

ENERGY EFFICIENCY INDICATOR

EAS Case

Cecilya Malik

ERIA Working Group on Energy Saving Potential

EAS MEMBER COUNTRIES

⦿ OECD Countries (IEA)

- Australia, Japan, Korea, New Zealand

⦿ Non-OECD/Non-IEA Countries

- China
- India
- ASEAN (Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand, Vietnam)

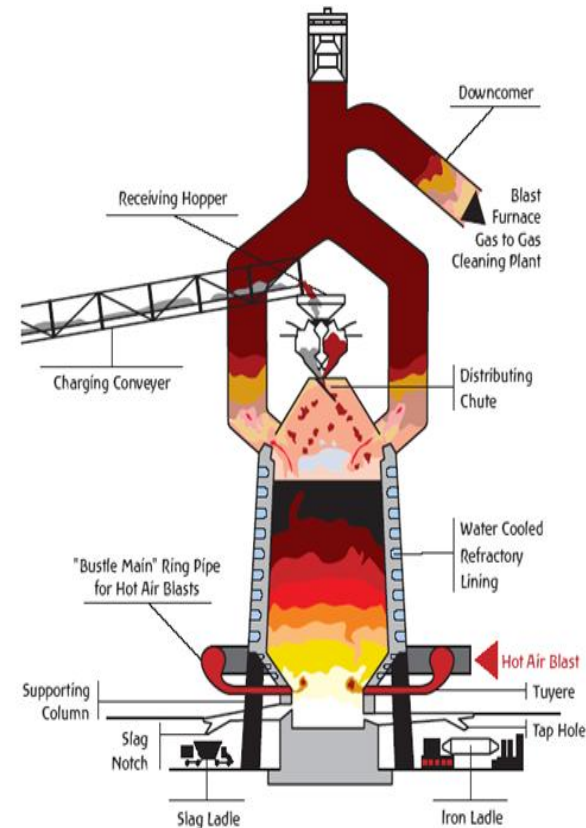
ENERGY INDICATORS TO MONITOR ENERGY SAVING ACTION PLANS

- ◉ Member countries implement their energy saving target and action plans.
- ◉ Need indicators to monitor energy saving plans
- ◉ ERIA WG on Energy Saving Potential can only provide aggregate indicators (TPES/GDP; TPES/capita, CO₂/GDP, Steam plant efficiency)
- ◉ Detailed indicators (cons./ton cement, lt/100 km, process efficiency) required breakdown of sectors to level of processes.
- ◉ Detail data will be necessary

FINAL ENERGY CONSUMPTION DATA (IEA MEMBER COUNTRY)

○ Industry

- Iron and Steel
- Chemical and Petrochemical
- Non-Ferrous Metals
- Non-Metallic Minerals
- Transport Equipment
- Machinery
- Mining and Quarrying
- Food and Tobacco
- Paper, Pulp and Print
- Wood and Wood Products
- Construction
- Textile and Leather
- Non-Specified Industry



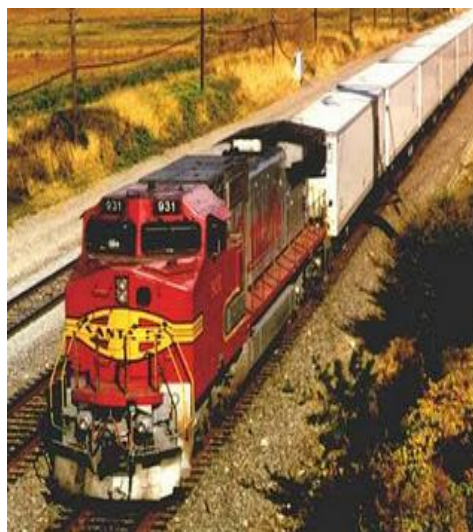
IEA'S DISAGGREGATION OF FINAL ENERGY CONSUMPTION (2)

○ Transportation

- International Civil Aviation
- Domestic Aviation
- Road
- Rail
- Inland Waterways
- Pipeline Transport
- Others

○ Other Sectors

- Residential
- Commercial and Public Services
- Agriculture and Forestry
- Fishing
- Non-Specified Other



FINAL ENERGY CONSUMPTION DATA (NON-IEA MEMBER COUNTRY)

	Industry				
	Coal	Oil	Gas	Electricity	Others
Brunei Darussalam	NA	NO	NA	NO	NA
Cambodia	NA	NO	NA	NO	NA
China	OK	OK	OK	OK	NA
India	OK	NO	NO	NO	NO
Indonesia	OK	NO	OK	NO	NO
Lao PDR	NO	NO	NA	NO	NO
Malaysia	OK	NO	NO	NO	NO
Myanmar	NO	NO	NO	NO	NO
Philippines	OK	OK	NA	OK	NO
Singapore	NO	NO	NA	NO	NA
Thailand	OK	OK	NO	OK	OK
Vietnam	NO	NO	NO	NO	NA

