Baseline For Japanese Wind Power Plant Project in Zafarana (Arab Republic of Egypt)

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* Energy Situation in Egypt

- Installed Power 17.67 GW
- Max. Demand 14.4 GW
- Annual Growth Rate 4-6 %
- Installed Power Plant According to Types:
  - Wind 0.56% - - - - - - - 0.82%
  - Hydro 14.5%
  - Thermal 85%
- Fuel Consumption Type for Thermal P.P
  - NG 89.2%
  - Oil 10.8%

* According to EEHC Annual Report (02/03)

Wind Projects in Egypt
(In cooperation with others)

1. Danish Wind Project
   a) Phase I 30 MW → Mar. 2001
   b) Phase II 30 MW → Nov. 2003
2. German Wind Project
   a) Phase I 33 MW → Mar. 2001
   b) Phase II & III 47 MW → April 2004
3. Spanish Wind Project

   85 MW —Starting→ 2006
4. Japanese Wind Project

   120 MW —Starting→ 2007

Japanese Wind Power Plant Project in Zafarana - Egypt

In Brief :

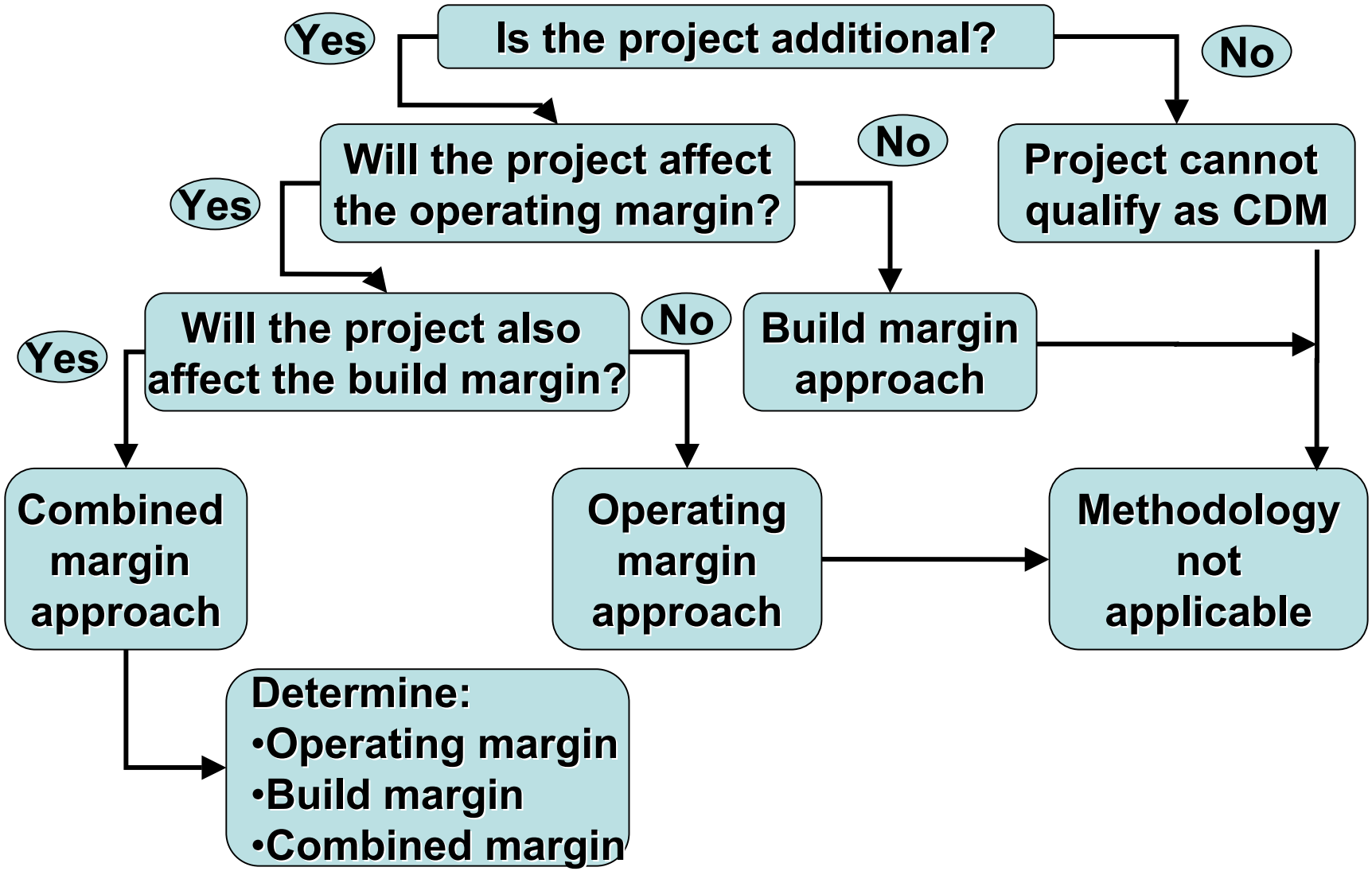
- Japanese wind power plant project is 120 MW
- Capacity factor 42 – 45 %
- Resultant 441,505 MWh of electricity / year
- Operating lifetime (minimum) is 20 years
- The plant site is located approx. 200 Km south east Cairo

