

Strengthening Planning Capacity for Low-Carbon Growth in Developing Asia TA-7645

Tools to Help Transiting to a Low Carbon Economy

**Low Carbon Asia Research Network (LoCARNet) First Annual Meeting
Mobilizing Wisdom for a Low-carbon Asia**

16-17 October 2012
Bangkok, Thailand



Project Overview

Participants: Indonesia, Malaysia, Philippines, Thailand, Viet Nam

Funding: Japan, UK and ADB

Component: Tools, Training and Analysis

Sectors:

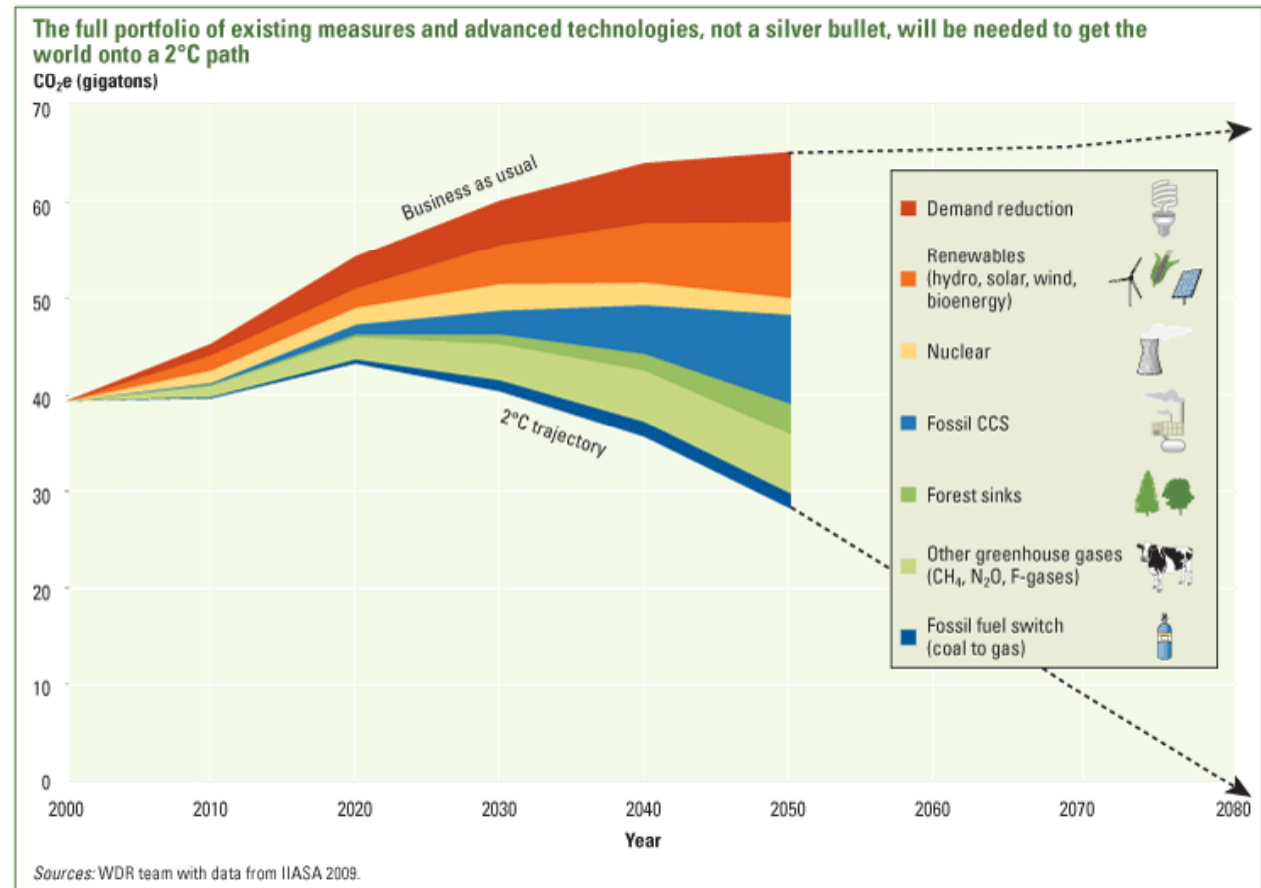
Energy (Household electricity, Land Transport, Power Generation), Industry, and LULUCF

Timeframe: 2010 - 2050

Implementation: Jan 2011 – June 2013



Green Growth



Involves agreeing on many cross-sector adaptation and mitigation measures

Is about generating an enabling environment (reinforced development planning, new policies, new markets)

And selecting an optimum mix of technology options and implementation timing

Green Growth is first and foremost about **Development**

Needs to value all of the benefits:

GHG Mitigation

Climate Resilience

Energy Security

Economic growth and stability

Trade Balance

Job creation and skill sets

Inflation

Quality of Life, etc

And reach consensus amongst multiple stakeholders:

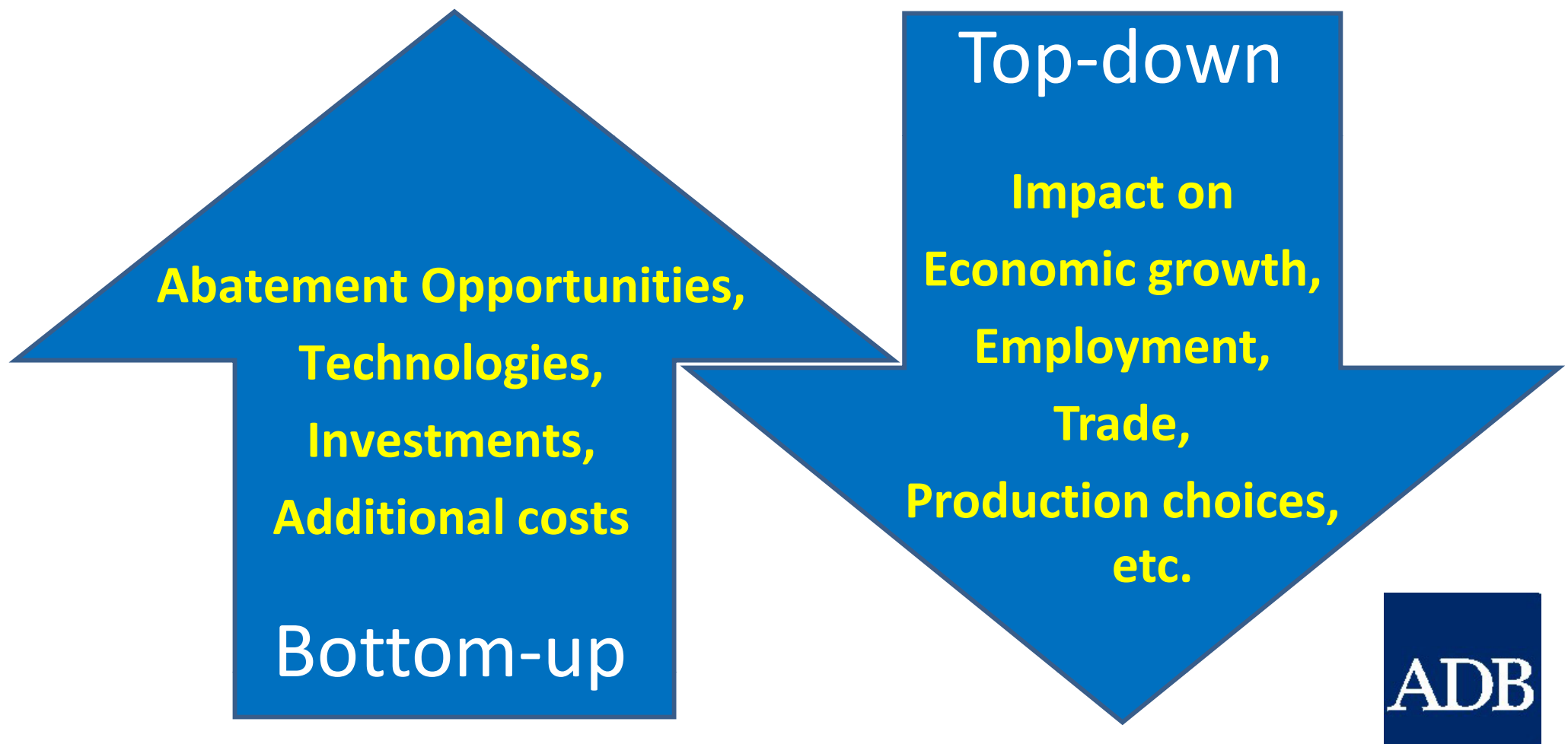
Investment priorities and amounts

Enabling policies, etc

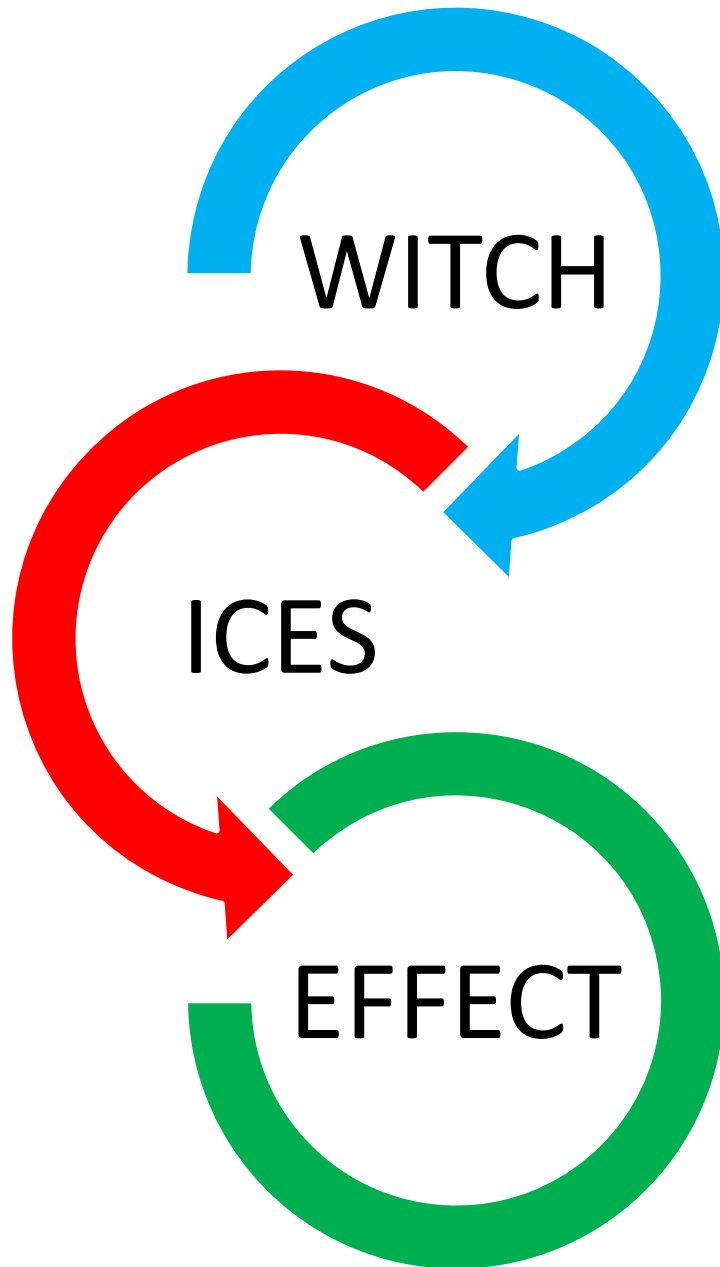


To EFFECT Low Carbon Development

Several tools are required to answer different questions



Model suite for low carbon growth assessment



WITCH

World Induced Technical Change Hybrid Integrated Assessment model

ICES

Recursive dynamic CGE multicountry-multisector model with international trade

EFFECT

Energy Forecasting Framework and Emissions Consensus Tool

What is EFFECT?



- Developed by the World Bank originally for the India Low Carbon Growth Planning Study
- Excel-based, bottom-up, engineering style model
- Evaluates technology options and changes in activity using micro-level data and assumptions