OK - fuel is disaggregated

NO - not disaggregated

NA the sector does not use this fuel

FINAL ENERGY CONSUMPTION DATA (NON-IEA MEMBER COUNTRY)

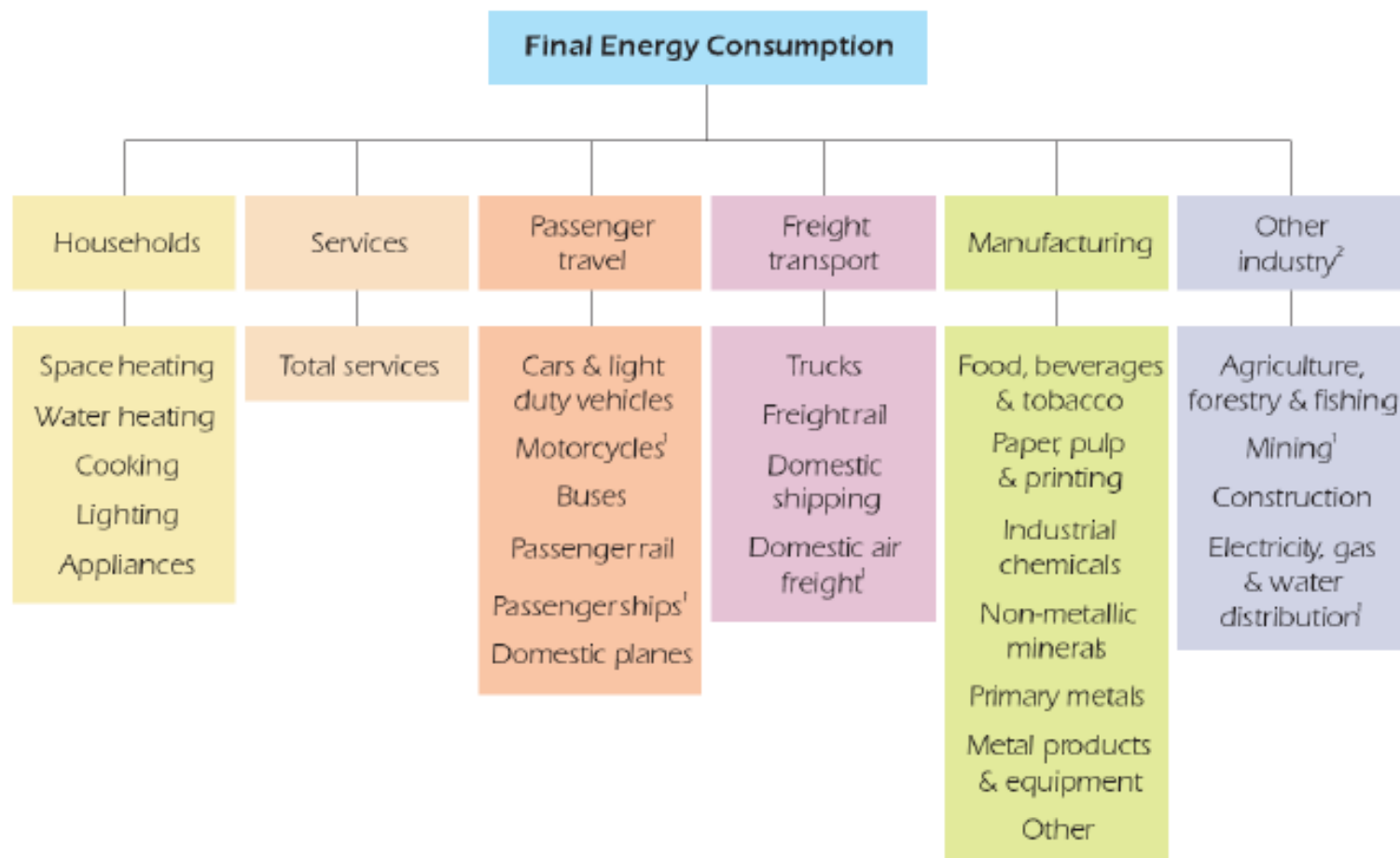
	Transportation			Others (Residential, Commercial, Agriculture)				
	Oil	Gas	Electricity	Coal	Oil	Gas	Electricity	Others
Brunei Darussalam	OK	NA	NA	NA	OK	NA	OK	NA
Cambodia	OK	NA	NA	NA	NO	NA	OK	NO
China	OK	OK	OK	OK	OK	OK	OK	NO
India	OK	OK	OK	OK	OK	OK	OK	OK
Indonesia	OK	OK	NA	NA	OK	OK	OK	OK
Lao PDR	OK	NA	NA	NA	OK	NA	OK	OK
Malaysia	OK	NO	OK	NA	OK	OK	OK	OK
Myanmar	OK	NO	NA	NA	OK	NO	OK	OK
Philippines	OK	NA	OK	NA	OK	NA	OK	OK
Singapore	OK	NA	OK	NA	NA	NA	OK	NA
Thailand	OK	OK	OK	NA	OK	NA	OK	OK
Vietnam	OK	NA	OK	OK	OK	NA	OK	OK

OK - fuel is disaggregated

NO - not disaggregated

NA the sector does not use this fuel

End-Use Coverage for IEA Indicators



¹ Not included in this study due to lack of consistent and reliable data series.