Japanese Wind Power Plant Project in Zafarana - Egypt

The project:

- Category of project activity is : Grid- connected electricity generation.
- Provide Zero green house gas (GHG) emission power.
- GHG reduction 227, 375 t CO_2 eq / year.
- Reduction 1.59 million t CO_2 eq (In the initial 7 years crediting period)
- The wind turbine size is to be between 600 KW and 1 MW (3 bladed machine)

Steps to determine Baseline



Definitions:

- **Baseline:**

  it is the reference value to estimate the reduction of CO_2 emissions.

  OR

  Business as usual if CDM project will not be implemented

Definitions:

- **Operating Margin:**

  Average of all generation types excluding low cost / must run plants. Those excluded were hydro facilities and existing wind plant.

- **Build margin:**

  Average of the most recent 5 plants built.

To determine Operating Margin

Notes:

For the Egypt's grid excluding Low-cost / must-run (around 33 power plants)

- **Total Capacity (MW) = 12,933**
- **Net Power (GWh) = 62,353**
- **Fuel Consumption (10^3 toe) = 14,378**

To determine Operating Margin

CO_2 emission = Fuel consumption X Net calorific X C emission X Fraction X Mass

		Value		Factor		Of C	conversion Factor
(10^3 toe)		(TJ / 10^3 toe)		(t C / TJ)		oxidized	(t CO_2 / t C)

CO_2 emission =

14,378 X 41.868 X 15.78 X 0.9945 X 44/12

CO_2 emission = 34,639,000 t CO_2

CO_2 emission Factor for operating margin	=	Sum of CO_2 emission for operating margin (t CO_2)	÷	Total grid electricity generated for operating margin (MWh)
	=	34,639,000	÷	62,353,000
	=	0.556 t CO_2 / MWh		

To determine build Margin

To obtain the CO_2 emission factor for the build margin, we have to calculate the emission factor for the resent 5 plants.

- Total Net Power (GWh) = 19,754
- Fuel consumption (10^3 toe) = 3,994

Egypt's grid excluding low-cost/must-run

Power Plant	Type of Generation	Capacity (MW)	Net Power (GWh)	Fuel Consumption (10^3 toe)
ShoubraEl Khima	ST	1260	7141	1686
Cairo West	ST	350	1563	426
Cairo West ext.	ST	660	3521	791
Cairo South I	CC(hybrid)	570	3236	711
Cairo South II	CC	165	1018	186
Wadi Hof	GT	100	20	8
Tebbin	GT	46	103	43
Tebbin	ST	45	7	3
Damietta	CC	1125	6736	1294
Talkha(CC)	CC	283.6	1410	346
Talkha(ST)	ST	90	1	0.2
Talkha 210	ST	420	1912	487
Ataka	ST	900	4634	1053
Abu Sultan	ST	600	2879	824
Shabab	GT	100	73	25
Port Said	GT	64	24	9