- Develops marginal abatement cost (MAC) analyses
- Supports consensus building and planning across key sectors of the economy
- Helps assess the impact of policy choices on GHG emission levels

Current modules



Land Transport



Power

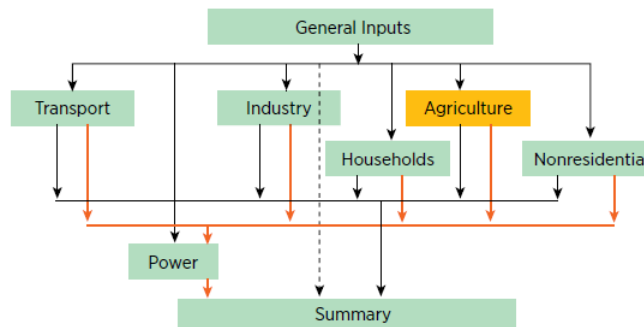


Industry



Household Electricity

Low Carbon Development Model Structure



Note: The agriculture module has not been developed at this stage.



Non-residential

Ribbon-based navigation, analysis and help

Marginal Abatement Cost, Carbon Price and IRR Calculator

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	
Fuel cost at Plant	Current	Change to	Current	Change to
	91.4		2235.333703	

Leave blue cells blank to use year-by-year assumptions from the General/EPrice sheet
US\$/GJ US\$/MWh

Calculate IRR

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

	Option A	Option B	US\$ c/kWh
Total Expenditure	22,096.8	17,725.1	10
Total Income at US 10	-4,371.7	4.4%	
Net profit			
IRR			