² Other Industry is included in the analysis only in the chapter Overall Trends and is not analysed separately.

ASSESSMENT OF DETAIL DATA

- ◉ **Data collection of energy indicators:**
 - Some countries still have difficulty to prepare energy consumption data by industry sub-sectors.
 - Many countries have difficulty to prepare end-use energy consumptions data.
- ◉ **Data collection of NRE technologies**
 - Many countries are able to report NRE capacity and production
- ◉ **Collection of detailed energy consumption data**
 - Need of energy consumption survey
 - Data to be collected should be accurate
- ◉ **Estimation methodology**
 - Estimation is indispensable to prepare detailed energy consumption data such as end-use data.
 - The estimation methodology should be unified.
- ◉ **Unique template for EAS**
 - How about IEA template?
 - Global standard
 - Compatible template of IEA is also useful

CONDUCTING ENERGY CONSUMPTION SURVEY

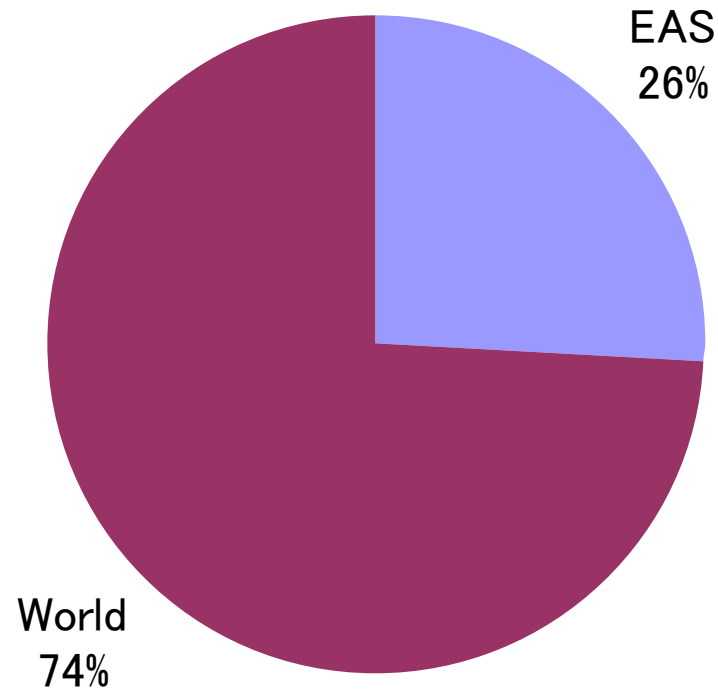
- ◉ **Industry sector**
 - Sample survey to energy intensive sub-sectors
 - Separate to several processes due to different activity
 - Regular survey
- ◉ **Transport sector**
 - Contact Ministry of Transport
 - Sample survey to household and road transport enterprises
 - Separate to vehicle type such as sedan and truck
 - Regular survey
- ◉ **Residential sector**
 - Cooperate with household survey conducted by Statistics Department
 - Energy consumption by fuel and electricity
 - Number of appliances , stoves and heaters
- ◉ **Commercial sector**
 - Sample survey to buildings
 - Energy consumption by fuel and electricity
 - Floor area, type of building

PILOT SURVEY ON ENERGY CONSUMPTION SURVEY

- Target sector: Residential
- Survey questionnaire:
 - Designed during the 1st meeting in September 2010
 - Electricity, LPG, Kerosene, Diesel, Natural gas, Coal briquettes and Biomass are covered.
 - Finalized by IEEJ as an Excel file
- Sample survey:
 - Participating countries: China and 8 ASEAN countries except Brunei and Vietnam
 - Target sample size: minimum 10 sample from urban area
 - After the survey, the countries were requested to revise electricity data in the questionnaire to eliminate negative numbers in other appliances use.
 - 6 ASEAN countries made this revision.

WHY IS THE RESIDENTIAL SECTOR IMPORTANT?

- The residential sector accounts for a quarter of total final consumption in the EAS region.



RESULT ON PILOT STUDY-PHASE 1

- From December 2010 to March 2011, there were 68 respondents from six countries.

	Number of Respondents	Persons per household	Floor area(m²)
Cambodia	12	6.42	132.17
Indonesia	9	4.33	111.78
Laos	10	4.50	128.40
Malaysia	9	4.78	167.39
Philippines	18	4.06	67.06
Singapore	10	4.60	188.60
TOTAL	68	4.75	124.64

RESULT ON PILOT STUDY-PHASE 1

- Due to a sampling bias which is concentrated on respondents with stable income, large floor space and living in urban area, number of electrical appliances are quite high in the EAS region.

