



**Asia-Pacific  
Economic Cooperation**

**APEC Workshop on Promoting the Development of Biomass Energy**

**Ha Noi, Viet Nam**

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**Summary Report**

**Energy Working Group**

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# **APEC Workshop on Promoting the Development of Biomass Energy**

**Ha Noi, Viet Nam**

## **Summary Report**

### **I. Introduction**

On 26 and 27 July 2016, the **APEC Workshop on Promoting the Development of Biomass Energy**, initiated by Viet Nam and co-sponsored by China and the United States, was held in Ha Noi, Viet Nam. Speakers and participants came from 10 APEC member economies (Chile; Indonesia; Malaysia; New Zealand; the Philippines; Peru; Chinese Taipei; Thailand; USA; Viet Nam) and one international organization (the Organization for Economic Cooperation and Development - OECD). Most of the Workshop participants were from the public sector, academic institutions or the private sector relating to biomass energy.

The Workshop sought to provide the opportunities for renewable energy experts, especially those in biomass energy from APEC member economies, biomass energy producers and investors (business sector) to share advantages, disadvantages, obstacles and recommendations on how to remove the obstacles and facilitate the development of biomass energy. It also aimed at creating a platform for APEC member economies to discuss, exchange on experiences, current strategies, policies, regulations and technologies on biomass energy facilitation and development. Last but not least, it is expected to explore potential cooperation opportunities among APEC member economies in developing biomass energy.

### **II. Background**

This project is designed to implement Leaders' and Ministers' notes in 2008 that "access to adequate, reliable, clean and affordable energy resources is vital to sustaining economic prosperity in the region." Furthermore, in 2011, the APEC Leaders clearly stated to promote green growth: "We are committed to advancing our shared green growth objectives. We can and must address both the region's economic and environmental challenges by speeding the transition toward a global low-carbon economy in a way that enhances energy security and creates new sources of economic growth and employment." At the 4<sup>th</sup> APEC Energy Ministerial Meeting in 2012, Ministers reiterated their work to "develop renewable energy sources" to increase energy security, contribute to APEC's "economic development and reduce emissions of carbon dioxide and other pollutants into the atmosphere." In 2014, APEC Economic Leaders recognized "the importance of promoting diversified energy supplies". Accordingly, in 2014, APEC Energy Ministers committed to promoting diversified energy supplies, where biomass energy is one of the important sources of renewable and clean energy.

Furthermore, this project would contribute to the APEC Energy Security Initiative (ESI). The APEC Leaders, once again, are committed to strengthening APEC Energy Security, and clearly stated in the 2012 Declaration: “Promote technology development and deployment of a low-emission energy supply including carbon capture, storage and use, and renewable energy sources such as bio energy from sustainable biomass sources” and in the 2013 Declaration: “Invigorate work to develop clean and renewable energy through public-private partnership, as a promising approach to ensure sustainable investment and development of new technology, and to promote energy security and efficiency and lowering of greenhouse gas emissions”. They also reiterated “to reduce APEC's aggregate energy intensity by 45 per cent by 2035”. In addition, this project directly supports the Action Plan in the APEC Leaders' Growth Strategy (2010) with regard to renewable energy development.

Themes covered during the two-day event included: (i) *The Overview of Biomass Energy Development in the APEC Region*; (ii) *Biomass Energy Development – Perspectives from the Public Sector*; (iii) *Biomass Energy Development – Perspectives from the Private Sector*; (iv) *Biomass Energy Development – Perspectives from International Organizations and the Academic Sector*; (v) *Case Studies in Biomass Energy Development in some APEC Member Economies* and (v) *The Way Forward*.

### **III. Discussion**

#### **Outcomes**

The *APEC Workshop on Promoting the Development of Biomass Energy* included two days for presentations and discussions on the state-of-play, development and trends of biomass energy development; views from various sectors on the development of biomass energy and recommendations on the way forward. The last session (recommendations for future activities) provided an opportunity to share what participants can take away from the Workshop, overcoming difficulties and promoting biomass energy development at the domestic and regional level as well as to suggest potential APEC capacity-building activities to most benefit APEC member economies. Overall, the Workshop achieved its main objectives as described in the project proposal. Moreover, all participants considered that it afforded many chances for valuable networking among representatives from the policy community, academics and private-sector actors in biomass energy sector from within and outside the APEC region.

