

UNDP ANNUAL WORK PLAN MONITORING TOOL

Together with project issue/risk logs, the following AWP Monitoring Tool should be used for the project review purpose.

Expected Outputs and Indicators: List all CP outputs and indicators, including annual targets.

Planned Activities: List all the activities including monitoring and evaluation activities, including evaluations, field monitoring visits, technical backstopping missions, and audits to be undertaken during the year towards stated CP outputs.

Expenditures: List actual expenditures against activities complete.

Results of Activities: For each activity, state the results of the activity.

Progress towards Achieving CP Outputs: Using data on annual indicator targets, state progress towards achieving the CP outputs. Based on the updated project issue/risk logs, comment on factors that facilitated and/or constrained achievement of results including:

- Whether risks and assumptions as identified in the CP M&E Framework materialized or whether new risks emerge; and
- Internal factors such as timing of inputs and activities, quality of products and services, coordination and/or other management issues.

TERMS OF REFERENCE – NATIONAL STEERING COMMITTEE

The National Steering Committee (NSC) will endorse and monitor the conduct of the project and provide strategic guidance to the project team on the implementation of the project.

The NSC will be chaired by the Deputy Director General II of EPU.

Members of the NSC may include EPU, NRE, MEGTW, MITI, MOSTI, MOT, MOA, MHLG, MFT and other related ministries.

The NSC will meet after the receipt of each project report or at least twice a year, whichever greater.

The NSC will have the following duties and responsibilities:

- i. Provide policy guidance on matters pertaining to the implementation of the project;
- ii. Monitor and evaluate the implementation of the project towards fulfilment of the objectives stated in the project document;
- iii. Review, approve and endorse proposed work plan and budget;
- iv. Initiate remedial actions to overcome all constraints in progress of the project;
- v. Review and approve relevant changes to the project design;
- vi. Coordinate the roles of the various organizations involved in the execution of the project and ensure harmony with related activities;
- vii. Advice on the long term sustainability strategy of the project; and
- viii. Review and approve all related reports to the projects.

TERMS OF REFERENCE – TECHNICAL WORKING COMMITTEE

The Technical Working Committee (TWC) will assist the NSC in monitoring the conduct of the project and providing technical guidance on the implementation of the project.

The TWC will act as technical advisor to the NSC.

The TWC will be chaired by the Director of ENRES EPU /NPD.

ENRES EPU will act as Secretariat to the TWC.

The members of the TWC will consist of representatives from the EPU, NRE, MEGTW, UNDP, MARDI, NAHRI, European Commission, MMD and other key agencies determined by the NSC.

The TWC will be specifically responsible for:

- i. Provide guidance and decisions on matters pertaining to the technical aspects of the project such as the data collection exercise, finalising inputs and outputs parameters, type of models to be used, the training strategy, the development of the models to ensure that they meet with the objectives set in the project document and with international good practices and standards;
- ii. Monitor and evaluate the technical implementation of the project towards fulfilment of the objectives stated in the project document;
- iii. Review and comment on the proposed technical work plan and budget;
- iv. Regular monitoring of the progress of the project and recommend approved technical reports to the NSC; and
- v. Review policy recommendations to be endorsed in the NSC.

TERMS OF REFERENCE – NATIONAL PROJECT DIRECTOR

National Project Director is a staff member of the Government of Malaysia's implementing agency of a UNDP-supported project and in this case will be the Director of ENRES EPU .

His/her main responsibility is to coordinate project activities among the main parties to the project: the Government co-coordinating authority, the consultant, and UNDP.

Specifically, he/she works in close collaboration with the Project Manager, as well as UNDP and his/her responsibilities include:

- i. Ensuring that the project document and project revisions requiring Government's approval are processed through the Government co-coordinating authority, in accordance with established procedures;
- ii. Preparing work plans in discussion with the Project Manager, EPU, UNDP and consultants;
- iii. Mobilizing national institutional mechanisms for smooth progress of project;
- iv. Reviewing project status reports;
- v. Providing direction and guidance on project-related issues;
- vi. Providing advice and guidance to the project team; and
- vii. Recommends financial transaction for approval.

TERMS OF REFERENCE – PROJECT MANAGER

The Project Manager will be primarily focused on the administrative, financial and operational aspects of the project.

The Project Manager's role is to manage and coordinate the implementation of various project activities in ensuring quality and timeliness of activities and delivery of outputs.

He/She will be based at EPU full-time and the specific tasks of the Project Manager are as follows:

- Provide direction for the project based on the project document and decisions made by the TWC and NSC;
- Manage and coordinate the implementation of project activities to ensure the maintenance of quality, timeliness, and delivery of outputs;
- Liaise and work closely with the project partners and beneficiaries;
- Report regularly to the NSC, TWC and NDP on the project's progress;
- Confidentiality of information must always be upheld and any release of info must have prior consent from EPU and UNDP;
- Maintain close contact with designated focal points from EPU, UNDP and other stakeholders, indicating any estimated changes to the work plan, and proposing a budget revision when appropriate;
- Ensure that the requisite allocations are available in accordance with the agreed budget and established schedules of payment, if any, in consultation with EPU and UNDP;
- Coordinate and facilitate the work of multiple component teams engaged in the implementation of project activities;
- Work closely with EPU, UNDP and other key stakeholders in drafting and preparation of relevant Terms of Reference for consultants;
- Monitor the project funds and resources. Prepare progress and financial reports of the project when required;
- Maintain an up-to-date accounting system to ensure accuracy and reliability of financial reporting;
- Be responsible to prepare relevant documentation for meeting purposes;
- Be responsible for the delivery of the project results and final outputs;
- Ensure all working documents are recorded in an appropriate manner for the purpose of project monitoring and review; progress reporting; and financial monitoring and quality assurance especially on record keeping for audit purposes;
- Establish a monitoring plan for activities implemented by project consultants to ensure the maintenance of quality, timeliness, and delivery of outputs;
- Be actively involved in the preparation of relevant knowledge products (including publications and reports);
- Where necessary and upon advice by UNDP, perform the function of ATLAS External User, creating requisitions and vouchers, and other relevant ATLAS processes; and

- To assist EPU, UNDP and other stakeholders in the subject matter as and when requested.

Duration: July 2011 – June 2012

Reports to: National Project Director, under the guidance of EPU and UNDP

Qualifications and skills:

- i. Master's degree or equivalent in Economics, Environmental Science or a related discipline. Work experience in lieu of formal qualifications will also be considered;
- ii. At least 10 years' experience working and has a **deep understanding in various climate change economic models** especially in adaptation and mitigation sector is highly appreciated;
- iii. Experience in policy development and is highly knowledgeable in UNFCCC subject matters especially relating to GHG inventories and impact studies;
- iv. Project management experience will be an essential. Candidate must be able to multitask and work independently;
- v. Be proactive, energetic, committed and innovative;
- vi. Have good interpersonal skills, diligent, open-minded and dedicated. Flexible and mature person;
- vii. Excellent writing and organization skills. Strong command of English and Bahasa Malaysia.

TERMS OF REFERENCE – ECONOMISTS

The Economists will primarily focus on the technical and economic aspects of the project objectives.

Their role is to carry out economic assessment, develop the economic models, and examine the economic impact of climate change.

In this regard, they will focus on the cost and benefit of options and measures to adapt to and mitigate the effects of climate change.

The specific tasks of the Economists are:

- i. Develop economic models and techniques to analyse the impact of climate change;
- ii. Analyse the economic impact of carbon emission reductions for selected sectors;
- iii. Analyse the impact of climate change on selected sectors: sea level rise, precipitation, and temperature;
- iv. Analyse the intricacies of the post-Kyoto scenarios: e.g. Malaysia's inclusion as an Annex 1 country; and
- v. Analyse the potential impact of economic growth on carbon emissions.

Duration: Based on man-months needed

Reports to: Project Manager and National Project Director

Qualifications and skills:

- i. Master's degree or equivalent in Economics, Environmental Science or a related discipline. Work experience in lieu of formal qualifications will also be considered;
- ii. At least 10 years' experience working and has a **deep understanding in various climate change economic models** especially in adaptation and mitigation sector is highly appreciated;
- iii. Experience in policy development and is highly knowledgeable in UNFCCC subject matters especially relating to GHG inventories and impact studies;
- iv. Project management experience will be an essential. Candidate must be able to multitask and work independently;
- v. Be proactive, energetic, committed and innovative;
- vi. Have good interpersonal skills, diligent, open-minded and dedicated. Flexible and mature person; and
- vii. Excellent writing and organization skills. Strong command of English and Bahasa Malaysia.

TERMS OF REFERENCE – LOCAL CONSULTANTS/ RESOURCE PERSON

The local consultant will primarily focus on the technical and scientific aspects of the ECCM project, especially the aspects related to impacts and causes.

They would most likely have worked on one of the NC2 components.

Their role is to assist in updating and maintaining the technical and scientific databases related to climate change that were initiated and compiled under NC2.

They will also provide technical and scientific advisory service to the Economists who are working on the project.

The specific tasks of the Local Consultants are:

- i. Update and maintain the climate change database for the duration of the ECCM project;
- ii. Assist in forecasting the potential changes in the climate change parameters, especially sea level rise, precipitation, temperature, etc.;
- iii. Advise the project economists on the feasibility of valuing climate change impacts;
- iv. Provide leads to impact studies in particular areas; and
- v. Participate in meetings and workshops as requested by EPU.

Duration: based on man-months needed

Reports to: Project Manager and National Project Director

Qualifications and skills:

- i. Experience with NC2 project or with expertise in climate change impacts;
- ii. Involved in one or more components of climate change studies for the Malaysian government;
- iii. Experience in policy aspects of climate change;
- iv. Be proactive, energetic, committed and innovative;
- v. Have good interpersonal skills, diligent, open-minded and dedicated. Flexible and mature person; and
- vi. Excellent writing and organization skills. Strong command of English and Bahasa Malaysia.

Economics of Climate Change for Malaysia

Technical Workshop Report

3-4 August 2010

Economic Planning Unit

Presentations:

1) *Introduction to the ECCM Technical Workshop - Mr. Azhar Noraini, EPU*

Mr. Azhar Noraini, Director of the Environment and Natural Resource Economics Section (ENRES), Economic Planning Unit (EPU) gave a welcoming remark to all participants. He emphasised that the function of the technical workshop as platform to share technical information and exchange knowledge on the economics and climate change models available. The objectives of the workshop is to get an in depth understanding of the existing economic and climate change-related models of climate change such as their key features, strengths and limitations, relationship between Global Climate Model's (GCM) and the economic models as well as the experience and key challenges in developing a country-level model. He informed and briefed the participants on the objectives of the Economics of Climate Change (ECCM) study undertaken by EPU and how the outcome of the study will provide the basis for Malaysia's position at the international climate change negotiations. The ECCM study consists of three components, namely, i) Development of Economics Models; ii) Development of Database; and iii) Policy Options. He also stressed on the rationale of the study and the importance to conduct the study now as the country will be facing higher costs and bigger risks of the adverse impact of climate change if the country is delaying the actions in mitigating as well as adapting to impacts of climate change. As such, he hoped targeted ministries will provide full assistance to make the ECCM study a success. Lastly, he briefed all participants on the agenda of the workshop.

2) *Overview of Modeling Framework for Economics of Climate Change: Adaptation and Mitigation - Dr. Suphachol Suphachalasai (ADB)*

Dr. Suphachol thanked EPU for inviting the Asian Development Bank (ADB) to be part of this important initiative. He shared an overview of the modeling framework on economic of climate change focusing on mitigation and adaptation aspects based on ADB's experience in conducting the Regional Review of Economics of Climate Change for Southeast Asia. He informed that the overall objective of their study is to support adaptation and low carbon planning for a better policy making while focus on economic aspects to help prioritise options and estimates funding needed. It also helps to raise public awareness on climate change challenges and to disseminate knowledge and information to other countries. Among the key outputs from the study includes costs of climate change taking into account the cost-benefit or cost-effectiveness of options; marginal adaptation; estimation of funding needed; and results under different climate and policy scenarios.

Dr. Suphachol introduced the modeling framework on Impact & Adaption. He also briefed on the two climate change models, namely, General Circulation Model (GCM) and Regional

Climate Model (RCM). Both models complement each other and normally are used in parallel in order to achieve better results. To move the ECCM forward, he advised the project to define what was already been done and the existing model used in Malaysia and determine the gaps.

Dr. Suphachol emphasised on the climate model that fits into the physical impact and vulnerability assessment. He also briefed on the scenarios that fit into the climate models such as risk mapping. On economic assessment, he touched on the two types of model applicable to climate change, which are i) top-down climate-economic model; and ii) general equilibrium approach. There are three types of combination of approaches that can be used, namely i) bottom-up; ii) impact assessment modules (IAM); and iii) general equilibrium. These models can be used together to complement each other.

In his second session, Dr. Suphachol focused on Low Carbon-Mitigation modelling framework. He explained on the i) bottom-up energy model which looks at energy supply and demand sectors; and ii) top-down economic model which is scenario-driven IAM. He also briefed on the advantage of using a hybrid model which allow us to look at wider impacts. Finally, he talked about dealing with uncertainties that may exist and the climate policy simulation tool.

Discussion

The workshop took note of the following:

- Malaysia should put aside the global scenario while running on the model. Malaysia should think in terms of GDP growth, growth rate, urbanization and economy; on where we will be achieving in the next 10 years.
- The project shouldn't down scale all GCM available due to time frame. The wise choice is to pick a few GCM and down scale it based on the RCM available. A total of 10 GCM is suggested to start with. More resources will be needed if more GCM is used. As conclusion, the scope of the study will be the deciding factor in choosing the number of GCM used in the study.
- Projections can go to as far to year 2100 for adaptation.
- The project shouldn't focus on all crops in agriculture but only to cover on major crops which are important to Malaysia.
- Historical data of temperature rise, sea level rise and extreme event can be obtained from IPCC report. MMD commented that they didn't have a full record on the extreme event. But in the analysis of extreme event, it is actually by how much change is the extreme event is going to occur. This question has not been answered yet. IPCC will come out a report on extreme event by next year.
- Marginal abatement cost is not the same with other country because of the different technology used.
- The model split can model the implementation of public transport in major cities. Some assumptions need to be made such as networking and number of cars. However, the model can interface with the existing transport system.
- The first phase utilizing the model was completed in South East Asia. Project is now on going in South Asia (Macau) and North Asia. With the output from the model, ADB provides information to the government and make recommendations based on the outcome from the model.

- The project needs to understand and utilize the existing models used in NC2 in order to develop a national model. At this point of time, it is rather difficult to set a benchmark model that links with the global, regional and national model.

3) NC2: GHG Inventory - Dr. Elizabeth Philip (FRIM)

Dr. Elizabeth of FRIM, NRE informed the participants on the greenhouse gases (GHGs) inventory used for the development of Malaysia's Second National Communication (NC2). She stressed that CO₂ concentrations have been increasing since year 1970 till 2008 from 1.3 ppm to 1.9 ppm. There are five sectors assessed for the NC2 which are energy, industrial processes, agriculture, LULUCF and waste. Changes in GHG emissions in 1994 and 2000 were tabulated.