	(unit per household)						
	Cambodia	Indonesia	Laos	Malaysia	Philippines	Singapore	Total
AC	1.33	1.00	1.00	0.56	0.28	2.00	0.96
Fan	4.08	1.56	2.60	4.00	2.72	2.40	2.91
Exhaust Fan	0.17	0.89	3.10	0.00	0.11	0.00	0.63
Electric Range/Stove	0.00	0.00	0.90	0.11	0.33	0.30	0.28
Rice Cooker	0.58	0.89	1.00	0.89	0.61	0.90	0.78
Microwave	0.00	0.33	0.50	0.78	0.33	0.70	0.41
Refrigerator	0.67	1.00	1.00	1.00	0.94	1.00	0.93
Water heating(electric)	0.08	0.44	1.00	0.44	0.06	0.90	0.43
CRT TV	1.25	1.00	1.60	0.78	1.17	0.00	1.00
LCD TV	0.33	1.00	0.20	0.89	0.28	1.00	0.56
Desktop	0.42	0.44	0.20	0.11	0.33	0.80	0.38
Laptop	1.08	1.00	0.40	1.56	0.67	0.70	0.87
Washing Machine	0.42	0.89	0.70	1.00	0.67	1.00	0.75
Iron	0.92	1.00	0.70	1.00	0.94	0.00	0.78
Video Players (VHS, DVD, etc)	0.67	0.44	1.00	0.56	0.67	0.00	0.57
Incandescent bulb	1.17	0.67	0.50	0.56	0.61	0.00	0.60
Fluorescent lamp (old type)	0.75	0.11	3.20	1.22	0.83	0.00	1.00
Fluorescent lamp (thin tubes)	5.00	2.00	5.40	4.78	0.61	11.80	4.47
CFL	4.33	6.89	5.30	5.33	5.17	0.00	4.53