#### **Key Issues Discussed**

##### *Opening remarks*

In his opening remarks, **H.E. Mr Nguyen Cam Tu (Deputy Minister of Industry and Trade, Viet Nam)**, stressed that in the APEC developing economies like Viet Nam, renewable energy is a relatively new field, undeveloped and accounts for a very modest proportion of the total energy supply of the economy. This condition is due to the fact that the majority of the developing economies in the Asia-Pacific region have the same characteristics and weaknesses: the lack of infrastructure, expertise, poverty of practical

experience in the management and operation of the machine operates, the limitation of resources especially technological resources and finance.

In his opinion, biomass includes natural plants, industrial plants, algae etc.. or as agricultural residues and forestry. Moreover, biomass also includes material considered of waste from food production process water, sludge/sewages, fertilizers, additives products industry etc. He highlighted that if we know how to take the advantage effectively and scientifically, huge biomass resources should be produced every day on earth and would help generating tremendous energy resources, which will be beneficial for both human lives and the environment.

According to Mr Nguyen, APEC has been implementing many exciting collaborative activities to enhance energy saving and the development of clean energy sources, in order to achieve the objective of the sustainable development of the APEC members

The Deputy Minister expressed hope that with the active participation of scholars, policy makers, representatives from organizations and the private sector in and out of the Asia Pacific region, the Workshop participants would be able to identify and to propose many useful and feasible initiatives, aiming to maximize the effectiveness of the biomass energy in order to ensure social security and sustainable development.

#### *Workshop's sessions*

Experts provided presentations on the following topics:

1/ In Session 1, **Mr Todd Pray, Department Head, Advanced Biofuels Process Demonstration Unit, Berkeley Lab, University of California, USA** presented about “The Overview of Biomass Energy Development in the APEC Region”. **Mr Todd Pray** started his presentation by showing a diagram about biofuel technology “pathways” and listed out names of organizations dealing with these issues of the State such as Bioenergy Technology Office, Office of Energy Efficiency and Renewable Energy. He shared that, after decades of Department of Energy (DOE)’s support, four commercial bio-refineries have begun production and DOE helped new technologies overcome gaps in private sector funding. The speaker shared that, in September 2014, three projects were selected under the DPA Initiative to build commercial bio-refineries to produce drop-in fuels for military applications, domestic fuels from non-food biomass feedstocks, cost – competitive biofuels. Mr Todd Pray also mentioned about the bio-economy concept and the potential impacts of a billion ton bio-economy. About the key products in development, the speaker shared that the US produced 15% of global chemicals and chemicals comprise 12% of all US exports. The current biomass utilization for energy in the US includes corn grain, wood/wood waste, vegetable oils, landfill gas, biogenic MSW, animal manure etc. He provided some outstanding projects in biomass energy such as POET-DSM, DuPont and Abengoa. The speaker presented in-depth information on ideas of California state, which can significantly cut greenhouse gas emission through 2030. California focused on organic waste utilization and food waste availability. At the end of the presentation, Mr Tood Pray introduced about Zero waste Energy Development Company (ZWEDC)/LBNL Collaboration which is the

largest dry anaerobic digestion facility in US and generates renewable power, compost, fertilizer.