Dr. Elizabeth reminded the participants that the increase of percentage change in emissions in industrial processes and LULUCF are contributed by the additional of subsectors. Trends in GHG emissions of year 2000, 2005 and 2007 were also presented. From a net sink country in 2000, Malaysia has become a net source in year 2007. Energy and waste sector over the years since 1990 has increased, whereas agriculture and LULUCF sectors have been stabilized. The speaker highlighted few points as concluding remark:

- Improvements on NC2 inventory on data gathering and wider scope were covered
- Energy sector remains the largest contributor of GHG emissions
- GHG emissions per capita increased by 13%
- Key Sources Category Analysis was undertaken to identify major emission activities
- Roles of government and supporting agencies crucial in building a sustainable inventory

Discussion

The workshop took note of the following:

- At present, there is no attempt to bring the baseline data forward (from year 2000 to 2007). However, some subsectors are trying to move towards that direction.
- Once NC2 is finalised, FRIM will provide full data to all 5 subsectors' heads.
- As for NC2 data requirement, it is possible to have a one stop center requirement, however, when we are going to higher tier or IPCC 2006 guidelines, it will be rather difficult as it requires agency to provide inputs. Small discrepancies in data will create error. As for DOS, it is not fair for them to keep the information that only will be used for inventory. Addition to that, such information will change rapidly. However, this matter is worth to be discussed further.

4) NC2: Vulnerability and Adaptation (V&A) - Ir. Mohd Zaki M. Amin (NAHRIM)

Ir. Zaki from NAHRIM, NRE gave an overview on the effect on temperature and sea level due to global climate change. Temperature and sea level has been increasing over the years. According to IPCC Assessment Report 4, 2007, the global average surface warming

will increase by 1.1°C to 6.4°C, whereas the sea level will rise between 18 and 59 cm by 2100 and oceans will become more acidic. NAHRIM conducted climate change projection for Malaysia using Regional Hydro-Climate Model. Key-output from the following study was presented:

- Study of the Impact of Climate Change on the Hydrologic Regime & Water Resources of Peninsular Malaysia (2006)
- Study of the Impact of Climate Change on the Hydrologic Regime & Water Resources of Sabah and Sarawak (2007-2010)

Apart from that, the participants were also briefed on impact and vulnerability of water resources, floods, landslide, water supply, agriculture, biodiversity and many more. NAHRIM suggested several adaptation measures for water resources, agriculture, forestry, biodiversity, coastal and marine, energy and many more. NAHRIM also highlighted on the urgent need to develop a V&A process and procedures as well as to conduct further research and data collection for a quantified and qualified development of options and decision-making.

Discussion

The workshop took note of the following:

- DSSAT model is used for agriculture assessment.
- Adaptation measures are based on cross sectoral analysis in a form of matrix (7 sectors x 7 sectors). With that exercise, the most vulnerable factor is chosen.
- MRT project was not taken into account in the study as at the point of the study, KTMB came up with adaptation and V&A measures without considering MRT. However, the study will take note on this new development.
- NAHRIM has identified the need of RM200 million to implement the affirmative climate change programs for the duration of 5 years. Part of the fund will be directed to NAHRIM under Kajian Lanjutan Perubahan Iklim (under 10th Malaysia Plan). The remaining fund will be directed to other ministries. However, NAHRIM do have the specific list of the total RM200 million projects.
- The implementation of MRT in end of this year or early next year will help a lot in reducing emission. However, this can be achieved if right materials (track, design) are used during the implementation. As such, once the report has been endorsed, the report's findings should be communicated to the respective stakeholders. Guideline should be established as well.
- Socio economic is a small subsector in the overall report. However, there are still gaps on how this subsector can link to the seven sectors. According to Lestari, they have conducted the study on each sector. It is up to NAHRIM on how they want it to be presented, either combine with existing chapter or stand-alone chapter.
- The model able to design a plant taking into account of climate change scenario based on climate projection data.

5) NC2: Mitigation Assessment for Second National Communication –
Mr. Azman Zainal Abidin (Green Technology Malaysia)

The mitigation group head, Mr. Azman Zainal Abidin of Green Technology Malaysia presented on the focus of mitigation analysis on five sectors: i) energy, ii) waste, iii) agriculture, iv) forestry and v) industrial processes. Forecast scenarios for energy, forestry

and waste were presented with several assumptions made. To come out with the scenarios, input were taken from the existing policies statement, action plan that have been proposed and studies carried out by the government.

As summary, few potential mitigation options for the five sectors were highlighted such as:

- Implementation RE and EE in energy
- Maintaining forest coverage, reduce emission from forest and land use in LULUCF
- Encourage methane capture facilities, palm oil millers to capture biogas and encourage composting of organic waste for waste sector
- Rice management, livestock management, manure management and nitrogenous fertilizer management for agriculture
- Employ processes to reduce clinker use in cement production in industrial processes

Discussion

The workshop took note of the following:

- Based on the study carried out by the Malaysia Industrial Energy Improvement Programme, the energy efficiency conservation programme only starts at 2015.
- The mitigation assessment did not take into account of the fuel subsidy which is going to end in 2015. However, for academic purposes, study can take into account of this factor if EPU to provide the percentage of fuel subsidy reduction.
- Subsidy rationalization of fuel can be obtained from PEMANDU website.
- Third National Communication will cover more aspects including new measures and proposed programmes.
- Currently, the data for agriculture sector are insufficient

6) *Climate Change in Malaysia: Balancing Adaptation and Mitigation Needs by Dr. Yap Kok Seng (MMD)*

Dr. Yap from Malaysian Meteorological Department (MMD) elaborated on the relationship between key climate bodies such as IPCC, UNFCCC, Kyoto Protocol and AWG-KP. He also highlighted the progress of current negotiations between these bodies and how Malaysia will be affected to face the implication. Currently Malaysia's CO₂ emission is 0.66% of world emissions. Projected CO₂ emission till year 2020 was also presented.

Dr. Yap also briefed on the steps involved in the production of climate change information. The model path of AOGCMs Regional Impacts / Adaptive Response was elaborated. From the model, several projections on temperature changes and rainfall changes were made. The speaker ended the presentation with several remarks:

- Mitigation costs will depend on:
 - (a) International agreements on GHG limitations
 - (b) Cost of green technology
- Need to assess implications to cost on current negotiation on GHG limitation trends
- Longer term adaptation implementation at local scale require further improvements of climate change projections

- Simplest but not optimal approach on adaptation is to adapt to current climate variability and extremes and growth
- Stepwise implementation to improve adaptation to future climate change

Discussion

The workshop took note of the following:

- There isn't a big gap in conducting the ECCM study as the main bulk of the data is available from the NC2 database.
- One of the components in ECCM is to develop an economic model. This economic model will link with a physical model. At present there is no link. One of the outcomes of this project is to link the two models so that policy makers can understand the two models and make better policy decision. There is a need to translate the science into dollar and cents.

7) Green Technology: A Driver Towards Sustainable Development – Ms. Punitha Silivarajoo (KeTTHA)

Ms. Punitha from the Ministry of Energy, Green Technology and Water (MEGTW) gave a general introduction on green technology and the National Green Technology Policy. The benefits of using green technology includes minimise degradation of the environment; zero or low GHGs emission; safe for use; conserve energy and natural resources; and promotes the use of RE. Green technology will provide benefits to the environment, natural resources, improve health level and also to conserve the ecosystem. She also elaborated on the government initiatives pertaining to this subject. These initiatives cover transportation, building, energy, water and waste management. Finally she highlighted the challenges Malaysia is facing and the way forward for Malaysia in this green technology initiatives.

Discussion

The workshop took note of the following:

- SIRIM is looking at the green label components. No technical aspect is available during presentation. However, MEGTW briefed the participants on the three types of product. Type I products will be products with label such as eco label. Type II will be self-declared where people will come and claim that their product is green. Type III product will have a very stringent guideline. Carbon footprint will be included under Type III. The meeting hoped the water component will be included as well as it is the next emerging issues.
- Green Technology Sector with Green Tech Malaysia are initiating a 10% saving for government building in Putrajaya. Study showed that if the exercise is being conducted successfully, a total of RM11 million will be saved in a year for government building in Putrajaya plus the reduction in carbon emission.
- The Public Works Department will come up with guideline incorporating green features. All future design for infrastructures and buildings will have to adhere to the green guideline.

- Younger generation will be the driver in the green agenda in the future. It is hope the in the next 5 to 10 years, society will have a better mindset on this initiatives. However, publicity, awareness and promotion cannot be lacking.
- Majority of the beneficiary of Green Technology Financing Scheme is the Renewable Energy project. MEGTW only does the technical evaluation and issuance of green certificate. After approval from MEGTW, banks will assess the application from industries and determine the decision.

8) *Policy Study on Climate Change - Dr. Joy Pereira (LESTARI)*

Dr. Joy Pereira of LESTARI, UKM informed that the National Policy on Climate Change (NPCC) was already approved by the Cabinet in 2009. However, it is yet to be launched. She gave an overview and highlights from the NPCC and the process that was involved in developing NPCC.

She touched on the importance of the availability of climate change policy as climate change is cross sectoral in nature, transcends to all levels and measures to mitigate or adapt to it need to be mainstreamed into development plans.

Discussion

The workshop took note of the following:

- The NPCC will be launched anytime soon.
- The NPCC has referred to the NGTP to ensure no overlapping.
- There is a need to assess, evaluate and monitor the implementation of both policies and action plan. There are allocations and continuations to identify the performance indicators, both in terms of process and the outcome.
- The two policies were mentioned in the 10th MP.

9) *Understanding Climate Change Impacts, Assessment and Adaptation Using NAHRIM Regional Hydro-Climate Model - Ir. Mohd Zaki M. Amin (NAHRIM)*

Ir. Zaki of NAHRIM, NRE gave an overview on the possible impact and implications on water and coastal due to climate change in Asian region. Among the impact and implications are decreasing supply of freshwater; higher risk of inland and coastal flooding; and risk for coastal ecosystem. Overall impacts of climate change were also highlighted in the presentation. He also briefed on the five adaptation guiding principles which consists of sustainable development; resilience; governance; knowledge and information sharing; and economics and financing.

Case study on MUDA and Barat Laut Selangor that focus on impact assessment of climate change on irrigation and water supply scenario using the regional hydrologic-atmospheric model (RegHCM-PM) of Peninsular Malaysia were presented. Ir. Zaki also presented the flood risk management and its relation with climate change using several adaptation tools such as Future Hydro-Climate Data Retrived System. Flood map on Sg. Muar with several scenarios were presented. Finally, the speaker touched on water resources adaptation strategy and planning. He stressed that vulnerability and adaptation cannot be separated and

bodies (government-link agencies, business, NGOs and communities) must work hand in hand in order to minimize the impact of climate change.

Discussion

The workshop took note of the following:

- A model has to be modified to incorporate local conditions in order to have a more reflective result.
- NAHRIM uses 100 years probability concept to predict for future extreme events especially flood.
- It is a challenge to make good decisions with incomplete information as this will affect the investment decision. To make better decision, other factors need to be considered apart from the result from the model.

First Day Discussion

The discussion took note of the following:

Economic Model

- Economic model(s) are being used in EPU. However, the model is not link with any environment component or used to analyse enviromental concerns. It is a big challenge to link the economic model with any physical model.
- With those models available in Malaysia, project should look at how to soft link the models within the same structure or framework. For example, with two models in different institute, project should coordinate the input/output in order for both models to run in parallel under the same scenario. For instance, output from climate modeling to be input to impact assessment model and the output from it will be as input to economic model.
- NC2 are done across the board, however no quantitative assessment was conducted across sector (e.g rice). To overcome this, NC2 technical team should identify the gap. With that, the team will know what type of activities or work need to be commisioned. For example, assessment for rice is not done in NC2, and if the ECCM study plan to include this sector, the DSSAT model can be utilised.
- ECCM study needs to utilise the existing model and framework from agencies/ministries.
- EPU is using a CGE model to do analysis on human capital sector. Even though it is not meant for environmental analysis, the component in the model can be modified.
- Currently there are a lot of studies being carried out by ministries/universities. As such, it is crucial to know the status of such studies and to consolidate the outcome from the study.
- Suggestable time frame in stock taking exercise is approximately two to three months.
- Recently, a study utilizing the I-O 2005 was conducted in the NKEA lab. The model covers all 12 economic sectors. The model later links with demograhic model, climate change model as well as science based model. The meeting thinks that it is a good

platform to obtain information from the model as the model projects till year 2020 and the model is able to link with climate change model.

- The meeting thinks that projection should go further than 2020 so that a bigger picture can be seen.
- Currently NC2 is using year 2000 data as baseline. In order to upgrade the data to year 2005 as baseline, there are two sectors that need to work towards that direction.
- NC2 covers on agriculture and forestry under the land-use change as per IPCC guidelines. It does not cover other land-use such as urban. However, Town and Country Planning Department emphasised that there is a need to cover on urban land use where there will be changes in urban life style when people start using public transport. ECCM to consider if this area to be taken into account.
- Project team will consists of members of NC2, NRE, JKR, Dept of local government and national security council, among others.
- The scope and scenario for the study has yet to be decided. Initial plan is to continue from NC2 but project will likely to simplify the sector to make the policy makers more clear in making decision and also because of the limitation the study is facing.

Work Plan

- The timeline for this study is 2 years.
- Component 2 which is developing the database will kick start the study. FRIM is currently the coordinator for the GHG inventory data, once the NC2 is finalised, they will ensure each of the NC2 working group have the full inventory.
- There are suggestion for these NC2 data to be handed over Dept. Of Statistics. They may also later take up the task to be one stop center for environmental data (e.g. ECCM and Sustainable Development Indicator).
- Since the project is a continuous study from NC2, it is hoped that the project will be able to achieve its objective without much limitations.
- It is crucial to monitor the time used while conducting the model to avoid any delay in the study.
- Some data which are already available (e.g. climate data from MMD or NAHRIM), needs to be validated if the data is usable or adjustment are needed.
- Currently there is no documentation of modelling framework from ADB. Project believed with a proper documentation, it will help the team to visualize the types of output from the model. However, the official documentation on South Asia will be available early next year.

Second Day Discussion

The discussion took note of the following:

- One of the gaps identified for the study is data on rice sector. MARDI commented that they have initiated the modification of DSSAT model for analysing rice sector. However, it has yet to be implemented as it requires detailed technical data which is currently not available in MARDI. The focal point for this is Dr. Zabawi (MARDI).

