

**NATIONAL KEY ECONOMIC AREAS
(NKEA)**

**NATIONAL BIOGAS IMPLEMENTATION
(EPP5)**

**BIOGAS CAPTURE AND CDM PROJECT
IMPLEMENTATION FOR PALM OIL MILLS**

1.0 INTRODUCTION

Version 1.0: 1 December 2010

1.1 Purpose

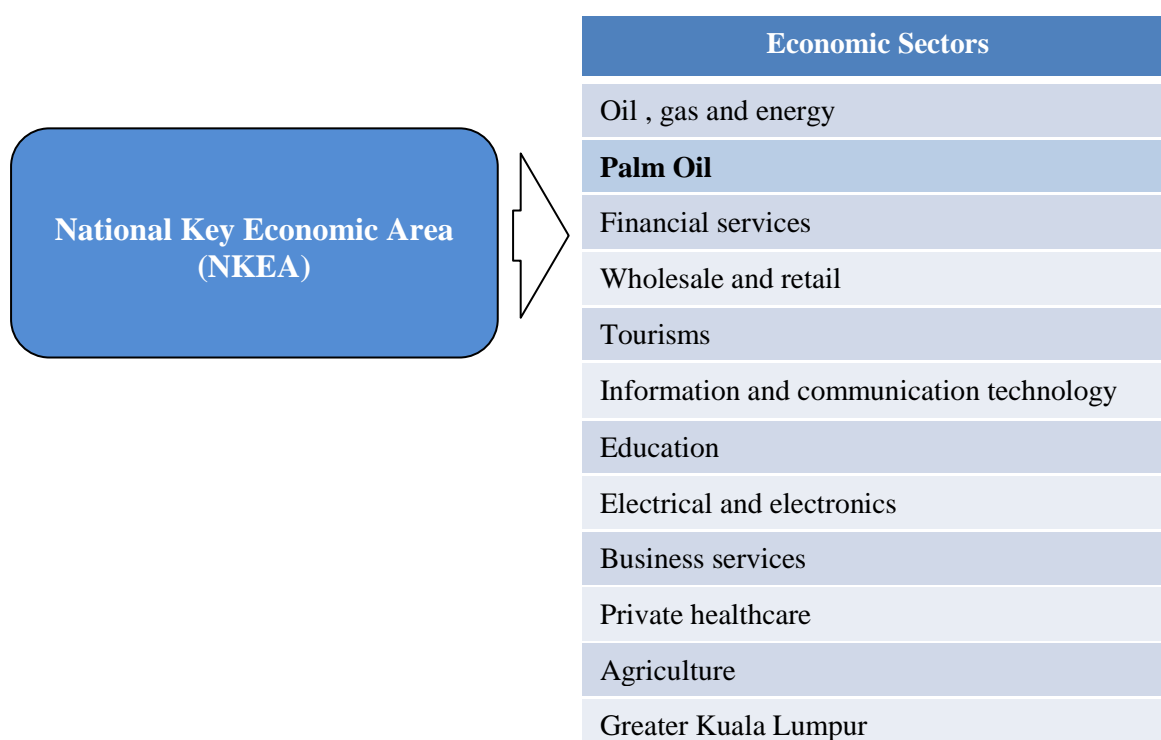
The purpose of this document is;

- To encourage palm oil mills in Malaysia to implement biogas trapping and utilisation
- To inform palm oil millers on the benefits of biogas trapping and provide the relevant information to facilitate planning and implementation

The importance of biogas trapping is evident from its inclusion as one of the eight Entry Point Projects (EPPs) of the palm oil sector under National Key Economic Areas.

1.2 National Key Economic Area (NKEA)

Malaysia is to focus on 12 National Key Economic Areas (NKEAs) to boost the economy and achieve a high income status by 2020. These 12 NKEAs are the core of the Economic Transformation Programme (ETP) and will receive prioritised government support including funding, top talent and Prime Ministerial attention. In addition, policy reforms such as the removal of barriers to competition and market liberalisation will be targeted at these NKEAs. This programme (NKEAs) will be the driver to stimulate economic activity that will contribute towards attaining high income, sustainability and inclusiveness to the nation.



There will be dedicated attention from the Prime Minister and fast-track mechanisms to resolve disputes or bottlenecks in implementing the NKEAs. The Government is also committed to the on going support of growth in the non-NKEA sectors. However the Government will focus and put more efforts on realizing the NKEAs because of the significance of their potential Gross National Income (GNI) contribution.

