Some Methodological Issues in CDM Analyses of Power Sector Projects

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Introduction

- GHG abatement cost and emission mitigation due to a candidate CDM power project can vary depending upon whether or not no-regret DSM options are considered in the power development plan.

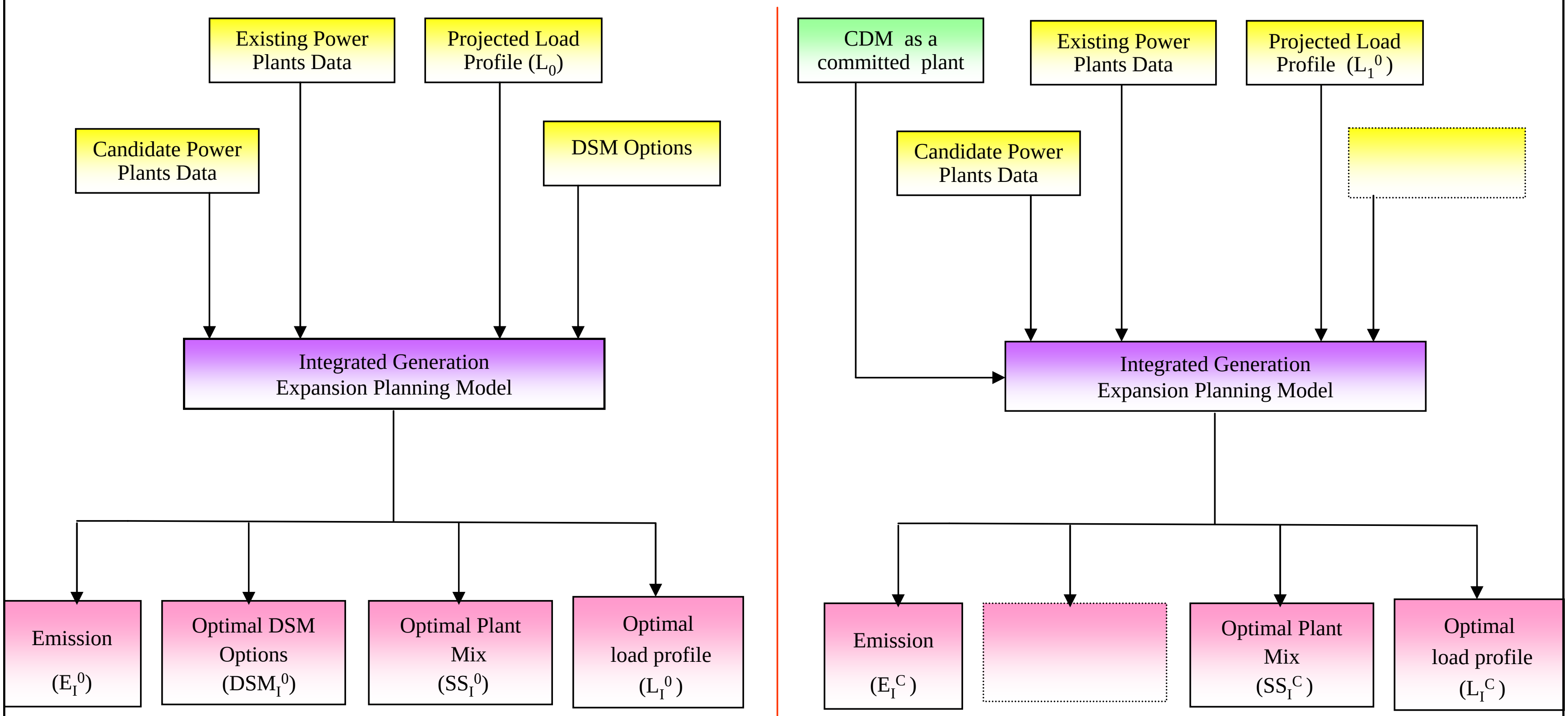
    - Power development planning without no-regret DSM option (i.e., TRP)
    - Power development planning with DSM option (i.e., IRP)
    - Capacity-mix, fuel-mix and generation-mix will be different under TRP and IRP
    - Baseline emission and total cost will also be different
    - A CDM power plant can affect the generation-, capacity- and fuel-mix differently under TRP and IRP.