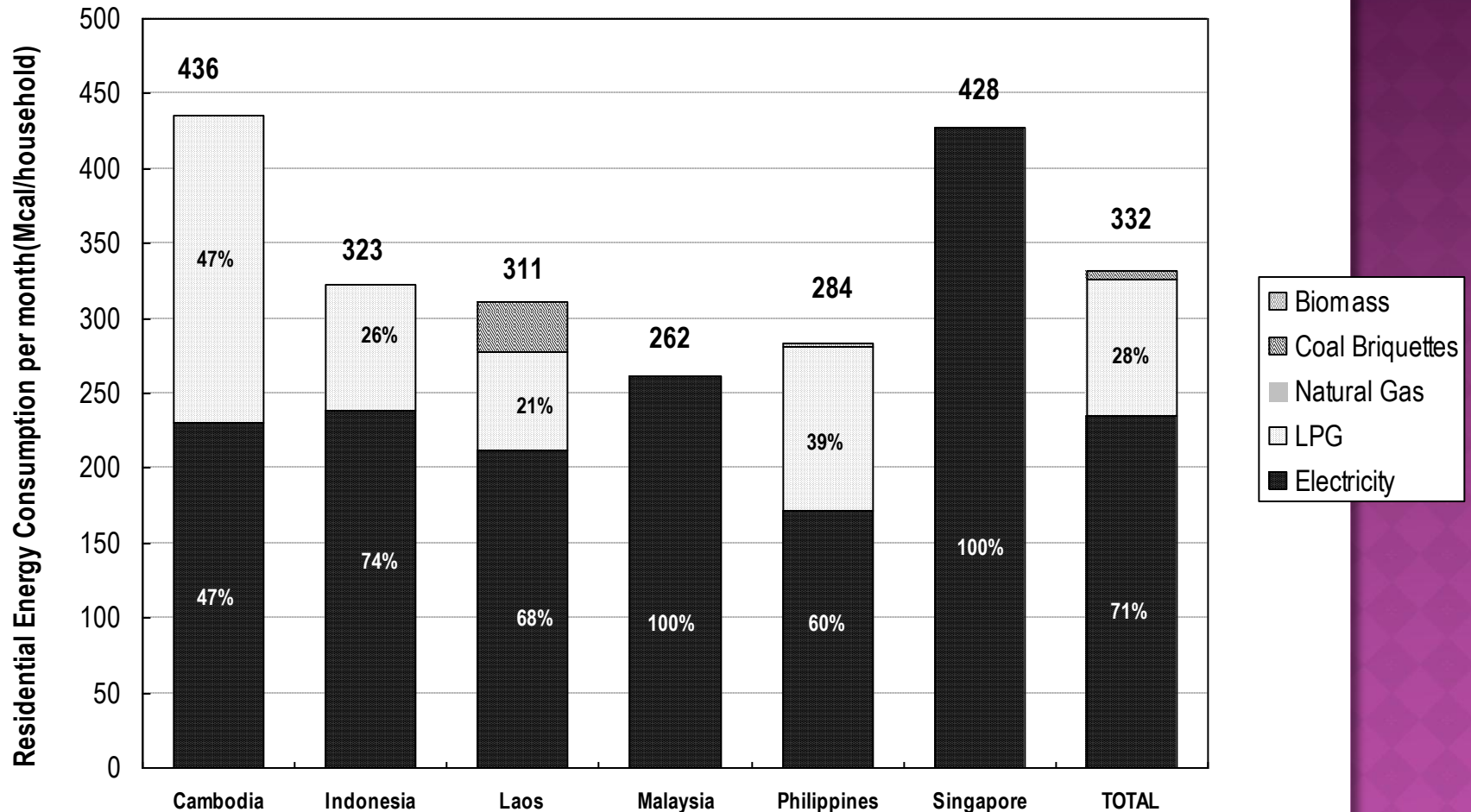
RESULT ON PILOT STUDY-PHASE 1

- Use of air-conditioning is quite higher than in cooler countries.

	AC		Fan		Exhaust Fan	
	hours per day	days per month	hours per day	days per month	hours per day	days per month
Cambodia	4.28	24.44	7.50	28.75	5.00	18.00
Indonesia	6.00	30.00	5.86	23.57	2.25	22.50
Laos	2.20	17.40	3.25	23.50	4.49	30.00
Malaysia	4.20	20.00	9.67	28.89	0.01	30.00
Philippines	2.00	26.00	7.18	27.94	5.50	25.00
Singapore	5.56	17.25	4.88	17.50	-	-
TOTAL	4.24	22.50	6.64	25.79	3.81	26.94