1.3 NKEA: Palm Oil

Malaysia’s palm oil industry is one of the important industries of the nation and it is the fourth largest contributor to the national economy and currently accounts for RM53 billion in GNI. The Palm Oil NKEA is targeted to raise a total GNI contribution of RM125 billion to reach RM178 billion by 2020. As a major contributor to economic growth, the palm oil NKEA programme plans to implement eight cores Entry Point Project (EPPs) in spanning the palm oil value chain. The palm oil cores EPPs programme are;

Palm Oil NKEA Programme		
Upstream productivity and sustainability	EPP 1	Accelerated replanting to clear backlog of old, low yielding palms
	EPP 2	Increase the national fresh fruit bunches (FFB) yield
	EPP 3	Improve workers’ productivity through the introduction or scale up new techniques
	EPP 4	Increase national average oil extraction rate (OER)
	EPP 5	Build biogas facilities at mills across Malaysia
Downstream expansion and sustainability	EPP 6	Shift Malaysia’s focus towards high value oleo derivatives
	EPP 7	Emphasise early commercialisation of second generation biofuels
	EPP 8	Expedite growth in food & health-based downstream segment

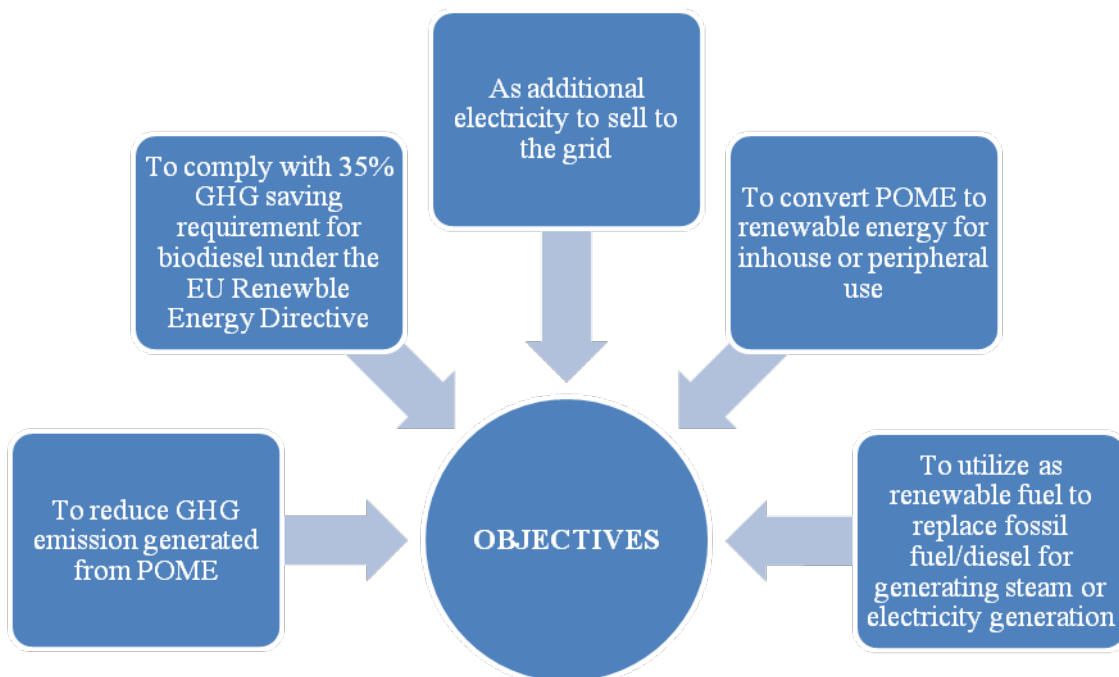
EPPs No.5 aims to achieve the installation of biogas facilities in all palm oil mills in Malaysia by 2010.

2.0 EPP 5: BUILD BIOGAS FACILITIES AT MILLS ACROSS MALAYSIA

2.1 Biogas As Potential Renewable Energy (RE)

2.1.1 Why embark on biogas capture?

It is most importance for the palm oil industry to capture biogas from POME. The reasons and benefits of biogas capture are many. These include additional revenues from sale of surplus energy and carbon credits. Furthermore, biogas capture will reduce the carbon footprint of palm oil production and enable competitive market access of palm products to environmentally sensitive markets such as the European country (EU) and United State (AS).



2.1.2 Benefits of Biogas Capture

- Reduces the emission of Greenhouse Gases (GHGs) i.e methane and CO₂
- Reduces land used for palm oil mill effluent (POME) treatment
- Enhance revenue of palm oil mill
- Could be implemented as Clean Development (CDM) project
- The CDM project transforms reduction of emission of CO₂ and methane into cash flow through sale of carbon credits

- Reduce global and local environmental impact
- Encourage technology innovation and R&D

Reduce dependence of fossil fuel, and enhances fuel diversity and security of energy supply.

2.1.3 How to Capture Biogas?

POME biogas capturing has gained attention across palm oil industry due to the vast potential of methane recovery for clean renewable gas fuel as much as for the avoidance of greenhouse gas emissions (GHG) which is recognized by the Clean Development Mechanism (CDM) under the Kyoto Protocol for Certified Emission Reduction (CER) credits.

Biogas capturing from POME can be carried out by a number of methods, based on various local and foreign technologies. Closed-tank anaerobic digester system with Continuous Stirred Tank Reactor (CSTR), Methane Fermentation System and Reversible Flow Anaerobic Baffled Reactor (RABR) system are among the technologies offered by the technology providers.