During discussions, **Mr Todd Pray** explained that California State has a goal towards 100% renewable energy in its electricity and currently investment in renewable energy focused on technology. Regarding California state greenhouse gas emission policies, Mr Pray highlighted that the State provides credits under the Low Carbon Fuels Standard for advanced bio fuels and California's policies are more stringent and go beyond those of the whole economy. California has an ethanol industry and also significant oil production. In California, some analyses indicate that 15 per cent of organic waste goes to bio energy, Mr Pray replied to the participants that the rest of organic waste goes to landfill and technologies are being developed to use more of this resource. Comparing thermos-chemical and bio-chemical process, the speaker was of the view that biochemical has some advantages such as specificity of production of certain molecules as compared to thermochemical derived bio-crude oil, which may have issues when blending with traditional crude oil. Last but not least, Mr Pray insisted that renewable energy fuel is not the goal in the US only but also a global goal and a number of companies world-wide participated in the bio-fuel industry over many year and have diversified and sold other higher value products such as facial cream, fragrance, etc. derived from bio-based processes.

2/ During Session 2 on “Biomass Energy Development – Perspectives from the Public Sector”, there were two speakers: **Mr Nguyen Duc Cuong (Director of Renewable Energy, Institute of Energy, Viet Nam)** and **Mr Zulfan Zul (Head of Bioenergy Engineering and Environmental Affairs, Directorate General of New Renewable Energy and Energy Conservation, Ministry of Energy, Indonesia)**.

- **Mr Nguyen Duc Cuong** first introduced biomass resource availability in Viet Nam that includes agriculture residues, energy crops, forest residues and others. According to Mr Nguyen, natural forest and rice straw create the highest energy for usage. He shared that, the biomass consumption mostly are used for heating at industry and family. The biomass conversion and supply technologies are direct combustion, gasification, charcoal and briquettes and pellets. Mr Nguyen provided some figures of biomass energy development with support from the Ministry of Industry and Trade or the Government of Viet Nam. In his view, electricity purchase price incentive and taxes incentive are two important supports from the government. For the price incentive, the Electricity Corporation of Viet Nam (EVN) must buy all electricity from the grid-connected biomass power plants according to the Standardized Power Purchase Agreement (SPPA), the contract duration is up to 20 year with possible extension and applied for two main types of biomass projects. For the tax incentive, exemption of import duties will be applied for the imported materials, equipment, equipment and machineries which are not manufactured yet in Viet Nam; special support for investment. Mr Nguyen introduced some biomass projects under planning and pipeline. He shared the target of Viet Nam’s government in 2020 is 265 TWh, 2025 is 400 TWh and 2030 is 572 TWh. Mr Nguyen concluded his presentation

by observing that Viet Nam has great potential to develop biomass for energy, however the exploitation is limited and not correspondent to the economy's potential. Besides, the planning/mapping of biomass electricity development needs to be conducted soon.

- **Mr Zulfan Zul** divided his presentation into three main parts: *(1) Policy for Energy Development; (2) Policy and Implementation of Bioenergy; (3) Incentives and Investment*. He first introduced about the priority for domestic energy development based on five principles. Mr Zul showed a diagram about the new and renewable energy supply refers to Indonesia's Energy Policy in 2025. In addition, he listed out some main policies on bioenergy development which include laws and regulations. The potential of producing bioenergy was presented through some tables and pictures. The speaker said that Indonesia has potency to produce palm oil mill and in fact there are 686 units of palm oil mills, the average of capacity 30 to 60ton/hour of FFB processed. The current capacity of bioenergy based on-grid power plant in 2015 was 119,6 MW (palm oil waste 102 MW; municipal solid waste 17,6 MW) and off-grid power plant was 1.626 MW. Biomass in Indonesia can generate electricity up to 32 GW, according to Mr Zulfan information. Mr Zul also highlighted the Waste to Energy (WtE) Program that can be developed in all regions of the economy and contributes to improve the cleanliness and health of the city. The Program received great support from the government and partners such as EU. The Government of Indonesia has provided incentive to the bioenergy sector by creating market, pricing and feed-in tariff, financial incentives, easing in licensing, research and development. He showed way to start an investment in Indonesia and suggested three type of cooperation include: human, technology and business development. To conclude the presentation, Mr Zul emphasised that the Government of Indonesia together with all stakeholders would continuously support bioenergy development. Indonesia would continue to work with other economies and international community to develop sustainable bioenergy and also global environmental issues.

