



# Strengthening Planning Capacity for Low Carbon Growth in Developing Asia: Project Overview

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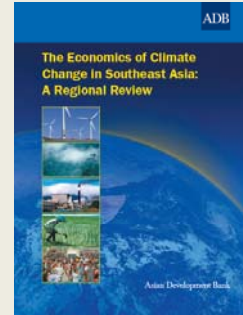
# The Economics of Climate Change at ADB

- Support adaptation and low carbon planning, and inform policy making
- Share knowledge and build capacity, based on research focusing on economic aspects
- Raise public awareness about climate change challenges and opportunities

# Why economics?—it helps answer important policy questions

- How much would climate change cost us?
- Is it worth taking action?
- To what extent and when?
- What and where first?
- What are the levels of investment and financing needed?
- What policies will help ensure consistency across adaptation and low carbon agendas?

# Regional Studies



- SE Asia (completed)
  - Phase II: **Strengthening Planning Capacity for Low Carbon Growth in Developing Asia** (started in Q1 2011)
- South Asia
  - Part I – Cleaner Technologies and Options (completed)
  - Part II – Adaptation and Impact Assessment (tbc Q1 2013)
- Pacific (tbc Q4 2012) – impact and adaptation
- NE Asia (tbc Q1 2013) – adaptation and LCG
- Central and West Asia (started in Q3 2012)

Strengthening Planning Capacity for  
Low Carbon Growth in Developing Asia:  
**Project Overview**