2.1.4 Utilization of Biogas Capture

Biogas can be used for all applications in place of natural gas. Since most boilers do not require high quality gas specification the use of biogas in boilers are most encouraged and has been increasing rapidly. Stationary engines such as pumps, generators and power tools are also a popular option for the utilization biogas. In vehicle fuel, upgrading of the biogas quality is necessary. Upgrading the biogas includes the reduction of H₂S concentration and CO₂. Connecting the electricity generated to the national electricity grid is another profitable way of utilizing the biogas, which is in tune with the target set in the Malaysian Fifth Fuel Policy of achieving 5% of national grid-connected electricity generation from renewable sources.

2.1.5 Comparison of Biogas Capture Technologies

Several systems to generate biogas from POME have been developed using both local and foreign technology. The technologies are summarised as follows;

Name of technology provider	System	Life term	HRT	Final discharge		Volume of biogas generated
				BOD	COD	
Keck Seng flow stirred tank reactor (CSTR)	Continuous	>20	18	250-500	8000-12,000	~0.35 Nm ³ per kg of COD
Majurutera stirred tank reactor (CSTR)	Complete	10	-	-	-	20 m ³ per tonne of POME
BEE	High efficiency methane fermentation system	20-25	9	300-500	2000-3000	>25 m ³ per tonne of POME
SIRIM (pilot scale)	Reversible flow anaerobic baffled reactor (RABR)	>20	10-15	-	6000	0.23 Nm ³
UPM-FELDA-Kyushu Institute of Biogas Technology	Semi-commercial closed anaerobic digester	25	10	-	2000	20 m ³ of biogas / m ³ of POME
Ronser Bio-Tech and Shanghai-Jiaotong University on zero-discharge treatment technology	AnaEG (Combination of UASB and EGSB technologies)	>20	4	-	2000	> 0.5 Nm ³ per reduced COD volume (based on 90% COD removal rate)

2.1.6 Total Potential of Biogas from POME

The potential energy generated from biogas is 1.88 million MWhr of electricity which is equivalent to 261 MW of the potential power based on 21% efficiency in a steam plant (based on yield of FFB in 2009).

Material	Production Rate	Quantity
FFB (mil. tonnes)		85.71
Effluent	67% of EFB	57.42 million tonne = 57.42 million m ³
Biogas	28 m ³ m ⁻³	1607.76 million m ³
Biogas CV at 35°C	20 MJ m ⁻³	32155.2 million MJ
Total heat value	1607.76 x 20 million MJ = 32155.2 million MJ	8.93 million MWhr *1MWhr = 1 MJ/3600
Power Output	21% of heat output	8.93 million MWhr x 21% = 1.88 million MWhr
Power plant size	Plant operates 300 days year ⁻¹ = 7200 hr year ⁻¹	1 880 000 / 7200 = 261.11 MW

2.1.7 Technical Configurations of Biogas Utilization in Palm Oil Mills

There are various ways in utilizing of POME biogas especially in palm oil mills. With the proper technical configuration and system, biogas generated from the POME can be directly converted into useful energy either for thermal, electricity or both. Basically, setting up the biogas plant in palm oil mills would be useful to the millers that require an additional energy for downstream activities operated in the palm oil mill such as EFB fibre plant or kernel crushing plant, as well as for grid-connection purpose under Small Renewable Energy Power (SREP) Programme

The biogas can be also upgraded and stored as a natural gas quality for utilization in the transportation or vehicle used in the palm oil mills. Options of the biogas utilization in palm oil mills are briefly described in the following section.

2.1.8 Option for Utilization

For Combined Heat and Power (CHP) for production of steam and electricity (direct thermal and electricity generation)

Palm biogas can be co-fired with oil palm biomass in the existing palm oil mill boiler. Steam produced from this co-firing process is used to generate electricity using the steam turbine and low pressure steam that leave the turbine will be used for milling process. The boiler shall require some modifications especially the feeding part of the biogas into the boiler chamber. The use of biogas which is known as an efficient with high CV fuel, appears to be thermodynamically interesting, technically compromise and economically attractive technique by promoting a number of advantages. Besides that, due to the high CV of the palm biogas compared to the palm biomass, this approach will significantly reduce or eliminate the usage of palm shell. The use of mesocarp fibre may also be reduced. The excess palm biomass in particularly palm shell may be sold to other industries that require solid fuel for their CHP plant.

For steam generation only (thermal energy generation)

Production of steam using biogas as fuel can be carried out either by firing the biogas (with or without other fuels) using either high or low pressure boiler. One of efficient ways to produce heat or steam from biogas is by using a package boiler. As the package boiler is designed to use natural gas and fuel oil, therefore the utilization of biogas in package boiler is considered as a direct and simplest method to produce energy from biogas without major modification required. Biogas is also can be co-fired with natural gas and fuel oil for the similar purpose, therefore it would reduce the consumption of these much more expensive fuels compared to biogas. The existing boiler at palm oil mills may also be used to generate steam with co-firing approach but again some modifications are required.