- There are suggestion for public health sector to be taken up as part of the study scope. There are some limitations, for example, i) there isn't any model available in carry out qualitative evaluation on health impact; ii) the existing model also cannot handle microbe mutation that migrate across biota.
- Currently, UKM with collaboration from Ministry of Health and Taiwan University is embarking a study in developing a quantitative model to measure impact of air pollution on health, mainly in Klang Valley. With the pieces of studies is scattered around universities, there is a need to gather all information available and to fit into a bigger picture.
- Town planning particular in urban area which is near to the coastal area is also a concern where the sea level rise will be an issue. A study on sea level rise in Port Klang was conducted where there is some economic components that can be extracted from the study.
- Town and Country Planning Department suggested that data on urban land use be incorporated in NC2, in order to capture the compact development activities that will be undertaken in future.
- Land use vs land use change.
- Sector on fisheries is not covered in NC2. The meeting founds that it is rather difficult to predict marine resources.
- Projection in NC2 is up to year 2020. At project's point of view, mitigation can goes up to 2030 while adaptation will likely projected to 2100.
- It is wise to have more details data up to 2030 for policy makers in making decision, especially to have a completed baseline data of 2005 because of our pledge to the UNFCCC is based on 2005 level.
- Energy, waste, LULUCF and agriculture sector may be continued in ECCM project. Building will be subsector of energy. Two scopes were suggested in the meeting, namely urban land use and transportation.
- It is crucial to form a steering committee for the study. Steering committee comprises of various experts such as economists, engineers, NC2 team and researchers.

General

- The Technical Workshop was completed, however there are still grey area that need to be address such as the scope of the study. Work plan and composition of the study will be proposed during the upcoming National Steering Committee. Some adjustment need to made to the NC2 structure, if the study intent to adapt NC2 working structure.
- Scope of ECCM shouldn't be too wide. Project should continue from NC2 work and also concentrate on certain critical subsectors such as transportation to be separated from energy sector. This will help in getting the attention of policy makers.
- The study should be completed within the limited time frame and budget. However, if there is any other studies identified from ECCM, the study can be taken up using EPU budget.

Scope

Among the scopes identified are:

- Energy
- Transport

- Solid waste
- Waste collection
- Health

Time frame

- Project initial start date is Aug 1, 2010.
- Stock taking exercise shall be completed in 3 months time.
- Inception Workshop to be conducted once stock taking exercise is about to complete (foreseen in November).

Annex IX**Economics of Climate Change Malaysia – Stock Taking Exercise Report****Introduction:**

The Economics of Climate Change Malaysia (ECCM) project is a follow-up of the UNDP-assisted Second National Communications Project (NC2) project that is in the final stages of completion. The ECCM project's objectives are three-fold: (1) to develop economic models,

(2) to develop relevant databases, and (3) to quantify the options for meeting climate change challenges for Malaysia. The ECCM project made the assumption that it could build on the NC2 work and to utilize its databases, knowledge and resources to achieve its first objective, i.e. to develop the economic models. In this regard, the ECCM project organized a technical workshop to share with the key stakeholders the economic work that lie ahead, and also to learn from the NC2 experts the progress that was made under their project. The technical workshop was held 3-4 August 2010.

Despite the wealth of information that was presented at the workshop on the key findings and the models (and results), the post-workshop review by key members of the Technical Group felt that a more detailed examination of economic aspects NC2 was necessary as the ECCM project would require quantitative inputs. Thus, it was decided that a stock-taking exercise would be helpful for the ECCM project. There was a perceived gap in understanding and appreciation of the work done under the NC2 with regards to the economic elements of the various components. A study team was set up comprising of several EPU staff as well as UNDP consultants to undertake this work.

The Stock Taking Exercise was undertaken by the EPU between 16 August and 10 September 2010. In this exercise, various NC2 documents (some work-in-progress) were submitted by various agencies, including documentation of the scientific/engineering models. The findings and outcome of the stock-taking exercise would be used as inputs to prepare the Inception Report that is due before end-2010.

The study team expresses their appreciation and gratitude to all agencies that have provided information and documentation for this study.

1.10 *NC2 Approaches*

- 1.1 Climate change analysis starts with the predictions of certain global climate (GCM) models, viz. parameters that could affect future global climate, such as temperature, precipitation, sea level rise, storm surges, etc. From the GCMs, they are then downscaled into Regional Climate Change Models or RCMs. However, the findings of the RCMs are significant only at very gross levels, e.g. valid at 50km. They still need to be further downscaled so that more refined analysis (e.g. 9km) can be undertaken, and that is also the beginning of the NC2 work. NC2 had 3 components: adaptation, mitigation and GHG inventory.
- 1.2 Forecasts of the RCM work are made till 2100. Forecasts for the mitigation components are made till 2030 only. Some sectors in the mitigation section made their forecast till 2050. Each of the components are discussed below (details can be found in the NC2 sub-sectoral reports).
- 1.3 The Adaptation component of the NC2 comprise of a multi-disciplinary team of technical, socio-economic and economic staff members that put together the baseline conditions, made estimates of the future scenarios and examined economic impact. Seven sectors were covered: forestry, biodiversity, coastal, water, energy, health and agriculture. The team, led by Lestari, used mainly case study approaches or pilot studies to examine socio-economic impacts, although various sub-components used

various models (see below). The energy sector of the SEIA used I-O tables to estimate inter-sectoral linkage effects.

- 1.4 The Mitigation component of the NC2 also used a sectoral approach and they had technical and economic team members. The mitigation component covered 5 sectors: energy, forestry and land use, waste, agriculture and industrial processes.
- 1.5 The GHG component comprised of two main sectors: industrial processes and energy, with sub-sectors defined within them; energy (power, manufacturing, transport, agriculture and residential-commercial), and industrial processes (cement, minerals, chemicals, and metals). The estimates of GHG are made using the standard IPCC and UNFCCC guidebooks.

2.0 Models Used

- 2.1 The main climate change model used by the GCM-RCM was called PRECIS. The PRECIS climate model is an atmospheric and land surface model of limited area and high resolution, i.e. a regional modeling system. PRECIS can be run over any area of the globe and is designed to provide detailed regional climate information for impact studies. It has more than 15 output variables of which the main ones are rainfall, precipitation and temperature. Its resolution is for 50km. Detailed information is available in Annex 6a.
- 2.2 There are 2-3 models used by the Adaptation component: DSSATv.4 for agriculture (27 crops but for Malaysia, it would be for five (5) crops of rice, sweet potato, etc.) ; Reg-HCM for water resource, and for energy, the GTM's energy supply-demand model. It is important to note that all these models are technical models and the output is not economic information. However, the output of these models can be the inputs of the economic model.
- 2.3 DSSAT (Decision Support System for Agro-technology Transfer) is a software (www.icasa.net/dssat) package that integrates the effects of soil, crop phenotype, weather and management options that allows users to ask "what if" questions and simulate results. DSSAT v4 includes improved application programs for seasonal and sequence analyses that assess the economic risks and environmental impacts associated with irrigation, fertilizer and nutrient management, climate change, soil carbon sequestration, climate variability and precision management. Details are available in Annex 5a.
- 2.4 The Reg-HCM model, which was already presented at the Technical Workshop, is a regional hydrologic-atmospheric model of Peninsular Malaysia, and downscaled to 9km from the Canadian GCM1 model (410 km). It has five main output variables: precipitation, evapotranspiration, soil water storage, surface temperature and stream flow. It uses historical data (1984-1993) as inputs to the model and then simulates future data for 2025 to 2034, and for 2040 to 2050. Hence, it is also capable of modeling extreme events, providing 1-day, 2-day and 3-day events. It has already been

used for water resource assessments in the major crop producing areas. It has predicted periods of water surplus and drought situations for Muda and other river basins. The Reg-HCM model has also been applied to the study of floods in Peninsular Malaysia. In addition, climate change factors of extreme events have already been developed. According to the presentation by NAHRIM, they have applied the data into a flood damage software to obtain flood damage estimates. Hence, there is already a working example of the scientific/engineering approach into an economic model. Further, climate change planning applications have also been developed therefrom. Hence, there is a good example of a sectoral approach using data from the GCMs downscaled to RCMs, generating climate change factors, developing sectoral economic (damage) estimates and translating that information into planning applications.

- 2.5 For Mitigation, the energy component uses the LEAP model which is a widely-used software tool for energy policy analysis and climate change mitigation assessment. LEAP is an integrated modeling tool that tracks energy consumption, production and resource extraction in all sectors of an economy, and can be used to account for both energy and non-energy sector GHG sources and sinks. It also has the capacity to make regional assessments, and supports both demand and supply side modeling methodologies. The LEAP website (www.energycommunity.org) says that optimization modeling capability is being developed and will be available soon. Details of the LEAP model provided by GTM are contained in Annex 2a.
- 2.6 The Energy component did have some experience with MARKAL (www.etsap.org), which is a generic model tailored to represent the evolution of an energy system for a country, region, state or community for a period of 40 to 50 years. It balances the supply and demand through a set of energy or emission control technologies (defined by performance and cost characteristics) and then selects a set of technologies that minimizes the total energy system cost. MARKAL was used in the Danida-assisted Energy project, and analyses of the energy scenarios were generated. However, when the Danida project ended, the license on MARKAL expired as well and the GTM team that worked on MARKAL was disbanded. As most of the key members of the project have left GTM, it may not be an easy exercise to reassemble the same team.
- 2.7 Two other model works was raised for discussion: the economic model used by EPU and the one used by the MOF. The MOF uses a simple spreadsheet (single household) model for forecasting but without any link to the green sector or climate change. MOF also uses an I-O table but it does not take any externalities into account, e.g. climate change. A CGE model would be capable to analyze the impact of certain economic changes (e.g. removal of fuel subsidy, foreign labour) on the macro-economy. However, for the EPU, there is a CGE model that is used by PMI (formerly the Human Resource Section). EPU Macro has a Social Accounting Matrix (SAM) which can examine other socio-economic impacts, and they also have an econometric model for forecasting purposes. EPU Macro is building a new CGE model (there is an old one but it has not been maintained). Thus, the main finding is that both institutions prefer the project to develop their own macro-economic model, preferably incorporating a green or climate change component, using CGE instead of partial equilibrium model. If that were the case, then feedback effects can also be examined.

- 2.8 The other economic model that was mentioned, GTAP (www.gtap.agecon.purdue.edu), is a global network of researchers and policy makers conducting quantitative analysis of international policy issues. GTAP-E (www.gtap.agecon.purdue.edu/resources/res_display.asp?RecordID=923), an extended version models the energy-economy-environment-trade linkages with an objective to aid applied economic policy analysis. GTAP has been used by UKM professors in trade analysis, and the opportunity exists to engage them to develop a GTAP-E version for Malaysia.

3.0 *Issues and Key Findings*

- 3.1 While the NC2 has provided a clear baseline of the situation in 2005, it does not yet have a clear forecast of the future, especially for the situation beyond 2020. Most of the socio-economic forecasts have their end-point in 2020. Given that this is a climate change study, the end-point is not nearly far ahead to experience the full effects of climate change. Most GCMs now forecast till 2100 and some to 2200. One should have good reasons to define the end-point for the ECCM study, and it is possible that there are different end-points for different components of the study, e.g. the mitigation component could have a different end-point than the adaption component. Nonetheless, one important area is also to develop a better understanding of the Malaysian economy beyond 2020 as it is the basis in which all economic analysis of climate change.
- 3.2 Another key issue is the linkage between the technical works of NC2 with the economic work of ECCM. More detailed assessments need to be done, particularly to continue the valuable work that the NC2 has reached at the technical level. Some progress had been made with the economic work and several models have provided a macro-overview of potential impact. However, the work is still sectoral in nature, and the macro-economic picture is not yet established. The economic cost of adaption has also not been clearly estimated, partly because the future scenarios themselves have not been clearly established. Thus, transitioning from the sectoral to the macro-economic picture seems to be an important area to work on for ECCM. The various models that have been discussed in the earlier section could be the inputs to the macro-economic model. However, a soft link of the models is probably better than a hardwired model link.
- 3.3 To undertake the work on the best options for reducing emission intensity by 40%, it would appear that it would require the use of an optimization model, especially one that is linked to the macro-economic model (however that might be defined). Although the end-point of that work is 2020, it seems that one could set this work as a priority for the ECCM project.
- 3.4 In terms of mitigation component, it would appear that the energy sector is critical. Here, there has been limited use of MARKAL but the project should not assume that this experience can still be easily accessed. A new team is needed. One opportunity that has emerged is that the ADB is embarking on a study to examine the potential for building a low carbon economy in four countries (www.pid.adb.org/pid/TaView.htm?projNo=43552&seqNo=01&typeCd=2) in the region:

Indonesia, Philippines, Thailand and Vietnam. An offer is under discussion to extend that study to Malaysia. If the agreement works out, then it would mean that the resources of the ECCM project could be used to address areas where resources are lacking (e.g. NC2 continuing support) or applied to new areas.

- 3.5 Both EPU (Macro) and MOF have suggested that a CGE model be developed for climate change and they do not recommend a partial equilibrium model approach. EPU (Macro)'s experience is that it would take about two-thirds of a year to build one. One would have to use the 2005 I-O tables as the basis for starting this work. Who would maintain this model, assuming that it has utility beyond the project? A suggestion: develop a partial model in the project period, and if it works well, then consider developing a full CGE model after 2012. Of course, the cost for undertaking this kind of work has not been anticipated in the ECCM project, and if the suggestion were to be taken up, additional resources would need to be found.
- 3.6 The study team had identified that GTAP experience exists. In fact, the NC2 report mentioned this as a possible follow-up effort. However, as of now, the study team has not found any experience in the GTAP-E work so far, although there is a group in UKM that is working on GTAP. It seems important to link up with this group in order to tap into their economic modeling experience. The extension of the model GTAP-E has integrated energy-environment-economy-trade modules and these would be extremely useful for policy analysis. In this regard, the suggestion of designating an institution as a focal point for economic modeling and with the intention to make that into a centre of excellence should be taken up.
- 3.7 Extending the NC2 work as the basis for ECCM is vital. Many of the institutions that were providing inputs to NC2 on a gratis basis may not be so cooperative when it comes to ECCM. Under NC2, the basis for cooperation was voluntary and that meant the NC2 work was of a lower priority to the primary work of the participating institutions. The end result was a delay in the NC2 project. The various institutions have indicated that they would offer services in consultancy terms and not on a voluntary basis as under NC2. If this were the case, then the timely completion of the ECCM project is contingent upon finding sufficient resources to allow for this engagement.
- 3.8 While it is clear that there are climate change impacts over the long term, it is not the only factor that is affecting the socio-economic conditions that is experienced today. In other words, short term socio-economic changes are felt more directly than long term climate changes. While the changes to weather patterns that might be attributable to climate changes are being experienced, socio-economic changes also change the socio-economic conditions very rapidly and could in some ways make adaptation and mitigation more costly as a result. One has to bear in mind that climate change effects are not the only effects that are being considered in any development agenda. Thus, it is clear that an economic case need to be made for climate change.

