Transformation with Information Provision Scheme (EMTIPS), and the ASEAN Standard Harmonization Initiative for Energy Efficiency (ASEAN-SHINE) on air-conditioners and lighting.

3.4.4 One of the most successful programmes implemented by the EE&C-SSN is the annual ASEAN Energy Awards (AEA), which have been conducted since the year 2000. Initially having only two (2) categories, the AEA now consists of five categories, including awards for energy efficiency in buildings, energy management and green building status. The AEA is a much sought-after accolade by building developers with a total of 628 companies participating

and 411 awards won since the introduction of the competition. Furthermore, to professionalise EE practices, the EE&C-SSN successfully implemented the ASEAN Energy Management Accreditation Scheme (AEMAS), supported by €1.7 million of funding from the EU in 2011. As of 2015, a total of 1,686 energy managers and 9 companies have been accredited.

Strategies and Action Plans 2016-2020

3.4.5 The AMS are all at different stages of development in energy efficiency and conservation. With the growing focus on energy security, energy efficiency is no longer an untapped fifth fuel, together with oil, natural gas, coal and renewables, but could be considered as a critical step for ASEAN to achieve sustainable economic growth, market integration and mitigate the adverse impacts of climate change. In this regard, the EE&C-SSN is responsible for continually leading the efforts in the region to achieve the aspirational goal of reducing energy intensity in ASEAN by 20% by 2020 as a medium-term target and 30% by 2025 as a long-term target based on the 2005 levels. The targets were proposed by the ASEAN Working Group on the Development of Long-term Energy Intensity Target that was established jointly by ACE and the EE&C-SSN.

3.4.6 To achieve this target, the EE&C-SSN will embark on projects aimed at harmonising EE standards of appliances such as air-conditioners and lightings which are expected to help improve energy efficiency especially in the residential sector by a range of 5-10%. In 2013, EE&C-SSN had successfully harmonised the testing methods for EE standards of air-conditioners by aligning it to ISO 5151-2010. A significant part of this initiative on the regional roadmap, the EE&C-SSN is exploring mutual recognition arrangements (MRA) for the harmonisation of testing methods on EE standards, hopefully to facilitate trade in order to achieve the AEC goals of a single market in ASEAN.

3.4.7 As the involvement of the private sector and the stimulation in EE investment through financial institutions are critical to the successful implementation of the programme, enhanced dialogue and exchanges will be undertaken for information on energy policy, notably through the establishment of networks, fora, conferences and seminars as well as encouraging new initiatives with the

private sector and financial institutions. The conduct of a feasibility study on EE in the Transport Sector would be considered during this period.

Table 6. Outcome-based Strategies for Energy Efficiency and Conservation

Outcome-based Strategy 1: Harmonisation and Promotion of Energy Efficiency Standards and Labelling on various kinds of energy-related products. Targeted products: Air-conditioning and Lighting	
Action Plans	a. Develop regional policy and roadmap for Minimum Energy Performance Standards (MEPS) implementation; • Market Survey • Review and summarise for standard and approach b. Develop national policy and roadmap for MEPS implementation • Mutual Recognition Agreement (MRA) on testing methods of EE standards for air-conditioning • Identify capacity and target • Identify approach c. Develop Infrastructure for MEPS Implementation at a national level d. Awareness raising for consumers
Outcome-based Strategy 2: Enhancing private sector participation including Energy Service Companies (ESCOs) for EE&C promotion.	
Action Plans	a. Create more opportunities for private sector (EE technology providers, ESCOs) to promote EE&C through activities such as seminars, workshops, business conferences, business matching, etc. b. Continue capacity-building activities in technical and management areas. c. Continue annual competition on ASEAN Energy Awards.
Outcome-based Strategy 3: Developing green building codes which support the use of high energy efficient products.	
	a. Review existing and international experience of green building codes. b. Develop draft guidelines on ASEAN Green Building Code and Promotional Scheme on green building code. c. Capacity Building for designers and auditors.