For electricity generation

Internal combustion engine such as gas engine and diesel engine can be used to directly convert biogas for electricity. Biogas is burnt with oxygen (air) in the combustion chamber to produce force that generating mechanical energy for electricity. Generating electricity using the gas engine is a proven technique with thermal efficiency ranging from 35 to 42%. It is usually capable to produce high electricity energy either for internal uses or grid connection purpose. Besides that, biogas can be used in a diesel genset whereby may reduce the diesel consumption up to 70%. However, this approach requires some engine modification including feeding parts, air intake device and fuel setting.

Other potential prospective applications

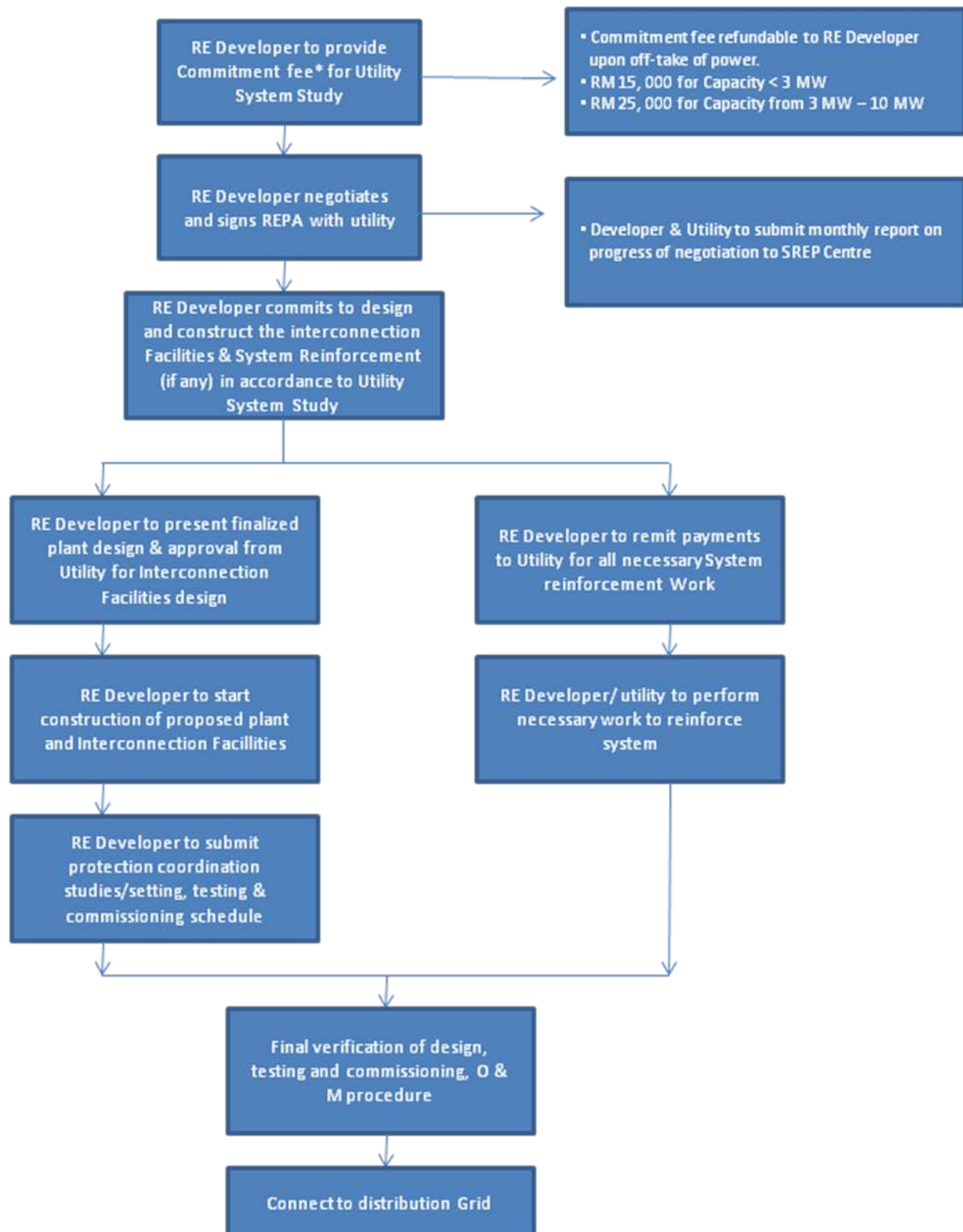
Biogas generated from POME can also be upgraded and used for other potential applications especially for external usages include the following :

- Use as a compressed natural gas (CNG) which can be an alternative for natural gas vehicles (NGV). This CNG can be used as alternative fuel for vehicles used in palm oil mills such as forklift, lorry etc
- Feeding into natural gas (NG) pipeline or bottling and transporting for industrial use.
- For other operational units that require energy such as vapour absorption chiller, hot water and hot air production – provided that the mills with downstream activities such as biodiesel plant, EFB Fibre Plant and Kernel Crushing plant
- For future 2nd generation biofuel projects such as production of hydrogen, biomethane etc

**Economic Analysis on Potential of POME Biogas and Energy Production from a
Typical 60 tonne FFB / hour Palm Oil Mill (based on basic financial model)**