4.0 *Assessment*

- 4.1 Based on the stock-taking assessment, it seems clear that the ECCM project can start with the technical models that have been developed under NC2. The ECCM project

must forge the link of technical with the economic models. The work done by the JMM in translating various GCMs into RCMs, PRECIS and in forecasting the key (climate change) parameters will provide the range of variables with which to input into the other models.

- 4.2 The LEAP (energy) model with the energy balance, forecasting and emissions modules, and with the optimization module will be a good starting point for the mitigation section. As noted above, the optimization module will formulate an integrated solution for reaching the emissions intensity targets in the most cost-effective manner. If resources are available, the ECCM project could explore the purchase and use of the MARKAL model.
- 4.3 Models, such as DSSAT and Reg-HCM, will facilitate a sectoral approach into agriculture and water resource sectors. The gap in the current work done is a more comprehensive look at Sea Level Rise and Storm Surges. Here, it is clear that some effort will need to be devoted to a more detailed look at this area.
- 4.4 In terms of the link to economic models, the GTAP-E could be a temporary solution. There is a GTAP model for Malaysia in use. The key issue is to explore the use of GTAP-E to incorporate the energy-environment components. A partial analysis could be organized with the EPU Macro Section to analyse various scenarios with climate change effects included.
- 4.5 Beyond the ECCM project, there is the possibility of developing a CGE model. The ECCM work will explore whether the analytical capabilities can be further extended with other macro-economic models, whether they are CGE or econometric based ones.

ECCM Project Schedule for 2010

The deadlines for 2010 on this project are

- 1st draft Stock Taking Report: 13 September
- 1st TWG: 21 September
- PAGE 2009 training: 28-30 September
- Final Stock Taking Report draft ready: 11 October
- 1st NSC: 15 October
- Inception Workshop: November
- 1st draft Inception report: 11 November
- Final draft Inception report: early December

Prepared by:

ECCM Team /13 September 2010

ECCM Team Members for Stock Taking Exercise

Azhar Noraini, EPU

Dayang Nor Izan Abang Halil, EPU

Irene Chung, EPU

Lim Wei Urn, EPU
Zawina Ahmad, UNDP
Chang Yii Tan, UNDP

ECCM Technical Committee Members, Stock Taking Exercise

EPU (ENRES, Macro)
NRE (CEMD)
KETTHA (Energy, Green Tech)
GTM
FRIM

Stock-Taking Exercise: Schedule of Meetings

Date	Time/Venue	Institutions	Notes
16 Aug	9am ENRES	LESTARI	Annex 1
	11am ENRES	Green Tech Malaysia	Annex 2 Annex 2a (LEAP)
17 Aug	10am FRIM	FRIM (GHG and Forestry Adaptation)	Annex 3
	12noon FRIM	FRIM (Biodiversity Adaptation)	
19 Aug	9am ENRES	NAHRIM	Annex 4
	11am ENRES	MARDI	Annex 5 Annex 5a (DSSAT)
23 Aug	2.30pm MMD	MMD	Annex 6 Annex 6a (PRECIS)
24 Aug	10am ENRES	EPU Macro and Treasury	Annex 7
2 Sept	10am ENRES	Stock-Taking Review by Tech Committee	Annex 8
3 Sept	2.45pm UKM	Prof Jamal Othman	Annex 9

Economics of Climate Change for Malaysia Study

Appendix 1: Stock Taking Exercise 2010 with LESTARI

Date : 16 August 2010
Venue : ENRES, EPU
Time : 0900 – 1110

Ms. Dayang on behalf of ENRES, EPU started the discussion with a short welcoming remarks and thanked representatives from LESTARI for their time.

The ECCM's consultant, Mr. Chang, explained that the purpose of the stock taking exercise is to have a better understanding of the models/approaches/methods used for analysing the socio-economic impacts response (SEIR) to climate change impacts; the advantages/limitations of the models/approaches/method; its coverage and uncertainties; and how it will be linked to the economic models. The meeting was informed that the ECCM will be using the output/outcome from the NC2 as input into the economic analysis. The stock taking exercise also includes discussions on the following:

- Methods to link the scientific data from NC2 to the economic models;
- Determine whether models being used are correlated and standardisation of definitions in terms of time frame, forecasting across all sectors;
- Identify resource persons with experience in the relevant models;
- Level of support and involvement from relevant key agencies/stakeholders;
- Establishment of networks to ensure the effectiveness of achieving end result;
- Data or database; and
- Case studies.

Dr. Joy on behalf of LESTARI discussed relevant issues under the SEIR component of the Vulnerability & Adaptation Group under the NC2, among which include:

- 7 sectors and 2 sub-sectors were studied under SEIR (health, coastal & marine, agriculture, energy, biodiversity, forestry, and water)
- a considerable amount of case studies were conducted to further understand the socio-economic impacts on each sector and some are still on-going:
 - Coastal – progressing slowly. Only covered the scientific part and have yet to touch the economics part of it;
 - a case study in Port Klang to calculate potential consequences of sea-level rise (0.5 m; and 1.0 m) to the residential and commercial areas surrounding it;
 - JPS conducted a national coastal vulnerability study some time ago but now NAHRIM is also working on it. But not sure whether NAHRIM's work is a continuation of JPS's work;
 - Other case studies (by NAHRIM) includes: Langkawi & Tg. Piai
 - Fisheries not included

- Health – quite advanced. Currently developing a methodology to estimate the economic cost of health impacts particularly on vector-borne diseases (focus area: Hulu Langat, Putrajaya & Seremban) and air pollutant diseases (focus area: Klang Valley);
 - use DALYS and DOSE-response method and modifies the WHO approach according to Malaysian needs;
 - Working with Dr. Syed Jamil and Dr. Rizal on a case-mix study (developed by Dr. Syed Junid, HUKM) to calculate costs of illness related to air pollutant/climate change;
 - 4 working groups on health sector: Dr. Er (integration), Dr. Mazura (air pollutant), HUKM (case-mix), and IMR (vector & air pollutant).
- Agriculture – work by MARDI is quite advanced;
 - Prof. Chamhuri (UKM) assisting on livelihood aspect;
 - Dr. Ekhwan: using hydro-logical model to look at relationship of selected crops and its impact to the economy.

Other matters:

- Fisheries currently is not taken into account as changes (whether or not due to climate change?) isn't obvious and no one seems to be working in this area;
- Adaptation measures must be considered individually for different sectors;
- Use of GIS mapping is crucial in order to see the vulnerability of an area;
- Health sector is not so spatial but it has a strong link to poverty (according to Raja Datuk Zaharaton, ex-DG of EPU and is currently in Poverty Mapping study)
- However, most of the work under SEIR is a case-study level and no projection yet. But, not all data may be applied to the I/O model
- LESTARI would provide some documents to EPU:
 - A complete set of individual reports of SEIR - NC2 (2 reports)
 - DID's Coastal Vulnerability study
 - A hardcopy of *Operasi Universiti Penyelidikan* (OUP)
 - List of publications
 - List and contacts of SEIR working group and list of contacts would be sent by Mr. Tan of LESTARI
- Sectors and contact persons:

○ Health	-	Dr. AC Er (UKM)
○ Coastal & Marine	-	NAHRIM
	-	Dr. Rawshan (UKM)
○ Water	-	Prof. Shahwahid (UPM)
○ Forest	-	Ms. Poh Lye Yong (JPSM)
○ Biodiversity	-	Dr. Lim Hin Fui (FRIM)
○ Energy	-	En. Azman Zainal Abidin (PTM/GTM)
	-	Dr. A.Hamid Jafaar (UKM)
○ Agriculture	-	Dr. Zabawi (MARDI)
- Other contacts:

- Tan Sri Dr. Salleh Yasin (Head of UNU Global Health on Climate Change, HUKM)
- Prof. Jamal Hisham Hashim (UKM – seconded to UNU)

Attendance:

Prof Joy Pereira
Dr Er Ah Choy
Dr Rawshan Ara Begum
Mr Tan Ching Tiong
Mr Md. Shahin Mia
Dayang Nor Izan Abang Halil
Lim Wei Urn
Irene Chung
Chang Yii Tan

Economics of Climate Change for Malaysia Study

Appendix 2: Stock Taking Exercise 2010 with Green Tech Malaysia

Date : 16 August 2010
Venue : ENRES, EPU
Time : 1115 – 1230

Ms. Dayang on behalf of ENRES, EPU started the discussion with a short welcoming remarks and thanked representatives from Green Technology Malaysia (GTM) for their time.

The ECCM's consultant, Mr. Chang, explained the purpose of the stock taking exercise was to have a better understanding of the models/approaches/methods used for the mitigation analysis under NC2; advantages/limitations of the models/approaches/method; its coverage and uncertainties; and how it will be linked to the economic models. The meeting was informed that the ECCM will be using the output/outcome from the NC2 as input to the economic analysis. The stock taking exercise also includes discussions on the following:

- Methods to link the scientific data from NC2 into the economic models;
- Determine whether current models being used are correlated and standardisation of definition in terms of time frame, forecasting, etc. across all sector;
- Identify resource person with experience in relevant models;
- Level of support and involvement from relevant key agencies/stakeholders;
- Establishment of networks to ensure the effectiveness of achieving end result;
- Data or database;
- Case studies.

The discussion continued with explanation from Mr. Azman of GTM, Head of Mitigation Group-NC2 on the following issues:

- GTM uses the Long-range Energy Alternative Planning model (LEAP) to forecast energy sector of different scenarios and estimate the energy trends as there is a close link between GDP and energy. Input for LEAP:
 - Population
 - GDP (look at total value of GDP as required by NC2) but can always break it down into details if needed
- LEAP is an open source programme and is able to capture and calculate gases needed for research (cheaper & less time consuming); baseline data such as GDP and population needs to be inputted to enable the software to analyse and assess climate change mitigation;
- LEAP can produce results by region if regional data is available; breakdown of parameters (variables) are possible too, provided data exist;
- MicroFit (an economic model) can be used to establish the economic connection and see the forecast;

$$\begin{array}{ccccc} \text{LEAP} & + & \text{MicroFit} & = & \text{Forecast} \\ (\text{energy data}) & & (\text{GDP, Population, etc.}) & & \end{array}$$

- Another model is Market Allocation (MARKAL), which uses time series data, energy system organization and a flexible “what-if” framework to analyze among others resource supply, fuel processing, conversion technology, transmission and distribution networks, and energy use;
- MARKAL is not an open source programme, therefore will incur cost (20,000) if it's intended to be used. GTM has used MARKAL before. However, most of the officers who were trained have left GTM. If need be, they can still be contacted;
- For the NC2, GTM reports on mitigation of the following 5 sectors, namely:
 - Energy (GTM)
 - Power sector, manufacturing, transport, residential, commercial
 - Forestry (Dr. Gary)
 - Industrial processes (GTM) (only involve in production, not combustion)
 - Mineral, chemical industries, iron & metal
 - Waste (JPSPN)
 - Agriculture (MARDI);
- Availability of data:
 - CDM & energy balance – available
 - Emission reduction from type of energy use – available
 - GHG inventory for energy sector (actual: up to 2005; and at least 2008 data for energy but for waste and agriculture, actual data is up to year 2000 only)
- Annual National Energy Balance is published every year by GTM based on actual data from key stakeholders (IPP, TNB, Petronas, etc.) It is reported as national data but GTM do have data for Sabah dan Sarawak;
- Previous DANIDA IRP study (implemented by Energy Section, EPU) would be a good reference for ECCM Study.

Other matters:

- The discussion noted that a Carbon Asset Management Programme (CAMP) has been submitted to Ministry of Natural Resources and Environment for deliberation. The paper mainly discusses on key sectors and type of technology needed to move the country nearer towards 40% reduction of carbon intensity. CAMP would also look beyond intensity and study nett emission as well;
- GTM currently has no economic case study but will furnish EPU with the full report on inventory and mitigation done; pervious MARKAL team contact details and document on Energy Balance.

- On participation matter, GTM expresses that a further discussion would be needed before agreeing to the amount of work they are able to commit.

Attendance:

En Azman Zainal Abidin
Radin Diana Radin Ahmad
Cik Sazalina Zakaria
Dayang Nor Izan Abang Halil
Lim Wei Urn
Irene Chung
Chang Yii Tan

Appendix 2a: GTM

EPU-UNDP Economics of Climate Change for Malaysia Study Stock-taking Exercise (August 2010)

PART A

Participating Institutions: Please fill in the information about the models that have been used for climate change studies at your institution/project (e.g. the NC2 study).

1. Model name
LEAP (Long-range Energy Alternative Planning)
2. Brief description
A widely-used software tool for energy policy analysis and climate change mitigation assessment
3. Model developer
Stockholm Environment Institute
4. Responsible officers/housing institution
Malaysian Green Technology Corporation (Greentech Malaysia)
5. Analysis: impact and adaptation or mitigation
Mitigation
6. Type: climate model, V&A assessment, impact/adaptation assessment, economic model, energy system, GHG inventory tool, or sector-specific

- Climate Model, Economic Model, Energy System, GHG Inventory Tool
7. Coverage of sectors (pls specify)
Currently in National Energy Balance format, but can be tailored to user requirement
8. Geographical coverage/resolution (if applicable)
Currently Malaysia, but can go down to regions or states depending on data availability
9. Time horizon and time step
For NC2 study - base year 2000, forecast until 2030 - but we can decide what we want
10. Output variables
For NC2 study - Energy, GDP, population, and C02 emissions - but can be more depending on user requirement
11. Key drivers

For NC2 study - GDP, population – but can be more depending on user requirement

12. Policies and measures that have been/can be considered

For the NC2 study - Energy Efficiency in Industrial and Commercial sector, Renewable Energy in Power Generation, Nuclear Energy in Power Generation, Renewable Energy in Transport Sector

13. Treatment of uncertainty (yes or no, if yes, how)

No

14. Previous application and current usage

Regional Cooperation Projects e.g. ASEAN Energy Outlook, and NC2 Study

15. Scenarios

For the NC2 study - EE Scenario, RE Scenario, NUC (Nuclear) Scenario, APS Scenario, BAU Scenario

16. Publication and references

EPU, DOS, TNB, PETRONAS, NEB

Economics of Climate Change for Malaysia Study

Appendix 3: Stock Taking Exercise 2010 with FRIM (GHG Inventory)

Date : 17 August 2010
Venue : FRIM, Kepong
Time : 10.00 am – 1.00 pm

Ms. Dayang on behalf of ENRES, EPU started the discussion by thanking FRIM for their time and hosting the discussion.

The ECCM's consultant, Mr. Chang, explained the purpose of the stock taking exercise which is to have a better understanding of the models/approaches/methods used in the GHG Inventory exercise under the NC2; the advantages/limitations of the models/approaches/method; its coverage and uncertainties; and how it will be linked to the economic models. The meeting was informed that the ECCM will be using the output/outcome from the NC2 as input for it to run the economic analysis. The stock taking exercise also includes discussions on the following:

- Methods to link the scientific data from NC2 into the economic models;
- Determine whether current models being used are correlated and standardisation of definition, time frame, forecasting, etc. across all sectors;
- Identify resource person with experience in relevant models;
- Level of support and involvement from relevant key agencies/stakeholders;
- Establishment of networks to ensure the effectiveness of achieving end result;
- Data or database; and
- Case studies.