During discussions, **Mr Zulfan Zul** explained that Indonesia has been rationalizing fossil fuel and increasing renewable energy percentage with a balance of demand and supply side. On a question from the floor on ways that Governments do to develop biomass energy market, Mr Zulfan Zul provided information that the Government will issue regulations and policies as well as tax incentives and percentage of biomass power in the total electricity. He also explained that in Indonesia, state owned enterprises have to purchase electricity from renewable energy sources with subsidized prices. Regarding technologies to develop biomass energy, Mr Zul stated that some technologies are imported but most of them are developed domestically. Moreover, he observed that Indonesia has huge solid wastes from farms but challenge is to mix buns of supplies for energy development.

During discussions, **Mr Nguyen Duc Cuong** stated that the Government of Viet Nam has a big ambition in developing biomass energy by 2030 but barriers still remained: He

observed that more interventions and stronger policies are needed from the Government. In the context that coal thermal power plants are complained due to dust and smoke pollution, biomass plant should be considered as they help to solve the situation. In addition, loan interests are high, the price of bio-energy is relatively low, technological efficiency is also low (currently in Viet Nam, there are 42 biomass plants are operating with capacity of 23 MW/each plant). On Government's support, Mr Nguyen reiterated that supports are in forms of price subsidies, tax incentives, low interests (8.55 per cent per year) from the Bank of Development of Viet Nam. He informed that the Ministry of Industry and Trade of Viet Nam are drafting a guidebook to invest in biomass energy to reduce procedures for investors. Mr Nguyen also provided information that imported equipment for biomass plants will be exempted from import duties and the Government of Viet Nam also provides supports in terms of eliminating and reducing enterprise income taxes, preferences in land and building rental. In the long term, the Government of Viet Nam will continue subsidies for supplying energy for poor and remoted households. Last but not least, Mr Nguyen observed that there is a need of reasonable policies to phase out subsidies for coal, oil and other forms of fossil fuels.

3/ During Session 3 on “Biomass Energy Development – Perspective from the Private Sector”, there were two speakers: **Mr Vu Quang Dang** (**Manager, Quang Trung International Consultancy firm, Viet Nam**) and **Mr Edgardo A. Alfonso** (**Chief Operating Officer San Jose City I Power Corporation, San Jose City, the Philippines**).

- **Mr Vu Quang Dang** divided his presentation into three parts: *Introduction of Viet Nam and Energy Sector; Biomass Energy in Viet Nam; Perspectives from the Private Sector in Biomass Energy Development in Viet Nam*. In the introduction part, he shared that, the generation and buying was 159.4 billion kWh in December 2015 with electricity growth of 11.4%. The power plants are mostly hydropower, wind power and biogas. About the potential and current status of biomass energy in Viet Nam, Mr Vu reiterated that with the variety of resources, Viet Nam can install 100 factories with a capacity up from 500 to 20 MW each. Since biomass energy is mostly used for heating, powering, briquetting/ pelleting, he also shared some information about the target of Viet Nam's Government in producing biomass energy. Regarding the policies and regulations, Mr Vu provided some examples in pricing, contract duration, incentive on investment fund and export credit, plan of using biomass etc. At the end of the presentation, the speaker listed out some advantages and disadvantages in biomass energy development in Viet Nam from the perspective of private sector.
- **Mr Edgardo A. Alfonso** began his presentation by briefing about the Philippines Renewable Energy Law (RA9513). He mentioned some common sources of dry and wet biomass in the Philippines. There are three kind of biomass to energy technology including power/heat generation using biomass as fuel, biochar production, refuse derive fuel. Mr Alfonso cited out some advantages, disadvantages of biomass energy and also drivers of biomass energy

development in the Philippines' private sector. Furthermore, he named some challenges in biomass energy development such as site selection, permitting and licenses, politics, funding and finishing the project as per government approved work program budget. Mr Alfonso shared that under rules of the Philippines' Department of Energy, biomass projects are given a time frame of 3 years from project planning to commercial operation. The speaker provided some figures about power situation outlook in the Philippines which showed that the available capacity will increase from 16,000 MW to 26,000 MW in 2030. To conclude the presentation, Mr Alfonso showed pictures and information on some biomass energy projects in the Philippines.