Introduction

Issues:

- How to determine the additional emission mitigations due to the CDM project under IRP ?
- What would be the baseline emission and costs with and without no-regret DSM options ?
- What would be the additional emission mitigations due to the candidate CDM project with and without DSM options ?

Emission mitigation with CDM project under IRP



Emission Mitigation due to CDM-Plant, $\Delta E_{CDM} = E_I^0 - E_I^C$

Rebound effect

Energy efficiency improvement results in a decrease in the effective price of services which would increase the service demand. As a result, actual energy savings due to the introduction of efficient appliances would be less than the savings based on engineering estimates (also known as "feedback effect").

How big is the rebound effect?

Examples:

- Actual savings due to efficiency improvement on home-heating appliances: 8 to 13 percent below than the engineering estimate (Dubin, Miedema and Chandran, 1986).
- Khazzoom (1987) reports actual electricity savings from electrically heated homes 67% less than the engineering estimate of savings.

Rebound effect

(1) According to Khazzoom, 1980:

$$\mathbf{e} = |\gamma| - 1$$

where,

e = elasticity of demand for electricity with respect to appliance efficiency, and

γ = long-run price elasticity of demand for electricity

Here, rebound effect (Khazzoom) = $|\gamma|$

(2) According to Henly et.al., 1988:

$$\mathbf{e} = |\gamma| + \gamma_{s,k} \cdot \gamma_{k,\eta} - 1$$

where,

$\gamma_{s,k}$ = elasticity of service demand with respect to appliance price and

$\gamma_{k,\eta}$ = elasticity of appliance price with respect to efficiency

Here, rebound effect (Henley et al) = $|\gamma| + \gamma_{s,k} \cdot \gamma_{k,\eta}$

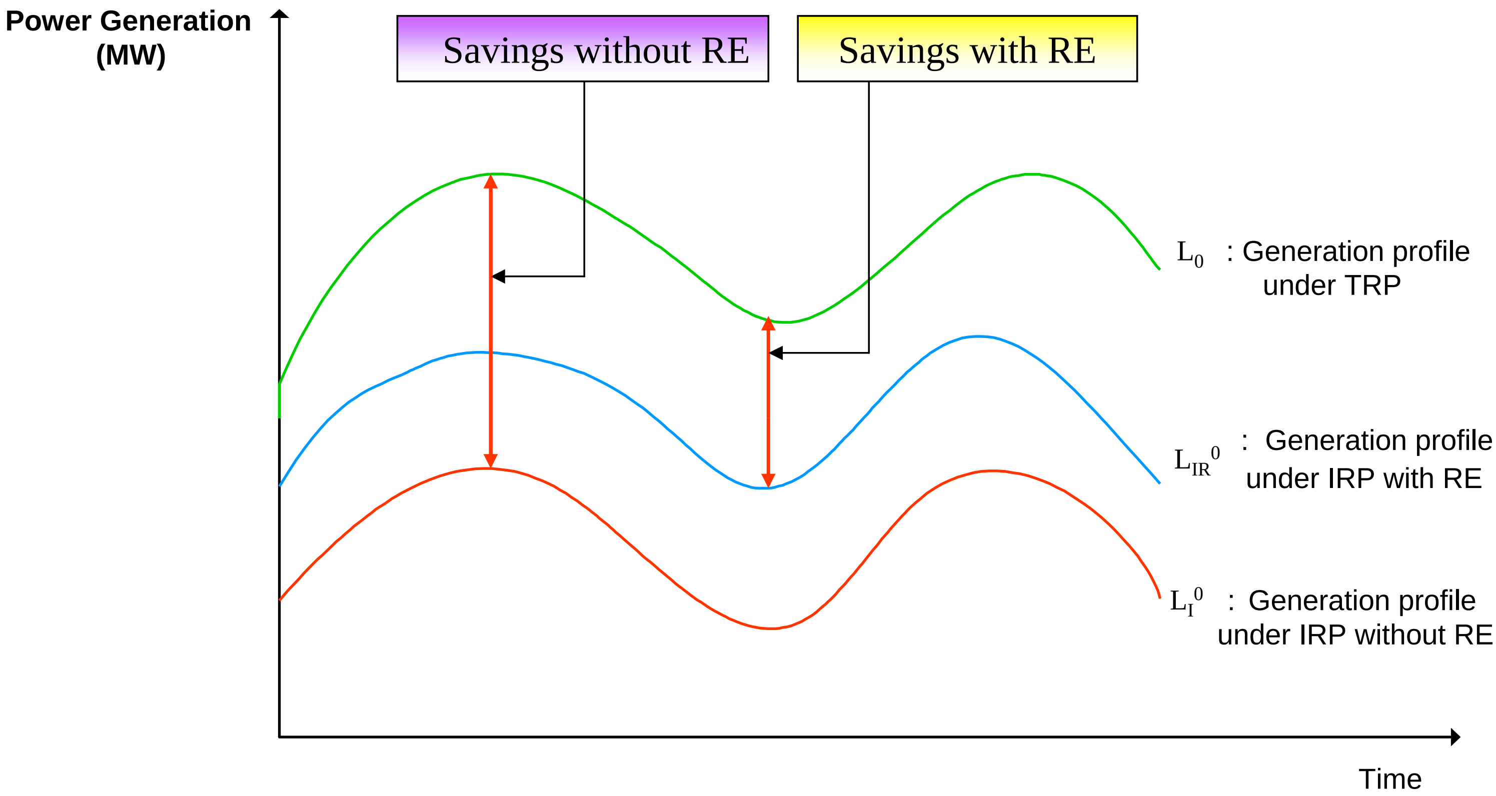
Note that: RE (Henley et al) < RE (Khazzoom)