Discussion continued with explanation from Dr. Abdul Rahim Nik and Dr. Elizabeth Philip from FRIM on the following issues:

- FRIM currently uses 2 models/software (both are open source) for the purpose of NC2's GHG Inventory (but maybe there are other better models available):
 - IPCC Workbook – used for all other sectors except agriculture
 - UNFCCC Software – used for agriculture (latest software with added feature which can be used to identify key sources)
 - Currently, only Agriculture uses the UNFCCC Software. The rest of the sectors use the IPCC Workbook. Eventually, all sectors would need to move towards UNFCCC Software and as newer international guidelines are produced over time
 - The software however does not allow 'importing' of data from Excel based, it need to be keyed-in manually
- There are 4 focal point for the GHG Inventory, which are:
 - LULUCF – Dr. Elizabeth, FRIM (oil palm, rubber, urban tree planting – yearly inventory)
 - Energy – Ms. Radin Diana, Green Tech Malaysia (GTM)
 - Industrial Processes – Ms. Radin Diana, GTM
 - Waste – Mr. Rushdan, DOE

(DOE handles 3 types of waste: solid, commercial (include industrial and oil palm waste but exclude food waste) and wastewater)

- Agriculture – Mr. Shuhaimen, MARDI
- FRIM offered to assist in synthesising the inventory data needed for the ECCM if EPU can identify what information is needed
- Dr. Rahim Nik opines that summarised/synthesised data would be sufficient for ECCM; data collected on yearly basis (except agriculture which is done every 3 years but data for 2005 is projected). For other sectors, 2007 data are projected. Complete baseline starts at year 2000 (actual data)
- For the NC2, projection is made up to year 2020 but maybe in the future can project up to year 2050
- FRIM's projection would be higher than GTM as FRIM looks at energy in total while GTM took certain components only (energy & industrial processes)
- Correlation of i.e. GDP, population growth, industries, etc. with the sector needs to be understood for creating a projection curve; Malaysian economy relies heavily on trade, therefore, in-depth understanding in this area is important
 - oil palm is heavily discuss as the industry is under international audit
- Issues to take note of:
 - Waste data is updated till year 2000 and uses national average, not state average;
 - LULUCF – data collected by region (Peninsula, Sabah & Sarawak);
 - Agriculture – national data (takes rice cultivation, manure and livestock production);
 - GIS was not used because Malaysia practices selective logging in certain areas which cannot be captured by GIS. So, GIS data not so inaccurate;
 - In NC2 calculation, we did not include protection/reserve forest because it was not allowed in the 1996 IPCC guidelines but in the 2000 and 2003 guidelines, this category is allowed.
- Agriculture and Industrial Processes projections are based on IPCC's 10% increase as Malaysia does not have own projection scenario
- Forestry: not much quantitative work has been done on land use change impact on biodiversity; linkages to climate change
 - Malaysian classification of forest: protection, production (depending on age), mangrove, peat swamp, rubber, oil palm, urban forestry and forest plantations
- Asia Pacific Integrated Model (AIM) which is a Japanese model could be given due attention to evaluate its relevance to ECCM (a brochure was handed over to the team)
- REDD+ is an incentive for states to maintain their forests, can be implemented locally using finance from large corporation. Information on forest and water catchment area in Sabah & Sarawak is currently not transparent, therefore might create some complication

Other matters:

- FRIM would positively support and give full cooperation towards ECCM. A softcopy of the GHG reports would be sent through email to Cik Dayang by Dr. Elizabeth.
- Dr. Rahim Nik suggested that it would be a good exercise to identify which Ministry/agencies are in possession of what type of information during this exercise.
- It might be necessary to meet up with Ministry of Transport officers to understand the in-house initiatives/activities that are currently being work on.

Persons attending:

Dr Abdul Rahim Nik

Dr Elizabeth Philip

Dayang Nor Izan Abang Halil

Lim Wei Urn

Chang Yii Tan

Stock Taking Exercise 2010 with FRIM (V&A)

Bio-Diversity (V&A) discussion with Dr. Lim:

- For the moment, it is hard to establish a significant link on how climate change affects biodiversity per se as evidence indicates that the change is caused by other factors (human activities)
 - The link to bio-diversity is even harder as the known linkage is weak
- Bio-diversity might not be worth researching further in ECCM due to its weak linkages

Attendance:

Dr Lim Hin Fui

Dayang Nor Izan Abang Halil

Lim Wei Urn

Chang Yii Tan

Economics of Climate Change for Malaysia Study

Appendix 4: Stock Taking Exercise 2010 with NAHRIM

Date : 19 August 2010
Venue: ENRES, EPU
Time : 0900 – 1030

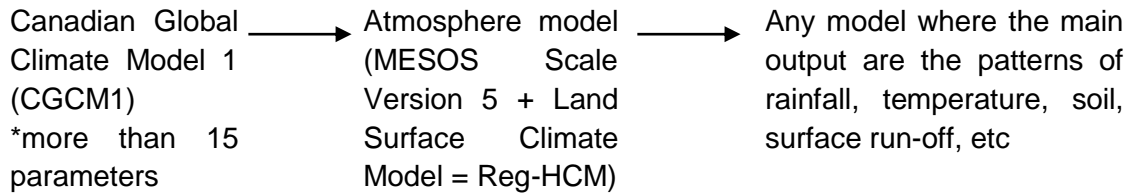
Ms. Dayang on behalf of ENRES, EPU started the discussion with a short welcoming remark and thanked representatives from NAHRIM for their time. The purpose of the discussion is to know the type of model that NAHRIM used in carrying out the vulnerability and adaptation (V&A) study for the NC2, in-depth information of the model, parties involved in the study as well type of data needed to conduct the study.

The stock taking exercise includes discussions on the following:

- Type of model used
- Projections used in the model
- Treatment of uncertainty
- Case studies implemented on the model

Among issues discussed includes:

- Regional Hydro-Climate Model (Reg-HCM) is currently used by NAHRIM in predicting the climate change impacts.
- On coastal and marine, a study named National Coastal Vulnerability Index (NCVI) utilizing MIGHT 21 (Coastal Hydro Dynamic model) was conducted by JPS and UTM as the consultant. The study was conducted in order to assess the vulnerability at Tanjung Piai and Langkawi. The study at Tanjung Piai shows a 1.3 mm/year rise. This rate is derived following the 26 year of data gathering at Tanjung Piai. Using this rise rate, 50 years and 100 years prediction is conducted.
- According to NAHRIM, the study on sea level rise was conducted using local data and global prediction where the sea level rise is estimated to be 1.3 mm / year. The meeting was informed that the condition at Tanjung Piai is more alarming than at Langkawi. However, the JPS study has not included other parts of Malaysia.
- The meeting was also notified that NAHRIM is currently conducting a detailed regional study on sea level rise for Malaysia (Peninsular Malaysia, Sabah and Sarawak), which is projected to be completed by year end. The study will look at the sea level rise of the country and areas that may be inundated. However, the study is using statistical info/local data/historical data and not based on climate change scenario.
- Reg-HCM is only applied to land surface and did not cover sea level rise. Another separate model is used to determine the sea level rise. MIGHT 21 is used to predict the impact of hydro dynamic and inundation where the model can project the final output in 2D and 3D. However, it needs input from Reg-HCM.
- Following is the flow of the models:



- It is not necessary to use numerous models in a particular study. Models need to be selected to suit to the region. For example in the study, Sabah and Sarawak only uses 4 scenarios based on 2 GCM where 3 scenarios were predicted by ECHAM 5 from Germany and 1 scenario predicted by MRI from Japan. There is no issue of using different models in a particular study.
- Under the IPCC AR4 study which simulate climate projection in South East Asia region, several models were used but the study found out that the output of the 2 models (ECHAM 5 and MRI) are more accurate.
- PRECIS, a RCM from UK. Its limitation is that it is not detailed enough as it uses 50 km resolution.
- Reg-HCM is specifically configured for Malaysia by NAHRIM where it integrates hydro aspect in it. It is more detailed as it predicts up to 25 km resolution and every polygon and depth of each layer is counted. Effort is being made to increase the resolution up to 12 km.
- The Reg-HCM only generates 1 scenario.
- PRECIS uses 5 scenarios:
 - ERA 40
 - HAT AM3 A2
 - HAT AM3 P2
 - HAT AM3 baseline
 - ECHAM5
- There is no limitation in setting common scenario however, to determine the model's needs. The project needs to decide on its purpose and how detail the assessment will be. For example, if we want to study a small area, PRECIS will not be suitable because it will cover an area of 2500 km² (50 km x 50 km resolution). Thus, a more refined model is needed.
- NAHRIM plans to introduce a climate change factor that can be used by JPS and JKR to plan their infrastructure development. Currently the study is still on-going and foreseen to be completed by year end.
- For example, an analysis was conducted at Sg. Johor based on rainfall and flood level. The study found out that, the 100 year return period from observed record under the climate change scenario would become a 20 year return period.
- For treatment for uncertainties in the Reg-HCM, NAHRIM introduced the "biased correction factor". When there is any error in the model, it will be corrected.
- NAHRIM is forecasting up to 2050 on yearly basis (using Reg-HCM). In the NAHRIM study, due to limitation of the model, projection for Peninsular Malaysia is for the period of 2025-2034 and 2041-2050. Baseline data was from 1984 to 1993. At Sabah and Sarawak, the projection is from 1970-2100.

- The current limitation in running model is available data. In order to predict a 100 years scenario, a total of 30 years record is needed. For the 50 years scenario, data of 20 years data is needed.
- The meeting took note that NAHRIM has conducted a study on storm surges particularly on tsunami.

NAHRIM's suggestion for ECCM:

- Project to select one area (e.g. Klang Valley) to assess/analyse all the sectors identified. This approach will give clearer and accurate results of each scenario and will assist in development of policy options as all sectors are inter-related to each other in one area.
- Later, to duplicate to other areas.
- Sectors under V&A – NC2:
 - water resources
 - forestry
 - biodiversity
 - agricultural
 - public health
 - energy
 - coastal & marine
- Subsectors:
 - socio-economic impacts response (SEIR)
 - climate change projection

Other matters:

- NAHRIM would provide the following document to EPU:
 - Full report on V&A
- Contact Person at JPS for NCVI – Mr. Roslan Sukimin, Bhgn. Pantai

Attendance:

Ir Mohd Zaki M Amin
 Dayang Nor Izan Abang Halil
 Lim Wei Urn
 Irene Chung
 Zawina Ahmad
 Chang Yii Tan

Economics of Climate Change for Malaysia Study

Appendix 5: Stock Taking Exercise 2010 with MARDI

Date : 19 August 2010
Venue: ENRES, EPU
Time : 1100 – 1200

Ms. Dayang on behalf of ENRES, EPU started the discussion with a short welcoming remarks and thanked representatives from MARDI for the time. She gave an overview of the study to both the representatives from MARDI since it is the first time for both of them to discuss on the ECCM.

The stock taking exercise includes discussions on the following:

- DSSAT model
- Application of the model
- Database
- Limitations the model

Among issues discussed includes:

- The DSSAT software is not free: estimated cost of US\$3,000. MARDI received a complimentary copy of the software for few months and received training in the US (some time ago). MARDI will report back on the exact cost and date of expiry.
- Projected information such as rainfall and temperature from NAHRIM will be the input into DSSAT.
- Crops co-efficient is one of the limitations MARDI is facing. MARDI needs to have their own detailed experiment to determine the crop co-efficient. DSSAT is a physiological model as such physiological data is required. Currently, MARDI is using general default value (IR84 – value from ERI) in crop co-efficient.
- MARDI informed that it is not encouraged to use value from other countries as it will generate inaccurate results. The changing of weather pattern will definitely affect the planting schedule of a crop, its productivity and may be slightly affects the variability.
- DSAAT can simulate output for 17 crops (www.icasa.net/dssat/product.html) but in Malaysia, DSAAT can only be used on the following crops such as maize, sweet potato, and rice.
- The meeting was informed that there's another model for oil palm plantation – perennial model. The exercise is headed by MPOB.
- Cocoa was not included in the NC2 exercise and it uses another model as well. There's also a separate model used for rubber.
- In order to overcome the limitation on crop co-efficient, MARDI is taking up experiment on this by monitoring weather temperature and flowering season on certain crops in Malaysia.
- It was noted that the raining season will affect the pattern of crops (particularly on rice). MARDI also informed that for NC2 purpose, they only take into account the amount of changes and not the pattern of changes. As such, MARDI will continue to

look at the pattern of changes. From the projection from NAHRIM, MARDI will be able to develop the planting schedule. This is important for the main grainery area such as MADA and KADA.

- DSSAT allow generation of scenario such as increase the temperature. In NC2, 2 scenarios were generated, 2 degree Celsius and 4 degree Celsius rise in temperature.
- DSSAT able to project to n numbers of years provided n number of years of data is given.
- Crop co-efficient for DSSAT usually do not change unless new variety pops up such as increase in water resources and drought resistance.
- The few main output from the model is crop yield, resources and environment impact. DSSAT also able to stimulate result on the economic aspect. For example, by putting in the cost of fertilizer, the model able to predict the cost-effectiveness. This will help in terms of doing planning as well.
- DSSAT is not able to predict for future event as it is a roughly independent environment model. DSSAT can take environmental event from external source such as input from NAHRIM.
- Problem: Irrigation scheme for paddy in Malaysia is only to supplement rainfall and not to fully support the planting area. This happened because on average, Malaysia has a high rainfall pattern. However, in the future, when weather is drier, irrigation system in Malaysia will require assistance. Might create competition for water among sectors.
- There was a study conducted together with KAFSA on the food security versus the production of rice.
- DSSAT is run by grainery area. For example, if the study is done for MADA, soil data from MADA is required. Output from the model can be translated into mapping.
- To run projections, MARDI need to do monitoring and collection of databut they have no funding for this purpose. Research funding under MOSTI cannot be used as MOSTI did not considered collection of data as research work. As such, MARDI is facing difficulty in requesting for funding for future research.
- Currently for NC2, MARDI only utilize data at MADA as research area. There are a total of 7 to 8 grainery areas in Malaysia.
- No treatment of uncertainty in DSAAT. The rule of thumb is “garbage in garbage out”. As such, data input to the model is very crucial in terms of accuracy.
- There’s a probability distribution in the model where percentage of accuracy can be calculated.

GHG Inventory

- No model was used for agriculture sector in GHG inventory exercise under NC2. This sector only utilises UNFCCC workbook (latest with additional feature that can identify key sources).
- The limitation faced by MARDI is lack of emission factor for rice, livestock and soil. MARDI is using default value in the absence of the emission factor.