Outcome-based Strategy 4: Enhance the participation of financial institutions in EE&C development.	
	a. Meetings/Workshops to establish a network of banks/financial institutions to finance energy efficiency projects. b. Training on Financing Energy Efficiency Projects. c. Creating a Pilot Project to Finance Energy Efficiency. d. Drafting guidelines to finance energy efficiency projects. e. Implementation of Financing Energy Efficiency Projects by the Banks/financial institutions.

3.5 Programme Area No.5 – Renewable Energy

Background

3.5.1 To address the challenges of sustainable energy growth and climate change, the AMS have been following a deliberate policy of diversifying and using indigenous energy sources efficiently at the national level. To this end, the AMS have developed and implemented several renewable energy initiatives, such as bio-fuels, solar PV programmes, as well as promoting open trade, facilitation and cooperation in the renewable energy sector. The AMS deployment of renewable energy technologies was initially based on policies to reduce oil consumption but later included policies to mitigate environmental impacts of fossil fuel use, including the potential effects of climate change. The RE-SSN is responsible for carrying out the implementation of renewable energy programmes to increase the diversity of energy supply and to reduce the environmental impact of energy use in the region.

Key Achievements 2010-2015

3.5.2 In 2013, the amount of ASEAN's electricity produced from renewable energy sources[9] was 169.34 TWh, accounting for about 21% of total electricity generation. In the same year, ASEAN marked an unprecedented success,

[9] Source of renewable energy: Commercial Biomass, Biogas, Geothermal, Solar, Wind, all sizes of Hydro and Municipal Waste.

achieving 25% share of RE in total installed capacity or about 45.7 GW. This exceeded the 2015 collective target set out in APAEC 2010-2015 of 15% for regional renewable energy of total installed power capacity. The installed RE capacity increased by 42% from 2010-2013. Among the renewable energy sources, hydropower (of all sizes and types) had the highest contribution, with about 37.2 GW in installed capacity in 2013.

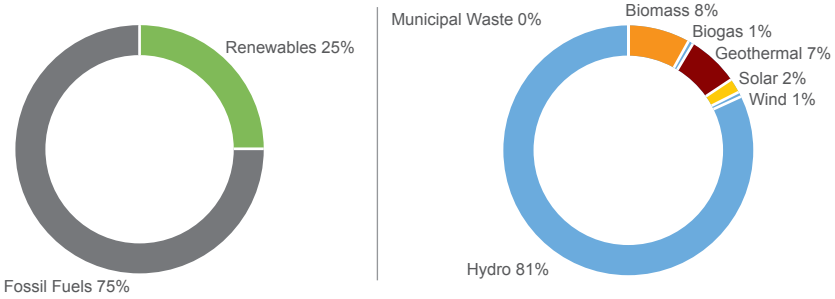

Figure 8. Installed Capacity of Renewable Energy in 2013 in ASEAN

3.5.3 The Renewable Energy Support Programme for ASEAN (ASEAN-RESP), which is jointly implemented by ACE, the German International Cooperation (GIZ) and the RE-SSN have achieved key deliverables under the APAEC 2010-2015, including joint studies on Renewable Energy Support Mechanism for Bankable Projects, Off-grid Rural Electrification Approaches, and Renewable Energy Technical Standards in ASEAN. The ASEAN-RESP also established the Hydropower Competence Centre (HYCOM) in Bandung, Indonesia in 2011 to develop and transfer best practices in small-scale hydro power. The on-line ASEAN Renewable Energy Information was established to provide key ASEAN information on RE studies, country profiles, and reports. The RE Business Directory and RE Permit Procedures were also completed and published. To help shape influential RE policies and increase deployment of RE projects in the ASEAN Member States, several focus group discussions were organised, such as, i) CO_2 reduction – Greater Role of RE in ASEAN Power Generation Sector; ii) Impacts of Renewable Energy Integration through Grid Connection; iii) RE Lending Guidelines; iv) Business Models for Rural Electrification; v) Technical Standards for PV Hybrid System; and vi) Recommendation on RE Permit Procedures.