Material	Production Rate / conversion factor	Quantity
FFB		60 t/hr or 432, 000 t/yr
Effluent	@ 65% of FFB processed	39 t/hr or 39 m3/hr
Biogas	@ 28 m3 / m3 POME	1092 m3/hr
Potential energy from biogas	@ 20000 kJ/m3	21840000 kJ/hr or 6067 kJ/s or kW
Power Output / size of power plant	@ 30% of thermal efficiency	1.8 MW
Potential electricity to the grid	@ 80% utilization factor x 7200 hrs/year (300 days x 24 hrs)	10,368,000 kWhr /yr
Potential of electricity sales	@ RM 0.21/kWh	RM 2.18 million /yr or RM 45.72 million for 21 yrs.
Total CAPEX	@ RM 9 million / MW	RM 16.2 million
Total OPEX/ year	@ 4% / year of CAPEX	RM 648,000 / year
Net profit per year	(Annual electricity sales – OPEX)	RM 1.532 million per year
Payback period	RM 16.2 / 1.532	10.6 yrs
Internal rate of Return (IRR)	-	9%

Flow Chart for Applying Connection to Utility's Distribution System



2.1.9 Incentives for Renewable Energy (RE)

Commercial and industrial business entities which are involved in energy business using renewable energy resources for generation of electric power or sell to local utilities provider distribution grid system are eligible to apply for fiscal incentives.

<p>Pioneer Status (PS)</p>	<ul style="list-style-type: none"> • The PS provides exemption from income tax (25% from 2009 onwards) on 100% of statutory income for 10 years. • Accumulated losses and unabsorbed capital allowances incurred during the pioneer period can be carried forward and deducted against post pioneer income of the company.
<p>Investment Tax Allowance (ITA)</p>	<ul style="list-style-type: none"> • Under ITA, 100% of qualifying capital expenditure incurred within 5 years can be utilized against 100% of the statutory income for each year of assessment. • Unutilized allowances can be carried forward to subsequent years until fully utilised.
<p>Eligible Activities for PS and ITA</p>	<ul style="list-style-type: none"> • Companies intending to sell all the energy generated to its related companies or any other companies are eligible to <ul style="list-style-type: none"> • (1) PS with tax exemption of 100% of statutory income for 10 years • (2) ITA of 100% for 5 years to be offset against 100% of the statutory income • Companies intending to generate RE for own consumption are eligible to; <ul style="list-style-type: none"> • (1) ITA of 100% for 5 years to be offset against 100% of the statutory income • Companies intending to sell all the energy generated to its related companies or any other companies and for its own used are eligible to <ul style="list-style-type: none"> • (1) PS with tax exemption of 100% of statutory income for 10 years for energy sold • (2) ITA of 100% for 5 years to be offset against 100% of the statutory income for the whole project
<p>Import Duty and Sales Tax Exemption</p>	<ul style="list-style-type: none"> • Companies generating RE can also apply for import duty and sales tax exemption on import machinery, equipment, materials, spare parts and consumables used directly in the generation process and that are not produced locally. • Exemption of tax on revenue from sale of CERs

Technology Provider For Biogas Implementation

Company	Address	Contact Person
Biogas Environmental Engineering Sdn Bhd	28-3, Jalan 1/116B Sri Desa Entrepreneurs Park Odd Kuchai Lama 58200 Kuala Lumpur	Tel : +603-79842422 Fax : +603-79842896
Sirim Bhd (Environment and Bioprocess Technology Centre)	1, Persiaran Dato' Menteri Section 2, P.O. Box 7035 40911 Shah Alam, Selangor	Tel : +603-55446552/6556 Fax : +603-55446590
Custom-Craft Sdn. Bhd.	No.5, Jln Kipas 34/9 Bukit Kemuning, Light Ind. Park, Seksyen 34, Shah Alam, 40,000 Selangor, Malaysia.	Tel : +603-58807611 Fax : +603-58807616
Eco-Ideal Consulting Sdn. Bhd.	Suite C-7-2, Wisma Goshen, Plaza Pantai, Jln 4/83A Off Jln Pantai Baharu, 59200 Kuala Lumpur, Malaysia.	Te l : +603-22848102 Fax : +603-22848102
Biotec International Asia Sdn. Bhd.	2nd Floor, Block A, 45 Medan Setia 1, Plaza Damansara, 50490 Kuala Lumpur, Malaysia.	Tel : +603-2080-2080 Fax : +603-2080-2090
Varec Biogas	29-A, Jalan Kenari 17E, Bandar Puchong Jaya, Puchong 47100 Selangor.	Tel : +6 03-8076 5778 Fax : +6 03-8076 5773
Enviro-LIFT Services Sdn Bhd	6B Jalan Astaka L U8/L Bukit Jelutong Business and Technology Centre 40150 Shah Alam Selangor Darul Ehsan Malaysia	Tel : +603-78463682 Fax : +603-78463615
Elco Management Consultants Sdn. Bhd.	70-02, Jalan Ros Merah 3/2, Taman Johor Jaya, 81100 Johor Bahru Johor, Malaysia.	Tel : +6-07-352 9002 Fax : +6-07-352 8002