- Other than that, MARDI informed that data collection is also one of the limitation faced by them. MARDI has the accessibility of data however; the data is not tailored for inventory calculation.

Other matters:

- Potential trainer of DSSAT model is Prof. Atachai from Thailand.

Attendance:

Dr Mohammad Zabawi Abdul Ghani
En Shuhaimen
Dayang Izan Halil
Lim Wei Urn
Irene Chung
Zawina Ahmad
Chang Yii Tan

Appendix 5a: EPU-UNDP

Economics of Climate Change for Malaysia Study Stock-taking Exercise (August 2010)

PART A

Participating Institutions: Please fill in the information about the models that have been used for climate change studies at your institution/project (e.g. the NC2 study).

1. Model name

DSSAT (The Decision Support System for Agrotechnology Transfer)

2. Brief description

The Decision Support System for Agrotechnology Transfer (DSSAT) is a software package integrating the effects of soil, crop phenotype, weather and management options that allows users to ask "what if" questions and simulate results. DSSAT v4 includes improved application programs for seasonal and sequence analyses that assess the economic risks and environmental impacts associated with irrigation, fertilizer and nutrient management, climate change, soil carbon sequestration, climate variability and precision management. DSSAT have been widely used to simulate crop yield of a system under different management strategies, select management practices for optimum resource use and sustainable crop production with minimum malefic effect on environment, take right decision based on economic return of a system and alter management options based on weather changing. Although it has been extensively used in both developed and developing countries to increase food production and for nutrient and water management, it can still be exploited to solve many problems in this present age of information.

3. Model developer

International Benchmark Sites Network for Agrotechnology Transfer (IBSNAT) with collaboration from the University of Florida, the University of Georgia, University of Guelph, University of Hawaii, the International Center for Soil Fertility and Agricultural Development, Iowa State University and other scientists associated with ICASA.

4. Responsible officers/housing institution

Dr Mohamad Zabawi bin Abdul Ghani, Mr. Kamarul Azwan bin Aba, Mrs Engku Elini binti Engku Ariff.

5. Analysis: impact and adaptation or mitigation

Impact, adaptation and mitigation

6. Type: climate model, V&A assessment, impact/adaptation assessment, economic model, energy system, GHG inventory tool, or sector-specific

Crop model

7. Coverage of sectors (pls specify)

The DSSAT package incorporates models of 27 different crops.

8. Geographical coverage/resolution (if applicable)

The user can then simulate multi-year outcomes of crop management strategies for different crops at any location.

9. Time horizon and time step

None

10. Output variables

Crop yield, resource use, and environmental impact as a function of weather and soil data, genetics, and crop management.

11. Key drivers

The required minimum weather data includes:

- **latitude and longitude of the weather station,**
- **daily values of incoming solar radiation (MJ/m²-day),**
- **maximum and minimum air temperature (°C), and**
- **rainfall (mm).**

Desired soil data includes soil classification (e.g. USDA/NRCS), surface slope, soil color, permeability, and drainage class. Soil profile data by soil horizons include:

- **upper and lower horizon depths (cm),**
- **percentage sand, silt, and clay content,**
- **1/3 bar bulk density,**
- **organic carbon,**
- **pH in water,**
- **aluminum saturation, and**
- **information on abundance of roots..**

Management data includes information on planting date, dates when soil conditions were measured prior to planting, planting density, row spacing, planting depth, crop variety, irrigation, and fertilizer practices.

12. Policies and measures that have been/can be considered

None

13. Treatment of uncertainty (yes or no, if yes, how)

None

14. Previous application and current usage

Determine the effects of climate on crop production.

15. Scenarios

Change in climatic variables such as temperature, solar radiation and rainfall patterns

16. Publication and references

Crop Model User's Guides

Economics of Climate Change for Malaysia Study

Appendix 6: Stock Taking Exercise 2010 with JMM

Date : 23 August 2010
Venue : Bilik Cumulus, JMM
Time : 1430 – 1630

Ms. Dayang on behalf of ENRES, EPU started the discussion by thanking Malaysian Meteorological Department (JMM) for their time and hosting the discussion.

The ECCM's consultant, Mr. Chang, explained the purpose of the stock taking exercise which is to have a better understanding of the models/approaches/methods used in the projection of climate changes for NC2; the advantages/limitations of the models/approaches/method; its coverage and uncertainties; and how it will be linked to the economic models. The meeting was informed that the ECCM will be using the output/outcome from the NC2 as input for the economic analysis. The stock taking exercise also includes discussions on the following:

- Methods to link the scientific data from NC2 into the economic models;
- Determine whether current models being used are correlated and standardisation of definition in terms of time frame, forecasting, etc. across all sectors;
- Identify resource person with experience in relevant models;
- Level of support and involvement from relevant key agencies/stakeholders;
- Establishment of networks to ensure the effectiveness of achieving end result;
- Data or database;
- Case studies.

Discussion continued with explanation from Dr. Yap Kok Seng and Dr. Wan Azli on the following issues:

- Climate projection is important for adaptation measures.
- The Adaptation activities in NC2 basically was based on NAHRIM's Reg-HCM model which only focus on a single downscaling from the Canadian GCM and focus only on rainfall distribution and not drought. NAHRIM is currently running a 9 km resolution on Sabah & Sarawak and have yet to be completed. NAHRIM's projection is directly linked to impacts on agriculture sector but how it relates to other sectors was still unsure.
- Downscaling from one GCM is not sufficient and that we need to run the coarse or regional model which is recommended by IPCC e.g. PRECIS model by Hadley centre. With one model only, the accuracy is very doubtful and uncertainty is very high.
- JMM runs 10 GCMs simultaneously including the Canadian model used by NAHRIM and the result for rainfall distribution showed differences for the same period of time but the trend is similar. As for temperature, the variation shows a consistent increasing trend from 1 degree to 3.6 degree for all 9 models.

- Rainfall is unpredictable because it is made of the force from climate change and the weather instability. Additionally, the model itself runs on different assumption and data used to generate the result. Even the scientific community is uncertain about the rainfall prediction especially post 2030.
- If the prediction is correct, the Government need to be prepared with better adaptation measures to address excess of water until 2030 and to prepare for drought period until 2040. Maybe Malaysia needs to start looking at its ground water as one of the strategies. Other factors such as population also need to be considered.
- IPCC noted the uncertainty issues on rainfall and they have managed to get a consensus on the mid latitude rainfall distribution due to the consistency of the distribution pattern by the different models used but not for the tropics. As such, in the IPCC 4th Assessment Report (AR4), there was a lack of discussion on the tropics rainfall distribution.
- JMM suggested that both extreme weather events must be looked at in line with IPCC direction.
- On sea level rise, can use JPS study, National Coastal Vulnerability Index (NCVI). It is the only study that uses the actual historical data to come up with the sea level rise and very gross economic impact to the affected areas. The study only focus at two places; Tanjung Piai in Johor and Langkawi, Kedah.

To submit to EPU:

- To plot both temperature and rainfall separately for Peninsula Malaysia, Sabah and Sarawak
- To include NAHRIM's rainfall projection in the plot as well, up to 2050
- Ensemble the model for both middle and end century (both rainfall and temperature) and to plot NAHRIM's rainfall projection for Peninsula only as comparison. To calculate the mean and standard deviation.
- To plot the rainfall distribution by region/zone in Peninsula Malaysia, Sabah and Sarawak e.g. north, south, east and west for better spatial distribution

Attendance:

Dr Yap Kok Seng
 Dr. Wan Azli
 Mr. L. K. Ling
 Mr. Mohankumar
 Mr. Kumaredran
 Dayang Nor Izan Abang Halil
 Lim Wei Urn
 Zawina Ahmad
 Chang Yii Tan

Appendix 6a: JMM
EPU-UNDP Economics of Climate Change for Malaysia Study
Stock-taking Exercise (August 2010)

PART A

Participating Institutions: Please fill in the information about the models that have been used for climate change studies at your institution/project (e.g. the NC2 study).

1. Model name
PRECIS (Providing Regional Climate for Impact Studies)
2. Brief description
The PRECIS climate model is an atmospheric and land surface model of limited area and high resolution, i.e. a regional modeling system. PRECIS can be run over any area of the globe on a PC or High Performance Computing Cluster (HPCC) system. PRECIS is designed to provide detailed regional climate information for impacts studies. PRECIS with software tools allow display and processing of the data produced by PRECIS to generate climate and climate change scenarios.
3. Model developer
This model has been developed at the Hadley Centre, UK Meteorological Office.
4. Responsible officers/housing institution
**Dr. Wan Azli Wan Hassan & Officers at the Numerical Weather Prediction Section / Malaysian Meteorological Department.
(Responsible officer at the Hadley Centre, UK: Dr. David Hassell)**
5. Analysis: impact and adaptation or mitigation
PRECIS only provide climate scenarios (e.g. temperature & precipitation/ rainfall), and the scenarios can be utilised for climate change impact studies.
6. Type: climate model, V&A assessment, impact/adaptation assessment, economic model, energy system, GHG inventory tool, or sector-specific
Climate Model (Regional)
7. Coverage of sectors (pls specify)
Produce climate change scenarios for impact assessment.
8. Geographical coverage/resolution (if applicable)
Southeast Asia / 50km resolution
9. Time horizon and time step
**Iteration time steps: 5 minutes
Output time horizons: daily, monthly, seasonal (3 monthly), annual,**

10. Output variables

- i) **Pressure (Sea Surface and other levels)**
- ii) **Wind Speed & Direction (U and V Wind components)**
- iii) **Temperature (Land Surface, Sea Surface and other levels)**
- iv) **Potential Temperature**
- v) **Specific Humidity**
- vi) **Relative Humidity**
- vii) **Short Wave Radiation**
- viii) **Long Wave Radiation**
- ix) **Evaporation**
- x) **Surface Latent Heat Flux**
- xi) **Potential Evaporation Rate**
- xii) **Transpiration Rate**
- xiii) **Panofsky Peak Gusting**
- xiv) **Rainfall**
- xv) **Soil Moisture**
- xvi) **Geopotential Height**

11. Key drivers

- i) **Pressure**
- ii) **U Wind**
- iii) **V wind**
- iv) **Potential Temperature**
- v) **Specific Humidity**

12. Policies and measures that have been/can be considered

Analysis of simulations conducted using the PRECIS Regional Climate Model (RCM) had been submitted to the related government institutions using the climate change simulation report released by the Malaysian Meteorological Department, entitled: Climate Change Scenarios for Malaysia 2001-2099, in January 2009.

13. Treatment of uncertainty (yes or no, if yes, how)

Uncertainties due to conversion of greenhouse gases emissions to atmospheric concentrations, natural variability, imperfect representation of atmospheric processes in the Global Climate Model (GCM) outputs and modeling of future emissions are not treated. Nevertheless addition of some spatial detail of local land surface & vegetation is considered before simulations were carried out.

14. Previous application and current usage

The PRECIS RCM had been used to simulate future climate projections using A2, B2 and A1B emission scenarios depicted by the HadAM3P and HadCM3 GCMs (Hadley Centre Global Model). Presently PRECIS is being prepared to simulate future climate projections for the ECHAM5 GCM.

15. Scenarios

- i) **A1B (medium GHG emission scenarios), simulation for 2001 – 2099**

- ii) **A2 (medium high GHG emission scenarios), simulation for 2070 - 2100**
- iii) **B2 (medium low GHG emission scenarios), simulation for 2070 - 2100**

16. Publication and references

- i) **Climate Change Scenarios for Malaysia 2001 to 2099, 2009 ISBN 978-983-99679-4-3**
- i) **Climate Change Scenarios and Impact of Global Warming on Winter Monsoon, Vol 40, Dec 2008 – Feb 2009, *Ingeneiur*, 5 – 9**
- ii) **Climate Change Scenarios for Malaysia , submitted for Akademi Sains Malaysia, 2010**

PART B

1. Economists who have experience with the models: names and contact.
2. Level of support for and involvement in the ECCM project: persons, availability, commitment and involvement.
Dr Wan Azli, Mr Ling, Kumarendren, Mohan Kumar
3. Data and databases, including content, ownership, sharing and updating issues.
MMD will maintain the databases and participate in the study
4. Case studies (economic) that could complement the models.
5. Other matters of your interest but not discussed.

Some interesting results:

The PRECIS model shows that between 2010-2030 heavier rainfall is expected. However, between 2030-2040, drought is expected. Such findings require policy attention as climate proofing will mean greater investment in drainage in one period and more water storage in the next (e.g. need to develop or tap into groundwater system).

MMD's impression is that little coordination of the RCM results with the impact analysis.

MMD will provide the following support

- 1- 2 out of 4 impacts: precipitation (IPCC) and temperature (PRECIS model); and will need to incorporate PRECIS and NAHRIM for 2000-2050 projections.
- 2- Maps to include Ensemble projections (average the high and low) for 2000-2099 period (and also include PRECIS and NAHRIM (PM, Sabah and Sarawak). All GCM and RCM will forecast 100 years but higher resolution forecasts from other sectors – probably for 50 years only;
- 3- +/- sign changes

SLR and storm surges also need to be studied (beside precipitation and temperature) but JPS and NAHRIM will provide these.

Baseline or reference scenario:

1961-1990 is usually the reference scenario

1990-1999 is the last decade of the last century, IPCC baseline

2000-2009 is the first decade of this century and all forecast will start here.

Economics of Climate Change for Malaysia Study

Appendix 7: Stock Taking Exercise 2010 with MOF and Makro

Date : 24 August 2010
Venue : ENRES, EPU
Time : 1000 – 1130

Ms. Dayang on behalf of ENRES, EPU started the discussion with a short welcoming remarks and a brief explanation on the activities that have been conducted so far. She also thanked the representatives from MOF and Makro for their time.

The ECCM's consultant, Mr. Chang, explained the purpose of the stock taking exercise which is to have a better understanding of the models/approaches/methods used for analysing the socio-economic impacts response (SEIR) under the study; the advantages/limitations of the models/approaches/method; its coverage and uncertainties; and its linkage to the economic models. The meeting was informed that the ECCM will be using the output/outcome from the NC2 as input for it to run the economic analysis. The stock taking exercise also includes discussions on the following:

- Methods to link the scientific data from NC2 into the economic models;
- Determine whether current models being used are correlated and standardisation of definition in terms of time frame, forecasting etc. across all sector;
- Identify resource person with experience in relevant models;
- Level of support and involvement from relevant key agencies/stakeholders;
- Establishment of networks to ensure the effectiveness of achieving end result;
- Data or database; and
- Case studies.