Strategies and Action Plans 2016-2020

3.5.4 The development of renewable energy in the AMS covers hydro, geothermal, solar photovoltaics, solar thermal, wind, bio-energy (bio-ethanol, bio-diesel, biogas, bio-oil) and waste. Others, such as ocean energy (thermal, wave, and tidal), fuel cell, hydrogen and coal liquefaction/gasification are in the research, development and demonstration stages. Solar and wind energy are still considered capital intensive and not as affordable as conventional energy. ASEAN needs more technology transfer and meaningful partnerships to make these energy sources viable, to meet its increasing requirements. The AMS also recognise that renewable energies are crucial for increasing the diversity of energy supply and reducing the environmental impact of energy use in the region.

3.5.5 During Phase I, efforts will be devoted to the commercialisation and marketing of renewable energy technologies. A market study will be conducted to identify and address the constraints in the development and deployment of renewable energy in terms of the technology and financing which would enable the renewable industry and its players to be self-sustaining. It is also envisaged that by 2020, a roadmap with clear policies, response plans and programmes for R&D in renewable energy will enable the commercialisation, investment, market and trade potential of renewable energy technologies to be realised.

3.5.6 With the shifting paradigm that renewable energy development and deployment can be further enhanced, ASEAN will continue to work with DPs and IOs given the global interest in sustainable energy development. To follow-up on the next phase of their initiative to harmonise standards/codes for solar photovoltaics, RE-SSN, jointly with ACE is working with GIZ. RE-SSN is also working with the Government of Japan for funding consideration under the ASEAN-Japan Investment Fund (JAIF) on the “Promotion on High Efficiency Biomass Technology Utilisation in ASEAN Countries” and “Capacity Building Workshop on Commercial Biodiesel Production”. The RE-SSN is also collaborating with the Southeast Asian Collaboration for Ocean Renewable Energy (SEAcORE) in activities to further explore the potential of ocean renewable energy in the ASEAN region. The RE-SSN is also in collaboration with the International

Renewable Energy Agency (IRENA), and both have initiated preparatory action on a joint initiative to apply a regional approach in facilitating the integration of various renewable energy into the regional power mix.

Table 7. Outcome-based Strategies for Renewable Energy

Outcome-based Strategy 1: Aspirational target to increase the component of RE to 23% by 2025 in the ASEAN Energy Mix.	
Action Plans	a. The AMS to enhance and implement RE policy and targets. b. Develop and adopt ASEAN RE Roadmap by 2020. c. Monitor RE capacity additions/deployment of the AMS on an annual basis.
Outcome-based Strategy 2: Enhance awareness on the role of renewable energy among policy makers, private sectors and public.	
Action Plans	a. Develop a nodal network with at least minimum two (2) regional or international institutions on renewable energy by 2020. b. Develop an RE-hub information sharing mechanism among AMS on renewable energy data, policy instruments, policy update, and best practices for promoting renewable energy. c. Conduct at least two (2) high level policy dialogues. d. Conduct annual technical training on renewable energy.
Outcome-based Strategy 3: Enhance R&D network on RE technology development and utilisation within the region.	
	a. Establish a nodal network with at least minimum two (2) research institutions or universities to promote cooperation, technology development, sharing of research facilities and exchange and mobility of researchers on renewable by 2020.
Outcome-based Strategy 4: Increase the promotion of renewable energy financing schemes.	
	a. Establish a nodal network with at least two (2) national / regional / international financial institutions for renewable energy financing. b. Develop a guideline of RE Support Mechanism for Bankable Projects. c. Conduct regular training on renewable energy financing.

Outcome-based Strategy 5: Increase the commercial development and utilisation of biofuels with a reference standard to facilitate deployment.	
	a. Develop a nodal network with automotive and related industries on technological know-how and R&D activities for biofuel. b. Conduct market studies to fully determine the commercial potential of bioenergy.