During discussions, **Mr Edgardo A. Alfonso** insisted that support from the Government is crucial especially on FIT and land conversion policies otherwise the private sector will face with difficulties in approaching potential biomass energy area of development. He reiterated that APEC economies should prioritize developing biomass energy and other clean technologies for their energy needs. With adequate government supports biomass energy plants are easy to put up and are good in terms of mitigating climate change. However, the Philippines' energy sector is still heavily dependent on imported coal and oil, while its abundant biomass energy resources are waiting to be fully harnessed. He recommends that biomass energy development should be given an open ended target as biomass power generation plants are good replacement for coal-fired power plants.

During discussions, **Mr Vu Quang Dang** is of the view that compared to wind and solar energy, it seemed that biomass energy is lack of attention in Viet Nam. He strongly believes that investment in biomass energy will add more value and benefits all stakeholders (investors, the people, and agricultural sector). Moreover, the price of electricity from biomass energy should be increased as it's now quite low. Mr Vu stated that biomass energy is quite new and there has not been proper database on biomass energy in Viet Nam. There should be a specific mechanism and regulation on biomass energy as the general mechanism (currently applying for solar and wind energy) is inapplicable for biomass.

4/ During Session 4 on “Biomass Energy Development – Perspectives from International Organizations and the Academy Sector”, there were two speakers: **Mr Todd Pray (Department Head, Advanced Biofuels Process Demonstration Unit, Berkeley Lab, University of California, USA)** and **Mr Gerard Bonnis (Principal Administrator in the Environment Directorate, Organization for Economic Cooperation and Development - OECD)**.

- To begin the presentation, **Mr Todd Pray** introduced Berkeley Lab which leads efforts that combine the power biology with the tools of engineering to develop sustainable energy solutions and improve human health. Mr Todd Pray shared an example about actinorhodin case study which showed the whole process from the components to the factoring design, construction and metabolomics. He mentioned about 3 case studies from working with different bio-product and bio-

energy companies Lygos, Microvi Biotechnologies and FATER. Some advanced technologies were also introduced such as lab-scale hydrolysis process optimization, bench-scale enzymatic saccharification, optimized hydrolysis performance at bench scale, bench-scale fermentation validation, mock and post-consumer waste material performance. At the end of the presentation, the speaker introduced about ABPDU which was established by American Recovery and Reinvestment Act funding in 2009. Some biomass energy of ABPDU were presented including biomass pretreatment and catalysis, enzymatic saccharification, fermentation, recovery and rheology, and analytical chemistry.

- As a Senior Policy Analyst of OECD, **Mr Gerard Bonnis** first described recent trends and outlooks in the global use of biomass energy. According to the IEA, biomass energy currently accounts for 10% of global primary energy demand, being the 4<sup>th</sup> largest energy source after coal, oil and natural gas. By 2030 the IEA expects China to take the lead in the use of solid biomass for electricity generation (to keep up with growing electricity demand). After that, Mr Bonnis warned about the need to carefully assess the environmental impacts of biomass energy before promoting its use. In particular, there is an ongoing debate on the impact of biofuel feedstock production on land use change (direct and indirect). The carbon neutrality of woody biomass is also being challenged (e.g. burning wood takes few minutes whilst CO<sub>2</sub> uptake by new trees takes decades; hence CO<sub>2</sub> uptake would need to be discounted related to the immediate release of CO<sub>2</sub>). Besides, the biomass-fired power plants are often based on similar technologies as fossil fuel-fired power plants, which allowed their early deployment at commercial scale. However, the CO<sub>2</sub> efficiency of electricity production via woody biomass combustion is lower than with coal and the incomplete burning of biomass is responsible for 15% of methane emissions from the energy sector. Biomass energy initial development was motivated by the promise of greenhouse gas emission savings, i.e. on the assumption that its use was carbon neutral. This assumption remains to be demonstrated and other externalities associated with biomass energy production need to be carefully assessed. Mr Gerard Bonnis then shared OECD policy advice to build the foundation for a greener energy sector which includes, in particular, putting a price on carbon and phasing out fossil fuel subsidies. At the end of the presentation, the speaker highlighted the need to develop sustainability criteria to promote the development of biomass energy. He also reiterated that powering cars with edible plants and burning wood to make electricity were still causing controversy in the world. Nine OECD Council recommendations on assessing the sustainability of “Bio-based products” were listed out for reference.