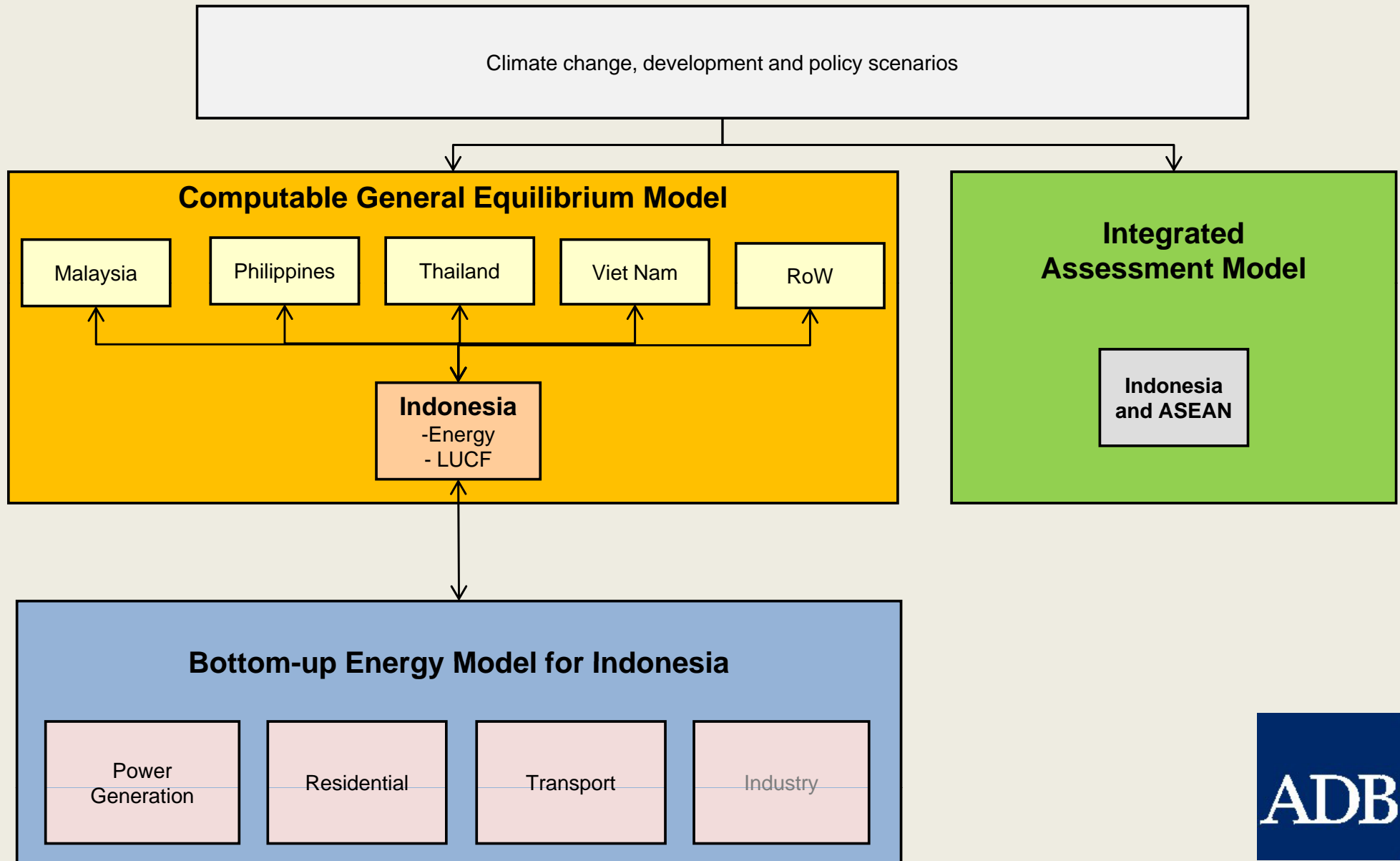
# Project Objectives

- Customize low-carbon growth ***planning tool*** that is transparent, flexible, and user-friendly
- Help update ***low-carbon growth roadmap and*** evaluate targets/plans
- Provide ***hands-on training*** to enhance the capacity of relevant agencies and institutions to maintain and utilize models and database

# Project at a Glance

- **Participation:** Indonesia, Malaysia, Philippines, Thailand, and Viet Nam
- **Funding:** Japan, UK, and ADB
- **Component:** tools, training, and analysis
- **Sector:** Energy (power, transport, household) and LUCF
- **Implementation:** Jan 2011-Sep 2013

# A suite of tools (Indonesia case)





# Towards a hybrid framework—why?

- Capture interactions between market-based instruments and technology options
- Capture macro-economic changes (technical, prices, elasticities, structural, GDP growth) and impacts on energy systems and options
- Capture the impact of LC technologies on non-energy sectors, and the economies (employment, welfare, trade, etc)
- Capture (strategic) interactions among countries, regional cooperation, policy spill-over effects

Instructions and Help

Choose alternate source data folder

Read aggregation scheme from file

View/change regional aggregation

View/change sectoral aggregation

Title	RunGTAP	Version	Closure	Shocks	Solve	Results
<h1>RunGTAP</h1> <h2>A CGE Model of World Trade</h2>						