3.6 Programme Area No.6 – Regional Energy Policy and Planning

Background

3.6.1 Energy policy and planning in ASEAN has been developed individually by the AMS given that they are at different stages of development. That said, the level of integration in energy policy and planning in ASEAN is still nascent among the AMS and much needs to be done to raise the expertise in this area.

Key Achievements 2010-2015

3.6.2 The REPP-SSN successfully completed the APAEC 2010-2015 Full Term Review (FTR)[10], which was endorsed by the 33rd ASEAN Ministers on Energy Meeting (AMEM) in Kuala Lumpur, Malaysia, on 7th October 2015. The final score of 4.52 out of 5 signalled that the individual SSNs/SEBs responsible for the seven Programme Areas achieved 90% of the targets and activities under the APAEC 2010-2015.

3.6.3 With the aim of enhancing ASEAN's engagement with DPs and IOs, REPP-SSN's key achievement was the successful signing of the ASEAN-IEA MoU in 2011 on the side-lines of the 29th AMEM in Brunei Darussalam. The MoU has enabled ASEAN to collaborate and benefit from IEA through Ministerial Dialogues and expertise in key areas of ASEAN's interest, including energy data collection/analysis, gas market industry dialogue, emergency preparedness, etc.

[10] The FTR final score was computed by aggregating the individual scores of all activities undertaken by the seven programme areas in APAEC during 2010-2015.

3.6.4 In addition to the key responsibility of overseeing the preparation, evaluation and monitoring of regional energy plans of the APAEC under Programme Area 6, REPP-SSN has also successfully implemented a number of capacity building activities, such as i) ASEAN fuel policy for power generation, ii) ASEAN-RESP on Rural Electrification, iii) Energy Supply Security Planning Program (ESSPA) and iv) ASEAN Energy Outlook, amongst others.

Strategies and Action Plans 2016-2020

3.6.5 To support energy connectivity and integration in ASEAN, the REPP-SSN will take a longer term view of global trends and its cross-cutting nature to address key energy challenges to enhance security, accessibility and sustainable development. This will frame the REPP-SSN's efforts to identify and prioritise opportunities emerging from these trends for ASEAN in order to maximise the benefits to support the APAEC theme.

3.6.6 For Phase I, the REPP-SSN will take bold steps to focus on topics to strengthen energy resilience and emergency preparedness in energy infrastructure/facilities to facilitate the AMS in their energy planning and development process. Of note, REPP-SSN aims to better profile the ASEAN energy sector internationally, with regard to the growing intra-regional connectivity and interaction, through regular publications to highlight the various activities undertaken by the SSNs and SEBs. This will enable the REPP-SSN to communicate better to external stakeholders, including current and potential DPs and IOs, on the progress of current initiatives and achievements on energy cooperation.

3.6.7 Collaborating with DPs and IOs, the REPP-SSN will identify bold strategies to develop robust and reliable energy data and energy outlook to facilitate policy analysis on the various energy-related issues for AMS. To achieve these key strategies, the REPP-SSN plans to arrange the signing of MoUs between ASEAN Ministers and two (2) key IOs such as International Renewable Energy Agency (IRENA) and International Atomic Energy Agency (IAEA) by 2020. Annual Ministerial dialogues on key issues relevant to ASEAN will be organised so that IOs can share the latest global developments and trends. Separately, a platform to reach out to established regional institutions/universities as well as industry to share national, regional and global energy trends on the advanced energy sector will also be established.