During discussions, a view from the floor was that non-governmental organizations have been complaining about deforestation to produce biomass energy feedstock (e.g. a dispute arose between an NGO and an energy company wishing to ship wood pellets to Europe that had originated from Canadian primary forest - supposedly infested with the mountain pine beetle). Air pollution concerns were also raised about burning wood for

heating. Therefore, it is essential to manage forests and use wood sustainably. A participant also informed that when it comes to road fuels, Governments levy taxes rather than granting public financial support (e.g. in the EU, taxes commonly account for 75 per cent of road fuel price). **Mr Todd Pray** shared information that the US set standards for vehicle using biofuel as well as incentives for price of bio-fuel. He gave an example in California regarding an initiative on low carbon fuel standards (has been applied for 3 years) and priorities in getting loans for large scale projects. Mr Brian Cox (a speaker from New Zealand) raised concern on biofuel subsidies and their consequences for the biomass energy market if they are removed and business dependent on them consequently fail when policies change. He informed that in New Zealand that there are no biofuel subsidies but Government supports development of the biomass energy market through assistance through the Bioenergy Association on preparation and delivery of information, case studies and installation of demonstration facilities. Assistance is given through the Association to both biomass energy fuel suppliers and users.

5/ During Session 5 on “Case Studies in Biomass Energy Development in some APEC Member Economies”, there were two speaker: **Dr Maliwan Haruthaithasan (Deputy Director, Kasetsart Agriculture and Agro-industrial Product Improvement Institute (KAPI), Kasetsart University, Thailand)** and **Mr Brian Cox (Executive Officer, Bioenergy Association of New Zealand, New Zealand)**.

- **Dr Maliwan Haruthaithasan** started her presentation by introducing Thailand’s energy update with the total energy consumption from 2009 to 2014 and the installed capacity of electricity generation. She shared some plans and policies related to biomass energy in Thailand which include Alternative Energy Plan, Power Development Plan, Energy Efficiency Development Plan etc. Thailand is considered to have potential development on biomass energy with large land use and various sources of biomass feedstock. The speaker showed a diagram on the supply chain of Biomass in Thailand from the agriculture products (input) to the biomass power plants and other industrial plants. **Dr Haruthaithasan** mentioned the Thailand alternative energy development plan (AEDP) 2015 which has the objectives to promote power generation from municipal solid waste, biomass and biogas to benefit farmer and communities, to set target of the provincial renewable energy development by zoning of electricity demand and renewable energy potential, to power generation from solar and wind if the investment cost will be able to compete with power generation using liquefied natural gas and to incentive for using competitive bidding and promoting the utilization by energy consumption reduction. She shared about AEDP targets and current situations in the form of electricity and some supporting measures. In summary, she briefed on Strategic Plan for Biomass Energy Development with three strategic issues and cited out some biomass energy development barriers.
- After giving a brief introduction about Bioenergy Association, **Mr Brian Cox** presented New Zealand energy market which include natural resources, the

energy consumption, government policies, energy end use by sector and predicted growth in biomass energy. The speaker shared some issues related to developing the biomass energy from the organic waste, transportation, technologies, growth. Mr Cox provided comprehensive information on the wood energy in New Zealand which supply 14% of New Zealand energy and well established conventional combustion technologies. Besides, there are opportunities for additional plantation forestry as New Zealand is hill economy so it is ideal for forestry. About wood fuel market issues, Mr Brian Cox mentioned about sale and purchase issues for example: multi-sources of fuel requirements, buyer-seller communication, and quality specification. To improve the energy market, the speaker gave some recommendations from the information exchanges between buyers and seller to the action to ensure quality of biomass energy and quality management system. In conclusion, Mr Brian Cox shared some experiences in fuel testing, strength of biomass energy and also barriers to growth of biomass energy.

