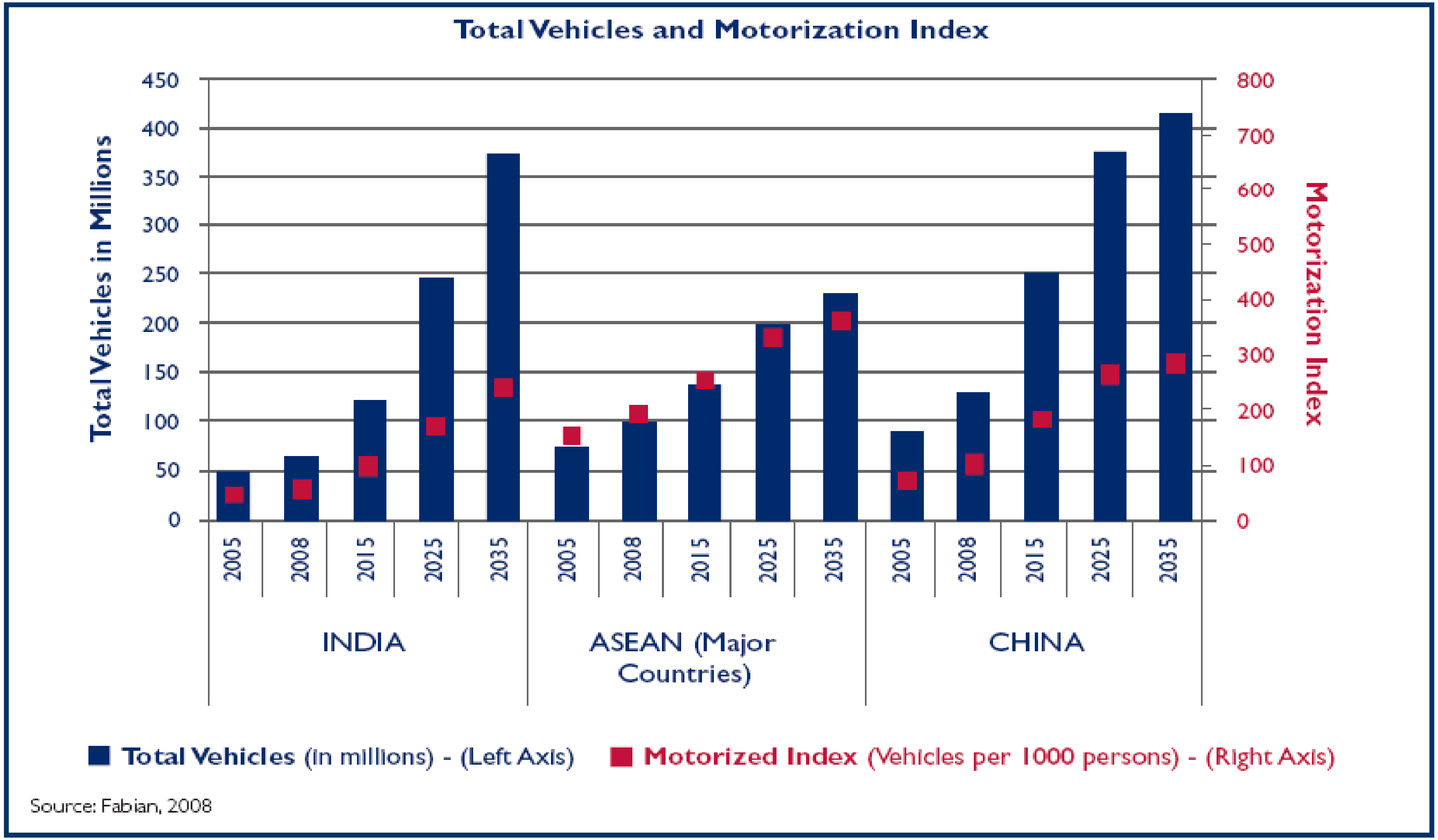
Co-benefits in the transport sector: a roadmap