Table 8. Outcome-based Strategies PA.6: Regional Energy Policy and Planning

Outcome-based Strategy 1: To better profile ASEAN's energy sector internationally.	
Action Plans	a. Develop an annual publication on ASEAN Energy Cooperation to highlight the key activities of the SSNs and SEBs as well as the opportunities for further cooperation with DPs IOs. b. Publish regular regional energy outlooks. c. Publish ASEAN energy statistics, policy reviews and analysis series including issues related to the APAEC programmes.
Outcome-based Strategy 2: Raise the level of data and analysis on ASEAN's energy policy and planning.	
Action Plans	a. Conduct at least one (1) workshop/training course on energy policy and planning with relevant DPs/IOs. b. Conduct at least one (1) workshop/training course on in-depth data analysis with relevant DPs/IOs. c. Facilitate at least one (1) attachment secondment opportunity on data analysis with relevant DPs/IOs.
Outcome-based Strategy 3: Strengthen collaboration with DPs and IOs.	
	a. Organise policy dialogues with global and regional institutions on relevant energy developments, i.e. SOME/AMEM-Industry Dialogue or Ministers-CEO Dialogue, ASEAN Energy Business Forum (AEBF), etc. b. Organise a joint study and / or research with IOs, Research Institutes, Universities and Industry. c. Sign MoU or equivalent Agreement with two (2) new IOs by 2020.
Outcome-based Strategy 4: Strengthen resilience and emergency preparedness in energy infrastructure/facilities to mitigate the impact of climate change and natural disasters.	
	a. Conduct at least one (1) workshop/training course on emergency preparedness with relevant DPs/IOs. b. Work with SEBs and relevant DPs/IOs to conduct at least one (1) table-top emergency preparedness exercise. c. Conduct at least one (1) workshop/training course on vulnerability assessment of energy infrastructure/facilities with relevant DPs/IOs.

Outcome-based Strategy 5: Effectively manage the implementation of the APAEC 2016-2025.	
	a. Monitor and evaluate the progress of the APAEC programmes. b. Conduct a Mid-term Review of the APAEC 2016-2025 Phase I in 2018. c. Develop the APAEC 2016-2025 Phase II, starting in 2018 for endorsement by AMEM in 2020.

3.7 Programme Area No.7 – Civilian Nuclear Energy

Background

3.7.1 Civilian nuclear energy, as a clean source of energy can help ASEAN meet its growing energy demand in the region. As a number of the AMS have considered to embark on nuclear energy for power generation as an option, the Nuclear Energy Cooperation Sub-Sector Network (NEC-SSN) was established in 2008 as the responsible specialised energy body to shepherd ASEAN-wide cooperation and facilitate information sharing and exchange, technical assistance, networking and training on the use of nuclear energy for power generation purposes.

Key Achievements 2010-2015

3.7.2 The NEC-SSN has implemented several regional initiatives specifically related to challenges in civilian nuclear safety and security over the past 5 years. From 2012-2014, ACE and Korea Nuclear Association for International Cooperation (KNA) organised courses for a total of more than 120 ASEAN senior policy makers and working level personnel on nuclear energy policies, technologies and trends, operation and management, safety regulations and site visits to nuclear facilities. ACE also co-organised several workshops to increase the level of awareness and appreciation of nuclear energy security culture in cooperation with Russia, the U.S. and Japan. In 2015, ACE and China organised a capacity-building programme to enhance the understanding

on nuclear energy for more than twenty ASEAN senior decision-makers and to develop the path for nuclear energy cooperation between China and the ASEAN Member States.

3.7.3 To identify the key concerns of ASEAN to build its capacity in nuclear energy for power generation, the ACE, in collaboration with the NEC-SSN, conducted a survey on "Country Needs on Nuclear Cooperation". The 30th AMEM which was held on 12th September 2012 in Phnom Penh, Cambodia, noted the findings of the survey of country needs for nuclear cooperation which would serve as a useful reference for the NEC-SSN in enhancing the work programme with DPs and IOs.

Strategies and Action Plans 2016-2020

3.7.4 To enhance cooperation in areas such as public information/awareness, capacity building, including human resource development, education & training, nuclear safety, emergency preparedness and regulatory framework of civilian nuclear power plants (NPPs) in ASEAN, the NEC-SSN will collaborate with IOs such as IAEA, Asian Nuclear Safety Network (ANSN), Forum for Nuclear Cooperation in Asia (FNCA), amongst others, in accordance with the laws and regulations of the respective AMS and the relevant international agreements.