Q2 Engineering Sdn. Bhd.	Unit 6-09, Block E, Phileo Damansara 1 No. 9, Jalan 16/11, Off Jalan Damansara 46350, Petaling Jaya, Selangor Malaysia	Tel : +60 3 7665 3788 Fax : +60 3 7665 3799
CST Engineering Sdn. Bhd.	8 Jalan Pendidik U/31, Hicom Glenmarie Industrial Park, 40000 Shah Alam, Selangor, Malaysia	Tel : +603- 5569 5514 Fax : +603- 5569 5529
Kim Loong Resources Berhad	Unit No. 203, 2nd Floor, Block C, Damansara Intan, No. 1, Jalan SS 20/27, 47400 Petaling Jaya.	Tel : +603- 7118 2688 Fax : +603-7118 2693
Aquarius system (M) Sdn. Bhd.	6B Jalan Astaka L U8/L, Bukit Jelutong Business and Technology Centre 40150 Shah Alam, Selangor Darul Ehsan Malaysia	Tel : +603-78463682 Fax : +603-78463615
Choon Hin Enviromental Sdn. Bhd.	No. 6-10, Jalan Jati 86000 Kluang	Tel : +6012-7602999 Fax : +607-773 7626
BELL Group of Companies	No 125, Jalan SS15/5A, 47500 Subang Jaya, Selangor.	Tel : +603-56343888 Fax : +603-56340723
Global Strategic Sdn. Bhd	NO. 5-2 Second Floor, Jalan 3/76D, Desa Pandan 55100 Pandan Selangor.	Tel : +603-92842030 Fax : +603-92852030
Green & Smart Sdn. Bhd.	No. 40-2, Jalan Tun Sambanthan 3, Brickfields, 50470 Kuala Lumpur, Malaysia	Tel : +603- 2260 1477 Fax : +603-2260 1478
AES AgriVerde Services (Malaysia) Sdn Bhd	Suite 23.01 Level 23 Centrepoint South Mid Valley City Lingkaran Syed Putra 59200 Kuala Lumpur Malaysia	Tel : +60322879868 Fax : +60322876998

Biox Carbon	Level 8 (Lot A), MNI Twins-Tower2 No.11, Jalan Pinang, 50450 Kuala Lumpur	Tel : +603-21636299 Fax : +60321637299
Konzen Enviroment Sdn Bhd	No. 1, 2nd Floor, Jalan Singa E 20/E, Section 20, Shah Alam 40300 Selangor	Tel : +603-55488898 Fax : +6 03-55428898
Majutera Sdn Bhd	C1-11 1st Floor Dataran Ara Damansara Jalan PJU 1A/20B, 47301, Petaling Jaya, Selangor	Tel : +60 3-7846 8509 Fax : +60 3-7842 2376
YTL- SV Carbon Sdn Bhd	Level 4, Annexe Block, Lot 10 Shopping Centre, 50, Jalan Sultan Ismail, 50250 Kuala Lumpur, Malaysia.	Tel : +603-2144 7200 Fax : +603-2144 7573
Sime Darby Plantation Sdn Bhd.	14th Floor, Wisma Consplant I No. 2, Jalan SS 16/4 47500 Subang Jaya Selangor Darul Ehsan	Tel : +603- 5631 7133 Fax : +603- 5636 7588
Ronser-Biotech Sdn Bhd	C 708, Metropolitan Square, Jalan PJU 8/1, Bandar Damansara Perdana, 47820 Petaling Jaya, Selangor, Malaysia	Tel : 603 - 7728 8999 Fax : 603 - 7725 3300 Email : ronser@streamyx.com

3.0 CLEAN DEVELOPMENT MECHANISMS (CDM)

The Clean Development Mechanism (CDM) is a scheme under the Kyoto Protocol, United Nations Framework Convention on Climate Change (UNFCCC) which helps developing countries achieve sustainable development through the sale of certified emission reductions (CER), or carbon credits, to developed and industrialized countries. The CDM scheme was introduced by Kyoto Protocol;

- To stream fund and technology to developing countries so they can meet sustainable development targets,
- To encourage the developed country to invest in carbon emission reduction project that meets the protocol's target

3.1 Benefits of CDM project in Malaysia

For Malaysia, the CDM is facilitated by Conservation and Environmental Management Division (CEMD) of the Minister of Natural Resource and Environment (NRE) as Designated National Authority (DNA). Malaysia DNA and CEMD serve as a secretariat for evaluation of CDM projects via establishment of a National Committee on CDM (NCCDM) and two Technical Committee i.e The Technical Committee on Energy and The Technical Committee on Forestry. The CDM project activities bring the following benefits;

- Helps developed countries meet their emission reduction targets under the Kyoto Protocol
- Helps the palm oil industry meet increasingly stringent sustainability requirements.
- The CDM project transforms reduction of emission of CO₂ and methane into cash flow
- The CDM approval mechanisms able to create new commodity

3.2 Estimated of CER from Biogas CDM Project

Reduction of 1 tonne of CO₂ equivalent generates 1 tonne CER.