Header	Type	Dimension	Coeff	Total	Name	
1	CTVD	RE	REG*EGYCOM		0	total value of carbon taxes in M USD
2	NCTD	RE	REG		0	Domestic nominal carbon tax in USD per ton of C.
3	RCTD	RE	REG		0	Domestic real carbon tax in USD per ton of C.
4	CH4S	RE	PROD_COMM_HH*REG	CH4_S_EM	1613.96	CH4 sectoral emissions
5	CH4T	RE	REG	CH4R	1613.96	CH4 Total emissions
6	CO2	RE	REG*EGYCOM	CO2	7734.42	CO2 emissions in M tons of C
7	CO2A	RE	REG*TR_COM_HH	rCO2A	7734.42	CO2 emissions in M tons of C by sector
8	CO2Q	RE	REG	CO2TOT	7734.42	CO2 emissions quota (M tons of C)
9	CO2R	RE	EGYCOM*TR_COM_HH*REG	rCO2	7734.42	CO2 emissions in M tons of C by sector and EGYCOM
10	CO2T	RE	REG	CO2TOT	7734.42	total CO2 emissions in M tons of C
11	CSTK	RE	TVINTAGE*ENDW_COMM*TREEMGMT*REG	TMCStk_DGTM	553813.13	DGTM data categories: 2. CO2 stock, in m. tons of C
12	CTLV	RE	REG*EGYCOM	CTAXVAL	0	total value of carbon taxes in M USD
13	CTRA	RE	REG	CO2TRAD	0	value of permit trading in M. 2001 USD
14	CVOL	RE	REG*EGYCOM	CDCVOL	12530.85	demand of energy comm (Mtoe)(excl. crude oil to P.C)
15	CWFD	RE	TRAD_COMM*PROD_COMM*REG	CWFD	6156.00	carbon tax power on domestic uses by firms
16	CWFI	RE	TRAD_COMM*PROD_COMM*REG	CWFI	6156.00	carbon tax power on imported uses by firms
17	CWGD	RE	TRAD_COMM*REG	CWGD	324.00	carbon tax power on domestic demands by government
18	CWGI	RE	TRAD_COMM*REG	CWGI	324.00	carbon tax power on imported demands by government
19	CWPD	RE	TRAD_COMM*REG	CWPD	324.00	carbon tax power on domestic demands by households
20	CWPI	RE	TRAD_COMM*REG	CWPI	324.00	carbon tax power on imported demands by households
21	DEBT	RE	REG	DEBT	0	Intal Debt level
22	DFNC	RE	TRAD_COMM*PROD_COMM*REG	VDFA	40242258.73	domestic intermediate inputs net of C tax
23	DGNC	RE	TRAD_COMM*REG	VDGA	6909615.77	domestic purchases by government net of C tax
24	DPNC	RE	TRAD_COMM*REG	VDPA	22402820.20	domestic purchases by households net of C tax
25	DPMS	RE	REG	DPARSUM	18.00	Sum of Distribution Parameters in Household Demand System
26	DVER	RE	1	VERNUM	5.00	Format of GTAP data
27	DVOL	RE	REG*EGYCOM	DVOL	16088.19	volume of domestic production (Mtoe)
28	EMIC	RE	REG*EGYCOM	EMIC	1353.76	Emission coefficients in M tons of C. per Exajoule
29	EVNC	RE	EGYCOM*TR_COM_HH*REG	ENERCONS	12530.85	Energy volume consumption in Mtoe
30	EVFA	RE	ENDW_COMM*PROD_COMM*REG	EVFAX	36200791.86	Endowments - Firms' Purchases at Agents' Prices
31	EVOA	RE	ENDW_COMM*REG	EVOAX	27920242.69	Endowments - Output at Agents' Prices
32	FGSS	RE	PROD_COMM_HH*REG	FGAS_S_EM	142.36	FGAS sectoral emissions
33	FGST	RE	REG	FGSR	142.36	FGAS total emissions
34	IFNC	RE	TRAD_COMM*PROD_COMM*REG	VIFA	8332813.90	imported intermediate inputs net of C tax
35	IGNC	RE	TRAD_COMM*REG	VIGA	156499.32	imported purchases by government net of C tax
36	IPNC	RE	TRAD_COMM*REG	VIPA	2771345.82	imported purchases by households net of C tax
37	MVOL	RE	REG*EGYCOM	MVOL	3997.80	volume of energy imports (Mtoe)
38	N2OS	RE	PROD_COMM_HH*REG	N2O_S_EM	813.07	N2O sectoral emissions
39	N2OT	RE	REG	N2OR	813.07	N2O Total emissions
40	NCOE	RE	NCO2*ENDW_COMM*PROD_COMM*REG	NC_ENDW_CEOX	1083.62	Non-CO2 emissions assoc. with endowment by industries-M. m
41	NCOF	RE	NCO2*TRAD_COMM*PROD_COMM*REG	NC_TRAD_CEOc	485.86	Non-CO2 emissions assoc. with input use by industries-M. m.ton
42	NCOO	RE	NCO2*PROD_COMM*REG	NC_QO_CEOc	990.45	Non-CO2 emissions assoc. with output by industries-M. m.ton
43	NCOPI	RE	NCO2*TRAD_COMM*REG	NC_HH_CEOc	9.45	Non-CO2 emissions assoc. with input use by households-M. m