Jane Romero
Climate Change Group
IGES

WANTED:
sustainable transport roadmap

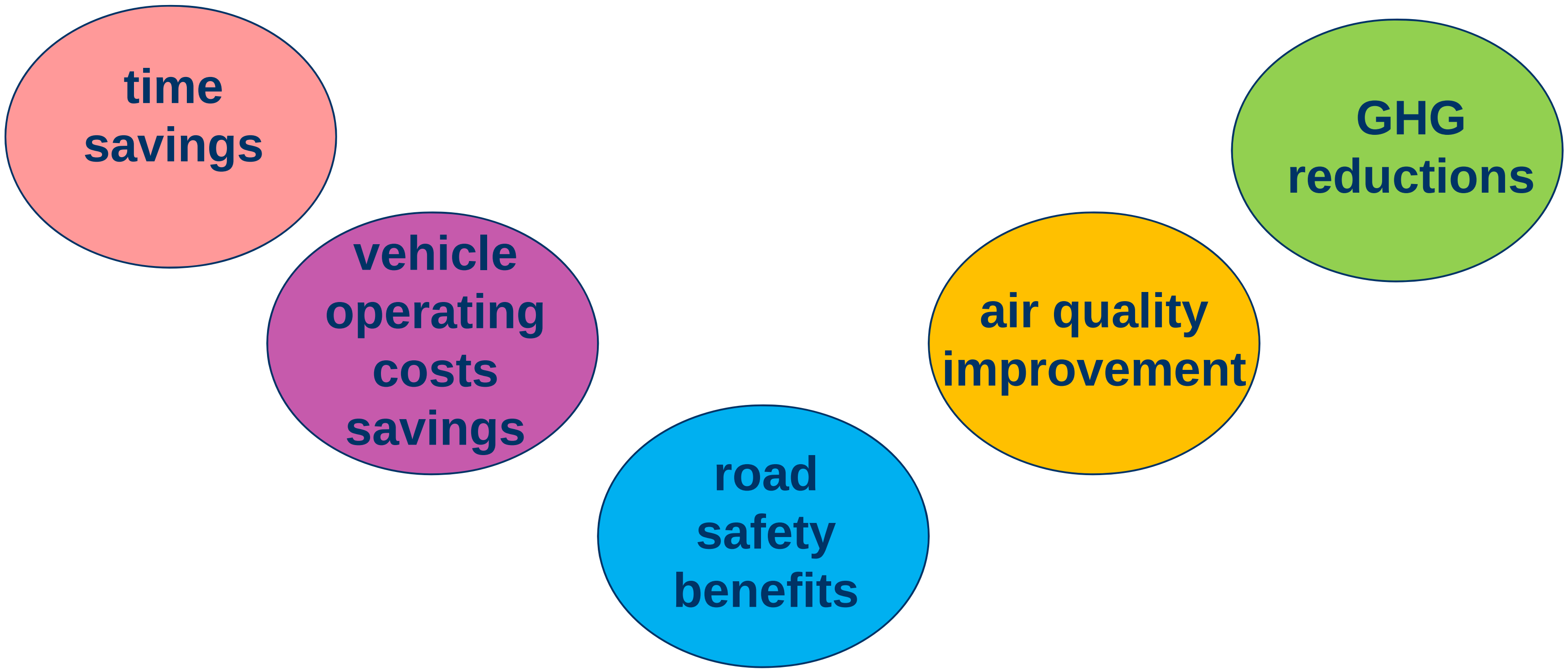
"Traffic is not just a line of cars. It is a web of connections. **A real solution will look at relationships across the entire road network and all the other systems that are touched by it**: our supply chains, our environment, our companies, the way people and communities live and work." IBM 2010 Commuter Pain Survey