3.7.5 As public acceptance is very important for the plan, the NEC-SSN will continue to enhance capacity building activities and institutional arrangements for cooperation on nuclear energy in order to create public awareness and promote public education on NPPs and build a positive image of nuclear use in a comprehensive and concrete manner toward regional energy security; and encourage information sharing relating to civilian nuclear energy amongst the AMS in a systematic way.

Table 9. Outcome-based Strategies for Civilian Nuclear Energy

Outcome-based Strategy 1: Build up capabilities on nuclear energy, including nuclear regulatory frameworks, civilian nuclear safety on emergency response and preparedness, amongst policy makers and technical officers.	
Action Plans	a. Organise at least one (1) activity each on regional nuclear safety framework, public acceptance and emergency response with relevant DPs/IOs. b. Organise various study-visits, attached to the established international nuclear institutions. c. Conduct Technical-assistance/technical study on nuclear safety and enhance capacity on emergency planning exercises including emergency preparedness and response plans.
Outcome-based Strategy 2: Improve public understanding on nuclear power generation in the ASEAN region.	
Action Plans	a. Organise at least one (1) activity on public education to raise awareness on the development to better understand the necessity for nuclear energy as an alternative energy option for ASEAN. b. Develop regional public communication strategies to enhance understanding on nuclear power generation.
Outcome-based Strategy 3: Strengthen regional cooperation on nuclear.	
	a. Conduct a study on the potential regional nuclear energy arrangements / agreements. b. Create a portal of nuclear communities and database on nuclear for sharing information on nuclear regulatory systems, civilian nuclear safety on emergency response and preparedness, amongst policy makers and technical officers.

4. CONCLUSION

4.1 The APAEC 2016-2025 Phase I: 2016-2020

The APAEC 2016-2025 is a dynamic and living document which identifies outcome-based strategies and actions to enhance energy connectivity and market integration in ASEAN to achieve energy security, accessibility, affordability and sustainability for all under the framework of the AEC.

The AMS commitment and strong leadership through the specialised energy bodies and sub-sector networks, including ACE as the implementing secretariat, are crucial to the successful implementation of the APAEC. The APAEC is expected to bring benefits to all AMS and achieve the aspirations of the ASEAN Community under the ASEAN Charter.

Enhanced energy cooperation and collaboration with DPs/IOs, industries and the academia shall play an important role in the implementation of the APAEC.

4.2 The APAEC 2016-2025 Phase II: 2021-2025

The preparation of the APAEC 2016-2025 Phase II (2021-2025) shall be initiated in 2018 taking into consideration the various aspects of the implementation and progress of the APAEC 2016-2025 Phase I. The timeline is shown in Figure 9 below.

Figure 9 Timeline for the Review and Updating of the APAEC 2016-2025

LIST OF ACRONYMS

ACA	:	ASEAN Coal Awards
ACE	:	ASEAN Centre for Energy
ACDIS	:	ASEAN Coal Database and Information System
ADB	:	Asian Development Bank
AEA	:	ASEAN Energy Awards
AEBF	:	ASEAN Energy Business Forum
AEC	:	ASEAN Economic Community
AEMAS	:	ASEAN Energy Management System
AEO4	:	4th ASEAN Energy Outlook
AERN	:	ASEAN Energy Regulatory Network
AFOC	:	ASEAN Forum on Coal
AGCC	:	ASEAN Gas Consultative Council
AGTP	:	APG (ASEAN Power Grid) Generation & Transmission Planning
AIMS	:	ASEAN Interconnection Master Plan Studies
AJEEP	:	ASEAN-Japan EE Programme
AMEM	:	ASEAN Ministers on Energy Meeting
AMS	:	ASEAN Member States
ANSN	:	Asian Nuclear Safety Network
APAEC	:	ASEAN Plan of Action for Energy Cooperation
APG	:	ASEAN Power Grid
APGCC	:	ASEAN Power Grid Consultative Committee
APS	:	Advancing Policy Scenario
APSA	:	ASEAN Petroleum Security Agreement
ASCOPE	:	ASEAN Council on Petroleum
ASEAN-RESP	:	the Renewable Energy Support Programme for ASEAN
ASEAN-SHINE	:	ASEAN Standard Harmonization Initiative for Energy Efficiency
ATSO	:	APG Transmission System Operator Institution
BAU	:	Business as Usual
BSCFD	:	billion standard cubic feet per day
CAA	:	Commercial Arrangement Area
CCS	:	Carbon Capture and Storage
CCT	:	Clean Coal Technology
CEO	:	Chief Executive Officer