	rCO2A	4 Livestock	5 Timber	6 Coal	7 Oil	8 Gas	9 Oil Pcts	10 Biofuels	11 Nuclear	12 Solar	13 Wind	14 Hydrd	15 OthElv	16 Heavy ind	17 Light ind	18 Services	19 HH	Total
1 USA	3.1	0.5	0.3	5.4	16.3	200.3	0.0	0.0	0.0	0.0	0.0	0.0	619.4	187.0	35.7	357.1	279.7	1714.4
2 WEURO	3.1	0.8	0.0	3.5	7.2	193.2	0.0	0.3	0.0	0.0	0.0	0.0	258.0	151.8	30.8	219.5	195.4	1072.5
3 EEURO	1.3	0.3	0.4	0.0	0.9	26.7	0.0	0.0	0.0	0.0	0.0	0.0	72.5	20.7	4.5	20.2	20.5	170.1
4 KOSAU	1.1	0.3	0.6	0.7	5.8	64.0	0.0	0.0	0.0	0.0	0.0	0.0	146.6	62.0	6.0	52.5	31.3	373.0
5 CAJANZ	0.5	0.9	0.2	3.5	8.3	114.7	0.0	0.0	0.0	0.0	0.0	0.0	130.6	105.3	16.1	111.8	69.5	566.0
6 TE	2.8	1.6	0.6	6.1	12.1	101.0	0.0	0.1	0.0	0.0	0.0	0.0	325.2	96.1	15.1	103.9	95.3	766.6
7 MENA	0.5	0.0	0.0	6.3	8.1	78.1	0.0	0.0	0.0	0.0	0.0	0.0	129.9	83.6	9.4	76.1	75.8	470.9
8 SSA	0.1	0.0	0.0	1.5	1.7	1.4	0.0	0.0	0.0	0.0	0.0	0.0	8.5	4.4	2.4	15.1	10.7	46.3
9 SASIA	0.0	0.0	0.0	0.0	0.2	1.7	0.0	0.0	0.0	0.0	0.0	0.0	13.4	12.2	1.2	10.0	7.5	46.7
10 CHINA	4.9	2.3	24.0	8.2	16.4	252.6	0.0	0.0	0.0	0.0	0.0	0.0	651.9	312.0	31.8	94.1	93.8	1509.7
11 EASIA	0.0	0.0	0.0	0.0	0.2	3.5	0.0	0.0	0.0	0.0	0.0	0.0	12.7	16.7	2.2	10.0	2.9	48.2
12 IND	0.0	0.0	0.4	0.7	1.2	31.1	0.0	0.0	0.0	0.0	0.0	0.0	165.9	48.9	8.4	23.1	36.0	315.6
13 IDN	0.0	0.2	0.0	0.6	1.3	11.9	0.0	0.0	0.0	0.0	0.0	0.0	23.7	21.5	4.2	16.7	15.6	96.2
14 MYS	0.0	0.0	0.0	0.0	0.0	4.4	0.0	0.0	0.0	0.0	0.0	0.0	10.9	7.9	1.5	8.4	5.0	38.1
15 PHL	0.0	0.0	0.3	0.4	0.4	0.2	0.0	0.0	0.0	0.0	0.0	0.0	6.8	2.3	0.9	5.8	2.9	20.1
16 THA	0.2	0.0	0.0	0.4	1.4	5.5	0.0	0.0	0.0	0.0	0.0	0.0	17.2	12.2	3.0	12.6	6.1	59.5
17 VNM	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	4.7	6.4	1.2	5.1	3.5	21.5
18 LACA	2.3	0.3	0.1	8.8	11.5	54.7	0.0	0.0	0.0	0.0	0.0	0.0	74.3	74.6	8.2	89.4	67.4	399.1
Total	20.0	7.4	27.1	46.1	92.8	1145.3	0.0	0.4	0.0	0.0	0.0	0.0	2672.2	1225.6	182.4	1231.4	1019.0	7734.4

Double-click on an item to view it (or arrow keys + space bar)

start

Mail - Inbox - IBM L...