Rebound effect

Rebound effect from selected studies

Study	Focus of the Study	Rebound effect (%)
Khazzoom (1987)	Use of energy efficient appliances in US	75
Greene (1992)	Vehicle efficiency improvement in US	5-15
Murck et.al (1985)	Policy simulation to reduce wood use in Sudan	48
Jones (1993)	Passenger vehicle use and rebound effect in US	60
Zein-Elabdin (1997)	Improved stoves programs in Sub-Saharan Africa	50
Ronald and Haugland (1994)	Energy conservation in commercial/household sectors in Norway	10-40

Generation savings in IRP with and without RE



Power Generation Profiles under TRP and IRP Cases

Simulation results from a case study of Vietnam

Total CO_2 emission during the planning horizon in different cases, million tons

Cases	CO_2 Emissions	CO_2 Emissions avoided +
TRP Base Case without RE	848.6	
IRP Base Case with RE	730.8	
TRP-CDM-Hydro #	830.1	18.5
IRP-CDM-Hydro with RE *	709.8	20.3

+ Each figure here is with respect to the corresponding base case (i.e., baseline emission).
* With the same level of generation as in IRP base case
# The size of the CDM-Hydro is 105 MW, ROR type

Total SO_2 and NO_x emission during the planning horizon, thousand tons

Cases	SO_2	NO_x
TRP Base Case	3,630.0	2,960.0
IRP Base Case with RE	3,196.0	2,423.2
TRP-CDM-Hydro	3,580.2	2,877.7
IRP-CDM-Hydro with RE*	2,960.9	2,319.5

* With the same level of generation as in IRP base case

Simulation results from a case study of Vietnam

Total cost of the generation during the planning horizon, average incremental generation cost (AIC) and incremental cost of the emission abatement at 1998 prices.

Cases	Total discounted cost (10^6 $)	AIC (Cents/kWh)	Incremental abatement cost (US$/ton of carbon)
TRP Base Case	9934.9	2.87	
IRP Base Case with RE	8553.0.6	2.85	
TRP-CDM-Hydro	10050.3	3.36	46.2
IRP-CDM-Hydro with RE *	8879.0	3.20	36.2

* With the same level of generation as in IRP base case

Some Methodological Issues in CDM Analyses of Power Sector Projects

Thank you.