En. Md Saad and Dr. Siva of MOF informed the meeting on the type of models that is use by MOF and their limitations. Among matters discussed include:

- They used to have a very sophisticated econometric model but now they use a simple excel spreadsheet where Dr. Siva is the expert.
- Computable General Equilibrium (CGE) model is basically used for policy analysis and comparative static analysis but not for forecasting. The econometric model is used for forecasting. But, they do not have any connection between physical science to their economic model.
- These models serve Treasury functions only e.g. what happens if tax is reduced, if we stop importing foreign labour etc. Although they did plan to incorporate climate change into their model, they will not proceed with this plan since EPU is already taking it up.
- MOF uses the Econometric model and they are developing a CGE dynamic model with assistance from the Centre of Policy Studies, Monash University, but this new model does not take climate change into consideration.
- As such their model cannot generate scenarios to show the impact to society if any climate change activities were to be input e.g. removal of fuel subsidy which indirectly

a climate change impact. The model is not designed to do that. What the model does is that it will say what will happen to GDP, what will happen to which industry – it is a single house hold system

- They have tried to run the model by taking out subsidies, but did not succeed. Even Bank Negara only managed to come up with impact only to inflation and GDP, using their model.
- Energy modelling team which used to be at EPU was very strong with TNB and Petronas as members. Now, not sure what the structure is. Agriculture has no model.
- They suggest for the ECCM Project to build our own model and to get the best and the latest technology in the world. It must be user friendly and most importantly, get after sales service. We need continuous technical support. Google for experts in the subject area.
- Centre of Policy Studies, Clayton, Monash has developed economic model related to climate change for the US and many other countries.
- Even Vietnam is in the progress of developing its own economic model related to climate change.
- Rough estimation to set our own model is about RM1,000,000.00.
- A global model called the Global Trade Analysis Project (GTAP) is currently being maintained by Purdue University in the US and in Malaysia, Prof. Jamal of UKM is currently undertaking the study.
- MOF Input-Output (I-O) model does not capture climate change effect e.g. CO₂ emission, GHG emission etc. The model is based on the System of National Accounts. It does not take into account externalities e.g. change in weather, change in gas. It does not understand all this.
- Need to get a model that encompasses green accounts (Green Accounting).
- ADB is at the frontier of the economics of climate change – Mr. Sugiarto from Indonesia is the expert in CGE although only focus towards the economics.
- In Malaysia, we do not have any local experts on dynamic CGE model yet.
- Different universities teach different parts of the model, but nobody actually came and teaches us how we can bring all the parts together. We need that kind of support.
- They expressed willingness to contribute to the project as much as they can
- They could not answer Part A of the questionnaire because MOF does not do any climate change forecasting. MOF does only short term yearly budgeting forecasting and only focus on physical policy, monetary policy and projecting macro variables. No social planning either.

En. Abu Zeid and Pn. Noriyah of EPU (Macro) also informed the meeting on the type of models that they use and their limitations. Among issues discussed includes:

- Currently, they are establishing their own new dynamic CGE model which will start around November 2010 and will be done within 9 months with budget around RM610,000. It will focus more on income and poverty and if we want to include climate change, it will be a big shift.
- We can model the impact of climate change to Agriculture, for example, where crop yields is an input to the economic model. However, it won't be able to model direct climate change impacts, e.g. CO₂ emission. Need to find the soft linkages.
- They are using an EPU Econometric model, completed in 2007. It can do forecasting from year 2010 to 2020 as well as some simulations such as what if we spend

7 billion, what is the impact on economy in terms of consumption, investment, import, export and also on the supply side like agriculture, mining, construction, services etc. It uses the Generalised Algebraic Modelling System (GAMS) and outputs its results that are compatible for DOS.

- They also have the Micro Frame for each of the sectors i.e. demand side, supply side and public sector.
- With regards to coming up with a soft link, maybe we can use the frame work for the supply side to generate the outcome. We need to quantify the impact of climate change and transfer into the economic model. Maybe OE and DE can also be involved in this activity.
- CYT-agreed that we need to come up with an intermediate model where we can generate something but we want to look at the implication at what we generate. Need to find the linkages
- If need to apply for funding for the new model, it should go under PO6.
- Other matters:
 - En. Zeid to e-mail a study on impact of climate change to economy using CGE model from Australia.
 - Makro Section to fill in the questionnaire with brief detail of the models used.
 - MOF will be a member of the TWG committee.

Attendance:

Mr Md Saad Hashim, MOF
Dr V. Siva, MOF
Puan Noriyah Kandar, EPU Macro
En Abu Zeid Mohd Ariff, EPU Macro
Dayang Nor Izan Abang Halil
Lim Wei Urn
Irene Chung
Chang Yii Tan
Zawina Ahmad

Economics of Climate Change for Malaysia

Appendix 8: Review of Stock Taking Exercise

2 September 2010

10.00 am

ENRES Meeting Room

1. Opening remarks were given by En Azhar and he welcomed the participants to the review meeting. He gave a short background of the ECCM project, highlighting its objectives and the purpose of the meeting, which was to hear the progress and update of the stock-taking exercise. He then passed the floor over to Chang to provide an update of the project.

Chang gave a short brief of the progress, starting with the Technical Workshop 3-4 August 2010, and the preliminary conclusion that a stock-taking exercise was necessary to learn about the NC2 progress, particularly the transition from the technical-scientific findings to economics. Hence, about half a month's effort had been expended, with discussions arranged by EPU to learn more from the three main components, i.e. V&A, Mitigation and GHG inventory. A total of 8 meetings were held over the period. It had been a very enlightening process and the findings are summarised for this meeting.

2. Discussions:

- a. Various approaches were used in NC2 by the 3 components: all of the NC2 teams comprise both technical and economic staff members but there is a lack of economists working on economic modelling. Hence, there are no macro-economic results. This will be a constraint going forward, especially linking the NC2 work with the economic aspects. All institutions still maintain their databases because NC2 has not closed yet but this could be a problem going forward. All key institutions have expressed an interest to work and support the ECCM project.
 - Mitigation: 5 sectors were covered and sectoral approach was used;
 - V&A: 7 sectors were covered using multidisciplinary approach
 - GHG Inventory: 2 sectors with several sub-sectors, using well-defined IPCC and UNFCCC guidelines were used for estimating GHG. 2005 baseline for most of the sectors with 1 or 2 sectors still making estimates.

There was a suggestion to build expertise in the economic work. Two suggestions were made: appointing an institution (RI or University) or gathering together the experts. The suggestion was to assign the task to build the expertise to an institution, and to focus and concentrate all assistance to this central purpose.

- b. Technical and economic models used the three components: several models have been used by the various institutions, and they include:
 - PRECIS Model (an RCM downscaled from GCMs),
 - LEAP (Long Range Energy Alternative Planning) Model,

- Energy Supply-Demand Model,
- DSSAT v4 (Decision Support System for Agro-technology Transfer),
- Reg-HCM (Regional Hydro-Climate Model), and
- MARKAL (energy model for policy analysis)

[Note that MARKAL license expired with the Danida Energy project]

- Gaps identified: sea level rise and storm surges is important but there is no national estimate (we have not met JPS yet). Feedback from various sources indicates that a Shoreline Management Plan is being done but its relationship with climate change isn't exactly clear. Pilot studies have been done in Tanjung Piai and Langkawi. Lestari has conducted a pilot study if (Port Klang) but these are not country wide studies. Probably need a GIS team. A detailed look into this gap needs to be made.

More effort to examine the linkage between the technical models and the economic models need to be undertaken. EPU Macro indicated that a dedicated climate change macro-planning model is needed to enable EPU to explore options for various questions arising from the climate change perspectives.

- c. Issues and suggestions arising from the findings:
 - CGE or partial equilibrium approach: in terms of building own CGE model, it was clear that this could be a phase II project (post-2012);
 - ADB is willing to support this effort (Low Carbon Economy project) and the paperwork is being facilitated to bring them in for the current project;
 - sectors for ECCM: EPU asked which sectors for ECCM to focus in – it was clear that some sectors were obvious candidates (energy, water, agriculture but where data is available, sectors can be included later)
- d. the PAGE2009 workshop training: 28-30 September 2010
 - co-sponsor: British High Commission
 - EPU has been given 6 places in the training workshop;
 - Have identified 6 participants, (EPU, MOF, MARDI, UKM, ECCM);
 - Venue to be decided with British High Commission;
 - Need several licenses (RISK) and very costly. Need some solution in this area so as not to bust the budget.

3. Work plan (Sept-Nov): an overview of the work plan was presented.

- a. Stock-Taking will be completed 13 Sept
- b. briefing to top management, 21-Sept
- c. TWG: 23-Sept
- d. NSC: 15-October
- e. Inception workshop: 20-21 Oct and
- f. Inception Report: 12 Nov (first draft)

4. Other matters.

KETTHA agreed to cooperate and support the study, providing data on the energy sector. Other agencies also agreed to support.

The next meeting (TWG) will be announced and is expected third week of September.

Attendance:

Azhar Noraini, EPU, Chairman

Badariah Abdul Malek, KeTTHA

Faisal, NRE

Abu Zeid Mohd Ariff, EPU Macro

Dayang Nor Izan Abang Halil, EPU

Lim Wei Urn, EPU

Irene Chung, EPU

Zawina Ahmad

Chang Yii Tan

Economics of Climate Change for Malaysia

Appendix 9: Discussion with Prof Jamal Othman

3 September 2010

2.45 pm

Prof Jamal's (7.435) Room, Econs Faculty, UKM

Introduction:

Chang gave an overview of the ECCM project, the stock taking exercise and the purpose of the visit – which is to discuss the work that Prof Jamal is doing on the GTAP model and possible inclusion in the ECCM project, as well as to chat about the PAGE Model workshop 28-30 September.

Prof Jamal explained that the GTAP model was a global CGE model that was developed out of Purdue University (US). It is a macro-economic model of a country and researchers are required to input their own country structure to the model. It has a trade bias and is particularly suitable for a country like Malaysia. With that it can be used as an analytical tool to examine various policy scenarios, and he had used it to look at trade issues, particularly issues related to the FTA.

The GTAP model also has an extension, known as GTAP-E, which incorporates energy or green components to the model and thus it can be used to examine climate change issues or impacts to the economy.

To achieve a cost-effective emissions reduction strategy, it would be necessary to use a optimisation model, and that may have to be combined with any other macro-economic model that is used for the ECCM project.

On the PAGE model training, Prof Jamal indicated that it was his role to learn and spread knowledge, and he would support the ECCM project. He would also like to go for the PAGE training and is willing to commit to the three days. He will send in his CV. He mentioned that his colleague, Prof Abdul Hamid Jaafar, who worked on the NC2 (SEIA) and is also working on GTAP. He is another potential participant for the course. To reduce cost, Jamal could purchase the RISK software under this project.

Attendance:

Prof Jamal Othman, Prof of Economics, UKM
Lim Wei Urn, EPU ENRES
Chang Yii Tan, ECCM

TECHNICAL TRAINING ON PAGE 2009 TRAINING: PARTICIPANT FEEDBACK**Summary of Evaluation Sheet****Title of event** : Economics of Climate Change PAGE 2009 Training Workshop**Date** : 28 – 30 September 2010**Total respondents: 13 people**

		Strongly Disagree	Disagree	Agree	Strongly Agree
1	SPEAKER/TRAINER				
	The trainer displayed thorough knowledge of the topics that he is discussing and training			2	11
	The trainer is able to effectively manage questions from the floor				13
	The presentation and training were presented in a clear and organised manner			3	10
	The trainer was interactive enough			1	12
	Time schedule was observed by the trainer				13
	The Q and A session was sufficient			2	11
	Enough emphasis was given by trainer on hands-on activities			2	11
2	TRAINING MATERIALS/HAND-OUTS				
	Hands-on activities were sufficient enough			6	7
	The materials handed out are relevant to the training conducted			5	8
	The materials are useful for the participants in understanding the issues discussed			7	6
3	SUBJECT MATTER				
	The training was relevant to the issues at hand and to the participants			2	11
	The training was useful to address the issues			6	7
	The technical information provided are easy to understand		1	10	2
	The training provided the clear linkages between impact and economic costs			3	10
4	OVERALL RATING				
	The training is timely, relevant, useful and addresses issues at hand			3	10
5	Are you confident in using the model in your own work and teachings hereafter	Yes - 11		No - 2	

6. COMMENTS AND SUGGESTIONS (in no specific order):

- a. Is it possible to arrange procurement of system in bulk for participants to obtain a discount
- b. We have obtained fundamental knowledge and experience to conduct policy analysis for our work
- c. A separate module on basic feature and commands on @Risk software
- d. This is a really good training course. However, it is a little bit short
- e.
 - A micro-climatic issues may be incorporated induce development of the model
 - Game theoretic interaction can be proposed in future hands on activities

MINUTES OF MEETING

**ECONOMICS OF CLIMATE CHANGE FOR MALAYSIA (ECCM) STUDY
TECHNICAL WORKING COMMITTEE (TWC) MEETING 1/2010**

Date: 23 September 2010 (Thursday)
Time: 10.00 a.m.
Venue: Meeting Room A,
Level 6, Block B6,
Economic Planning Unit,
Prime Minister's Department

Attendance

1. Mr. Azhar Noraini - Chair
Director, Environment and Natural Resource Economics Section (ENRES)
Economic Planning Unit (EPU)
2. Ms. Zarina Ali Merican
ENRES, EPU
3. Mr. Abu Zeid Mohd. Arif
Macroeconomics Section, EPU
4. Ms. Haniza Abd. Aziz
Energy Section, EPU
5. Ms. Norhaslinda Sibi
Ministry of Finance (MOF)
6. Mr. Mohamad Farid Mohd Aris
Ministry of Industrial Trade and Industry (MITI)
7. Dr. Gary William Theseira
Environmental Management and Climate Change Division
Ministry of Natural Resources and Environment (MNRE)
8. Ms. Badriyah Hj. Abd. Malek
Energy Sector
Ministry of Energy, Green Technology and Water (MEGTW)
9. Ms. Nur Haziqah bt. Mohd. Zaki
Energy Sector, MEGTW

10. Mr. Md. Farid b. Md. Salleh
Green Technology Sector, MEGTW
11. Dr. Yap Kok Seng
Malaysian Meteorology Department (MMD)
Ministry of Science, Technology and Innovation (MOSTI)
12. Ms. Hajjah Kalsom Abd. Ghani
Department of Environment (DOE), MNRE
13. Dr. Wan Azli Wan Hassan
MMD, MOSTI
14. Ms. Zaidah Zainal Abidin
Department of Statistics (DOS), MOSTI
15. Dr. Elizabeth Philip
Forest Research Institute of Malaysia (FRIM), MNRE
16. Ir. Mohd. Zaki Mohd. Amin
National Hydraulic Research Institute Malaysia (NAHRIM), MNRE
17. Dr. Mohamad Zabawi Abdul Ghani
Malaysian Agricultural Research and Development Institute (MARDI)
Ministry of Agriculture and Agro-Based Industry (MOA)
18. Ms. Engku Elini Engku Ariff
MARDI, MOA
19. Dr. Er Ah Choy
LESTARI, Universiti Kebangsaan Malaysia
20. Mr. Gurmit Singh
Centre for Environment, Technology and Development, Malaysia (CETDEM)
21. Mr. Chang Yii Tan
PE Research Sdn. Bhd
22. Ms. Dayang Nor Izan Abg. Halil
ENRES, EPU
23. Ms. Najwa Omar
Energy Section, EPU

Absent with apologies

1. Malaysian Green Technology Corporation

Secretariat

1. Mr. Lim Wei Urn
ENRES, EPU
2. Ms. Irene Chung
ENRES, EPU
3. Zawina Ahmad
ENRES, EPU/UNDP

1. Opening Remarks

The Chair, welcomed and thanked the members for attending the 1st Technical Working Committee (TWC) meeting for the Economics of Climate Change for Malaysia (ECCM). He introduced Mr. Chang Yii Tan as the project's consultant and informed the meeting that the Project Manager has yet to come on board. He invited the members to give their continuous support and assistance to the project.