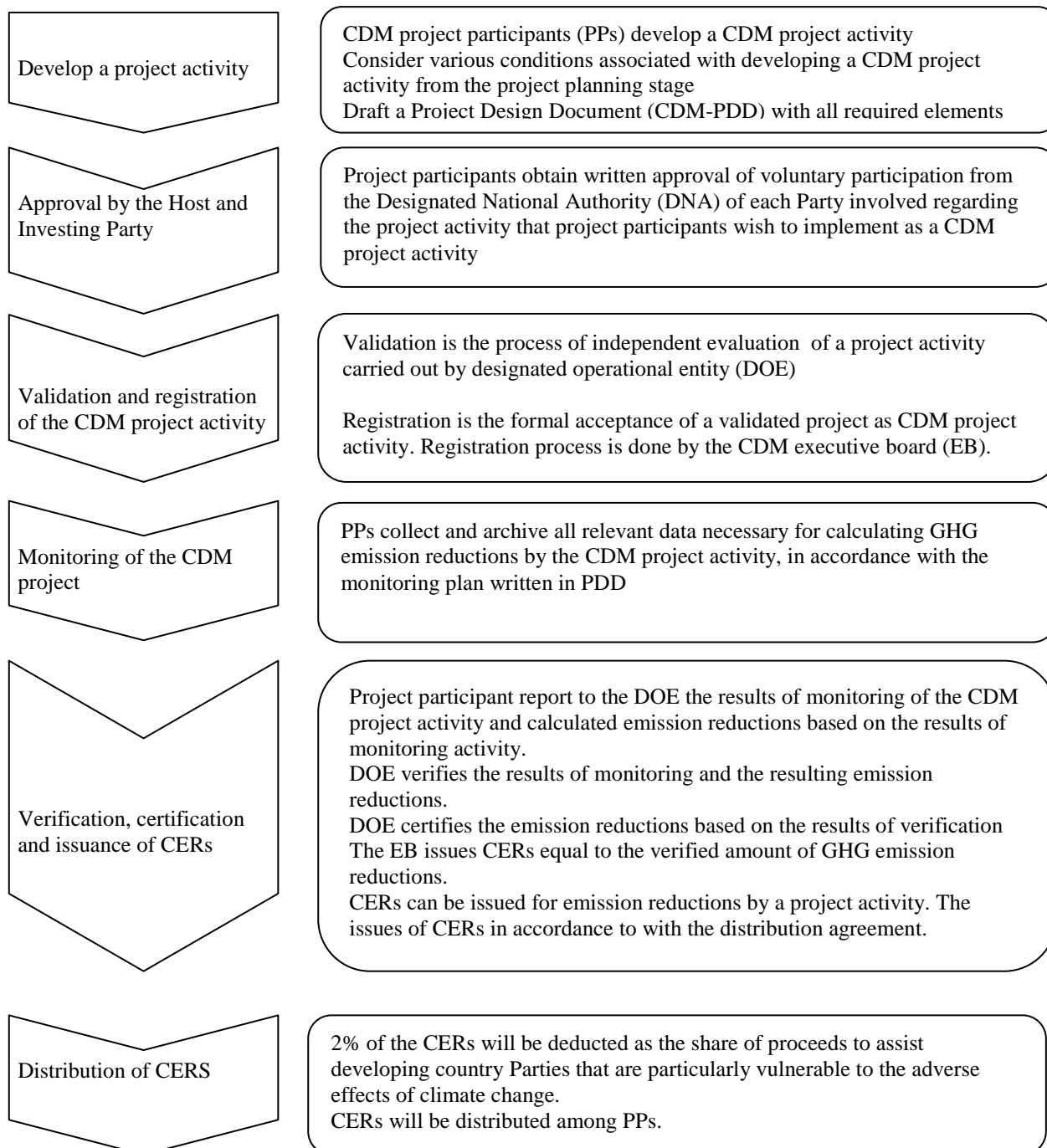
Estimated CERs generated for a 60 t/hr mill	= 30,000 – 40,000 tonnes
Estimated revenue generated for each mill (based on €10/tCO ₂ e)	= RM1.5 million per year (for 21 years)

Mills are advised to consult an established and regent able CDM consultant to assist in CDM application.

3.3 National project CDM criteria

- Criterion 1** Project must support the sustainable development policies of Malaysia and bring direct benefits towards achieving sustainable development
- Criterion 2** Project implementation must involve participation of Annex I party/Parties as CER buyer. In addition they are encouraged to participate as equity of technology provider
- Criterion 3** Project must provide technology transfer benefits and/or improvement of technology, including enhancement of local technology
- Criterion 4** Project must fulfil all condition underlined by the CDM Executive Board as follow;
- i. Voluntary participant
 - ii. Real, measurable and long-term benefits related to mitigation of climate change; and
 - iii. Reductions in emissions that are additional to any that would occur in the absence of the certified project activity
- Criterion 5** Project proponent should justify the ability to implement the proposed CDM project activity