End

Decomposition of emission mitigation with CDM project under IRP

Total emission mitigation with the introduction of committed CDM in IRP comprises three components:

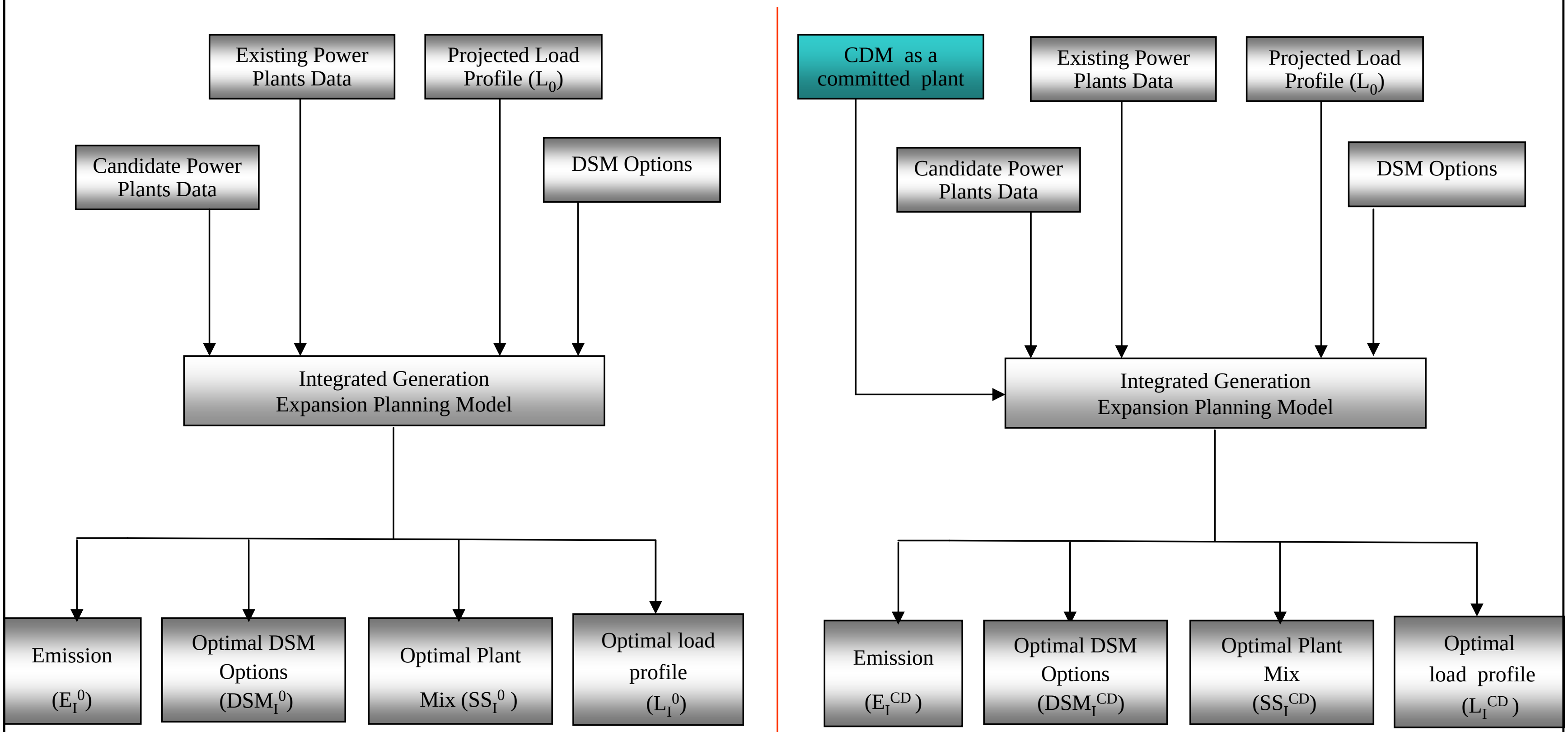
- **Supply-side effect:** change in emission due to the change in generation- mix after the CDM is introduced
- **DSM effect:** change in emission due to change in the level of DSM after the CDM is introduced
- **Joint effect**

i.e. $\Delta E_{Total} = \Delta E_{SS} + \Delta E_{DSM} + \Delta E_{JOINT\ EFFECT}$

Issue:

What is the level of emission mitigation solely due to CDM i.e. Supply-side effect ?

Emission mitigation with the CDM project and DSM



Emission Mitigation due to CDM-Plant and DSM, $(\Delta E_{CDM} + \Delta E_{DSM}) = E_I^0 - E_I^{CD}$