	Option A	Option B	Difference (A - B)	Units
Choose installed Capacity of Option A	500.0			MW
Push Button to set Capacity	677.8	51,118.6	-177.8	MW
Total Generation (based on lifetime of Option A)	115,779.3	166,897.9	-51,118.6	GWh
NPV in year 0 (Discounted cash flow)				
New Plant Investment	5,216.0	4,487.3	728.6	EFF (E+06)
Cost of Renovation or Retrofit	40.5	50.6	-10.1	EFF (E+06)
Residual Value of new plant		-27.7	27.7	EFF (E+06)
Residual Value of renovated plant		0.0	0.0	EFF (E+06)
O&M Fixed	537.4	191.7	345.7	EFF (E+06)
O&M Variable	431.3	690.8	-259.5	EFF (E+06)
Total fuel cost at Plant	1,565.3	16,704.0	-15,138.7	EFF (E+06)
Total Expenditure	7,790.5	22,096.8	-14,306.3	EFF (E+06)
CO2e Emissions (undiscounted)				
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		
Break-even Price of Carbon				
Price of CO2e per Gg to give same net discounted value to both Options			7.2	EFF (E+06)/Gg
Exchange Rate			4.5	EFF / USD
Price of CO2e per ton to give same net discounted value to both Options			1,599.8	USD /CO2
Marginal Abatement Cost				
Discounted Expenditure difference / Undiscounted CO2 Emissions			2.0	
Exchange Rate			4.5	
Discounted Expenditure difference / Undiscounted CO2 Emissions			16.0	

Easy to understand, adaptable, modifiable

		Units \ Year	Baseline 2009	2010	2011	2012	2013	2014	2015	2016	2017
Unfreeze Titles											
		Constant Peso of year:	2009	2009							
Demanded Grid Supply											
	All Sector	GWh	37,027	42,590	45,328	48,021	50,794	53,712	56,704	60,136	63,136
Supplied Demand											
Demand Supply Criteria (Plan)											
	Supply Shortage	%	-21.50%	-12.06%	-18.47%	-15.91%	-5.00%	-3.00%	-1.00%	0.00%	0.00%
	Safety Factor reserve for forecast errors	%	0.0%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	3.50%	3.50%
	Percentage that can be satisfied by lowering frequency	%	-3%	-3.00%	-3.00%	-3.00%	-3.00%	-3.00%	-1.00%	-1.00%	-1.00%
	Spinning tertiary reserve	%	0.0%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	2.50%
	Total Spinning Reserve	%	-24.50%	-15.06%	-21.47%	-18.91%	-8.00%	-6.00%	-2.00%	2.50%	5.00%
#TSD	All Sector - Supplied Demand	GWh	27,956	36,176	35,596	38,941	46,730	50,489	55,569	61,640	67,136
	Surplus (Shortage is negative)	GWh		-6414.0	-9732.0	-9080.8	-4063.5	-3222.7	-1134.1	1503.4	3199.9
Demand Supply (Real)											
	All Sector - Supplied Demand	GWh	40241.6	41698.2	43132.6	43892.1	46403.0	46403.0	50867.0	57104.0	69241.6
	Surplus (Shortage is negative)	GWh	3214.3	-891.4	-2195.6	-4129.2	-4390.7	-7308.6	-5836.6	-3032.2	5321.6
	Surplus (Shortage is negative)	%	8.68%	-2.09%	-4.84%	-8.60%	-8.64%	-13.61%	-10.29%	-5.04%	8.33%
	First Year when supply exceeds average yearly demand		2036								
	System Load Factor	%	79.18%	79.18%	79.18%	79.18%	79.18%	79.18%	79.18%	79.18%	79.18%
	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
	Additional reserve Capacity	%	0%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Required Capacity	MW	4030.4	5215.4	5131.9	5614.0	6737.1	7278.9	8011.4	8886.5	9673.7

Used by the World Bank, ADB and others in many country-level and sub-national studies

Countries

Brazil, Georgia, India, Indonesia, Macedonia, Malaysia, Nigeria, Philippines, Poland, Thailand, Vietnam

Sub-national studies

Bangkok, Beijing, Chengdu, Guangzhou, Hanoi, Ho Chi Minh City, Jakarta, Manila, Mexico City, Ulaanbaatar

Basis for CTF measurement methodology

Uses same approach as needed for Measurement-Recording-Verifying (MRV) mitigation measures

Base emissions factors meet 2006 IPCC Guidelines

Easily incorporates local emissions factors, data and assumptions

Contains multiple technology options

45 technologies for power generation

25 technologies for transport etc.



How is EFFECT being used in TA-7645?

Strengthening Planning Capacity for Low-Carbon Growth in Developing Asia

Working with Country Experts and National Counterparts:

Objective:

Tools and training to facilitate transition towards low-carbon development using a country-specific, low-carbon growth modeling framework that is transparent, flexible, user-friendly, and designed for sharing and consensus building

Serve as a platform for experience sharing, policy dialogue and cooperation

Scenario analyses:

Develop a “business-as-usual” reference scenario 2010-2050

and low-carbon scenarios taking into account suitable technology options in each of the sectors

Soft-linked to the ICES CGE analysis and outputs



Thank You

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