CDM PROJECT CYCLE



List of CDM Consultants in Malaysia

CDM CONSULTANT		COMPANY	CONTACT
1	Mr. Ilango S. Bharathi G. Senior Manager (CDM projects)	YTL SV Carbon Sdn.Bhd Level 4 Annex Block Lot 10 Shopping Centre 50, Jalan Sultan Ismail 50250 Kuala Lumpur	Tel: 03-21447200 Fax: 03-21447573 H/P: 017-2026456 ilango@ytl.com.my
2	Dr. B.G. Yeoh (Client Manager)	EcoSecurities Malaysia Sdn Bhd Mid Valley City No. 1, Medan Syed Putra Utara 59200 Kuala Lumpur	Tel: 03-22820612/32 Fax: 03-22820652 H/P:012-3112289, 013-3306863 bgyeoh@ecosecurities.com
3	Bhavna Khandhar Perenia Carbon - complete carbon solutions	Perenia Carbon Unit 509 Block B Phileo Damansara II Jalan Section 16 46350 Petaling Jaya Selangor Australia Office: Level 7 111 Pacific Highway North Sydney NSW 2060 Ausutralia	Tel: 03-79505521 Fax: 03-79552110 H/P: 0122039240 bhavna.khandhar@pereniicarbon.com Tel: 61299261702 Fax: 61299261799
4	Mr.Arthur Wayne House @Ibrahim President	Averest Agriculture & Farming Sdn Bhd Suite 5D08 Emerald Hill Cangkat Bukit Indah 2 Bukit Indah 68000 Ampang Selangor 50490 Kuala Lumpur	03-42706312 H/P: 012-9154546 wayne@fiurthgeneration.ca house.wayne@gmail.com
5	MR. SOON HUN YANG	Eco-Ideal Consulting SB Suite C-7-2, Wisma Gosen, Plaza Pantai 5 Jalan 4/83A Off Jln Pantai Baru 59200 Kuala Lumpur, Malaysia	Tel: 603-78768102 / 22848102 Fax: 603-22848103 Mobile : 019-8188102
6	MS. ROSE ARIFFIN	Environmental Resources Management Unit 19-06-01, 6th Floor PNB Damansara, 19 Lorong Dungun Damansara Heights 50490 KUALA LUMPUR	Tel: 019 - 330 9192
7	DR. TONG SOO LOONG	Enviro-Lift Services Sdn. Bhd. 6B Jalan Astaka L U8/L Bukit Jelutong Business and Technology Centre 40150 SHAH ALAM	Tel: 603 - 7846 3682 Fax: 603 - 7846 3615

8	MR. HENRIK RYTTER JENSEN Chief Consultant	36th Floor, Menara Maxis Kuala Lumpur City Centre 50088 KUALA LUMPUR	Tel: 012 - 302 3914
9	MS. SHEILA SHARMA	ENVIRON Consulting Services (M) Sdn. Bhd. A307, Phileo Damansara 2 15, Jalan 16/11 46350 PETALING JAYA	Tel: 012 - 206 8654
10	MR SIM KEAN HONG CDM Project Manager	KYOTOenergy Sdn Bhd (Malaysia Representative Office) Unit SVP4, Jalan Cinta Kasih Country Heights, 43000 Kajang, SELANGOR	Tel: 603 - 8739 0240 Fax: 603 - 8739 0235 Mobile: 6012 - 499 1896
11	MS TEE HUI YONG Senior Consultant (Environment)	GHD Perunding Sdn Bhd 22 nd Floor The Mall Putra Place 100 Jln. Putra 50350 KUALA LUMPUR	Tel: 603-2332 3886 Fax: 603-2332 3990 Email: huiyong.tee@ghd.com
12	MR. LEONG KWOK YAN Leong Partnership Advocates & Solicitors	Suite 501, Block E Phileo Damansara 1 9, Jalan 16/11 46350 Petaling Jaya, Selangor	Tel: 03-79554030 Fax: 03-79559681 Email: leongky@leongpartnership.com
13	MS MICHELLE CHAN Business Development Director Southeast Asia Carbon Markets (Carbon Trader/Broker)	Mercuria Welstar Enterprise Co. Ltd 88 Soi Bangna-Trad 30 Bangna-Trade Road Bangna, Bangkok, Thailand	Tel: 00662-770-3993 668-5642-3993 6012-3161900 Fax: 00662-398-9339
14	GERALD P. HAMALIUK Chief Technology Officer	GenPower Carbon Solution Services (Malaysia) Sdn. Bhd. Level 22, Unit A-22-13, Menara UOA Bangsar, No.5, Jalan bangsar Utama 1 59000 Kuala Lumpur, Malaysia	Tel: 603-22826841 H/P: 60172472917 Email: ghamaliuk@gpcarbonolutions.com
15	Rober C Y Cheong Head of Climate Change and Carbon Sevices	TUV NORD (Malaysia) Sdn. Bhd. No.20 Jalan Tiara 3, Tiara Square Taman Perindustrian UEP 47600 Subang Jaya Selangor, Malaysia	Tel : 603-8023 2124 Fax: 603-80234410 H/P: 6012-5010066 Email: rober.cheong@tuv-nord.com