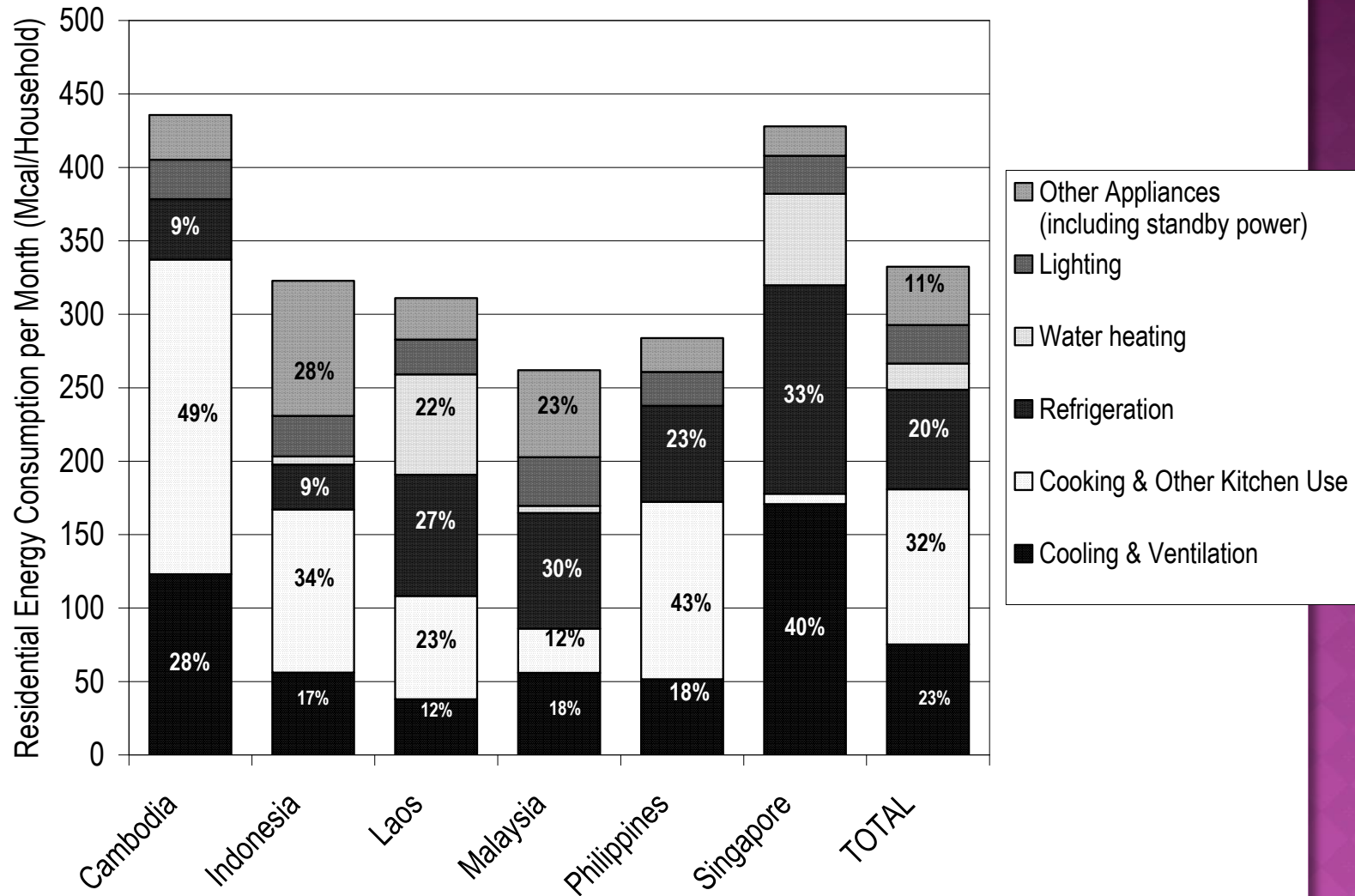
RESULT ON PILOT STUDY-PHASE 1

■ Monthly energy consumption by end use



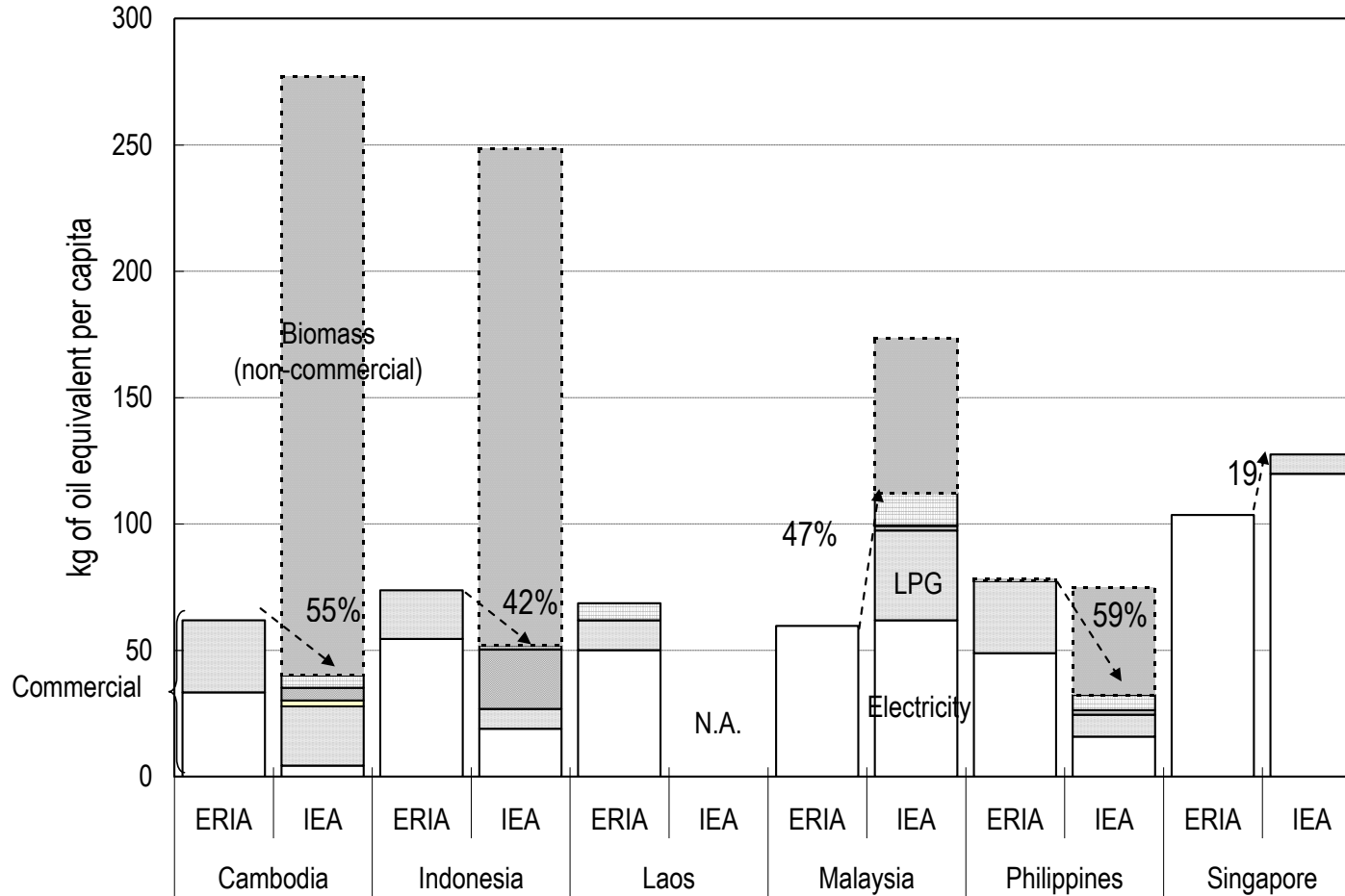
RESULT ON PILOT STUDY-PHASE 1

■ Monthly energy usage by country



RESULT ON PILOT STUDY-PHASE 1

- Comparison between the survey results and IEA statistics



NEED TO EXPAND PILOT SURVEY ON ENERGY CONSUMPTION

- Reduce sampling bias
- Sampling concentrate on households with stable income.
- It is necessary to hand out questionnaires to households living in rural area.
- Estimate consumption by electricity appliance, A/C, TV, PC, Refrigerator and washing machine...