Rapid motorization in developing countries



TRANSPORT CO-BENEFITS APPROACH:

aims to reduce greenhouse gas emissions, prevent environmental pollution, and support sustainable development **all at the same time**



We need a paradigm shift

AVOID ⇨	compact city / mix land-use / telework /
SHIFT ⇨	integrated public transport system / railway / bus rapid transit (BRT) / NMTs – walking, cycling
IMPROVE ⇨	fuel efficiency / vehicle efficiency / ITS / emissions standards / alternative energy (incl. biofuels)

Transport projects/policies are not created equal

	Pollution	CO2	Congestion
Improve – reduce emissions per km			
Technology / vehicle change	+++	++	?
Improved driving skills	++	+	+
Fuel-switch (CNG, LPG, biofuels)	++	?	?
Shift – reduce emissions per unit transported			
Passenger transport:			
Mode switch	+++	++	+++
Usage of larger units	+	+	++
Improved occupancy rates	++	++	++
Freight transport	++	++	++
Avoid – reduce number of trips			
Land use – Behavioral change	+++	+++	++
TDM / TOD	++	+++	++

Why quantify co-benefits?

everyone appreciates the “co-benefits approach” but operationalizing the concept is perceived as hard work with less incentive

o the numbers serve as proof to influence **better decision-making** and **implementation**
o if it can be measured, it can be managed
o the ‘proof’ can **leverage financing**

Not a new tool, bringing in more benefits

CDM

PDD for CDM

GHG reduction measured numerically

SD benefits mentioned qualitatively

Co-benefits

"PDD for NAMAs"

GHG reduction measured numerically

Other SD impacts measured numerically also

Cost benefit Analysis

C/B Analysis

Environmental impacts often neglected

SD impacts measured in monetary terms

Balance bet. GHG and other co-benefits

MRV

Co-benefits

Construction emissions should also be added for large projects

Transport Co-benefits Guidelines

Available for download at:
http://www.cobenefit.org

Time savings

Benefit of travel time saving $BT = BT_o - BT_w$

Total Travel time cost (per year) $BT_i = \sum_j \sum_l \left(Q_{ijl} \times T_{ijl} \times \alpha_j\right) \times 365$

where,

BT : Benefit of travel time saving

BT_i: Total Travel time cost with/without project

Q_{ijl} : traffic volume for j vehicle type on link l, with/without project (vehicle/day)

T_{ijl} : average travel time for j vehicle type on link l, with/without project (minute)

α_j : value of time for j vehicle type (monetary unit/minute*vehicle)

i : $i = w$ with project, $i = O$ without project,

j : vehicle type

l : link

Unit value of time per vehicle type (in US $/vehicle-minute)

Vehicle type (j)	Japan	Thailand
Passenger car	0.44	0.061
Bus	4.10	0.031
Van	0.53	-
Small truck	0.52	-
Ordinary truck	0.70	0.031
Motorcycle	-	0.010

Note: Based on 2008 data and prices

Vehicle operating costs savings

Benefit of vehicle operating cost reduction $BR = BR_o - BR_w$

Total Travel time cost (per year) $BR_i = \sum_j \sum_l \left(Q_{ijl} \times L_l \times \beta_j\right) \times 365$