During discussions, regarding assessing qualities of pellets, **Mr Brian Cox** reaffirmed that the qualities of pellets are internationally standardized. Customers can choose pellets on different criteria. In New Zealand, there has not been import-export activities of pellets due to long distance from New Zealand to other economies. In terms of waste and pollution of biomass projects, Mr Cox informed that the environmental standards are applied in this case, regardless of types of plants. New Zealand give priorities to processing on-site water and dealing with air pollution. Regarding prices from biomass energy, Mr Cox stated that there is no public information but he believed that areas that has coal will have lower price. However, he gave an example that a plant using a boiler that cause air pollution so it had to purchase wood pellets (costly as wood pellets have to be shipped from far away region) but it's a kind of trade-off as the plant will not need to buy a new boiler.

During discussions, **Dr Maliwan Haruthaithasan** informed that licences for building a biomass plant in Thailand is time consuming as it is required to get permission from the Ministry of Energy and the Ministry of Industry. She observed that the success of biomass energy development in Thailand is thanks to marketing strategies of the private sectors, assisting from the Government to the private sectors, capacity building activities of the Government to train farmers and communities. A participant from Thailand provided information that the Government of Thailand set the objective of producing 5,500 MW biomass electricity in 2036, which is quite challenging. The participant also stated that the Government of Thailand has assisted investors to use biomass burner instead of fossil burner (assisting in 30 per cent of investment, maximum 2 million Thailand Baht).

#### **IV/ Conclusions and Recommendations**

1/ The consensus view of the Workshop's speakers, moderators and participants agreed that the project achieved its intended objectives. They considered the Workshop to have evaluated to be good for APEC to continue to share and discuss in-depth and various

knowledge, experience and challenges on biomass energy development from various APEC member economies. Participants also said that the Workshop had provided a great opportunity for networking with experts from within and outside APEC region.

2/ The Workshop concluded with a break-out session, which discussed: (i) Ways to overcome difficulties and promote biomass energy development at the domestic and regional level; (ii) Enhancing capacity building activities to promote biomass energy.

2.1/ The Workshop's participants listed, among others, challenges in biomass energy development such as high disparity of prices between biomass and oil, land use, funding, feedstock consolidation, logistics and transport of feedstock, technology, research and development of bioethanol and biofuel, efficient biomass energy law and regulation, procedures to develop a biomass plant, lack of a long and stable bioenergy policy etc. They suggested ways to overcome difficulties and promote biomass energy development at the domestic and regional level should be:

- To promote biomass energy at municipal level with evaluation on own resources to best use their biomass to generate energy;
- To develop firm policies and regulations to give good economic impacts/ specific targets on biomass energy utilization. To appoint a specific agency (i.e one-stop center) to facilitate biomass energy development;
- To promote competitive advantages at company level;
- Focus on 1 or 2 biomass energy priorities and respective technologies, especially key technologies on power generation system;
- Develop APEC common standards in biomass energy area as well as a harmonized regional standards on biomass palettes;
- Transparency in biomass energy regulation;
- Develop APEC case studies or best practices on biomass energy development;
- Set clear targets on biomass energy development;
- Set up joint projects among APEC members;
- Capacity building for APEC members on small low-risk projects
- Establish an APEC network for information sharing on biomass energy development
- Continue information sharing on strategies and experience to develop biomass projects, policies on research and development on new crops etc.

2.2/ The Workshop's participants suggested ways to enhance capacity building activities to promote biomass energy should be:

- Activities towards skilled workers for biomass plants;

- Develop new products, new research areas;
- Promote trainings/workshops which include field trips/site visit;
- Establish partnership among biomass energy developers;
- Utilize existing documentation, trainings, case studies.