CERM	:	Coordinated Emergency Response Measures
CNE	:	Civilian Nuclear Energy
CO_2	:	Carbon Dioxide
CSR	:	Corporate Social Responsibility
DPs	:	Dialogue Partners
ECAP	:	Energy Conservation Workshop under AJEEP
EE	:	Energy Efficiency
EE&C-SSN	:	Energy Efficiency and Conservation Sub-sector Network
EMTIPS	:	Energy Market Transformation with Information Provision Scheme
ESCOs	:	Energy Service Companies
ESSPA	:	Energy Supply Security Planning Program
FNCA	:	Forum for Nuclear Cooperation in Asia
FSRU	:	Floating Storage and Regasification Unit
FTR	:	Full Term Review
GCCSI	:	Global Carbon Capture and Storage Institute
GDP	:	gross domestic product
GIZ	:	Deutsche Gesellschaft für Internationale Zusammenarbeit
GW	:	Gigawatt
HAPUA	:	Heads of ASEAN Power Utilities/Authorities
HPA	:	Hanoi Action Plan
HYCOM	:	Hydropower Competence Centre
IAEA	:	International Atomic Energy Agency
IEA	:	International Energy Agency
IMF	:	International Monetary Fund
IOs	:	International Organisations
IRENA	:	International Renewable Energy Agency
ISO	:	International Organization for Standardization
JCOAL	:	Japan Coal Energy Centre
JDA	:	Joint Development Area
JAIF	:	Japan-ASEAN Integration Fund
KNA	:	Korea Nuclear Association for International Cooperation
LNG	:	Liquefied Natural Gas
LTMS	:	Lao PDR, Thailand, Malaysia, Singapore
MDBs	:	Multilateral Development Banks

MEPS	:	Minimum Energy Performance Standards
Mmscfd	:	Million standard cubic feet per day
MoU	:	Memorandum of Understanding
MRA	:	mutual recognition arrangements
Mtoe	:	million tonnes of oil equivalent
Mtpa	:	million tonnes per annum
MW	:	megawatt
NEC-SSN	:	Nuclear Energy Cooperation Sub-sector Network
NPPs	:	nuclear power plants
OECD	:	the Organisation for Economic Co-operation and Development
PIP	:	Power Integration Project
PPP	:	purchasing power parity
PROMEEC	:	Promotion of EE&C
PV	:	Photovoltaics
QTR	:	quarter
R&D	:	Research and development
RE	:	Renewable energy
REPP-SSN	:	Regional Energy Policy and Planning Sub-sector Network
RE-SSN	:	Renewable Energy Sub-sector Network
RGT	:	regasification terminals
SEAcORE	:	South East Asian Collaboration for Ocean Renewable Energy
SEB	:	specialized energy body
SLNG	:	Singapore LNG
SOME	:	Senior Officials Meeting on Energy
SSNs	:	sub-sector networks
TAGP	:	Trans-ASEAN Gas Pipeline
TBC	:	to be confirmed
TPES	:	Total Primary Energy Supply
TWh	:	terawatt-hours
UNEP	:	United Nations Environment Programme
UNFCCC	:	United Nations Framework Convention on Climate Change
U.S	:	Unites States of America
VAP	:	Vientiane Action Plan
WEO	:	World Energy Outlook

ACE Building, 6th Floor
Jl. HR. Rasuna Said Block X-2, Kav. 07-08
Jakarta 12950, Indonesia
Tel No: (62-21) 527 9332
Fax No: (62-21) 529 9350

www.aseanenergy.org