where,

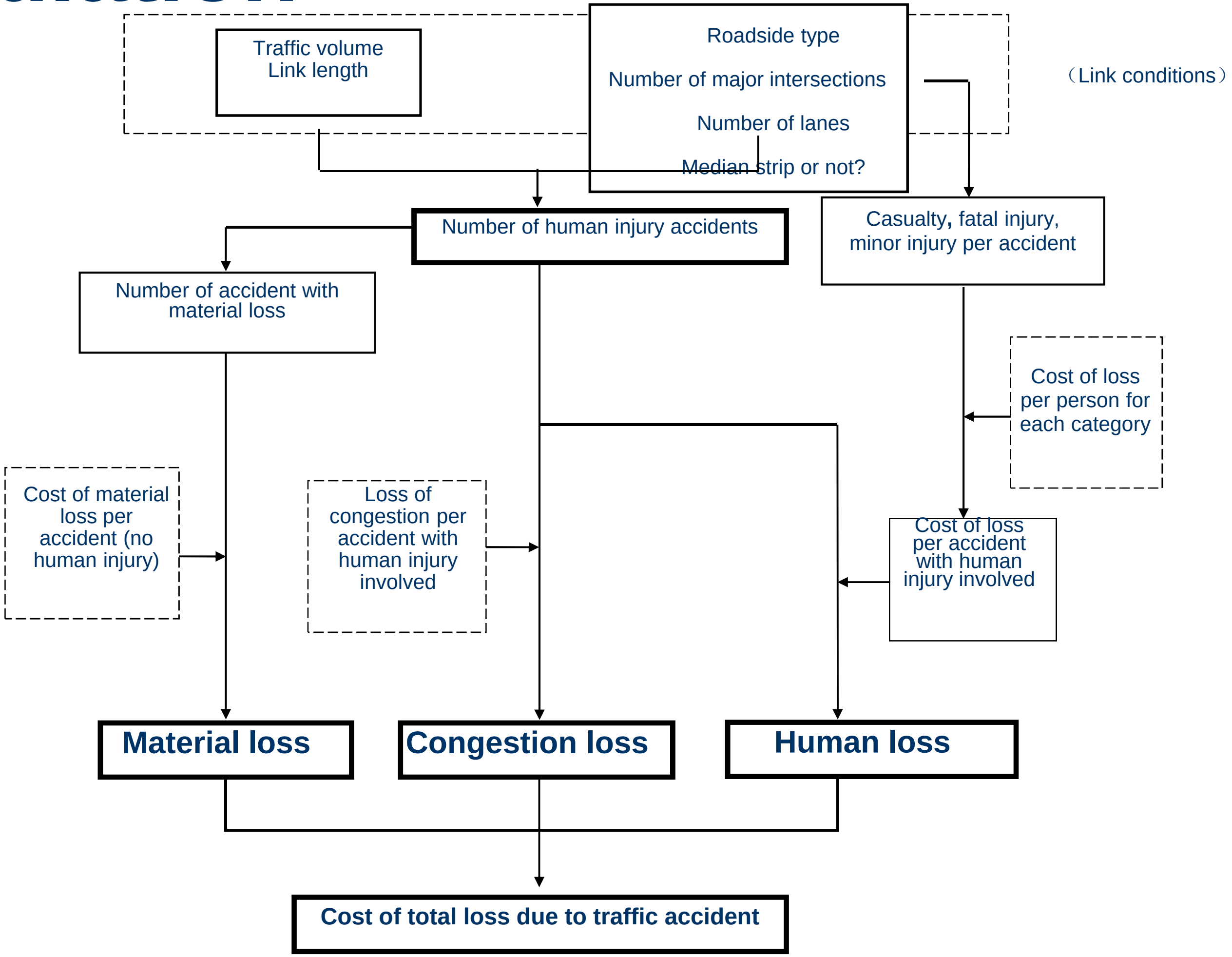
- BI: Benefit of vehicle operating cost reduction
- BI_i: Total vehicle operating cost with/without project
- Q_{ijl}: traffic volume for j vehicle type on link l, with/without project (vehicle/day)
- L_l: Link length of link l (km)
- β_j: value of vehicle operating cost for j vehicle type (monetary unit/minute*vehicle)
- i: $i=w$ with project, $i=C$ without project,
- j: vehicle type
- l: link