Final Presentations ...

myADB

6 Lat

7 EU

8 ME

9 SSA

10 Res

CO2A: REG\*TR\_COM\_HH CO2 emissions in M tons of C by sector

5:35 PM

Summary Power Industry Select Calculation Run Scenario 1 Scenario Analysis Calculator General Help Protect Sheet View Side by Side  
 General Households Agriculture Specifications Run Scenario 2 MAC, Carbon price and IRR Page Topics New Window Synchronous Scrolling  
 Quit EFFECT Nonresidential Transport Other Sheets Run Current selection Glossary Switch Window Reset Windows for Scroll  
 Sectors Power Analysis EFFECT Help Built In

D5 fx

### Marginal Abatement Cost, Carbon Price and IRR Calculator

**Perform these 5**

- 1** Select technologies to be compared  
 Option A: Coal - SubCrt-600  
 Option B: Gas - SingleCycle - 100
- 2** Set options in the Control Panel as required [See Here](#)
- 3** Choose installed Capacity of Option A: 500.0 MW
- 4** Push Button to set Capacity

	Option A	Option B	Difference (A - B)	Units
Total Generation (based on lifetime of Option A)	115,779.3	166,897.3	-51,118.6	GWh
<b>NPV in year 0 (Discounted cash flow)</b>				
New Plant Investment	5,216.0	4,487.3	728.6	EFP (E+06)
Cost of Renovation or Retrofit	40.5	50.6	-10.1	EFP (E+06)
Residual Value of new plant		-27.7	27.7	EFP (E+06)
Residual Value of renovated plant		0.0	0.0	EFP (E+06)
O&M Fixed	537.4	191.7	345.7	EFP (E+06)
O&M Variable	431.3	690.8	-259.5	EFP (E+06)
Total fuel cost at Plant	1,565.3	16,704.0	-15,138.7	EFP (E+06)
Total Expenditure	7,790.5	22,096.8	-14,306.3	EFP (E+06)
<b>CO2e Emissions (undiscounted)</b>				
LCA Upstream Emissions for new plant	172.9	1,845.8	-1,672.9	Gg
LCA Upstream Emissions of Renovation or Retrofit	0.0	0.0	0.0	Gg
Total CO2e emissions from both fuels	107,152.7	98,461.1	8,691.6	Gg
Total CO2e Emissions	107,325.7	100,307.0	7,018.7	Gg
	0.927	0.601		
<b>Breakeven Price of Carbon</b>				
Price of CO2e per Gg to give same net discounted value to both Options			7.2	EFP (E+06)/Gg
Exchange Rate			4.5	EFP / USD
Price of CO2e per ton to give same net discounted value to both Options			1,599.8	USD tCO2
<b>Marginal Abatement Cost</b>				
Discounted Expenditure difference / Undiscounted CO2 Emissions			2.0	
Exchange Rate			4.5	
Discounted Expenditure difference / Undiscounted CO2 Emissions			448.0	

#### Control Panel

Currently: Reference Case 10% Discount Rate

**Use fixed discount rate for financial analysis**  
 Yes FALSE Annual 4.4% %  
If "Yes" is not selected, uses year-by-year assumptions from the General/Econ sheet

**Use fixed discount rate for accruing benefits from carbon**  
 Yes FALSE Annual % %  
If "Yes" is not selected, uses year-by-year assumptions from the General/Econ sheet

**Use fixed fuel price**

	Option A	Option B
Current	91.14	2235.333703
Change to		

**Fuel cost at Plant** EFP t  
Leave blue cells blank to use year-by-year assumptions from the General/Eprice sheet  
 US\$20.1 US\$433.5