ADDITIONAL ITEM

- ◉ Consumption and expense on monthly basis
- ◉ General question to come up with sampling bias
- ◉ Usage of electricity appliance in detail, not only hours of usage, but also ...
 - Hours and days of usage for cooling on monthly basis
 - Age of electricity appliance
 - Manufacturer of electricity appliance

PILOT SURVEY ON ENERGY CONSUMPTION SURVEY (2ND PHASE)

- ⦿ Participation: ASEAN9 + China
- ⦿ Period: September 2011 to February 2012, 6 months
- ⦿ Sample: at least 10 from urban and 10 from rural areas
- ⦿ Power rating: Use national standard power rating table of each appliance
- ⦿ Bill of electricity, LPG, Kerosene, Natural gas and coal briquette are collected monthly basis.
- ⦿ Detailed questions on electricity will be conducted at least once during the survey but more if possible.
- ⦿ IEEJ will deliver the final questionnaire in Excel
- ⦿ IEEJ will also develop the analysis tool for the questionnaires.

QUESTIONNAIRE – PHASE2

■ General questions

General Questions

1. How many persons are there in your household?	<input type="checkbox"/> people
2. What is the size of the floor area of your house/dwelling.	<input type="checkbox"/> square meters
3. How many people stay at home from at 8:00 AM to at 6:00 PM?	<input type="checkbox"/> people
4. How many hours do the people stay at home per day?	<input type="checkbox"/> hours
5. How many times do you cook per day?	<input type="checkbox"/> times
6. Type of residence	<input type="checkbox"/> House(rent) <input type="checkbox"/> House(own) <input type="checkbox"/> Condominium(rent) <input type="checkbox"/> Condominium(own) <input type="checkbox"/> Apartment(rent) <input type="checkbox"/> Apartment(own)
7. Do you live in urban area or rural area?	<input type="checkbox"/> Urban area <input type="checkbox"/> Rural area

QUESTIONNAIRE – PHASE2

■ Electricity

Questionnaire for End-Use Energy Consumption Survey in the Residential Sector

<Electricity questionnaire>

1. How much electricity do you use at home?

	Consumption(kWh)	Expense (local currency)	Expense (US\$)
January			
February			
March			
April			
May			
June			
July			
August			
September			
October			
November			
December			

QUESTIONNAIRE – PHASE2

■ Electricity (ex)

1. How much electricity do you use at home?

	Consumption(kWh)	Expense (local currency)
January	195	4557
February	198	4628
March		3918
April		3897
May		3667
June	146	3137
July	146	3114
August	184	3918
September	174	3670
October	159	
November	185	

1. How much electricity do you use at home?

	Consumption(kWh)	Expense (local currency)
January	195	4557
February	198	4628
March	168	3918
April	169	3897
May	168	3667
June	146	3137
July	146	3114
August	184	3918
September	174	3670
October	159	3345
November	185	3917
December	161	3414

QUESTIONNAIRE – PHASE2

■ Electricity (Cooling)

2. How many days do you use air conditioner (A/C) and electric fan at home in a year?

	A/C(only)	Fan(only)	A/C and Fan(both)
January			
February			
March			
April			
May			
June			
July			
August			
September			
October			
November			
December			

3. How many equipments for cooling do you use?

KIND OF EQUIPMENT	EQUIPMENT		AVERAGE NUMBER	
	NUMBER OF UNITS	AGE OF EQUIPMENT	POWER RATING (WATTS)	HOURS OF DAILY USAGE
A	B	C	D	E
Air Conditioner (AC)				
AC1				
AC2				
AC3				
AC4				
Electric Fan (Fan)				
Fan1				
Fan2				
Fan3				
Fan4				
Exhaust Fan (EF)				
EF1				
EF2				
EF3				

QUESTIONNAIRE – PHASE2

■ Electricity (Cooking)

4. Cooking and other kitchen use

KIND OF EQUIPMENT	EQUIPMENT		AVERAGE NUMBER		
	NUMBER OF UNITS	AVERAGE OF USAGE DAYS PER MONTH	POWER RATING (WATTS)	HOURS OF DAILY USAGE	AVERAGE OF USAGE DAYS PER MONTH
F	G	H	I	J	K
Electric Range/Stove					
Rice Cooker					
Microwave					
Others (specify)					
<i>Dishwasher</i>					
<i>Food processor</i>					
<i>Blenders</i>					

5. Refrigeration

KIND OF EQUIPMENT	EQUIPMENT			AVERAGE NUMBER	
	NUMBER OF UNITS	AGE OF EQUIPMENT	MANUFACTURER	SIZE	Unit
L	M	N	O	P	Q
Refrigerator/Freezer					Liter
Freezer(only)					
Others (specify)					