Ordinary road （DID） **（Unit ： US $/vehicle･km）**

Speed (km/hour)	Passenger car	Bus	Ave. passenger car class (incl. bus)	Small truck	Ordinary truck
5	0.47	1.20	0.48	0.36	0.82
10	0.34	1.01	0.35	0.31	0.67
15	0.30	0.94	0.31	0.29	0.60
20	0.27	0.89	0.28	0.27	0.55
25	0.26	0.86	0.27	0.26	0.51
30	0.25	0.84	0.26	0.25	0.48
35	0.24	0.82	0.25	0.25	0.45
40	0.24	0.81	0.25	0.24	0.44
45	0.24	0.81	0.24	0.24	0.43
50	0.23	0.80	0.24	0.24	0.42
55	0.23	0.80	0.24	0.24	0.41
60	0.24	0.80	0.24	0.24	0.41

Note1) Prices in 2008
Note2) Unit cost between classes of speed in the table should be calculated by linear interpolation.
Note3) Values of 60km/h are used respectively, in the case of speeds beyond 60km/h

Framework of accident loss calculation



Estimation of emission reductions

Bottom up

$ER_i = \Sigma(BE_{i,k} - PE_{i,k})$

$BE_{i,k} = \Sigma(Q_{BL,j,k} \times L_k \times EF_{i, j, VBL,k})$
$\mathbf{PE_{i,k} = \Sigma(Q_{PJ,j,k} \times L_k \times EF_{i, j, VPJ,k})}$