#### Calculate IRR

Select "Yes" in "Use fixed discount rate for financial analysis"  
 Select Option A or Option B  
 Push Button to Calculate IRR

US\$ c/kWh 10

Total Expenditure	22,096.8	EFP (E+06)
Total Income at US 10	17,725.1	EFP (E+06)
Net profit	-4,371.7	EFP (E+06)
IRR	4.4%	

	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
12				<b>Unfreeze Titles</b>		Units \ Year				Baseline	<b>Scenario 1: Calculating on Average Energy plus 5% spinning reserves in 2012</b>							
13										2009	2010	2011	2012	2013	2014	2015	2016	2017
14						Constant Peso of year:		2009		2009								
16	<b>Demanded Grid Supply</b>																	
17				All Sector		GWh				37,027	42,590	45,328	48,021	50,794	53,712	56,704	60,136	63,136
20	<b>Supplied Demand</b>																	
21				<b>Demand Supply Criteria (Plan)</b>														
23				Supply Shortage	0	%				-21.50%	-12.06%	-18.47%	-15.91%	-5.00%	-3.00%	-1.00%	0.00%	0.00%
24				Safety Factor reserve for forecast errors	1	%				0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	3.50%	3.50%
25				Percentage that can be satisfied by lowering frequency	1	%				-3%	-3.00%	-3.00%	-3.00%	-3.00%	-3.00%	-1.00%	-1.00%	-1.00%
26				Spinning tertiary reserve	2	%				0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	2.50%
27				Total Spinning Reserve		%				-24.50%	-15.06%	-21.47%	-18.91%	-8.00%	-6.00%	-2.00%	2.50%	5.00%
29	#TSD			All Sector - Supplied Demand		GWh				27,956	36,176	35,596	38,941	46,730	50,489	55,569	61,640	67,136
31				Surplus (Shortage is negative)		GWh					-6414.0	-9732.0	-9080.8	-4063.5	-3222.7	-1134.1	1503.4	3193.6
33	<b>Demand Supply (Real)</b>																	
35				All Sector - Supplied Demand		GWh				40241.6	41698.2	43132.6	43892.1	46403.0	46403.0	50867.0	57104.0	69241.6
37				Surplus (Shortage is negative)		GWh				3214.3	-891.4	-2195.6	-4129.2	-4390.7	-7308.6	-5836.6	-3032.2	5324.3
38				Surplus (Shortage is negative)		%				8.68%	-2.09%	-4.84%	-8.60%	-8.64%	-13.61%	-10.29%	-5.04%	8.30%
41				First Year when supply exceeds average yearly demand						2036								
43				System Load Factor		%				79.18%	79.18%	79.18%	79.18%	79.18%	79.18%	79.18%	79.18%	79.18%
45				Equivalent Capacity		MW				4,030.4	5,215.4	5,131.9	5,614.0	6,737.1	7,278.9	8,011.4	8,886.5	9,673.7
47				Additional reserve Capacity		%				0%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
49				Required Capacity		MW				4030.4	5215.4	5131.9	5614.0	6737.1	7278.9	8011.4	8886.5	9673.7



# Progress and Timeline

- 1<sup>st</sup> Regional Consultation Meeting (Jan 2011)
- 2<sup>nd</sup> Regional Consultation Meeting (March 2012)
- 1<sup>st</sup> Regional Capacity Building (March 2012)
- National capacity building workshops (July 2012)
- Development of tools (on-going)
- Further training/consultation (Q3 2012—Q2 2013)
- Complete suite of tools v.1 installed (Q2 2013)
- Launch and dissemination of tools v.1 (Q3 2013)

# Thank You!

**Contact:**

**[ssuphachalasai@adb.org](mailto:ssuphachalasai@adb.org)**

The logo for the Asian Development Bank (ADB), consisting of the letters "ADB" in white, serif font, centered within a dark blue square.