QUESTIONNAIRE – PHASE2

■ Electricity

6. Water Heating

KIND OF EQUIPMENT	EQUIPMENT		AVERAGE NUMBER		
	NUMBER OF UNITS	AGE OF EQUIPMENT	POWER RATING (WATTS)	HOURS OF DAILY USAGE	AVERAGE OF USAGE DAYS PER MONTH
R	S	T	Y	V	W
Water heater					

7. TV and PC

KIND OF EQUIPMENT	EQUIPMENT			AVERAGE NUMBER		
	NUMBER OF UNITS	AGE OF EQUIPMENT	MANUFACTURER	POWER RATING (WATTS)	HOURS OF DAILY USAGE	AVERAGE OF USAGE DAYS PER MONTH
X	Y	Z	AA	AB	AC	AD
Television						
<i>CRT TV</i>						
<i>LCD TV</i>						
<i>Others</i>						
Personal Computer						
<i>Desktop</i>						
<i>Laptop</i>						

8. Washing Machine

KIND OF EQUIPMENT	EQUIPMENT			AVERAGE NUMBER
	NUMBER OF UNITS	AGE OF EQUIPMENT	MANUFACTURER	TIMES OF USAGE PER WEEK
AE	AF	AG	AH	AI
Washing Machine				
<i>Dry Machine</i>				

QUESTIONNAIRE – PHASE2

■ Electricity

9. Other appliance

KIND OF EQUIPMENT	EQUIPMENT
	NUMBER OF UNITS
AJ	AK
Iron	
Others (specify)	
<i>Video Players (VHS, DVD, etc)</i>	

10. Lighting

KIND OF EQUIPMENT	EQUIPMENT	AVERAGE
	NUMBER OF UNITS	HOURS OF DAILY USAGE
AL	AM	AN
Incandescent bulb		
Fluorescent lamp (old type)		
Fluorescent lamp (thin tubes)		
CFL		
LED		
Others		

QUESTIONNAIRE – PHASE2

■ Petroleum

Questionnaire for End-Use Energy Consumption Survey in the Residential Sector <Petroleum Product questionnaire>

1. Do you use LPG?

Yes
No

2. What is the amount of LPG do you use per month?

kg
m3
others

3. What is the price of LPG?

4. Total LPG consumption

	Consumption	Expense (local currency)	Expense (US\$)
January			
February			
March			
April			
May			
June			
July			
August			
September			
October			
November			
December			

QUESTIONNAIRE – PHASE2

■ Petroleum

5. Do you use Kerosene?

yes
no

6. Total Kerosene consumption

	Consumption(L)	Expense (local currency)	Expense (US\$)
January			
February			
March			
April			
May			
June			
July			
August			
September			
October			
November			
December			

7. Number of equipment

KIND OF EQUIPMENT	NUMBER OF UNITS
Cooking stove(LPG)	
Cooking stove(Kerosene)	
Water heater(LPG)	
Water heater(Kerosene)	
Generator(Kerosene)	
Kerosene lamp	

QUESTIONNAIRE – PHASE2

■ Natural gas

Questionnaire for End-Use Energy Consumption Survey in the Residential Sector <Natural gas questionnaire>

1. Do you use Natural gas?

Yes
No

2. Please answer energy unit written in bill?

cubic m
cubic feet
others

3. Total Natural Gas consumption

	Consumption	Expense (local currency)	Expense (US\$)
January			
February			
March			
April			
May			
June			
July			
August			
September			
October			
November			
December			

4. Number of equipment

KIND OF EQUIPMENT	NUMBER OF UNITS
Cooking stove(natural gas)	
Water heater(natural gas)	
Others	

QUESTIONNAIRE – PHASE2

■ Biomass

Questionnaire for End-Use Energy Consumption Survey in the Residential Sector

<Biomass questionnaire>

1. Do you use biomass at home?

Yes

No

2. Usage of wood and wood waste, ... and other biomass

KIND OF BIOMASS	TYPE OF USAGE		HOW OFTEN DOES your HOUSEHOLD CONSUMES BIOMASS?		
			every day	2-3 days per week	2-3 day per
A	B	C	D	E	F
Firewood	Cooking				
	Water Heating				
	Others				
Woodwaste	Cooking				
	Water Heating				
	Others				
Rice Husk	Cooking				
	Water Heating				
	Others				
Charcoal	Cooking				
	Water Heating				
	Others				
Other biomass	Cooking				
	Water Heating				
	Others				

QUESTIONNAIRE – PHASE2

■ Coal briquette

Questionnaire for End-Use Energy Consumption Survey in the Residential Sector

<Biomass questionnaire>

1. Do you use coal briquette in your household?

Yes

No

2.Usage of coal briquette

KIND OF BIOMASS	TYPE OF USAGE		HOW OFTEN DOES your HOUSEHOLD CONSUMES BIOMASS?		
			every day	2-3 days per week	2-3 day per
B	D		E	F	G
Coal briquette	Cooking				
	Water Heating				
	Others				

THANK YOU