Traffic volume

Emission factor

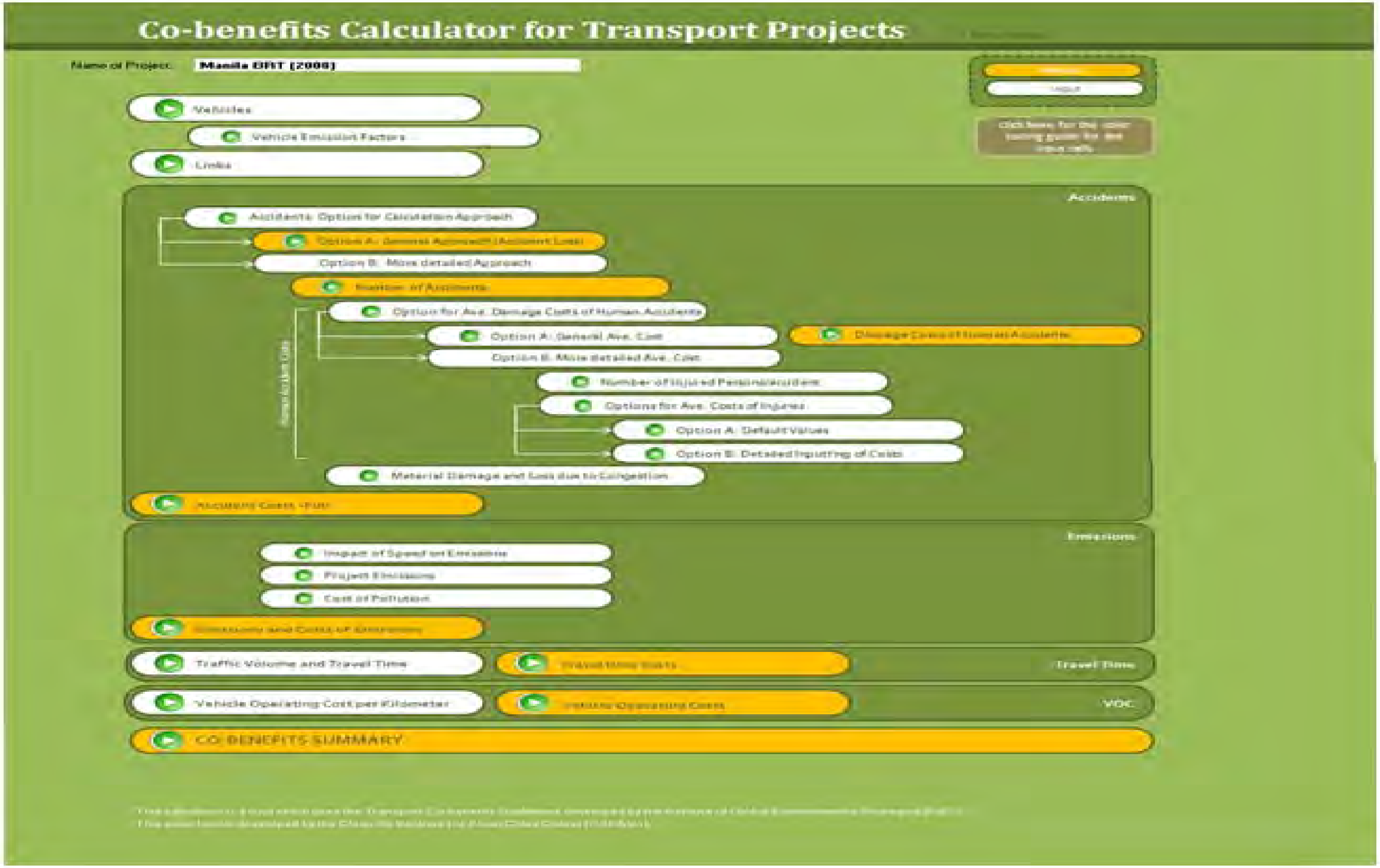
Top down

$ER = \Sigma(BE - PE)$

$BE = \Sigma(FC_{BL,m} \times NCV_m \times Ef_m)$
$PE = \Sigma(FC_{PJ,m} \times NCV_m \times EF_m)$

Amount of fuel

Transport Co-benefits Calculator



Case study: Bangkok BRT

	2006 Base case	2011 Without BRT scenario	2011 With BRT scenario	Difference between With and Without BRT scenarios
Time Cost (Baht/year)	467,088,340,223	372,519,518,162	369,352,291,793	-3,167,226,369
Operating Cost (Baht/year)	758,591,194,274	771,676,100,219	766,519,611,334	-5,156,488,885
Loss by Accident (Baht/year)*	143,215,180,809	138,838,420,713	137,465,291,897	-1,373,128,816

*Based on Japanese values

Emission reductions

	Pollutants	Emissions or emission reductions (t/day for CO_2, kg/day for others)	
Air pollutants	NOx	2006	
		2011 (Without BRT)	327,389
		2011 (With BRT)	325,930
		Reduction (Without –With BRT)	1,458
		Reduction rate ((Without –With BRT)/Without BRT)	0.45%
	CO	2006	
		2011 (Without BRT)	1,173,604
		2011 (With BRT)	1,160,929
		Reduction (Without –With BRT)	12,676
		Reduction rate ((Without –With BRT)/Without BRT)	1.08
	PM	2006	
		2011 (Without BRT)	13,858
		2011 (With BRT)	13,843
		Reduction (Without –With BRT)	15
		Reduction rate ((Without –With BRT)/Without BRT)	0.11%
Greenhouse gas	CO_2	2006	
		2011 (Without BRT)	67,327
		2011 (With BRT)	66,903
		Reduction (Without –With BRT)	424
		Reduction rate ((Without –With BRT)/Without BRT)	0.63%

Key points

❖ **Transport co-benefits (carbon dioxide reductions, urban air pollution improvement, public health impacts, vehicle operating costs, time savings and accident reductions) are estimated to be greater in Asia than other regions. Among possible transport options, public transportation projects have the highest co-benefits.**

❖ **Better decision-making is the key to capture holistic co-benefits.**

- Engaging more stakeholders
- "Re-educating" transport practitioners on other available sustainable transport modes and so-called climate experts the on the ground realities in dealing with emissions from transport sector
- CO_2 reduction alone is not enough to influence policymakers to adopt a paradigm shift, must highlight local developmental co-benefits
- Climate funds could break the inertia; incentivize environmentally sustainable, low-carbon transport policies and projects

Thank you for your attention.

Email: romero@iges.or.jp
Websites: www.iges.or.jp | ww.cobenefit.org