Arish	ST	66	356	108
Oyoun Mousa	ST	640	3655	823
Kafr El Dawar	ST	440	1411	376
Mahmoudia (G)	GT	180	51	19
Mahmoudia (CC)	CC	308	1898	386
Damanhour 300	ST	300	945	211
Damanhour Ext	ST	195	742	195
Damanhour (CC)	CC	152.8	923	177
Seiuf (G)	GT	200	38	14
Seiuf (ST)	ST	113	355	131
Karmouz	GT	25	1	0.1
Abu Kir	ST	900	3896	925
Sidi Krir 1.2	ST	640	3662	765
Matrouh	ST	60	149	41
Walidid	ST	600	2819	674
Kuriemat	ST	1245	6713	1489
Assiut	ST	90	461	152
ToTal		**12.933**	**62.353**	**14.378**

To determine build Margin

CO_2 emission for resent 5 plants =
Fuel consumption X Net calorific X C emission X Fraction X Mass

	(10^3 toe)		Value (TJ / 10^3 toe)		Factor (t C / TJ)		Of C oxidized	conversion Factor (t CO_2 / t C)
CO_2 emission =	3,994	X	41.868	X	15.78	X	0.9945	X 44/12

CO_2 emission = 9,334,181 t CO_2

CO_2 emission Factor for most resent 5 plants	=	Sum of CO_2 emission for resent 5 plants (t CO_2)	÷	Total grid electricity generated for resent 5 plants (MWh)
	=	9.334.181	÷	19,754,000
	=	0.473 t CO_2 / MWh		

The 5 Recent Plants

Plant	Plant Type	Net Power(GWh) (% of total[3])	Fuel Consumptions (10^3 toe)	Commissioning Date
Cairo North (2)	CC 750 MW	5256 (5.3%)	988 (based onNREA estimate of fuel consumption)	05/06 06/07
Cairo North (1)	CC 750 MW	5256 (5.3%)	988 (as above)	03/04 04/05
Zafarana	Wind 77 MW	280 (0.3%)	0	03/04
Suez Gulf 1.2 BOOT	ST 682 MW	4481 (4.6%)	1009 (based on Oyoun Msousa)	02/03
Port Said East 1.2 BOOT	ST 682 MW	4481 (4.6%)	1009 (as above)	02/03
TOTAL		**19754**	**3994**	

To determine Combined Margin CO_2 emission Factor

$$\text{CO_2 emission Factor for combined margin (t CO2 / MWh)} = \frac{\text{CO_2 emission factor for operating margin (t CO2 / MWh)} + \left(\text{CO_2 emission factor for build margin (t CO2 / MWh)} \times n \right)}{1 + n}$$

Notes:

- n is the capacity value for wind power
  n = 1 does not take into account the volatility of wind power output
  n = 0.6 does
  (The more conservative number selected)

To determine Combined Margin CO_2 emission Factor

For n = 1

$$CO_2 \text{ emission factor} = \frac{0.556 + (0.473 \times 1)}{2}$$

$$= \underline{0.515} \text{ t } CO_2 / MWh$$

For n = 0.6

$$CO_2 \text{ emission factor} = \frac{0.556 + (0.473 \times 0.6)}{1.6}$$

$$= \underline{0.525} \text{ t } CO_2 / MWh$$

Baseline emission

- CO_2 emission factor for n = 1 is lower than n = 0.6
- Its result is selected as the emission factor representing the baseline grid electricity generation in the interest of conservation

CO_2 emission = Electricity produced by the project (MWh / year) X CO_2 emission factor (t CO_2 / MWh)

= 441,504 X 0.515

= 227,375 t CO_2 / year

Emission reduction for the initial 7 years

= 1,591,625 t CO_2 eq

The PDD document can be accessed on :

http://cdm.unfcc.int/methodologies/process

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