2. Presentation

The meeting took note of the presentation by the project consultant (see attachment).

3. Discussion

The meeting discussed the following:

- 3.1 CETDEM raised the issue of urbanisation/human settlement. He suggested that it should be included because of its relation to the issue of transportation and waste.
- 3.2 MMD raised on the sea level rise (SLR) issue. It is important to see how it will affect the economy.
- 3.3 FRIM proposed to include water resources in the study as water is one of the basic needs and its deficit/excess has repercussions to other sectors.
- 3.4 MEGTW brought the attention to the issue of low carbon economy and reminded all ministries to work together to address climate change taking into account existing policies as well as current initiatives taken by other ministries/agencies.
- 3.5 MNRE suggested that the focus of ECCM should be on the low hanging fruits.
- 3.6 The meeting was informed that the Asian Development Bank (ADB) is undertaking a project on "Strengthening Planning Capacity for Low Carbon Growth in Developing Asian" and Malaysia has been invited to participate in that initiative.
- 3.7 The meeting took note of proposal to include Land Use, Land Use Change and Forestry (LULUCF) and social behavioral change.
- 3.8 The meeting was informed that currently Malaysia do not have any environment/climate change specific economics model. So, there might be a need to explore the possibility of developing a CGE model for this purpose.

4. Decision

The meeting decided the following:

4.1 Selected sectors are divided into three categories as follows:-

- 1) Mitigation
 - a. Energy (including Industrial Processes);
 - b. Transportation; and
 - c. Waste.
- 2) Adaptation
 - a. Water resources;
 - b. Coastal (including sea level rise); and
 - c. Land use, land use change and forestry (LULUCF) or Agriculture, Forestry and Land Use (AFOLU).
- 3) Cross Cutting
 - a. Food security;
 - b. Energy security; and
 - c. Urbanization.

4.2 The meeting was invited to revert and comment on the terms of reference and committee members list of participants for both the Technical Working Committee (TWC) and National Steering Committee (NSC) by 29 September 2010 (Wednesday).

Action: All

5. Closing

The Chair thanked all members for attending the TWC 1/2010 meeting and subsequently adjourned the meeting at 1 pm.

**MINIT MESYUARAT JAWATANKUASA PEMANDU KEBANGSAAN 1/2010
KAJIAN *ECONOMICS OF CLIMATE CHANGE FOR MALAYSIA* (ECCM)**

Tarikh: 16 November 2010 (Selasa)
Masa: 9.30 pagi
Tempat: Bilik Mesyuarat B
Aras 6, Blok B6
Unit Perancang Ekonomi
Jabatan Perdana Menteri
Kehadiran: Seperti Lampiran I

1. *Perutusan Pengerusi*

Tuan Pengerusi mengalu-alukan kehadiran ahli mesyuarat ke Mesyuarat Jawatankuasa Pemandu Kebangsaan (NSC) Bil. 1/2010 bagi kajian *Economics of Climate Change for Malaysia* (ECCM). Tuan Pengerusi memohon maaf bagi pihak Timbalan Ketua Pengarah II, Unit Perancang Ekonomi, Jabatan Perdana Menteri (UPE, JPM) kerana tidak dapat mempengerusikan mesyuarat ini atas sebab yang tidak dapat dielakkan. Tuan Pengerusi memaklumkan bahawa mesyuarat ini bertujuan untuk mengesahkan perkara-perkara berikut:

- i. Skop kajian;
- ii. Aktiviti-aktiviti yang dirancang; dan
- iii. Terma rujukan dan keahlian NSC.

2. *Pembentangan Kajian ECCM*

Mesyuarat mengambil maklum akan pembentangan UPE, JPM mengenai kajian ECCM.

3. *Perbincangan*

Mesyuarat mengambil maklum:

- 3.1 akan keterangan bahawa isu utama yang dihadapi adalah masalah kekurangan data dan ketiadaan pengumpulan data berpusat. Sehubungan itu, pengumpulan data alam sekitar yang komprehensif merangkumi data seperti pelepasan gas rumah hijau (GHG) perlu dibangunkan. Adalah dicadangkan agar Jabatan Statistik menerajui usaha untuk pengumpulan data alam sekitar yang komprehensif memandangkan bidang tugasnya dalam mengumpul dan mentafsir perangkaan bagi tujuan pembentukan dan pelaksanaan dasar-dasar Kerajaan. Dengan penguatkuasaan Akta Perangkaan 1965 (semakan 1989), Jabatan Statistik boleh mengarahkan pihak terbabit mengemukakan data yang dikehendaki kepadanya;

- 3.2 bahawa projek mempunyai kekangan dari segi masa dan sumber kewangan. Oleh yang demikian, kajian ini akan hanya memfokus kepada beberapa sektor seperti *water resources and coastal; land use, land use change and forestry; food security; energy security; dan urbanization*;
- 3.3 bahawa siri *stock taking exercise* telah dilaksanakan dengan beberapa agensi utama yang terbabit dalam penyediaan *Malaysia's Second National Communication (NC2)* seperti Kementerian Tenaga, Teknologi Hijau dan Air, Institut Penyelidikan & Kemajuan Pertanian Malaysia, Institut Penyelidikan Perhutanan Malaysia, Jabatan Meteorologi Malaysia dan *Malaysia Green Technology Corporation*. Tujuannya adalah untuk memahami dengan lebih mendalam model dan kaedah kajian yang digunakan dalam NC2, kelebihan dan kekangan model tersebut dan bagaimana ia dapat dikaitkan dengan model ekonomi;
- 3.4 bahawa penglibatan aktif semua Kerajaan Negeri adalah penting memandangkan isu-isu perhutanan serta guna tanah yang terletak di bawah bidang kuasa Kerajaan Negeri memainkan peranan penting dalam usaha mitigasi dan adaptasi perubahan iklim. Oleh yang demikian, Kerajaan Negeri perlu memahami peranan yang dimainkan olehnya dalam usaha membantu negara membangunkan ekonomi rendah karbon dan seterusnya mengurangkan pelepasan GHG;
- 3.5 keterangan bahawa sebagai negara *non-Annex 1* kepada *United Nations Framework Convention on Climate Change* dan *Kyoto Protocol*, Malaysia tidak terikat kepada sebarang komitmen untuk mengurangkan pelepasan GHG. Walau bagaimanapun, dalam usaha mencapai status negara maju menjelang 2020, negara perlu menukar strategi ke arah pertumbuhan ekonomi rendah karbon sebagai persediaan dalam melaksanakan langkah mitigasi dan adaptasi perubahan iklim;
- 3.6 cadangan agar satu laman web dibangunkan untuk berperanan sebagai platform bagi membolehkan pelbagai pihak membicarakan dan bertukar pandangan mengenai isu perubahan iklim;
- 3.7 bahawa Rancangan Fizikal Negara yang juga menggariskan dasar berkaitan perubahan iklim di mana dalam rancangan tersebut, struktur pelan negeri disaran untuk mengambil kira kesan perubahan iklim. Garis panduan berkaitan kawalan pantai juga akan dikeluarkan;
- 3.8 keterangan bahawa *Asian Development Bank* dan *British High Commission* juga menyalurkan bantuan teknikal melalui *United Nation Development Programme* dalam pelaksanaan kajian ECCM termasuk memberi khidmat nasihat teknikal serta input dalam pelaksanaan bengkel latihan serta seminar;
- 3.9 pembentangan skop kajian, aktiviti-aktiviti yang dirancang serta terma rujukan dan keahlian Jawatankuasa Pemandu Kebangsaan. Adalah dicadangkan agar Urusetia mempertimbang semula senarai keahlian Jawatankuasa Pemandu Kebangsaan; dan

- 3.10 cadangan penubuhan *Center of Excellence* bagi membangunkan kapasiti dan kemahiran dalam bidang ekonomi perubahan iklim dan alam sekitar ditangguhkan bagi mengenal pasti agensi/institusi yang sesuai.

4. Keputusan

Mesyuarat bersetuju supaya:

- 4.1 Jabatan Statistik menerajui usaha pengumpulan data berkaitan alam sekitar dan perubahan iklim yang komprehensif. Urusetia perlu mengenalpasti data-data berkaitan yang perlu dikumpul dan seterusnya membincangkan perkara ini dengan lebih lanjut bersama Jabatan Statistik;

Tindakan: Urusetia dan Jabatan Statistik

- 4.2 perbincangan lanjut di antara Urusetia dengan Kementerian/Jabatan yang berkaitan mengenai pangkalan data alam sekitar serta sumber data-data tersebut.

Tindakan: Urusetia dan Kementerian/Jabatan berkaitan

- 4.3 maklumbalas mengenai cadangan skop kajian ECCM, terma rujukan dan keahlian Jawatankuasa Pemandu Kebangsaan dikemukakan kepada Urusetia sebelum 30 November 2010 sekiranya ada.

Tindakan: Urusetia dan ahli mesyuarat

- 4.4 *Malaysian Palm Oil Board* dan MARDI dilibatkan di dalam kumpulan kerja yang akan ditubuhkan di bawah Jawatankuasa Kerja dan cadangan untuk menubuhkan *Center of Excellence* ditangguhkan buat sementara waktu.

Tindakan: Urusetia

5. Penutup

Mesyuarat ditangguhkan pada jam 12.00 tengahari dengan ucapan terima kasih daripada Tuan Pengerusi.

SENARAI KEHADIRAN

- | | | | |
|-----|---|---|-----------|
| 1) | En. Azhar Noraini
Pengarah
Seksyen Ekonomi Alam Sekitar dan Sumber Asli
Unit Perancang Ekonomi | - | Pengerusi |
| 2) | Pn. Juziana Binti Mat Zain
Seksyen Pertanian,
Unit Perancang Ekonomi | | |
| 3) | Pn. Haniza Binti Abdul Aziz
Seksyen Tenaga,
Unit Perancang Ekonomi | | |
| 4) | Pn. Najwa Omar
Seksyen Tenaga,
Unit Perancang Ekonomi | | |
| 5) | En. Muhammad Bin Abd. Rahman
Seksyen Ekonomi Makro,
Unit Perancang Ekonomi | | |
| 6) | En. Abu Zeid Bin Mohd Arif
Seksyen Ekonomi Makro,
Unit Perancang Ekonomi | | |
| 7) | En. Abdul Halimi Bin Taifor
Seksyen Ekonomi Makro
Unit Perancang Ekonomi | | |
| 8) | En. Mohd Isa Bin Othman
Seksyen Infrastruktur dan Kemudahan Awam
Unit Perancang Ekonomi | | |
| 9) | Dr. V. Sivabalasingam
Kementerian Kewangan | | |
| 10) | En. Muhammad Akram Bin Ab. Aziz
Kementerian Kewangan | | |
| 11) | Dr. Gary William Theseira
Kementerian Sumber Asli dan Alam Sekitar | | |
| 12) | En. Mohd. Azlan
Kementerian Tenaga, Teknologi Hijau dan Air | | |
| 13) | En. Kasman Bin Gendu
Kementerian Kerja Raya | | |
| 14) | Dr. Lokaman Hakim Bin Sulaiman
Kementerian Kesihatan | | |

- 15) En. Mano a/l Verabathran
Kementerian Pengangkutan
- 16) En. Hj. Amran Hj. Sameon
Kementerian Perdagangan Antarabangsa dan Industri
- 17) En. Paul Wong Kok Kiong
Kementerian Perumahan dan Kerajaan Tempatan
- 18) En. Wan Mazlan Wan Mahmood
Kementerian Perusahaan, Perladangan dan Komoditi
- 19) En. Hizan Bin Wahed
Kementerian Kemajuan Luar Bandar dan Wilayah
- 20) En. Kamaluddin Bin Nordin
Kementerian Wilayah Persekutuan
- 21) En. Ong Hwa Chong
Unit Perancang Ekonomi Negeri Johor
- 22) En. Shahrizzaman Bin Jibin
Unit Perancang Ekonomi Negeri Kedah
- 23) En. Mohd. Khairul Adzhar Mohd. Adnan
Unit Perancang Ekonomi Negeri Kelantan
- 24) Pn. Mariya Binti Mohd
Unit Perancang Ekonomi Negeri Sembilan
- 25) En. Ahmad Suqairy Bin Alias
Unit Perancang Ekonomi Negeri Perak
- 26) En. Hezwandey Hashim
Unit Perancang Ekonomi Negeri Perlis
- 27) Pn. Shamsiah Binti Jirat
Unit Perancang Ekonomi Negeri Sabah
- 28) Pn. Effy Rafidah Bidin
Unit Perancang Ekonomi Negeri Selangor
- 29) En. Ahmad Farhan Bin Abdul Wahab
Unit Perancang Ekonomi Negeri Terengganu
- 30) En. Chang Ngee Hui
Unit Perancang Ekonomi Negeri Sarawak
- 31) En. Gurmit Singh
CETDEM
- 32) Pn. Hilary Chiew
Third World Network

- 33) En. K.N. Gobinathan
Persatuan Pekilang-Pekilang Malaysia
- 34) Pn. Wan Haslina Binti Wan Hussin
Persatuan Pekilang-Pekilang Malaysia
- 35) En. Loh Keng Kong
Persatuan Pekilang-Pekilang Malaysia

Tidak Hadir Dengan Maaf

- 1) Kementerian Luar Negeri
- 2) Kementerian Sains, Teknologi dan Inovasi
- 3) Kementerian Pertanian dan Industri Asas Tani
- 4) Unit Perancang Ekonomi Negeri Melaka
- 5) Unit Perancang Ekonomi Negeri Pahang
- 6) Unit Perancang Ekonomi Negeri Pulau Pinang
- 7) *Business Council for Sustainable Development Malaysia*
- 8) SMI Association

Urusetia

- 1) Cik Dayang Nor Izan Abang Halil
Seksyen Ekonomi Alam Sekitar dan Sumber Asli
Unit Perancang Ekonomi
- 2) En. Lim Wei Urn
Seksyen Ekonomi Alam Sekitar dan Sumber Asli
Unit Perancang Ekonomi
- 3) Pn. Irene Chung
Seksyen Ekonomi Alam Sekitar dan Sumber Asli
Unit Perancang Ekonomi